

## Geraniaceae in Thailand

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### ABSTRACT

Members of the geranium family (Geraniaceae) native to Thailand are enumerated. Two genera, *Geranium* (3 species) and *Pelargonium* (1 species) are recognized. *Pelargonium* is a new genus record for Thailand and Asia Major (except Asia Minor-Anatolia). Keys to the Thai species, descriptions, information on distribution and ecology, as well as conservation status, are provided.

KEYWORDS: Geraniales, Doi Chiang Dao, endemic species, disjunct distribution, taxonomy.

Accepted for publication: 5 August 2020. Published online: 2 October 2020

### INTRODUCTION

Geraniaceae is a family of ca 835 species mainly distributed in temperate and subtropical regions worldwide (Albers & van der Walt 2007). Except in *Hypseocharis* J.Rémy, the family is uniquely characterized by its schizocarpic fruit with styles united around a central column and generally breaks up elastically at maturity (Chant, 1993; Albers & van der Walt, 2007). According to Stevens (2001 onwards) there are five genera in Geraniaceae, i.e., *Geranium* Tourn. ex L. (ca 430 spp.), *Pelargonium* L'Hér. ex Aiton (ca 280 spp.), *Erodium* L'Hér. ex Aiton (ca 80 spp.), *Monsonia* L. (ca 40 spp.: inc. *Sarcocaulon* Sweet), and *Hypseocharis* (1–3 spp.).

Geraniaceae representatives in Thailand are uncommon and always occur in high altitude areas or mountain summits, especially in the north. Before 2000, there were only two *Geranium* species reported:

*G. lambertii* Sweet subsp. *siamense* (Craib) T.Shimizu and *G. nepalense* Sweet (Craib, 1926; Shimizu, 1970). Subsequently, an additional species, *G. ocellatum* Jacquem. ex Cambess. was noticed (Aedo *et al.*, 2016). During research on this family for the Flora of Thailand treatment based on both herbarium specimens worldwide, e.g., BK, BKF, E, K, L, P, SING, QBG, and additional field work, one more species was discovered and reported for the first time in Thailand - *Pelargonium apetalum* P.Taylor, an east African species, as the result of a very long-distance dispersal from its known areas in Malawi, Tanzania, and Zimbabwe. The genus *Pelargonium* was formerly known only from Africa, Asia Minor, and Australia (Albers & van der Walt, 2007; Fiz *et al.*, 2008). This discovery in Thailand represents a new genus record outside its known distribution range. In total, two genera with four native species of Geraniaceae are recognized for the country.

### TAXONOMY

#### KEY TO THAI GERANIACEAE SPECIES

1. Leaves 3–8 deeply lobed, subtriangular, pentagonal, suborbicular, to subreniform in outline; flower actinomorphic; hypanthium absent
  2. Flower 1–3.2 cm across; petals present; fertile stamens 10
    3. Flower 2.8–3.2 cm across; Petals ± twice as long as sepals, 7–9 veined
    3. Flower 1–1.3 cm across; Petals slightly longer than sepals, 3–5 veined
  2. Flower 0.4–0.6 cm across; petals absent; fertile stamens 5
1. Leaves unlobed to very shallowly 3–5(–7)-lobed, ovate to cordate in outline; flower zygomorphic; hypanthium present
  1. ***Geranium lambertii* subsp. *siamense***
  2. ***Geranium nepalense***
  3. ***Geranium ocellatum***
  4. ***Pelargonium apetalum***

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## ALTERNATE KEY TO THAI SPECIES (FROM FRUITS)

1. Awns generally  $\pm$  recurved at maturity, not spirally coiled  
 2. Mericarp glabrous, with 8–10, prominent, parallel, transverse ribs  
 2. Mericarp hairy, surface smooth without any ribs  
 3. Awns densely hairy; hairs to 1 mm long; mericarps 4.1–4.3 mm long  
 3. Awns subglabrous to hairy; hairs to 0.4 mm long; mericarps 2.2–3.3 mm long  
 1. Awns spirally coiled (in dry condition) at maturity

3. *Geranium ocellatum*1. *Geranium lambertii* subsp. *siamense*2. *Geranium nepalense*4. *Pelargonium apetalum*

**1. *Geranium lambertii* Sweet subsp. *siamense* (Craib) T. Shimizu, Tonan Ajia Kenkyu (The Southeast Asian Studies) 8(2): 180. 1970.**—*G. siamense* Craib, Bull. Misc. Inform. Kew 4: 158. 1926; Smitinand, Nat. Hist. Bull. Siam. Soc. 21: 102. 1966. Type: Thailand, Chiang Mai, Doi Chiang Dao, 2,100 m alt., 6 Nov. 1922, *Kerr 6601*, (holotype **K!**; isotype **BK!**). Figs. 1E & 2D.

Perennial, decumbent to ascending herbs, with a few branches, almost all part especially the young ones covered with rigid, patent to retrorse, eglandular, yellowish-white hairs, 1–2.5 mm long, becoming glabrous with age. *Stems* to 70 cm long, ca 2 mm in diam, densely pilose when young. *Leaves* palmatifid, generally opposite, rarely alternate; stipules free or basally connate, ovate-lanceolate, broadly lanceolate, to oblanceolate, 2.5–6 by 2–4.7 mm, apex acuminate,  $\pm$  pilose; petiole 0.8–3.1(–20) cm long, densely pilose in the upper part; blades pentagonal to pentagonal-reniform, or subtriangular in outline, (1–)3.6–4.2(–6.4) by (1–)4–5(–8.4) cm, deeply divided about  $\frac{3}{5}$ – $\frac{4}{5}$  of the radius into (3–)5–7 palmately segments, chartaceous, upper surface sparsely pubescent, lower surface  $\pm$  densely pilose especially along veins; segments obovate, obliquely obovate, to rhomboid in outline, mid-segment largest, becoming smaller toward both ends, (0.5–)1–2.1 by (0.3–)0.5–1.9 cm, apex acute to rounded, margin with 1–3(–4) lobe(s) in each side; lobes 1–4 mm wide, apex mucronate. *Inflorescences* a 1–2-flowered cymule; peduncles absent in 1-flowered cymules, or 5–9 cm long in 2-flowered cymules, densely pilose; bracts and bracteoles narrowly triangulate-lanceolate, 4–5(–8.5) by 1–2 mm, apex obtuse, acute, or to 0.8 mm long mucronate, abaxially sparsely to densely pilose. *Flowers* actinomorphic, rose pink to pale pink with dark veins, 2.8–3.2 cm across; pedicels 1.5–4 cm long, densely pilose. *Sepals* 5, oblong to broadly lanceolate, 7–10 by 4–4.5 mm, enlarging in fruit, 5 veined, adaxially glabrous, abaxially long pilose especially along veins, hairs to 2.5 mm long, apex abruptly constricted in to a 1.7–2.2 mm long mucro. *Petals* 5, obovate to broadly obovate, 14–18 by

8–11.5 mm, apex rounded to slightly emarginate, base cuneate, 7–9 veined, glabrous on both sides except yellowish-green pilose at the inner base. *Stamens* 10; filament pinkish, 8–10 mm long, dorsally densely pubescent in the lower-half; anther yellowish-brown, sometimes with a purplish-blue ring along margin, elliptic-oblong, ca 1 mm long. *Ovary* ca 1 mm long, densely pubescent; style 5–8 mm long, pubescent; stigma 5-lobed, purplish-red, filiform, 3–5 mm long. *Fruits* ca 2.6 cm long; columella pubescent; awn ca 1.4 cm long, outer surface densely pubescent; mericarps pale brown, subellipsoid-oblong, 4.1–4.3 mm long, ca 2.5 mm in diam., pilose. *Seeds* pale brown, ca 3.4 mm long, glabrous.

Thailand.—NORTHERN: Chiang Mai [Doi Chiang Dao (Doi Cheng Duo), 2,100 m, 6 Nov. 1922, *Kerr 6601*, (**K**, **BK**); *ibid.*, 2,100–2,200 m., 3 Dec. 1961, Smitinand & Anderson 7292 (**BKF**, **K**); *ibid.*, Shimizu *et al.* T4378; *ibid.*, 14 Sept. 1967, Shimizu *et al.* T10143 (**BKF**, **KYO** not seen); *ibid.*, 26 Sept. 1971, Murata *et al.* T15287 (**BKF**); *ibid.*, 1 Dec. 1984, Koyama *et al.* T39750 (**BKF**); *ibid.*, 2,100 m, 21 Nov. 1999, Suksathan 2211 (**QBG**); *ibid.*, 2,225 m, 15 Oct. 2000, Suksathan 2859 (**QBG**).

Distribution.—Endemic to Northern Thailand, known only from the type locality.

Ecology.—Scattered in open rocky-grassy slopes and ridges between 1,900–2,225 m alt. Flowering and fruiting September–January.

Vernacular.—Che rani um chiang dao (เจราเนียม เชียงดาว)(General).

Conservation status.—This endemic taxon occurs only at higher elevations of Doi Chiang Dao (extent of occurrence <100 km<sup>2</sup>) with an area of occupancy estimated less than 2.5 km<sup>2</sup> in total. In the last decade, high ridges and summit of this mountain have been heavily destroyed by annual fires causing expansion of an alien weed, *Ageratina adenophora* (Spreng.) R.M.King & H.Rob. Therefore, the status is assessed as Critically Endangered (CR): B1ab (iii); B2ab (iii) (IUCN 2019).

Notes.— *Geranium lambertii* subsp. *siamense* differs from typical *G. lambertii* by having no glandular hairs (vs glandular hairs presented on pedicels and sepals in typical *G. lambertii*), and pale pink filaments (vs dark pink in typical *G. lambertii*) (Shimizu, 1970).

**2. *Geranium nepalense*** Sweet, Geraniaceae. 1: t. 12. 1820; Edgeworth & Hook.f., Fl. Brit. India 1: 430. 1875; Tardieu-Blot, Fl. Indo-Chine 1: 551. 1945; A.J.C.Grierson & D.G.Long, Fl. Bhutan 1(3): 79. 1987; R.Knuth in Engl., Pflanzenr. IV-129, 53: 192. 1912; Hara, Fl. East. Himal. 167. 1966; T.Shimizu, Tonan Ajia Kenkyu (The Southeast Asian Studies) 8(2): 180. 1970; L.Xu & C.Aedo, Fl. China 11: 15. 2008. Type: Nepal, cult, in Chelsea, *W. Anderson s.n.* (CGE? not seen), cited by Veldkamp & Moerman (1978). Figs. 1F & 2E.

— *Geranium radicans* DC., Prodr. [A.P. de Candolle] 1: 639. 1824. Type: Nepal, *Wallich s.n.* (lectotype **GDC!**, designated by Veldkamp & Moerman, 1978; isolectotypes **K** not seen, **NY!**, **W** not seen.).

— *Geranium lavergneanum* H.Lév., Bull. Soc. Agric. Sarthe ser. 2, 31(4): 319. 1904. Type: China. Yunnan, Hin-y-hie, 10 Apr. 1897, *Bodinier 1534* (lectotype **E!**, designated by Lauener, 1967; isolectotype **P!**).

— *Geranium fangii* R.Knuth, Repert. Spec. Nov. Regni Veg. 40: 218. 1936. Type: China. Szetschuan, Nanchuan Hsien, 2,400–2,700 m alt., 1928, *Fang 834* (lectotype **E!**, designated by Aedo in 2006 [http://data.rbge.org.uk/herb/E00216777], cited in “Geranium Taxonomic Information System” (Aedo, 2020); isolectotypes **GH!**, **P!**).

— *Geranium oliganthum* C.C.Huang, Acta Phytotax. Sin. 1(2): 161. 1951.— *Geranium nepalense* var. *oliganthum* (C.C.Huang) C.C.Huang & L.R.Xu, Fl. Reipubl. Popularis Sin. 43(1): 35. 1998. Type: China. Hebei (Hopei), near Eastern Tombs, 770 m alt., 17 Jun 1931, *K.M.Liou 331* (holotype **PE?** not seen).

— *Geranium jinchuanense* Z.M.Tan, Bull. Bot. Res., Harbin 14: 232. 1994. Type: China. Jinchuan County, by the road, near the town, 2,150 m alt., 4 June 1979, *Jinchuan Exped. 322* (holotype **SM** not seen).

Perennial, decumbent to ascending herbs, with a few branches, often rooting at nodes. *Stems* green to reddish, terete, to 50 cm long, 1–2 mm in diam.,

sparsely to densely pilose especially when young, with patent to retrorse, eglandular, yellowish-white hairs, to 1 mm long. *Leaves* palmatifid, basally deciduous rosette, cauline ones opposite, rarely alternate; stipules lanceolate to narrowly lanceolate, to 10 by 2.5 mm, apex long attenuate, sparsely to densely pilose; petioles 0.2–21 cm long, with patent, eglandular hairs, ca 0.5 mm long; blades pentagonal, reniform, to subtriangular in outline, 1.9–5.6 by 2.2–5.9 cm, deeply divided about  $\frac{1}{3}$ – $\frac{3}{4}$  of the radius in to 3–5(–7) palmately segments, chartaceous, upper surface sparsely pubescent with short stiff white hairs, ca 0.2 mm long, lower surface long pubescent especially along veins; segments obovate, broadly oblanceolate, to rhomboid in outline, each  $\pm$  equal in size or mid-segment largest, 0.5–2 by 0.3–1.5 cm, apex acute to rounded, margin with 1–6 lobes in each side; lobes 0.5–3.5 mm wide, apex abruptly mucronate. *Inflorescences* a 1–2-flowered cymes; peduncles 2.2–8 cm long, pubescent with patent, eglandular hairs; bracts and bracteoles narrowly lanceolate, 2–5 by 0.5–1 mm, apex acuminate. *Flowers* actinomorphic, pale pink to bluish-pink with dark veins, 1–1.3 cm across; pedicels 1.5–3 cm long, pubescent with patent, eglandular hairs. *Sepals* 5, oblong to elliptic, 4.5–5.5 by 1.3–2.8 mm, enlarging in fruit, 3–5 veined, adaxially glabrous, abaxially pubescent especially along veins and margins, apex abruptly constricted in a 0.5–1 mm long mucro. *Petals* 5, obovate to narrowly obovate, 5.5–8 by 3–4 mm, base cuneate, 3–5 veined, glabrous on both sides except pubescent inner base. *Stamens* 10; filament light green to white, ca 3.3 mm long, dorsally densely pubescent in the lower-half; anther purple, round-oblong, ca 0.8 mm long. *Ovary* ca 1 mm long, densely pubescent; style ca 1 mm long, subglabrous to sparsely pubescent; stigma 5-lobed, purplish-red, filiform, ca 1.3 mm long. *Fruits* ca 1.3 cm long; columella glabrous; awn 1–1.4 cm long, outer surface subglabrous to sparsely or densely covered with patent, eglandular hairs, 0.1–0.4 mm long; mericarps brown, subellipsoid, 2.8–3.2 mm long, ca 1.5 mm in diam., densely covered with long patent hairs. *Seeds* ca 2.5 mm long.

Thailand.— NORTHERN: Chiang Mai [Chom Thong, Mae Klang Luang (Doi Inthanon), 1 Feb. 1983, *Somkit 440* (**BKF**); Fang, Doi Angkhang, 1,500 m, 3 Dec. 1974, *Sadakorn 365* (**BK**); *ibid.*, 1,650 m, 6 May 1974, *Sadakorn 318* (**BK**); Fang, Mae Ngon, Ban Luang, ca 1,200 m, 5 Feb. 1986,

*Paisooksantivatana* Y1787-86 (**BK**, **BKF**); Phitsanulok [Phu Rom Rot, Phu Miang, 1,200–1,600 m, 3 Oct. 1967, Shimizu *et al.* T11524 (**BKF**, **K**, **KYO** not seen); Phu Hin Rong Kla, 1,600 m, Suksathan (pers. obs.)].

Distribution.— Afghanistan, Pakistan, Nepal (type), Bhutan, India, Sri Lanka, China, Korea, Myanmar, Laos, Vietnam, Indonesia (Sumatra).

Ecology.— Growing by roadsides, paddy fields or edges of hill evergreen forest between 1,200–2,500 m alt. Flowering and fruiting September–February.

Vernacular.— Lakueiko (ละก้วยค้อ) (Karen-Chiang Mai); che ra nium pa (เจรานียมป่า), che ra nium ne pan (เจรานียมเนปาล) (General).

Conservation status.— This species is widely distributed in eastern Asia from the west Himalaya to Korea and southward to Sumatra. It is assessed as Least Concern (LC) (IUCN 2019).

Notes.— *Geranium nepalense* is characterized by having small pinkish to bluish white flowers. Even though it is a widespread species in northern Thailand, it is not so common.

**3. *Geranium ocellatum*** Jacquem. ex Cambess., Voy. Inde [Jacquemont] 4 (Bot.): 33. t. 38. 1841; Edgeworth & Hook.f., Fl. Brit. India 1: 433. 1875; Nasir, Y.J., Fl. Pakistan 149: 7. 1983; L.Xu & C.Aedo, Fl. China 11: 10. 2008; Aedo *et al.*, Syst. Bot. 41(2): 369. 2016. Type: India, Jammu & Kashmir, Pentapotamide, pagum Sera, 26–27 Apr. 1831, *V. Jacquemont s.n.* (lectotype **P!** [*Jacquemont 203?*], designated by Kokwaro, 1971a; isolectotypes: **K** not seen, **MPU** not seen). Figs. 1A–D & 2A–C.

— *G. ocellatum* var. *himalaicum* R.Knuth in Engl., Pflanzenr. IV-129, 53: 62. 1912.— *G. mascatense* var. *himalaicum* (R.Knuth) Babu ex Raizada, Suppl. Duthie's Fl. Upper Gangetic Plain 4: 36. 1976. Type: India, Manipur, Khongui valley, *G. Watt 6313* (lectotype: **P!**, designated by Aedo *et al.*, 2016; isolectotypes **E!**, **K!**).

— *G. ocellatum* var. *yunnanense* R.Knuth in Engl., Pflanzenr. IV-129, 53: 62. 1912.— *G. mascatense* var. *yunnanense* (R.Knuth) Raizada, Suppl. Duthie's Fl. Upper Gangetic Plain 36. 1976.— *Geranium tapintzense* C.C.Huang, Notes Roy. Bot. Gard. Edinburgh 42(2): 326. 1985, **nom. nov.** Type: China,

Yunnan, bei Tapin-tze, 1883–1885, *P.J. Delavay 2491* (holotype: **B** destroyed; isotypes: **BM** not seen, **E!**, **G** not seen, **MPU** not seen, **P!**). For more type information see Aedo *et al.*, (2016).

— *G. kweichowense* C.C.Huang, Notes Roy. Bot. Gard. Edinburgh 42(2): 325. 1985. Type: China, Guizhou, Kweichow province, Lo-fou, Mar. 1909, *J. Cavalerie 3615* (holotype: **E!**; isotypes: **K!**, **P!**).

Annual, suberect, decumbent, to ascending herbs, with a few branches. *Stems* terete, to 60 cm long, up to 1 mm in diam., densely pubescent with patent to retrorse, glandular hairs, 0.1–0.7 mm long, sometimes sparsely interspersed with longer glandular hair, 1.2–3 mm long. *Leaves* palmatifid, basally rosette, cauline ones opposite; stipules narrowly triangulate to lanceolate, 2.1–8 by 0.5–2 mm, apex long attenuate, abaxially sparsely to densely covered with glandular hairs, margins long ciliate, to 0.7 mm long; petioles 0.8–13.5 cm long, with patent glandular hairs, to 0.5 mm long; blades reniform to suborbicular in outline, (0.4–)1.3–2.8 by (0.3–)1.7–3.1 cm, deeply divided about  $\frac{1}{3}$ – $\frac{1}{2}$  of the radius in to 5–7(–9) palmately segments, thin chartaceous, both surface sparsely to densely pubescent with short glandular hairs, 0.1–0.3 mm long especially along veins and margins; segments spatulate-flabellate to oblanceolate, rarely oblong in outline, mid-segment largest, (2.8–)6.5–12.5 by (1.4–)3.8–12 mm, apex divided ca  $\frac{1}{3}$  of its length in to 2–3 sub-segments, each with (0–)2–3 lobes at margin; lobes 0.4–1.2 x 0.4–1.1 mm, apex abruptly mucronate. *Inflorescences* a pseudo umbel, (1–)2–6(–8)-flowered, usually subtended by 2–6 long petiolate, 3–5-lobed, reduced leaves; peduncle absent to 3.5 mm long, densely glandular; bracts and bracteoles lanceolate, narrowly lanceolate to linear, 0.8–2.2 by 0.1–0.5 mm, apex acuminate to attenuate, outer surface and margin with long glandular hairs, to 0.5 mm long. *Flowers* very small,  $\pm$  actinomorphic, 4–6 mm across; pedicels 1–6.7 mm long, densely glandular. *Sepal* 5, subulate to oblong-lanceolate, 2.7–3 by 1–1.5 mm, enlarging in fruit, 3-veined, adaxially glabrous, abaxially subglabrous to pubescent with glandular hairs, to 0.5 mm long especially along veins, margins hyaline, glabrous, apex abruptly constricted in a 0.2–0.3 mm long mucro. *Petals* absent. *Stamens* 5; filament filiform, ca 1.3 mm long, glabrous; anther oblong, ca 0.2 by 0.1 mm. *Ovary* ca 0.5 mm long, glabrous; style ca 0.5 mm long, densely pubescent; stigma



5-lobed, short and stout, ca 0.5 mm long. *Fruits* 1.2–1.4 cm long; columella glabrous; awn lanceolate-oblong, 8–8.2 by 3 mm, outer surface sparsely to densely glandular, to 0.1 mm long; mericarps dark brown, oblong-ellipsoid, 1.8–2 mm long, 1–1.2 mm in diam., glabrous, with 8–10, prominent, parallel, transverse ribs; basal prong spinelike, 2–3 mm long. *Seeds* glabrous, ca 1.5 mm long.

Thailand.— NORTHERN: Chiang Mai [Doi Chiang Dao, 5 Dec. 2002, 2,000 m, *Chamchumroon et al. VC.1709* (BKF); *ibid.*, 21 Dec. 1931, *Put 4463* (BK, C not seen, GH not seen, K, P)].

Distribution.— Afghanistan, Pakistan, India (type), Nepal, China.

Ecology.— Open grassy slope near summit, at about 2,000 m alt. Flowering and fruiting November–December.

Vernacular.— Che ra nium nu (เจราเนียมหนู) (General).

Conservation status.— Even though *Geranium ocellatum* is widely distributed from Afghanistan eastward to China and should be assessed as Least Concern (LC) (IUCN 2019), in Thailand it is rare and has been collected only twice in 1931 and 2002 around the summit area of Doi Chiang Dao, the place where forest fires often unusually disturbed, therefore the Thai population is under threat.

Notes.— Generally, *Geranium ocellatum* is easily recognized by having purple petals with a dark purplish-red base, and mericarps with 8–14 parallel, transverse ribs (Aedo *et al.*, 2016). In Thai plants, however, the petals are absent and the stamen number is also reduced from 10 to 5. These characters are commonly known in cleistogamous flowers of *Geranium* sect. *Trilopha* (Aedo *et al.*, 2016); it is worth noting that chasmogamous or open flowers, so far, have not been observed in any Thai specimens. I have not seen a specimen of *Koyama et al. 39750* kept at GH that was cited under this species by Aedo *et al.* (2016), but the same specimen number kept at BK is clearly not *G. ocellatum* but *G. lambertii* subsp. *siamense*.

**4. *Pelargonium apetalum*** P.Taylor, Hooker's Icon. Pl. 36: t. 3579. 1962; Müller, T., Fl. Zambesiaca 2(1): 145. 1963; Kokwaro, J., Fl. Trop. E. Afr.: 1. 1971. Types: Tanganyika, Songea District, Matengo Hills, near R. Luhekea about 1–5 km. NE. of Mpapa,

*Milne-Redhead & Taylor 10377B* (holotype K!; isotypes B!, BM not seen, BP not seen, BR!, EA!, LISC not seen, P!, SRGH!). Figs. 1G & 2F–G.

Annual, short ascending to prostrate herbs, 15–50 cm long, almost all part covered with sessile to short glandular hairs to 0.08 mm long interspersed with white, long stiff patent hairs, 0.4–2 mm long. *Stems* terete, 2–4 mm in diam., with a few branches, glandular and pilose. *Leaves* simple, generally opposite, one in each pair usually smaller than the other, occasionally basally alternate; stipule ovate-lanceolate to subtriangular, 3–5 by 1–2.5 mm, apex obtuse to long apiculate, base cuneate to broadly cuneate, membranous, both surfaces subglabrous to sparsely pubescent, margins long ciliate; petioles terete, to 2.5–56 mm long, glandular and ± pilose; blades simple, ovate, cordate, to compressed cordate, 0.8–2.6(–3.5) by 0.6–1.4(–3.7) cm, unlobed to shallowly 3–5(–7)-lobed, apex obtuse, base truncate to cordate-cuneate, chartaceous, margin coarsely serrate, sparsely hispid and glandular in both surfaces especially along veins. *Inflorescences* a pseudo-umbel, (1–)2–4-flowered; peduncles up to 1.5 cm long, ± pilose with glandular and eglandular hairs; bracts and bracteoles free or basally connate in a pair, each lanceolate, ca 3.5 by 1.5 mm, apex acuminate-mucronate. *Flowers* very small, green to dull red, zygomorphic; pedicels 3–9 mm, with glandular and ± eglandular hairs. *Hypanthium* 2–2.5 mm long, reddish, densely glandular. *Sepals* 5, light green with white margins, elliptic-lanceolate, posterior one largest, not or slightly reflexed, other 4 smaller, subequal, ± strongly reflexed, 3.5–5 by 1.5–2 mm, adaxially subglabrous to sparsely glandular, adaxially densely hispid and glandular apex mucronate up to 0.2 mm long, margins ciliate, enlarging and inflexing in fruit. *Petals* absent. *Stamens* 10, 5 antheriferous, other 5 reduced without anthers; fertile filaments white, acicular, ca 2 mm long, sparsely pilose, base adnate and connate; sterile filaments narrower and slightly longer; anthers pale pink, short, ca 0.4 mm long. *Ovary* densely pubescent, ca 1 mm long, style ca 0.5 mm long, densely pubescent, stigma pinkish-red, 5-lobed, ca 0.5 mm long. *Fruits* 2.2–3.4 cm long; columella densely short-pubescent; awn 1–1.7 cm long, outer surface glabrous, inner surface with long, thin, white, caducous hairs, to 7 mm long; mericarps pale brown with black mottles, sub-ellipsoid, ca 3 mm long, 1.2 mm in diam., densely pubescent. *Seeds* pale brown, ca 2 mm long, glabrous.

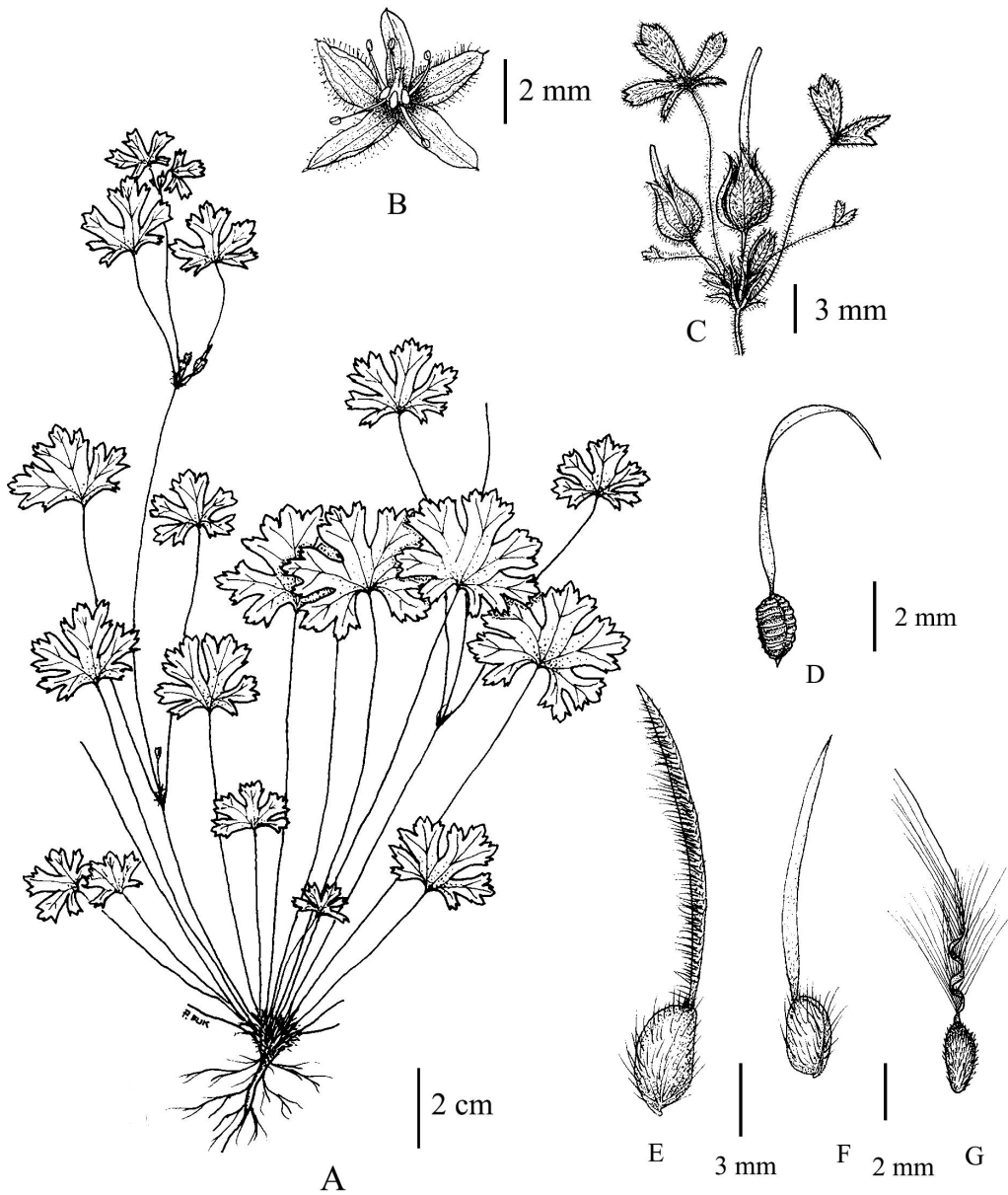


Figure 1. A–D: *Geranium ocellatum* Jacquem. ex Cambess.: A. habit; B. flower; C. inflorescence and infructescence; D. mericarp with awn. [Chamchunroon et al. VC 1710 (BKF)]; E. *G. lambertii* Sweet subsp. *siamense* (Craib) T.Shimizu: mericarp with awn. [Suksathan 2859 (QBG)]; F. *G. nepalense* Sweet: mericarp with awn. [Paisooksantivatana Y1787-86 (BKF)]; G. *Pelargonium apetalum* P.Taylor: mericarp with awn [Schanzer N03-065 (BKF)]. Drawn by Piyakaset Suksathan.



Figure 2. A–C: *Geranium ocellatum* Jacquem. ex Cambess.: A. habit; B. flower (scale bar = 2 mm); C. infructescence; D. *G. lambertii* Sweet subsp. *siamense* (Craib) T.Shimizu: habit & flowers; E. *G. nepalense* Sweet: flower; F–G: *Pelargonium apetalum* P.Taylor: F. flower; G. mature infructescence. Photos A, C by Voradol Chamchumroon, B, E, F by Piyakaset Suksathan, D, G by Pramote Triboun.



Thailand.— NORTHERN: Chiang Mai, Doi Chiang Dao, ca 2,000 m, 5 Dec. 2002, *Schanzer N03-065* (BKF); *ibid*, 2,000 m, 5 Dec. 2002, *Chamchumroon et al. VC1710* (BKF); *ibid*, 2,100 m, 15 Oct. 2000, *Suksathan 2943* (QBG).

Distribution.— Eastern Africa (Malawi, Tanzania (type), Zimbabwe).

Ecology.— Terrestrial in open grassy slopes or on rock, near the summit of Doi Chiang Dao at 2,000–2,200 m alt. Flowering and fruiting October–December.

Vernacular.— Long klai (หลงไคล)(General).

Conservation status.— *Pelargonium apetalum* is known from eastern Africa with a disjunct distribution to Doi Chiang Dao in Northern Thailand where it was collected only twice. At Doi Chiang Dao, this rare species occurs around the summit area (less than 0.2 km<sup>2</sup>) and is threatened by annual fire and invasive weeds, but since we do not know its current status in eastern Africa, it is assessed as Data Deficient (DD).

Notes.— *Pelargonium apetalum* belongs to section *Peristera* DC. because of its slender, annual habit with small flowers (Bakker *et al.*, 1998; Röschenbleck *et al.*, 2014). This section has disjunct distribution from southern Africa to Australia. The new occurrence in Northern Thailand could also be another representative evidence supporting a recent long-distance dispersal theory for its section (Bakker *et al.*, 1998) that can undertake long dispersal events. Morphologically, the Thai and African plants are almost identical except more variation found in African plants e.g., petals are not always absent but sometimes present in Zimbabwe plants, stamens vary from 9 to 10 with 2–3(–5) fertile (Müller, 1963; Kokwaro, 1971b). Its autogamy is noticed from plants growing at Queen Sirikit Botanic Garden’s nursery which is also a mechanism employed by most Australian *Peristera* (Meve, 1995).

#### ACKNOWLEDGEMENTS

The author would like to thank curators and staff of herbarium mentioned. The author is also grateful to Dr Voradol Chamchumroon (BKF) for field photographs and additional information of *Geranium ocellatum*, Dr Pramote Triboun (NSTDA) for field photographs of *G. lambertii* subsp. *siamense*

and *Pelargonium apetalum*, Dr Somran Suddee (BKF), Dr Prachaya Srisanga (QBG), and Prof. Henrik Balslav (AAU) for their useful discussions.

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