

Taxonomic treatment of nyctanthous species of *Kaempferia* subgen. *Protanthium* (Zingiberaceae), with two new infraspecific taxa endemic to Thailand

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ABSTRACT

This study provides a comprehensive taxonomic revision and species re-circumscription of the night-flowering (nyctanthous) *Kaempferia* subgen. *Protanthium* in Thailand. Based on extensive morphological and phenological investigations, two new infraspecific taxa are described and illustrated: *K. albiflora* var. *longiflora* and *K. noctiflora* var. *villosa*. The discovery of *K. albiflora* var. *longiflora* significantly expands the known morphological boundaries of the species, characterized by possessing the longest floral tube (up to 10.5 cm) recorded within the subgenus and distinct linear to narrowly lanceolate-oblong leaf blades. Concurrently, *K. noctiflora* var. *villosa* is distinguished from existing varieties by its robust upright habit, higher leaf number, and a densely villous indumentum on nearly all vegetative and floral parts. Detailed descriptions, geographical distribution, habitat, and phenology are updated for all nyctanthous taxa. Furthermore, their conservation statuses are reassessed according to the IUCN Red List Categories and Criteria, with both new varieties being provisionally assessed as Critically Endangered (CR). Identification keys to the species and varieties within *K. albiflora*, *K. grandifolia*, and *K. noctiflora* are also presented.

Keywords: *Kaempferia albiflora*, *Kaempferia grandifolia*, *Kaempferia noctiflora*, taxonomic circumscription, taxonomy.

INTRODUCTION

Globally, the genus *Kaempferia* L. (Zingiberaceae) comprises 64 recognized species (POWO, 2026). While broadly distributed across monsoonal tropical Asia (Mabberley, 2017; Insisiengmay *et al.*, 2020), its center of diversity is Thailand, which harbors over 45 native species (Jenjittikul *et al.*, 2023; Nopporncharoenkul and Limtaropas, 2025). Taxonomically, *Kaempferia* is divided into two subgenera based on inflorescence position: subgen. *Kaempferia* and subgen. *Proanthium* (Horan.) Baker (Insisiengmay *et al.*, 2018). Species within subgenus *Kaempferia* typically bear terminal inflorescences that are enclosed within the innermost leaf sheaths or embedded in the pseudostems. In contrast, subgen. *Proanthium* produces inflorescences directly from the rhizome, separate from the vegetative shoot. These racemes are often partially subterranean and emerge before the leaves (Nopporncharoenkul and Jenjittikul, 2018).

Recent taxonomic revisions of subgen. *Proanthium* recognize 16 species in Thailand (Nopporncharoenkul and Jenjittikul, 2024; Nopporncharoenkul *et al.*, 2024b; Thaowetsuwan *et al.*, in press). Among these, three are nyctanthous (night-blooming): *K. albiflora* Jenjitt. & Ruchis., *K. grandifolia* Saensouk & Jenjitt., and *K. noctiflora* Noppornch. & Jenjitt. (Saensouk and Jenjittikul, 2001; Nopporncharoenkul and Jenjittikul, 2017; Jenjittikul and Ruchisansakun, 2020; Meechonkit and Picheansoonthon, 2021; Nopporncharoenkul *et al.*, 2024a). Geographically, *K. albiflora* and *K. noctiflora* are endemic to Northern Thailand, while *K. grandifolia* is narrowly endemic to Khon Kaen Province in Northeastern Thailand. However, the original descriptions of these nyctanthous species were often based on limited living specimens due to their ephemeral nature and nocturnal anthesis, leading to an underestimation of their morphological variation. During recent field expeditions and specimen collections for the Flora of Thailand project, we discovered two ambiguous night-flowering taxa with white flowers in Tak and Chiang Mai Province of Northern Thailand. While these cryptic taxa share several floral affinities with *K. albiflora* and *K. noctiflora*, their distinct morphological characters warrant further investigation. Consequently, this study aims to revise and clarify the taxonomic circumscription of the nyctanthous species within *Kaempferia* subgen. *Proanthium* in Thailand.

MATERIALS AND METHODS

Field surveys and specimen collections were conducted across Thailand between 2015 and 2026. Morphological and phenological characteristics of *K. albiflora*, *K. grandifolia*, *K. noctiflora*, and the putative cryptic taxa were extensively evaluated through *in situ* observations and *ex situ* living collections. The latter were maintained at the National Science Museum Arboretum (NSM Arboretum), Pathum Thani Province; the Zingiberaceae nursery at Queen Sirikit Botanic Garden (QSBG), Chiang Mai; and Adiantum Time Nursery, Ratchaburi, Thailand. In addition to living material, protologues and herbarium specimens of subgen. *Proanthium* deposited at Bangkok Herbarium (BK), The Forest Herbarium (BKF), Queen Sirikit Botanic Garden Herbarium (QBG), Singapore Botanic Gardens Herbarium (SING), and

Suan Luang Rama IX Herbarium (SLR) were studied. Digital images from online databases, including the Kew Data Portal (<http://apps.kew.org/herbcat/navigator.do>) and the Chinese Virtual Herbarium (CVH; <https://www.cvh.ac.cn/spms/list.php?taxonName=Kaempferia>), were also consulted. Morphological terminology follows Beentje (2016). Diagnostic characters were evaluated and compared with morphologically allied taxa. The provisional conservation status of the new taxa was assessed according to the IUCN Red List Categories and Criteria, version 16 (IUCN Standards and Petitions Committee, 2024). The extent of occurrence (EOO) and area of occupancy (AOO) were calculated using the GeoCAT geospatial tool (Bachman *et al.*, 2011). All type specimens were deposited at QBG and SLR.

RESULTS

Taxonomic Treatment

Key to the nyctanthous species of *Kaempferia* subgen. *Protanthium*

- 1a. Floral plane flat (parallel to the substrate); lateral staminodes and labellum arranged in same plane, horizontal to slightly arcuate; labellum deeply incised, around or more than 3/5 of its length. 2
- 1b. Floral plane vertical (perpendicular to the substrate); lateral staminodes upright to slightly arcuate; labellum deflexed in distal half, incised to ca. 1/2 of its length. 3. *K. noctiflora*
- 2a. Anther crest bifid; leaf blade orbicular, suborbicular to ovate; ligule bilobed, ca. 1 cm long. 2. *K. grandifolia*
- 2b. Anther crest irregularly tridentate; leaf blade broadly elliptic, ovate, lanceolate to linear; ligule bilobed or bilobed-truncate, 1–3 mm long. 1. *K. albiflora*

Kaempferia albiflora Jenjitt. & Ruchis., Kew Bull. 75(1)–13: 1 (2020).

Kaempferia uttaraditensis Picheans. & Meechonk., Pak. J. Bot. 53(6): 2221 (2021).

Types. Thailand: Wang Prachop, Mueang Tak District, Tak Province, 22 Apr 2002, *Tiptabiankarn 7911* (holotype: BKF; isotype: SLR).

Description. Rhizomatous perennial herb, up to 40 cm tall. Rhizome ovoid to subglobose, 1–1.7 cm long, 1–2.4 cm in diam., brown externally, creamy white internally, with short fascicled storage roots and terminal tubers. Root stalks swollen, 0.4–4.5 cm long, 0.2–0.5 cm in diam.; tubers ovoid, ellipsoid to fusiform, 1–5 cm long, 0.6–1.6 cm in diam. Leafy shoot with 3–8 leaves, semi-appressed to the ground or erect. Pseudostem almost subterranean or upright, 4–22 cm long, composed of leaf sheaths. Bladeless sheaths 2–3, up to 10 cm long,

green to purplish red, apex rounded, obtuse to mucronate, villous. Leaf sheaths green to purplish red, villous; ligule bilobed or bilobed-truncate, lobes broadly triangular to rounded, apex obtuse to rounded, 1–2 mm long, semi-translucent, greenish white to purplish red, villous; pseudopetiole subsessile to 4 cm long, green to purplish red, villous; leaf blade broadly elliptic, ovate, lanceolate to linear, $9\text{--}32 \times 1\text{--}10$ cm, adaxially dull green, glabrous, abaxially green to deep purplish red, villous, base cuneate, attenuate to obtuse, margin entire to slightly undulate with a deep purplish red band, apex acute, mucronate to attenuate. Inflorescence lateral, emerging from the rhizome before the leaves, partly embedded in the soil; peduncle obscured by bladeless sheaths, up to 7 cm long, glabrous or villous; raceme fusiform-ovoid, 3–8.5 cm long, 1–1.5 cm in diam., composed of up to 20 bracts, each supporting a single flower; bracts broadly ovate to lanceolate-ovate, $3.6\text{--}6.5 \times 0.6\text{--}2.4$ cm (outer ones larger), apex mucronate, caudate to acute, light green to creamy white, sometimes tinged reddish to deep purplish red at apex and margin, glabrous or villous; bracteoles lanceolate-ovate, $10\text{--}20 \times 5\text{--}10$ mm, hyaline, apex deeply bifid, lobes acute, glabrous. Flowers 5.8–14 cm long, nocturnal; floral plane flat and parallel to the ground; lateral staminodes and labellum arranged in same plane, horizontal to slightly arcuate. Calyx 3.8–9.2 cm long, 0.4–0.7 cm in diam., with a unilateral incision 1.2–2.2 cm long, apex irregularly trilobed with 3 cuspidate teeth, semi-translucent, light green, glabrous. Floral tube 4.5–10.5 cm long, 0.2–0.3 cm in diam., white, glabrous, narrowly cylindrical at base, narrowly funnel-shaped distally; dorsal corolla lobe lanceolate-oblong, $2.5\text{--}6.5 \times 0.5\text{--}0.7$ cm, apex hooded, aristate, arista 2–6 mm long, concave, white, glabrous; lateral corolla lobes lanceolate-oblong, $2.5\text{--}5.8 \times 0.5\text{--}0.6$ cm, apex aristate (arista 1–3 mm long) to acute, white, glabrous. Lateral staminodes obovate, elliptic to oblanceolate, $2.2\text{--}4.6 \times 1.2\text{--}2$ cm, apex acute, obtuse, rounded to mucronate, white. Labellum obdeltoid to broadly obovate, $3\text{--}4.6 \times 3.3\text{--}5.3$ cm, white with a basal pale yellowish patch (rarely with two pale purple patches), bilobed, incised to ca. 2/3 of its length, base involute; lobes broadly obovate to suborbicular, imbricate, $2\text{--}3.2 \times 1.3\text{--}2.8$ cm, apex rounded, undulate, crenate to incised, , partly overlapping. Stamen 9–20 mm long, subsessile; filament up to 1 mm long; anther 9–18 mm long (including crest), connective white, glabrous, anther thecae $4\text{--}6 \times 1.5\text{--}2$ mm, white to creamy white; anther crest reflected at ca. 135° to the anther, oblong, ovate, elliptic to obdeltoid, $5\text{--}14 \times 4\text{--}6.5$ mm, apex irregularly tridentate, the middle tooth shorter and wider than the laterals. Pistil 5.5–12 cm long; ovary cylindrical, 3.5–8 mm long, 1.5–3.5 mm in diam., trilocular, creamy white to creamy yellow glabrous; epigynous glands 2, subulate, 5–8 mm long, creamy white to creamy yellow; style 5–11 cm long; stigma crateriform, $1.5\text{--}2.6 \times 0.5\text{--}1.4$ mm, ostiole ciliate. Fruit ellipsoid to subglobose, 2–3.5 cm long, 0.6–1.5 cm in diam., trilocular, creamy white to yellowish green, sometimes with brownish red spots, glabrous. Seeds obovoid to ellipsoid, 4–7.2 mm long, 3–4 mm in diam., neon yellow, yellowish cream to pale brown; aril white, semi-translucent, laciniate.

Key to the varieties in *Kaempferia albiflora*

1. Floral tube 4.5–5.5 cm long; leafy shoot with 3–5 leaves, semi-appressed to the ground; leaf blade broadly elliptic, ovate to lanceolate-oblong, $9\text{--}25 \times 4\text{--}10$ cm. **var. *albiflora***
1. Floral tube 8–10.5 cm long; leafy shoot with 7–8 leaves, erect; leaf blade linear to narrowly lanceolate, $18\text{--}32 \times 1\text{--}4.5$ cm. **var. *longiflora*, var. nov.**

Kaempferia albiflora* var. *albiflora

(Figures 1–2)

Description. Rhizomatous perennial herb, up to 15 cm tall. Rhizome ovoid to subglobose, 1–1.7 cm long, 1–2.4 cm in diam. Root stalks 0.5–1.8(–4.5) cm long, 0.3–0.5 cm in diam.; tubers 1.5–5 cm long, 1–1.6 cm in diam. Leafy shoot with 3–5 leaves, semi-appressed. Pseudostem almost subterranean, 4–9(–22) cm long. Bladeless sheaths 4–8.5 cm long, light green to purplish red, apex rounded to obtuse, sparsely villous. Leaf sheaths green to purplish red, sparsely villous; ligule bilobed-truncate, lobes broadly triangular, apex obtuse to rounded, 1–2 mm long, semi-translucent, greenish white to purplish red, sparsely villous; pseudopetiole subsessile to 2.5 cm long, green to purplish red, sparsely villous; leaf blade broadly elliptic, ovate to lanceolate-oblong, $9\text{--}25 \times 4\text{--}10$ cm, adaxially dull green, glabrous, abaxially green to deep purplish red, sparsely villous, base cuneate, attenuate to obtuse, margin entire to slightly undulate with a deep purplish red band, apex acute to attenuate. Inflorescence lateral; peduncle up to 4 cm long, glabrous; raceme fusiform-ovoid, (3–)4.5–5.2 cm long, 1–1.5 cm in diam., composed of up to 20 bracts; bracts broadly ovate to lanceolate-ovate, $3.6\text{--}5 \times 2\text{--}2.4$ cm, apex mucronate to acute, light green to creamy white, sometimes tinged deep purplish red at apex and margin, glabrous; bracteoles lanceolate-ovate, $10\text{--}20 \times 6\text{--}10$ mm, hyaline, apex deeply bifid, lobes acute, glabrous. Flowers 5.8–7.2 cm long; Calyx 3.8–4.6 cm long, 0.4–0.6 cm in diam., with a unilateral incision 1.2–1.5 cm long, apex trilobed with 3 cuspidate teeth, semi-translucent, pale green, glabrous. Floral tube 4.5–5.5 cm long, 0.2–0.3 cm in diam., white, glabrous; dorsal corolla lobe lanceolate-oblong, $(2.5\text{--})3\text{--}4 \times (0.5\text{--})0.6\text{--}0.7$ cm, apex hooded, aristate (arista 2–3 mm long), concave, white, glabrous; lateral corolla lobes lanceolate-oblong, $(2.5\text{--})3\text{--}3.8 \times 0.5\text{--}0.6$ cm, apex aristate (arista ca. 1 mm long) to acute, white, glabrous. Lateral staminodes obovate, elliptic to oblong, $(2.2\text{--})3.2\text{--}4 \times 1.2\text{--}2$ cm, apex acute, obtuse to rounded, white. Labellum obdeltooid to broadly obovate, $3\text{--}3.5 \times 3.3\text{--}4.8$ cm, white with a basal pale yellowish patch (rarely with two pale purple patches), bilobed, incised to ca. 2/3 of its length, base involute; lobes broadly obovate to suborbicular, imbricate, $2\text{--}2.8 \times 1.3\text{--}2.5$ cm, apex rounded, undulate to slightly obcordate. Stamen 9–20 mm long, subsessile; filament up to 1 mm long; anther 9–18 mm long (including crest), connective white, glabrous; anther thecae $4\text{--}6 \times 1.5\text{--}2$ mm, white to creamy white; anther crest reflected at ca. 135° to the anther, oblong to ovate, $(5\text{--})7\text{--}14 \times (4\text{--})4\text{--}6.5$ mm, apex irregularly tridentate, the middle

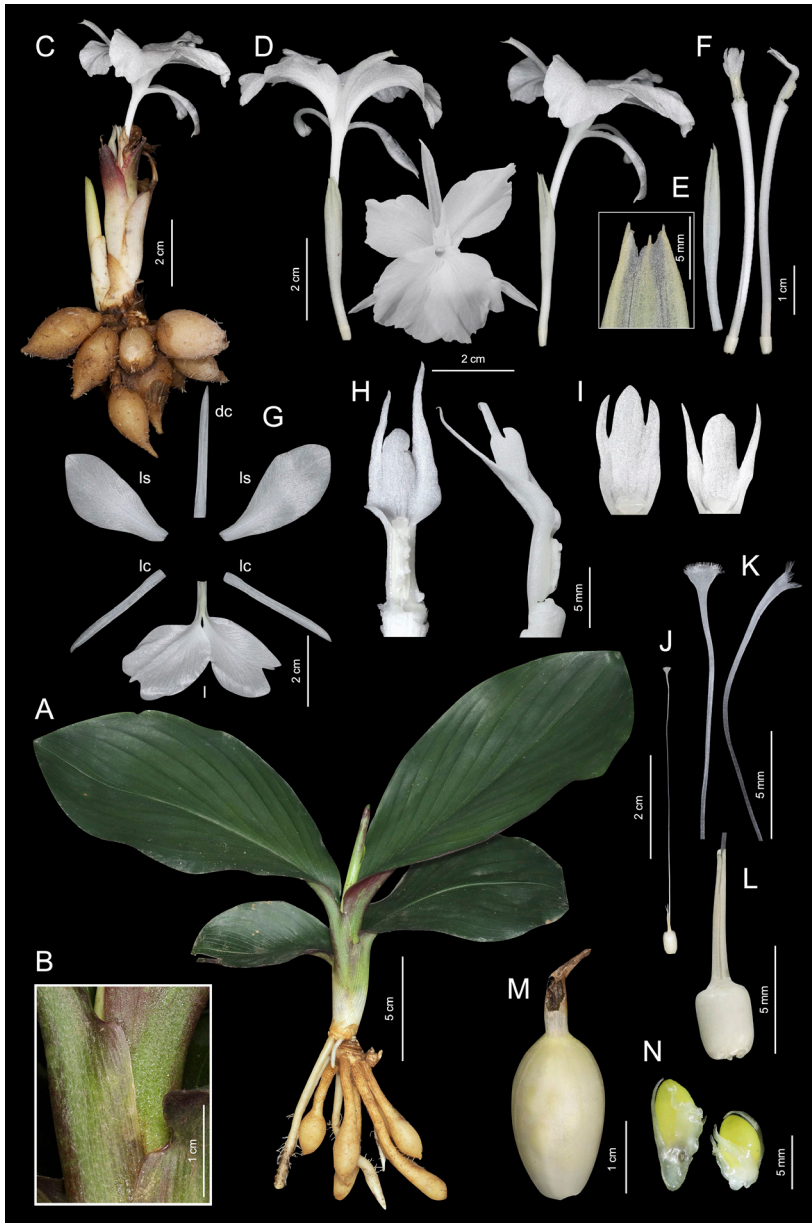


Figure 1. *Kaempferia albiflora* var. *albiflora*: A, Habit; B, Detail of ligules and leaf sheaths; C, Inflorescence and rhizome; D, Flower in front, side and top view; E, Calyx (inset: detail of apex); F, Floral tube with ovary and stamen in front and side view; G, Flower dissection (dc, dorsal corolla lobe; l, labellum; lc, lateral corolla lobe; ls, lateral staminode); H, Stamens in front and side view; I, Detail of anther crests in front and side view; J, Pistil; K, Detail of stigma and style in front and side view; L, Ovary with epigynous glands; M, Fruit; N, Seeds. Photos by Nattapon Nopporncharoenkul of a plant vouchered by N. Nopporncharoenkul NNSB-634 (QBG).

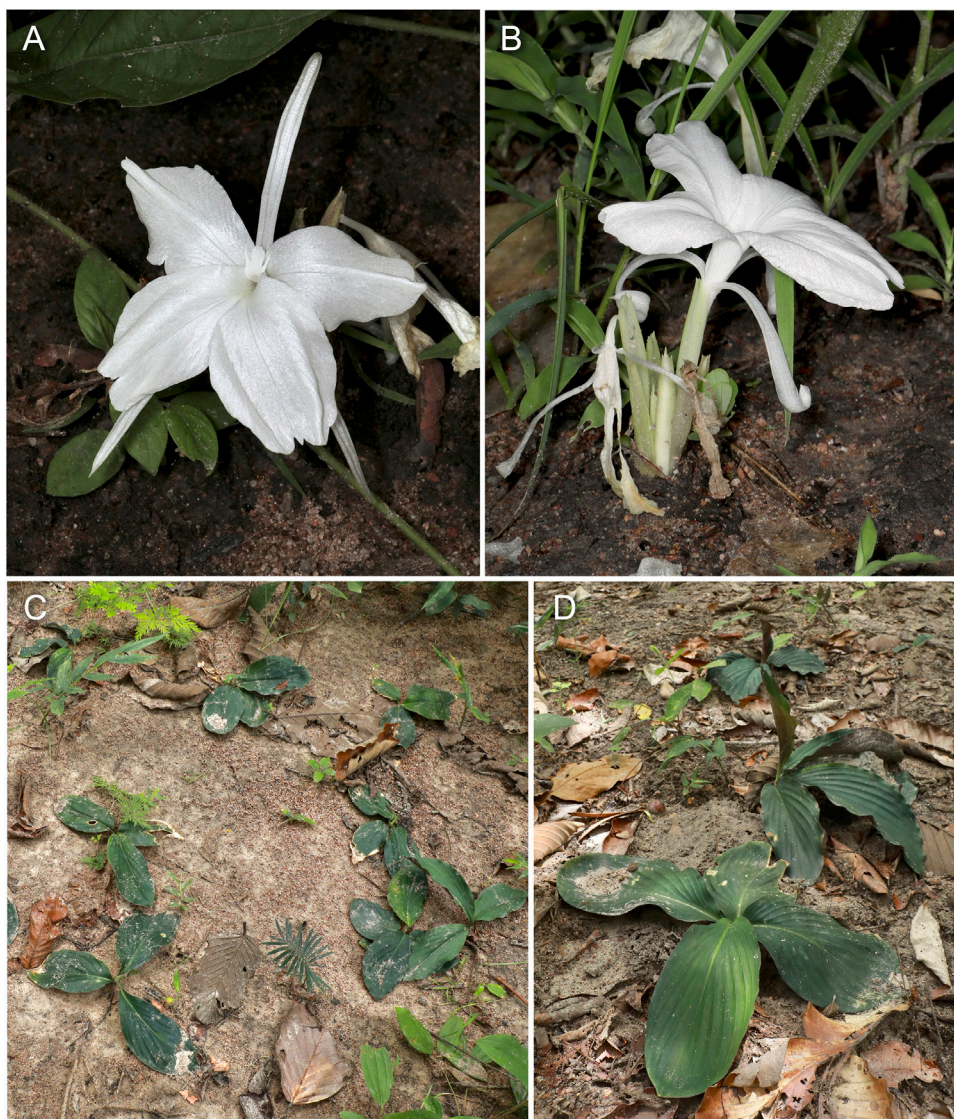


Figure 2. *Kaempferia albiflora* var. *albiflora*: A–B, Flower in top and side view, from Phran Kratai District, Kamphaeng Phet Province (29 May 2025); C–D, Habit of the plants from Phran Kratai District, Kamphaeng Phet Province (6 September 2024). Photos by Nattapon Nopporncharoenkul.

tooth shorter and wider than the laterals. Pistil 5.5–7 cm long; ovary cylindrical, 3.5–5 mm long, 1.5–3 mm in diam., creamy white, glabrous; epigynous glands 2, subulate, 5–8 mm long, creamy yellow; style 5–6.4 cm long; stigma crateriform, $1.5\text{--}1.8 \times 0.5\text{--}0.8$ mm, ostiole ciliate. Fruit ellipsoid to subglobose, 2–3 cm long, 0.6–1.5 cm in diam., creamy white to yellowish green, sometimes with brownish red spots, glabrous. Seeds obovoid to ellipsoid, (4–)6.5–7.2

mm long, 3–4 mm in diam., neon yellow to pale brown; aril white, semi-translucent, lacinate.

Distribution and habitat. *Kaempferia albiflora* var. *albiflora* is an endemic to Northern Thailand, where it is distributed across Kamphaeng Phet, Phitsanulok, Sukhothai, Tak, and Uttaradit Provinces. It typically grows on fine sandy soil in partially shaded deciduous dipterocarp forests, at elevations ranging from 110–160 m (Figure 5).

Phenology. Flowering period begins in May and continues until early July, with leafy shoots typically emerging in June. Fruits and seeds mature from June to July. In cultivation (*ex situ*), flowering may occur earlier, starting in April. The plants enter dormancy in November.

Vernacular name. Proh Mang Mum (เปรี้ยวแมงมูม).

Preliminary conservation status. *Kaempferia albiflora* var. *albiflora* has an estimated extent of occurrence (EOO) of 10,200 km² and an area of occupancy (AOO) of 60 km², with a population exceeding over 1,000 mature individuals (GeoCAT; Bachman *et al.*, 2011). Although some subpopulations are situated within protected community forests, several others in unprotected localities are severely threatened by the expansion of cassava cultivation. Therefore, *K. albiflora* var. *albiflora* is assessed as Vulnerable (VU) under criteria B1ab(iii,v) + B2ab(iii,v); C2a(i) according to the IUCN Red List Categories and Criteria, version 16 (IUCN Standards and Petitions Committee, 2024).

Additional specimens examined. THAILAND. Kamphaeng Phet Province: Phran Kratai District, 3 May 2018 (fl.), *N. Nopporncharoenkul* NNSB-634 (QBG). **Phitsanulok Province:** Wat Bot District, 7 Jul 2010 (fl.), Tiptabiankarn 19212 (SRL); 13 Jun 2019 (fl.), *N. Nopporncharoenkul* NNSB-741 (SLR, flowers preserved in spirit). **Sukhothai Province:** Khiri Mat District, 1 Jun 2012 (fl.), Tiptabiankarn 20524 (SRL). **Tak Province:** Wang Prachop, Mueang Tak District, 22 Apr 2002 (fl.), Tiptabiankarn 7911 (BKF, SRL); Wang Prachop, Mueang Tak District, 1 Jun 2017 (fl.), *N. Nopporncharoenkul* NNSB-546 (QBG). **Uttaradit Province:** Tha Sak, Phichai District, 22 Apr 2017 (fl.), *N. Nopporncharoenkul* NNSB-532 (SLR, flowers preserved in spirit).

Kaempferia albiflora* var. *longiflora Noppornch. & Somnoo, **var. nov.**
(Figures 3–4)

Types. Thailand: Wang Prachop, Mueang Tak District, Tak Province, 130 m, 20 May 2019, *N. Nopporncharoenkul* NNSB-716 (holotype: QBG, including flowers preserved in spirit as part of a single specimen; isotype: SLR).

Diagnosis. Similar to *Kaempferia albiflora* var. *albiflora* in its floral characters, but clearly differs by its significantly longer floral tube, 8–10.5 cm long (vs. 4.5–5.5 cm long), a tufted habit with up to 6 shoots (vs. typically solitary shoot), an upright leafy shoot reaching up to 40 cm tall with 7–8 leaves per shoot (vs. a semi-appressed leafy shoot up to 15 cm tall with a mostly subterranean pseudostem and 3–5 leaves), and linear to narrowly lanceolate-oblong leaf blades (vs. broadly elliptic, ovate to lanceolate-oblong leaf blades).

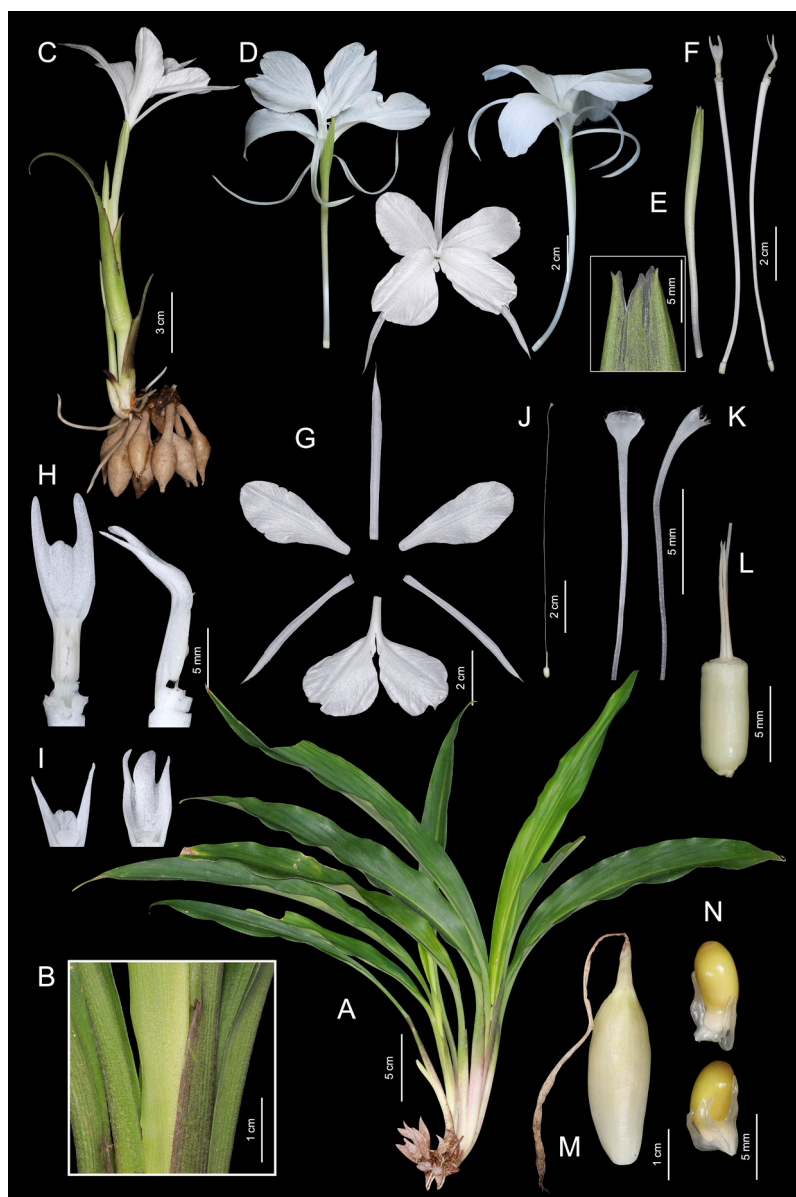


Figure 3. *Kaempferia albiflora* var. *longiflora*: A, Habit; B, Detail of ligules and leaf sheaths; C, Inflorescence and rhizome; D, Flower in front, side and top view; E, Calyx (inset: detail of apex); F, Floral tube with ovary and stamen in front and side view; G, Flower dissection (dc, dorsal corolla lobe; l, labellum; lc, lateral corolla lobe; ls, lateral staminode); H, Stamens in front and side view; I, Detail of anther crests in front and side view; J, Pistil; K, Detail of stigma and style in front and side view; L, Ovary with epigynous glands; M, Fruit; N, Seeds. Photos by Nattapon Nopporncharoenkul of a plant vouchered by N. Nopporncharoenkul NNSB-716 (QBG).



Figure 4. *Kaempferia albiflora* var. *longiflora*: A–B, Flowers, from Mueang Tak District, Tak Province (28 May 2025); C–E, Habit of the plants from Mueang Tak District, Tak Province (6 September 2024). Photos by Nattapon Nopporncharoenkul.

Description. Rhizomatous perennial herb, 30–40 cm tall. Rhizome ovoid to subglobose, 1–1.2 cm long, 1–1.4 cm in diam. Root stalks 0.4–2(–2.8) cm long, 0.2–0.4 cm in diam.; tubers fusiform to narrowly fusiform, 1–3 cm long, 0.6–1.2 cm in diam. Leafy shoot with 7–8 leaves, erect. Pseudostem upright, up to 11 cm long. Bladeless sheaths 2, up to 10 cm long, green, apex mucronate, villous. Leaf sheaths light green to purplish red, villous; ligule bilobed, lobes rounded, 1–2 mm long, semi-translucent, light green to purplish red, villous; pseudopetiole 2.5–4 cm long, green, villous; leaf blade linear to narrowly lanceolate, 18–32 × (1–)1.5–3.2(–4.5) cm, adaxially green, glabrous, abaxially green, villous, base attenuate, margin entire to slightly undulate, apex acute to mucronate. Inflorescence lateral; sheathing bracts 2, ovate to lanceolate, 2.5–7 × 1–1.2 cm, apex mucronate to attenuate, light green to deep reddish, sparsely villous; peduncle up to 4 cm long, sparsely villous; raceme fusiform-ovoid, 5–8.5 cm long, 1–1.5 cm in diam., composed of up to 8 bracts; bracts ovate to lanceolate-ovate, 5–6.5 × 0.6–2 cm, apex mucronate to caudate, light green, sometimes reddish at apex and margin, sparsely villous; bracteoles lanceolate-ovate, 10–20 × 5–8 mm, hyaline, apex irregularly bifid, sparsely villous. Flowers 12–14 cm long. Calyx 7.3–9.2 cm long, 0.5–0.7 cm in diam., with a unilateral incision 1.8–2.2 cm long, apex irregularly trilobed, light green, glabrous at apex. Floral tube 8–10.5 cm long, 2.5–3 mm in diam., white, glabrous; dorsal corolla lobe lanceolate-oblong, (5–)6–6.5 × (0.5–)0.6–0.7 cm, apex hooded, aristate, arista 5–6 mm long, white, glabrous; lateral corolla lobes lanceolate-oblong, (4–)5–5.8 × 0.5–0.6 cm, apex aristate, arista 2–3 mm long, white, glabrous. Lateral staminodes obovate to oblanceolate, (3.5–)4–4.6 × 1.6–2 cm, apex obtuse, rounded to mucronate, usually arcuate, white. Labellum obdeltoid to broadly obovate, (3.5–)4.2–4.6 × (3.8–)4.8–5.3 cm, white with a basal pale yellowish patch, sometimes with two pale purple patches, bilobed, incised to ca. 2/3 of its length; lobes broadly obovate to suborbicular, imbricate, 2.7–3.2 × 2.5–2.8 cm, apex crenate to incised, arcuate. Stamen 10–16 mm long, subsessile; anther 9–15 mm long (including crest), connective white, glabrous; anther thecae 4–5 × 1.8–2 mm, creamy white; anther crest reflected at ca. 135° to the anther, elliptic to obdeltoid, 6–10 × 4–5 mm, apex irregularly tridentate, middle tooth shorter and wider than the laterals. Pistil 9.2–12 cm long; ovary 5–8 mm long, 3–3.5 mm in diam., creamy yellow, glabrous; epigynous glands 2, subulate, 6–8 mm long, creamy yellow; style 8.5–11 cm long; stigma crateriform, 2.6 × 1.4 mm, ostiole ciliate. Fruit ellipsoid, 3–3.5 cm long, 1–1.2 cm in diam., creamy white to yellowish, glabrous. Seeds ellipsoid to obovoid, 6.5–7 mm long, 3–3.5 mm in diam., yellowish cream; aril white, semi-translucent, laciniate.

Distribution and habitat. The new variety is endemic to a restricted area in Wang Prachop, Mueang Tak District, Tak Province, Northern Thailand. It grows in partially shaded deciduous dipterocarp forests on fine sandy soil, typically occurring in close proximity to tree bases or stumps, at an elevation of approximately 130 m (Figure 5).

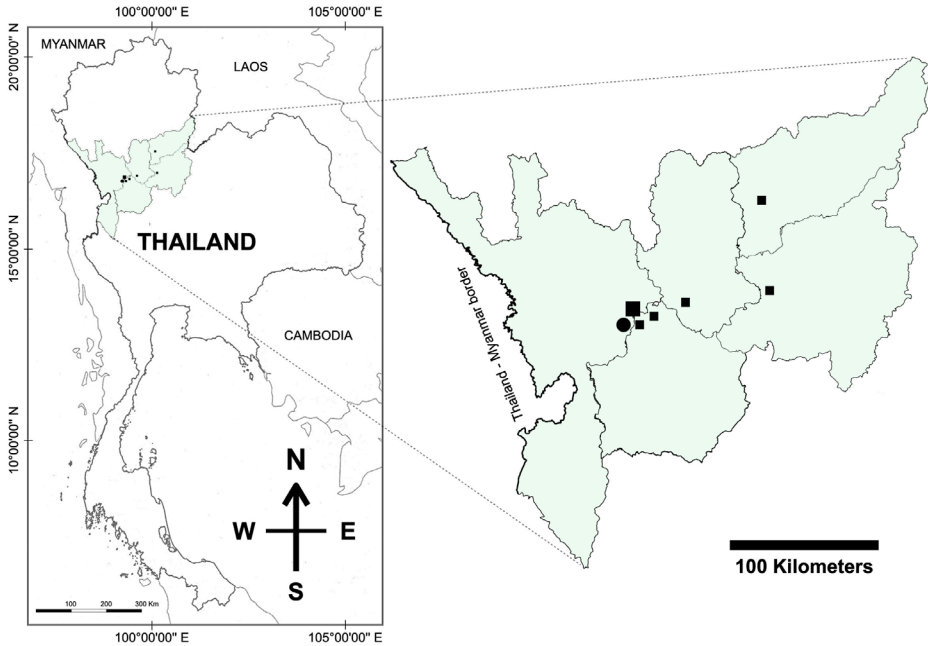


Figure 5. Distribution of *Kaempferia albiflora* var. *albiflora* (squares) and *K. albiflora* var. *longiflora* (dot). The larger sizes indicate the type localities.

Phenology. Flowering begins in late May and continues through June, with leafy shoots typically emerging in June. Fruits and seeds reach maturity from June to July. In cultivation (*ex situ*), flowering may occur earlier, starting in April. The plants enter dormancy in November.

Etymology. The varietal epithet “*longiflora*” is derived from Latin, referring to the exceptionally elongate floral tube, which represents the longest recorded within *Kaempferia* subgen. *Protanthium*.

Vernacular name. Proh Mang Mum Dok Yao (เปราะแมงมุดอกยาว).

Preliminary conservation status. Based on extensive field surveys conducted throughout Thailand over several years, this new variety is currently known only from the type locality, with a population of fewer than 100 individuals. Although EOO cannot be calculated for a single locality, the AOO is estimated to be less than 1 km². Furthermore, the occurrence is not within a legally protected area and is surrounded by rice paddies, cassava plantations, and a refuse dump. Consequently, the population is at high risk of decline due to agricultural expansion and habitat deterioration. Based on the available information, *K. albiflora* var. *longiflora* is provisionally assessed as Critically Endangered (CR) under criteria B1ab(i,iii,v) + B2ab(i,iii,v); C2a(ii) (IUCN Standards and Petitions Committee, 2024).

Additional specimens examined. THAILAND. Tak Province: Wang Prachop, Mueang Tak District, 130 m, 20 May 2019 (fl.), N. Yadee, N. Tathana, T. Somnoo 20192239 (QBG); Wang Prachop, Mueang Tak District, 6 Sep 2024, *N. Nopporncharoenkul NNSB-1074* (SLR, including flowers preserved in spirit).

Note. *Kaempferia albiflora* var. *longiflora* consistently exhibits significant morphological differences from *K. albiflora* var. *albiflora*. Field investigations confirmed that the population of *K. albiflora* var. *albiflora* was not found co-occurring with *K. albiflora* var. *longiflora* in its natural habitat. This distinct parapatric distribution, coupled with its stable morphological characteristics, led us to establish it as a new variety rather than a new form.

Kaempferia grandifolia Seansouk & Jenjitt., *Nordic J. Bot.* 21: 139 (2001).
(Figures 6–7)

Types. Thailand: Kok Phu Ta Kha, Phu Wiang District, Khon Kaen Province, 5 March 1998, Saensouk 55 (holotype: BKF; isotype: AUU, BK, KKU).

Description. Rhizomatous perennial herb, up to 8 cm tall. Rhizome subglobose, 1.5–2.5 cm long, 1.5–2.5 cm in diam., light brown externally, creamy white internally, with fascicled storage roots and terminal tubers. Root stalks swollen, 1.5–5.5(–9.5) cm long, up to 0.6 cm in diam.; tubers fusiform, ellipsoid to narrowly ovoid, 2.3–6 cm long, 1.2–2 cm in diam. Leafy shoot with 3–5 leaves, semi-appressed to the ground. Pseudostem almost subterranean, up to 10 cm tall, composed of leaf sheaths. Bladeless sheaths 2–3, (3–)6–9 cm long, green, apex rounded to mucronate, mucro ca. 1 mm long, sparsely villous. Leaf sheaths green with purplish red margins, sparsely villous; ligule bilobed, lobes rounded to broadly triangular, apex obtuse, (0.6–)1–1.4 cm long, semi-translucent to opaque, green to purplish red, sparsely villous; pseudopetiole subsessile; leaf blade suborbicular (proximal two leaves), broadly elliptic to ovate, 14–42 × 13–28 cm, adaxially dull green, usually with a pale silver-grey variegated pattern along the margin, glabrous, abaxially green, usually with a purplish red patch from the apex, sparsely villous, base attenuate to obtuse, margin entire to slightly undulate, apex mucronate, mucro 1–2 mm long. Inflorescence lateral, emerging before the leaves, mostly embedded in the soil; peduncle obscured by bladeless sheaths, up to 1 cm long, sparsely villous; raceme fusiform-ovoid, ca. 5.5 cm long, 1.6 cm in diam., composed of up to 30 bracts; bracts deltoid-ovate to lanceolate-ovate, 2.5–5.5 × 1.7–2.5 cm (outer ones larger), apex mucronate, creamy white to pale brown with reddish to pale brownish veins, sparsely villous; bracteoles lanceolate-ovate, ca. 25 × 5–7 mm, hyaline, apex irregularly bifid (incision 4–5 mm long), apex mucronate to acute, sparsely villous. Flowers ca. 8 cm long, nocturnal; floral plane flat and parallel to the ground, lateral staminodes and labellum arranged in the same plane, horizontal to slightly arcuate. Calyx 4.3–5.5 cm long, 0.4–0.5 cm in diam., with a unilateral incision 0.9–1.4 cm long, apex truncate to shallowly trilobed-crenate with 3 mucronate teeth, semi-translucent white, sparsely villous. Floral tube 5–6 cm long, ca. 2 mm

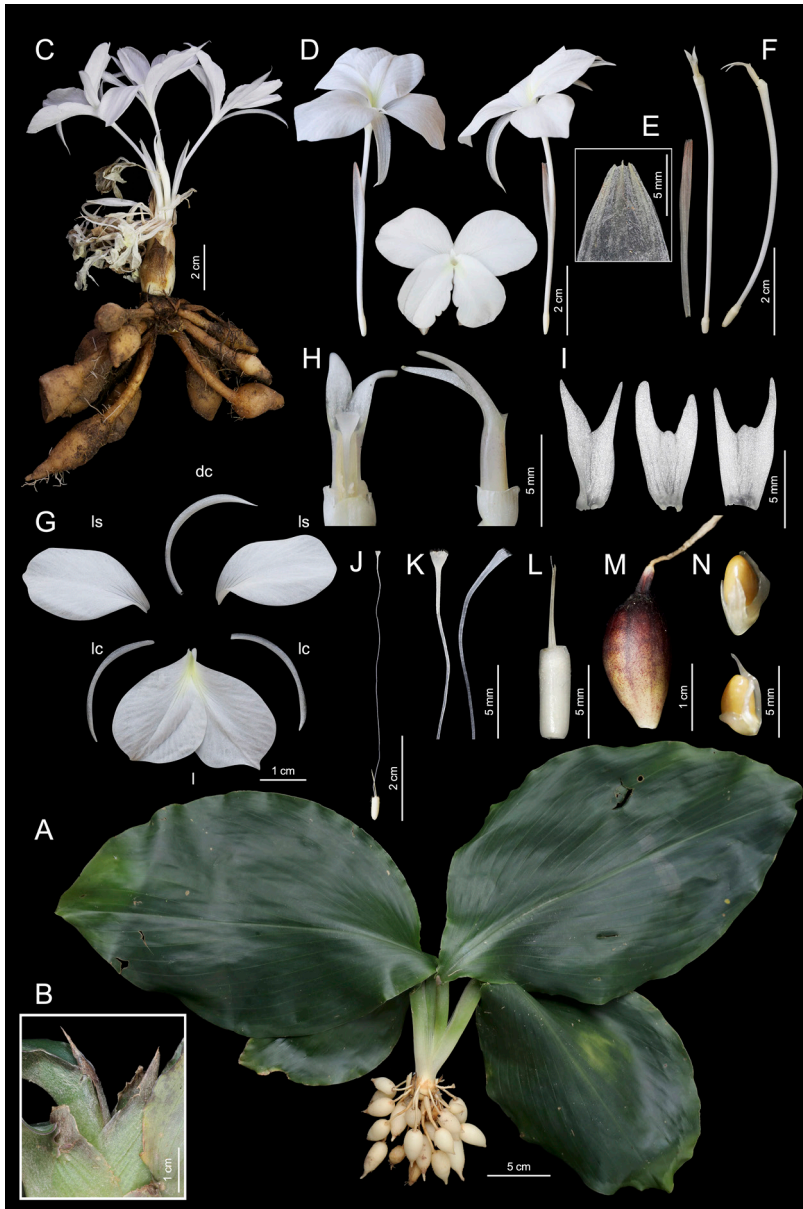


Figure 6. *Kaempferia grandifolia*: A, Habit; B, Detail of ligules and leaf sheaths; C, Inflorescence and rhizome; D, Flower in front, side and top view; E, Calyx (inset: detail of apex); F, Floral tube with ovary and stamen in front and side view; G, Flower dissection (dc, dorsal corolla lobe; l, labellum; lc, lateral corolla lobe; ls, lateral staminode); H, Stamens in front and side view; I, Detail of anther crests in front and side view; J, Pistil; K, Detail of stigma and style in front and side view; L, Ovary with epigynous glands; M, Fruit; N, Seeds (Photos by Nattapon Nopporncharoenkul of a plant voucherred by N. Nopporncharoenkul NNSB-519, SLR).

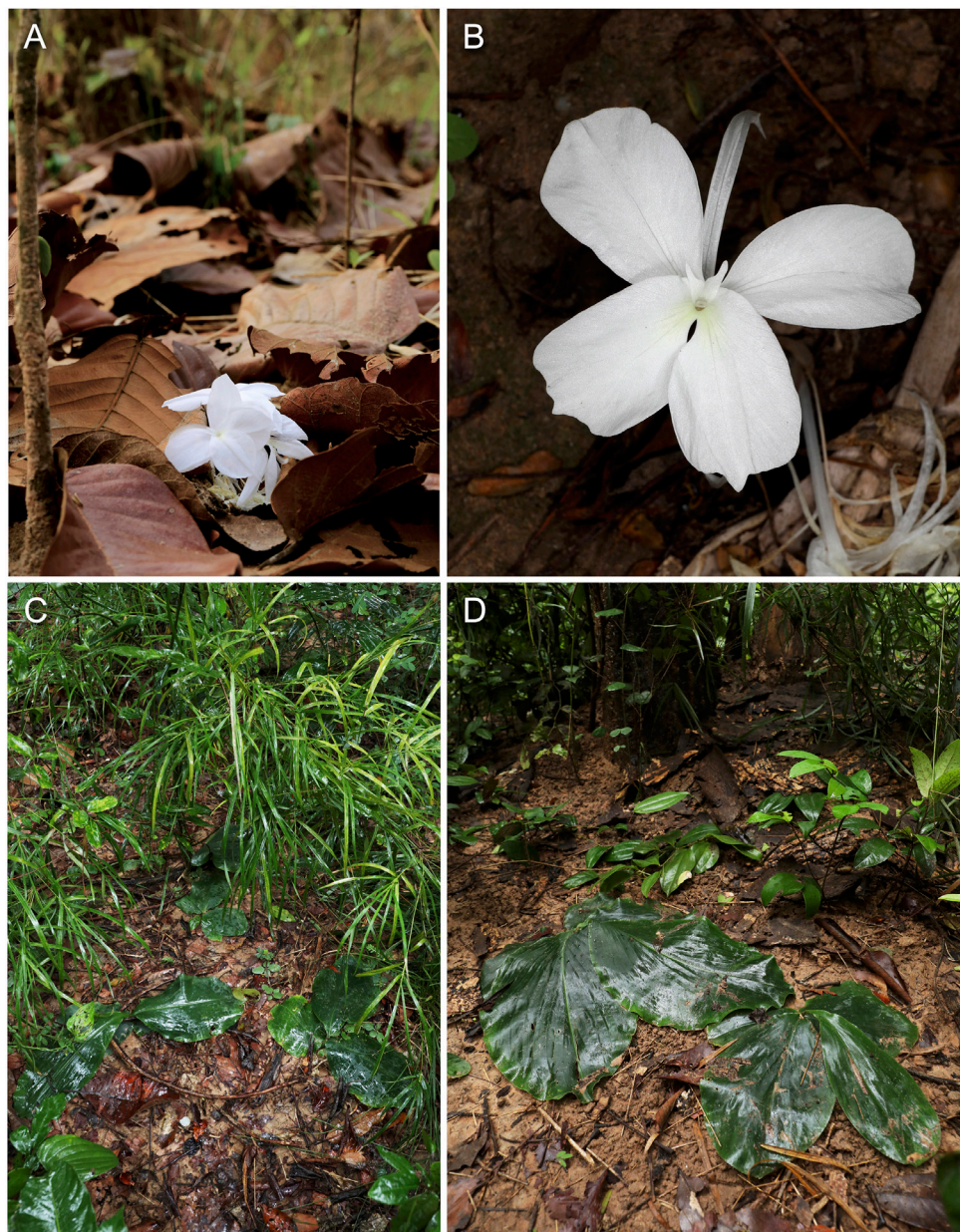


Figure 7. *Kaempferia grandifolia*: A–B, Flowers, from Phu Wiang District, Khon Kaen Province (28 February 2015); C–D, Habit of the plants from Phu Wiang District, Khon Kaen Province (16 October 2020). Photos by Nattapon Nopporncharoenkul.

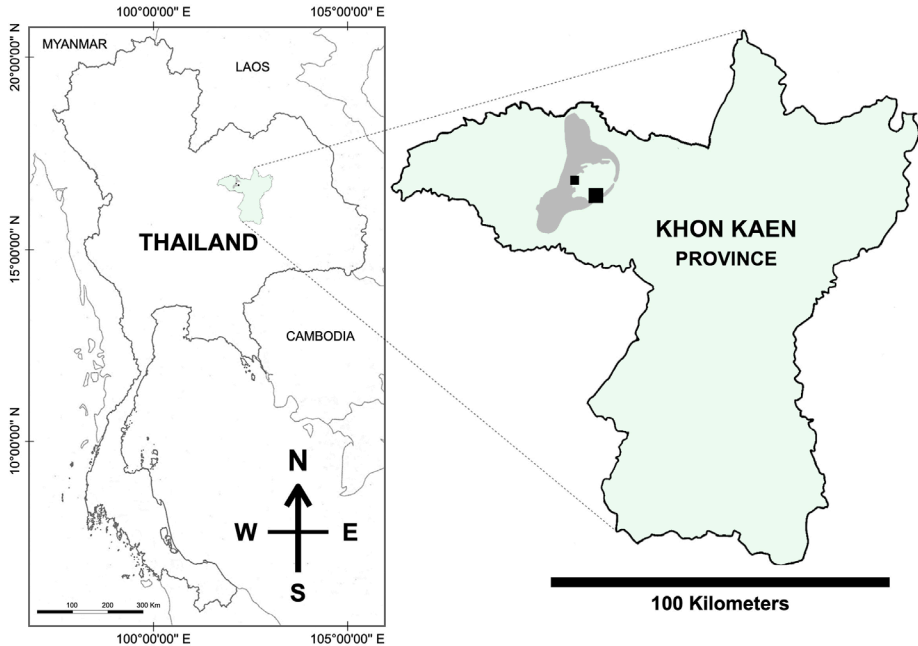


Figure 8. Distribution of *Kaempferia grandifolia* (squares). The larger size indicates the type locality.

in diam., white, glabrous, narrowly cylindrical at base, narrowly funnel-shaped distally; dorsal corolla lobe lanceolate-oblong, $3.3\text{--}3.6 \times 4\text{--}5$ cm, apex hooded, mucronate, mucro ca. 4 mm long, concave, arcuate, white, glabrous; lateral corolla lobes lanceolate-oblong, $2.9\text{--}3.4 \times 0.3\text{--}0.4$ cm, apex mucronate, mucro ca. 1 mm long, concave, arcuate, white, glabrous. Lateral staminodes obovate to ellipsoid, $2.7\text{--}3.2 \times 1.5\text{--}1.8$ cm, apex cuspidate, acute to rounded (rarely slightly obcordate), white. Labellum broadly obovate to obdeltoid, $2.2\text{--}2.6 \times 3.2\text{--}3.7$ cm, white with a basal pale yellow patch (rarely with two pale purple spots), deeply bilobed, incised to more than $2/3$ of its length, base involute and enclosing the anther; lobes suborbicular to broadly obovate, $2.2\text{--}2.5 \times 1.4\text{--}1.9$ cm, apex cuspidate, rounded to slightly obcordate, partly overlapping, arcuate. Stamen 7–10 mm long, subsessile; filament up to 1 mm long; anther 4–5 mm long (including crest), connective white, glabrous; anther thecae $3.5\text{--}4 \times 1$ mm, creamy white; anther crest reflected at ca. 135° to the anther, oblong, $4\text{--}5.5 \times 2.3\text{--}3$ mm, apex conspicuously bifid to bilobed, lobes acute. Pistil 5.5–6.5 cm long; ovary cylindrical, 4–5 mm long, 2–3 mm in diam., trilocular, creamy white, sparsely villous; epigynous glands 2, subulate, ca. 6 mm long, creamy white; style 5–6 cm long; stigma crateriform, ca. 1.5×1 mm, ostiole ciliate. Fruit obovoid to ellipsoid, 2–2.5 cm long, 1–1.2 cm in diam., trilocular, pale brown to deep purple with deep reddish to deep purplish red spots, sparsely villous. Seeds obovoid to ellipsoid, 4–5 mm long, 2–3 mm in diam., pale brown; aril white, semi-translucent, lacinate.

Distribution and habitat. *Kaempferia grandifolia* is endemic to Thailand, where it is restricted to the Phu Wiang Mountain Range in Khon Kaen Province, Northeastern Thailand. It grows on fine sandy soil in partially shaded deciduous dipterocarp forests, at elevations ranging from 230–400 m (Figure 8).

Phenology. Flowering period begins in February and continues until March, with leafy shoots typically emerging in April. Fruits and seeds mature from March to April. The plants enter dormancy in November.

Vernacular name. Tup Mup Bai Yai (ตูปหมูปใบใหญ่)

Preliminary conservation status. *Kaempferia grandifolia* has an estimated extent of occurrence (EOO) of 400 km² and an area of occupancy (AOO) of less than 10 km², with a total population of approximately 100 mature individuals (GeoCAT; Bachman *et al.*, 2011). Although several subpopulations are located within protected areas, such as Phu Wiang National Park and the Kok Phu Ta Kha Plant Genetic Conservation Project (under the Royal Initiative of Her Royal Highness Princess Maha Chakri Sirindhorn), they remain threatened by habitat disturbance resulting from dinosaur fossil exploration and related activities. Consequently, *K. grandifolia* is assessed as Endangered (EN) B1ab(iii,iv,v) + B2ab(iii,iv,v); C2a(i) based on the IUCN Red List Categories and Criteria, version 16 (IUCN Standards and Petitions Committee, 2024).

Additional specimens examined. THAILAND. Khon Kaen Province: Kok Phu Ta Kha, Phu Wiang District, 230 m, 28 February 2015 (fl.), *N. Nopporncharoenkul* NNSB-320 (SLR, including flowers preserved in spirit); Kok Phu Ta Kha, Phu Wiang District, 230 m, 6 March 2017 (fl.), *N. Nopporncharoenkul* NNSB-519 (SLR); Phu Wiang National Park, Phu Wiang District, 400 m, 26 April 2023, *N. Nopporncharoenkul* NNSB-907 (SLR).

Kaempferia noctiflora Noppornch. & Jenjitt., Phytotaxa 316(1): 67 (2017); Ann. Bot. Fenn. 61: 79 (2024).

Types. Thailand: Ban Sahakorn, Mae On District, Chiang Mai Province, 23 May 2015, *N. Nopporncharoenkul* NNSB-340 (holotype: BKF; isotype: E, SING, BK, QBG, SLR). Figures 10–14.

Description. Rhizomatous perennial herb, up to 45 cm tall. Rhizome ovoid to subglobose, 0.8–2 cm long, 0.8–1.8 cm in diam., brown externally, creamy white internally, with short fascicled storage roots and terminal tubers. Root stalks swollen, 0.2–2.5 cm long, 0.2–0.6 cm in diam.; tubers ovoid, ellipsoid, fusiform to narrowly fusiform, 1–3.5 cm long, 0.4–1.2 cm in diam. Leafy shoot with 3–8 leaves, semi-appressed to the ground or erect. Pseudostem almost subterranean or upright (up to 15 cm tall), composed of leaf sheaths. Bladeless sheaths 2–3, up to 10 cm long, light green (sometimes with deep purplish red at apex), reddish to deep purplish red, apex rounded, cuspidate to mucronate (mucro ca. 1 mm

long), villous. Leaf sheaths green, reddish to deep purplish red, densely villous; ligule bilobed-truncate, lobes rounded to broadly triangular with obtuse apex, 1–4 mm long, translucent to opaque, greenish white to purplish red, villous; pseudopetiole subsessile to 6 cm long, green to deep purplish red, villous; leaf blade ovate, elliptic to lanceolate-oblong, $10\text{--}35 \times 5\text{--}15$ cm, adaxially dull green, greyish green to deep purple, often with a deep purplish red patch along the midvein, or with 1–3 layers of white to pale silver-grey variegated pattern along leaf edges, between midrib and both side of edges (rarely fully pale silver-grey leaves), glabrous or sparsely villous, abaxially light green to deep purplish red, villous, base acute, attenuate, obtuse to rounded, sometimes slight oblique, margin entire to slightly undulate with purplish red band along the margin, apex attenuate, acuminate, mucronate to cuspidate. Inflorescence lateral, emerging from the rhizome before the leaves, partly embedded in the soil; peduncle obscured by bladeless sheaths, up to 5 cm long, glabrous or sparsely villous; raceme fusiform-ovoid, 3–4.5 cm long, 1–2 cm in diam., composed of up to 20 bracts; bracts deltoid-ovate to lanceolate-ovate, $1.2\text{--}4.5 \times 0.6\text{--}3.8$ cm (outer ones larger), apex mucronate, creamy white, light green, reddish to purplish red, villous; bracteoles lanceolate-ovate, $10\text{--}17 \times 4\text{--}8$ mm, hyaline, apex irregularly deeply bifid, apices mucronate to acute, glabrous or sparsely villous. Flowers 5.5–11 cm long, nocturnal (var. *noctiflora* and var. *villosa*) or diurnal (var. *thepthepae*); floral plane perpendicular to the ground, lateral staminodes upright to arcuate and distal half of labellum deflexed. Calyx 2.8–6.3 cm long, 0.3–0.6 cm in diam., with a unilateral incision 0.7–1.5 cm long, apex truncate to shallowly trilobed-crenate with 3 mucronate teeth, semi-translucent white, yellowish green, light green to reddish, glabrous or sparsely villous. Floral tube 3.5–7 cm long, 2–2.5 mm in diam., white, glabrous, narrowly cylindrical at base, narrowly funnel-shaped distally; dorsal corolla lobe lanceolate-oblong, $2.5\text{--}5 \times 0.4\text{--}0.8$ cm, apex hooded, mucronate, mucro 1–5 mm long, concave, arcuate, white, glabrous; lateral corolla lobes lanceolate-oblong, $2.5\text{--}4.5 \times 0.3\text{--}0.6$ cm, apex mucronate, mucro ca. 1 mm long, concave, arcuate, white, glabrous. Lateral staminodes oblanceolate, elliptic, obovate to broadly obovate, $2.2\text{--}4.5 \times 1\text{--}3.8$ cm, apex cuspidate, acute, obtuse to rounded, sometimes slightly arcuate, white. Labellum broadly broadly obovate to obdeltoid, $2.5\text{--}4.5 \times 1.5\text{--}3.8$ cm, white, usually with a basal pale yellowish patch (var. *noctiflora* and var. *villosa*) or light purple, with a central white to creamy white patch at the base, flanked by two light purple stripes extending towards the center of the lobes (var. *thepthepae*), bilobed, incised to 1/2 to 2/3 of its length, base flat; lobes suborbicular, obovate to elliptic, $1.3\text{--}2.5 \times 1\text{--}1.8$ cm, apex acute, rounded, cuspidate, crenate to obcordate, partly overlapping, arcuate. Stamen 10–18 mm long; filament 1–2 mm long, 1–2.5 mm broad, white puberulent with very short glandular hairs dorsally and laterally; anther 10–18 mm long (including crest), connective white, puberulent with very short glandular hairs dorsally and laterally; anther thecae $3\text{--}6 \times 1\text{--}2.2$ mm, white to creamy white; anther crest reflected at $135^\circ\text{--}150^\circ$ to the anther, ovate, elliptic to oblong (narrowly obdeltoid), $4\text{--}12 \times 2.5\text{--}6$ mm, apex bifid to bilobed, usually

with 2–3 small crenate teeth, apices acuminate, acute to obtuse. Pistil 5.2–8 cm long; ovary cylindrical, 3–6 mm long, 2–3 mm in diam., trilocular, creamy white, glabrous or sparsely villous; epigynous glands 2, subulate, 3.5–7 mm long, creamy white; style 4.8–7.3 cm long, stigma crateriform, $1.2\text{--}3 \times 0.8\text{--}1.5$ mm, ostiole ciliate. Fruit subglobose, ellipsoid, ovoid to oblate, 1.8–2.5 cm long, 0.8–1.2 cm in diam., trilocular, creamy white, yellowish cream, green, pale brown, sometimes with reddish spots/stripes, glabrous or sparsely villous. Seeds obovoid, ellipsoid to prolate, 4–7.5 mm long, 2–4 mm in diam., creamy yellow, greenish yellow to pale brown, sometimes with reddish spots; aril white, semi-translucent, lacinate.

Key to the varieties in *Kaempferia noctiflora*

- 1a. Labellum white or white with a central pale-yellow patch at the base. 2.
- 1b. Labellum white to light purple, with a central white to creamy white patch at the base, flanked by two light purple stripes extending towards the center of the lobes. **var. *thepthepae***
- 2a. Leafy shoot semi-appressed to the ground, with 3–6 leaves; leaf blade ovate to elliptic, $10\text{--}25 \times 7\text{--}14.5$ cm, adaxially dull green to deep purple, usually with a deep purplish red patch along the midvein; pseudopetiole subsessile to 1 cm long, sparsely villous. **var. *noctiflora***
- 2b. Leafy shoot upright up to 45 cm tall, with 6–8 leaves; leaf blade narrowly ovate, elliptic to lanceolate-oblong, $13\text{--}35 \times 5\text{--}8.5$ cm, adaxially greyish green; pseudopetiole 2–6 cm long, densely villous **var. *villosa*, var. nov.**

Kaempferia noctiflora var. *noctiflora*

(Figures 9–10)

Description. Rhizomatous perennial herb, up to 5–12 cm tall. Rhizome ovoid to subglobose, 1.2–2 cm long, 1.2–1.8 cm in diam. Root stalks 0.5–2.5 cm long, 0.3–0.5 cm in diam.; tubers fusiform to ellipsoid, 1.2–3.5 cm long, 0.8–1.4 cm in diam. Leafy shoot with 3–5(–6) leaves, semi-appressed to the ground. Pseudostem almost subterranean, 3–4.5(–8) cm tall. Bladeless sheaths up to 5.5 cm long, green to purplish red, apex rounded to cuspidate, sparsely villous. Leaf sheaths green to purplish red, sparsely villous; ligule bilobed-truncate, lobes broadly triangular with obtuse apex, 2–3 mm long, translucent, greenish white to purplish red, sparsely villous; pseudopetiole subsessile, up to 1 cm long, green to purplish red, sparsely villous; leaf blade ovate to elliptic, $10\text{--}17(–25) \times 7\text{--}10(–14.5)$ cm, adaxially light green, dull green to deep purple, usually with a deep purplish red patch along the midvein (rarely with white to pale silver-grey variegated pattern along leaf edges, between midrib and both side of edges), glabrous, abaxially light green to deep purplish red, sparsely villous, base acute, obtuse to rounded, margin entire to slightly undulate with light purplish red band, apex acuminate to cuspidate. Inflorescence lateral; peduncle up to 1 cm long; raceme fusiform-

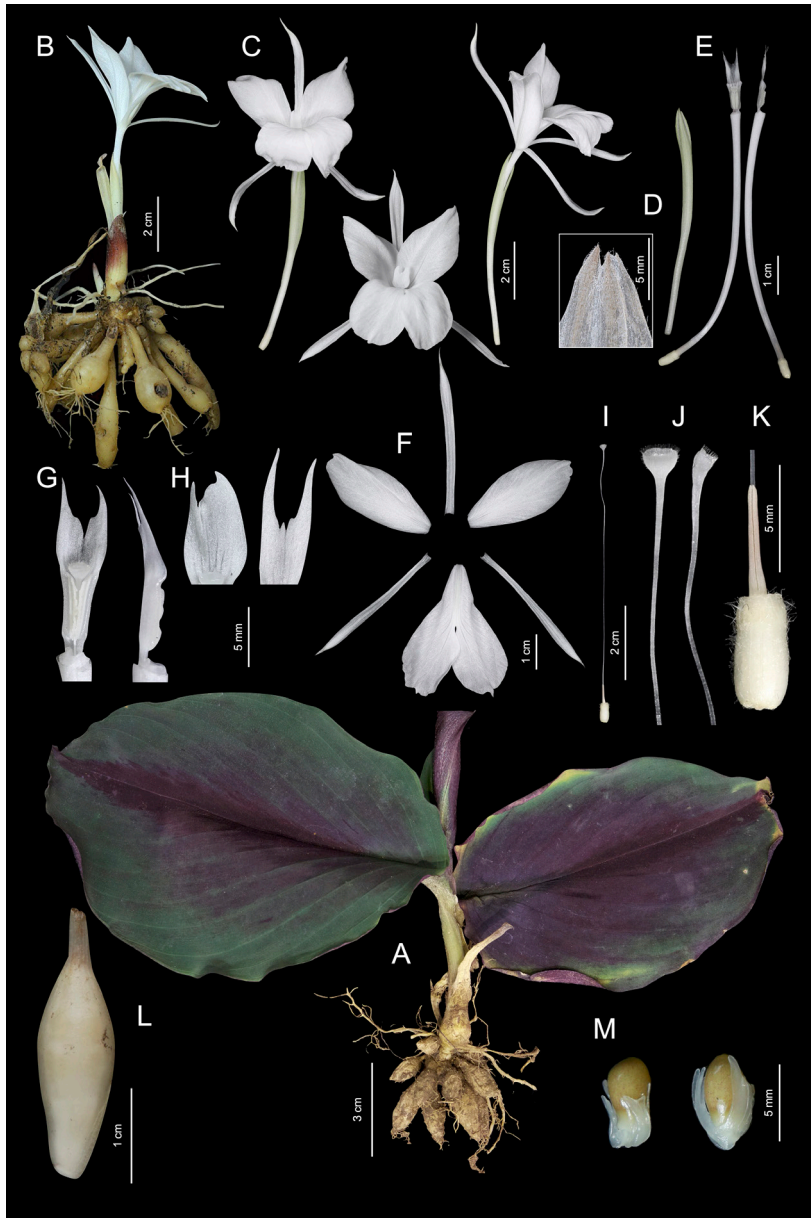


Figure 9. *Kaempferia noctiflora* var. *noctiflora*: A, Habit; B, Detail of ligules and leaf sheaths; C, Inflorescence and rhizome; D, Flower in front, side and top view; E, Calyx (inset: detail of apex); F, Floral tube with ovary and stamen in front and side view; G, Flower dissection (dc, dorsal corolla lobe; l, labellum; lc, lateral corolla lobe; ls, lateral staminode); H, Stamens in front and side view; I, Detail of anther crests in front and side view; J, Pistil; K, Detail of stigma and style in front and side view; L, Ovary with epigynous glands; M, Fruit; N, Seeds (Photos by Nattapon Nopporncharoenkul of a plant vouchered by N. Nopporncharoenkul NNSB-340, BKF).



Figure 10. *Kaempferia noctiflora* var. *noctiflora*: A, Habitat; B, Flowers, from Doi Saket District, Chiang Mai Province (26 May 2025); C–D, Habit of the plants; C, Plant from Mae On, Chiang Mai Province (17 August 2015); D, Plant from Doi Saket District, Chiang Mai Province (3 September 2024). Photos by Nattapon Nopporncharoenkul.

ovoid, 3–4 cm long, (0.8–)1.2–1.5 cm in diam., composed of up to 20 bracts; bracts ovate to lanceolate-ovate, $1.3\text{--}3.5 \times 2\text{--}3$ cm, apex mucronate, creamy white, green to deep reddish, sparsely villous; bracteoles lanceolate-ovate, $12\text{--}17 \times 6\text{--}7$ mm long, hyaline, apex deeply bifid, apices acute, glabrous or sparsely villous. Flowers 6–11 cm long, nocturnal; Calyx (2.8–)3.4–6.3 cm long, (0.3–)0.5–0.6 cm in diam., with unilateral incision 0.7–1.5 cm long from apex, apex trilobed with 3 cuspidate-teeth, semi-translucent, white, yellowish white, greenish white to reddish, glabrous or sparsely villous. Floral tube (3.5–)5–7 cm long, ca. 0.2 cm in diam., white, glabrous; dorsal corolla lobe lanceolate-oblong, $3.5\text{--}5 \times 0.4\text{--}0.6$ (–0.7) cm, apex hooded, mucronate, mucro 4–5 mm long, concave, white, glabrous; lateral corolla lobes lanceolate-oblong, $3.2\text{--}4.5 \times 0.4\text{--}0.5$ cm, apex mucronate, mucro ca. 1 mm long, concave, white, glabrous. Lateral staminodes oblanceolate, obovate to elliptic, $3\text{--}4 \times 1.2\text{--}2$ cm, apex acute to obtuse, white. Labellum obdeltoid to broadly obovate, $3.2\text{--}4.5 \times 2.2\text{--}3.8$ cm, white with a central pale yellow patch at the base, bilobed, incised to ca. 1/2 of its length, base flat; lobe obovate, $1.9\text{--}2.4 \times 1.4\text{--}1.7$ cm, apex acute, rounded, crenate to slightly obcordate. Stamen 12–18 mm long; filament 1–2 mm long, 1.6–2.5 mm broad, white, puberulent with very short glandular hairs dorsally and laterally; anther 12–18 mm long (including crest); connective tissue white, puberulent with very short glandular hairs dorsally and laterally; anther thecae $4\text{--}6 \times 1\text{--}2.2$ mm, white to creamy white; anther crest anther crest reflected at ca. 150° to the anther, oblong to ovate, $7\text{--}12 \times 3\text{--}5.5$ mm, apex bifid to bilobed, usually deeply to anther crest base, sometimes with 2–3 small teeth between lobes, apices acuminate (outer), acute to obtuse (inner). Pistil 6.5–8 cm long; ovary cylindrical, 3–6 mm long, 2–3 mm in diam., creamy white, sparsely villous; epigynous glands 2, subulate, 4–5 mm long, creamy white; style 6–7 cm long; stigma crateriform, $2.5\text{--}3 \times 1.5$ mm, ostiole ciliate. Fruit ellipsoid, 1.8–2.2 cm long, 0.8–1 cm in diam., yellowish green, green to pale brown, sparsely villous. Seeds obovoid to ellipsoid, 4.5–7.5 mm long, 2–3 mm in diam., greenish yellow to pale brown; aril white, semi-translucent, lacinate.

Distribution and habitat. *Kaempferia noctiflora* var. *noctiflora* is endemic to Chiang Mai Province, Northern Thailand. It grows on loamy soil, usually with decayed rocks, in partially shaded deciduous dipterocarp forests at foothills and on hills, at elevations ranging from 400–700 m (Figure 15).

Phenology. Flowering period begins in late April and continues until June, with leafy shoots typically emerging in June. Fruits and seeds mature from May to July. The plants enter dormancy in November.

Vernacular name. Proh Ra Tri (เปราะราตรี)

Preliminary conservation status. *Kaempferia noctiflora* var. *noctiflora* is known from several localities in Chiang Mai Province, Northern Thailand. It has an estimated extent of occurrence (EOO) of ca. 3,000 km² and an area of occupancy (AOO) of ca. 1,000 km², with a total population exceeding 1,000 mature individuals (GeoCAT; Bachman et al., 2011).

However, its populations are currently threatened by habitat loss and fragmentation resulting from agricultural expansion and road construction. Furthermore, this variety is frequently collected from the wild by local people for consumption and as an ornamental plant. Based on the IUCN Red List Categories and Criteria, version 16 (IUCN Standards and Petitions Committee, 2024), *K. noctiflora* var. *noctiflora* is assessed as Vulnerable (VU) under the criteria B1ab(iii,v) + B2ab(iii,v); C2a(i).

Additional specimens examined. THAILAND. Chiang Mai Province: Ban Sahakorn, Mae On District, 11 June 2016 (fl.), *N. Nopporncharoenkul* NNSB-465 (SLR); 24 June 2017 (fl.), *N. Nopporncharoenkul* NNSB-554 (BKF); Huai Sai, Mae Rim District, 21 April 2018 (fl.), *N. Nopporncharoenkul* NNSB-619 (SLR); 26 April 2018 (fl.), *N. Nopporncharoenkul* NNSB-625 (SLR); Don Kao, Mueang Chiang Mai District, 13 June 2016 (fl.), *N. Nopporncharoenkul* NNSB-468 (SLR); Kuet Chang, Mae Taeng District, 6 May 2019 (fl.), *N. Nopporncharoenkul* NNSB-708 (SLR); Chang Phueak, Mueang Chiang Mai District, 10 May 2018 (fl.), *N. Nopporncharoenkul* NNSB-640 (SLR); 26 May 2019 (fl.), *N. Nopporncharoenkul* NNSB-725 (SLR); Phrao District, 30 May 2018 (fl.), *N. Nopporncharoenkul* NNSB-653 (SLR); Choeng Doi, Doi Saket District, 2 May 2024 (fl.), *N. Nopporncharoenkul* NNSB-974 (SLR); 3 September 2024, *N. Nopporncharoenkul* NNSB-1055 (SLR).

Kaempferia noctiflora var. *thepthepae* Noppornch. & Somnoo, Ann. Bot. Fenn. 61: 79 (2024). (Figures 11–12)

Types. Thailand: Mae Pong, Doi Saket Tak District, Chiang Mai Province, 349 m a.s.l., 20 June 2023, *N. Nopporncharoenkul* NNSB-928 (holotype: QBG, including flowers preserved in spirit as part of a single specimen; isotype: BK, BKF, SLR).

Description. Rhizomatous perennial herb, up to 5 cm tall. Rhizome ovoid to subglobose, 0.8–1.5(–2) cm long, (0.8–)1.2–1.8 cm in diam. Root stalks 0.2–1.6 cm long, 0.2–0.6 cm in diam.; tubers fusiform to ovoid, (1–)1.5–3.5 cm long, 0.7–1 cm in diam. Leafy shoot with 3–4(–7) leaves, semi-appressed to the ground. Pseudostem almost subterranean, up to 6 cm tall. Bladeless sheaths up to 5 cm long, deep purplish red, sometimes light green with deep purplish red at apex, apex shortly mucronate, densely villous. Leaf sheaths deep purplish red, densely villous; ligule bilobed-truncate, lobes triangular with obtuse apex, 1–4 mm long, opaque, deep purplish red, densely villous; pseudopetiole subsessile to 2 cm long, deep purplish red, densely villous; leaf blade ovate to elliptic, 11.5–23(–25) × 7–12.5(–15) cm, adaxially dull green to deep purple, usually with a deep purplish red patch along the midvein, sometimes with 1–3 layers of white to pale silver-grey variegated pattern along leaf edges, between midrib and both side of edges (rarely fully pale silver-grey leaves), glabrous or sparsely villous, abaxially deep purplish red (rarely dull green), densely villous, base slightly oblique, rounded to obtuse, margin entire to slightly undulate with deep purplish red band, apex attenuate to



Figure 11. *Kaempferia noctiflora* var. *thepthevae*: A, Habit; B, Inflorescence and rhizome; C, Flower in front, side and top view; D, Calyx (inset: detail of apex); E, Floral tube with ovary and stamen in front and side view; F, Flower dissection (dc, dorsal corolla lobe; l, labellum; lc, lateral corolla lobe; ls, lateral staminode); G, Stamens in front and side view; H, Detail of anther crests in front and side view; I, Pistil; J, Detail of stigma and style in front and side view; K, Ovary with epigynous glands; L, Fruit; M, Seeds (Photos by Nattapon Nopporncharoenkul of a plant vouchered by N. Nopporncharoenkul NNSB-928, QBG).



Figure 12. *Kaempferia noctiflora* var. *thepthepae*: A–B, Flowers in habitat; A, Plant from Mae Pong, Doi Saket District, Chiang Mai Province (20 June 2023); B, Plant Sala Pang Sak from Doi Saket District, Chiang Mai Province (2 May 2024); C–E, Habit of the plants; C–D, Plants from San Kamphaeng District, Chiang Mai Province (24 October 2023); E, Plant from Doi Saket District, Chiang Mai Province (24 October 2023). Photos by Nattapon Nopporncharoenkul.

mucronate. Inflorescence lateral; peduncle up to 2 cm long; raceme fusiform-ovoid, 3–3.8 cm long, 0.8–1.5 cm in diam., composed of up to 15 bracts; bracts broadly ovate to lanceolate-ovate, 1.3–3.8 × 0.4–3 cm, apex mucronate, light green, sometimes with longitudinal reddish to deep brownish red veins from apex, sparsely villous; bracteoles lanceolate-ovate, 12–13 × 4–8 mm long, hyaline, apex deeply bifid, apices acute, sparsely villous. Flowers 5.5–8 cm long, diurnal; Calyx 3–3.8 cm long, 0.4–0.5 cm in diam., with unilateral incision 1–1.2 cm long from apex, apex trilobed with 3 cuspidate-teeth, semi-translucent white, sparsely villous. Floral tube 4.5–5.5 cm long, 0.2–0.3 cm in diam., white, glabrous; dorsal corolla lobe lanceolate-oblong, (2.5–)3–4.5 × (0.5–)0.6–0.7 cm, apex hooded, mucronate, mucro 1–2 mm long, concave, white, glabrous; lateral corolla lobes lanceolate-oblong, (2.5–)3–4.2 × (0.3–)0.5–0.6 cm, apex mucronate, mucro ca. 1 mm long, concave, white, glabrous. Lateral staminodes obovate, elliptic to oblong, (2.2–)3.5–4.2 × (1–)1.4–1.8 cm, apex cuspidate, acute to obtuse, white. Labellum obdeltoid to obovate, (2.5–)3.5–4.5 × (1.5–)2.6–3.2 cm, white to light purple, with a central white to creamy white patch at the base, flanked by two light purple stripes extending towards the center of the lobes, bilobed, incised to 1/2 to 3/5 of its length, base flat, lobe suborbicular, obovate to elliptic, (1.3–)2–2.5 × (1–)1.3–1.8 cm, apex rounded, obcordate, cuspidate to slightly crenate. Stamen 10–18 mm long; filament 0.8–1 mm long, 1–1.5 mm broad, white, puberulent with very short glandular hairs dorsally and laterally; anther (8–)10–16 mm long (including crest); connective tissue white, puberulent with very short glandular hairs dorsally and laterally; anther thecae (3–)3.5–4.5 × 1–1.5 mm, white to creamy white; anther crest reflected at 135°–150° to the anther, ovate to oblong (rarely narrowly obdeltoid), (4–)5–8(–11) × 2.5–5.5 mm, apex bifid to bilobed, incised to 2–5.5 mm, sometimes with 1–2 small teeth between lobes, apices acute to obtuse. Pistil 5.2–5.5 cm long; ovary cylindrical, 3.5–5 mm long, 2–2.5 mm in diam., creamy white, sparsely villous; epigynous glands 2, subulate, 3.5–5 mm long, creamy white; style 4.8–5 cm long; stigma crateriform, 1.2–1.5 × 0.8–1 mm, ostiole ciliate. Fruit ellipsoid to subglobose, 2–2.5 cm long, 1–1.2 cm in diam., creamy white, sparsely villous. Seeds obovoid to ellipsoid, 4.5–5.8 mm long, 2–2.5 mm in diam., creamy yellow to pale brown; aril white, semi-translucent, lacinate.

Distribution and habitat. *Kaempferia noctiflora* var. *thepthepae* is endemic to Chiang Mai Province, Northern Thailand. It grows on fine sandy soil, usually with decayed sandstone rocks having a sugary texture, in partially shaded deciduous dipterocarp forests at foothills and on hills, at elevations ranging from 340–500 m (Figure 15).

Phenology. Flowering period begins in May and continues until mid-June, with leafy shoots typically emerging in June. Fruits and seeds mature from June to July. The plants enter dormancy in November.

Vernacular name. Proh Nop Pa Rat (เปราะนพรัตน์)

Preliminary conservation status. *Kaempferia noctiflora* var. *thepthepae* is currently known from five localities in Chiang Mai Province, Northern Thailand. It has an estimated

extent of occurrence (EOO) of ca. 80 km² and an area of occupancy (AOO) of ca. 40 km², with a total population exceeding over 1,000 mature individuals (GeoCAT; Bachman et al., 2011). Despite the population size, it faces multiple threats, including habitat disturbance from agricultural expansion, livestock grazing, and waste dumping within its area of occurrence. Furthermore, this variety is subject to overexploitation, being collected from the wild by local people for home consumption (young leaves) and sold as a rare ornamental plant. Based on the IUCN Red List Categories and Criteria, version 16 (IUCN Standards and Petitions Committee, 2024), *K. noctiflora* var. *thepthepae* is assessed as Endangered (EN) under the criteria B1ab(i,iii,v) + B2ab(i,iii,v); C2a(ii).

Additional specimens examined. THAILAND. Chiang Mai Province: Mae Pong, Doi Saket District, 349 m, 19 August 2015, *N. Nopporncharoenkul* NNSB-403 (SLR); 6 June 2020 (fl.), *N. Nopporncharoenkul* NNSB-769 (SLR); 24 October 2023, *N. Nopporncharoenkul* NNSB-954 (SLR); On Tai, San Kamphaeng District, 10 June 2020 (fl.), *N. Nopporncharoenkul* NNSB-787 (SLR); Huai Sai, San Kamphaeng District, 24 October 2023, *N. Nopporncharoenkul* NNSB-953 (QBG, SLR); Sala Pang Sak, Doi Saket District, 2 May 2024 (fl.), *N. Nopporncharoenkul* NNSB-973 (SLR); 3 September 2024, *N. Nopporncharoenkul* NNSB-1056 (SLR).

***Kaempferia noctiflora* var. *villosa* Noppornch., var. nov.**

(Figures 13–14)

Types. Thailand: Rong Wua Daeng, San Kamphaeng District, Chiang Mai Province, 344 m, 10 May 2025, *N. Nopporncharoenkul* NNSB-1083 (holotype: QBG, including flowers preserved in spirit as part of a single specimen; isotype: SLR).

Diagnosis. Similar to *Kaempferia noctiflora* var. *noctiflora* in its floral characters, but differs by an upright leafy shoot up to 45 cm tall, with 6–8 leaves (vs. leafy shoot semi-appressed to the ground, with 3–6 leaves), narrowly ovate, elliptic to lanceolate-oblong leaf blade, 13–35 × 5–8.5 cm (vs. ovate to elliptic leaf blade, 10–25 × 7–14.5 cm), adaxially greyish green (vs. adaxially dull green to deep purple, usually with a deep purplish red patch along the midvein), and longer pseudopetiole, 2–6 cm long (vs. pseudopetiole subsessile to 1 cm long).

Description. Rhizomatous perennial herb, up to 45 cm tall. Rhizome ovoid to subglobose, 1.5–2 cm long, 1–1.6 cm in diam., brown externally, creamy white internally, with short fascicled storage roots and terminal tubers. Root stalks swollen, 0.2–0.5 cm long, 0.2–0.3 cm in diam.; tubers fusiform to narrowly fusiform, 1–2(–3.5) cm long, 0.4–1.2 cm in diam. Leafy shoot with 6–8 leaves, erect. Pseudostem upright, up to 15 cm tall, composed of leaf sheaths. Bladeless sheaths 2–3, up to 10 cm long, deep reddish, apex mucronate, mucro ca. 1 mm long, densely villous. Leaf sheaths reddish to purplish red, densely villous; ligule bilobed-truncate, lobes rounded to triangular with obtuse apex, 1–2 mm long, opaque, purplish

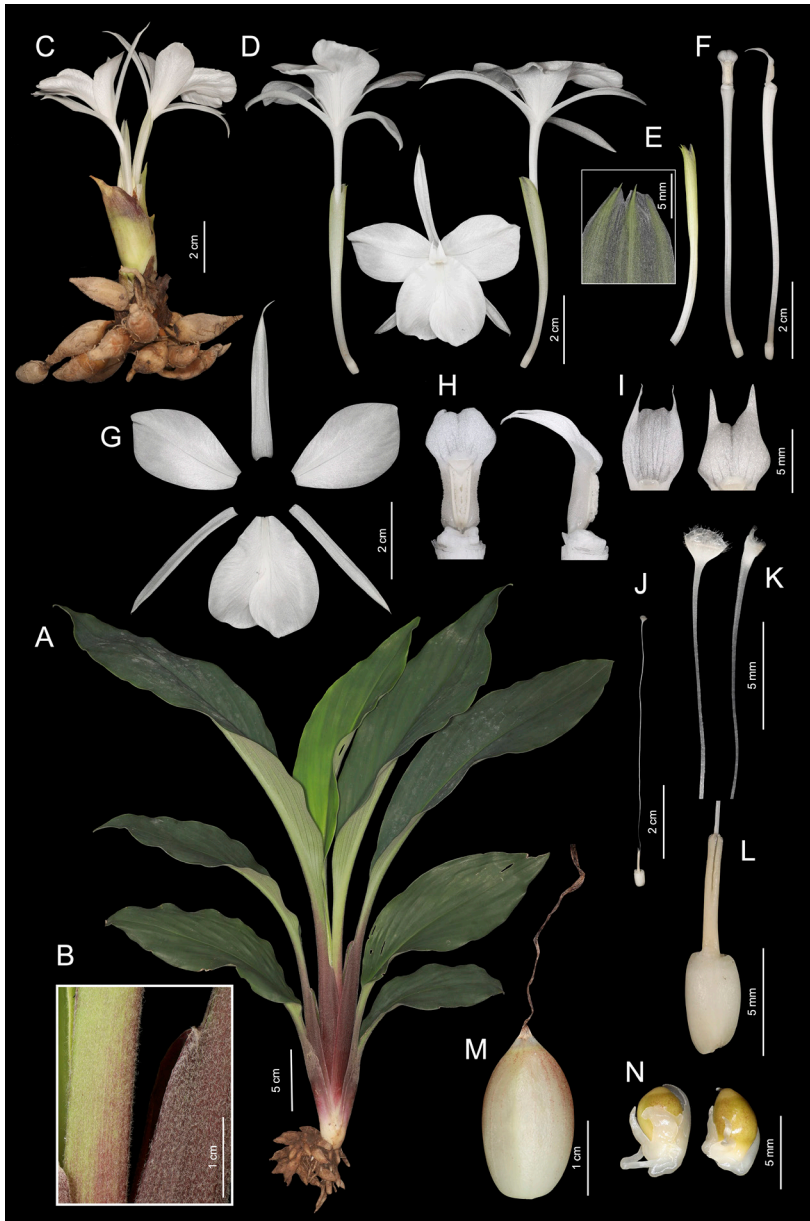


Figure 13. *Kaempferia noctiflora* var. *villosa*: A, Habit; B, Detail of ligules and leaf sheaths; C, Inflorescence and rhizome; D, Flower in front, side and top view; E, Calyx (inset: detail of apex); F, Floral tube with ovary and stamen in front and side view; G, Flower dissection (dc, dorsal corolla lobe; l, labellum; lc, lateral corolla lobe; ls, lateral staminode); H, Stamens in front and side view; I, Detail of anther crests in front and side view; J, Pistil; K, Detail of stigma and style in front and side view; L, Ovary with epigynous glands; M, Fruit; N, Seeds (Photos by Nattapon Nopporncharoenkul of a plant vouchered by N. Nopporncharoenkul NNSB-1083, QBG).



Figure 14. *Kaempferia noctiflora* var. *villosa*: A–B, Flowers in habitat, plants from San Kamphaeng District, Chiang Mai Province (9 May 2026); C–D, Habit of the plants from San Kamphaeng District, Chiang Mai Province (22 June 2024). Photos by Nattapon Nopporncharoenkul (A–B) and Trinath Kaninth (C–D).

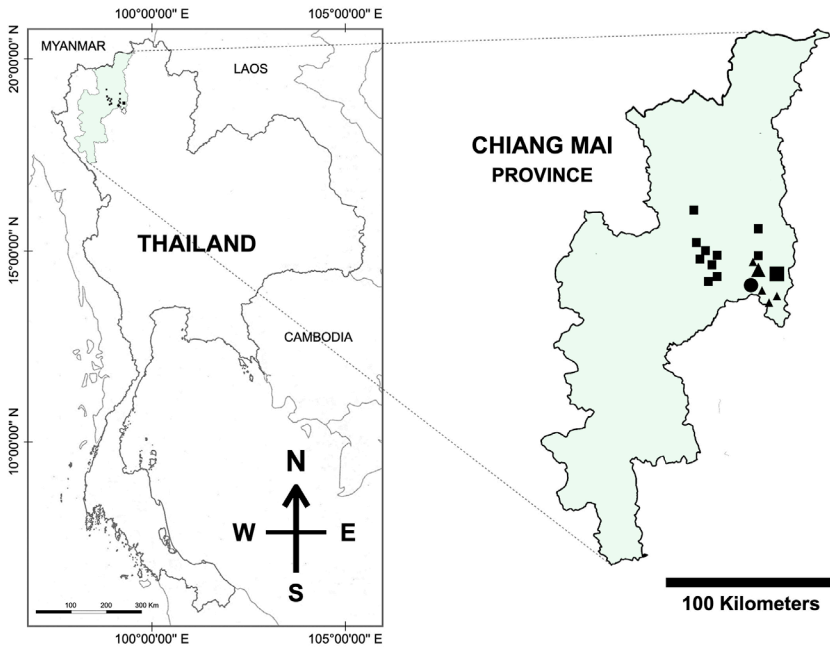


Figure 15. Distribution of *Kaempferia noctiflora* var. *noctiflora* (squares), *K. noctiflora* var. *thepthepae* (triangles) and *K. noctiflora* var. *villosa* (dot). The larger sizes indicate the type localities.

red, densely villous; pseudopetiole 2–4(–6) cm long, purplish red, densely villous; leaf blade narrowly ovate (proximal two leaves), elliptic to lanceolate-oblong, $13\text{--}35 \times 5\text{--}8.5$ cm, adaxially greyish green, glabrous, abaxially green, densely villous, base attenuate to obtuse, margin entire to slightly undulate, apex attenuate. Inflorescence lateral, emerging before the leaves; sheathing bracts 2, deltoid-ovate, $1\text{--}5.5 \times 1\text{--}2$ cm, apex mucronate to acute, light green to reddish, sparsely villous; peduncle up to 5 cm long, glabrous or sparsely villous; raceme fusiform-ovoid, $4\text{--}4.5$ cm long, $1\text{--}2$ cm in diam., composed of up to 15 bracts; bracts deltoid-ovate to lanceolate-ovate, $1.2\text{--}4.5 \times 0.6\text{--}3.8$ cm (outer ones larger), apex mucronate, light green, reddish to purplish red, densely villous; bracteoles lanceolate-ovate, $10\text{--}14 \times 4\text{--}8$ mm, hyaline, apex irregularly bifid (incision ca. 4 mm long), apices mucronate to acute, sparsely villous. Flowers ca. 8 cm long, nocturnal. Calyx $5\text{--}5.5$ cm long, $0.5\text{--}0.6$ cm in diam., with a unilateral incision ca. 1 cm long, apex truncate to shallowly trilobed-crenate with 3 mucronate teeth, semi-translucent light green, glabrous or sparsely villous. Floral tube $5.5\text{--}6.8$ cm long, $2\text{--}2.5$ mm in diam., white, glabrous; dorsal corolla lobe lanceolate-oblong, $4\text{--}4.2 \times 0.8$ cm, apex hooded, mucronate, mucro ca. 5 mm long, concave, arcuate, white, glabrous; lateral corolla lobes lanceolate-oblong, $3.5\text{--}3.8 \times 0.5\text{--}0.6$ cm, apex mucronate, mucro ca. 1 mm long, concave, arcuate, white, glabrous. Lateral staminodes obovate to broadly obovate, $3\text{--}3.3 \times 1.7\text{--}2$ cm, apex acute, obtuse to rounded, arcuate, white. Labellum

broadly obovate to obdeltoid, $3.2\text{--}3.5 \times 2.5\text{--}2.8$ cm, pure white or white with a basal pale yellowish patch, bilobed, bilobed, incised to ca. 1/2 of its length, base flat; lobes suborbicular to broadly obovate, $1.8\text{--}1.9 \times 1.7$ cm, apex acute to rounded, arcuate. Stamen 12–14 mm long, subsessile; filament up to 1 mm long, puberulent with very short glandular hairs dorsally and laterally; anther 11–13 mm long (including crest), connective white, puberulent with very short glandular hairs dorsally and laterally; anther thecae $4\text{--}5 \times 1\text{--}1.2$ mm, creamy white; anther crest reflected at ca. 135° to the anther, elliptic to ovate, $7\text{--}8 \times 5\text{--}6$ mm, apex bifid to bilobed, usually with 2 small crenate teeth. Pistil 6–7.3 cm long; ovary cylindrical, 4–5 mm long, 2–3 mm in diam., trilocular, creamy white, glabrous or sparsely villous; epigynous glands 2, subulate, 6–7 mm long, creamy white; style 6–7.3 cm long; stigma crateriform, ca. 2×1 mm, ostiole ciliate. Fruit ovoid to oblate, 2–2.5 cm long, 1–1.2 cm in diam., trilocular, yellowish cream with several stripes of reddish spots, glabrous or sparsely villous, containing 22–34 seeds. Seeds prolate to obovoid, 4–5 mm long, 3–4 mm in diam., yellow with reddish spots; aril white, semi-translucent, laciniate.

Distribution and habitat. *Kaempferia noctiflora* var. *villosa* is endemic to a restricted area in Huai Sai, San Kamphaeng District, Chiang Mai Province, Northern Thailand. It grows on fine sandy soil, usually with decayed rocks, in partially shaded deciduous dipterocarp forests at foothills and on hills, at elevations ranging from 340–350 m (Figure 10).

Phenology. Flowering period begins in May and continues until June, with leafy shoots typically emerging in June. Fruits and seeds mature in June. The plants enter dormancy in November.

Etymology. The varietal epithet “*villosa*” refers to the prominent villous indumentum present on the leaf sheaths, pseudostems, pseudopetioles, abaxial leaf surface, inflorescence bracts, and calyx.

Vernacular name. Proh Ra Tri Kon Pui (เปราะราตรีชนปุย)

Preliminary conservation status. *Kaempferia noctiflora* var. *villosa* is currently known only from its type locality in Chiang Mai Province, Northern Thailand. Based on extensive field surveys, the population consists of approximately 100 mature individuals. The extent of occurrence (EOO) is estimated at 44 km² (based on the potential distribution area using google earth), and the area of occupancy (AOO) is estimated to be less than 4 km². As the locality is situated outside of any legally protected areas, the population is at high risk of decline due to ongoing agricultural expansion and habitat deterioration. Given that the taxon is known from only a single location and its small population size is under immediate threat, *K. noctiflora* var. *villosa* is provisionally assessed as Critically Endangered (CR) based on the criteria B1ab(i,iii,v) + B2ab(i,iii,v); C2a(ii) according to the IUCN Red List Categories and Criteria, version 16 (IUCN Standards and Petitions Committee, 2024).

Additional specimens examined. THAILAND. Chiang Mai Province: Rong Wua Daeng, San Kamphaeng District, Chiang Mai Province, 24 May 2024 (fl.), N. Nopporncharoenkul NNSB-978 (SLR).

Notes. Our decision to recognize *K. noctiflora* var. *villosa* as a new variety is based on two key observations. Firstly, it displays consistent and often significant morphological differences when compared to previously described varieties within the species. Secondly, extensive field studies revealed that populations of *K. noctiflora* var. *villosa* are geographically distinct; we did not observe sympatric populations of *K. noctiflora* var. *noctiflora* or var. *thepthepae* within its natural range. This clear parapatric distribution pattern, combined with its stable morphological distinctiveness, supports its designation as a variety, distinguishing it from a mere form which typically represents minor, co-occurring variations within a population.

DISCUSSION AND CONCLUSION

The taxonomic revision and species re-circumscription of the nyctanthous *Kaempferia* subgen. *Protanthium* in Thailand has elucidated its diversity, confirming the presence of three species: *K. albiflora*, *K. grandifolia*, and *K. noctiflora*, and reveals a higher degree of morphological variation than previously documented. In this study, we formally describe and report two new infraspecific taxa, *K. albiflora* var. *longiflora* and *K. noctiflora* var. *villosa*, which significantly redefine the diagnostic boundaries of their respective species. Both newly recognized varieties are characterized by consistent and significant morphological differences from other varieties within their respective species. The discovery of *K. albiflora* var. *longiflora* is particularly noteworthy; its floral tube, reaching up to 10.5 cm, represents a record length for the subgenus (Table 1). This extreme morphology suggests a highly specialized relationship with long-tongued nocturnal pollinators, such as the sphingid moth. Concurrently, *K. noctiflora* var. *villosa* is distinguished from existing varieties by its robust upright habit, higher leaf number, and a densely villous indumentum on nearly all vegetative and floral parts (Table 2). Furthermore, extensive field observations revealed that the populations of these two new varieties maintain distinct geographical distributions, showing no sympatric occurrences with other established varieties. This study not only clarifies the taxonomic status of the nyctanthous complex but also underscores the urgent need for conservation of these narrow endemics. The recognition of these new taxa, both provisionally assessed as Critically Endangered (CR), provides essential data for the Flora of Thailand and establishes a vital framework for future studies on the reproductive biology and evolutionary history of the Zingiberaceae.

Table 1. Morphological comparison of *Kaempferia albiflora* var. *albiflora* and *K. albiflora* var. *longiflora*.

Characters	<i>K. albiflora</i> var. <i>albiflora</i>	<i>K. albiflora</i> var. <i>longiflora</i>
Leafy shoot	semi-appressed up to 15 cm tall, with 3–5 leaves	erect up to 40 cm tall, with 7–8 leaves
Leaf shape	broadly elliptic, ovate to lanceolate-oblong, 9–25 × 4–10 cm	linear to narrowly lanceolate, 18–32 × (1–)1.5–3.2(–4.5) cm
Floral tube	4.5–5.5 cm long, 0.2–0.3 cm in diam.	8–10.5 cm long, 2.5–3 mm in diam.
Anther crest	reflected at ca. 135° to the anther, oblong to ovate, (5–)7–14 × (4–)4–6.5 mm, apex irregularly tridentate	reflected at ca. 135° to the anther, elliptic to obdeltoid, 6–10 × 4–5 mm, apex irregularly tridentate

Table 2. Morphological character comparison of *Kaempferia noctiflora* var. *noctiflora*, *K. noctiflora* var. *thepthepae*, and *K. noctiflora* var. *villosa*.

Characters	<i>K. noctiflora</i> var. <i>noctiflora</i>	<i>K. noctiflora</i> var. <i>thepthepae</i>	<i>K. noctiflora</i> var. <i>villosa</i>
Leafy shoot	semi-appressed up to 12 cm tall, 3–5(–6) leaves	semi-appressed up to 5 cm tall, 3–4(–7) leaves	erect up to 45 cm tall, with 6–8 leaves
Leaf blade	ovate to elliptic, 10–25 × 7–14.5 cm, adaxially light green, dull green to deep purple, usually with a deep purplish red patch along the midvein (rarely with white to pale silver-grey variegated pattern along leaf edges, between midrib and both side of edges)	ovate to elliptic, 11.5–25 × 7–15 cm, adaxially dull green to deep purple, usually with a deep purplish red patch along the midvein, sometimes with 1–3 layers of white to pale silver-grey variegated pattern along leaf edges, between midrib and both side of edges (rarely fully pale silver-grey leaves)	narrowly ovate, elliptic to lanceolate-oblong, 13–35 × 5–8.5 cm

Table 2. Continue.

Characters	<i>K. noctiflora</i> var. <i>noctiflora</i>	<i>K. noctiflora</i> var. <i>thepthepae</i>	<i>K. noctiflora</i> var. <i>villosa</i>
Labellum	white with a central pale yellow patch at the base	white to light purple, with a central white to creamy white patch at the base, flanked by two light purple stripes extending towards the center of the lobes	white or white with a basal pale yellowish patch
Anther crest	reflected at ca. 150° to the anther, oblong to ovate, 7–12 × 3–5.5 mm, apex bifid to bilobed, sometimes with 2–3 small teeth between lobes	reflected at 135°–150° to the anther, ovate to oblong (rarely narrowly obdeltoid), 4–11 × 2.5–5.5 mm, apex bifid to bilobed, sometimes with 1–2 small teeth between lobes	reflected at ca. 135° to the anther, elliptic to ovate, 7–8 × 5–6 mm, apex bifid to bilobed, usually with 2 small crenate teeth

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