

Kaempferia nigrifolia (Zingiberaceae), a new species from Central Thailand

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Abstract: *Kaempferia nigrifolia* Boonma & Saensouk, a new species of Zingiberaceae from Central Thailand, is described and illustrated along with photographs, notes on its distribution and habitat. An identification key to the species of *Kaempferia* in Thailand is also presented.

Keywords: *Kaempferia*, New species, Taxonomy, Thailand, Zingiberaceae.

Introduction

Kaempferia L. (Zingiberaceae) commemorates the German physician and traveler Engelbert Kaempfer (1651–1716), the first westerner who collected plant specimens in Thailand (Larsen & Larsen, 2006). Based on the position of the inflorescence, the genus is divided into two subgenera: subgen. *Kaempferia* (Baker, 1890) and subgen. *Protanthium* (Horan.) Baker (Insiengmay *et al.*, 2018). Species in subgen. *Kaempferia* produce terminal inflorescences while those in subgen. *Protanthium* produce inflorescences directly from the rhizome (Insiengmay *et al.*, 2018). Sirirugsa (1992) recognized fifteen species of *Kaempferia* from Thailand. Subsequently, about forty species were reported by Boonma *et al.* (2020) and Jenjittikul and Larsen (2020). While investigating the species diversity of Zingiberaceae in Thailand, specimens of an undescribed species of *Kaempferia* similar to *K. pulchra* Ridl. was found in Saraburi province, Central Thailand. After

comparing and examining species with similar characteristics, we found that this specimen did not match any existing taxa, hence it is described and illustrated here as new to science. A key to species of *Kaempferia* in Thailand is provided for facilitating their identification.

Materials and Methods

Live specimens of *Kaempferia* were collected from the field in Wihan Daeng District, Saraburi Province, Central Thailand, between 2018 and 2019 and measurements of the plant parts were taken. The protogynes of morphologically similar species (Baker, 1890; Ridley, 1899; Holtum, 1950) and type specimens housed in various herbaria (BK, BKF, KKU, QBG) in Thailand, including digital images available online were compared.

Taxonomic treatment

***Kaempferia nigrifolia* Boonma & Saensouk, sp. nov.**

Figs. 1–3

The new species is similar to *K. pulchra* Ridl. but differs in having sessile leaves, shorter (*c.* 1 cm long) peduncle, broadly obovate light purple staminodes with white spot at base, longer than labellum, deeply divided light purple labellum with a white spot at the base and obovate lobes, sessile stamens and white triangular anther-crest which is bend to the back and lower than the plane of the petals.

Type: THAILAND, Saraburi Province, Wihan Daeng district, 70–185 m, 03.08.2018, T. Boonma 14 (holo KKU!; iso QBG!, BKF!, BK!).

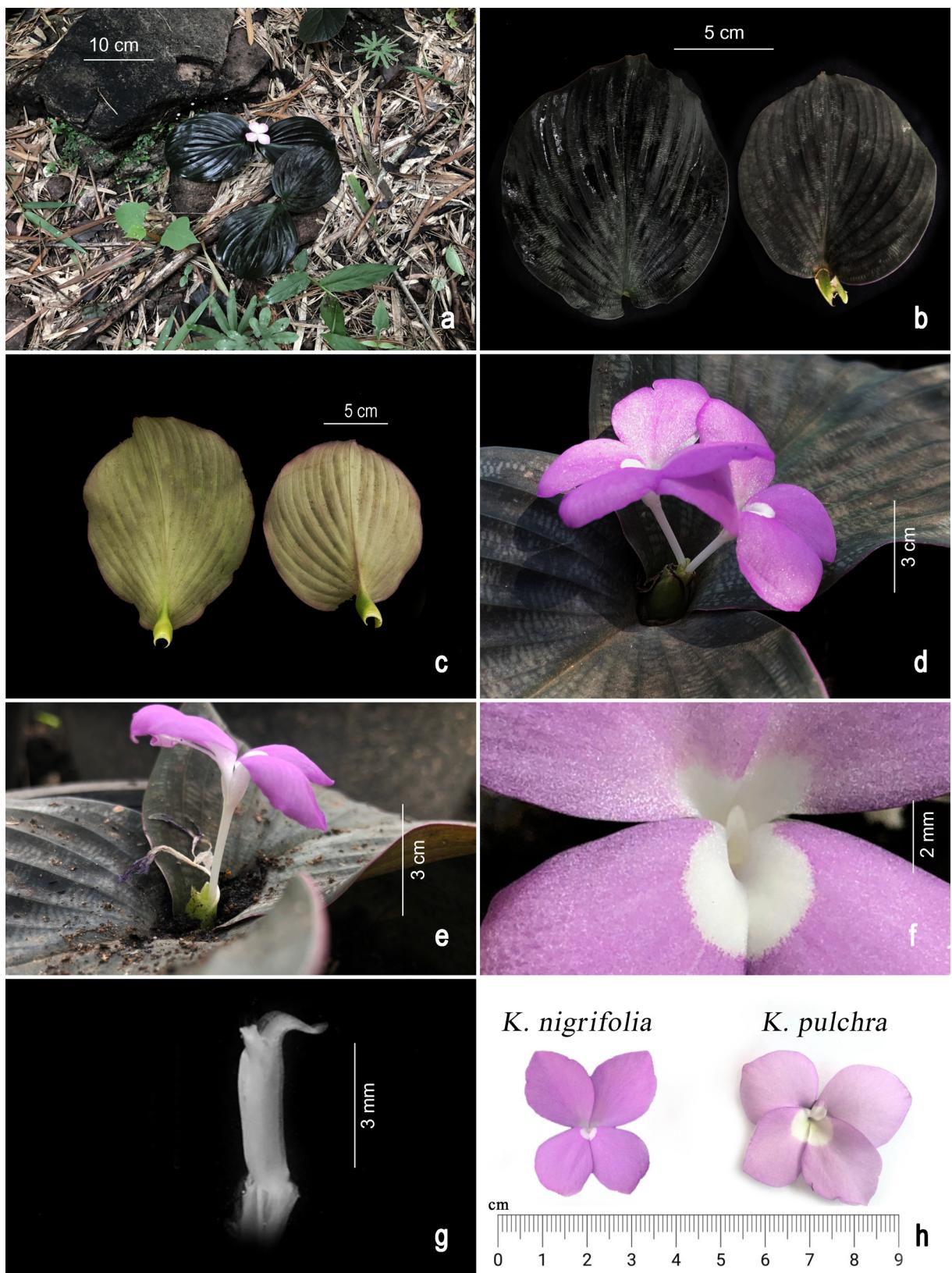


Fig. 1. *Kaempferia nigrifolia* Boonma & Saensouk: **a.** Plants in natural habitat; **b.** Leaf—upper surface; **c.** Leaf—lower surface; **d.** Flower—oblique top view; **e.** Flower—side view; **f.** Flower—top view; **g.** Anther with crest; **h.** Comparison of flowers of *K. nigrifolia* and *K. pulchra*—top views (a-g from T. Boonma 14; photos by Thawatphong Boonma)

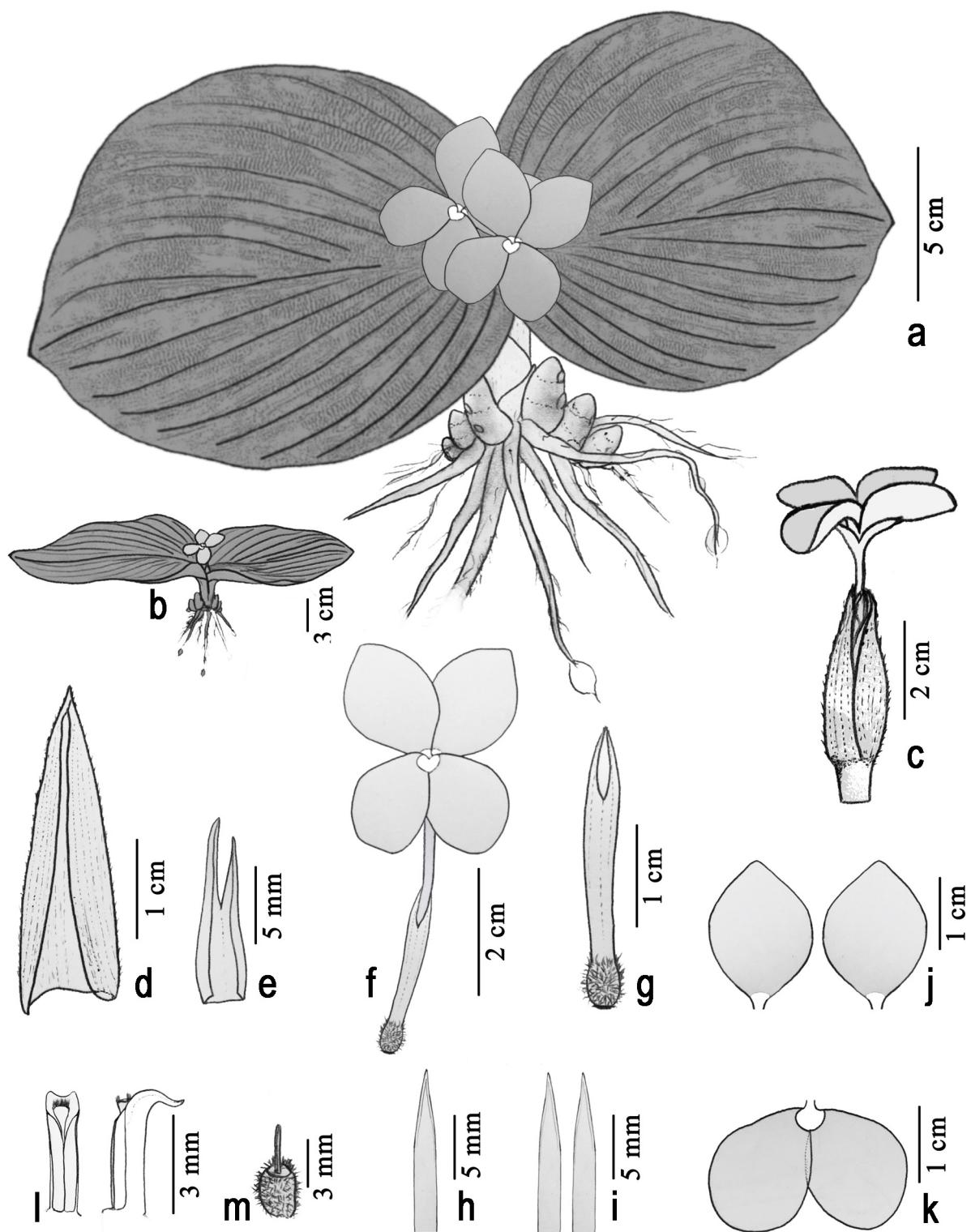


Fig. 2. *Kaempferia nigrifolia* Boonma & Saensouk: **a.** Habit—top view; **b.** Habit—oblique side view; **c.** Inflorescence; **d.** Bract; **e.** Bracteole; **f.** Flower with calyx and ovary; **g.** Calyx and ovary; **h.** Corolla dorsal lobe; **i.** Corolla lateral lobes; **j.** Lateral staminodes; **k.** Labellum; **l.** Anther with crest and stigma; **m.** Ovary with epigynous glands (from T. Boonma 14; drawn by Thawatphong Boonma).

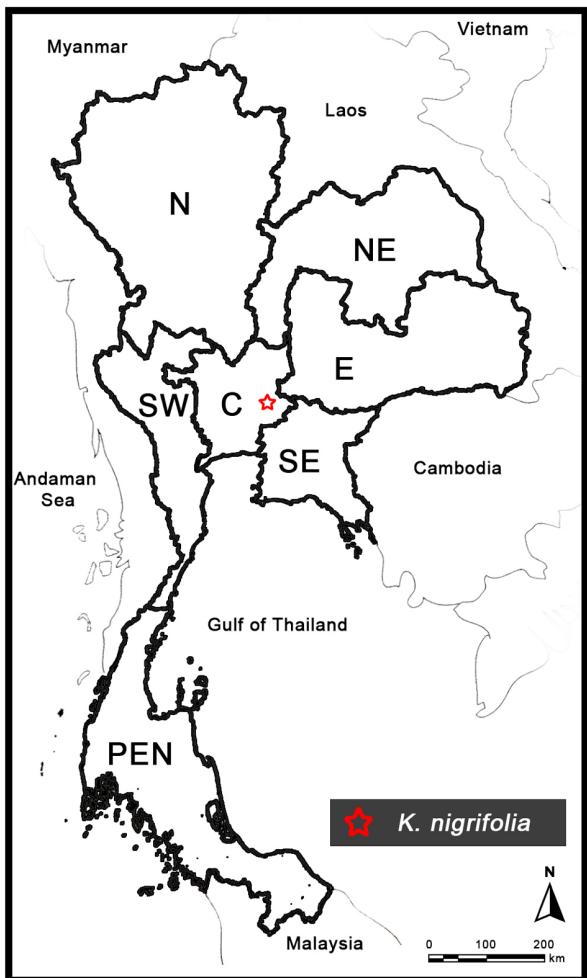


Fig. 3. Map showing the distribution of *K. nigrifolia* Boonma & Saensouk in Thailand.

Perennial herbs, c. 3 cm tall. Rhizome vertical, ovoid, brown outside, pale yellow inside, lightly fragrant, c. 2.5 × 1.5 cm, with several fibrous roots bearing tubers. Cataphylls 2–3, lanceolate, apex acuminate, dark reddish-brown, green at base, 1–3 cm long, hairy. Leaves 2, sessile, flat or horizontal on the ground; sheaths 2.5–3 cm long, green or green with reddish-brown, hairy; ligule membranous, 1–3 × c. 10 mm, bi-lobed with rounded apex, sparsely hairy; lamina orbicular to sub-orbicular, 12–16(–18) × 11.5–14(–16) cm, base cuneate or sub-cordate, apex acute, margins entire, widely undulate with dark reddish-brown along the margins, upper surface black or black with light grey markings, sparsely hairy (mostly at the midrib-base), obviously embossed veins, lower surface

grey-green with reddish-brown, veins hairy. Inflorescence enclosed by two cataphylls; peduncles less than 1.4 cm long, white with light pale green at tip, glabrous. Bracts lanceolate, 2.8–3.3 × 1.1–1.7 cm, mucronate to acute at apex, green with brownish green at tip and pale green at base, hairy. Bracteoles lanceolate, 11.5–12.3 × c. 4 mm, translucent white, bi-lobed; lobes 5–6 mm, acuminate at apex, sparsely hairy. Flowers 24–27. Calyx tubular, translucent white, c. 2.3 cm long, with one deep incision c. 6 mm, apex acute, hairy. Corolla tube white, c. 3.5 cm long; dorsal lobe lanceolate, white, c. 1.5 × 0.32 cm, apex little hooded, acuminate; lateral lobes lanceolate, white, c. 1.3 × 0.35 cm, apex little hooded, acuminate, glabrous. Staminodes 2, broadly obovate, obtuse at apex, c. 1.9 × 1.5 cm, light purple above with white spot at base, white below, glabrous. Labellum light purple above with a white spot at base, white below, deeply divided to the edge of white spot; lobes obovate, c. 1.75 × 1.4 cm, apex rounded. Stamens sessile, white, glabrous; anthers c. 3.2 mm long; anther-crest triangular and bend to the back, c. 1.3 × 1 mm, lower than the plane of the petals, acuminate at apex, white, glabrous. Ovary spheroid, 3.5–4 × c. 2.5 mm, densely hairy; style filiform, c. 4 cm long, slender, white; stigma obconic, c. 1 × 0.8 mm, creamy white, 2-lipped, lips equal, ciliate, cilia c. 0.4 mm long; epigynous glands 2, c. 3 mm long, slender, white. Capsules sub-globose to prolate spheroid, c. 1.2 × 1 cm, densely hairy, light purple with purple veins, brown when old; seeds c. 3 × 2 mm, brown with white arils.

Vernacular name: ‘Nillakan’ in Thai language, refers to its black leaves.

Flowering & fruiting: Flowering from late May to September and fruiting from August to late October.

Habitat: Occurring at elevations of 70–185 meters above sea level, growing in sandy loam soil, moist and close to the watercourse in a deciduous forest.

Etymology: The specific epithet ‘*nigrifolia*’ is derived from two Latin words; ‘*nigrum*’ meaning ‘black’ and ‘*folia*’ meaning ‘leaves’ referring to its black leaves.

Table. 1 Morphological comparison of *K. nigrifolia* and *K. pulchra*

Characters	<i>K. nigrifolia</i> Boonma & Saensouk	<i>K. pulchra</i> Ridl.
Leaves	Orbicular to sub-orbicular, flat, or horizontal on the ground, black or black with light grey markings adaxially and dark reddish-brown along the margins, sparsely hairy (mostly at the midrib-base)	Ovate, blunt, spreading out usually flat on the ground, dark olivaceous black with grey markings above, glabrous
Petioles	Absent	c. 7. 42 cm long
Peduncle	≤ 1.4 cm long, white with light pale green at tip	c. 7. 62 cm long, green
Corolla lobes	Lanceolate, apex little hooded, acuminate	Linear, obtuse, reflexed
Staminodes	Broadly obovate, light purple with a white spot at base, longer than labellum	Obovate, mauve, as long as labellum
Labellum	Light purple above with pure white spot at base, lower surface white; deeply divided to the edge of white spot; lobes obovate, apex rounded	Mauve with the base pale yellowish white, deeply bilobed; lobes oblong, apices rounded to obtuse
Stamen	Sessile	With very short filament
Stigma	Lips equal	Lower lip prolonged
Anther crest	White, triangular and bend to the back, lower than the plane of the petals, apex acuminate	White with mauve tip, long-linear, apex rounded, recurved

Distribution: Hitherto endemic to Central Thailand (Fig. 3).

Key to the species of *Kaempferia* in Thailand

1. Inflorescence terminal from pseudostem, appears along with leaves (subgen. *Kaempferia*) 2
1. Inflorescence directly from rhizome, appears before the new leave (subgen. *Protanthium*) 26
2. Leaves erect from the ground 3
2. Leaves horizontal near the ground 13
3. Lamina filiform, linear or less than 4 cm broad 4
3. Lamina lanceolate to orbicular, broader than 4 cm, 8
4. Leaves villous below *K. spoliata*
4. Leaves glabrous 5
5. Staminodes absent *K. sisaketensis*
5. Staminodes present 6
6. Ligules present; leaves elliptic-linear to linear, 0.5–1 cm broad *K. larsenii*
6. Ligules absent; leaves filiform, less than 0.5 cm broad 7
7. Leaves up to 14 cm; anther-crest not divided or crenate *K. fallax*
7. Leaves 15–20 cm long; anther-crest divided. *K. filifolia*
8. Petioles ≤ 1 cm long 9
8. Petioles > 2 to 10 cm long 10
9. Ovary glabrous; leaf-blade green, glabrous on both surfaces with wavy margins *K. angustifolia*
9. Ovary sparsely hairy; leaf-blade green with dark green spots above, pubescent on both surfaces with entire margin *K. maculifolia*
10. Ovary glabrous; leaves glabrous on both surfaces with purple coloration at margins.... *K. mahasarakhamensis*
10. Ovary hairy; leaves pubescent below 11
11. Leaves tomentose on both surfaces; labellum pubescent *K. koontermii*
11. Leaves glabrous above, pubescent below; labellum glabrous 12

12. Labellum shallowly divided or emarginate; staminodes oblong, 1–1.3 × c. 0.3 cm
 *K. parviflora*
12. Labellum divided to the base; staminodes broadly obovate or sub-orbicular, 1.5–2 × 1–1.7 cm *K. elegans*
13. Staminodes light brown or white 14
13. Staminodes lilac, purple or violet 21
14. Staminodes light brown *K. saraburiensis*
14. Staminodes white 15
15. Labellum purple *K. marginata*
15. Labellum white 16
16. Leaves dull green with dark blotches
 *K. pardi*
16. Leaves green without dark blotches 17
17. Labellum white with yellow spot at base .. 18
17. Labellum white with purple, lilac, or red 19
18. Leaves glabrous on both surfaces
 *K. roscooeana*
18. Leave glabrous above and pubescent below..
 *K. koratensis*
19. Calyx and ovary hairy; labellum white, sometimes with a darker reddish patch at the inner base of each lobe with longitudinal white line at the base of lobes *K. phuphanensis*
19. Calyx and ovary glabrous; labellum white with purple blotch at center or with purple marking at base 20
20. Bracts hairy *K. laotica*
20. Bracts glabrous *K. galanga*
21. Calyx and ovary hairy 22
21. Calyx and ovary glabrous 24
22. Stigma capitate, deep red purple; anther crest reniform; leaves glaucous, green *K. glauca*
22. Stigma 2-lipped, creamy white or white; anther crest triangular or linear; leaves dark olivaceous black with grey markings above or black or black with light grey markings ... 23
23. Peduncles less than 1 cm long; stamens sessile; anther crest triangular and bend to the back; staminodes broadly obovate, light purple with white spot at base, longer than labellum; labellum light purple with pure white spot at base; leaves sessile, black or black with light grey markings, sparsely hairy above
 *K. nigrifolia*
23. Peduncles c. 7.6 cm long; stamens with very short filament; anther crest very long linear apex entire rounded, recurved; staminodes obovate, mauve, as long as labellum; labellum lilac with the base pale yellowish-white spots; leaves petiolate, dark olivaceous black with grey markings above, glabrous above
 *K. pulchra*
24. Calyx acute at apex *K. picheansoonthonii*
24. Calyx bifid at apex 25
25. Staminodes oblong, purple; labellum obovate-cuneate, purple *K. siamensis*
25. Staminodes obovate, pink to light purple; labellum broadly obovate, pink to purple with two deep purple spots in the center
 *K. minuta*
26. Leaves horizontal, near the ground 27
26. Leaves erect, pseudostem well developed ... 29
27. Leaves sparsely hairy above *K. lopburiensis*
27. Leaves glabrous above 28
28. Staminodes broadly obovate, light purple; labellum light purple with deep purple at base
 *K. udonensis*
28. Staminodes oblong, white; labellum white with pale yellow spot at base, obovate
 *K. grandifolia*
29. Leaves less than 5 cm wide *K. graminifolia*
29. Leaves more than 5 cm wide 30

30. Rhizome producing several shoots
..... *K. caespitosa*
30. Rhizome producing a single shoot 31
31. Petioles more than 5 cm long 32
31. Petioles sessile to sub-sessile or up to 5 cm long 33
32. Labellum white to purple with deep purple at the center with prominent yellow patch from the base to sinus *K. simaoensis*
32. Labellum white to purple with deep purple at the center without yellow patch ... *K. rotunda*
33. Anthesis nocturnal, flower opens around 06 pm 34
33. Anthesis diurnal, flower opens around 05 35
34. Staminodes and labellum laid on the same plane; sinus depth two-third of labellum length; anther crest with irregular tridentate apex, the middle tooth shorter and wider than the outers *K. albiflora*
34. Staminodes upright with deflexed distal half of the labellum; sinus depth half of labellum length; anther crest with bilobed apex, usually with two small teeth between lobes
..... *K. noctiflora*
35. Leaves glabrous above *K. aurora*
35. Leaves scabrous or sparsely hairy above 36
36. Ovary glabrous; staminodes white to purple, broadly obovate to oblong, erect with deflexed distal half of the labellum; labellum deep purple toward the base, apically bilobed, lobes narrowly obovate, rounded at apex to slightly emarginated *K. kamolwaniae*
36. Ovary scabrous; staminodes light pink, broadly ovate, apex acute, laid on the same plane with labellum; labellum light pale pink with dark

pink towards and almost reaching the base with white at base, respectively, deeply bilobed, each lobe obovate, apex rounded and slightly acute at tip *K. takensis*

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