Taxonomy of the genus *Kaempferia* (Zingiberaceae) in Thailand

Puangpen Sirirugsa*

ABSTRACT

Fifteen species of *Kaempferia* are enumerated for Thailand. A key to the Thai species as well as the descriptions and illustrations are provided.

INTRODUCTION

The genus *Kaempferia* Linn. is comprised of approximately 60 species distributed from tropical Africa to India and throughout SE Asia. The genus have been treated regionally by BAKER (1890) for India, SCHUMANN (1904) for Asia, GAGNEPAIN (1908) for Indo-China, VALETON (1918) for Java and Malaya, RIDLEY (1924) and HOLTTUM (1950) for Malay Peninsula. However, a few species from Baker as well as several species from Schumann were confused with the genus *Boesenbergia* and its allies, and have been separated. LARSEN (1962) described *K. filifolia* as a new species. In Thailand 15 species of *Kaempferia* are now recognized.

Kaemferia Linn. Sp. Pl. 1: 1753.

Perennial herbs. *Rhizome* fleshy, usually short, with several roots in a fascicle; roots often bearing tubers. *Leaves* 1 to few, rising from the rhizome; blades filiform to very broad; petiole usually short; sheath often keeled, broad and short; ligule small, inconspicuous, or none. *Inflorescence* usually enclosed by the two innermost leaf-sheaths, or by bladeless sheaths as in *K. rotunda*. *Flowers* few to many, spirally arranged, forming head-like inforescence, each solitary accompanied by 2 small bracteoles in the axil of a bract. *Bracts* usually lanceolate or linear. *Calyx* tubular, divided along one side, the apex

* Department of Biology, Faculty of Science, Prince of Songkla University, Hat Yai, Thailand.

unequally 2– to 3–lobed. *Corolla-tube* long and slender; lobes subequal, usually linear. *Staminodes* petaloid, often similar to the halves of the labellum, white or lilac. *Labellum* usually deeply bilobed or emarginate as in *K. parviflora,* the two halves often of similar shape and size to the staminodes, mostly obovate, usually white or purple, sometimes marked with a different colour. *Stamen* with very short filament or sessile; anther usually 2-5 mm long, longitudinally dehising; anther–crest usually large, entire or lobed. *Ovary* trilocular, placentation axile; stylodes mostly filiform. *Fruit* not seen.

KEY TO THE SPECIES IN THAILAND

1. Leaves erect
   2. Leaf-blade elliptic-linear, linear or filiform
      3. Lower leaf-surface villous; staminodes absent **1. K. spoliata**
      3. Leaves glabrous; staminodes present
         4. Ligule present; leaf-blade elliptic-linear to linear, 0.5 – 1 cm broad **2. K. larsenii**
         4. Ligule absent; leaf-blade filiform, less than 0.5 cm broad
            5. Leaves up to 14 cm; anther-crest not divided or crenate **3. K. fallax**
            5. Leaves 15 – 20 cm long; anther-crest divided **4. K. filifolia**

2. Leaf-blade much broader, lanceolate to orbicular
   6. Petiole 1 – 10 cm long; anther-crest entire
      7. Labellum divided to the base; staminodes broadly obovate or sub-orbicular, 1.5 – 2 × 1 – 1.7 cm **5. K. elegans**
      7. Labellum shallowly divided or emarginate; staminodes oblong, 1 – 1.3 × 0.3 cm **6. K. parviflora**
   6. Petiole up to 1 cm long; anther-crest divided
      8. Inflorescence from the leafless rhizome; anther-crest oblong, 9 – 12 × 3 – 4 mm, 3 – lobed, the outer lobes acute and elongate, the middle one shorter, entire or emarginate, ovary hairy **7. K. rotunda**
      8. Inforescence between the two innermost leaf-sheaths; anther-crest quadrangulate ca 3.5 mm long, bifid; ovary glabrous **8. K. angustifolia**

1. Leaves horizontal, near the ground
   9. Anther-crest deeply divided
      10. Labellum divided to the middle; staminodes oblong, ca 2 × 0.5 cm **9. K. siamensis**
      10. Labellum divided to the base; staminodes obovate or oblanceolate, 1.5 – 2 × 0.7 – 1.2 cm

11. Leaf-margin purple; labellum purple, sometimes with longitudinal white bands near the margins **10. K. marginata**
11. Leaf-margin usually white; labellum white with purple marking at the base **11. K. galanga**

9. Anther-crest entire or emarginate
12. Inflorescence pedunculate; calyx and ovary hairy
13. Anther-crest clawed, blade oblanceolate with acute or rounded apex, ca 7 × 5 mm, claw ca 3 mm long **12. K. pulchra**
13. Anther-crest reniform, recurved, ca 1.5 × 4 – 5 mm **13. K. glauca**
12. Inflorescence sessile; calyx and ovary glabrous
14. Leaves glabrous on both sides; anther-crest small, ovate, keeled, entire, ca 1.5 × 2 mm **14. K. roscoeana**
14. Leaves with hairy under surface; anther-crest rectangular, 3 – 5.5 × 1 – 3 mm, entire or emarginate **15. K. laotica**

1. Kaempferia spoliata P. Sirirugsa, Nord. J. Bot. 9(3): 259. Fig. 1 Q-V. 1989.

Herb 9 – 12 cm tall. *Rhizome* short, bearing several roots in a fascicle. *Leaves* 6 – 7, radical, sessile; blade linear 6 – 8(– 13) × 0.6 – 0.8(– 1) cm, apex acuminate, base cuneate, upper surface glabrous, under surface villous; leaf-sheaths 3 – 6 cm long, margin membranous, glabrous; bladeless sheaths ca 3 mm long; ligule triangular, membranous, glabrous, 1 – 2 mm long. *Inflorescence* rising between the two innermost leaves. *Flowers* several; bracts linear-lanceolate, 5 – 6.5 × 1 cm, glabrous, apex acute to acuminate; bracteoles linear, glabrous, 2.5 – 3 cm long, apex acuminate, sometimes hooded. *Calyx* glabrous ca 4.5 cm long, apex bifid. *Corolla-tube* slender, ca 9 cm long, lobes linear; dorsal lobe ca 2.7 × 0.4 cm, apex hooded, short aristate; lateral lobes ca 2.5 × 0.4 cm, apex hooded, mucronate or blunt. *Staminodes* absent. *Labellum* divided to the base, each lobe obovate or suborbicular, 2 – 3 cm. *Stamen* with very short filament; anther ca 4 mm long, anther-crest oblong, 0.8 – 1.5 cm long, apex entire or toothed. *Ovary* ca 4 × 2 mm, glabrous; stylodes filiform, ca 6 mm long; ovules many.

T h a i l a n d.— EASTERN: Si Sa Ket type, MAXWELL 76 – 493, (Kanthralak, Dongrak Range at Chong Bat Lak).

D i s t r i b u t i o n.— Endemic to EASTERN Thailand.

E c o l o g y.— In open, wet, sandy savanna, ca 450 m alt.

2. **Kaempferia larsenii** P. Sirirugsa, Nord J. Bot. 9(3): 257. Fig. 1 H-P. 1989. Plate I : 1.

Herb, 8 – 10 cm tall. *Rhizome* small with slender roots. *Leaves* 2 – 4, radical; blades elliptic-linear to linear, 6 – 9 × 0.5 – 1 cm, apex hooded and acute, base cuneate, glabrous; petiole ca 1 cm; leaf-sheaths 3 – 4 cm long; bladeless sheath ca 3.5 cm long; ligule broadly triangular ca 1 mm long, glabrous. *Inflorescence* sessile, rising between the two innermost leaves. *Flowers* ca 8; bracts linear, ca 3 × 0.3 cm; bracteoles linear, slender, ca 1.5 cm long. *Calyx* ca 3 cm long, apex bifid, glabrous. *Corolla-tube* ca 5.5 cm long, lobes linear; dorsal lobe ca 1.4 × 0.25 cm, apex blunt. *Staminodes* obovate, ca 1.4 × 0.7 cm. *Labellum* divided to the base, each lobe obovate, ca 1.7 × 0.7 cm. *Stamen* sessile; anther ca 2 mm long, anther-crest obovate, ca 3.7 × 2.7 mm, apex rounded, entire or slightly crenate. *Ovary* ca 3 × 1 mm, glabrous; stylodes filiform, very slender, ca 2.5 mm long; ovules several.

T h a i l a n d.— EASTERN: Ubon Ratchathani (type, **Nilviset** 19, Buntharik)

D i s t r i b u t i o n.— Endemic to Eastern Thailand.

E c o l o g y.— Common by stream, in open area.

3. **Kaempferia fallax** Gagnep., Bull. Soc. Bot. Fr. 4. ser. 3: 259. 1903; Schum. in Pflanzenr. Zingib. 4: 437. 1904; Gagnep. in Fl. Gen. I-C: 48. 1908. 3.

Herb, 10 – 12 cm tall. *Rhizome* small with slender roots. *Leaves* 2 – 4; blades elliptic-linear to linear, 6 – 8 × 0.7 – 1 cm, apex acute and hooded, base cuneate; petiole 1 – 2 cm long; leaf-sheaths 2.8 – 4 cm long; bladeless sheaths ca 3.5 cm long; ligule bilobed, short and broad. *Inflorescence* sessile, rising between the two innermost leaves. *Flowers* ca 8; bracts linear, ca 3 × 0.3 cm glabrous, apex acuminate; bracteoles slender, linear, ca 1.5 cm long. *Calyx*

ca 3 cm long, glabrous, apex bifid. *Corolla-tube* ca 5.5 cm long, lobes linear; dorsal lobe ca 1.4 × 0.25 cm, apex hooded, aristate; lateral lobes ca 1.4 × 0.2 cm, apex blunt. *Staminodes* obovate, ca 1.4 × 0.7 cm. *Labellum* deeply divided, each lobe obovate, ca 1.7 × 0.7 cm. *Stamen* sessile; anther slender ca 3 mm long, anther-crest quadrate, bilobed, ca 2.5 × 2 mm. *Ovary* ca 3 × 1 mm, glabrous; stylodes filiform, ca 2.5 mm long.

T h a i l a n d.— EASTERN: Ubon Ratchathani.

D i s t r i b u t i o n.— Laos [type, Me Khong, vers La-Khon (= Nakhon Phanom)].

E c o l o g y.— In sandy soil, near the bank of the river.

4. Kaempferia filifolia Larsen in Bot. Tidsskr. 58: 201. 1962. Plate I : 2.

Herb, up to 20 cm tall. *Rhizome* short, bearing several roots in a fascicle. *Leaves* ca 10; blades filiform, 9 – 15 cm long, glabrous, apex hooded, acicular; bladeless sheaths 5 – 7 cm long; ligule none. *Inflorescence* sessile, rising between the two innermost leaves. *Flowers* few; bracts linear, 6 – 10 cm long, apex acute, ciliate; bracteoles linear, ca 2.2 cm long. *Calyx* ca 7 cm long, apex 3 – dentate. *Corolla-tube* ca 10 – 14 cm long; dorsal lobe linear ca 3 × 0.45 cm, apex hooded, aristate; lateral lobes not seen. *Staminodes* clawed, obovate-oblong, ca 2 × 1.3 cm, apex unequally bilobed. *Labellum* divided to the base, each lobe obovate-oblong, ca 2 × 0.8 cm, apex irregularly toothed. *Stamen* sessile; anther ca 4 mm long, anther-crest rectangular, ca 3 × 1.2 mm, apex unequally bilobed. *Ovary* ca 4 mm long.

T h a i l a n d.— NORTH-EASTERN: Nakhon Phanom (type, KEER 21500, Phu Wat); EASTERN: Roi Et; Ubon Ratchathani (Buntharik).

D i s t r i b u t i o n.— Endemic to North-Eastern Thailand.

E c o l o g y.— In shallow soil or wet ground, scattered in deciduous forest, 150 – 300 m alt.

5. Kaempferia elegans Wall. ex Bak. in Fl. Br. Ind. 6: 222. 1890; Schum. in Pflanzenr. Zingib. 4: 82. 1904; Ridl., Fl. Mal. Pen. 4: 245. 1924; Holttum,

Gard. Bull. Sing. 13: 123. 1950.- *K. crawfurdii* Wall., Cat. in ed. – *Monolophus elegans* Wall, Pl. Asiat. Rar. 1: 24. t. 27. 1830; Horan., Monogr.: 22. 1862.

Herb, 10 – 20 cm tall. *Rhizome* with fibrous roots bearing globose tubers. *Leaves* usually 2, erect; blades elliptic or elliptic-oblong, rarely lanceolate or ovate, 4 – 25 × 2 – 13 cm, apex acute or mucronate, base cuneate or subcordate, upper surface glabrous, under surface finely hairy; petiole 1 – 10 cm long; bladeless sheaths usually one, 3 – 10 cm long, hairy; ligule triangular, 2 – 5 mm long. *Inflorescence* rising between the leaf-sheaths, usually elongate, peduncle hairy, 3 – 20 cm long. *Flowers* several; bracts lanceolate, 2.5 – 6 cm long, apex acute; bracteoles unequal, lanceolate, 1.5 – 2 cm long, apex acute. *Calyx* 2 – 3 long, sparsely hairy, apex acute or bifid, ciliate. *Corolla-tube* 5 – 7 cm long, lobes lanceolate-linear or linear, 1.7 – 2 × 0.5 – 0.8 cm long; dorsal lobe hooded, apex acuminate; lateral lobes apex obtuse. *Staminodes* broadly obovate or suborbicular, 1.5 – 2 × 1.4 – 1.7 cm. *Labellum* divided to the base, each lobe obovate, 2.3 – 2.8 × 1.3 – 1.6 cm. *Stamen* with very short filament; anther ca 3 mm long, anther-crest orbicular, 3 – 5 × 6 – 8 mm. *Ovary* hairy, ca 4 × 2 mm long; stylodes ca 2 mm long; ovules many.

T h a i l a n d.— NORTHERN: Chaing Mai, Phitsanulok, Nakhon Sawan; SOUTH-WESTERN: Kanchanaburi, Ratchaburi; PENINSULAR: Chumphon, Surat Thani (Ko Samui), Trang.

D i s t r i b u t i o n.— India, Burma (type, **Wallich** 6593, Tenasserim), Malay Peninsula.

E c o l o g y.— Common by streams, often on limestone boulders, in mixed deciduous forest, from sea level to 1000 m alt.

6. Kaempferia parviflora Wall. ex Bak. in Fl. Br. Ind. 6: 221. 1890; Schum. in Pflanzenr, Zingib. 4: 78. 1904. Plate I : 3

Herb, 6 – 10 cm tall. *Rhizome* dark purple, with several succulent roots in a fascicle. *Leaves* 1 to several; blades ovate or elliptic, slightly unequal sided, 7 – 11 × 4 – 6 cm, apex acute or mucronate, base subcordate, upper surface glabrous, under surface hairy; petiole ca 3 mm long, hairy; leaf-sheaths ca 6 cm long, margin membranous, red-tinted; bladeless sheaths greenish,

purple-tinted; ligule broadly triangular, ca 2 mm long, membranous, caducous. *Inflorescence* enclosed by the two innermost leaf-sheaths or by the leaf-sheath and the bladeless sheath, usually elongate; peduncle 5 – 6 cm long. *Flowers* few; bracts oblong ca 1.7 – 2.3 × 0.6 cm, glabrous, apex rounded; bracteoles linear, 0.6 – 1.2 × 0.1 – 0.2 cm, glabrous, apex rounded. *Calyx* 1.8 – 2.2 cm long, finely hairy, apex bifid. *Corolla-tube* 3 – 3.2 cm long, lobes linear; dorsal lobe ca 1.2 × 0.25 cm. apex hooded, aristate; lateral lobes slightly smaller, apex rounded. *Staminodes* white, oblong, 1 – 1.3 × 0.3 cm, apex acute or rounded. *Labellum* purple, darker at the middle, obovate, 1.2 – 1.5 × 0.8 – 0.9 cm, apex emarginate. *Stamen* with very short filament, ca 1 mm long; anther ca 2 mm long, anther-crest suborbicular, entire or emarginate, 1 – 1.5 × 2 mm. *Ovary* ca 2 × 1 mm, hairy; stylodes filiform 8 – 9 mm long.

T h a i l a n d.— NORTHERN: Tak; SOUTH-WESTERN: Kanchanaburi.

D i s t r i b u t i o n.— India, Burma (type, **Wallich** 6587, Bank of the River Attran).

E c o l o g y.— Scattered in moist soil, shaded bamboo or deciduous forest, 75 – 500 m alt.

V e r n a c u l a r.— Krachai dam (กระชายดำ)

7. Kaempferia rotunda Linn., Sp. Pl.: 3. 1753; Roscoe, Monand. Pl. t. 97. 1828; Wight, Icon. t. 2029. 1853; Schum. in Pflanzenr. Zingib. 4 : 87. 1904; Gagnep. in Fl. Gen. I-C : 47. 1908; Bak. in Fl. Br. Ind. 6: 22. 1890; Valet., Bull. Jard. Bot. Buitenzorg ser. 2. 27 : 109. 1918; Ridl., Fl. Mal. Pen. 4 : 246. 1924; Holttum, Gard. Bull. Sing. 13 : 120. 1950. Plate II : 4.

Herb, 12 – 30 cm tall. *Rhizome* with roots bearing tubers. *Leaves* 2 – 4, erect; blades elliptic or lanceolate-oblong, (7)12 – 25(36) × 4 – 6(11) cm, apex acute, base cuneate, upper surface glabrous, under surface hairy; petiole 1 – 2 cm long, hairy; leaf – sheaths 6 – 10 cm long, hairy; bladeless sheaths 4 – 6 cm long, hairy; ligule membranous, broadly triangular, 3 – 4 mm long, hairy. *Inflorescence* appearing from the leafless rhizome, shortly pedunculate, subtended by few broad sheaths; the longest sheath ca 5 cm long. *Flowers* several; bracts keeled, lanceolate, 2 – 4 × 1 – 2 cm, hairy, apex mucronate,

ciliate; bracteoles keeled, lanceolate, 1.8 – 2.3 × 1 cm, hairy, apex acute, ciliate. *Calyx* ca 3 – 5.2 cm long, hairy, apex bilobed. *Corolla-tube* 5 – 5.5 cm long, lobes linear; dorsal lobe 4 – 5 × 0.6 cm, apex hooded, aristate; lateral lobes ca 3.6 – 4.2 × 0.5 cm, apex aristate. *Staminodes* white, purple-tinted, oblong, 3 – 4 × 1.6 cm. apex rounded. *Labellum* purple, ca 4 × 2 – 2.5 cm, deeply bilobed, each lobe elliptic, apex rounded or mucronate. *Stamen* with short filament, ca 3 mm long; anther ca 5 mm long, anther-crest oblong, 9 – 12 × 3 – 4 mm, 3 – lobed; the outer lobes acute and elongate, the middle one shorter, entire or emarginate. *Ovary* 4 – 6 × 2 – 4 mm, hairy; stylodes linear, 3 – 5 mm long; ovules many.

T h a i l a n d.— NORTHERN: Chaing Mai, Lampang, Uttaradit, Phitsanulok, Tak; NORTH-EASTERN: Loei, Khon Kaen; CENTRAL: Saraburi; SOUTH-EASTERN: Chonburi; SOUTH-WESTERN: Uthai thani Kanchanaburi.

D i s t r i b u t i o n.— India (type, Himalaya), Ceylon, Indo-China, Malay Peninsula, Java.

E c o l o g y.— On limestone hill or in open grassy area, open lower montane forest and mixed deciduous forest, (50 –)200 – 1300 m alt.

V e r n a c u l a r.— Waan dokdin (ว่านดอกดิน), Waan tuu muup (ว่านตูหมูบ) (Loei); Waan nonlap (ว่านนอนหลับ) (Chiang Mai); Waan som (ว่านส้ม) (Khon Kaen); Waan haao non (ว่านหาวนอน) (Ratchaburi); Ueang din (เอื้องดิน) (Northern).

8. Kaempferia angustifolia Roscoe, Trans. Linn. Soc. 8: 351. 1807; Monandr. Pl. t. 04. 1828; Roxb. Fl. Ind. 1: 17.1820; Horan., Monogr.: 21. 1862; Bak. in Fl. Br. Ind. 6:219. 1890; Schum. in Pflanzenr. Zingib. 4: 86. 1940. – *K. roxburghiana* Schult., Mant. 1: 83. 1822. – *K. undulata* Teysm. et Binn.., Neederl. Kruidk. Arch. 3 391. 1855. (non Link in Dietr. syn.); Valet., Icon. t. 376. 1914. Plate II : 5.

Herb 3 – 4 cm tall. *Rhizome* short, with several roots bearing ovoid tubers. *Leaves* 3 – 5, radical, erect; blade elliptic – oblong, 14 – 20 × 4 – 10 cm, sometimes ca 4 × 1 cm, unequal sided; apex acute, base cuneate and sulcate, margin wavy, both surfaces glabrous; veins raised from the base and

curved up toward the apex; petiole ca 1 cm; leaf-sheath flattened, white, ca 3.5 cm long and 1.5 cm wide; ligule in conspicuous. *Inflorescence* sessile, enclosed by the innermost leaf-sheaths. *Flowers* 10 – 12; bracts white, lanceolate, ca 3 × 0.9 cm, apex acute; bracteoles unequal, linear, keeled, 9 – 12 × 0.25 mm, apex acute, ciliate. *Calyx* 4 – 5 cm long, apex 3 – lobed. *Corolla-tube* white, glabrous, 7.5 – 8.5 cm long, lobes white; dorsal lobe oblong, ca 3.5 × 0.3 cm; lateral lobes slightly shorter. *Staminodes* white, obovate-oblong or oblong, ca 3 – 3.7 × 1 – 1.5 cm. *Labellum* lilac with dark purple blotch at the centre, obovate, ca 3 × 2.5 cm, bilobed, divided to the middle. *Stamen* white, filament flat, ca 3 mm long; anther-crest quadrate, white with light purple blotch at the centre. *Ovary* ca 5 × 2 mm, glabrous; stylodes filiform ca 8 mm long; ovules many.

T h a i l a n d.— EASTERN: Ubon Ratchathani; CENTRAL: Saraburi.

D i s t r i b u t i o n.— India (type, Himalaya), Java.

E c o l o g y.— In paddy field or in shaded rocky area in the hardwood forest.

V e r n a c u l a r.— Thao nhang hang (เฒ่าหนังแห้ง), Prab samut (ปราบสมุทร)

9. Kaempferia siamensis P. Sirirugsa, Nord. J. Bot. 9(3): 257. Fig. 1 A-G. 1989.

Herb, 2 – 3 cm tall. *Rhizome* bearing several tuberous roots. *Leaves* usually solitary, sessile; blade horizontal, near the ground, suborbicular, glabrous, 7.5 – 13 × 7.5 – 12.5 cm, apex rounded or mucronate, base rounded or subcordate; leaf-sheath 2 – 3 cm long, glabrous; ligule conspicuous. *Inflorescence* sessile, enclosed by the leaf-sheath. *Flowers* 10 – 12; bracts keeled, lanceolate, ca 2 × 0.4 cm, apex acute, ciliate; bracteoles ca 1.5 cm long, glabrous. *Calyx* ca 3 cm long, glabrous, apex bifid. *Corolla-tube* ca 3 cm long, lobes linear; dorsal lobe ca 2.3 × 0.35 cm, apex hooded, acuminate; lateral lobes ca 2 × 0.3 cm, apex hooded, acute. *Staminodes* purple, oblong, ca 2 × 0.5 cm, apex rounded, slightly undulate. *Labellum* purple, obovate-cuneate, ca 2 × 1.5 cm, bilobed, divided to the middle. *Stamen* filament very short, ca 2 mm long; anther ca

3 mm long, anther-crest ca 5 × 2.5 mm, deeply bilobed; lobes lanceolate, equal or rerely unequal, apex acute. *Ovary* ca 4 × 2 mm, glabrous; stigma funnelshaped, ciliate; stylodes filiform, ca 6 mm long; ovules many.

T h a i l a n d.— NORTH-EASTERN: Sakon Nakhon (type, YUKTATHATA33

D i s t r i b u t i o n.— Endemic to North-eastern Thailand.

E c o l o g y.— In evergreen forest.

10. Kaempferia marginata Caray in Roscoe, Monandr. Pl. t. 93. 1898; Horan. Monogr. : 21. 1862; Bak. in Fl. Br. Ind. 6: 219. 1890; Schum. in Engler's Bot. Jahrb. 27: 337. 1899; in Pflanzenr. Zingib. 4: 78. 1904. Plate II : 6.

Herb, 3 – 5 cm tall. *Rhizome* short with few roots in a fascicle. *Leaves* usually 2, sessile; blades elliptic or orbicular, 8 – 14 × 5 – 11.5 cm, unequal sided, apex acute, base cuneate, margin purple, upper surface glabrous, under surface hairy; leaf-sheaths ca 5 cm long; bladeless sheaths ca 3 cm long; ligule triangular, ca 4 mm long. *Inflorescence* enclosed by the two leaf-sheaths, peduncle ca 1 cm long. *Flowers* 6 – 8; bracts greenish – white, lanceolate, ca 3.8 × 1 cm. glabrous, apex acuminate; bracteoles folded, linear, ca 3.2 × 0.2 cm. *Calyx* ca 2.5 cm long, apex bifid. *Corolla-tube* ca 4 cm long, lobes linear; dorsal lobe ca 2.5 × 0.5 cm, apex hooded, acuminate; lateral lobes ca 2.4 × 0.3 cm, apex blunt. *Staminodes* white, obovate-cuneate, ca 2 × 1 cm. *Labellum* purple with lateral white bands between midrib and margin, obovate-cuneate, ca 2.2 × 1.8 cm, deeply divided. *Stamen* almost sessile, filament ca 1 mm long; anther ca 4 mm long; anther-crest quadrate, ca 5 × 4 mm, deeply divided. *Ovary* ca 4 × 2 mm, glabrous; stylodes filiform ca 4 mm long.

T h a i l a n d.— NORTHERN: Chaing Mai, Tak.

D i s t r i b u t i o n.— India, Burma (type, Parish, Tenasserim)

E c o l o g y.— In evergreen forest, ca 100 m alt.

V e r n a c u l a r.— Proh thuean (เปราะเถื่อน) (Prachuap Khirikhan, Chumpon); Proh paa (เปราะป่า) (Central)

11. Kaempferia galanga Linn., Pl.: 2. 1753; Blume, Enum. Pl. Javae: 47. 1827; Roscoe, Monandr. Pl. t. 92. 1828; Wight, Icon 6. t. 899. 1853; Horan, Monogr.: 21 1862; Bak. in Fl. Br. Ind. 6: 219. 1890; Schum. in Pflanzenr. Zingib. 4: 77. 1904; Valet., Bull. Jard. Bot. Buitenzorg ser. 2. 27: 108. 1918; Ridl., Fl. Mal. Pen. 4: 245. 1924; Holttum, Gard. Bull. Sing. 13: 121. 1950. Plate II : 7.

Herb, 2 – 5 cm tall. *Rhizome* with several roots bearing tubers. *Leaves* mostly 2, sessile, horizontal, flat on ground; blades ovate to suborbicular, unequal sided, 6 – 14 × 5 – 10 cm, apex mucronate or acute, base rounded-cuneate, upper surface glabrous, under surface softy hairy, margin usually white; leaf-sheath broad, thick and keeled, ca 5 cm long and 1 cm wide; ligule membranous, triangular, apex rounded, ca 3 mm long, hairy. *Inflorescence* sessile, enclosed by the two leaf-sheaths. *Flowers* many; bracts lanceolate, acuminate, glabrous. 2 – 3 × 0.7 – 1.3 cm; bracteoles linear, folded along the midrib, 2 – 3 cm long. *Calyx* 2 – 2.5 cm long, glabrous, apex bifid. *Corolla-tube* 3 – 4 cm long; lobes lanceolate; dorsal lobe 1.5 – 2 × 0.4 cm, apex keeled, aristate; lateral lobes 1.4 – 1.8 × 0.4 cm, apex keeled, blunt. *Staminodes* obovate-cuneate or oblanceolate, 1.5 – 2 × 0.7 – 1.2 cm. *Labellum* divided to the base, each lobe obovate, ca 1.8 × 1.3 cm, apex irregularly creanate. *Stamen* with very short filament, ca 2 mm long; anther 3 – 4 mm long, anther-crest 4 – 5 × 2 – 3 mm, deeply bilobed, each lobe rounded or unequally toothed. *Ovary* 3 – 4 × 2.5 mm, glabrous; stylodes filiform, ca 6 mm long; ovules everal.

T h a i l a n d.— NORTHERN: Chiang Mai, Tak, Nakhon Sawan; NORTH-EASTERN: Loei; EASTERN: Nokhon Ratchasima, Ubon Ratchathani; SOUTH-EASTERN: Prachin Buri, Chanthaburi; SOUTH-WESTERN: Kanchanaburi, Prachuap Khiri Khan; PENINSULAR: Surat Thani.

D i s t r i b u t i o n.— India (type, **Wallich.** 6581), Malay Peninsula, Java.

E c o l o g y.— Common in bamboo forest, often in evergreen and deciduous forest, rarely in open grass scrub, 50 – 400 m alt.

V e r n a c u l a r.— Proh hom (เปราะหอม); Hom proh (หอมเปราะ) (Central); Waan teen din (ว่านตีนดิน), Waan phaen din yen (ว่านแผ่นดินเย็น), Waan hom (ว่านหอม) (Northern)

12. Kaempferia pulchra Ridl., J. Str. Br. Asiat. Soc. 32: 107. 1899; Schum. in Pflanzenr. Zingib. 4: 79. 1904; Gagnep. in Fl. Gén. I – C.: 50. 1908; Valet., Bull. Jard. Bot. Buitenz. ser. 2. 27: 113. 1918; Ridl., Fl. Mal. Pen. 4: 245. 192; Holttum, Gard. Bull. Sing. 13: 122. 1950. Plate III : 8.

Herb, 3 – 10 cm tall. *Rhizome* short with several roots in a fascicle. *Leaves* 1 – 6, usually horizontal, sessile; blades elliptic, ovate, obovate and suborbicular; 5 – 18(– 30) × 2 – 10(– 16) cm, apex acute or mucronate, base cuneate, rounded or subcordate, upper surface glabrous, under surface hairy; leaf-sheaths 3 – 12 cm long; bladeless sheaths 2 – 8(– 18) cm long, hairy; ligule membranous, broadly triangular 3 – 5 mm long, hairy. *Inflorescence* enclosed by the inner leaf-sheaths; peduncle (0.5 –)5 – 17 cm long. *Flowers* 10 – 12; bracts lanceolate, 2.5 – 4 × 0.8 – 1 cm, hairy, apex acuminate; bracteoles keeled, lanceolate ca 1.4 × 0.15 cm, hairy, apex acuminate. *Calyx* 2 – 3 cm long, hairy, apex acute. *Corolla – tube* ca 5 cm long, lobes linear; dorsal lobe ca 2 × 0.4 cm, apex hooded, aristate; lateral lobes ca 1.7 × 0.3 cm, hooded, blunt. *Staminodes* lilac, clawed, blade obovate, ca 2.1 × 1.7 cm, stalk ca 6 mm long. *Labellum* lilac with white spot at the base, divided to the base, each lobe obovate, ca 2.7 × 1.5 cm. *Stamen* with very short filament; anther ca 5 mm long; anther-crest clawed, blade oblanceolate, ca 7 × 5 mm, apex acute or rounded, stalk ca 3 mm long. *Ovary* ca 3 × 2 mm, densely hairy; stylodes filiform, ca 6 mm long; ovules many.

T h a i l a n d.— NORTHERN: Phitsanulok, Tak, Nakhon Swan; CENTRAL :Saraburi; SOUTH-EASTERN: Chantaburi; SOUTH-WESTERN: Kanchanaburi, Rachaburi, Prachuap Khiri Khan (type); PENINSULAR: Chumphon, Ranong, Surat Thani, Krabi, Nakhon Si Thamarat.

D i s t r i b u t i o n.— Indo-China, Malay Peninsula, Java.

E c o l o g y.— Common on moist, limestone areas, in the evergreen

forest, often in the bamboo and mixed deciduous forest, from the sea level to 700 m alt.

V e r n a c u l a r.— Proh pa (เปราะป่า) (Peninsular).

13. Kaempferia glauca Ridl., J. Asiat. Soc. Bengal: 107. 1899; Schum. in Pflanzenr. Zingib. 4: 78. 1904; Gagnep. in Fl. Gen. I – C.: 51. 1908.

Herb, 2 – 4 cm tall. *Rhizome* short, bearing stout roots in a fascicle. *Leaves* 2 – 3, horizontal near the ground; blades suborbicular to elliptic, 8 – 12 × 7 cm, apex cuspidate, base rounded, upper surface sparsely hairy, under surface hairy; petiole and leaf-sheath 2.5 – 4 cm long; ligule inconspicuous. *Inflorescence* arising between the innermost leaf-sheaths; peduncle ca 2.3 cm long, hairy; spike ca 2.5 cm long. *Flowers* several; bracts lanceolate, apex acuminate, ca 3 × 0.5 cm, hairy; bracteoles lanceolate, hairy, apex acuminate, ca 1.6 × 0.2 cm. *Calyx* spathaceous, ca 2.5 cm long, hairy. *Corolla-tube* ca 5 cm long, lobes linear, ca 1.4 × 0.2 cm. *Staminodes* obovate-cuneate, ca 1.3 × 1 cm. *Labellum* suborbicular, ca 1.5 × 2 cm, deeply bilobed. *Stamen* sessile; anther ca 3 mm long; anther-crest large reniform, recurved, ca 1.5 × 4 – 5 mm. *Ovary* ca 3 mm long, hairy; stylodes minute, ca 1 mm long.

T h a i l a n d.— NORTHERN: Sukhothai.

D i s t r i b u t i o n.— Indo-China, Malay Peninsula.

E c o l o g y.— In rocky hardwood forest.

14. Kaempferia roscoeana Wall., Bot. Reg. t. 1212. 1829; Horan, Monogr.: 21. 1862; Hook. f., Bot. Mag. t. 5600. 1866; Bak. in Fl. Br. Ind. 6: 220. 1890; Schum. in Pflanzenr. Zingib. 4: 78. 1904. Plate III : 9.

Herb, 2 cm tall. *Rhizome* stout with several root tubers. *Leaves* two, flat on the ground, rather thick, sessile; blades suborbicular, 5 – 12 × 5 – 11.5 cm, apex mucronate, base rounded-cuneate, both surfaces glabrous, upper surface mottled dark green; leaf-sheaths keeled and thick, ca 2.5 cm long and 2 – 3 cm wide. *Inflorescence* short and compact, enclosed by the two leaf-sheaths. *Flowers* few; bracts oblong, ca 2.2 × 0.35 cm, apex acuminate,

glabrous; bracteoles folded, linear, glabrous, apex hooded, acute. *Calyx* ca 2 cm long, glabrous, apex bifid. *Corolla-tube* ca 4 cm long, lobes oblong; dorsal lobe ca 1.5 × 0.3 cm, apex hooded, acuminate; lateral lobes ca 1.3 × 0.2 cm, apex hooded, blunt. *Staminodes* pure white, obovate, ca 1.7 × 0.8 cm. *Labellum* white with yellow spot at the base, divided to the base, each lobe obovate, ca 1.6 × 0.9 cm, apex rounded. *Stamen* sessile; anther ca 3 mm long; anther-crest ca 1.5 × 1.5 mm, keeled, ovate, entire. *Ovary* ca 4 × 2 mm, glabrous; styles filiform, ca 3 mm long; ovules many.

T h a i l a n d.— NORTHERN: Chiang Mai, Tak; SOUTH-EASTERN: Kanchanaburi, Prachuap Khiri Khan.

D i s t r i b u t i o n.— India. Burma (type, Nepal).

E c o l o g y.-- Common in bamboo forest, rarely in dry dipterocarp forest, 80 – 400 m alt.

V e r n a c u l a r.— Proh paa (เปราะป่า) (Central)

15. Kaempferia laotica Gagnep., Bull. Soc. Bot. Fr. 54: 166. 1909. Plate III:10.

Herb, 2 – 3 cm tall. *Rhizome* short with several roots in a fascicle. *Leaves* usually 2, horizontal near the ground, sessile; blades suborbicular, 7 – 12.5 × 7 – 10.5 cm, apex mucronate, base rounded-cuneate, upper surface glabrous, under surface hairy; leaf-sheaths 2 – 4 cm long, hairy; ligule broad-triangular, up to 7 mm long, membranous, hairy. *Inflorescence* sessile, 2 – 3 cm long, enclosed by the two leaf-sheaths. *Flowers* ca 10; bracts lanceolate, ca 1.8 – 2.5 × 0.9 cm, hairy, apex acute; bracteoles linear, folded, 1.8 – 2.2 cm long, glabrous. *Calyx* 2.5 – 3 cm long, glabrous. *Corolla-tube* ca 3.7 – 4 cm long, lobes linear ca 2 × 0.4 cm. Staminodes white, obovate-cuneate, ca 2 × 1 cm. *Labellum* white with purple blotch at the centre, ca 2.5 × 2.3 cm, deeply divided; each lobe obovate, apex irregularly crenate or emarginate. *Stamen* with very short filament; anther ca 3 mm long; anther-crest rectangular, 3 – 5.5 × 1 – 3 mm, apex entire or emarginate. *Ovary* ca 4 mm long, glabrous; stylodes filiform, ca 4 mm long; ovules several.

T h a i l a n d.— NORTH-EASTERN: Sakon Nakhon.

D i s t r i b u t i o n.— Laos (type, Xieng-kouang).

E c o l o g y.— In evergreen forest.

A C K N O W L E D G E M E N T S

I am very grateful to Professor **Kai Larsen** for his advice and permission to use his valuable spirit collections of Thai specimens,* Thanks are also due to the curators of the following herbaria for the loan of herbarium specimens: AAU, BK, BKF, C, E, K, L, P and PSU. I am indebted to the Botanical Institute, University of Aarhus for facilities during the study. The Danish Ministry of Education supported my stay in Aarhus. I also thank Mrs. **Supee Saksuwan Larsen**, M.Sc., for her kind help in many ways.

R E F E R E N C E S

Baker, J.G. 1890 – 1892. Scitamineae. – In Hooker, J.D., Flora of British India 6, London, pp. 198 – 264.

Gagnepain, M.F. 1908. Zingibercées. – In Lecomte, H., Flore Génerale de L' Indo-Chine 6, Paris, pp. 25 – 121.

Holttum, R.E. 1950. Zingiberaceae of the Malay Peninsula. – Gardens' Bulletin, Singapore 13: 1 – 249.

Larsen, K. 1962. Studies in Zingiberaceae III. On a new species of *Kaempferia* from Thailand and its relatives.-Bot. Tidsskr. 58: 191-203.

Ridley, H.N. 1924. Flora of the Malay Peninsula 4, London, pp. 1 – 458.

Schumann, K. 1904. Zingiberaceae.- In Engler, A., Pflanzenreich 4. 46, Leipzig, pp. 1 – 458.

Valeton, T. 1918. New notes on the Zingiberaceae of Java and Malaya.-Bull. Jard. Bot. Buitenz. ser. 2, 27: 1 – 166.

*to **Ass.** Prof. Chirayupin Chantraprasong for sending some spirit specimens.