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Notes on the genus *Kaempferia* L. (Zingiberaceae) in Thailand

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Abstract

The genus *Kaempferia* L. (Ziniberaceae) is one of the important medicinal plant genera in Thailand. As a result of herbarium investigation and intensive field studies, 16 taxa are enumerated for Thailand in this account. Distinguishable morphological characteristics of these species are given. Photographic illustrations of some key species are included. The ethnobotany of the genus *Kaempferia* in Thailand is also discussed in four main aspects: food, medicine, belief, and horticulture.

Key words: **genus *Kaempferia* L. (Zingiberaceae), Thailand, taxonomy, ethnobotany**

Introduction

The family Zingiberaceae is one of the most important but least known medicinal plant families in Thailand. Several taxa of the family form the plant group known in Thai folk taxonomy as *wan*, a medicinal plant group in the Thai materia medica and recorded in the traditional Thai medical literature. The plants either have or lack underground storage roots or stems; some may be used for medicinal purposes, but some are believed to possess certain spiritual or magical effects.

During the past decade, we have been working to establish basaline knowledge about this plant group indigenous to Thailand, including taxonomic studies and ethnopharmacological documentation for further study, including for future drug development. Our focus on the genera *Caulokaemferia* K.Larsen, *Elettariopsis* Baker., *Gagnepainia* K.Schum., *Hedychium* J. König, *Hemiorchis* Kurz, and *Stahlianthus* Kuntze of the family Zingiberaceae resulted in the report of several new taxa and new records for Thailand,[1-10] with several more reports to be published.

The genus *Kaempferia* L. constitutes several *wan* known in the Thai literature, such as Wan Krachaidam (*K. parviflora* Wall. ex Baker), Wan Thao Nanghaeng (*K. angustifolia* Roscoe), Wan Karchae-chan (*K. galanga* L.), and Wan Chang-njang (*K. marginata* Carey), to name a few. Some of the *wan* in this genus are still taxonomically unknown, a few of which may be new to science, while some taxa are currently under intensive research for various aspects of drug development, e.g. *K. galanga* L. and *K. parviflora* Wall. ex Baker.

This paper is a preliminary report on this genus

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in two main aspects, taxonomy and ethnobotany, resulting from our specimen-based investigation and intensive field research throughout Thailand and Laos, combined with previous reports on the genus. The objective of the paper is to set up the most up-to-date baseline information on the genus *Kaempferia* L. for future studies on all aspects, including new drug development.

Taxonomy

History

The genus *Kaempferia* L. was established in 1753 with two species: *K. galanga* L. and *K. rotunda* L.[11,12] The former taxon was first described by a German botanist, Engelbert Kaempfer (1651-1716), and was chosen to be the lectotype for the genus by Hitchcock and Green, and by Phillips.[13,14] Since then, several new taxa from Asia and Africa have been described.

Baker (1890) listed four subgenera with a total of 22 species in his account on the genus *Kaempferia* L. for British India: *Sincorus* Horan. (12 species), *Protanthium* Horan. (2 species), *onolophus* Wall. (7 species), and *Stachyanthesis* Benth. (1 species).[15] However, some of these taxa have currently been transferred to other related genera, i.e. *Boesenbergia* Kuntze, *Camptandra* Ridl., *Caulokaempferia* K.Larsen, and *Stahlianthus* Kuntze. Much later, Kam (1980) made the exemplary and lucid analyses on the taxonomic history of the genus and pointed out that the subgenus *Sincorus* (Horan.) Baker includes the generic type, and, therefore, should become subgenus *Kaempferia*.[14] She tentatively recognized three groups as sections of Asiatic species: Sect. *Kaempferia* (the *K. galanga* group), Sect. *Protanthium* (Horan.) Benth. (the *K. rotunda* group), and Sect. *Stachyantheis* Benth., with only one taxon, *K. scaposa* (Dalz.) Benth.[14]

In his account, Gagnepain (1908) enumerated 13 taxa for Indochina.[16] Although most of his species are currently accepted, three have been placed under a different genus, *Boesenbergia* Kuntze. In 1924, Ridley reported five species in his treatment of the Malay Penninsula.[17] Holttum (1950) accepted four of Ridley's accounts, but transferred *K. cyanescens* Ridl. to *Haniffia cyanescens* (Ridl.) Holtt.[18]

Generic features

Schumann (1903) considered the trilocular ovary with axile placentation a key character of the genus *Kaempferia* L.[19] However, this character is common to other genera and seems to be variable within the genus.[14] Therefore, a combination of several diagnostic characteristics, both vegetative and floral morphology, is essential for taxonomic decision at any species level.

The vegetative characters of taxa found in Southeast Asia are often associated with the fleshy rhizomes, usually short, with several roots in a fascicle. The roots of some species, particularly those with inflorescence separated from and preceding leaf-shoots, are fibrous with terminal globular to fusiform storage tubers. Leaves range from one to a few; they are filiform to very broad, rising from the rhizomes, usually with keeled sheathes, short to long petioles, small, inconspicuous, or without ligules. One to a few large ovate to orbicular prostrate or accumbent leaves are characteristic of some taxa, e.g. *K. galanga* L., *K. laotica* Gagnep., *K. marginata* Carey. Narrowly linear to filiform leaf blades are unique to a certain group, i.e., *K. fissa* Gagnep., *K. fallax* Gagnep., and *K. filifolia* K. Larsen. However, from our intensive studies on the herbarium specimens available and our investigation of living specimens, these characters can vary greatly within a species.

The inflorescence of all species found in Thailand is either separated from (in all taxa preceding the appearance of the leaf-shoots), or terminal on and contemporaneous with the leaf-shoots. The terminal inflorescence often forms a pedunculate head, and all its primary bracts are always fertile. However, the radical inflorescence is either sessile or very shortly pedunculated, with 2-4 sterile sheathing bracts. The non-tubular primary bract is always accompanied by a shortly bilobed or bilobed-to-the-base bracteole, and subtends only one flower.

A combination of the overall floral morphology is characteristic of the Asiatic *Kaempferia* species. The labellum is separated from the lateral staminodes al-

most to the base, and is often deeply bilobed, except that of *K. parviflora* Wall. ex Baker. The lateral staminodes are always petaloid and the anther crest is always conspicuous and could be entire or dentate, straight or reflexed, and narrow or orbicular. Moreover, the stigma is always cup-shaped with ciliated rims and the stylodial glands are paired and needle-like.

However, morphological features can be greatly variable, even within the same taxon. Therefore, until the range of character variation of these generic features is fully understood, a single diagnostic character cannot be used for taxonomic decision-making.

Relationship

As pointed out by Holttum (1971), the genus *Kaempferia* L. is morphologically closely related to the genera *Boesenbergia* O.Kuntze and *Scaphochlamys* Baker.[18] Both *Kaempferia* and *Boesengergia* possess one flower in the axil of each bract, with one or two bracteoles. In contrast with the not-two-ranked bract arrangement and the often flat and bilobed labella of the *Kaempferia*, those of the *Boesenbergia* are two-ranked, and the labella often saccate with the distal part often being entire or crenate, and often reddish toward the apex. These characters clearly are distinct enough to differentiate the two genera.[18]

The rhizomes of the *Kaempferia* are either short fleshy elements or fleshy tuber-bearing roots, while those of the *Scaphochlamys* are less fleshy, often long creeping.[18] The short and compact inflorescence of the *Kaempferia* comprises one flower to each bract. The flower is accompanied by a more or less deeply bilobe bracteole or by two narrow separated bracteoles. The labellum is deeply bilobed (except *K. parviflora* Wall. ex. Baker), the anther crest is often large and petaloid, and the filament always very short, whereas those inflorescences of the *Scaphochlamys* consist of several flowers to each bract; however, the labellum is never so deeply bilobed, and the filament is always present.[18]

The *Kaempferia* L. is also related to the genus *Cornukaempferia* J.Mood & K.Larsen in general habit.[25] However, the *Kaempferia* always produces large, flat, and petaloid anther crests, never "Zingiber-like", as in the genus *Zingiber*. Also, the *Kaempferia* is also distinguishable by its more or less bilobe bracteoles, while the bracteole is absent in the *Cornukaempferia*.

The Thai Taxa

Of the 15 taxa accounted for in Thailand,[20,21] six were also reported for China.[22] *K. candida* Wall. was later reported to also be found in Thailand[23] and a new taxon, *K. grandifolia* Saensouk & Jenjitt., was also added.[24] All currently known Thai taxa can be divided into two groups, the *K. galanga*-group and the *K. rotunda*-group. The former group is characterized by a short multiflorous inflorescence that appears earlier before the leaves, while the latter group includes species in which the inflorescence has few flowers and is terminal on the leaf-shoots. In Thailand, three species, *K. candida* Wall, *K. grandifolia* Saensouk & Jenjitt., and *K. rotunda* L., represent the former group. To set up baseline information on the genus for further studies, all the Thai taxa will be discussed here briefly.

1. **K. angustifolia** Roscoe in Trans. Linn. Soc. 8: 351. 1807; Monandr. Pl. t. 04. 1828; Roxb., Fl. Ind. 1: 17. 1820; Horan., Monogr.: 21. 1862; Bak. in Hook., Fl. Br. Ind. 6: 219. 1894; Schum. in Engl., Pflanzenr. 4(46), 20 Heft: 86. 1904; Sirirugsa in Nord. J. Bot. 9: 259. 1989 & in Thai For. Bull. (Bot.) 19: 8-9. 1992.—*K. roxburghiana* Schult., Mant. 1: 83. 1822.—*K. undulata* Teysm. et Binn. in Neederl. Kruidk. Arch. 3:391. 1855. (non Link in Dietr. Syn.); Icon. T. 376. 1914. Plate II:5.

Type: Bangladesh, *Roxburgh* s.n. (holotype K)

This medicinal taxon is a variable species with the leaves ranging from small (about 4 × 1 cm) to quite large (14-20 × 4-10 cm). The distinguishable characteristic of this species are the erect elliptic-oblong leaves with undulate margins, the inflorescence borne in the two innermost leaf-sheaths, the quadrangulate and white (with a purple blotch at the center) anther crest (about 3.5 cm long) with a bifid apex, and the glabrous ovary. The labella of this species are lilac with purple blotch at the center, obo-

Fig. 1 *K. angustifolia* Roscoe, showing the plant habit, leaves and flower.

Fig. 2 *K. candida* Wall., showing the rhizome, roots, and an inflorescence.

Fig. 3 *K. candida* Wall., showing a rhizome, roots, and an inflorescence and details of the flowers.

vate and bilobe (in the middle), while the staminodes are white, obovate-oblong or oblong.

This species can be found in (its natural habitat) in Ubon Ratchathani Province of Thailand, but it is wildly cultivated, especially in northeastern Thailand, for spiritual and medicinal purposes. The cultivated ones seem to be much larger in habit.

2. **K. candida** Wall., Pl. Asiat. Rar. 1: 47, t. 56. 1830; Bak. in Hook., Fl. Br. Ind. 6: 222. 1894; Schum. in Engl., Pflanzenr. 4(46), 20 Heft: 87. 1904; Gagnep. in Lecomte, Fl. Gén. I.-C. 6: 47. 1908; Jenjitt. & K.Larsen in Thai For. Bull. (Bot.) 28: 45-46, figs. 1-2. 2000; T.L.Wu & K.Larsen in Z.L. Wu & PH. Raven, Fl. China 24: 369. 2000.

Type: Myanmar, *Wallich* 6585 (holotype K)

This edible taxon can be easily recognized by its radical inflorescences arising from the rhizomes before the appearance of the leaf-shoot, white erect lateral staminodes with yellow patches at the base, and white reflexed labellum apically two-lobed for about one-third its length, with two yellow lines at the center. The inflorescences appear from as early as March until late July.

This species is distributed from Myanmar and China (southwest Yunnan) through Vietnam, Laos and Cambodia.[22] In Thailand it was recorded in Kanchanaburi Province.[23] However, the authors also found this species in Tak, Mae Hong Son, and Chiang Mai.

3. **K. elegans** Wall. ex Baker. in Hooker, Fl. Br. Ind. 6:222. 1890; Schum. in Engl., Pflanzenr. 4(46), 20 Heft: 82. 1904; Ridl., Fl. Mal. Pen. 4:245. 1924; Holtt. in Gard. Bull. Sing. 13:123. 1950; Chung, Lime. Fl. Mal. 2: 711. 1973; Sirirugsa in Nord. J. Bot. 9: 259. 1989 & in Thai For. Bull. (Bot.) 19: 5-6. 1992; T.L.Wu & K.Larsen in Z.L.Wu & PH. Raven, Fl. China 24: 369. 2000.—*K. crawfurdii* Wall., Cat. in ed.—*Monolophus elegans* Wall., Pl. Asiat. Rar. 1:24. t. 27. 1830; Horan., Monogr. :22.1862. —*K. pulchra* Ridl. in J. Str. Br. Asiat. Soc. Bengal 32: 107. 1899.

Type: Myanmar, tenasserim, *Wallich* 6593 (Lectotype K)

This beautiful species is recognized here as conspecific to *K. pulchra* Ridl. It is also variable in plant habit. However, it can be readily distinguished by its erect leaf blades, with 1-10 cm long petioles and the triangular (2-5 mm long) ligules, long hairy pedunculated (1-20 cm) inflorescences, and violet flowers with large orbicular to oblong crests with variable apices.

This taxon is also widely distributed: from India and Myanmar to Thailand and Peninsular Malaysia. It can be found from the northern part of the country to Peninsular Thailand, often along the streams on limestone boulders in mixed deciduous forests. This species is widely cultivated in Thailand for horticultural purposes. The leaves are edible and the rhizomes are medicinal.

4. **K. fallax** Gagnep. in Bull. Soc. Bot. Fr. 4. ser. 3: 259. 1903; Schum. in Engl., Pflanzenr. 4(46), 20 Heft: 437. 1904; Gagnep. in Lecomte, Fl. Gén. I.-C. 6: 48. 1908; Sirirugsa in Nord. J. Bot. 9: 259. 1989 & in Thai For. Bull. (Bot.) 19: 4-5. 1992.

Type: Laos, *Harmand* s.n. (holotype P)

This taxon can be distinguished by its 2-4 linear leaves (not more than 1 cm wide), sessile inflorescences with pure white, night-blooming flowers, obovate lateral staminodes, deeply bilobed lips, and quadrate bilobed crests. It is closely related to *K. fissa* Gagnep. and *K. filifolia* K.Larsen. in plant habit and its white flowers. However, the leaves of the latter two taxa are filiformis and the anther crests are either square or rectangular with apices ranging from straight to bifurcate.

This species can be found thoughout southern Laos. It often grows in sandy soils near the banks of rivers or in paddy fields in Nakhon Phanom, Ubonratchathani and Amnat Charoen provinces in northeastern Thailand.

5. **K. filifolia** K.Larsen in Bot. Tidsskr. 58: 201. 1962; Sirirugsa in Nord. J. Bot. 9: 259. 1989 & in Thai For.

Fig. 4 *K. elegans* Wall. ex Baker, showing the plant habit, flowers and leaves.

Fig. 5 *K. elegans* Wall. ex Baker, showing detail of the flowers.

Fig. 6 *K. fallax* Gagnep., showing the plant habit and a flower.

Fig. 7 *K. fallax* Gagnep., showing detail of the flower.

Fig. 8 *K. filifolia* K.Larsen, showing the plant habit and a flower.

Fig. 9 *K. filifolia* K.Larsen, showing detail of the flower.

Bull. (Bot.) 19: 5. 1992.

Type: Thailand, Phu Wat (Mukdahan Province), *Kerr* 21500 (holotype K)

This taxon was described from the specimen collected by A.F.G. Kerr in 1932 from "Pu Wat (Nakawn Panom)", which is nowadays Phu Wat of Mukdahan Province in northeastern Thailand. The type specimen was described as closely related to *K. fissa* Gagnep. and *K. fallax* Gagnep, but it differs in the larger habits and anther crests. All three taxa possess pure white, night-blooming flowers. The connective appendage of this taxon may be described as rectangular with bifurcate apex, while those of the two latter species are short bifurcate and square respectively. However, these characters, which are used for taxonomic decision-making, are variable, especially the length of the leaves and corolla tubes.

During the past few years, the authors have made several visits to the sites of this taxon in Phu Phan National Park (Sakon Nakhon Province), Phu Wat (type location, formerly Nakhon Phanom, but now Mukdahan Province), Khong Chiam and Sirindhorn Districts (Ubonratchathani Province), including several other locations in southern Laos, to monitor and study the living populations. At this stage we suspect that this species may be conspecific to *K. fissa* Gagnep. A molecular study to confirm our hypothesis is in progress.

6. **K. galanga** L., Sp. Pl.: 2. 1753; Roxb., Pl. Ind. 1: 5. 1820; Bak. in Hook., Fl. Br. Ind. 6: 218. 1890; Schum. in Engl., Pflanzenr. 4(46), 20 Heft: 77. 1904; Gagnep. in Lecomte, Fl. Gén. I.-C. 6: 45. 1908; Ridl., Fl. Mal. Pen. 4:245. 1924; Holtt. in Gard. Bull. Sing. 13:117. 1950; Larsen in Bot. Tidsskr. 58: 201. 1962; Chung, Lime. Fl. Mal. 2: 703. 1973; Burtt & Smith in Dassanayake, Fl. Cey. 4: 508. 1983; Sirirugsa in Nord. J. Bot. 9: 259. 1989 & in Thai For. Bull. (Bot.) 19: 11. 1992; T.L.Wu & K.Larsen in Z.L.Wu & PH. Raven, Fl. China 24: 369. 2000.—*K. sessilis* König in Retz., Obs. 3: 67. 1783.—*K. humilis* Salisb., Prodr. 6. 1796.—*K. plantaginifolia* Salisb. in Trans. Hort. Soc. 1: 286. 1808.

Type: probably Hort. Cliff.

This generic type species is one of the important medicinal plants used in Thai traditional medicine. It can be readily distinguished from other taxa by its two horizontal (flat on the ground), ovate-to-suborbicular, unequal-side, sessile leaves with inflorescence enclosed in the two leaf-sheaths, and white flowers. The lateral staminodes are obovate-cuneate or oblanceolate and the labellum is divided to the base with a purple blotch at the base. The anther crest is 4-5 × 2-3 mm, deeply bilobed, each lobe being rounded or unequally toothed.

This taxon is distributed over a wide range: from India to Myanmar, China, Thailand, Indochina, Malay Peninsula and Java. It can be found in bamboo forests, often in evergreen and deciduous forests, in all parts of Thailand. It is widely cultivated in Thai home gardens as the leaves and rhizomes are used for food and medicine.

7. **K. glandifolia** Saensouk & Jenjitt. in Nord. J. Bot. 21: 139-140, Figs. 1-2. 2001.

Type: Thailand, Khon Kaen Province, Kok Phu Takla, *Saensouk* 55 (holotype BKF)

This unique species can be readily distinguished by its inflorescences on separate shoots arising from rhizomes appearing before the pseudostems, the 4-5 large (12.5-20 × 15-20 cm) almost horizontal (near the ground) suborbicular leaves, and the pedunculated (0.5-3 cm) inflorescences with pure white flowers. The anther crest of the flower is oblong with a conspicuously bilobed apex.

So far the taxon is known only from the type location in a restricted area of Khon Kaen Province in northeastern Thailand. The leaves and rhizomes are used by the local people for medicinal purposes.

8. **K. glauca** Ridl. in J. Asiat. Soc. Bengal: 107. 1899; Schum. in Engl., Pflanzenr. 4(46), 20 Heft: 78. 1904; Gagnep. in Lecomte, Fl. Gén. I.-C. 6: 51. 1908; Sirirugsa in Nord. J. Bot. 9: 259. 1989 & in Thai For. Bull. (Bot.) 19: 13. 1992.

Fig. 10 *K. glandifolia* Saensouk & Jenjitt., showing flowers.

Fig. 11 *K. glandifolia* Saensouk & Jenjitt., showing detail of its flower.

Fig. 12 *K. glandifolia* Saensouk & Jenjitt., showing the plant habit and leaves.

Type: Thailand, *Curtis* 3252 (lectotype K)

This taxon is placed among the *K. galanga* group, plants with 2-3 flat, near-the-ground leaves and inflorescences produced in the innermost leaf-sheaths. However, *K. glauca* Ridl. can be differentiated from other species of the same group by its glacous leaves, inflorescence with hairy peduncle and violet flowers, obovate-cuneate to suborbicular lateral staminodes, suborbicular labellum (divided to the base) with white blotch near the base, large violet recurved reniform anther crest, and the hairy calyx tube and ovary.

This species is distributed in Thailand and Laos.

9. **K. laotica** Gagnep. in Bull. Soc. Bot Fr. 54: 166. 1907; Gagnep. in Lecomte, Fl. Gén. I.-C. 6: 51. 1908; Sirirugsa in Nord. J. Bot. 9: 259. 1989 & in Thai For. Bull. (Bot.) 19: 14. 1992.

Type: Laos, Xiang-kouang, *Spire* 309 (holotype P)

This taxon is also in the *K. galanga* group, plants usually with two flat, near-the-ground leaves and inflorescences produced in the innermost leaf-sheaths. It differs from *K. elegans* Wall. ex Baker and *K. glauca* Ridl. by its sessile inflorescences and glabrous calyx tubes and ovaries. However, it is similar to *K. roscoeana* Wall., but differs in the following characters: the lower leaf surface is hairy and the anther crest rectangular with the entire or emarginate apex (compared with the leaves, both sides are glabrous and the anther crest is small, ovate keeled with the entire apex). The flower of this species is white with obovate-cuneate staminodes and deeply divided obovate lips with purple blotch at the center.

This species is distributed in evergreen forests in northeastern Thailand and in Laos.

10. **K. larsenii** Sirirugsa in Nord. J. Bot. 9: 257. 1989. Fig. 1 H-P & in Thai For. Bull. (Bot.) 19: 14. 1992.

Type: Thailand, Ubonratchathani, *Nilviset* 19 (holotype C, isotype BKF)

This species can be placed in the *K. galanga* L. group. It can be differentiated by its petiolated (about 1 cm long) elliptic-linear to linear leaf blade (up to 1 cm wide) with the hooded and acute apex, broadly triangular ligule (about 1 mm long), and the obovate anther crest with rounded or crenate apex. The flowers of this taxon are violet with the obovate staminodes and the lip divided to the base (each lobe obovate).

This species is distributed in northeastern Thailand (Ubonratchathani and Amnat Charoen provinces) and southern Laos (Champasak Province). It can be found in open areas and in paddy fields. It is used by the local people for medicinal purposes.

11. **K. marginata** Carey ex Roscoe, Monandr. Pl. Scitam.t. 93. 1824; Horan. Monogr.: 21. 1862; Bak. in Hook., Fl. Br. Ind. 6: 219. 1894; Schum. in Engl., Pflanzenr. 4(46), 20 Heft: 78. 1904; Sirirugsa in Nord. J. Bot. 9: 259. 1989 & in Thai For. Bull. (Bot.) 19: 10. 1992; T.L.Wu & K.Larsen in Z.L.Wu & PH. Raven, Fl. China 24: 370. 2000.

Type: Myanmar, Tenasserim, *Carey* no. ? (lectotype K)

This species resembles and may be conspecific to *K. galanga* L. However, the major differences of both taxa are the color of the leaf margin and color of the labellum. The leaf margin of *K. marginata* Carey is purple in color, while that of *K. galanga* L. is green. The labellum of the former is purple, sometimes with longitudinal white bands near the margin, whereas that of the latter is white with a purple marking at the base.

This taxon is distributed in a range from India, Myanmar, China, Thailand, Laos and Cambodia. In Thailand, it can be often seen in open areas, paddy fields, or evergreen forests in the northern, northeastern, and upper southern regions of the country. It is also used by the local people for food and medicine.

12. **K. parviflora** Wall. ex Baker. in Hook., Fl. Br. Ind. 6: 221. 1894; Schum. in Engl., Pflanzenr. 4(46), 20 Heft: 78. 1904; Sirirugsa in Nord. J. Bot. 9: 259. 1989 & in Thai For. Bull. (Bot.) 19: 6-7. 1992.

Type: Myanmar, Bank of the Attran River, *Wallich* 6587 (lectotype K)

Fig. 13 *K. laotica* Gagnep., showing the plant habit, leaves and flowers.

Fig. 14 *K. laotica* Gagnep., showing detail of its flower.

Fig. 15 *K. laotica* Gagnep., showing detail of its flower.

Fig. 16 *K. larsenii* Sirirugsa, showing the plant habit and infloresence.

Fig. 17 *K. parviflora* Wall. ex Baker, showing the plant habit.

Fig. 18 *K. parviflora* Wall. ex Baker, showing detail of its flower.

This is the most famous Thai taxon in recent times. Its rhizome is claimed to possess a potent male aphrodisiac effect, known locally as *wan krachai dam*, or *krachai dam*. This taxon possesses grayish to black rhizomes and the erect ovate or elliptic leaf blades, with 1-10 cm long petioles. The inflorescence is pedunculated (5-6 cm) with a few small flowers easily recognized by the white oblong staminodes, the obovate purple lip (darker in the middle) with the emarginated apex, and suborbicular (1-1.5 × about 2 mm) anther crest.

This species is distributed over an area from India and Myanmar to Thailand and Laos. In Thailand, it can be found in deciduous forests or moist bamboo forests in Tak and Kanchanaburi provinces. It is currently widely cultivated in Thailand for its black rhizomes.

13. **K. roscoeana** Wall., Bot. Reg. t.1212. 1829; Horan., Monogr.:21. 1862; Hook. f., Bot. Mag. T. 5600. 1866; Bak. in Hook., Fl. Br. Ind. 6: 220. 1894; Schum. in Engl., Pflanzenr. 4(46), 20 Heft: 78. 1904; Sirirugsa in Nord. J. Bot. 9: 259. 1989 & in Thai For. Bull. (Bot.) 19: 13-14. 1992.

Type: Myanmar, cultivated at K, Wallich no. ? (holotype K)

This species is characterized by its usually two large sessile suborbicular leaves and white flowers with yellow spot at the base of the labella. The leaves are flat on the ground, both sides glabrous, and often the upper surface mottled dark green. The staminodes are obovate and the labellum is deeply divided to form the obovate lobes with crenate or emarginate apex. The anther crest is characteristically rectangular (3-3.5 × 1-3 mm) with the entire or emarginate apex.

This taxon is distributed in a range from India, Nepal and Myanmar, to Thailand. It can be found in the bamboo and dry dipterocarp forests in Tak, Chiang Mai, Kanchanaburi, Nakhon Ratchasima and Prachuap Khiri Khan provinces of Thailand.

14. **K. rotunda** L., Sp. Pl.: 3. 1753; Roscoe, Monand. Pl. t. 97. 1828; Wight, Icon. T. 2029. 1853; Bak. in Hook., Fl. Br. Ind. 6: 222. 1890; Schum. in Engl., Pflanzenr. 4(46), 20 Heft: 87. 1904; Gagnep. in Lecomte, Fl. Gén. I.-C. 6: 47. 1908; Valet., Bull. Jard. Bot. Buitinzorg ser. 2. 27: 109. 1918; Ridl., Fl. Mal. Pen. 4:246. 1924; Holtt. in Gard. Bull. Sing. 13:120. 1950. Plate II: 4; Burtt & Smith in Dassanayake, Fl. Cey. 4: 509. 1983; Sirirugsa in Nord. J. Bot. 9: 259. 1989 & in Thai For. Bull. (Bot.) 19: 7-8. 1992; T.L.Wu & K.Larsen in Z.L.Wu & PH. Raven, Fl. China 24: 369. 2000.—*K. longa* Jacq., Pl. Hort. Schönbr. tab. 317. 1798.—*K. vercicolor* Salisb. in Trans. Hort. Soc. 1: 286. 1808.

Type: *Roscoe* ill?

This species, including *K. candida* Wall. and *K. glandifolia* Saensouk & Jenjitt., belongs to a group characterized by its radical inflorescences arising from the rhizomes before the appearance of the leaf-shoot. However, it can be differentiated from the later two taxa by its characteristic leaves and flowers. This taxon possesses 2-4, erect, ellictic or lanceolate-oblong leaves with the upper surface being glabrous and the lower surface hairy, and hairy petioles about 1-2 cm long. The oblong lateral staminodes are white (or light purple) with a purple tint, and the purple labellum is deeply bilobed (each lobe is elliptic), often with two darker purple blotches at the base of each lobe. The anther crest is characteristically oblong (9-12 × 3-4 mm) with the trilobed apex, the outer lobes are acute and elongated but the middle one is shorter (the apex being entire or emarginate).

This taxon is distributed from India through Sri Lanka, southern China, Indochina, Malay Peninsula and Java. In Thailand it had been recorded in all parts of the country. It can be found on limestone hills, open lower montane forests, open grassy areas, and in mixed deciduous forests, from as low an altitude as 50 m to above 1800 m on Doi Sam Phi Nong in Chiang Dao Wildlife Sanctuary (Chiang Mai Province).

15. **K. siamensis** Sirirugsa in Nord. J. Bot. 9: 257, 259. 1989. Fig. 1 A-G & in Thai For. Bull. (Bot.) 19: 9-10. 1992.

Fig. 19 *K. roscoeana* Wall., showing the leaves and flowers.

Fig. 20 *K. roscoeana* Wall., showing detail of the flower.

Fig. 21 *K. rotunda* L., showing detail of the flower.

Fig. 22 *K. rotunda* L., showing rhizome, roots and an infructescence.

Fig. 23 *K. siamensis* Sirirugsa, showing the plant habit.

Fig. 24 *K. siamensis* Sirirugsa, showing detail of the flower.

Fig. 25 *K. spoliata* Sirirugsa, showing detail of the flower.

Type: Thailand, Sakhon Nakhon, *Yuktathat* 133 (holotype E, isotype PSU)

This Thai endemic taxon was described from the specimen collected from Phu Phan National Park. It can be readily distinguished by its solitary, prostrate, sessile, suborbicular, glabrous leaf with conspicuous ligule, oblong purple staminodes with rounded or slightly undulate apex, purple obovate-cuneate, bilobed (with the apex divided to the middle) labellum, and deeply divided anther crest.

This species can be found in the type locations and its nearby evergreen forests.

16. **K. spoliata** Sirirugsa in Nord. J. Bot. 9: 259. 1989. Fig. 1 Q-V & in Thai For. Bull. (Bot.) 19: 3. 1992.
Type: Thailand, Sisaket, *Maxwell* 76-493 (holotype L, isotype BK, AAU)

This taxon is described from the specimen collected from Chong Bat Lak in the Phanom Dongrak Range on the Thai-Cambodian border. So far it is known only from the type location currently under the military control and closed to public access. It possesses most of the *Kaempferia* characters, but the absence of the two lateral staminodes itself has placed this species in the most unique taxon of the genus.

The original description of this taxon stated that "*...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... .*" [20,21] However, the first author made two visits, in 2004 and 2006, to the type location and its neighboring areas to study the living population and has collected some specimens. The living specimens are quite different from the earlier descriptions.

Ethnobotany

Ethnobotany is the multidisciplinary study of the direct interrelationship between people of any ethnicity and plants in their environment, with the focus on

Fig. 26 Dok Din (*K. candia* Wall.) is sold in local markets in Thong Pha Pum District of Kanchanaburi Province, Thailand.

food, medicine, dwelling, clothing, and art, culture and beliefs.[27-29] Research in the area of ethnobotany can be focused on a certain ethnic group or traditional society, certain geographical regions, or certain plant groups.[27] Methodologies employed in ethnobotanical and ethnobiological research, including research in traditional medicine, have been discussed in detail elsewhere.[30,31]

The senior author and his students have been working on the ethnobotany of the ginger family (Zingiberaceae) in Thailand during the past decade, and the results of that research will be published in the near future. The research methods employed have been discussed in detail in a separate publication.[32] Part of the result of our ethnobotanical research on the ginger family in Thailand will be discussed here briefly to complete our treatment of the genus *Kaempferia* L. The information reported here is from a combination of a literature survey and our field research.

Food

Some taxa in the genus *Kaempferia* L. are edible and are available in local markets from as early as the end of March and throughout the rainy season (May-October), and some are grown in home gardens.

The rhizomes and leaves of *K. galanga* L., known locally as *pro hom* (เปราะหอม), are used as a spice in a local Thai delicacy. The rhizomes, together with chillies and other ingredients are mixed and ground into a paste, which is used as a base for making a curry. The leaves, washed and cut into the very thin pieces, are used for seasoning the curry. Leaves of other taxa known locally as *pro pa* (เปราะป่า), i.e., *K. marginata* Carey, *K. elegans* Wall. ex Baker, can also

Fig. 27 Wan Krachai Dum (*K. parviflora* Wall. ex Baker) sold in Chatuchak Market (Bangkok)

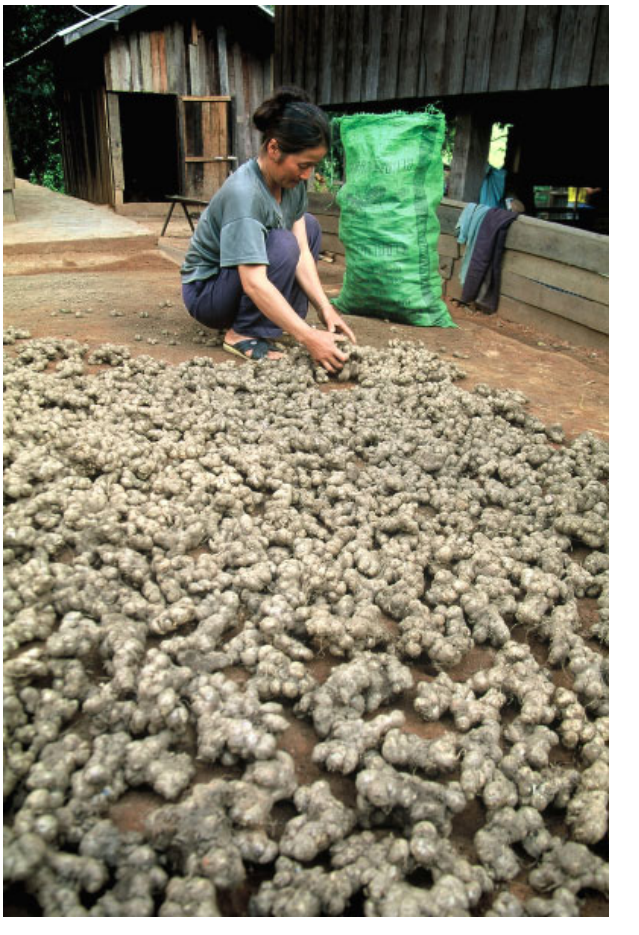

Fig. 28 Sun-drying Krachai Dum (*K. parviflora* Wall. ex Baker) after harvesting

be utilized for the same purpose. However, rhizomes of other species are not used as substitutes for those of *K. galanga* L. since they are too bitter.

Flowers of *K. candida* Wall. appearing before the leaf-shoots are collected from the wild by locals for either household use or for sale in local markets. It is used as a vegetable not only steamed or fried and eaten with *nam prik*, the Thai chilli dip, but also put into soup. This edible flower is known among the local people living along the western Thai-Myanmar border, in areas such a Kanchanaburi, Tak, and Mae Hong Son provinces, as *dok din* literally means "flowers of the soil").

The young inflorescences of *K. grandifolia* Saensouk & Jenjitt. are edible. The people living around the type location call the plant *toob-moob* or *toob-moob bai yai*. The young inflorescences are blanched and eaten as a vegetable.

Table 1. List of the wans in the genus *Kaempferia L.*

No.	Thai Name	Botanical Names	Use
1.	Wan Chao Noi Maha Phrom (ว่านเจ้าน้อยมหาพรหม)	*K.* aff. *rotunda* L.	Medicinal & spiritual
2.	Wan Phaya Nok-kum (ว่านพญานกคุ้ม)	*K.* aff. *parviflora* Wall.	Medicinal & spiritual
3.	Wan Khum-dong (ว่านคุ้มดง)	*K.* aff. *roscoeana* Wall.	Spiritual
4.	Wan Nok Khum (ว่านนกคุ้ม)	*K. elegans* Wall. ex Baker	Spiritual
5.	Wan Kam-bang (ว่านกำบัง)	*K.* aff. *elegans* Wall. ex Baker	Spiritual
6.	Wan Krachae Chan (ว่านกระแจะจันทน์)	*K.* aff. *galanga* L.	Medicinal & spiritual
7.	Wan Mai-deed (ว่านไม้ดีด)	*K. rotunda* L.	Medicinal & spiritual
8.	Wan Kai Dam (ว่านไก่ดำ)	*K. rotunda* L.	Spiritual
9.	Wan Pro Hom (ว่านเปราะหอม)	*K. galanga* L.	Medicinal
10.	Wan Pro Pa (ว่านเปราะป่า)	*K. marginata* Carey *K. roscoeana* Wall. *K. elegans* Wall. ex Baker	Medicinal
11.	Wan Krachai Dam (ว่านกระชายดำ)	*K. parviflora* Wall. ex Baker	Medicinal & spiritual
12.	Wan Thao Nang Haeng (ว่านเฒ่าหนังแห้ง)	*K. angustifolia* Roscoe	Medicinal
13.	Wan Prab Samut (ว่านปราบสมุทร)	*K. angustifolia* Roscoe	Medicinal & spiritual
14.	Wan Petch Kong (ว่านเพชรคง)	*K. angustifolia* Roscoe	Medicinal & spiritual
15.	Wan Hom (ว่านหอม)	*K. galanga* L.	Medicinal & spiritual
16.	Wan Thippa-nate (ว่านทิพย์เนตร)	*K. rotunda* L.	Medicinal & spiritual
17.	Wan Teen Yen (ว่านตีนเย็น)	*K.* aff. *galanga* L.	Medicinal
18.	Wan Pro Noi (ว่านเปราะน้อย)	*Kaempferia* sp.	Medicinal & spiritual

Medicine

In one of the oldest publications in the Thai herbal literature, *King Narai Remedies*, two crude drugs made from the genus *Kaempferia* L. are formulated in several herbal recipes. The herb *pro pom* (เปราะหอม) refers to the rhizomes of *K. galanga* L. and the crude drug known as *wan pro pa* (เปราะป่า) may refer to any of three taxa, *K. marginata* Carey, *K. elegans* Wall. ex Baker, and *K. roscoeana* Wall.[33] Selections from the Thai traditional medical literature state that *pro hom* is characteristically pungent and bitter in taste but possesses a carminative effect, while *pro pa*, although having the same taste, also has an antipyretic effect.[32] *Pro hom* (*K. galanga* L.) is recognized in two forms, the "red" and the "white" forms, and sometimes they are prescribed together as a set of drugs under the name *pro hom tung song* (The Two Pro Hom), i.e. *pro hom daeng* (*daeng* = red) and *pro hom khao* (khao = white). Both *pro hom* and *pro pa* are also occasionally prescribed as a set of drugs under the name *pro tung song* (The Two Pro).[34]

In northeastern Thailand, the local people living around the type location (Phu Wiang District of Khon Kaen Province) of *K. grandifolia* Saensouk and Jenjitt. use the leaves and rhizomes, blending them with husked rice, as an anti-herpes medication. The rhizomes of *K. filifolia* K. Larsen boiled with water are used for leucorrhoea in Ubonratchathani Province. Rhizomes of *K. larsenii* Sirirugsa, ground and applied externally, are used to treat inflammation caused by insects bites.

Recently, *wan krachai dam* (*K. parviflora* Wall. ex Baker), or currently known in short as "Krachai Dam", has become a popular herb. The purplish black rhizomes of this taxon are claimed to produce a male aphrodisiac effect. This species currently is cultivated nationwide to serve consumer demand and the price has increased tremendously, although it sometimes fluctuates. Research to prove this claim is ongoing.

Fig. 29 Wan Nok Kum (*K. elegans* Wall. ex Baker), a beautiful species grown as a garden plant or a pot plant, can be seen in most plant shops throughout Thailand.

Belief

The genus *Kaempferia* L. comprises several plants known in the Thai folk taxonomy as *wan*, a plant group, most of which have underground storage roots or stems; such plants are used as a medicine, or are believed to produce certain spiritual effects. Taxonomically, they are certain plants in several plant families, such as Araceae, Zingiberaceae, Liliaceae, Amaryllidaceae, and Orchidaceae, among others. From our research work on this folk plant group, we recognized some wans in this genus. Table 1 shows the list of the wans which, according to modern taxonomy, belong to the *Kaempferia* L. with their vernacular names and uses.

The "spiritual" uses shown in Table 1 are associated with a wide ranges of uses, including help in attracting other people, protection people from ghosts and evil, and protection of skin/bodies against any kind of weapons. Resulting from our intensive field trips throughout the country, we have collected these wans and identified them scientifically. Some folk taxa may turn out to belong to the same scientific taxon. This may be a result of the plants in this genus being quite variable vegetatively. *K. angustifolia* Roscoe is a good example, since the leaves can vary greatly in size and coloration, and hence have different vernacular names.

Horticulture

Some taxa in the genus *Kaempferia* L. have or may have horticultural potential. *K. elegans* Wall. ex Baker has been developed for this purpose owing to its beautiful leaves and flowers. It is commonly used as a garden decoration or as a pot plant. Leaf color, form, and coloration of this taxon are selected and cultivated according to market value.

Several other species, including *K. roscoeana* Wall., and *K. galanga* L., are also currently grown as pot plants.

Acknowledgements

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บทคัดย่อ

ข้อสังเกตเกี่ยวกับพืชสกุลว่านเปราะหอม (วงศ์ขิง) ในประเทศไทย

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**หน่วยวิจัยเภสัชพฤกษศาสตร์และเภสัชเวท คณะเภสัชศาสตร์ มหาวิทยาลัยขอนแก่น จังหวัดขอนแก่น ๔๐๐๐๒*

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พืชสกุลว่านเปราะหอมเป็นพืชในวงศ์ขิงสกุลหนึ่ง. การศึกษาเชิงพฤกษอนุกรมวิธานของพืชสกุลนี้ที่พบในประเทศไทยจากตัวอย่างพรรณไม้แห้งและตัวอย่างจริงในแหล่งกำเนิดธรรมชาติทั่วประเทศไทย ได้ข้อสรุปในเบื้องต้นว่าในประเทศไทยอาจพบพืชสกุลนี้ได้ ๑๖ ชนิด. รายงานนี้ได้สรุปประวัติการศึกษาด้านอนุกรมวิธานของพืชสกุลนี้พอเป็นสังเขป แล้วให้ข้อมูลเบื้องต้นเกี่ยวกับพืชแต่ละชนิดในด้านลักษณะเด่นสำหรับการจำแนกชนิด, การกระจายพันธุ์ และแหล่งที่พบในประเทศไทย. นอกจากนั้น ยังได้ให้ข้อมูลเบื้องต้นด้านพฤกษศาสตร์พื้นบ้านของพืชสกุลนี้อันเป็นข้อมูลที่ได้จากการศึกษาภาคสนามและการทบทวนวรรณกรรมที่เกี่ยวข้อง โดยเน้นด้านพืชที่ใช้เป็นอาหาร เป็นยาบำบัดโรค ใช้ในความเชื่อและไสยศาสตร์ และใช้เป็นไม้ประดับ.

คำสำคัญ: **พืชสกุลว่านเปราะหอม (วงศ์ขิง), ประเทศไทย, อนุกรมวิธาน, พฤกษศาสตร์พื้นบ้าน**