

A REVISION OF THE GENUS *BOESENBERGIA* KUNTZE (ZINGIBERACEAE) IN THAILAND

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ABSTRACT

Revision of the genus *Boesenbergia* (Zingiberaceae) in Thailand resulted in the recognition of 13 species. A key to the Thai species with descriptions and illustrations, and information on their distribution, ecology and vernacular names are presented.

INTRODUCTION

Boesenbergia is a genus of small rhizomatous herbs, mostly growing on the floor of the forest. About 40 species of the genus are distributed in tropical Asia. The genus has been treated by: BAKER (1890) for India, including two new species formerly described by WALLICH (1830); SCHUMANN (1904) for Borneo and Sumatra, and much later SMITH (1982) added eight new species; GAGNEPAIN (1908) for Indochina; VALETON (1918) for Java and Malaysia; RIDLEY (1924) and HOLTUM (1950) for the Malay Peninsula.

The type species of *Boesenbergia* is *Gastrochilus pulcherrima* Wall. According to the International Botanical Nomenclature *Gastrochilus* is invalid, being a later homonym of an orchidaceous genus (HOLTUM, 1950).

In Thailand 13 species of *Boesenbergia* are now recognized. A key to the Thai species, with descriptions, illustrations, and notes on their distribution, ecology and vernacular names is presented.

Boesenbergia O. Kuntze

Rhizome usually short, fleshy; leafy stem 20–60 cm tall, rarely up to 90 cm, bearing 1 to 8 leaves, usually with a few sheaths outside the leaf-sheaths. *Leaves* elliptic, oblong or elliptic-oblong, rarely ovate or lanceolate. *Petiole* 2–15 cm long, rarely sessile; ligule bilobed. *Inflorescence* terminal, between the two innermost leaf-sheaths or directly from the rhizome separately from the leaf-sheaths, axis of inflorescence bearing 2-ranked alternate bracts. *Bracts* oblong, elliptic or lanceolate, (2–5) × (1–2) cm, enclosing a single bracteole and a single flower; bracteoles shorter, either narrower or wider than the bract, both sides inflexed enfolding the flower. *Calyx* tubular, short, 3-lobed; lobes truncate or acute, deeply divided on one side. *Corolla*-tube slender, longer than bract; lobes usually subequal, the dorsal one the largest. *Labellum* usually longer than corolla-lobes and staminodes, saccate, the apex often irregularly crenate and crinkled, rarely bilobed. *Staminodes* obovate, elliptic or oblong, rarely ovate or oblanceolate, about the same length or shorter and a little wider than the corolla-lobes. *Stamen*: filament about as long as or either shorter or longer than

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the anther; anther opening by slits or in *B. curtisii* by apical pores; connective either produced beyond the thecae or not. *Ovary* glabrous or hairy, 3-locular or incompletely 3-locular with axile placenta, 1-locular with free-central placenta or in *B. parvula* with parietal placenta; stylodes slender 3–6 mm or up to 1 cm long. *Fruit* ellipsoid or cylindrical-ellipsoid. Seeds arrillate, relatively large; aril white.

Key to the Species in Thailand

1. Inflorescence basal directly from rhizome 2
1. Inflorescence terminal 3
2. Spike conical or oblong-conical, separate from leaf-sheaths. Stamminodes longer than half the length of labellum 1. *B. basispicata*
2. Spike linear, within leaf-sheaths. Stamminodes shorter than half the length of labellum 2. *B. prainiana*
3. Anther crest not produced beyond thecae 4
3. Anther crest produced beyond thecae 8
4. Pollen sacs poricidal dehiscing. Inflorescence not exerted from leaf-sheaths. Labellum not saccate 3. *B. curtisii*
4. Pollen sacs longitudinal dehiscing. Inflorescence elongate. Labellum saccate 5
5. Leaf base cordate; petiole relatively longer, up to 8 cm 4. *B. petiolata*
5. Leaf base cuneate, petiole relatively shorter, sessile or up to 5 cm 6
6. Ligule and ovary hairy 7
6. Ligule and ovary glabrous 5. *B. xiphostachya*
7. Leaves sessile, narrow, about 5 times longer than wide. Labellum ovate 6. *B. thorelii*
7. Leaves petiolate, broad, about 2 times longer than wide. Labellum obovate 7. *B. longipes*
8. Leaves absent at anthesis 8. *B. siamensis*
8. Leaves present at anthesis 9
9. Inflorescence compact, included, usually only flowers exerted beyond leaf-sheaths 9. *B. rotunda*
9. Inflorescence elongate, exerted from the leaf-sheaths 10
10. Peduncle 2-4 cm long. Inflorescence 10-20 cm long; two rows of bracts facing one way 10. *B. plicata*
10. Peduncle rarely longer than 2 cm. Inflorescence 3-12 cm long 11
11. Leaves lanceolate, apex long acuminate, base mostly truncate. Petioles usually longer than 15 mm and up to 35 mm. Corolla-lobes elliptic-oblong or oblong, apex acute or mucronate. Connective glabrous 11. *B. acuminata*
11. Leaves otherwise. Petioles rarely up to 12 mm. Corolla-lobes oblong, apex rounded. Connective hairy 12
12. Plant with leafy stem rarely more than 16 cm tall. Leaves ovate to elliptic, 2-5 cm long. Stamminodes oblong, glabrous, about 10x4 mm. Labellum ovate-oblong, glabrous, except the brownish-hairy base, 20-24 x 15-20 mm. Ovary 1-loculate 12. *B. parvula*

12. Plant with leafy stem 20-50 cm tall. Leaves elliptic or oblong, 10-40 cm long. Stamínodes obovate, glandular-hairy, ciliate, about 20x13 mm. Labellum ovate or suborbicular, glandular-hairy, ciliate, about 30-33 x 25-32 mm. Ovary 3-loculate

13. *B. pulcherrima*

1. *Boesenbergia basispicata* K. Larsen ex P. Sirirugsa, Nord. J. Bot. 7 (4) : 1987. Fig.1 (L-R) Plate I:1

Leafy stem 40–60 (–75) cm tall; sheaths up to 10 cm long, glabrous or glabrescent. Leaves 3–6; blades oblong, often unequal-sided, 15–35 x 4–9.5 cm, apex acuminate, base cuneate or obtuse, decurrent, upper surface glabrous, lower surface glabrescent. Petiole (5) 7–15 (18) cm long, glabrous; *ligule-lobes* broadly triangular or oblong, 3–6 mm long, glabrous; leaf-sheaths 8–14 cm long, glabrous or glabrescent. Inflorescence basal, ascending from rhizome, not enclosed by leaf-sheaths, conical or oblong-conical, 8–12 (–17) cm long; flowers about 12; peduncle ca. 5 mm long. Bracts dark reddish, mottled with pink, often incurved, ca. 3 x 1.9 cm, glabrous; bracteoles folded, ca. 1.4 x 0.8 cm, glabrous. Calyx pinkish, ca. 4 mm long, lobes short, truncate, ca. 1 mm long. Corolla: tube ca. 2.5 cm long; lobes elliptic, apex rounded, incurved, ca. 1.2 x 0.6 cm, glabrous. Labellum ovate or suborbicular, saccate, apex irregularly crenate and crinkled, ca. 2.0 x 1.7 cm, hairy at the base, finely ciliate. Stamínodes whitish, elliptic or ovate, apex rounded or bilobed, ca. 1.1 x 0.7 cm, longer than half the length of labellum, finely hairy and ciliate. Stamen: filament ca. 4 mm, sparsely brownish-hairy; anther ca. 5 mm; connective almost glabrous; crest not produced beyond the thecae. Ovary ca. 4 mm long, glabrous, incompletely 3-locular; stylodes linear, acute, ca. 5.5 mm long. Fruit ellipsoid, tapering towards apex, ca. 1.7 x 0.8 cm. Seeds ca. 7, arillate, 7–10 x 2–3 mm; aril whitish-hairy.

T h a i l a n d.—PENNINSULAR

Nakhon Si Thammarat (Khao Luang, type), Trang, Narathiwat.

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

E c o l o g y. —Common on damp slopes in evergreen forest, 300-600 m msl.

V e r n a c u l a r. —Krachai khao luang (กระชายเขาหลวง)

2. *Boesenbergia prainiana* (King ex Bak.) Schltr. in Fedd. Rep. 12:316.1913; Loes. in Pflanzenfam. 2. 15 a: 570.1930; Holttum, Gard. Bull. Sing. 13: 108. 1950. —*Kaempferia prainiana* King ex Bak. f. in Fl.Br. Ind. 6: 220. 1890; Schum. in Pflanzenr. 4. 46: 84. 1904.—*Gastrochilus prainiana* (King ex Bak.) Ridl., J. Str. Br. As. Soc. 32:115.1899; Fl. Mal. Mat. Pen 2: 18.1907; Fl. Mal. Pen. 4: 248.1924. —*Gastrochilus albosanguinea* Ridl., J. Str. Br. As. Soc. 32: 111.1899; Schum. in Pflanzenr. 4. 46:93. 1904; Ridl., Mat.Fl. Mal. Pen. 2:15.1907; Fl. Mal. Pen.4:247.1924. —*Boesenbergia albo-sanguinea* (Ridl.) Loes. in Pflanzenfam.2. 15 a: 568.1930. Fig.2, Plate I: 2

Leafy stem 25–40 cm tall; sheaths purple, the longest up to 12 cm long, hairy. Leaves 1–4, usually 1 or 2; blades elliptic or elliptic-oblong, rarely oblanceolate, often unequal sided, 12–23 x 5–10 cm, apex short acuminate, base cuneate, rarely rounded, and decurrent, upper surface glabrous, lower surface sparsely hairy. *Petiole* 2.5–6.5 (–9) cm long; *ligule-lobes* broadly triangular, 2–4 mm long, hairy; leaf-sheaths 4–10 cm long, hairy. *Inflorescence* basal, ascending from rhizome within the innermost leaf-sheath and clasped by sheaths, linear, 11–25 cm long; peduncle 1–4 cm long. *Bracts* incurved, ca. 1.8–2.2 x

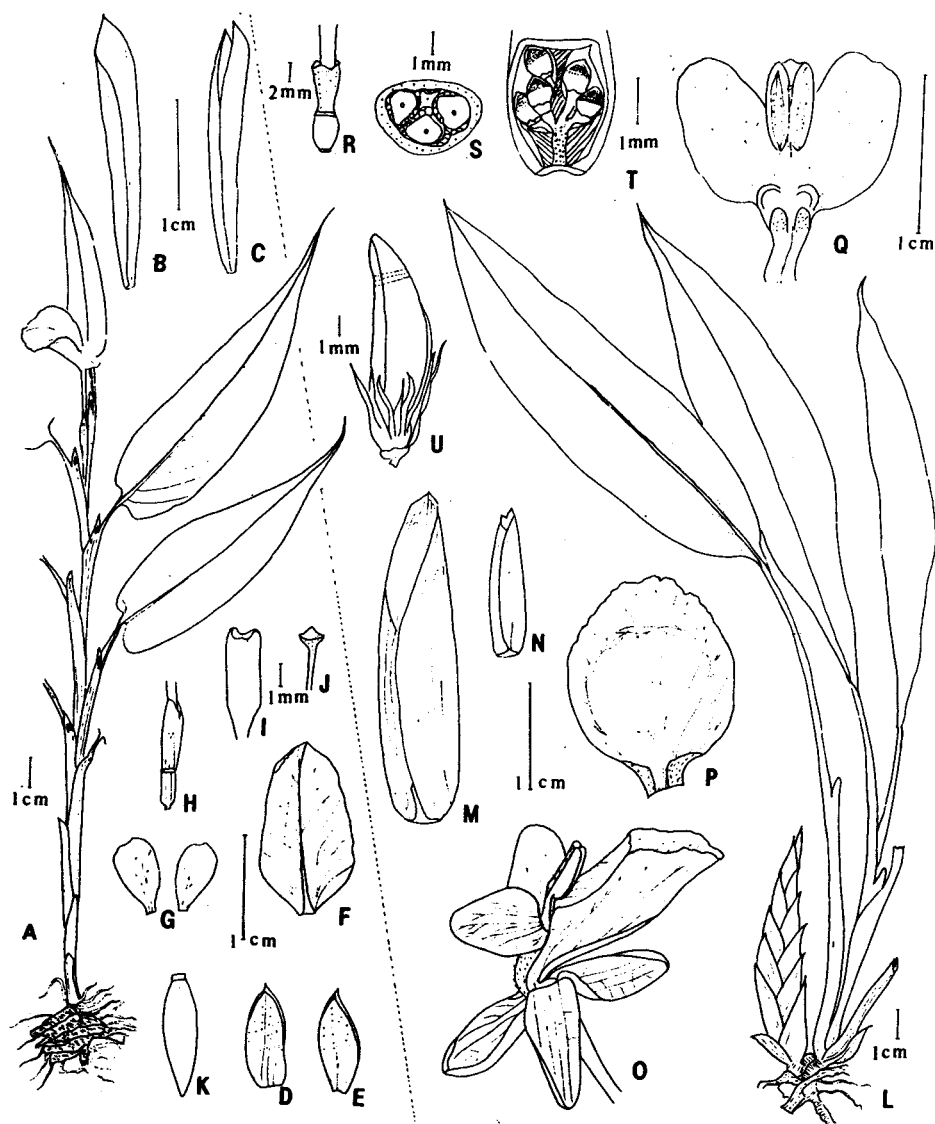


Figure 1. A-K : *Boesenbergia acuminata*. A : Habit. B : Bract. C : Bracteole. D : Dorsal corolla-lobe. E : One of lateral lobes. F : Labellum. G : Staminoles. H : Calyx and ovary. I : Anther from behind. J : Stigma. K : Fruit (A, K from Shimizu et al. T : 7917; B-J from Kerr 19738). L-U : *B. basispicata*. L : Habit. M : Bract. N : Bracteole. O : Flower. P : Labellum. Q : Staminoles and stamen from the front. R : Calyx and ovary. S : ovary in X.S. T : Ovary in L.S.. U : Seed. (after Sirirugsa, 1987).

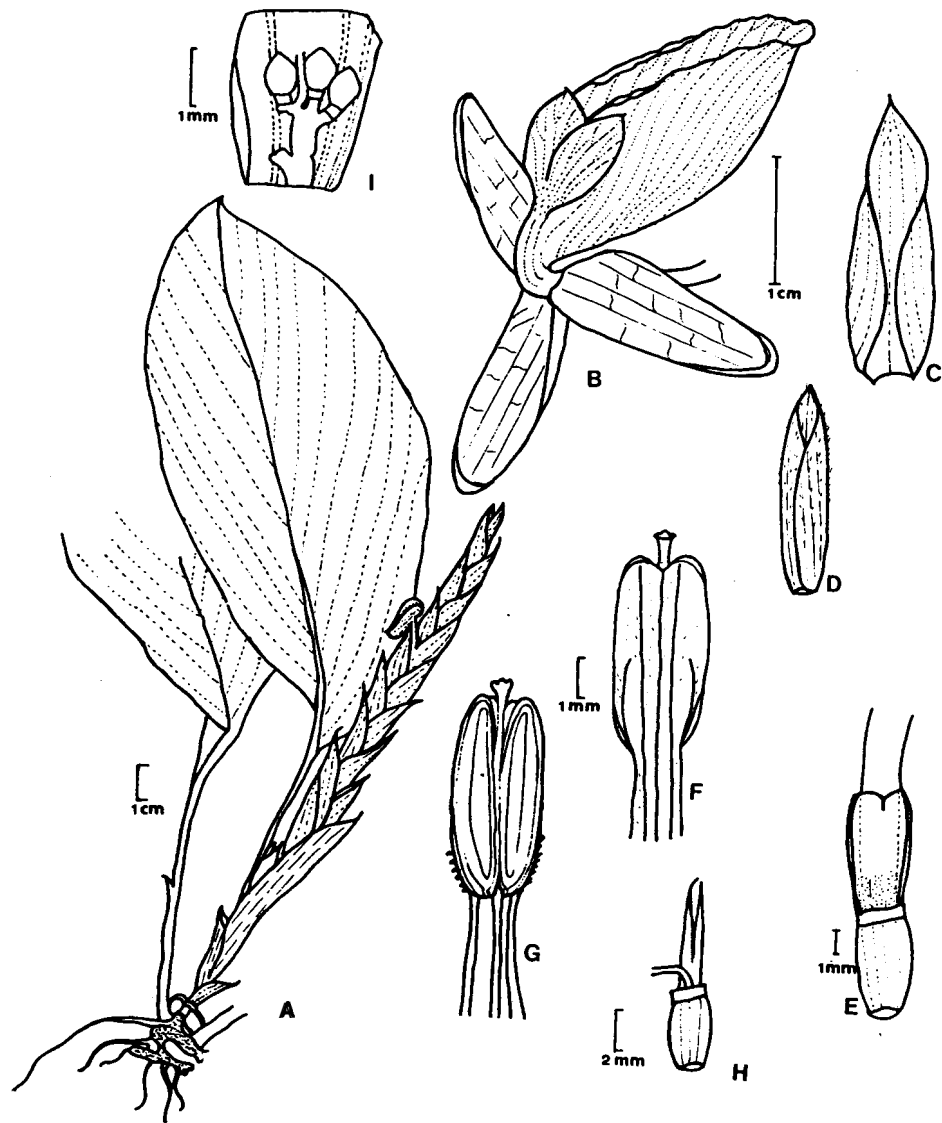


Figure 2. *Boesenbergia prainiana*. A : Habit B : Flower. C : Bract. D : Bracteole. E : Calyx and ovary. F : Stamen from behind. G : Stamen from the front. H : Stylodes and ovary. I : Ovary in L.S. showing seeds. (All from Charoenphol et al. 3987)

1.5 cm, sparsely hairy; bracteoles folded, 1.2–1.6 x 0.8 cm, sparsely hairy. *Calyx* tinted with red spots, 4–5 mm long; lobes truncate, ca. 1 mm long. *Corolla*: tube ca. 3.5 cm long; lobes lanceolate-oblong, apex rounded, 3.5–5 x 1.3 mm. *Labellum* whitish with red blotch at apex, ovate, strongly saccate, apex undulate and crinkled, ca. 2x1.7 cm, brownish-hairy. *Staminodes* whitish, elliptic, apex rounded, obtuse or mucronate, ca. 6.5 x 3.5 mm, shorter than half the length of labellum, glabrous, ciliate near the base. *Stamen*: filament ca. 6 mm long, finely hairy; anther ca. 5 mm long; connective hairy; crest not beyond thecae. *Ovary* ca. 3 mm long, glabrous, incompletely 3-locular; stigma trilobed; stylodes linear, acute, ca. 7 mm long.

T h a i l a n d . —SOUTH-WESTERN: Prachuap Khiri Khan;

PENINSULAR: Narathiwat, Pattani.

D i s t r i b u t i o n . —Malay Peninsular, (Perak, *King* 726, type), India.

E c o l o g y. —Common in evergreen forest, along stream, 50–400 m msl.

V e r n a c u l a r . —Kathue daeng (กะทือแดง)

3. *Boesenbergia curtisii* (Bak.) Schltr. in Fedd. Rep. 12:316. 1913; Loes. in Pflanzenfam. 2. 15a: 571. 1930; Holttum, Gard. Bull. Sing. 13: 112. 1950; Baker & Bakh.f. Fl. Java 3: 69. 1968.—*Gastrochilus curtisii* Bak. in Hook.f. Bot. Mag.: t.7363. 1894; Ridl., J. Str. Br. As. Soc. 32: 113. 1899; Mat. Mal. Pen. 2: 18. 1907; Fl. Mal. Pen. 4: 249. 1924.—*G. javanus* Schum. in Pflanzenr. 4. 46: 95. 1904, Valet.; Bull. Jard. Bot. Buitenzorg, ser. 2. 27: 92. 1918.—*G. acuta* Ridl. J. Str. Br. As. Soc. 59:202. 1911; Fl. Mal. Pen. 4: 249. 1924.—*Boesenbergia javanum* (Schum.) Schltr. in Fedd. Rep. 12: 316. 1913; Loes. in Pflanzenfam. 2. 15a: 571. 1930. Fig.3, Plate I: 3

Leafy stem 40–50(–90) cm tall; sheaths 7–13 (–18) cm long, hairy. *Leaves* 4–5; blades elliptic, elliptic-oblong to oblong, 12–40 (–48) x 3–16 (–18) cm, apex acuminate, base rounded or cuneate, more or less decurrent, sometimes subcordate. *Petiole* 6–10 (–16) cm long, sparsely hairy; ligule-lobes lanceolate, acute, 5–12 mm long, hairy; leaf-sheaths 7–13 cm long, sparsely hairy. *Inflorescence* terminal, enclosed by the upper two leaf-sheaths, 5–9 cm long; rachis short; peduncle 0.5–1.5 cm long. *Bracts* ca. 4.5 x 0.1 cm, hairy with red streaks; bracteoles ca. 4.2 x 1.2 cm, hairy, with red streaks. *Calyx* ca. 1.8–2.5 cm long, hairy; lobes acute, ca. 3 cm long, ciliate. *Corolla*: tube ca. 7 cm long, broadened upwards; lobes whitish, oblong, acute, 1.5–1.7 cm long. *Labellum* yellowish with pink streaks on either sides at the base, elliptic or obovate, apex lobed and irregularly crenate, reflexed, ca. 1.6x0.9 cm, hairy along at the median below the middle downwards.

Staminodes whitish, oblong, apex rounded or slightly lobed, ca. 1.5 x 0.5 cm, glabrous, with red blotches at the base. *Stamen*: filament ca. 4 mm long, hairy at the back; anther ca. 3 mm long; connective pubescent; pollen sacs poricidal opening, pore ciliate; crest bilobed, not produced beyond thecae. *Ovary* ca. 5 mm long, glabrous, 3-locular; ovules 4–5 in each locule; stigma lobed, ciliate; stylodes linear, 8–10 mm long.

T h a i l a n d . —SOUTH-EASTERN: Chon Buri; SOUTH-WESTERN: Kanchanaburi, Ratchaburi, Prachuap Khiri Khan; PENINSULAR: Chumphon, Surat Thani, Phangnga, Nakhon Si Thammarat, Trang, Phattalung, Songkla, Satun.

D i s t r i b u t i o n . —Malay Peninsula (Lankawi, Curtis 2896, type), Java, India.

E c o l o g y . —On limestone hill in evergreen or mixed deciduous forests, 0–300 m msl.

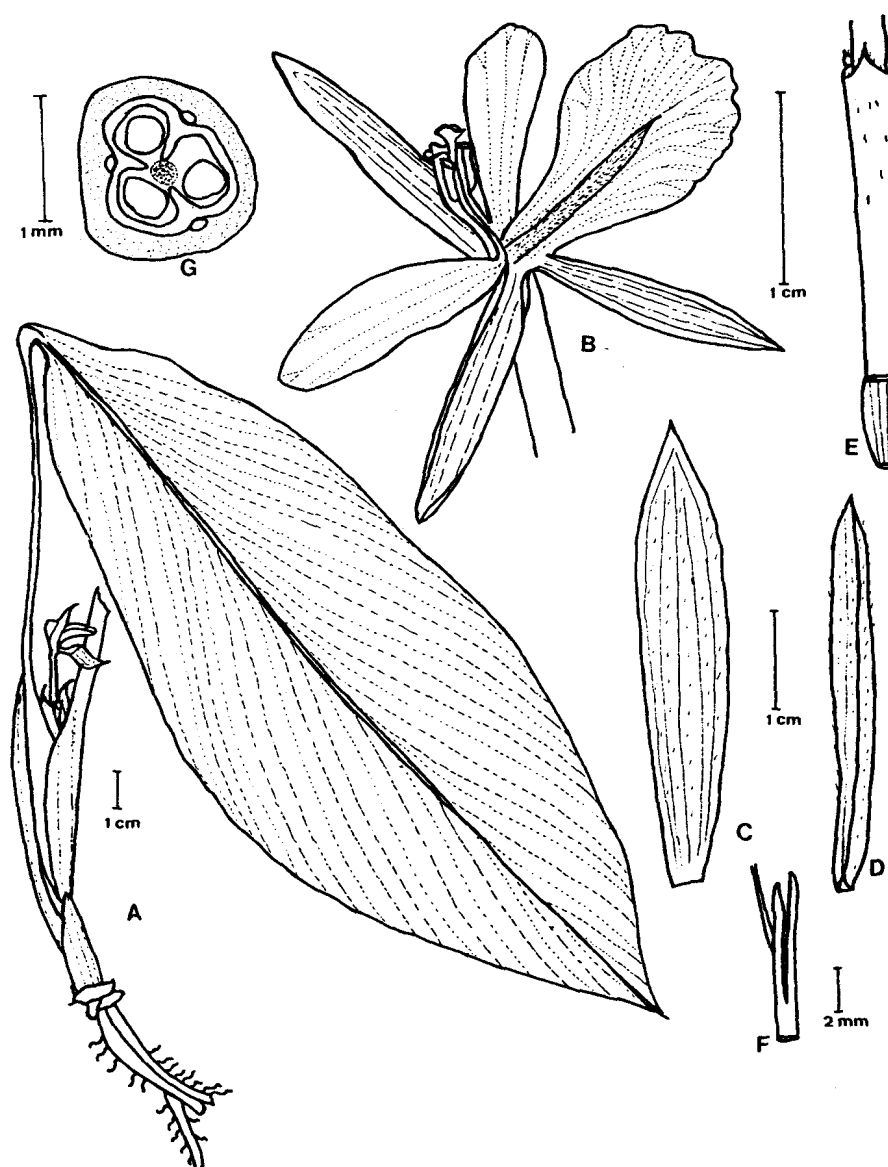


Figure 3. *Boesenbergia curtisii*. A : Habit. B : Flower. C : Bract. D : Bracteole. E : Calyx and ovary. F : Stylodes. G : Ovary in X.S. (A, from Charoenphol et al. 3643; B, C, D, from Kerr 10588; E, F, G, from Larsen 10458).

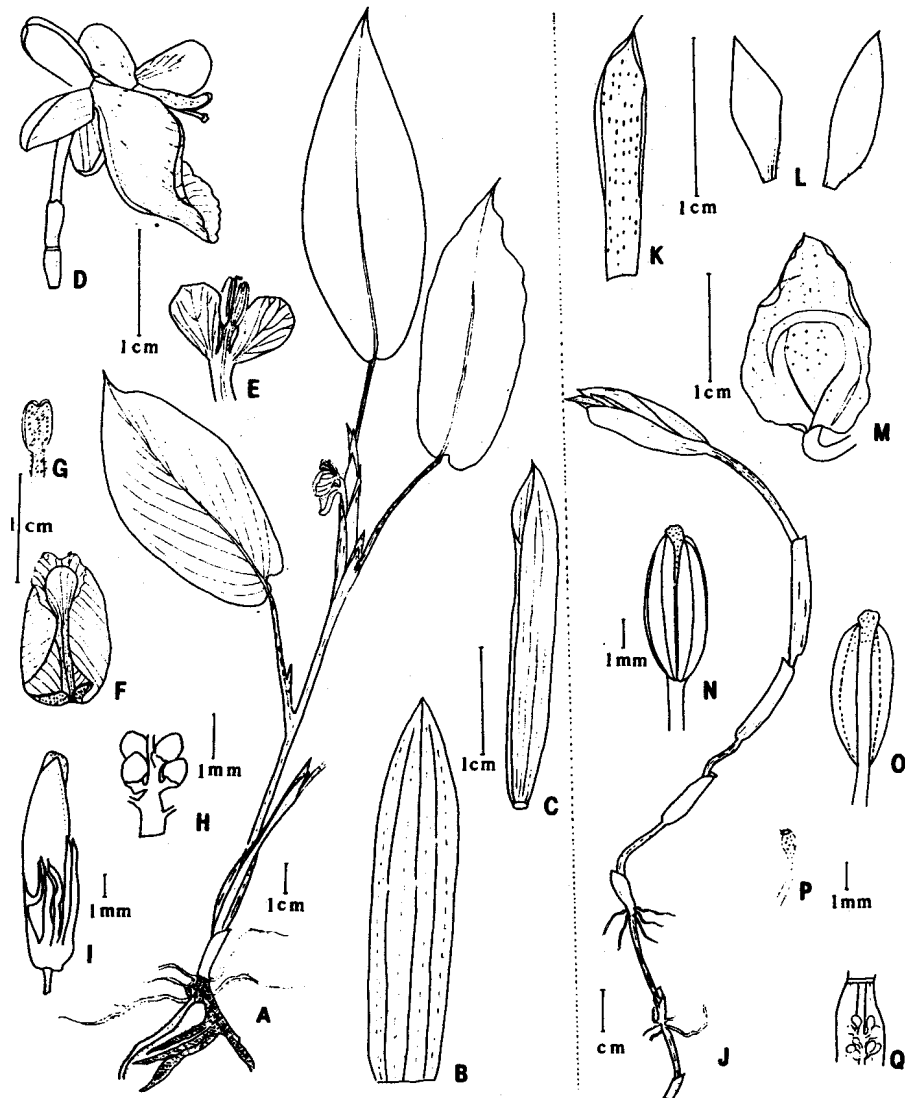


Figure 4. A-I: *Boesenbergia petiolata*. A: Habit. B: Bract. C: Bracteole. D: Flower. E: Staminodes and stamen from the front. F: Labellum. G: Stamen from behind. H: Ovules. I: Seed. (All from Maxwell 74-631). J-Q: *B. siamensis*. J: Habit. K: Dorsal corolla-lobe. L: Staminodes. M: Labellum. N: Stamen from the front. O: Stamen from behind. P: Stigma. Q: Ovary in L.S. (All from G. den Hoed 238). (after Sirirugsa, 1987)

4. *Boesenbergia petiolata* P. Sirirugsa, Nord. J. Bot. 7 (4): 423. 1987. Fig.4 (A-I)

Leafy stem ca. 50 cm tall; sheaths ca. 6–12 cm long, glabrous. *Leaves* 4–5; blades elliptic or oblong, rarely ovate, 7–19 x 2.5–6 cm, apex acuminate, base cordate, rarely truncate, both surfaces glabrous. *Petiole* 3 (4)–6 (–8) cm; ligule-lobes broadly triangular or oblong, apex obtuse, 7–15 mm long, membranous, glabrous; leaf-sheaths up to 20 cm long, glabrous, sometimes with gland-dots. *Inflorescence* terminal, between the upper two leaf-sheaths, later clasped by the uppermost leaf-sheath, ca. 8 cm long. *Bracts* ca. 3 x 0.8 cm, hairy; bracteoles ca. 2.3 x 0.3 cm, hairy. *Calyx* ca. 4 mm long; lobes broadly triangular, 1–1.5 mm long; lower part of the tube sparsely reddish-brown-hairy. *Corolla*: tube ca. 1.6 cm long, broadened upwards; lobes elliptic, apex rounded, incurved, ca. 1 x 0.5 cm, with gland-dots. *Labellum* obovate or suborbicular, strongly saccate, apex irregularly crenate and crinkled, ca. 1.5 x 1.5 cm, brownish-hairy, with gland-dots. *Staminodes* obovate, apex rounded, sometimes irregularly lobed, ca. 8 x 5 mm, glandular-hairy, with gland-dots. *Stamen*: filament ca. 4 mm, glandular-hairy; anther ca. 5 mm; connective glandular-hairy; crest bilobed, not produced beyond thecae. *Ovary* ca. 3–4 mm long, reddish-brown-hairy; stigma lobed; stylodes linear, acute, ca. 2.5 mm; placenta free-central; ovules ca. 6. Fruit ellipsoid, ca. 10 x 3 mm, sparsely reddish-hairy near the top and base. Seeds ca. 4, cylindrical-lanceolate, ca. 6.5 x 1 mm, finely hairy, with gelatinous cap, arillate; aril whitish.

T h a i l a n d. —NORTHERN: Chiang Mai, phitsanulok, EASTERN: Chaiphaphum, Nakhon Ratchasima; CENTRAL: Saraburi.

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

E c o l o g y. —In mixed deciduous and evergreen forests.

5. *Boesenbergia xiphostachya* (Gagnep.) Loes. in Pflanzenfam. 2. 15a: 568.1930. —*Gastrochilus xiphostachyum* Gagnep., Bull. Soc. Bot. Fr. 53: 147. 1906.

Leafy stem up to 70 cm tall, bearing 4–8 leaves; sheaths about 3, the longest up to 18 cm long. *Leaves* lanceolate, 13–20 (–30) x 3–5 (8.5) cm, apex acuminate, base cuneate, both surfaces glabrous. *Petiole* 2–5 cm long, glabrous; ligule-lobes oblong, apex rounded, 0.1–1.5 x 0.3–0.5 cm, glabrous; leaf-sheaths up to 27 cm long, glabrous. *Inflorescence* terminal, usually peduncle enclosed by the uppermost leaf-sheaths, extended to 25 cm long; flowers up to 20 or more; peduncle 2–6 cm long. *Bracts* ca. 5 x 1.4 cm, glabrous not concave; bracteoles folded, ca. 3 x 0.9 cm, hairy. *Calyx* ca. 5 mm long, lobes truncate. *Corolla*: tube extended, dilated to the top; lobes oblong, apex rounded, glabrous, ca. 1.2 x 0.5 cm. *Labellum* elliptic or ovate, saccate, apex irregularly crenate and crinkled, ca. 1.3 x 0.8 cm, glabrous with conspicuously gland-dots. *Staminodes* oblanceolate, glabrous with gland-dots. *Stamen*: filament 2–3 mm long, hairy; anther ca. 7.5 mm long, connective glandular-hairy, crest bilobed, not beyond thecae. *Ovary* ca. 4 mm long, glabrous, 1-locular; stylodes linear, obtuse, ca. 3 mm long; placenta free-central.

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

D i s t r i b u t i o n. —Indo-china (type).

E c o l o g y. —In evergreen forest.

6. *Boesenbergia thorelii* (Gagnep.) Loes. in Pflanzenfam. 2. 15a: 568.1930. —*Gastrochilus thorelii* Gagnep., Bull. Soc. Bot. France 14: 163. 1907.

Leafy stem up to 60 cm tall; sheaths ca. 3, up to 17 cm long, sparsely hairy or glabrous. *Leaves* 5–8, sessile; blades elliptic-oblong, 10–18 x 2–3.5 cm, apex acuminate, base cuneate, both surfaces glabrous or almost glabrous; ligule-lobes oblong, apex rounded, ca. 6–9 mm long, hairy, ciliate. *Inflorescence* terminal, enclosed by the uppermost leaf-sheaths, 5–8 cm long; peduncle ca. 1–1.2 cm long. *Bracts* ca. 3.4–4 x 0.6 cm, hairy, apex ciliate; bracteoles ca. 2.8 x 0.7 cm, hairy, apex ciliate. *Calyx* ca. 6 mm long, glabrous; lobes truncate, unequal, the longest one ca. 1.5 mm. *Corolla*: tube ca. 2.4 cm long, broadened towards the top, glabrous; lobes elliptic, apex rounded or short mucronate, 10–16 x 5–8 mm, glabrous, with gland-dots. *Labellum* ovate, strongly saccate, apex irregularly crenate, ca. 2.5 x 2.2 cm. *Staminodes* glabrous, with densely gland-dots. *Stamen*: filament ca. 6.5 mm, short brownish hairy; anther ca. 6 mm long; connective glandular-hairy; crest 2-lobed, not beyond thecae. *Ovary* ca. 2–6 mm long, glabrous; style upper part hairy; stigma ciliate; stylodes linear, acute, ca. 2–4 mm long; placenta free-central, ovules ca. 15.

T h a i l a n d. —CENTRAL: Saraburi; EASTERN: Nakhon Rachasima

D i s t r i b u t i o n. —Laos (Bassac, Thorel s.n. type, P)

E c o l o g y. —In bamboo-hardwood evergreen forest, ca. 200 m msl.

7. *Boesenbergia longipes* (King & Prain) Schltr. in Fedd.Rep. 12: 316.1913; Loes. in Pflanzenfam. 2. 15a: 571.1930; Holttum, Gard. Bull. Sing. 13: 114.1950. —*Gastrochilus longipes* King & Prain ex Ridley, J. Str. Br. As. Soc. 32:113.1899; Mat. Fl. Mal. Pen. 2: 17.1907. —*Kaempferia longipes* (King & Prain) Schum. in Pflanzenr. 4. 46: 79.1904. Fig.5 Plate I:4

Leafy stem ca. 50 cm tall; sheaths 6–10 cm long, purple, sparsely hairy. *Leaves* 2–5, rarely 1 or 6; blades elliptic or elliptic-oblong to oblong, mostly unequal sided, 10–12 x 4–7 cm, apex acuminate, base cuneate, upper surface glabrous, lower surface hairy. *Petiole* 3–4 cm long, sparsely hairy; ligule-lobes triangular or lanceolate, 1–2 cm long, hairy; leaf-sheaths 11–17 cm long, hairy. *Inflorescence* terminal, between the uppermost leaf-sheaths, ca. 10 cm long; peduncle 2–3 mm long. *Bracts* ca. 3 x 0.7 cm, hairy; bracteoles folded, ca. 2 x 0.8 cm, hairy. *Calyx* 5–7 mm long; lobes short and broadened, apex truncate, ca. 2 mm long, hairy. *Corolla*: tube ca. 2.4 cm long; lobes elliptic, apex rounded, incurved, ca. 1 x 0.7 cm, glabrous. *Labellum* whitish with red blotches at the middle, obovate, saccate, apex reflexed and crinkled, ca. 2–3 x 0.6–1 cm, outside short brownish hairy. *Staminodes* whitish, obovate, apex 2-lobed, ca. 9 x 7 mm, outside short brownish hairy at base. *Stamen*: filament ca. 3 mm long, short brownish hairy; anther ca. 6 mm long; connective glandular hairy; crest bilobed, not produced beyond thecae. *Ovary* ca. 4 mm long, sparsely hairy, trilocular; stigma inconspicuously lobed, not ciliate; stylodes cylindrical, ca. 4 mm long; placenta axile.

T h a i l a n d. —PENINSULAR: Nakhon Si Thammarat, Trang.

D i s t r i b u t i o n. —Malay Peninsula (Perak, Wray 4220, type).

E c o l o g y. —In shaded evergreen forest, ca. 150 m msl.

V e r n a c u l a r. —Nila phusi (นิลพุสี) (Southern)

8. *Boesenbergia siamensis* (Gagnep.) P. Sirirugsa, Nord. J. Bot. 7(4): 425, 1987. —*Gastrochilus siamense* Gagnep., Notul. Syst. 14. 1: 36.1950. Fig. 4 (J-Q)

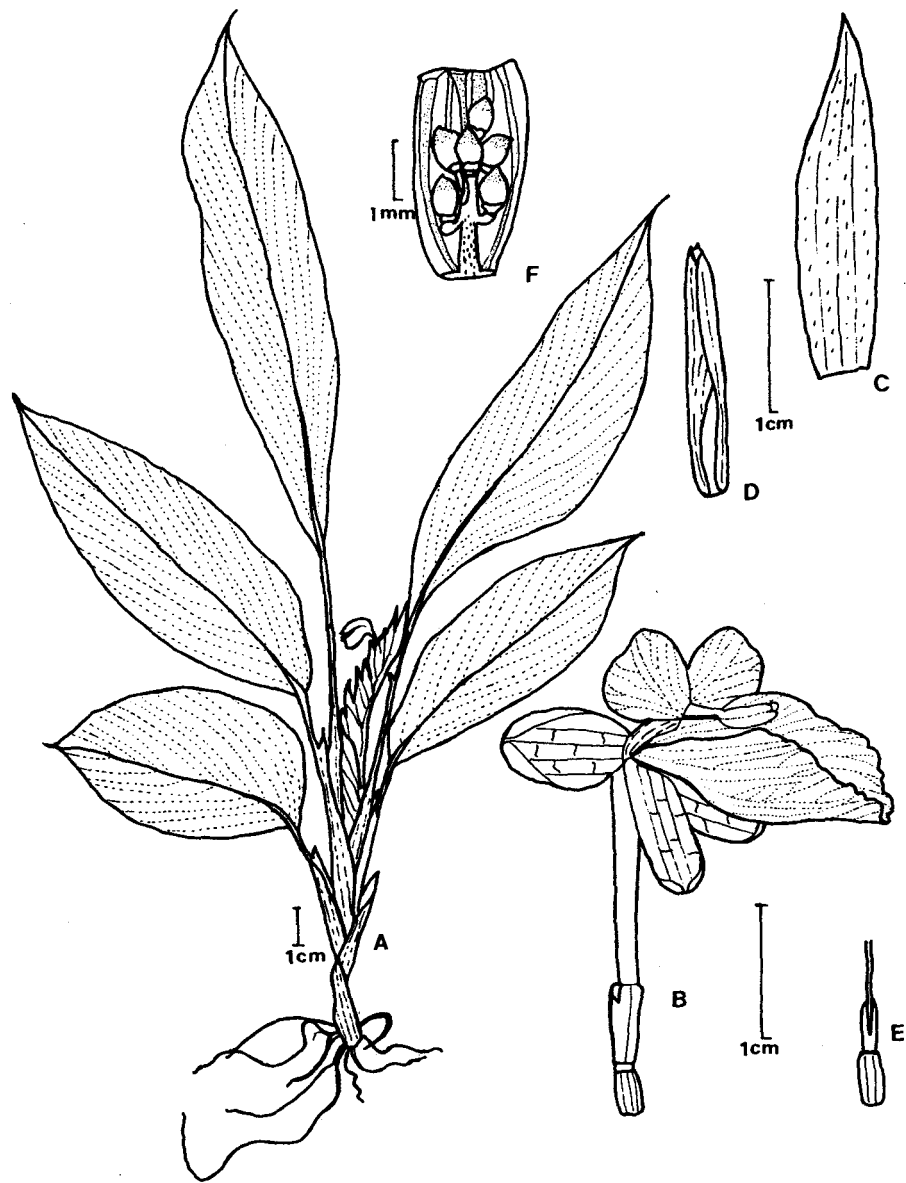


Figure 5. *Boesenbergia longipes*. A : Habit. B : Flower C : Bract. D : Bracteole E : Stylodes and ovary. F Ovary in l.s. showing seeds (All from P. Sirirugsa 1020).

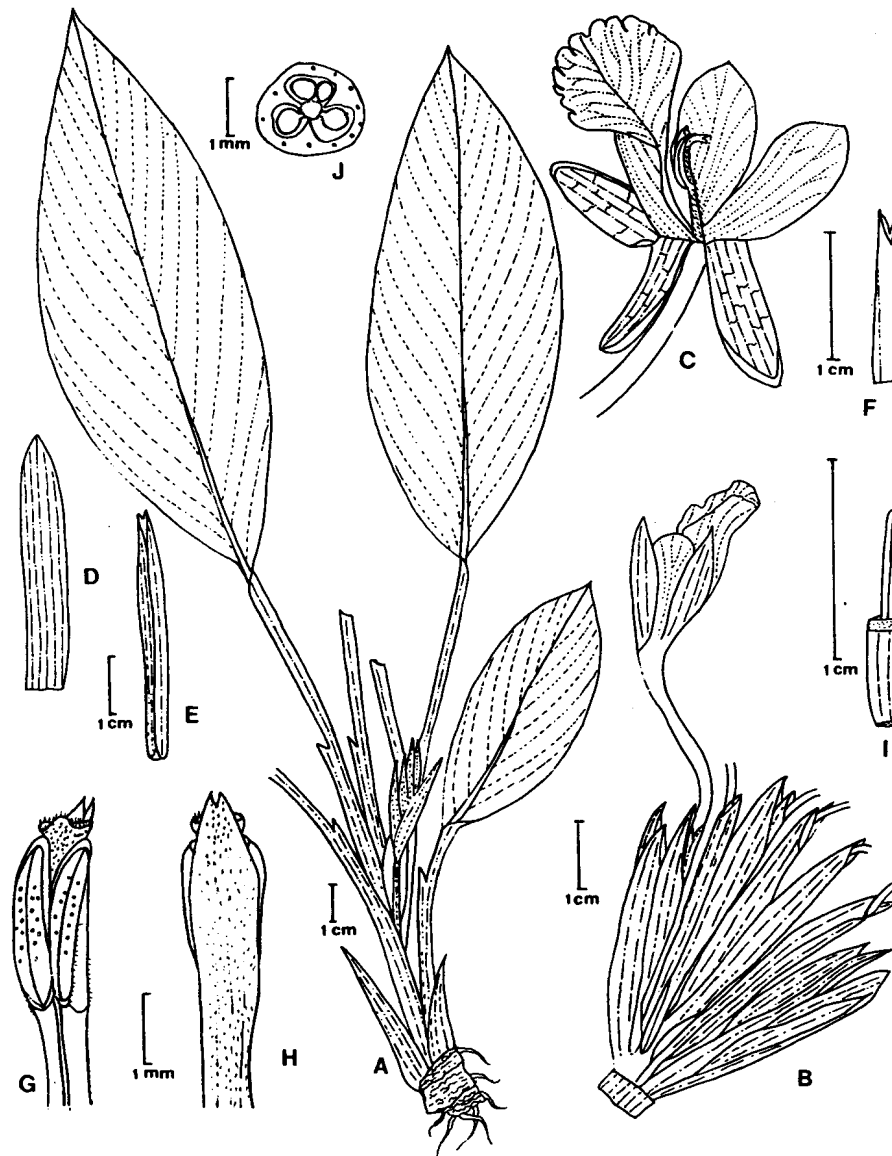


Figure 6. *Boesenbergia rotunda*. A : Habit. B : Inflorescence. C : Flower D : Bract. E : Bracteole. F : Calyx. G : Stamen from the front. H : Stamen from behind. I : Stylodes and ovary. (All from Larsen 5010).

Stem single, slender, ca. 20 cm tall; leafless at anthesis; sheaths ca. 5 to 6, each ca. 2–3 cm apart, the uppermost longest, ca. 3.4 cm long, glabrous with purple blotches. *Inflorescence* terminal, ca. 4 cm long; flowers ca. 6–7. Bracts ca. 3.5 x 0.7 cm, glabrous, with purple blotches; bracteoles ca. 2.5 x 0.6 cm, glabrous. *Calyx* ca. 3 mm long, lobes ca. 1 mm long. *Corolla*: tube ca. 3.2 cm long; lobes linear, apex acuminate, incurved, ca. 15–17 x 3–4 mm, glabrous with longitudinal red markings. *Labellum* ovate, apex obtuse, saccate, ca. 2 x 1.3 cm, hairy and with gland-dots. *Staminodes* elliptic-oblong, apex acute, ca. 9–10 x 3.5 mm, ciliate, inconspicuously hairy. *Stamen*: filament ca. 2.5 mm long, glabrous; anther ca. 4.5 mm long; connective glabrous; crest 3-lobed, with purple blotches, beyond thecae. *Ovary* ca. 4 mm long, glabrous, with red markings, 1-locular; stigma ciliate; styles linear, acute, ca. 4 mm long.

T h a i l a n d . —EASTERN: Kanchanaburi (type).

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

E c o l o g y . —Among blocks of limestone rocks in evergreen forest, ca. 150 m msl.

V e r n a c u l a r . —Krachai sayam (กระชายสยาม)

9. *Boesenbergia rotunda* (L.) Mansf. in Kulturpfl. 6: 239.1958; Burt & Smith, in Not. R.B.G. Edinb. 31.2:184. 1972; Wu Te-lin in, Fl. Reipub. Pop. Sin. 16.2: 46.1981. —*Curcuma rotunda* L., Sp. Pl. 1: 2.1753; Lour., Fl. Cochinch.: 11.1753. —*Kaempferia ovata* Roscoe, Trans. Linn Soc. 8: 351.1807. —*K. pandurata* Roxb., Asiat. Res. 11: 328. t.2.1810; Lindl., Bot. Reg. t. 173. 1816; Bak. in Fl. Br. Ind. 6: 220. 1890; Schum. in Pflanzenr. 46: 82. 1904; Gagnepain, Bull. Soc. Bot. Fr. 53: 52.1906. —*Gastrochilus pandurata* (Roxb.) Ridl., J. Str. Br. As. Soc. 32: 14.1899; Valet., Bull. Jard. Bot. Buitenz. 2. 27: 85.1918; Ridl., Fl. Mal. Pen. 4: 249.1924. —*Boesenbergia pandurata* (Roxb.) Schltr. in Fedd. Rep. 12: 316.1913; Loes. in Pflanzenfam. 2. 15 a: 570.1930; Holttum Gard. Bull. Sing. 13: 115.1950; Baker & Bakh.f., Fl. Java 3: 69.1968. —*Kaempferia cochinchinensis* Gagnep., Bull. Soc. Bot. 54: 165.1907. —*B. cochinchinensis* (Gagnep.) Loes. in Pflanzenfam. 2. 15 a: 571.1930. —*Gastrochilus rotunda* (L.) Alston in Handb. Fl. Ceylon. 6, Suppl.: 281.1931. Fig. 6 Plate II: 5

Leafy stem up to 80 cm tall, sheaths ca. 3, reddish, 9–16 cm long, glabrescent. *Leaves* 3–5 (–7): blades elliptic or oblong, 17–35 (–40) 6–10 (–12) cm, apex acute to acuminate, base truncate or cuneate and decurrent, upper surface glabrous, lower surface finely hairy, usually caducous when dry. *Petiole* (2) 5–12 cm long, glabrous; ligule-lobes broadly triangular or oblong, apex rounded, 2–6 mm long, hairy; leaf-sheaths 9–19 cm long, glabrescent. *Inflorescence* terminal, enclosed by the upper two leaf-sheaths, 5–7 cm long; rachis short and crowded with bracts, not elongate; peduncle 1–2 cm long; flowers ca. 10. Bracts ca. 4 x 0.7 cm, sparsely hairy; bracteoles about the same size as bracts. *Calyx* ca. 1.5 cm long, lobes ca. 2 mm long. *Corolla*: tube ca. 6 cm long; lobes pink, oblong, dorsal lobe apex acute, incurved, ca. 1.7 x 0.5 cm, lateral lobes apex rounded, incurved ca. 1.5 x 0.4 cm. *Labellum* pink at the apex and paler downwards, along median hairy below the middle downwards, elliptic or obovate-elliptic, slightly saccate, apex 2-lobed and reflexed, irregularly serrate and crinkled, ca. 2–3 x 1–1.5 cm, glabrous, with sparsely gland-dots. *Staminodes* pink, obovate or obovate-oblong, apex rounded, ca. 1.7 x 1 cm. *Stamen*: filament ca. 5 mm, white hairy at the back; anther about as long; connective glandular-

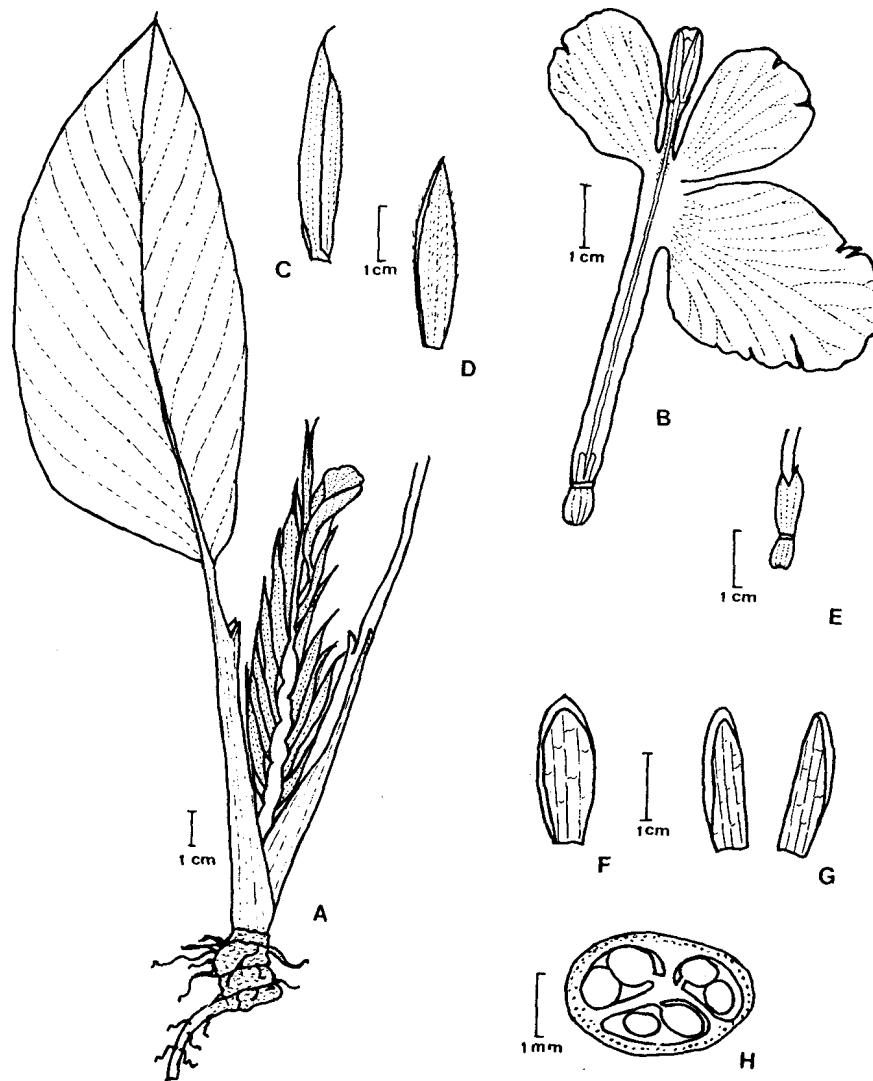


Figure 7. *Boesenbergia plicata*. A : Habit. B : Flower C : Bract. D : Bracteole. E : Calyx and ovary. F : Dorsal corolla-lobe. G : Lateral corolla-lobes. H : Ovary in x.s. (All from Newman 15).

hairy; crest bilobed, ca. 1.5 mm beyond thecae. *Ovary* ca. 5.5 mm. long, glabrous, 3-locular; stigma trilobed, ciliate; stylodes linear, ca. 6.5 mm long; placenta axile.

T h a i l a n d . —NORTHERN: Chiang Mai, Mae Hong Son, Lampang, Phitsanulok, Tak, Nakhon Sawan. NORTH-EASTERN: Phetchabun, Loei; EASTERN: Nakhon Ratchasima, Si Sa Ket; SOUTH-EASTERN: Chon Buri, Trat; SOUTH-WESTERN: Kanchanaburi, Ratchaburi; PENINSULAR: Ranong. Cultivated throughout the country.

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

E c o l o g y . —In mixed deciduous or evergreen forests, on limestone hill or along stream, from sea-level up to 1200 m msl.

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

10. *Boesenbergia plicata* (Ridl.) Holttum, Gard. Bull. Sing. 13: 109.1950. —*Gastrochilus plicata* Ridl., J. Str. Br. As. Soc. 44: 196.1905. —*Boesenbergia lurida* (Ridl.) Loes. in Pflanzfam. 2. 15a: 570.1930. —*B. plicata* var. *lurida* (Ridl.) Holttum, Gard. Bull. Sing. 13: 110.1950. Fig 7 Plate II: 6,7

Leafy stem up to 90 cm tall; sheaths up to 28 cm long, hairy. *Leaves* 2–7, mostly 3–5; blades oblong or elliptic-oblong, often unequal-sided, 15–35 (42) x 6–10 (14) cm, apex acuminate, base cuneate or rounded, sometimes cordate, upper surface glabrous, lower surface rarely sparsely hairy. *Petiole* (3) 6–15 (20) cm long, hairy; ligule-lobes triangular or oblong, apex rounded, 6–15 mm long; leaf-sheaths 8–23 cm long, hairy. *Inflorescence* terminal, between the two innermost leaf-sheaths, later elongate, (8) 10–20 (25) cm long; peduncle 2–4 cm long. *Bracts* alternate 2-ranked, facing one way, 4–5 x 1.2 cm, hairy; bracteoles folded ca. 4 x 1.8 cm hairy. 2–4 cm long. *Calyx* ca. 12 mm long, lobes ca. 1.5–2 mm long, reddish mottled. *Corolla*: tube ca. 3.8 cm long; lobes oblong, apex mucronate, incurved, ca. 2.3 x 1 cm, reddish mottled, glabrous, with gland-dots. *Labellum* elliptic or obovate, apex rounded, undulate and crinkled, not saccate, base with margin folded up and overlapping staminodes, ca. 3.5 x 2.5 cm, finely hairy, at base short brownish hairy, with gland-dots. *Staminodes* obovate-oblong, apex rounded or lobed, ca. 2.4 x 1.5 cm, hairy, finely ciliate and with gland-dots. *Stamen*: filament ca. 8 mm long, hairy; anther ca. 1 cm long; connective finely hairy; crest trilobed, shortly extended beyond thecae. *Ovary* 5–6 mm long, reddish-mottled, glabrous, 3-locular; stigma inconspicuously lobed, ciliate; stylodes linear, ca. 5 mm long. Placenta axile.

T h a i l a n d . —NORTHERN: Mae Hongson; SOUTH-EASTERN: Chon Buri; PENINSULAR: Chumphon, Surat Thani, Phangnga, Nakorn Si Thammarat, Trang, Songkhla, Satun.

D i s t r i b u t i o n . —Malay Peninsula (Langkawi, type), India.

E c o l o g y . —On limestone hill in evergreen forest, 1.5–600 m msl.

11. *Boesenbergia acuminata* P. Sirirugsa, Nord. J. Bot. 7 (4): 421. 1987. Fig. 1 (A–K)

Leafy stem ca. 33–65 cm tall, nodes elongate, sheaths the longest one ca. 8 cm, glabrous. *Leaves* ca. 11; blades lanceolate-oblong, 10–18 x 2–4 cm, apex long acuminate, base truncate, sometimes obtuse or subcordate, upper surface glabrous, lower surface sparsely hairy, *Petiole* 1–3.5 cm long, glabrous, with red blotches; ligule-lobes lanceolate or oblong, apex obtuse, central part greenish, margin membranous with red blotches; 6–13 mm long, glabrous; leaf-sheaths 10–13 cm, glabrous. *Inflorescence* terminal, clasped by

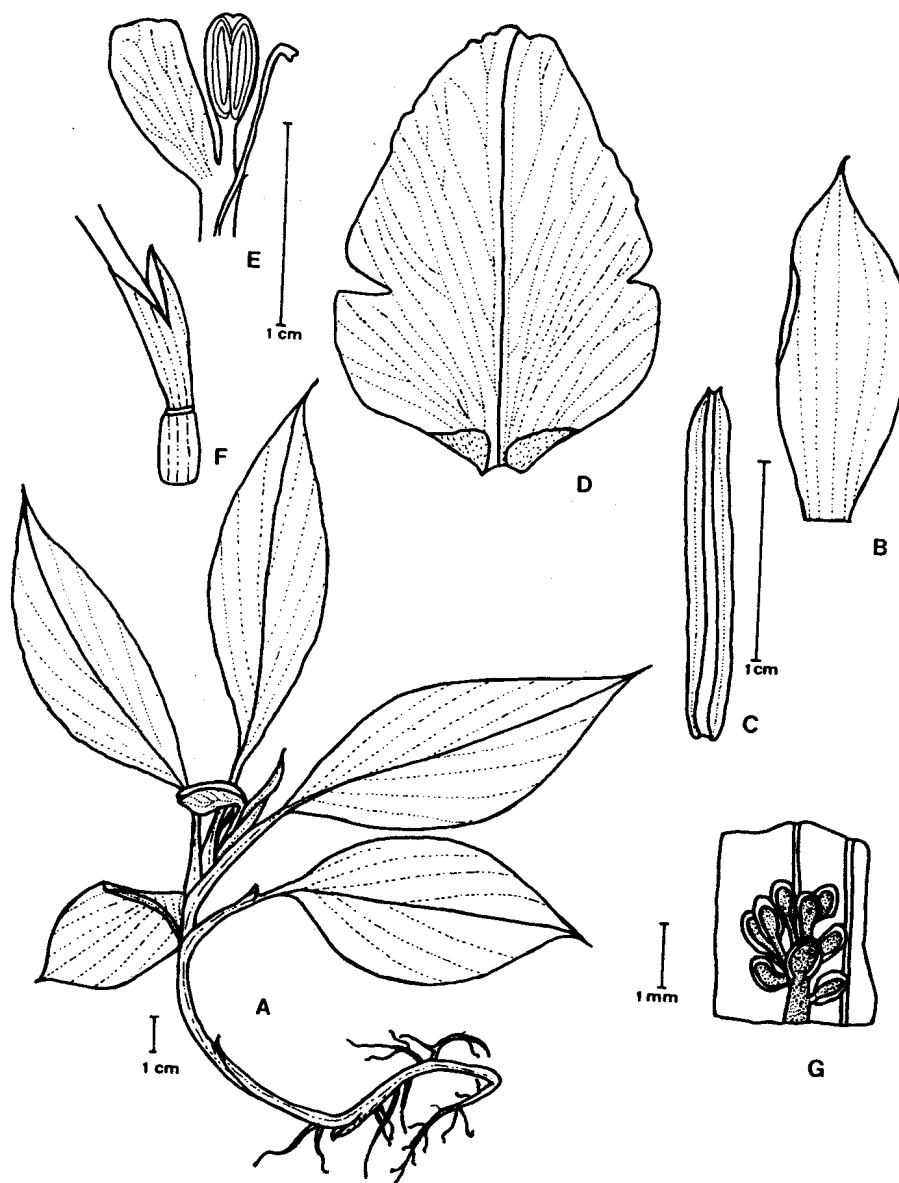


Figure 8. *Boesenbergia parvula*. A : Habit. B : Bract. C : Bracteole. D : Labellum. E : One of staminodes, stamen from the front, stigma and part of style. F : Calyx and ovary. G : Seeds and part of ovary wall. (A from Larsen et al. 2601; B, C, from Buesekom & Phenghlai 478; D, E, F, from Larsen 34522; G from Garrett 414).

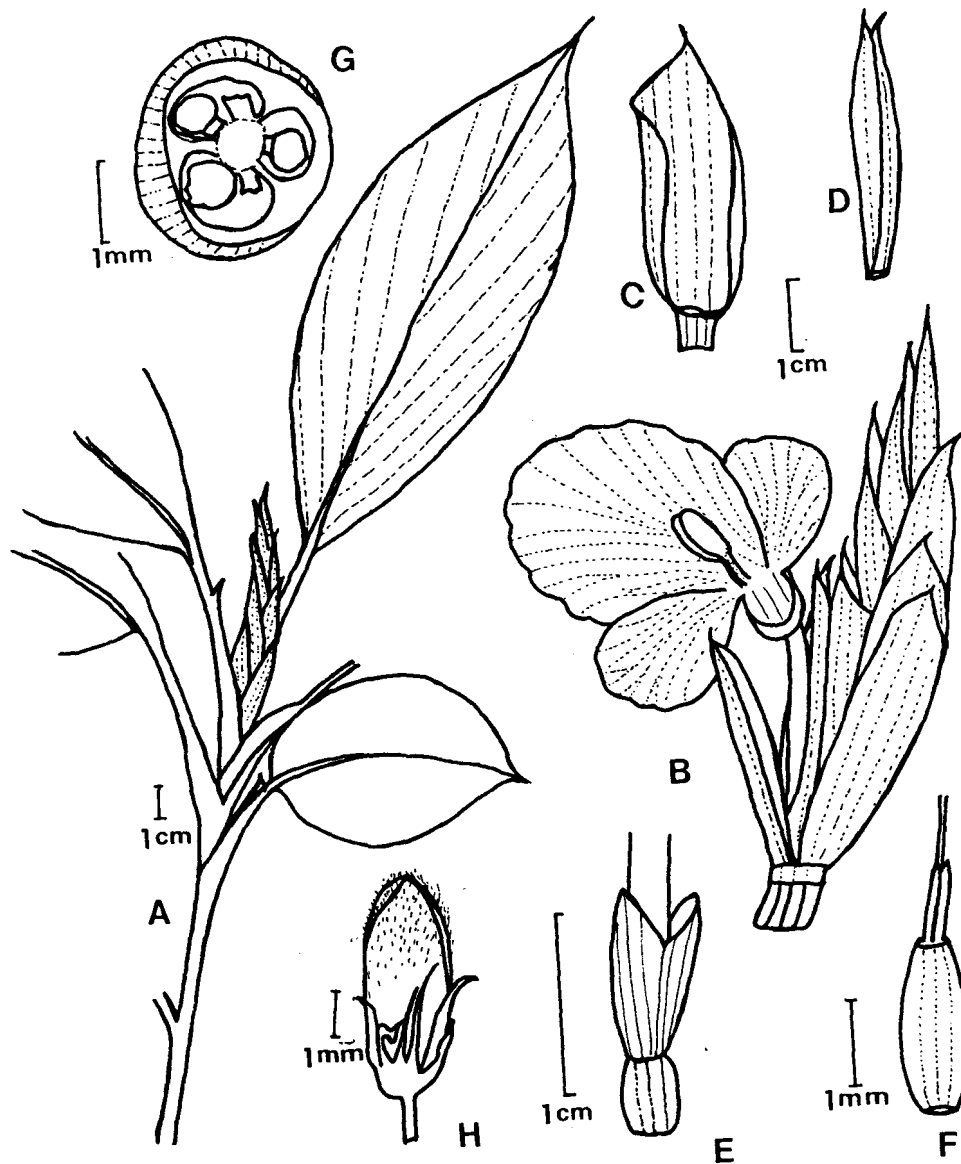


Figure 9. *Boesenbergia pulcherrima*. A : Habit. B : Inflorescence. C : Bract. D : Bracteole. E : Calyx and ovary. F : Stylodes and ovary. G : Ovary in x.s. H : Seed. (A, C, D, E, from Larsen 10645; B, F, G, H from Maxwell 74-820).

the uppermost leaf-sheath, ca. 4–7 cm long; peduncle 7–20 mm long. *Bracts* ca. 2.4–3.2 cm long, glabrous; bracteoles ca. 2–2.5 cm long, glabrous. *Calyx* ca. 7 mm long, lobes triangular, acute, ca. 1 mm long, glabrous. *Corolla*: tube ca. 2.8 cm long; lobes elliptic-oblong, apex acute or mucronate, incurved, ca. 10 x 4 mm, glabrous, with gland-dots. *Labellum* with gland-dots, elliptic or elliptic-ovate, incurved near the base, slightly saccate, apex rounded, ca. 1.6 x 1 cm, hairy from below the middle. *Staminodes* oblanceolate, apex rounded or lobed, 7.5–8 x 3.5–4 mm, usually hairy and ciliate, with gland-dots. *Stamen*: filament ca. 4 mm, basal part white hairy; anther 3–4.5 mm; connective glabrous; crest bilobed, reflexed. *Ovary* 4–5 mm long, glabrous, incompletely 3-locular; stigma trilobed, ciliate; stylodes linear, ca. 4 mm long. *Fruit* ellipsoid, tapering towards the base, ca. 1.2 cm long. *Seeds* ca. 3 mm long, glabrous.

T h a i l a n d . —PENINSULAR: Phangnga [Takua Thung, Thap Put (type)]

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

E c o l o g y . —On limestone cliff, ca. 80 m msl.

12. *Boesenbergia parvula* (Wall. ex Bak.) Kuntze, Rev. Gen.Pl.: 685.1891. —*Gastrochilus parvula* Wall. ex Bak. in Fl. Br. Ind. 6: 218.1890. —*B. parvula* (Wall. ex Bak.) Smitinand in Thai For. Bull. Bot. 2: 19.1955. Fig.8.

Leafy stem ca. 16 cm tall, sheaths up to 6 cm long, glabrous. *Leaves* 4–6; blades ovate to elliptic, 2–5 x 1.5–2.5 cm, apex acute to slightly acuminate, base rounded or cuneate, both surfaces glabrous, sometimes lower surface sparsely hairy. *Petiole* 2–12 mm long, of the uppermost leaves shorter, almost sessile; ligule-lobes broadly triangular, apex rounded membranous, glabrous, 2–3 mm long; leaf-sheaths up to 2 cm long, glabrous. *Inflorescence* terminal between the two uppermost leaf-sheaths, ca. 3 cm long; peduncle very short. *Bracts* oblong, hairy, apex ciliate, ca. 2x0.7 cm; bracteoles folded, ca. 1.8 x 0.5 cm, hairy, apex ciliate. *Calyx* 8–9 mm long, lobes ca. 4.5 mm long. *Corolla*: tube 1.8–2.3 cm long, broadened upwards; lobes oblong, apex rounded, incurved, 1–1.2 x 0.4–0.6 cm. *Labellum* whitish, with purple streak at the middle, sometimes with gland-dots, ovate-oblong, saccate, apex irregularly crenate, 2.0–2.4 x 1.5–2.0 cm, throat brownish hairy. *Staminodes* oblong, apex rounded, irregularly lobed, ca. 10 x 4 mm, glabrous, sometimes with gland-dots. *Stamen*: filament 3–7 mm long, sparsely hairy; anther 4.5–7 mm long; connective glandular-hairy; crest bilobed, shortly extended beyond thecae. *Ovary* ca. 3.5 mm long, one locular; stigma 4-lobed, ciliate; stylodes ca. 3 mm long; placenta parietal; ovules about nine.

T h a i l a n d . —NORTHERN: Chaing Mai (Doi Suthep); EASTERN: Chanthaburi; SOUTH-WESTERN: Kanchanaburi.

D i s t r i b u t i o n . —India, Burma (Tavoy, Wallich 6590, type).

E c o l o g y . —In evergreen forest, 300–1000 m msl.

13. *Boesenbergia pulcherrima* (Wall.) Kuntze, Rev. Gen.: 685.1891; Schltr. in Fedd. Rep. 12: 316.1913; Loes. in Pflanzenfam. 2. 15a: 568.1930; Holttum, Gard. Bull. Sing. 13: 109.1950. —*Gastrochilus pulcherrima* Wall., Pl. As. Rar. 1. t.24: 22.1830; Hook. f., Fl. Br. Ind. 6: 217.1890; Ridl., Mat.Fl. Mal. Pen. 2: 14.1907; Fl. Mal. 4: 247.1924. Fig.9, Plate II:8



Figure 10. *Boesenbergia rotunda* (L.) Mansf. Photo : P. Sirirugsa

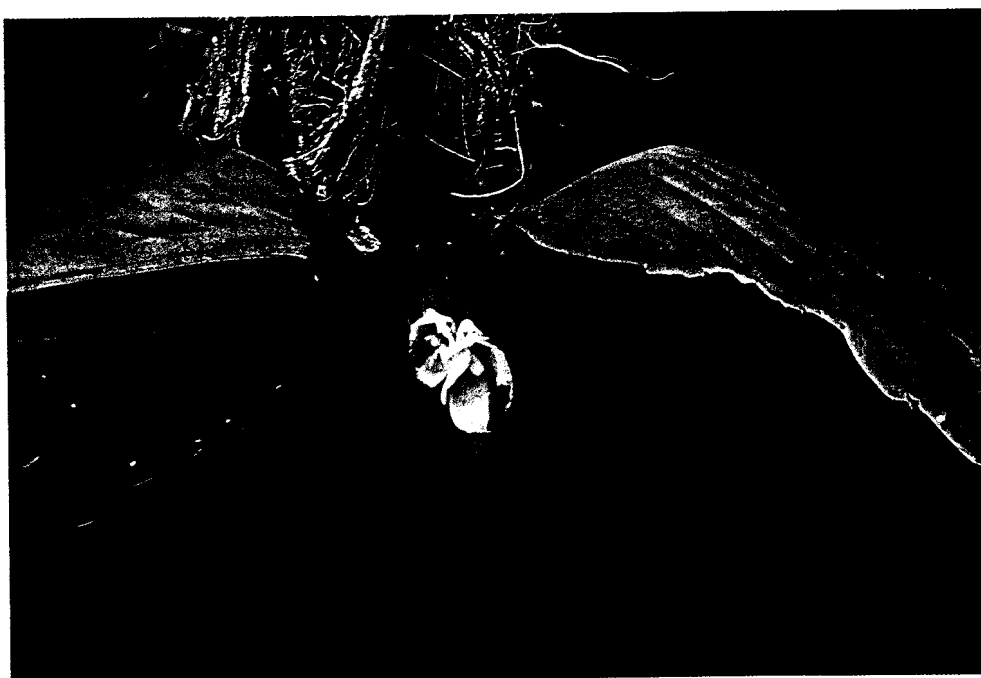


Figure 11. *Boesenbergia pulcherrima* (Wall) Kuntze Photo : K. Larsen

Figure 12. *Boesenbergia plicata* (Ridl.)
Holt. Photo : Sirirugsa



Figure 13. *Boesenbergia plicata* (Ridl.)
Holt. Photo : Sirirugsa



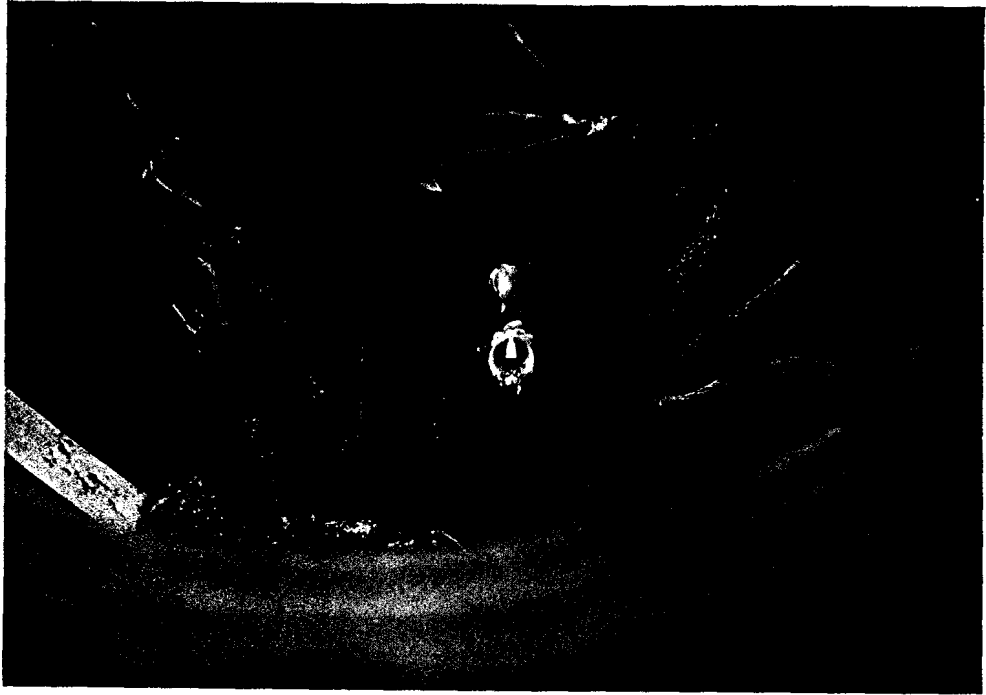


Figure 14. *Boesenbergia basispicata*
Larsen ex Sirirugsa Photo :
Sirirugsa



Figure 15. *Boesenbergia prainiana* (Bak.)
Schltr. Photo : K. Sridith



Figure 16. *Boesenbergia curtisii* (Bak.). Photo : P. Sirirugsa



Figure 17. *Boesenbergia longipes* (King & Prain) Schltr. Photo : P. Sirirugsa

Leafy stem slender, sometimes procumbent, 20–50 cm tall; sheaths 5–14 cm long, hairy. *Leaves* 5–7; blades elliptic or oblong, often unequal sided, 10–40 x 3–12 cm, apex acuminate, base cuneate and decurrent, upper surface glabrous, lower surface hairy. *Petiole* 3–20 mm; ligule-lobes lanceolate, 5–10 mm long, hairy; leaf-sheaths 3–7 cm long, hairy. *Inflorescence* terminal, enclosed by the upper two leaf-sheaths, rachis later elongate and exerted, 5–12 cm long, more or less sessile. *Bracts* ca. 4 x 1.7 cm, finely hairy; bracteoles ca. 3.2 x 1.5 cm, finely hairy. *Calyx* 7–8 mm long, lobes short, 1.5–4 mm long. *Corolla*: tube 2.7–3 cm long; lobes elliptic, 1.4–1.8 x 0.8–1 cm. *Labellum* whitish with a red mid-band from apex towards the throat, ovate or suborbicular, strongly saccate, apex rounded with margin crinkled and reflexed, 3–3.3 x 2.5–3.2 cm, glandular-hairy, ciliate. *Staminodes* obovate, apex rounded or irregularly lobed, ca. 2 x 1.3 cm, glandular-hairy, ciliate. *Stamen*: filament ca. 4 mm, short brownish hairy; anther ca. 7.5 mm; connective glandular-hairy; crest bilobed, shortly extended beyond thecae. *Ovary* ca. 4 mm long, glabrous, 3-locular; stigma ciliate; stylodes linear ca. 4 mm long; placenta axile, ovules ca. 5 to 6 in each locule. *Fruit* cylindrical-ellipsoid, ca. 14 x 4 mm. *Seeds* ellipsoid, whitish hairy ca. 5 x 2 mm, arillate; aril whitish.

T h a i l a n d . —NORTHERN: Chiang Mai, Phitsanulok, Tak; NORTH-EASTERN: Loei; EASTERN: Nakhon Ratchasima, Si Sa Ket; CENTRAL: Nakhon Nayok; SOUTH-EASTERN: Chon Buri, Chanthaburi, Trat; SOUTH-WESTERN: Kanchanaburi; PENINSULAR: Surat Thani, Pattani.

D i s t r i b u t i o n . —Burma (Tavoy, Wallich s.n. type), Malay Peninsula.

E c o l o g y . —In mixed evergreen forest, 50–800 m msl.

V e r n a c u l a r . —Bussabong (บุษบง), Put (ปุด).

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