



CHAPTER III

TAXONOMIC STUDY

A taxonomic account of the genus *Hedychium* in Thailand is involved key to the species, description, list of examined specimens, ecological and geographical distribution and including important notes.

Materials and methods

This study is based on field collections and herbarium materials. Field work was made during 2007-2009. All parts of plants such as inflorescences, fruits and habits, were photographed and the field notes were made. Plant materials were processed for herbarium specimens, flowers were preserved in 95% Ethanol and Glycerin. Pieces of young leaf were stored in silica gel for DNA extraction. Additional materials have been examined in the following herbaria: BK, BKF, CAL, CMU, K, KKU, L, P, PSU, QBG and SING.

Results

Twenty-five taxa of the genus *Hedychium* are recognized for Thailand. The taxonomic treatment, key to the species and varieties, description, illustrations and photograph illustrations of all species are provided.

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Hedychium J. König

J. König in Retz., Obs. 3: 73. 1783; Roxb., Fl. Ind. ed. 1: 9. 1820; Blume, Enum. Pl. Javae 1: 55. 1827; Roscoe, Monandr. Pl. t. 6: 47. 1828; Lestiboudois in Ann. Sci. Nat. 17: 113. 1829; Wall. In Hook. Kew Gard. Misc. 5: 321. 1853; Horan. Monogr. 24. 1862; Benth. & Hook.f., Gen Pl. 3: 642. 1883; O.G. Peters. In Engler u. Prantl, Pflzfam. 3(6): 19. 1889; Baker in Hook.f., Fl. Br. Ind. 6: 225. 1894; K. Schum. in Engl., Pflanzenr. 4(46): 40. 1904; Gagnep. in Lecomte, Fl. Gén. I.-C. 6: 70. 1908; Ridl., Fl. Mal. Pen. 4: 241. 1924; Fl. Java 3: 64-67. 1968; T.L. Wu & K. Larsen in Z.L. Wu & PH. Raven, Fl. China 24: 370-371. 2000; Holtt. in Gard. Bull. Sing. 13: 72-73. 1950.—*Gamochilus* T. Lestib., Ann. Sci. Nat. Bot. 2(15): 341. 1841.—*Gandasulium* Rumph. ex Kuntze, Revis. Gen. Pl. 2: 690. 1891.—*Brachychilum* (R.Br. ex Wall.) Petersen, Bot. Tidsskr. 18: 262. 1893.

Terrestrial, epiphytic or epilithic, perennial herb. *Pseudostems* 0.4-2.4 m high, leaf sheaths greenish or reddish, bladeless sheaths 2-5. *Ligule* oblong, 0.2-5.9 cm long, pubescent or glabrous, apex truncate-emarginate, acute, bilobed or rounded. *Leaves* lanceolate-oblong or elliptic, base cuneate, apex acute-acuminate or caudate, margin entire to slightly undulate, upper surface glabrous, lower surface glabrous or pubescent. *Inflorescence* a terminal spike, erect, 7.4-52.3 cm, glabrous or pubescent; peduncle 1.7-21.1 cm long; bracts imbricate-elongated to visible rachis or not imbricate, rachis usually visible, apex acute or rounded, glabrous or pubescent, each bract subtending of 1-7(-11) flowers; bracteole, folded or tubular, membranous, glabrous or pubescent, shorter or longer than bract. *Flowers* white, yellowish to golden yellow or reddish, fragrant; calyx tubular, split on one side, apex acute to 3-dented, glabrous or pubescent; corolla tube slender or twisted, glabrous or pubescent, 3-lobed, lobes linear, apex hooded; lateral staminodes linear-oblong, oblanceolate, or elliptic; labellum ovate-elliptic, obovate or suborbicular-orbicular, base attenuate into claw, apex acute or emarginate to deeply divided; filament 0.7-7.4 cm long, shorter or longer than labellum; anther dorsifixed, base divaricate 0.3-1.8 cm long; ovary glabrous or pubescent, 3-loculed, placentation axile, epigynous glands 2; stigma densely ciliate, green. *Fruits* glabrous or

pubescent, ellipsoid-oblong or globose. *Seeds* numerous, ellipsoid-oblong or globose, aril orange-reddish.

KEY TO THE SPECIES OF *HEDYCHIUM* IN THAILAND

1. Bracts imbricate (rarely elongated to visible rachis)
 2. Inflorescences cylindrical or ellipsoid. Lower leaf surface glabrous or hairy along midrib
 3. Anther 0.8-1.0 cm long
 4. Ovary glabrous **10. *H. malayanum***
 4. Ovary densely brownish hairy **16. *H. siamense***
 3. Anther 1.1-1.7 cm long
 5. Flowers yellow, curl-backward **9. *H. longicornutum***
 5. Flowers white, not curl-backward
 6. Labellum elliptic, apex emarginate **6. *H. ellipticum***
 6. Labellum obovate, apex deeply divided at base **8. *H. khaomaenense***
 2. Inflorescences conical-elongated to visible rachis. Lower leaf surface pubescent **5. *H. coronarium***
1. Bracts not imbricate, rachis usually visible
 10. Flowers strictly 1 per bract
 11. Flowers golden yellow **1. *H. aureum***
 11. Flowers white-pale yellow
 12. Filament longer than labellum **7. *H. gomezianum***
 12. Filament shorter than or as long as labellum
 13. Labellum lanceolate-oblong
 14. Lower leaf surface glabrous **13. *H. pauciflorum***
 14. Lower leaf surface tomentose **20. *H. tomentosum***
 13. Labellum obovate-elliptic
 15. Labellum apex bifid **14. *H. phuluangense***
 15. Labellum apex deeply divided at the base **18. *H. spicatum***
 10. Flowers more than 1 per bract
 17. Anther 3-5 mm long
 18. Ligules glabrous. Inflorescences bracts greenish **4. *H. collinum***
 18. Ligules villose. Inflorescences bracts reddish **21. *H. villosum***

17. Anther longer than 5 mm long

19. Flowers red

3. *H. coccineum*

19. Flowers white-pale yellow

20. Labellum elliptic, apex bifid

17. *H. speciosum*

20. Labellum obovate, suborbicular-orbicular

21. Filament shorter than or as long as labellum **11. *H. muanwongyathiae***

21. Filament longer than labellum

22. Labellum elliptic-oblong or ovate

23. Labellum elliptic-oblong, base attenuate into 3-4 mm claw

2. *H. biflorum*

23. Labellum ovate, base attenuate into 0.6-1.4 cm claw

15. *H. roxburghii*

22. Labellum suborbicular-orbicular

24. Filament white

19. *H. stenopetalum*

24. Filament pale salmon red

12. *H. neocarneum*

Botanical and taxonomic descriptions of *Hedychium* in Thailand

1. *Hedychium aureum* C. B. Clarke & Mann ex Baker, in J. D. Hooker, Fl. Brit. Ind. 6: 299. 1894 [Type: India: Khasia Hills, alt. 1,700-2,000 m; *Clarke & Mann* s.n. (CAL)].

Epilithic or epiphytic, perennial herb. *Pseudostems* 0.4-0.8 m high, bladeless sheaths 2-4. *Ligule* small, oblong, 1-3 by 4-5 mm, apex obtuse-shallowly bilobed, glabrous, reddish. *Leaves* sessile or petioleate, 4-8 mm long; blade lanceolate-oblong, 13.1-19.9 by 3.0-3.9 cm, base cuneate, apex acuminate, margin entire-slightly undulate, both surface glabrous. *Inflorescence* a terminal spike, erect, 3.7-5.4 cm long; peduncle 2.2-2.6 cm long, glabrous; bracts folded, lanceolate-oblong, 1.3-1.5 by *ca.* 0.6 cm, apex acute, glabrous, greenish, each subtending a cincinnus of 1 flower; bracteole tubular, 0.7-0.8 by *ca.* 0.4 cm, apex acute, membranous, glabrous. *Flowers* golden yellow; calyx tubular, 0.9-1.0 by 0.2-0.3 cm, apex acute, glabrous; corolla tube slender, 0.9-1.2 by 0.2-0.3 cm, 3-lobed, lobes linear *ca.* 1.0 by 0.2-0.3 cm, apex hooded, reddish; lateral staminodes oblanceolate, 0.8-1.0 by *ca.* 0.4 cm; labellum ovate, 0.9-1.1 by 0.7-0.8 cm, apex deeply divided; filament *ca.* 7 mm long, yellow; anther dorsifixed, *ca.* 5 mm long, base divaricate, yellow; ovary *ca.* 2 by 2 mm, 3-loculed, placentation axile, glabrous; epigynous glands 2, slender, *ca.* 2 by 1 mm, yellowish; stigma densely ciliate, yellow. *Fruits* subglobose-globose, 1.1-1.5 by 1.1-1.6 cm, glabrous, greenish. *Seeds* numerous, obovoid-oblong 5-7 by 2-3 mm, cover with reddish aril, globose 0.9-1.3 by 0.7-0.9 cm.

Thailand.—NORTHERN [Chiang Mai, Doi Chiang Dao Wildlife Sanctuary].

Distribution.—India (Khasia Hills).

Ecology.—Lower montane oak forest or upper montane scrub at the altitude of 1,314-2,084 m.

Phenology.—Flowering from August-September, fruiting from October-November.

Etymology.—The specific epithet is referred to the golden-yellow flowers.

Vernacular name.—Wan Pad Roi Sanom (ว่านแปดร้อยสนม), Ta Hoen Kam (ตาเหินคำ).

Note.—One of the small *Hedychium* species with remarkable golden-yellow flowers, 1-flowered bracts, small reddish ligules and thoroughly glabrous plant.

Specimen examined.—*P. Suksathan* 3913-in spirit (QBG); *P. wongsuwan* 123 (KKU), 124 (KKU), 126 (KKU), 128 (KKU), 54-in spirit (KKU), 55-in spirit (KKU).

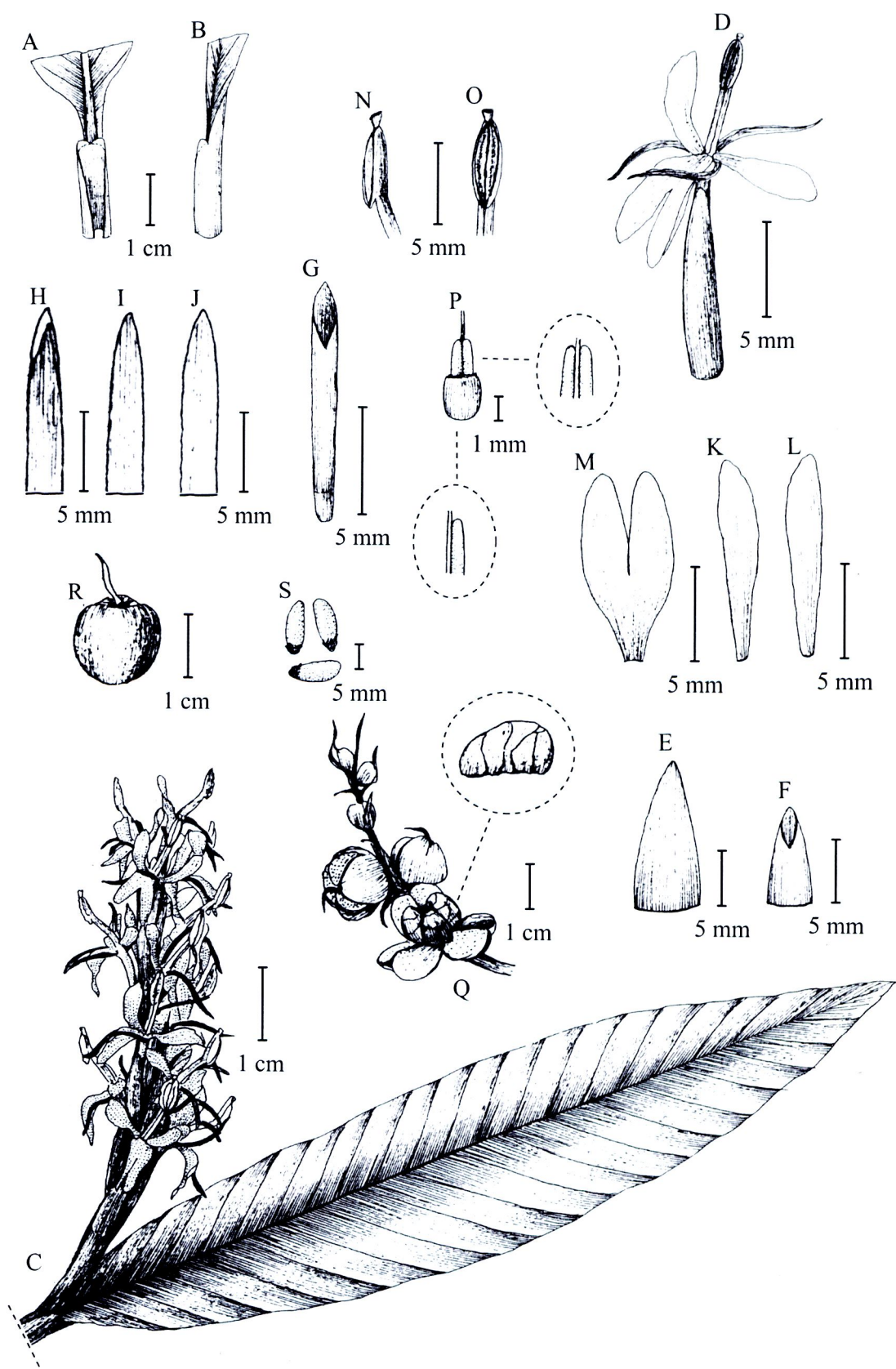


Figure 3.1



Figure 3.2 Photograph illustration of *H. aureum* C. B. Clarke & Mann ex Baker:
A. habit; B. part of leaf and ligule; C. inflorescence; D. fruiting plant;
E. young infructescence; F. infructescence with dehiscent fruits.

Figure 3.1 Illustrations of *H. aureum* C. B. Clarke & Mann ex Baker:

A. & B. part of a leaf with a ligule (front and side views); C. a leaf and an inflorescence; D. bract and flower; E. bract; F. bracteole; G. calyx tube and ovary; H. dorsal corolla lobe; I. & J. lateral corolla lobes; K. & L. staminodes; M. labellum; N. & O. anther and stigma (side and front views); P. epigynous glands; Q. infructescence R. fruit; S. seeds.

2. *Hedychium biflorum* Sirirugsa & K. Larsen, Nord. J. Bot. 15: 303, Fig. 1 J-O. 1995 [Type: Thailand: Tak, Khao Pha Wo, alt. *ca.* 750 m, 23 July 1973, on limestone hill; *Murata et al.* T-16946 (holotype L, isotypes AAU, BKF)].

Epilithic, perennial herb. *Pseudostems* 0.7-1.0 m high, bladeless sheaths 2-3. *Ligule* oblong, 3.4-3.6 by 1.4-1.8 cm, apex rounded or acute, membranous, sparsely hairy, greenish. *Leaves* sessile; blade elliptic-lanceolate, 43.0-48.0 by 11.7-12.2 cm, base cuneate, apex acuminate, margin undulate, upper surface glabrous, lower surface sparsely pubescent or glabrous. *Inflorescence* a terminal spike, erect, 27.6-46.2 cm long; peduncle 17.8-20.0 cm long, hairy; bracts lax, folded, greenish, triangular, 4.6-6.4 by 1.5-1.9 cm, sparsely hairy, apex acute, each subtending a cincinnus of 2(-4) flowers; first bracteole triangular, 0.6-1.0 by 0.3-0.6 cm, apex acute; second bracteole triangular, 5-7 by 3-5 cm, apex acute. *Flowers* white to pale yellow; calyx tubular, 2.2-2.5 cm long, apex 2-dented; corolla tube slender, 3.1-3.4 by 0.2-0.3 cm, 3-lobed, lobes linear, 3.1-4.2 by *ca.* 0.2 cm, apex hooded, greenish; lateral staminodes narrowly oblanceolate-oblong, *ca.* 5.0 by 0.4-0.5 cm; labellum elliptic-oblong, 3.4-3.8 by 1.5-1.6 cm, base attenuate into 3-4 by *ca.* 3 mm claw, apex deeply divided, 2.0-2.3 cm, white to pale yellow; filament salmon red, *ca.* 5.3 cm long; anther dorsifixed, 7-9 by 2-3 mm base divaricate, yellowish; ovary 3-4 by 2-3 mm, 3-loculed, placentation axile, densely hairy; stigma densely ciliate, green. *Fruits* subglobose-oblong, 1.0-1.2 by 0.8-1.1 cm, 3-ridged, pubescent, green. *Seeds* numerous, ellipsoid-orbicular, 5-6 by 2-3 mm, aril reddish orange.

Thailand.—NORTHERN [Tak, Mae Sot, Khao Pha Wo].

Distribution.—Endemic to Thailand.

Ecology.—Lower montane scrub on limestone hill at altitude *ca.* 750 m.

Phenology.—Flowering from June-July, fruiting from July-August.

Etymology.—The specific epithet is referred to 2-flowered per bract.

Note.—This species was described in 1994 that each bract subtended two flowers, hence the specific epithet “biflorum”. However, further investigation of living specimens from the type locality revealed 2-4 flowers per bract.

Vernacular name.—

Specimen examined.—*W. Pongamornkul* 1944 (QBG-2 sheets); *C. Picheansoonthon* 242 (KKU); *P. Wongsuwan* 45 (KKU), 46 (KKU).

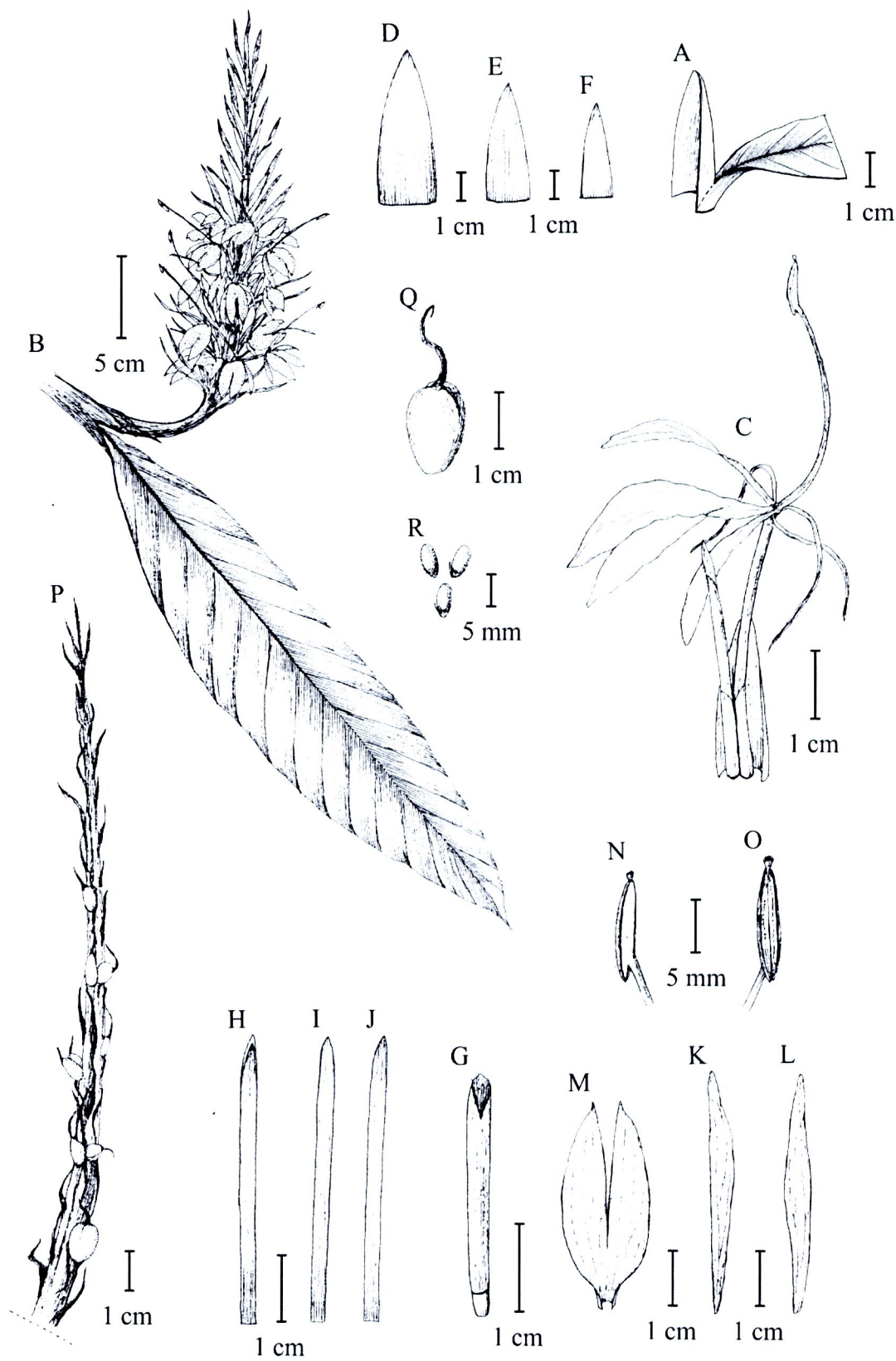


Figure 3.3



Figure 3.4 Photograph illustration of *H. biflorum* Sirirugsa & K. Larsen:
A. habit; B. ligule; C. inflorescence; D. close-up of flowers;
E. infructescence; F. close-up of fruit.

Figure 3.3 Illustrations of *H. biflorum* Sirirugsa & K. Larsen:
A. part of a leaf with a ligule; B. a leaf and an inflorescence; C. bract, bracteole and flowers; D. bract; E. first bracteole; F. second bracteole; G. calyx tube and ovary; H. dorsal corolla lobe; I. & J. lateral corolla lobes; K. & L. staminodes; M. labellum; N. & O. anther and stigma (side and front views); P. infructescence; Q. fruit; R. seeds.

3. *Hedychium coccineum* Buch.-Ham. ex Sm. in A. Ress Cycl. 17: 5. 1811 [*Type: Buch. Ham.* s.n. (lectotype K)]; Monandr Pl. t. 58. 1828; Reichb. Fl. Exotic 3. t. 184. 1835; Wall. in Hook. Kew J. Bot. 5: 372. 1853; Horan. Mono. Scitam.: 25. 1862; Baker in Hook.f., Fl. Br. Ind. 6: 231. 1892; K. Schum. in Engl., Pflanzenr. 4(46): 51. 1904; Gagnep. in Lecomte, Fl. Gén. I.-C. 6: 71. 1908; T.L. Wu & K.Larsen in Z.L. Wu & PH. Raven, Fl. China 24: 375. 2000.—*Gandasulium angustifolium* (Roxb.) Kuntze, Revis. Gen. Pl. 2: 690. 1891;—*G. coccineum* (Buch.-Ham. ex Sm.) Kuntze, Revis. Gen. Pl. 2: 690. 1891.—*H. angustifolium* Roxb., Fl. Ind. 1: 11. 1820;—*H. aurantiacum* Roscoe, Monandr. Pl. Scitam.: t. 61. 1825;—*H. carneum* Y.Y.Qian, Acta Bot. Austro Sin. 9: 48. 1994;—*H. coccineum* var. *angustifolium* (Roxb.) Baker in Hook.f., Fl. Br. Ind. 6: 231. 1892;—*H. coccineum* var. *carneum* (Roscoe) Baker in Hook.f., Fl. Br. Ind. 6: 232. 1892;—*H. coccineum* var. *longifolium* (Roxb.) Baker in Hook.f., Fl. Br. Ind. 6: 231. 1892;—*H. coccineum* var. *roscoei* Wall ex. Baker in Hook.f., Fl. Br. Ind. 6: 231. 1892;—*H. coccineum* var. *squarrosus* Wall ex. Baker in Hook.f., Fl. Br. Ind. 6: 231. 1892;—*H. longifolium* Roscoe, Monandr. Pl. Scitam.: t. 59. 1824;—*H. roscoei* Wall. ex Roscoe, Monandr. Pl. Scitam.: *Hedychium* verso. 1828;—*H. squarrosus* Buch.-Ham. ex Wall. in Hook. Kew J. Bot. 5: 372. 1853.

Terrestrial, perennial herb. *Pseudostems* 1.2-1.8 m high, leaf sheaths green, bladeless sheaths 2-3. *Ligule* oblong, 2.8-3.0 by 1.4-1.6 cm, apex obtuse to shallowly bilobed or acute, pubescent, green. *Leaves* sessile; blade oblong, 45.0-46.8 by 4.8-5.0 cm, base cuneate, apex acuminate, margin entire, upper surface glabrous, lower surface pubescent. *Inflorescence* a terminal spike, erect, 15.3-32.7 cm long, hairy; peduncle 6.2-14.1 cm long, hairy; bracts lax, folded, green, oblong, 3.0-4.0 by 1.3-1.6 cm, apex obtuse-acute, hairy, each subtending a cincinnus of 3-5 flowers; first bracteole tubular, 1.7-2.3 by 0.4-0.6 cm, apex acute, hairy, green; second bracteole tubular, 1.2-2.3 by 0.4-0.5 cm, apex acute, membranous, hairy, greenish; third bracteole tubular, 1.0-1.9 by ca. 0.4 cm, membranous, hairy, greenish. *Flowers* red; calyx tubular, 2.4-3.1 by 0.3-0.4 cm, apex 2-dented, hairy; corolla tube slender, 3.5-3.6 by 0.2-0.3 cm, 3-lobed, lobes linear, 2.7-3.9 by 0.3-0.5 cm, apex hooded, red; lateral staminodes oblanceolate, 2.1-2.9 by 0.6-0.8 cm, base attenuate into a 0.6-1.0 by 0.2-0.3 cm claw; labellum suborbicular, 2.1-2.6 by 1.7-2.0 cm, base attenuate into a 0.6-1.0 by ca. 3 mm claw, apex deeply

divided, 0.8-1.2 cm; filament red, 3.8-5.4 cm long; anther dorsifixed, 0.8-1.0 by 0.3-0.4 cm base divaricate, red; ovary 3-5 by 3-4 mm, 3-loculed, placentation axile, pubescent; epigynous glands 2, slender, 2-4 by 2 mm yellowish; stigma densely ciliate, green. *Fruits* ovoid-oblong, 2.6-3.8 by 2.3-2.5 cm, pubescent, green. *Seeds* numerous, ovoid-oblong, 4-5 by 2-3 mm, aril reddish orange.

Thailand.—NORTHERN [Chiang Rai; Mae Hong Son; Chiang Mai, Doi Chiang Dao, Doi Aangkhong and Doi Suthep-Pui].

Distribution.— Sri Lanka, Nepal, Bhutan, India (Sikkim), China (Southern Yunnan, Guangxi), Myanmar and Laos.

Ecology.—Lower montane pine-oak forest or lower montane scrub, at the altitude of *ca.* 1,000 m.

Phenology.—Flowering from June-August, fruiting from July-September.

Etymology.—The specific epithet is referred to red flower.

Vernacular name.—Kha Phai (คำไฟ), Za-ae Zaekaw (แซะเอแซก้อ) (Mae Hong Son).

Note.—This species possesses some distinctive characters of non-membranous ligules, oblong leaves and remarkably reddish-orange flowers, quite differentiated from the typical *Hedychium* species bearing membranous ligules and white to yellowish flowers.

Specimen examined.—*W. Pongamornkul* 324 (QBG); *P. Srisaga*, *S. Watthana* & *W. La-ongsri* 857 (QBG); *T. Santisuk* 1109 (PSU); *J. Sadakom* s.n. (BK); *J.F. Maxwell* 88-9111 (CMU, L); *M. Bhaumik* 3299 (CAL), 3427 (CAL); *P. Wongsuwan* 49 (KKU), 74 (KKU), 88 (KKU), 92 (KKU), 93 (KKU), 106 (KKU), 120 (KKU), 10-in spirit (KKU).

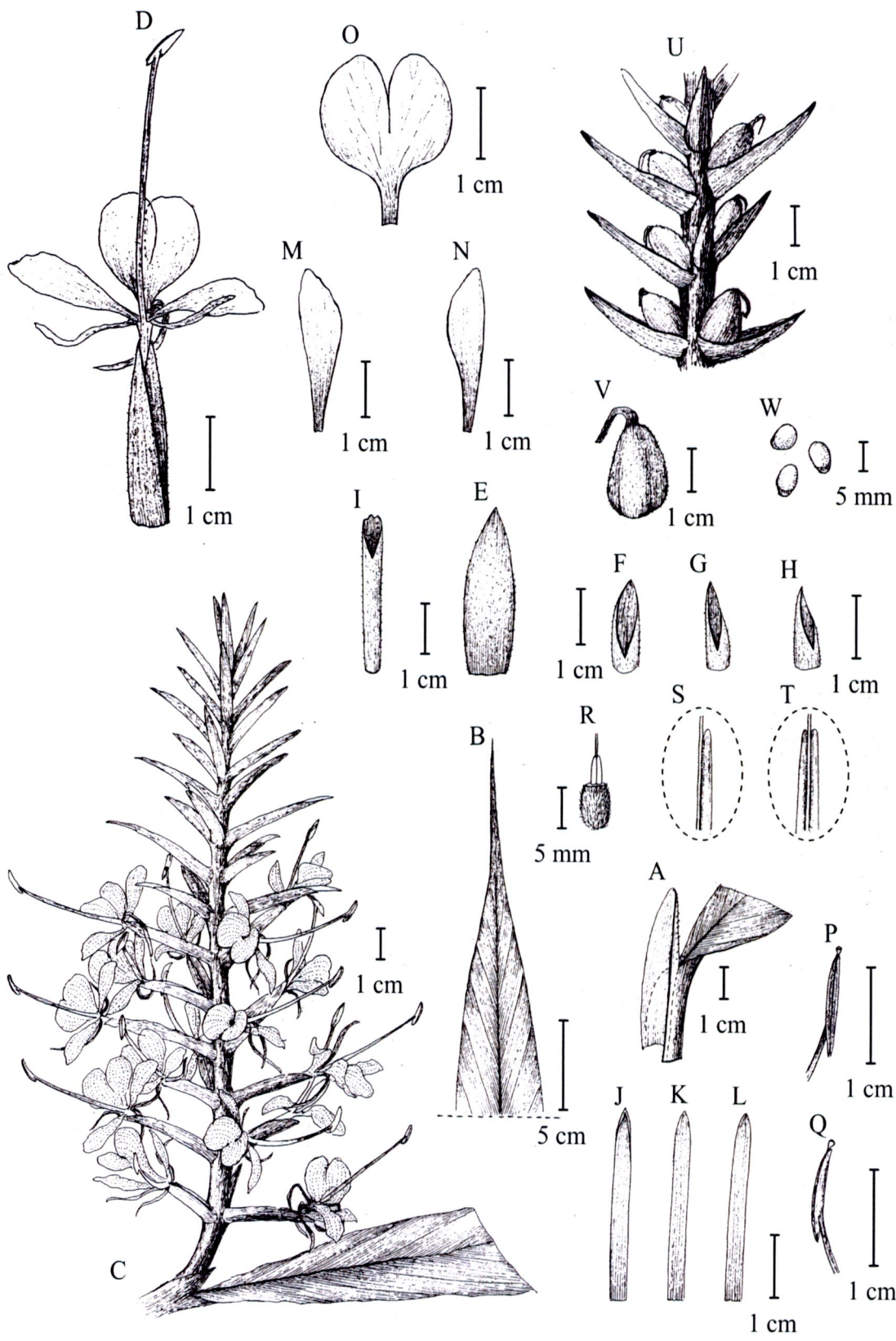


Figure 3.5



Figure 3.6 Photograph illustration of *H. coccineum* Buch.-Ham. ex Sm.:
A. habit; B. ligule; C. inflorescence; D. close up of flowers;
E. infructescence; F. infructescence with dehiscing fruits.

Figure 3.5 Illustrations of *H. coccineum* Buch.-Ham. ex Sm.:
A. a leaf with a ligule; B. leaf apex; C. a leaf and an inflorescence;
D. bract and a flower; E. bract; F. first bracteole; G. second bracteole;
H. third bracteole; I. calyx; J. dorsal corolla lobe; K. & L. lateral corolla
lobes; M. & N. staminodes; O. labellum; P.& Q. anther and stigma (front
and side views); R. ovary and epigynous glands; S. & T. epigynous
glands(rear and side views); U. infructescence; V. fruit; W. seeds.

4. *Hedychium collinum* Ridl., J. Straits Branch Roy. Asiat. Soc. 32: 103. 1899 [Type: Peninsular Malaysia: Kedah, Kedah peak, alt. 1,300 m, June 1893; *Ridley* s.n. (type K)]; K. Schum. in Engl., Pflanzenr. 4(46): 50. 1904; Ridl., Fl. Mal. Pen. 4: 241. 1924; Holtt. in Gard. Bull. Sing. 13: 75. 1950.—*H. paludosum* M.R.Hend., J. Malayan Brach. Roy. Asiat. Soc. 5: 273. 1927; Holtt. in Gard. Bull. Sing. 13: 77. 1950 [Type: Peninsular Malaysia: Pahang, Cameron Highlands, alt. ca. 1,500 m; *leg. Henderson* S.F.N. 17844].

Terrestrial or lithophytic, perennial herb. *Pseudostems* up to 1.1 m high, bladeless sheaths 2-4. *Ligule* oblong, 1.9-2.5 by 1.4-2.0 cm, apex obtuse-acute or bilobed, membranous, glabrous. *Leaves* sessile or shortly petiolate, 4-6 mm long; blade narrowly elliptic to lanceolate-oblong, 19.2-25.9 by 6.0-6.8 cm, base rounded or cuneate, apex acute-acuminate, margin entire, upper surface glabrous, lower surface glaucous. *Inflorescence* a terminal spike, erect, up to 22.5 cm long, hairy; peduncle ca. 6.6 cm long, hairy; bracts lax, folded, triangular, 2.9-3.5 by 1.4-1.7 cm, pubescent, greenish, each subtending a cincinnus of 3-4 flowers, apex acute; first bracteole greenish, tubular, 2.6-3.0 by 1.3-1.5 cm, apex acute, pubescent; second bracteole tubular, 2.3-2.5 by 1-1.2 cm, apex acute, pubescent; third bracteole, tubular, membranous, 1.8-2.2 by 0.8-0.9 cm, pubescent. *Flowers* white; calyx tubular, 3.4-4.4 by 0.3-0.4 cm, apex acute, hairy; corolla tube slender, 5.2-8.1 by 0.2-0.3 cm, 3-lobed, lobes linear, apex hooded, yellowish, 3.4-3.8 by 0.2-0.3 cm; lateral staminodes oblong, 3.3-3.9 by 0.3-0.5 cm; labellum obovate, 2.6-3.1 by 2.3-2.9 cm, base attenuate into a 3-6 by ca. 4 mm claw, apex deeply cleft, white; filament salmon red, 5.0-6.1 cm long; anther dorsifixed, 3-5 by 3-4 mm, base divaricate, salmon red; stigma densely ciliate, green.

Thailand.—PENINSULAR [Narathiwat and Yala, Hala-Bala Wildlife Sanctuary].

Distribution.—Peninsular Malaysia.

Ecology.—Tropical evergreen rain forest, at the altitude of ca. 1200 m.

Phenology.—Flowering in October.

Etymology.—The specific epithet is referred to the habitat, growing on hills.

Vernacular name.—Pud Suea (ปูดเสือ).

Note.—This plant can be easily recognized by its hairy bract, calyx tube, lax inflorescence, 3-4-flowered bracts and very small anther (3-5 mm long).

Specimen examined.—*A.F.G. Kerr* 7910 (K); *L. Wray & H.C. Robinson* 5513 (CAL); *M.R. Henderson* 23280 (CAL); *P. Wongsuwan* 107 (KKU).

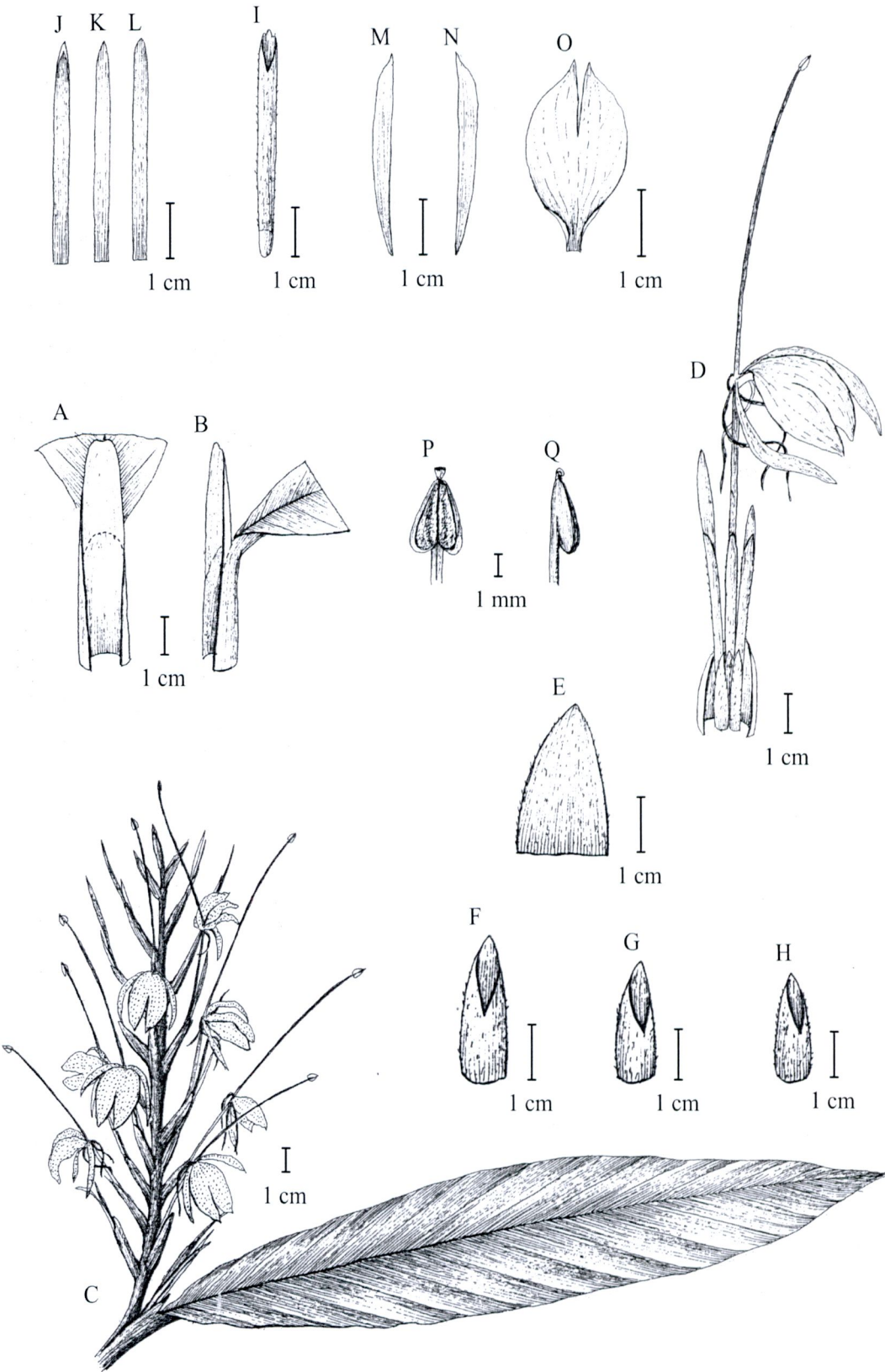


Figure 3.7



Figure 3.8 Photograph illustration of *H. collinum* Ridl.:
A. habit; B. ligule; C. inflorescence; D. & E. close-up of flower;
F. close-up of labellum.

Figure 3.7 Illustrations of *H. collinum* Ridl.:
A. & B. part of a leaf with a ligule (front and side views); C. a leaf and an
inflorescence; D. bract, bracteole and flowers; E. bract; F. first bracteole;
G. second bracteole; H. third bracteole; I. calyx tube and ovary; J. dorsal
corolla lobe; K. & L. lateral corolla lobes; M. & N. staminodes; O. labellum;
P. & Q. anther and stigma (front and side views).

5. *Hedychium coronarium* J. König, in Retz., Obs. 3: 73. 1783 [Type: India: Or; König s.n. (holotype C)]; Smith, Exotic. Bot. 2. t.107. 1805; Roscoe in Trans. Linn. Soc. 8: 343, fig. 6. 1807; Roxb., Fl. Ind. 1. 1:9. 1820; Monandr. Pl. t. 51. 1828; Wall. in Hook. Kew J. Bot. 5:325. 1853; Horan., Monogr.: 24. 1862; Baker in Hook.f., Fl. Br. Ind. 6: 225. 1894; K. Schum. in Engl., Pflanzenr. 4(46): 44. 1904; Gagnep. in Lecomte, Fl. Gén. I.-C. 6: 70. 1908; Holtt. in Gard. Bull. Sing. 13: 72. 1950; Fl. Java 3: 64-65. 1968; T.L. Wu & K. Larsen in Z.L. Wu & PH. Raven, Fl. China 24: 372. 2000.—*Kaempferia hedychium* Lam. Tabl. Encycl. i. 7;—*H. spicatum* Lodd., Bot. Cab. 7: t. 653. 1822;—*H. maximum* Roscoe, Monandr. Pl. Scitam.: t. 52. 1825;—*H. lingulatum* Hassk., Tijdschr. Natuurl. Gesch. Physiol. 5: 257. 1839;—*H. prophetae* Buch.-Ham. ex Wall., Hooker's J. Bot. Kew Gard. Misc. 5: 325. 1853;—*H. gandasulium* Buch.-Ham. ex Wall., Hooker's J. Bot. Kew Gard. Misc. 5: 325. 1853;—*H. coronarium* var. *maximum* Roscoe, Eichler C.F,P. von Martius & auct. Suc. (eds.) Fl. Bras. 3(3): 37. 1890;—*Gandasulium coronarium* (J. König) Kuntze, Revis. Gen. Pl. 2: 690. 1891;—*G. lingulatum* (Hassk.) Revis. Gen. Pl. 2: 690. 1891;—*Amomum filiforme* Hunter ex Ridl., J. Straits Brach Roy. Asiat. Soc. 53: 60. 1909.

KEY TO THE SPECIES

- 1. Flowers mostly thoroughly white, labellum with pale lemon green patch at base
 - 2. Bracts usually imbricate var. **coronarium**
 - 2. Bracts imbricate-elongated to visible rachis var. **forrestii**
- 1. Flowers white to pale yellow, labellum with dark yellow or yellow-orange patch at base
 - 3. Labellum with dark yellow patch at base var. **flavescenes**
 - 3. Labellum with yellow-orange patch at base var. **chrysoleucum**

var. **coronarium**

Terrestrial, perennial herb. *Pseudostems* 0.7-1.3 m high, leaf sheaths reddish, bladeless sheaths 4-5. *Ligule* 3.0-4.7 by 2.3-3.1 cm, apex truncate-emarginate, oblong, membranous, pubescent, greenish. *Leaves* lanceolate-oblong, 34.0-48.1 by 7.2-9 cm, base cuneate, apex acuminate to caudate, margin entire to slightly undulate, upper surface glabrous, lower surface pubescent. *Inflorescence* a terminal spike, erect, 5.3-7.1 cm long, hairy; peduncle 1.7-4.1 cm long, hairy; bracts conical imbricate, obovate, 5.5-6.0 by 3.0-3.8 cm, apex rounded, glabrous except apex and margin hairy, green, each bract subtending of 5-6 flowers; first bracteole, folded, lanceolate, 3.5-3.7 by 1.0-1.2 cm, apex acute, membranous, glabrous except apex hairy, greenish-white; second bracteole, folded, lanceolate, 3.2-3.3 by *ca.* 0.8 cm, apex acute, membranous, glabrous except apex hairy, greenish-white; third bracteole folded, lanceolate, *ca.* 3.1 by 0.6-0.7 cm, apex acute, membranous, glabrous except hairy apex, greenish-white; fourth bracteole lanceolate, 3.0-3.1 by 0.6-0.7 cm, apex acute, membranous, glabrous except hairy apex, greenish-white; fifth bracteole triangular, *ca.* 2.9 by 0.5 cm, apex acute, membranous, glabrous except apex hairy, greenish-white; sixth bracteole tubular, 2.2-2.4 by 0.2-0.3 cm, apex acute, membranous, glabrous except hairy apex, greenish-white. *Flowers* white, fragrant; calyx tubular, 3.7-4.1 by 0.3-0.4 cm, pubescent, apex 3-dented; corolla tube slender, 6.2-6.8 by *ca.* 3 cm, 3-lobed, lobes linear, apex hooded, thorn-liked, white, 2.5-2.9 by 0.4-0.5 cm; lateral staminodes oblanceolate to broadly oblong-elliptic, 3.7-4.2 by 1.7-1.9 cm; labellum suborbicular, 4.4-5.0 by 4.6-5.4 cm, base attenuate into *ca.* 1.0 cm claw, white with pale lemongreen patch at base, apex 2-cleft, 1.8-2.2 cm; filament white, 3.4-3.7 cm long; anther dorsifixed, base divaricate, yellowish, 1.2-1.5 by 0.2-0.3 cm; ovary glabrous or sparsely hairy, 4-5 by 2-3 mm, 3-loculed, placentation axile; epigynous glands 2, slender, *ca.* 2 mm, long yellowish; stigma densely ciliate, green. *Fruits* ellipsoid-oblong, 2.2-2.6 by 1.8-2.2 cm, green. *Seeds* numerous, elliptic-globose, 6-8 by 4-5 mm, reddish orange.

Thailand.—Cultivated throughout the country.

Distribution.—Widely cultivated throughout tropical countries.

Ecology.—Easily growing in moist areas.

Phenology.—Flowering in rainy season.

Etymology.—The specific epithet is referred to garlanding flower.

Vernacular name.—Maha Hong (มหาหงส์), Salata (สะเลเต) (Northeastern), Ta Hoen (ตาเหิน) (Northern).

Note.—*H. coronarium* is easily recognized by white flowers and imbricate bracts. It is often cultivated in healer household for a medicinal purpose and the flower is eaten as vegetable. Moreover it is also a source of perfume.

Specimen examined.—*P. Suksathan* 1981 (QBG); *BGO* 109 (QBG); *BGO. Staff* 5253 (QBG); *Serm* 138 (QBG); *K. Kertsawang* 605 (QBG); *M. Norsaengsri* 4004 (QBG); *A.F.G. Kerr* 3370 (K); *P. Sirirugsa* PS 1509 (PSU), 1252 (PSU); *R. Pooma with W. Werner* 25 (BKF); *C. Phengklai & T. Smitinand* 6032; *P. Wongsuwan* 66 (KKU), 68 (KKU).



Figure 3.9 Photograph illustration of ethnobotany:

A., B. & C. *H. coronarium* J. König var. *coronarium* J. König and *H. coronarium* J. König var. *chrysoleucum* (Hook.) Baker for the Buddha;
 D. *H. coronarium* J. König var. *coronarium* J. König for a woman to decorate.

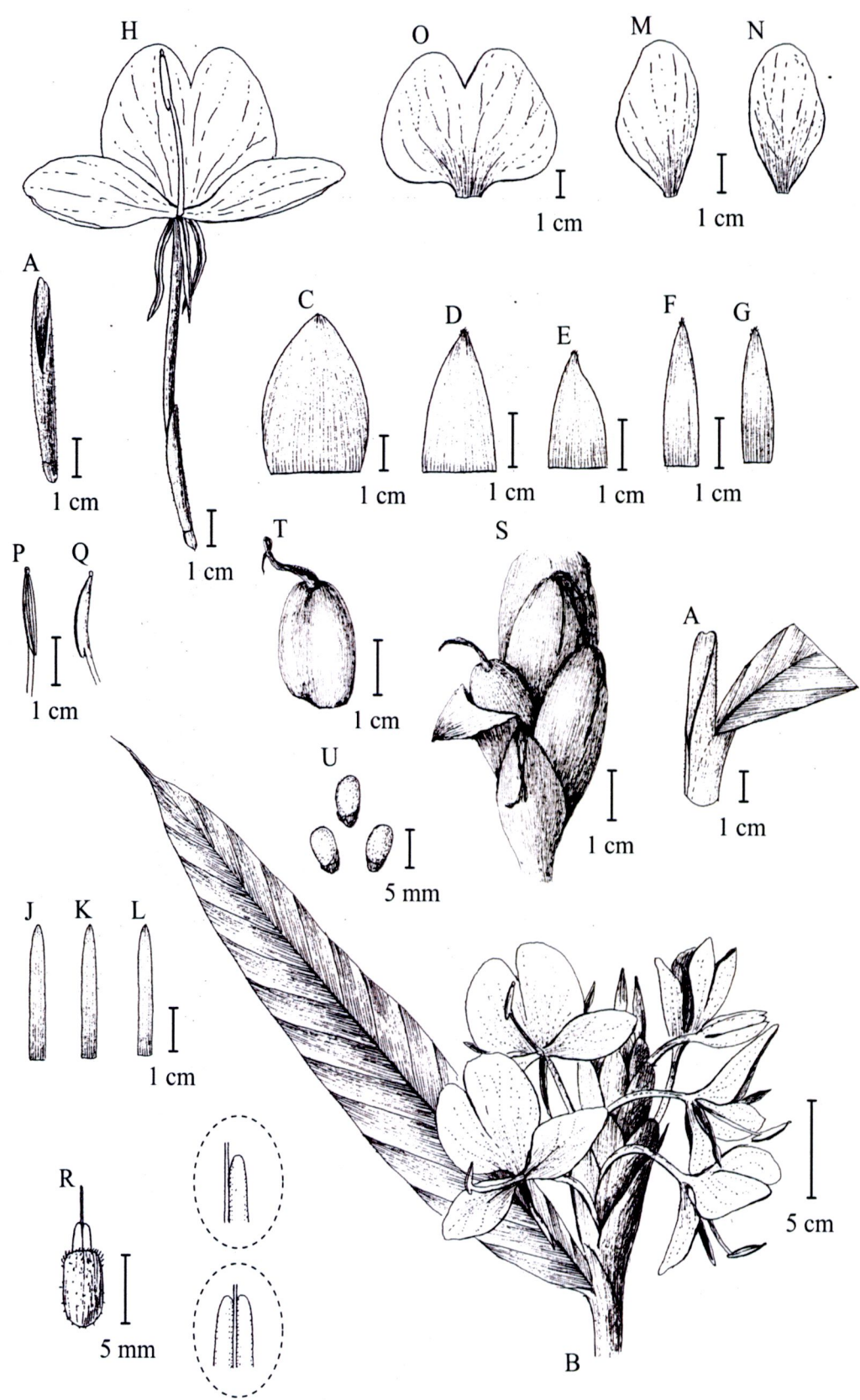


Figure 3.10



Figure 3.11 Photograph illustration of *H. coronarium* J. König var. *coronarium* J. König: A. part of leaves and ligules; B. & C. inflorescence; D. close-up of flowers; E. infructescence; F. infructescence with dehiscing fruits.

Figure 3.10 Illustrations of *H. coronarium* J. König var. *coronarium* J. König:

A. part of a leaf with a ligule; B. a leaf and an inflorescence; C. bract; D. first bracteole; E. second bracteole; F. third bracteole; G. fourth bracteole; H. a flower; I. calyx tube and ovary; J. dorsal corolla lobe; K. & L. lateral corolla lobes; M. & N. staminodes; O. labellum; P. & Q. anther and stigma (front and side views); R. ovary and epigynous glands; S. infructescence; T. fruit; U. seeds.

var. **chrysoleucum** (Hook.) Baker, in Hook.f., Fl. Br. Ind. 6: 226. 1892.—*H. chrysoleucum* Hook., Bot. Mag. 76: t.4516. 1850;—*H. coronarium* var. γ . Horan., Monogr. 24. 1862;—*H. chrysoleucum* Hook., K. Schum. in Engl., Pflanzenr. 4(46): 46. 1904;—*H. chrysoleucum* Holtt. in Gard. Bull. Sing. 13: 74. 1950;—*H. forrestii* Diels var. *latibracteatum* K. Larsen, Bot. Tidsskr. 61: 74. 1965.

Terrestrial, perennial herb. *Pseudostems* up to 1.2 m high, bladeless sheaths 3-4. *Ligule* oblong, 2.8-3.9 by 2.4-3.1 cm, apex rounded-acute or emarginate, membranous, pubescent, greenish. *Leaves* sessile; blade lanceolate-oblong or elliptic, 21.2-27.2 by 5.7-6.0 cm, base cuneate, apex acuminate, margin entire to slightly undulate, upper surface glabrous, lower surface pubescent. *Inflorescence* a terminal spike, erect, 4.5-9.5 cm long; peduncle 3.5-5.6 cm long; bracts conical imbricate-elongate, obovate-oblong, 3.6-4.0 by 1.7-2.3 cm, apex acute, pubescent, green, each bract subtending of 4-5 flowers; first bracteole folded, lanceolate, 2.4-2.5 by 0.7-1.0 cm, apex acute, membranous, pubescent, greenish-white; second bracteole folded, lanceolate, 0.6-1.0 by 2.2-2.3 cm, apex acute, membranous, pubescent, greenish-white; third bracteole folded, lanceolate, 1.8-2.0 by 0.5-0.9 cm, apex acute, membranous, pubescent, greenish-white; fourth bracteole lanceolate, 1.7-2.0 by 0.4-0.5 cm, apex acute, membranous, pubescent, greenish-white. *Flowers* white with yellow-orange patch at the base, fragrant; calyx tubular, 3.5-3.7 by 0.4-0.5 cm, apex 2-3-dented, pubescent; corolla tube slender, 8.0-8.1 by 0.3-0.4 cm, 3-lobed, lobes linear, 3.7-4.3 by 0.5-0.7 cm, apex hooded, thorn-like, yellowish; lateral staminodes oblanceolate to broadly oblong-elliptic, 3.0-4.3 by 1.3-2.0 cm; labellum suborbicular, 4.4-5.0 by 4.4-4.5 cm, base attenuate into 1.0-1.1 cm claw, white with yellow-orange patch at base, apex 2-cleft, 0.8-1.9 cm; filament orange, 3.7-4.0 cm long; anther dorsifixed, 1.2-1.4 by 0.3-0.4 cm, base divaricate, yellow-yellowish; ovary pubescent, 5-7 by 4-5 mm, 3-loculed, placentation axile; epigynous glands 2, slender, ca. 5 mm long, yellowish; stigma densely ciliate, green. *Fruits* ellipsoid-oblong, 2.1-2.5 by 1.6-2.1 cm, green. *Seeds* numerous, elliptic to globose, 5-8 by 4-5 mm, reddish orange.

Thailand.—Cultivated.

Distribution.—Cultivated throughout tropical countries.

Ecology.—Easily growing in moist areas.

Phenology.—Flowering in rainy season.

Etymology.—The variety epithet is referred to golden-yellow and white flower.

Vernacular name.—Maha Hong (มหาหงส์).

Note.—This plants easily recognized by white labellum with yellow-orang patch at the base and conical imbricate-elongate bracts.

Specimen examined.—*P. Wongsuwan* 47 (KKU), 32 (KKU).

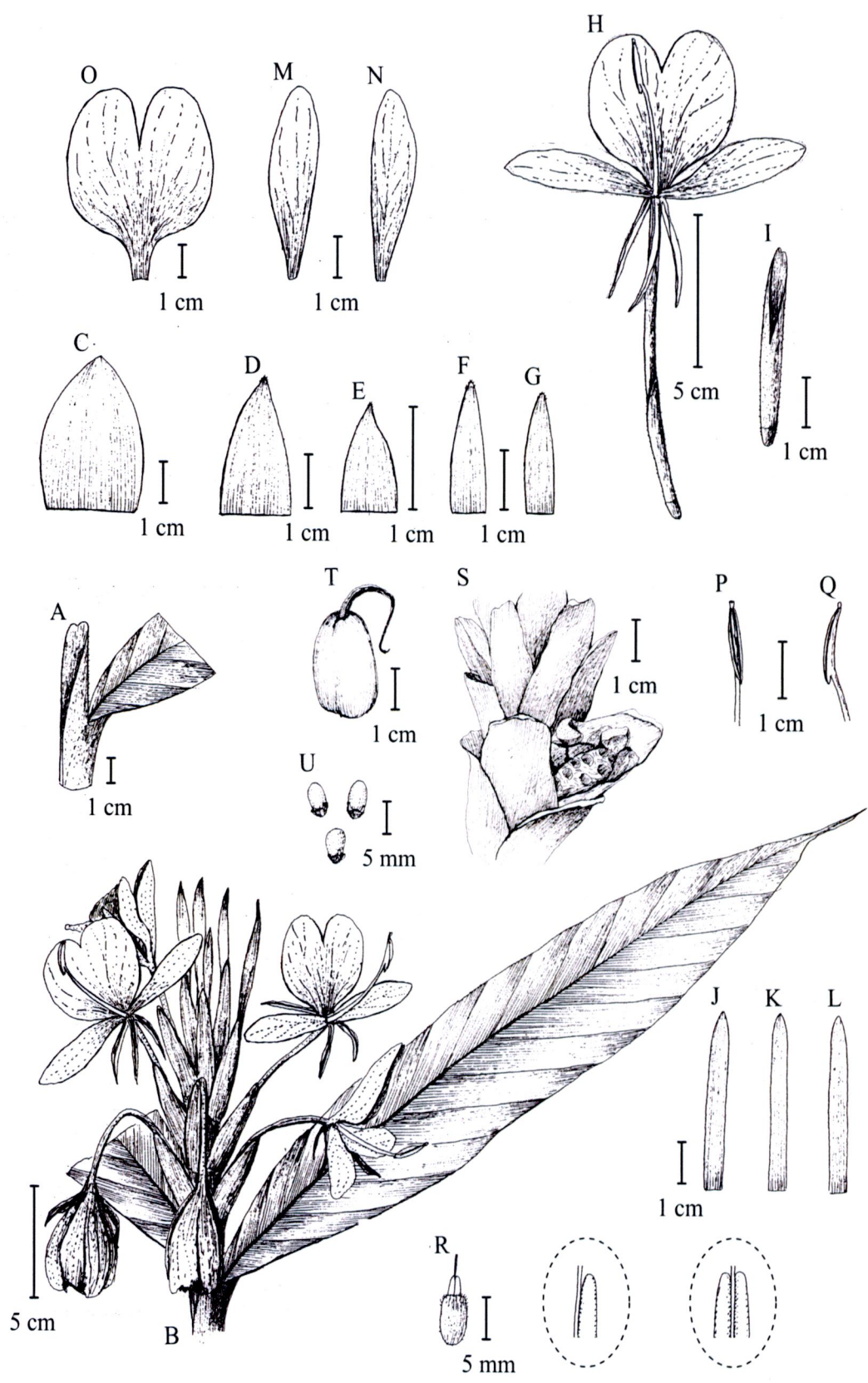


Figure 3.12



Figure 3.13 Photograph illustration of *H. coronarium* J. König var. *chrysoleucum* (Hook.) Baker: A. habit in cultivation; B. ligules; C. inflorescences; D. & E. close-up of flowers; F. infructescence with dehiscent fruits.

Figure 3.12 Illustrations of *H. coronarium* J. König var. *chrysoleucum* (Hook.) Baker: A. part of a leaf with a ligule; B. a leaf and an inflorescence; C. bract; D. first bracteole; E. second bracteole; third bracteole; G. fourth bracteole; H. a flower; I. calyx tube and ovary; J. dorsal corolla lobe; K. & L. lateral corolla lobes; M. & N. staminodes; O. labellum; P. & Q. anther and stigma (front and side views); R. ovary and epigynous glands; S. infructescence; T. fruit; U. seeds.

var. **flavescens** (Carey ex Roscoe) Baker, in Hook.f., Fl. Br. Ind. 6: 226. 1894 [Type: Himalayas; Wallich s.n.].—*H. flavum* Bot. Mag. T. 2378, non Roscoe;—*H. flavescens* Carey ex Roscoe, Monandr. Pl. Scitam.: t. 50. 1825;—*H. coronarium* var. β . Horan., Monogr. 24. 1862;—*Gandasulium peregrium* (N.E.Br.) Kuntze, Revis. Gen. Pl. 2: 690. 1891; —*H. sulphureum* Wall. ex Baker in Hook.f., Fl. Br. Ind. 6: 225. 1894;—*H. flavescens* Carey ex Roscoe, K. Schum. in Engl., Pflanzenr. 4(46): 46. 1904—*H. subditum* Turrill, Bull. Misc. Inform. Kew 1914: 370. 1914;—*H. coronarium* var. *subditum* (Turrill) Naik, Bull. Bot. Surv. India 3: 71. 1961;—*H. emeiense* Z.Y.Zhu, Acta Bot. Yunnan. 6: 65. 1984;—*H. panzhuum* Z.Y.Zhu, Acta Bot. Yunnan. 6: 63. 1984;—*H. flavescens* Carey ex Roscoe, T.L. Wu & K. Larsen in Z.L. Wu & P.H. Raven, Fl. China 24: 373. 2000.

Terrestrial, perennial herb. *Pseudostems* up to 2.5 m high, bladeless sheaths 4-5. *Ligule* oblong, 3.4-4.8 by 2.6-3.3 cm, apex rounded-emarginate, membranous, pubescent, greenish. *Leaves* sessile, blade lanceolate-oblong or elliptic, 41.9-50.5 by 7.5-10.0 cm, base cuneate, apex acuminate to caudate, margin entire to slightly undulate, upper surface glabrous, lower surface pubescent. *Inflorescence* a terminal spike, erect, up to 15 cm long, hairy; peduncle 3.0-4.8 cm long, hairy; bracts conical imbricate, obovate, 5.4-6.1 by 3.8-5.1 cm, apex rounded-acute, pubescent, green, each bract subtending of 5-6 flowers; first bracteole, folded, lanceolate, 2.7-4.1 by 2.0-2.3 cm, apex acute, membranous, pubescent, greenish-white; second bracteole, folded, lanceolate, 2.5-3.2 by 1.4-2.2 cm, apex acute, membranous, pubescent, greenish-white; third bracteole folded, lanceolate, *ca.* 2.2 by 1.2-1.6 cm, apex acute, membranous, pubescent, greenish-white; fourth bracteole lanceolate, 2.0-2.1 by 0.8-0.9 cm, apex acute, membranous, pubescent, greenish-white; fifth bracteole triangular, 1.1-1.7 by 0.7-1.2 cm, apex acute, membranous, pubescent, greenish-white; sixth bracteole tubular, *ca.* 1.1 by 0.6 cm, apex acute, membranous, pubescent, greenish-white. *Flowers* yellow, fragrant; calyx tubular, 4.0-4.5 by 0.5-0.6 cm, pubescent, apex 3-dented; corolla tube slender, 7.4-8.7 by 0.3-0.4 cm, 3-lobed, lobes linear, apex hooded, thorn-liked, yellow, 4.0-5.1 by 0.6-0.7 cm; lateral staminodes oblanceolate to broadly oblong-elliptic, 4.3-4.5 by 1.7-1.9 cm; labellum suborbicular, 4.0-4.9 by 3.5-3.7 cm, base attenuate into *ca.* 7 mm claw, white with dark yellow patch at base, apex 2-cleft, 6-7 mm; filament white, 5.4-5.6 cm long; anther

dorsifixed, base divaricate, yellowish, 1.1-1.2 by 0.3-0.4 cm; ovary pubescent, 4-5 by 4-5 mm, 3-loculed, placentation axile, epigynous glands 2, slender, yellowish, ca. 5 mm long, stigma green, densely ciliate. *Fruits* not seen.

Thailand.—Cultivated.

Distribution.—Cultivated throughout tropical countries.

Ecology.—Easily growing in moist areas.

Phenology.—Flowering in rainy season.

Etymology.—The variety epithet is referred to pale-yellow flower.

Vernacular name.—Maha Hong (มหาหงส์), Ta Hoen (ตาเหิน) (Northern).

Note.—This plants easily recognized by yellow flowers with dark yellow patch at the labellum base and conical imbricate bracts.

Specimen examined.—*P. Sirirugsa* PS1508 (PSU), 1170 (PSU), 1186 (PSU), 1279 (PSU); *P. Wongsuwan* 50 (KKU), 70 (KKU).

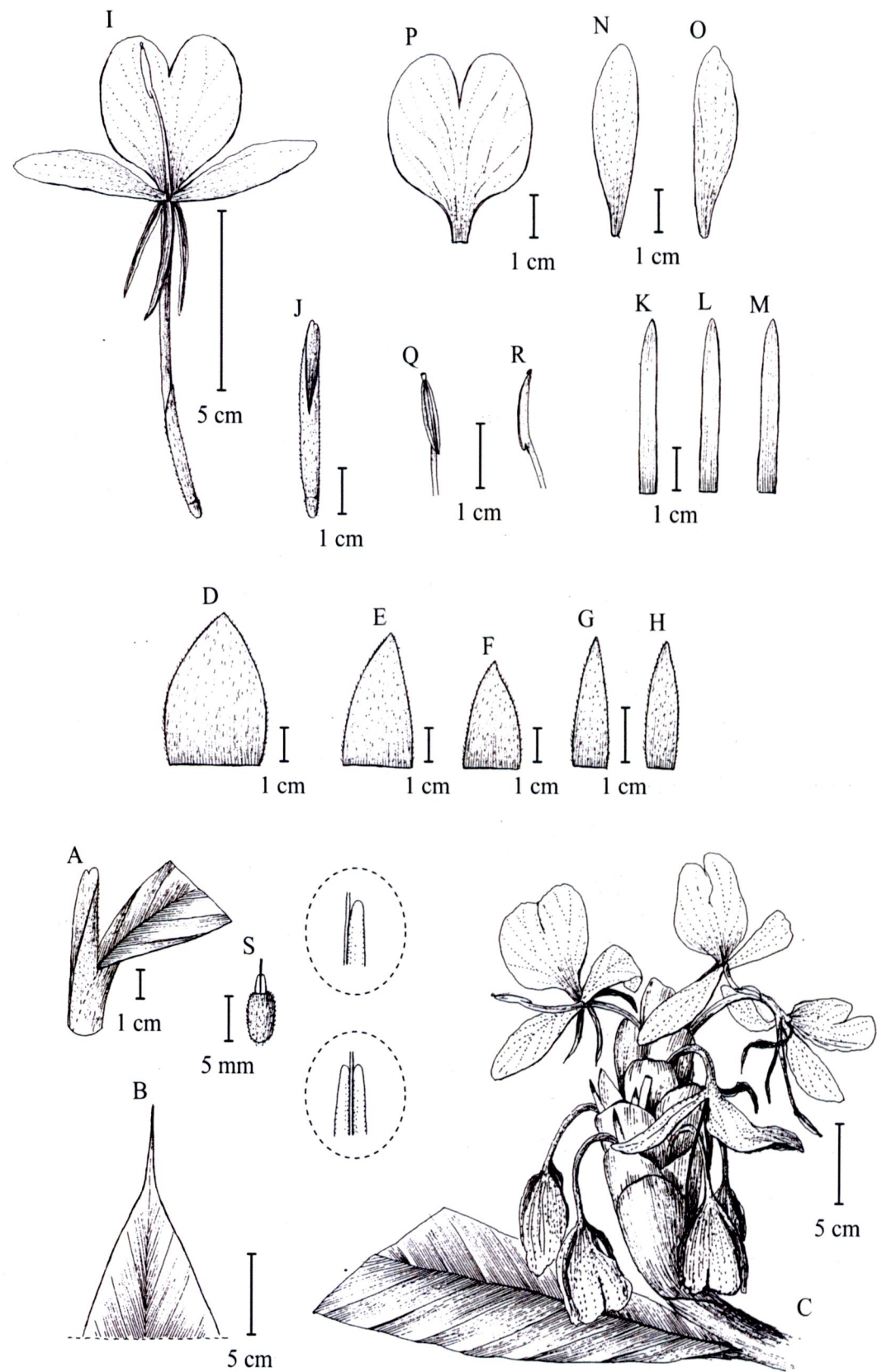


Figure 3.14



Figure 3.15 Photograph illustration of *H. coronarium* J. König var. *flavescens* (Carey ex Roscoe) Baker: A. habit in cultivation; B. ligules; C. inflorescence; D. & E. close-up of flower; F. anther and stigma.

Figure 3.14 Illustrations of *H. coronarium* J. König var. *flavescens* (Carey ex Roscoe) Baker: A. part of a leaf with a ligule; B. leaf apex; C. a flowering top showing a leaf and an inflorescence; D. bract; E. first bracteole; F. second bracteole; G. third bracteole; H. fourth bracteole; I. a flower; J. calyx tube and ovary; K. dorsal corolla lobe; L. & M. lateral corolla lobes; N. & O. staminodes; P. labellum; Q. & R. anther and stigma (front and side views); S. ovary and epigynous glands.

var. **forrestii** (Diels) Pichens. & Wongsuwan, var. nov.—*H. forrestii* Diels, Not. Roy. Bot. Gard. Edinb. 5: 304. 1912 [Type: China: Western Yunnan, Tali-valley, *G. Forrest* 4812];—*H. forrestii* Diels, T.L. Wu & K. Larsen in Z.L. Wu & P.H. Raven, Fl. China 24: 375-376. 2000.

Terrestrial, perennial herb. *Pseudostems* 1.3-1.7 m high, bladeless sheaths 2-4. *Ligule* oblong, 6.5-7.2 by 3.3-4.0 cm, apex rounded-acute or emarginate, membranous, pubescent, greenish. *Leaves* sessile, blade lanceolate-oblong, 65.0-69.1 by 15.5-17.3 cm, base cuneate, apex acuminate, margin slightly undulate, upper surface glabrous, lower surface pubescent. *Inflorescence* a terminal spike, erect, 18.0-26.7 cm long; peduncle 6.2-7.1 cm long; bracts conical imbricate-elongate to visible rachis, obovate, 5.3-6.8 by 2.5-3.4 cm, apex acute, pubescent, green, each bract subtending of (2-)3-4 flowers; first bracteole, tubular, 4.3-4.7 by 1.3-1.6 cm, apex acute, membranous, pubescent, greenish-white; second bracteole, tubular, 4.0-4.5 by 0.9-1.0 cm, apex acute, membranous, pubescent, greenish-white; third bracteole tubular, 3.2-3.9 by 0.7-0.8 cm, apex acute, membranous, pubescent, greenish-white; fourth bracteole tubular, 2.9-3.5 by 0.5-0.6 cm, apex acute, membranous, pubescent, greenish-white. *Flowers* white, fragrant; calyx tubular, 4.5-5.2 by 0.3-0.4 cm, pubescent, apex 2-3-dented; corolla tube slender, 7.3-8.2 by 0.3-0.4 cm, 3-lobed, lobes linear, apex hooded, thorn-like, white, 4.5-5.0 by 0.4-1.1 cm; lateral staminodes oblanceolate to broadly oblong-elliptic, 3.4-4.5 by 1.7-2.2 cm; labellum suborbicular, 3.5-5.3 by 3.4-5.2 cm, base attenuate into 7-9 mm claw, apex 2-cleft, 0.9-1.3 cm; filament white, 3.0-3.7 cm long; anther dorsifixed, 1.6-1.8 by 0.3-0.4 cm, base divaricate, yellowish; ovary pubescent, 7-8 by 4-5 mm, 3-loculed, placentation axile; epigynous glands 2, slender, ca. 5 mm, long yellowish; stigma densely ciliate, green. *Fruits* ellipsoid-globose or oblong, 2.8-3.5 by 2.1-2.4 cm, green. *Seeds* numerous, ellipsoid-globose, 6-8 by 4-5 mm, reddish orange.

Thailand.—NORTHERN [Mae Hongson, Khun Yuam].

Distribution.—China (Guangxi, Guizhou, Sichuan, Yunnan), Myanmar and Laos.

Ecology.—Open field.

Phenology.—Flowering from July-August, fruiting from August-September.

Etymology.—The specific epithet is after G. Forrest who collected the type specimen no. 4812 in July 1906 from Tali-valley (Western Yunnan).

Vernacular name.—

Note.—This plant is related to *H. coronarium* var. *coronarium*, but can be recognized in conical imbricate-elongate to visible rachis bracts.

Specimen examined.—*K. Larsen & S.S. Larsen* 1974 (K); *P. Wongsuwan* 77 (KKU), 78 (KKU).

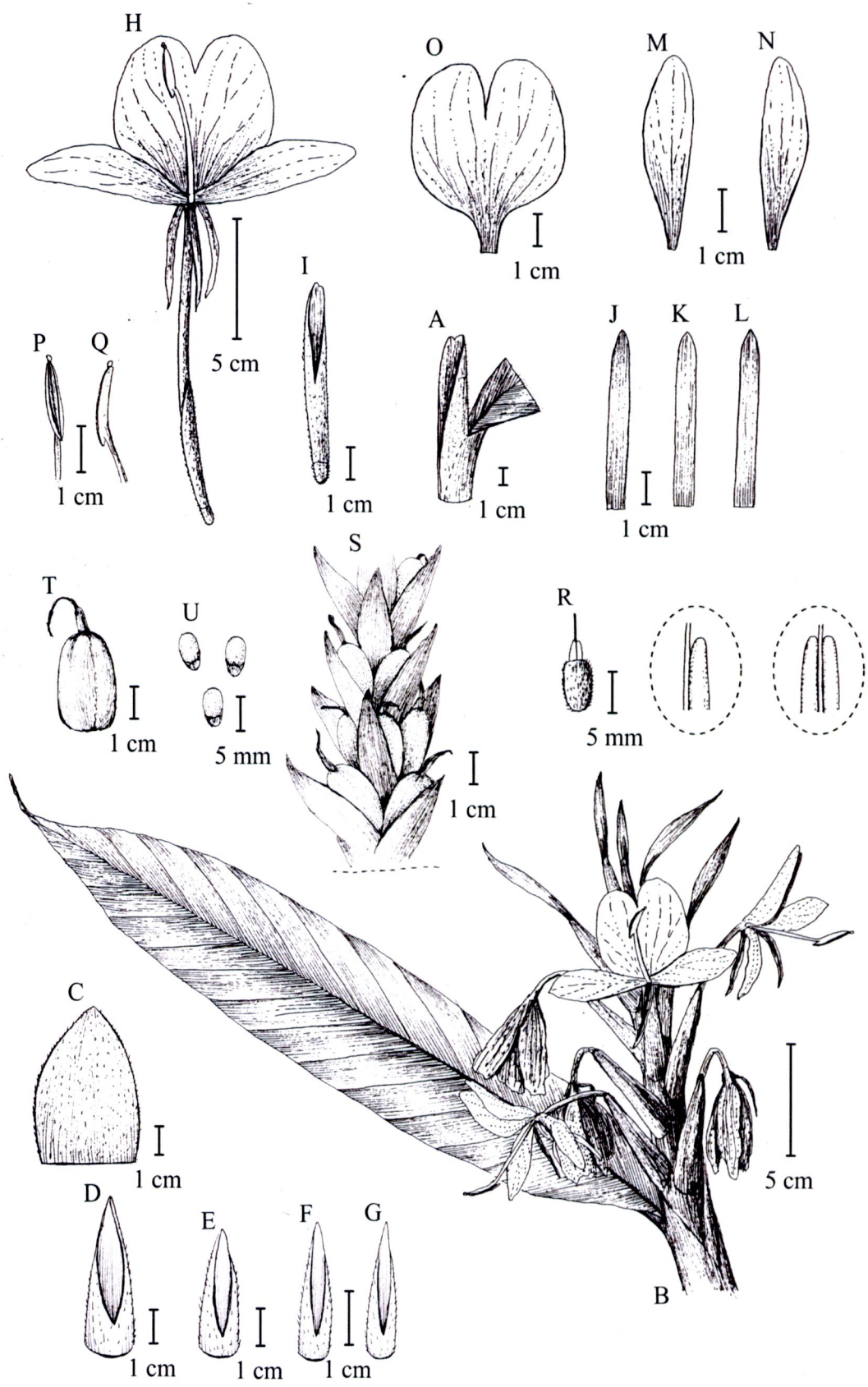


Figure 3.16



Figure 3.17 Photograph illustration of *H. coronarium* J. König var. *forrestii* (Diels) Picheans. & Wongsuwan: A. ligules; B. & C. inflorescence; D. close-up of flowers; E. infructescence; F. close-up of fruit.

Figure 3.16 Illustrations of *H. coronarium* J. König var. *forrestii* (Diels) Picheans. & Wongsuwan: A. part of a leaf with a ligule; B. a leaf and an inflorescence; C. bract; D. first bracteole; E. second bracteole; third bracteole; G. fourth bracteole; H. a flower; I. calyx tube and ovary; J. dorsal corolla lobe; K. & L. lateral corolla lobes; M. & N. staminodes; O. labellum; P. & Q. anther and stigma (front and side views); R. ovary and epigynous glands; S. infructescence; T. fruit; U. seeds.

6. *Hedychium ellipticum* Buch.-Ham. ex Sm. in Rees, Cyclop 16: 2. 1811 ; Monandr. Pl. t. 55. 1828; Lodding. Bot. Cabin. T. 1881. 1832; Wall. in Kew J. Bot. 5: 327. 1853; Horan. Monogr.: 25. 1862; Baker in Hook.f., Fl. Br. Ind. 6: 228. 1892; K. Schum. in Engl., Pflanzenr. 4: 48. 1904.—*Gandasulium ellipticum* (Buch.-Ham. ex Sm.) Kuntze, Revis. Gen. Pl. 2: 690. 1891;—*H. fastigiatum* Volgt, Hort. Suburb. Calcutt.: 570. 1845.

Epilithic, perennial herb. *Pseudostems* 0.5-1.4 m high, bladeless sheaths 2-4. *Ligule* oblong, 1.1-1.2 by 1.2-1.4 cm, apex obtuse-shallowly bilobed, membranous, glabrous or sparsely hairy, reddish. *Leaves* sessile or shortly petiolate 2-4 mm long; blade elliptic, 26.9-27.3 by 8.7-9.4 cm, base cuneate, apex acute, margin entire, both surface glabrous. *Inflorescence* a terminal spike, erect, 6.1-6.6 cm long; peduncle 3.5-5.4 cm long, glabrous; bracts imbricate, folded, oblong, 1.9-2.5 by 0.6-1.0 cm, apex acute, glabrous, green, each subtending a cincinnus of 1 flower; bracteole tubular, 1.1-1.2 by 0.3-0.4 cm, apex acute, membranous, glabrous. Flowers white to pale yellow; calyx tubular, 2.4-3.2 by 0.3-0.4 cm, apex acute to 3-dented, glabrous; corolla tube slender, 5.1-5.2 by 0.2-0.3 cm, 3-lobed, lobes linear 5.1-5.7 by 0.3-0.4 cm, apex hooded, yellowish; lateral staminodes oblanceolate-linear, 2.8-3.5 by 0.2-0.5 cm; labellum lanceolate with two segments, upper part elliptic, 3.4-3.9 by 0.8-1.2 cm, lower part attenuate into a 1.4-1.7 by *ca.* 0.2 cm claw, apex acute-emarginate; filament 4.1-5.4 cm long, yellowish; anther dorsifixed, 1.3-1.5 by 0.3-0.4 cm, base divaricate, salmon red; ovary 3-4 by 4-5 mm, 3-loculed, placentation axile, glabrous or sparsely hairy; epigynous glands 2, slender, *ca.* 2 by 1-2 mm yellowish; stigma densely ciliate, green. *Fruits* globose, 0.9-1.3 by 0.8-1.2 cm, glabrous, green. *Seeds* numerous, ellipsoid-globose, 4-5 by *ca.* 3 mm, aril reddish- orange.

Thailand.—NORTHERN [Chiang Rai, Mae Hong Son, Chiang Mai, Doi Chiang Dao, Doi Angkhang, Doi Suthep; Pitsanulok, Phu Hin Rong Kla]; NORTHEASTERN [Loei, Phu Kradueng, Phu Ruea, Phu Luang].

Distribution.—Nepal, Bhutan, India, Myanmar and Laos.

Ecology.—Common in lower montane scrub, at the altitude of 1,000-1,474 m.

Phenology.—Flowering from June-August, fruiting from July-September.

Etymology.—The specific epithet is referred to elliptic leaved.

Vernacular name.—Ta Hoen Wai (ต๋นหั้นไหว).

Note.—This plant is distributed from Himalayas to Thailand. It can be easily recognized by imbricate and glabrous 1-flowered bracts, white lanceolate labellum with acute-emarginate apices and filament twice as long as the labellum.

Specimen examined.—*Native* DE 304 (BKF); *TH. Wongprasert et. al.* 046-53 (BKF); *S. Wathana* 2432 (QBG); *NanaKorn et. al.* 6979 (QBG); *P. Srisanga* 2122 (QBG); *C. Maknoi* 948 (QBG); *Hans Banziger* 708 (CMU), 753 (CMU); *J.F. Maxwell* 88-995 (CMU); *A.F.G. Kerr* 788 (K), 2658 (K); *Adisai* 828 (BK); *P. Triboun* 123-inspirit (BK), 135-inspirit (BK), *P. Triboun et. al.* 556-inspirit (BK); *J.F. Maxwell* 88-402 (L); *G. Murata, K. Iwasaki, C. Phengklai* T 14928 (L), T 15015 (L); *K. Larsen, T. Santisuk, E. Warncke* 2918 (L); *M.N. Tamura et. al.* 60740 (BKF); *M.N. Tamura, S. Khoailm, W. Boonsawat & J.F. Maxwell* T-60765; *R.F.D. Herb* 4421 (BKF); *P. Wongsuwan* 52 (KKU), 58 (KKU), 72 (KKU), 110 (KKU), 115 (KKU), 12-inspirit (KKU), 15-inspirit (KKU), 17-inspirit (KKU), 18-inspirit (KKU).

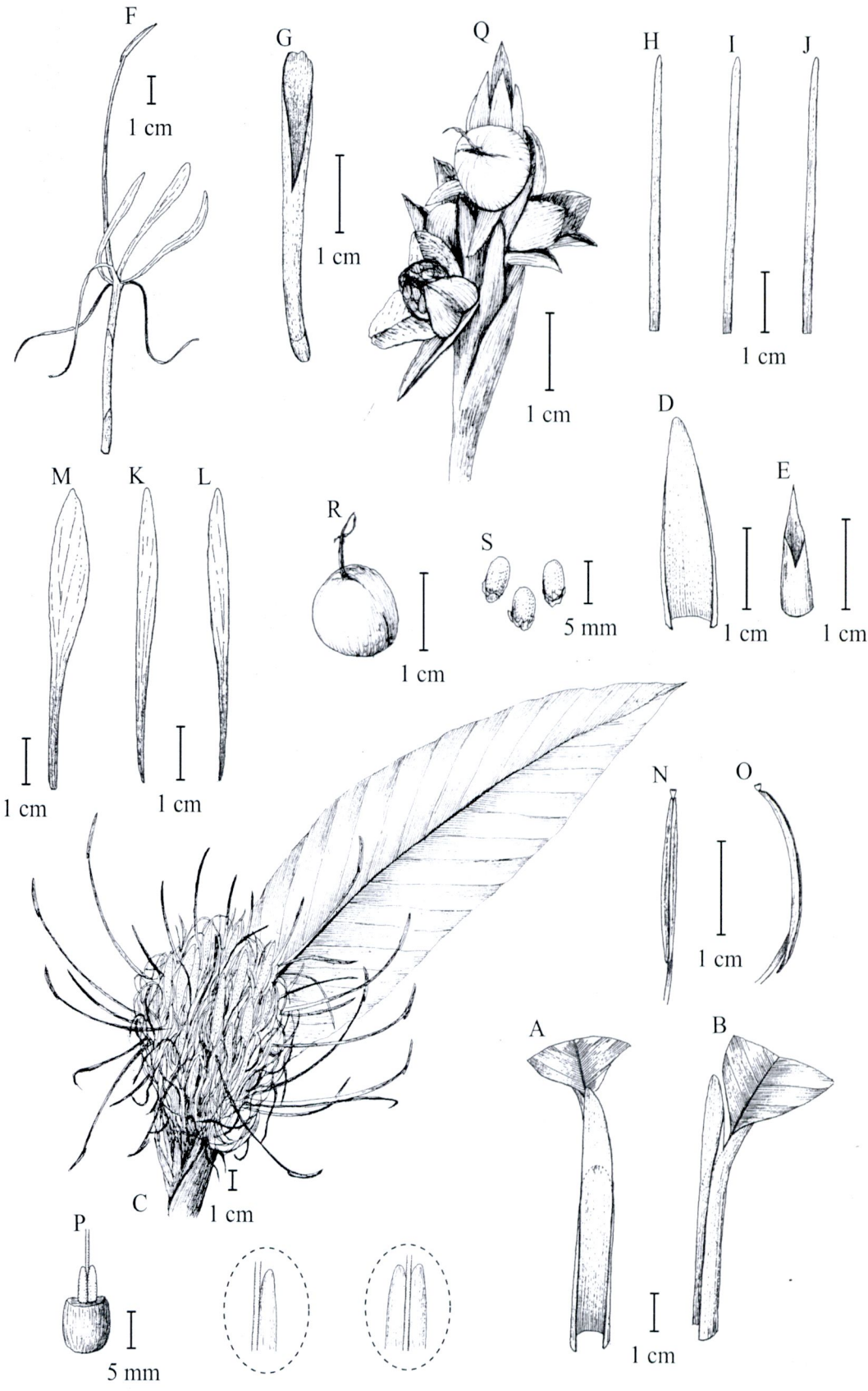


Figure 3.18

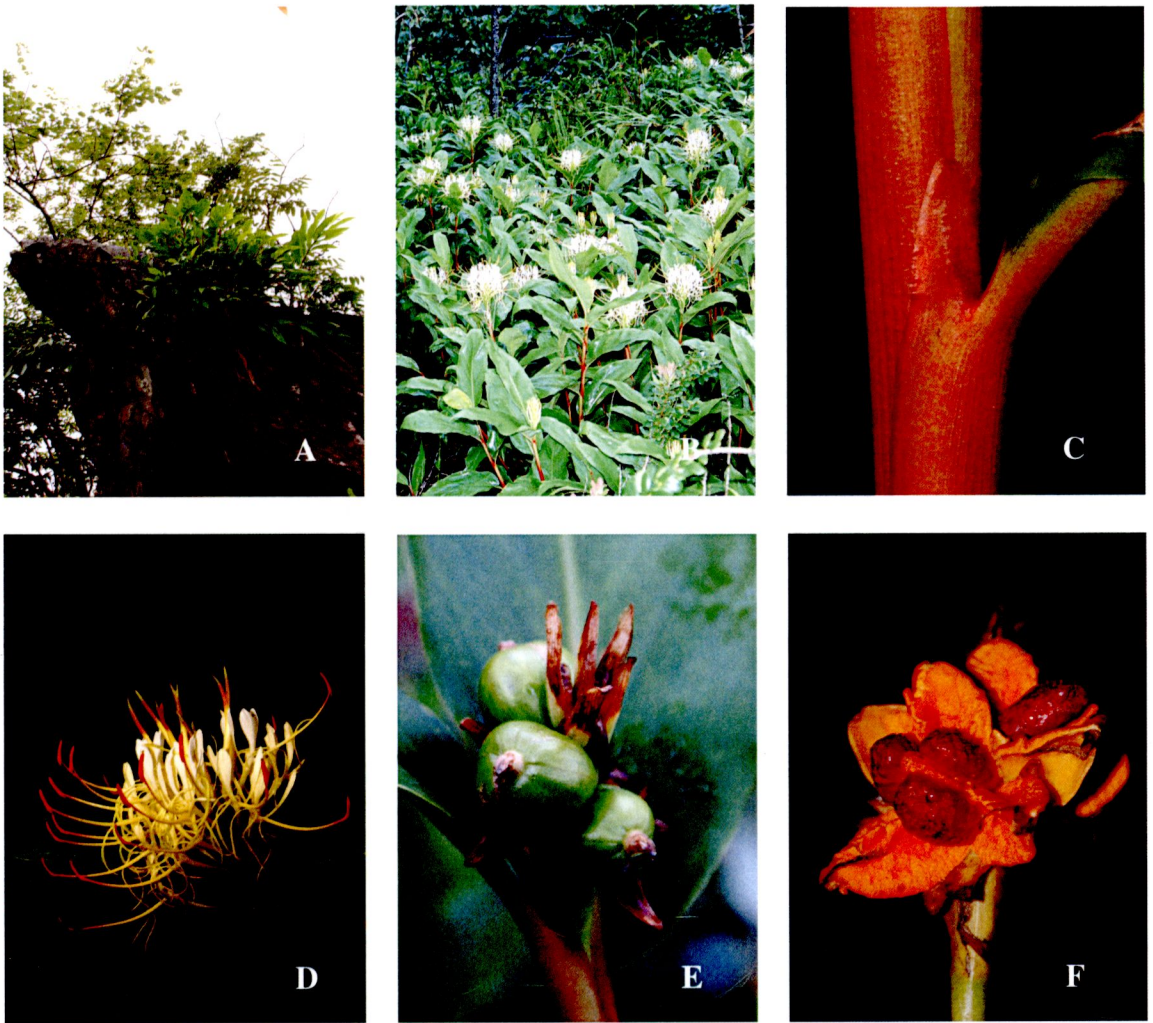


Figure 3.19 Photograph illustration of *H. ellipticum* Buch.-Ham. ex Sm.:

A. & B. habit; C. ligule; D. inflorescence; E. infructescence; F. infructescence with dehiscent fruits.

Figure 3.18 Illustrations of *H. ellipticum* Buch.-Ham. ex Sm.:

A. & B. part of a leaf with a ligule(front and side views); C. a leaf and an inflorescence; D. bract; E. bracteole; F. bract, calyx tube and a flower; G. calyx tube and ovary; H. dorsal corolla lobe; I. & J. lateral corolla lobes; K. & L. staminodes; M. labellum; N. & O. anther and stigma (front and side views); P. ovary and epigynous glands; Q. infructescence; R. fruit; S. seeds.

7. *Hedychium gomezianum* Wall., [Cat. no. 6543] in Kew J. Bot. 5: 368. 1853 [Type: Myanmar: Tavoy, *Gomez* (lectotype K)]; Horan., Prodr. Mono. Scitam.: 25. 1862; Baker in Hook.f., Fl. Br. Ind. 6: 228. 1894; Schum. in Engl., Pflanzenr. 4(46): 55. 1904.—*Gandasulium gomezianum* (Wall.) Kuntze, Revis. Gen. Pl. 2: 690. 1891.

Epiphytic, perennial herb. *Pseudostems* 0.2-0.9 cm high, leaf sheaths red, bladeless sheaths 3-5. *Ligule* oblong, 3.3-8.3 by 1.1-1.8 cm, apex acute, membranous, pubescences, reddish or greenish. *Leaves* sessile or shortly petiolate, 4-7 mm long; blade lanceolate-oblong, 13.8-37.5 by 4.2-8.8 cm, base cuneate or oblique, apex acute, margin slightly undulate, both surface glabrous, midrib pubescent. *Inflorescence* a terminal spike, erect, 10.4-21.3 cm long; peduncle 2.9-4.4 cm long; bracts lax, folded, greenish, oblong, 1-2.1 by 0.3-0.7 cm, apex acute, pubescent or glabrous, each subtending a cincinnus of 1 flower; bracteole oblong, 0.5-1.5 by 0.3-0.5 cm, apex acute, membranous, pubescence or glabrous, greenish. *Flowers* white, then yellow, fragrant; calyx tubular, 2-2.3 cm by 0.2-0.3 cm, apex acute to 3-dented; corolla tube slender, 2.3-5.1 by *ca.* 0.2 cm, 3-lobed, lobes linear, 4.5-4.8 by 0.2-0.4 cm apex hooded, yellowish; lateral staminodes narrowly oblanceolate, 3.25-3.8 by 0.2-0.4 cm, base attenuate into a 1.3-1.7 by *ca.* 0.1 cm claw, apex acute; labellum elliptic, 2.7-3 by 0.9-1.1 cm, base attenuate into a 0.7-1 cm by 2-2.5 mm claw, apex deeply divided, 0.8-1.5 cm; filament 3.2-5.8 cm long, salmon red; anther dorsifixed, 0.9-1.2 by *ca.* 0.2 cm, base divaricate, yellowish to pale salmon red; ovary pubescent, 2-3 by *ca.* 2 mm, 3-loculed, placentation axile; epigynous glands 2, slender, 2-3 by *ca.* 1 mm yellowish; stigma densely ciliate, green. *Fruits* subglobose, 1.2-1.7 by 1.25-1.5 cm, greenish, pubescent. *Seeds* numerous, oblong, 3.5-4 by 1.5-2 mm, aril reddish-orange.

Thailand.—NORTHERN: [Tak, Mae Sot], SOUTH-EASTERN: [Chantaburi; Trat, Ko Chang], PENINSULAR [Krabi; Ranong, Khlong Naka; Surat Thani; Trang, Namtok Praan].

Distribution.—Myanmar (Tavoy), Peninsular Malaysia

Ecology.—Tropical evergreen rain forest, at the altitude of *ca.* 460 m.

Phenology.—Flowering from June-August, fruiting from July-September.

Etymology.—The specific epithet is named after Gomez who collected the type specimens.

Vernacular name.—Khing Haeng (กิ่งแห้ง)

Note.—This plant is recognized by 1 flower per bract, elliptic labellum with deeply divided apex and flower with strong fragrance in early evening. It is often cultivated in healer household for a medicinal purpose.

Specimen examined.—*P. Sirirugsa* PS 1510, PS 1511 (PSU); *T. Santisuk* 592 (K); *A.F.G. Kerr* 205-6, 19722 (K); *C. Niyomdham* 349 (K); *P. Wongsuwan* 63, 71, 87, 105; 11, 28, 33-inspirit (KKU).

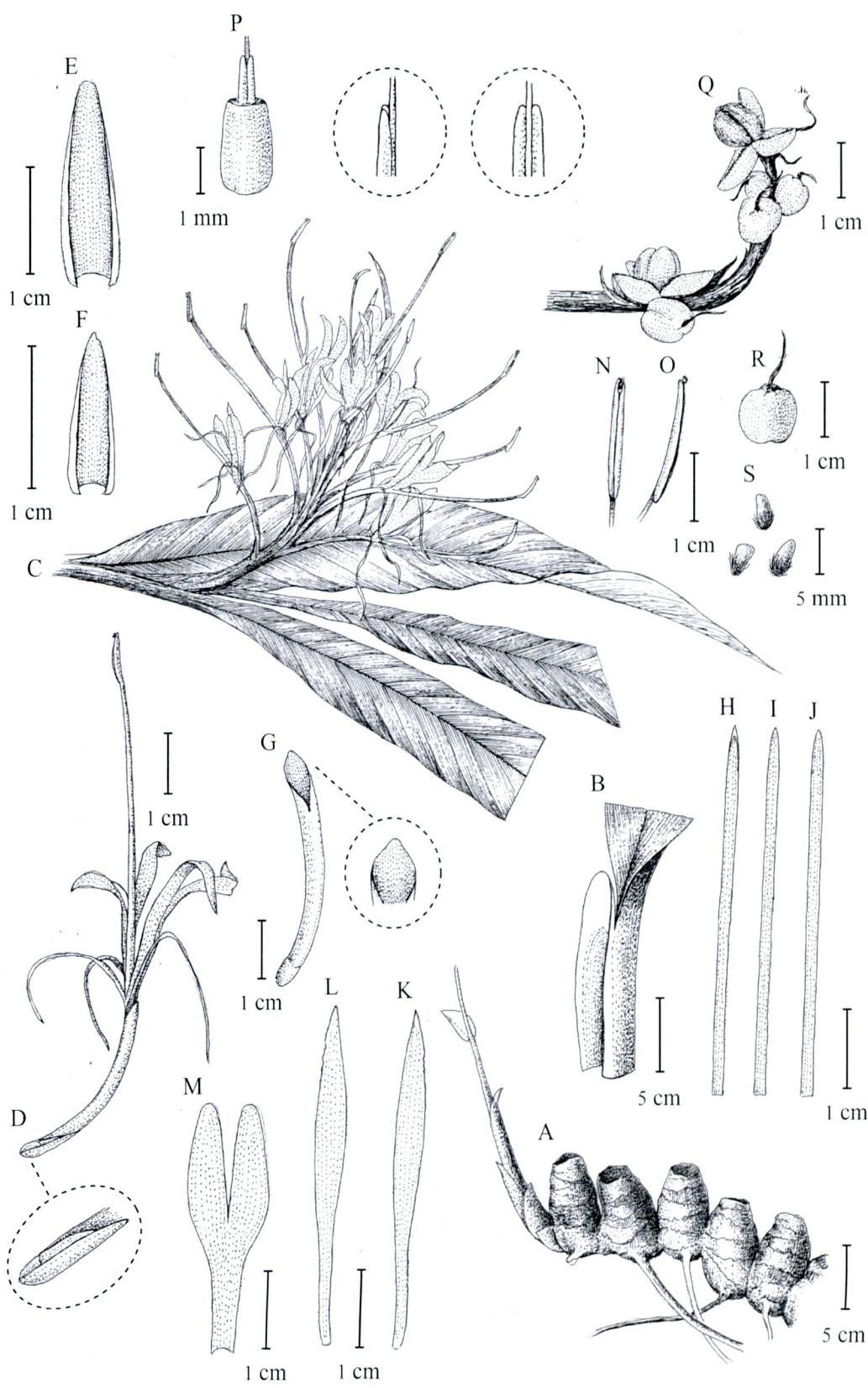


Figure 3.20

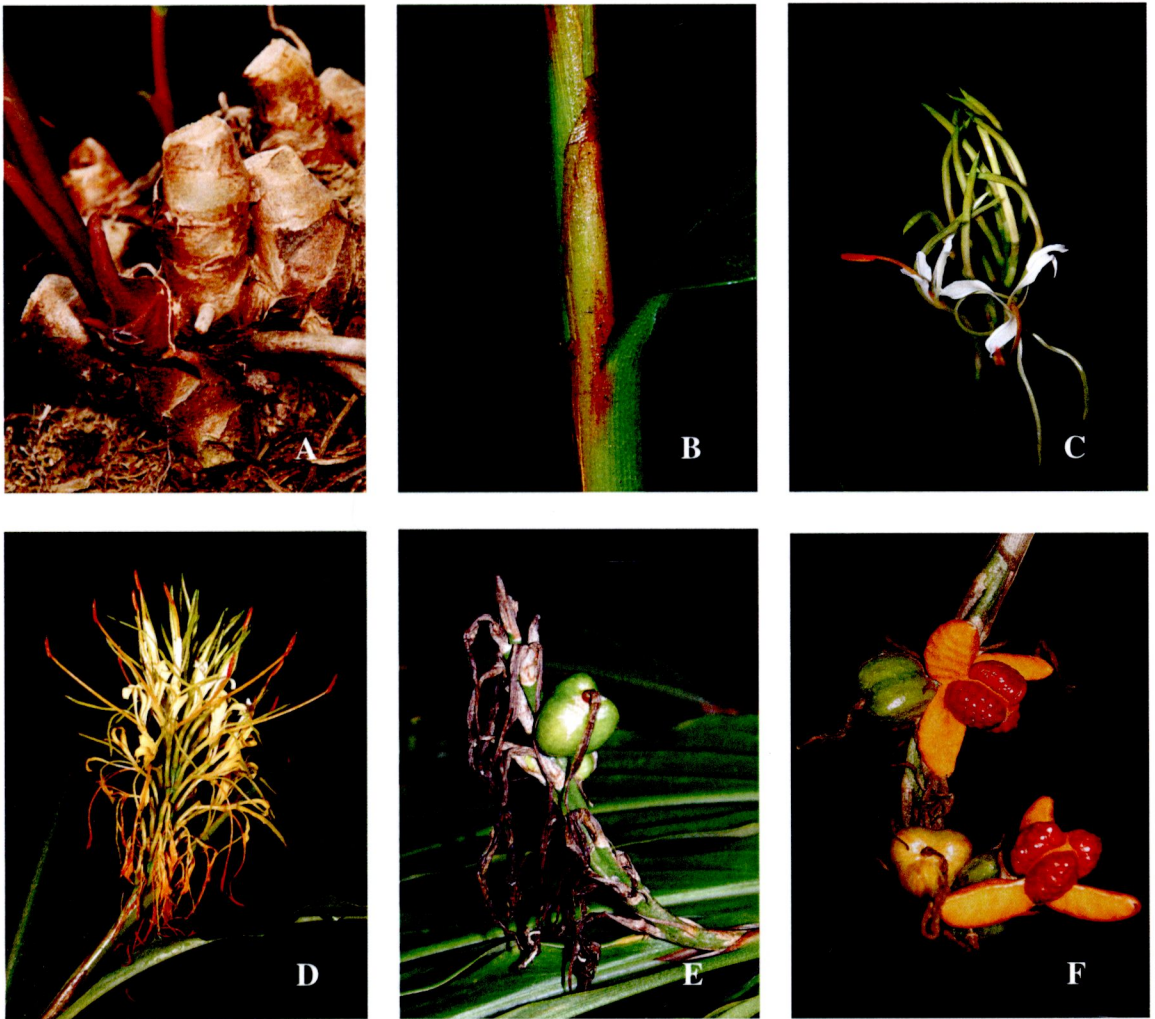


Figure 3.21 Photograph illustration of *H. gomezianum* Wall.:

A. rhizomes; B. ligules; C. & D. inflorescence; E. infructescence; F. infructescence with mature and dehiscing fruits.

Figure 3.20 Illustrations of *H. gomezianum* Wall.:

A. rhizome; B. part of a leaf with a ligule; C. a leaf and an inflorescence; D. a flower; E. bract; F. bracteole; G. calyx tube and ovary; H. dorsal corolla lobe; I. & J. lateral corolla lobes; K. & L. staminodes; M. labellum; N. & O. anther and stigma (front and side views); P. ovary and epigynous glands; Q. infructescence; R. fruit; S. seeds.

8. *Hedychium khaomaenense* Picheans. & Mookamul, *Folia malaysiana* 6: 20-22, 26. plates 2, 7-10. 2005. [Type: Thailand: Nakhon Si Thammarat, Yong Waterfall National Park, Khaomaen, N 08° 17.560', E 99° 39.753', alt. 1,123 m, 23 July 2003; *Picheansoonthon & Mookamul* 544 (holotype BKF, paratypes SING, PEK)]

Terrestrial, perennial herb. Pseudostems upto 1.2 m high, bladeless sheaths 2-4. Ligules oblong, 3.1-4.7 by 1.5-2.2 cm, apex unequally bifid, lobes round, glabrous. *Leaves* subsessile, or shortly petiolate 1.2-1.5 cm long; blades elliptic, 25.6-32.5 by 12.5-17.7 cm, base cuneate, apex acute-acuminate, upper surface glabrous, lower surface hairy along the midrib. *Inflorescence* a terminal spike 12.0-20.5 cm long, peduncle 4.2-5.4 cm long; bracts imbricate, ovate to oblong, 6.4-7.0 by 2.8-3.8 cm, apex acute or obtuse, glabrous, each subtending a cincinnus of 1-2 flowers; first bracteole tubular, 5.5-5.9 by 0.5-0.6 cm, apex acute, glabrous, ribbed; second bracteole 4.9-5.4 by *ca.* 0.5 cm. *Flower* white to yellow, fragrant; calyx tubular, 8.2-8.8 cm long, apex acute, split on one side, glabrous except ciliate apex; corolla tubular, 13.4-13.8 cm long, glabrous, lobes linear, 6.0-6.2 by 0.2-0.3 cm, apex hooded; staminodes lanceolate, 6.2-6.6 by 1.4-1.6 cm, base attenuate into 1.5-2.1 claw, apex acute; labellum broadly obovate, 5.2-5.4 by 4.1-4.2 cm, base attenuate into 0.5-0.9 cm claw, apex deeply divided, cleft to a depth of 2.5-2.6 cm, apex of the lobes shortly acuminate; filament 5.3-5.4 cm long, yellow, anther dorsifixed, 1.4-1.5 cm long, base divaricate, yellowish; ovary glabrous, 4-7 by *ca.* 3 mm, 3-loculed, placentation axile; epigynous glands 2, slender, 1-2 by *ca.* 1 mm yellowish; stigma green, densely ciliate. Fruit oblong, 3.2-3.6 by 1.3-1.4 cm, red, crowned with persistent calyx.

Thailand.—PENINSULAR [Nakhon Si Thammarat, Yong Waterfall National Park, Khao Maen; Khao Luang National Park, Lan Trai; Khao nun National Park].

Distribution.—Endemic to Thailand.

Ecology.—Lower montane rain forest, at the altitude of 1,093-1,237 m.

Phenology.—Flowering from July-August, fruiting from August-September.

Etymology.—The specific epithet is referred to Khaomaen, the type locality.

Vernacular name.—Hong Hoen (หงส์เหิน).

Note.—Three species of *Hedychium* in Thailand, *H. cylindricum* var. *siamense*, *H. khaomaenense* and *H. malayanum* exhibit cylindrical inflorescences. *H. khaomaenense* is readily distinguished by broadly obovate labellum, with deeply divided apex, each lobes with short acuminate apices.

Specimen examined.—*P. Wongsuwan* 64; 48-inspirit (KKU).

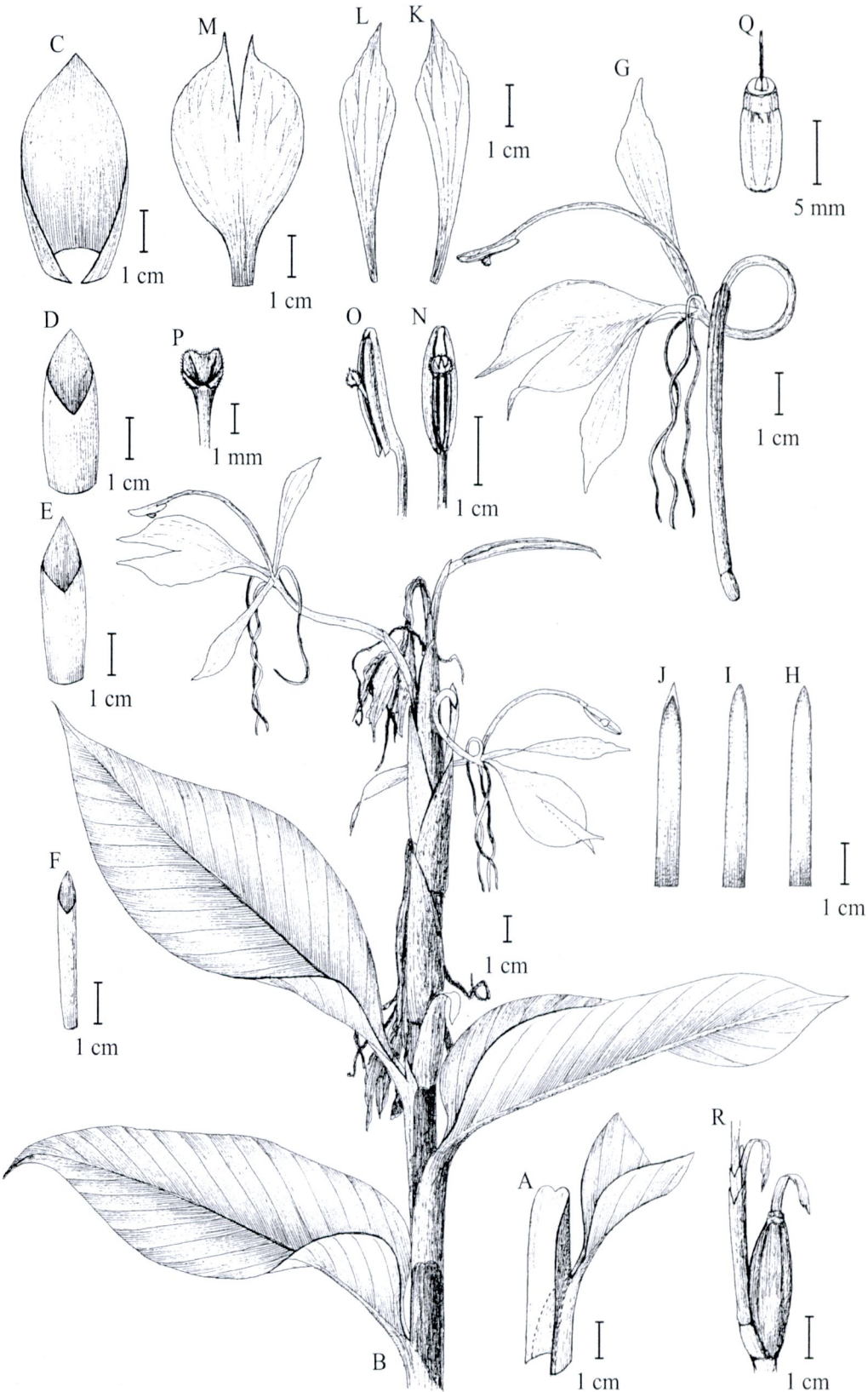


Figure 3.22

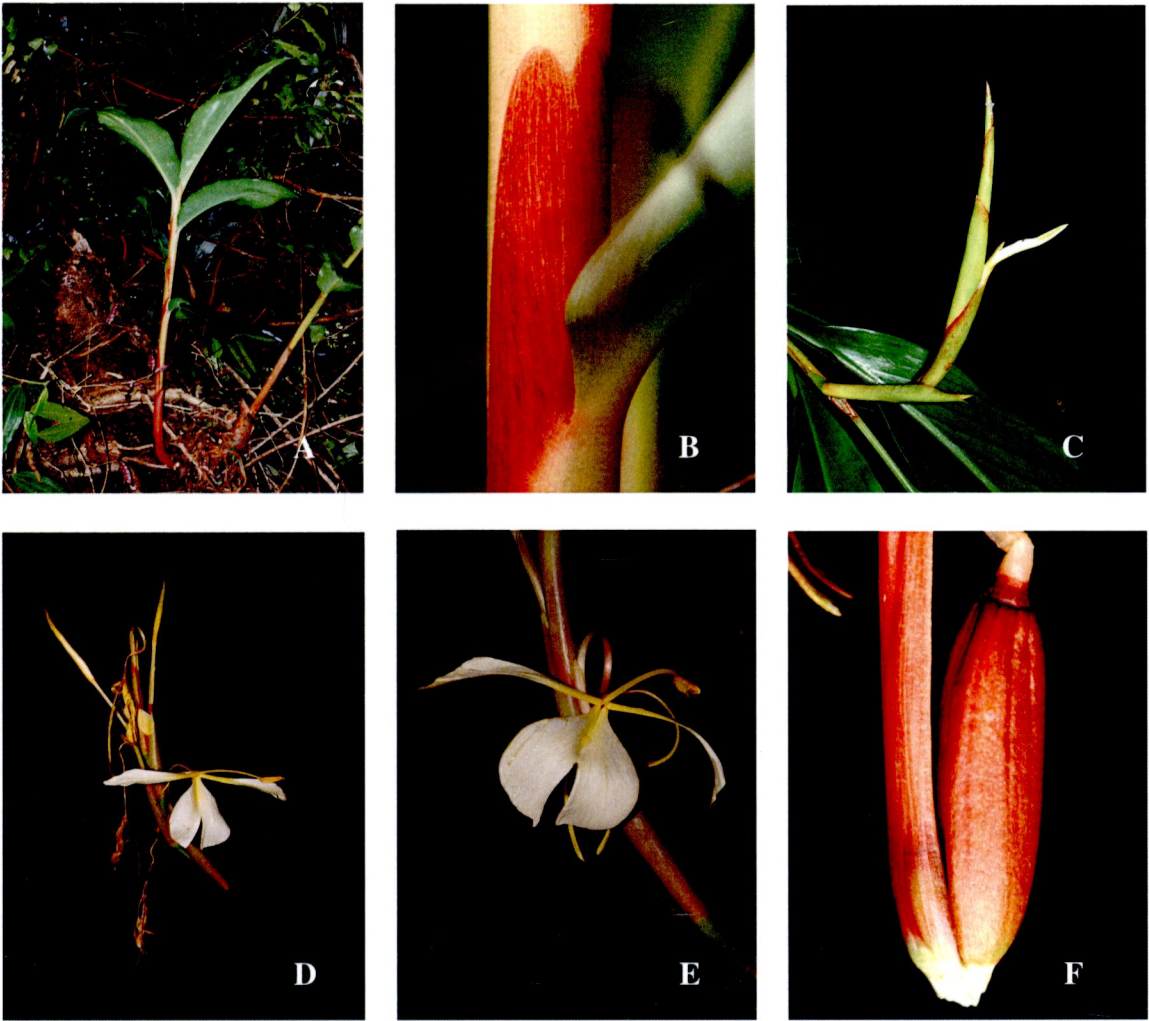


Figure 3.23 Photograph illustration of *H. khaomaenense* Picheans. & Mokkaikul:
A. habit; B. ligule; C. young inflorescence; D. inflorescence;
E. close-up of flower; F. fruit.

Figure 3.22 Illustrations of *H. khaomaenense* Picheans. & Mokkaikul:
A. part of a leaf with a ligule; B. a leaf and an inflorescence; C. bract;
D. first bracteole; E. second bracteole; F. calyx tube; G. a flower;
H. & I. lateral corolla lobe; J. dorsal corolla lobe; K. & L. staminodes;
M. labellum; N. & O. anther and stigma(front and side view);
P. stigma; Q. ovary and epigynous glands; R. fruit.

9. *Hedychium longicornutum* Griff. ex Baker, in Hook.f., Fl. Br. Ind. 6: 228. 1894 [Type: Peninsular Malaysia: Malacca; *Griffith*]; Ridl. J. Straits Brch. R. Asiat. Soc. 32: 100. 1899; K. Schum. in Engl., Pflanzenr. 4(46): 55. 1904; Ridl. Fl. Mal. Pen. 4: 242. 1924; Holtt. In Gard. Bull. Sing. 13: 77-78. 1950.—*H. crassifolium* Baker, in Hook.f., Fl. Br. Ind. 6: 228. 1894.—*H. longicornutum* var. *minor* Ridl., Bull. Misc. Inform. Kew. 1926: 88. 1926 [Type: Indonesia: Sumatra, Siberut, 28 September 1924; C. Boden-Kloss 14599 (K)].

Epiphytic, perennial herb. *Pseudostems* up to 0.6 m high, bladeless sheaths 2-3. *Ligule* oblong, 3.1-4.9 by 1.3-1.7 cm, apex acute, membranous, greenish. *Leaves* sessile, blade elliptic-lanceolate, 32.1-36.7 by 7.7-7.8 cm, base cuneate, apex acute, margin slightly undulate, both surfaces glabrous, midrib sparsely hairy. *Inflorescence* a terminal spike, erect, ca. 8.5 cm long; peduncle ca. 4.2 cm long; bracts imbricate, ovate, 2.8-3.0 by 0.9-1.0 cm, apex acute, greenish with brownish hairy, each subtending a cincinnus of 1 flower; bracteole tubular, ca. 1.2 by 0.3 cm, apex acute, membranous, pubescent or glabrous, greenish. *Flowers* yellow to orange; calyx tubular, 2.8-3.1 by ca. 3 cm, apex 2-3-dented, orange; corolla tube curl-backward, 3.5-3.8 by ca. 3 cm, 3-lobed, lobes linear, 5.3-5.8 by 0.4 cm, apex hooded, yellowish; lateral staminodes oblong, 3.7-4.0 by 0.6-0.7 cm, apex acute, curl-backward, margin undulate; labellum, 2.9-3.0 by 0.7-1.1 cm, base attenuate into 0.5 claw, apex deeply divided to the base, 2.4-2.5 cm long, each lobe linear 2.4-3.0 by ca. 0.3 cm, orange; filament 7.7-7.9 cm long, orange; anther dorsified, 1.1-1.2 by 0.2-0.3 cm, base divaricate, yellowish to pale salmon red; ovary pubescent, 4 by ca. 4 mm, 3-loculed, placentation axile; epigynous glands 2, slender, 2-3 by ca. 1 mm, yellowish; stigma densely ciliate, green. *Fruits* subglobose to globose, 0.8-1.2 by 1.0-1.2 cm, pubescent, greenish. *Seeds* numerous, oblong, 6-8 by 3-4 mm aril reddish-orange.

Thailand.—PENINSULAR [Narathiwat and Yala, Hala-Bala Wildlife Sanctuary].

Distribution.—Peninsular Malaysia

Ecology.—Tropical evergreen rain forest and peat swamp forest.

Phenology.—Flowering from April-May, fruiting from May-June.

Etymology.—The specific epithet is referred to horn-shaped labellum.

Vernacular name.—Pud Duean (ปูดเดียน)

Note.—This plant can be easily recognized by 1-flowered bracts, yellow flower, curl-backward staminodes and labellum. Roots are used to treat earache. Pounded root or the whole plant is a remedy for intestinal worms.

Specimen examined.—*C. Niyomdham* 1197 (L, K); *M.C. Lakshnakara* 780 (BK); *P. Wongsuwan* 44; 29-in spirit (KKU).

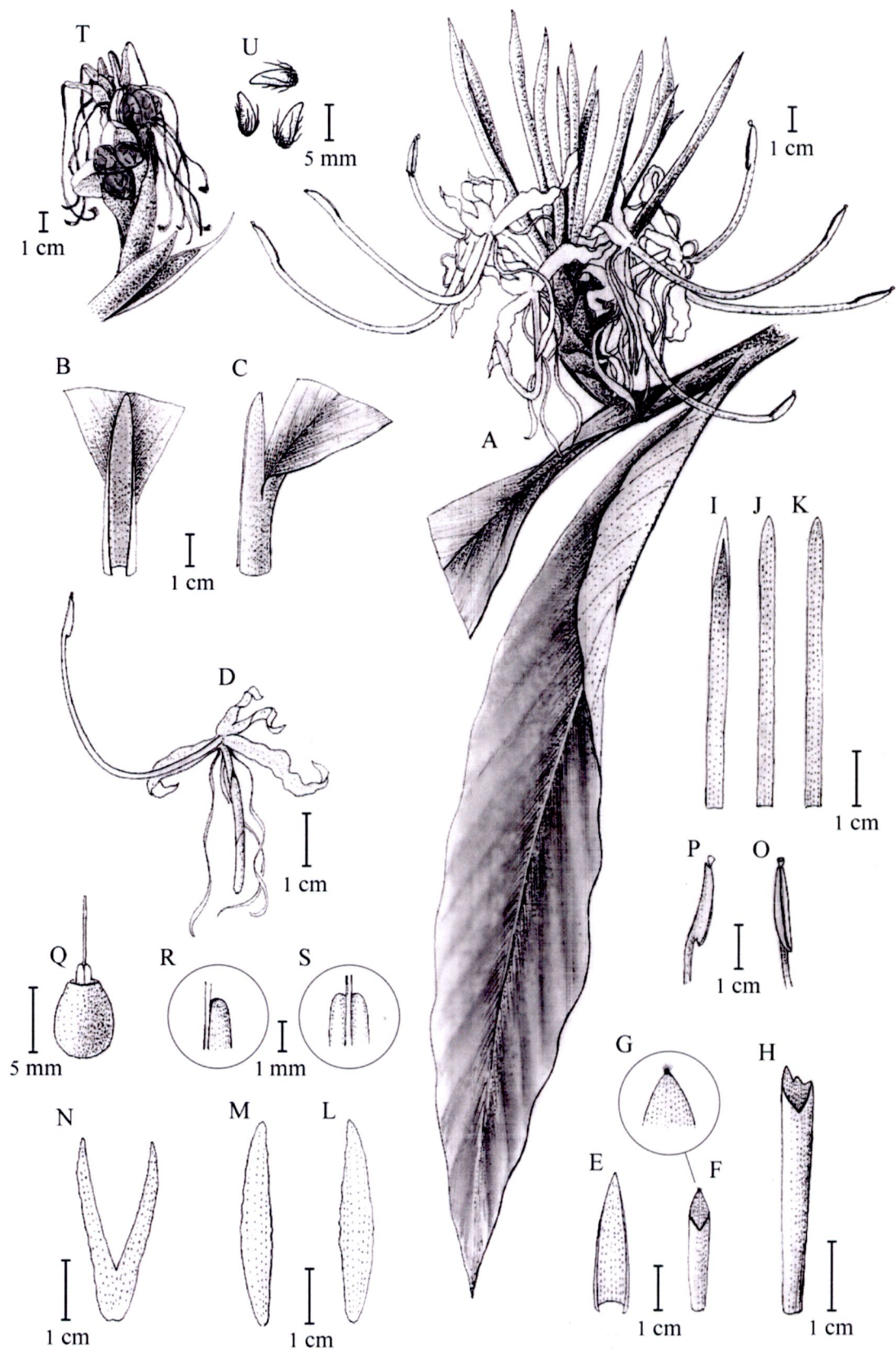


Figure 3.24



Figure 3.25 Photograph illustration of *H. longicornutum* Griff. ex Baker:
A. habit in cultivation; B. ligule; C. young inflorescence;
D. inflorescence; E. close-up of flower; F. infructescence with dehiscing
fruits.

Figure 3.24 Illustrations of *H. longicornutum* Griff. ex Baker:
A. a leaf and an inflorescence; B. & C. part of a leaf with a ligule (front and
side views); D. a flower; E. bract; F. bracteole; G. apex of bracteole;
H. calyx; I. dorsal corolla lobe; J. & K. lateral corolla lobes;
L. & M. staminodes; N. labellum; O. & P. anther and stigma (front and side
views); Q. ovary and epigynous glands; R. & S. epigynous glands;
T. infructescence; U. seeds.

10. *H. malayanum* Ridl. ex Burkill & Holttum, Gard. Bull. Straits Settlement. 3: 82. 1923 [Type: Peninsular Malaysia: Pahang, Fraser's Hill, October 1921; *Ferguson-Davie* (holotype K, isotype SING)]; Ridl., Fl. Mal. Pen. 4: 241-242. 1924; C. Picheansoonthon & P. Wongsuwan, J. Royal Inst. Thail. 43(3): 237-252. 2008.

Epiphytic, perennial herb. *Pseudostems* 0.2-0.6 cm high, leaf sheaths green, margin red, bladeless sheaths 2-3. *Ligule* ovate, 5.2-5.6 cm long, apex acute, membranous, sparsely hairy, pale greenish. *Leaves* subsessile or petiolate, 1.5-3.0 cm long; blade elliptic-oblong, 28.0-42.0 by 9.0-12.7 cm, base cuneate, apex acute or shortly acuminate, margin slightly undulate, upper surface glabrous, lower surface hairy along the midrib. *Inflorescence* a terminal spike, erect, 10.3-14.0 cm long, peduncle 7.5-10.5 cm long; bracts imbricate, overlapping, broadly ovate, 4.5-5.0 by 4.7-6.3 cm, apex rounded or acute, margin free to the base, sparsely hairy, green with reddish margin, each subtending a cincinnus of 1-2 flowers; bracteoles tubular, 3.5-4.0 by 1.8-2.4 cm, apex acute, split on one side to a depth of *ca.* 1.5 cm, hairy, reddish. *Flowers* white; calyx tube slender, 5.5-6.8 cm long, apex acute, glabrous; corolla tube narrow, 9.0-11.5 cm long, 3-lobed, lobe linear, 4.0-4.5 by *ca.* 0.1 cm; lateral staminodes narrowly lanceolate-oblong, 4.5-5.5 by *ca.* 0.3 cm; labellum shorter than staminodes, obovate, 3.8-5.1 by 1.0-1.6 cm, deeply divided, base attenuate into a 0.7-2.3 cm claw; filament *ca.* 5 cm long, anthers dorsifixed, 0.8-1.0 cm long, base divaricate, yellowish; ovary green, glabrous, *ca.* 3 by 4 mm, 3-loculed, placentation axile; epigynous glands 2, *ca.* 3 mm long, yellowish; stigma densely ciliate, greenish. *Fruits* broadly ellipsoid to broadly ovoid, 3.5-4.0 by 2.3-2.50 cm, trilobe, glabrous, pale reddish/greenish.

Thailand.—PENINSULAR [Yala, Hala Wildlife Sanctuary, Hungus peak].

Distribution.—Peninsular Malaysia (Fraser's Hill – Type, Cameron Highlands).

Ecology.—Tropical evergreen rain forest, at the altitude of *ca.* 1,200 m.

Phenology.—22 April 2003, cultivated from plants collected on top of Hangus mountain

Etymology.—The specific epithet is referred to the type locality, Peninsular Malaysia, Pahang, Fraser's Hill.

Vernacular name.—

Note.—This species can be recognized by large broad, glabrous, overlapping bracts, long narrow staminodes and ovate-obovate deeply-bilobed labella.

Specimen examined.—*Picheansoonthon* 168, 181 (BKF) *P. Wongsuwan* 89; 48-in spirit (KKU).

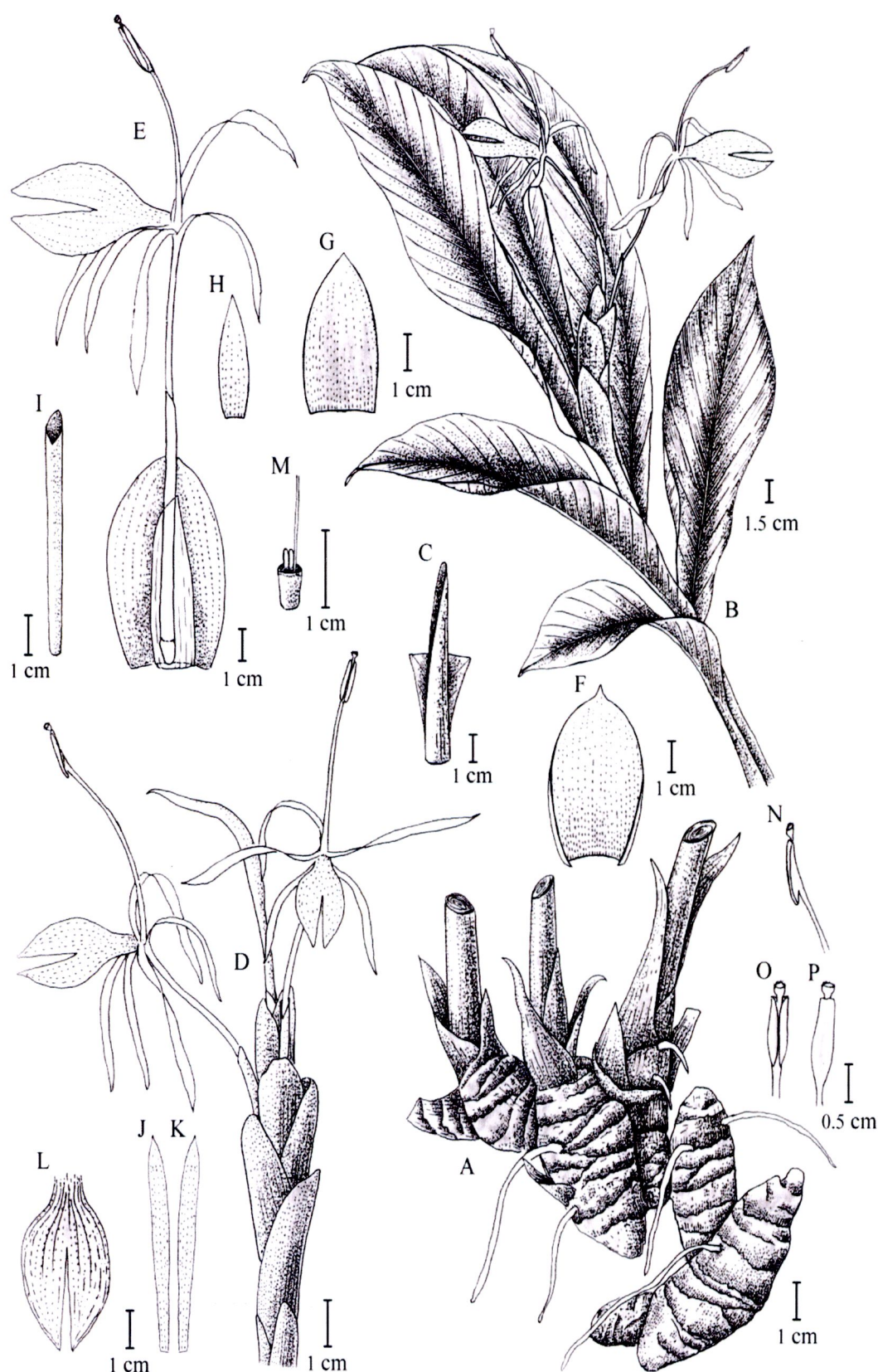


Figure 3.26



Figure 3.27 Photograph illustration of *H. malayanum* Ridl.:

A. ligule; B. & C. inflorescence; D. close-up of flower; E. infructescence; F. infructescence with dehiscing fruits.

Figure 3.26 Illustrations of *H. malayanum* Ridl.:

A. rhizomes and roots; B. a leaf and an inflorescence; C. part of a leaf with a ligule; D. part of an inflorescence; E. bract, bracteole and a flower; F. bract; G. & H. bracteoles; I. calyx tube; J. & K. staminodes; L. labellum; M. ovary and epigynous glands; N., O. & P. anther and stigma (side, front and rear views).

11. *Hedychium muanwongyathiae* Picheans. & Wongsuwan, J. Jpn. Bot. 84: 330-337. 2009 [Type: Thailand: Northern, Chaing Mai, Doi Angkhang, N 19° 50' 48", E 99° 03' 004", alt. 1,044 m, 10 August 2008; *Picheansoonthon & Wongsuwan* 064 (holotype BKF, paratypes BK, SING)].

Terrestrial, perennial herb. Pseudostems 0.75-1.26 cm high, bladeless sheaths 2-4. *Ligule* oblong, 2.4-3.1 by 3.3-4.6 cm, apex round, membranous, pubescent, reddish. *Leaves* sessile; lanceolate-oblong, 38.3-48.5 by 17.8-19.4 cm, base cuneate, apex acuminate-caudate, margin entire, upper surface glabrous, lower surface pubescent. *Inflorescence* a terminal spike, erect, 21.6-28.2 cm long; peduncle 5.5-7.6 cm long, glabrous; bracts lax, folded, oblong, 4.3-4.5 by 1.4-1.8 cm, apex acute, glabrous, greenish, each subtending a cincinnus of 2-4 flowers; primary bracteole tubular, 2.4-2.9 by 1.3-1.9 cm, apex acute, membranous, glabrous except apex hairy; second bracteole tubular, *ca.* 2.2 by 0.1-1.1 cm, apex acute, glabrous except apex hairy; third bracteole tubular, 1.5-1.8 by 0.7-0.9 cm, apex acute, membranous, glabrous except apex hairy; fourth bracteole tubular, 1-1.4 by 0.4-0.5 cm membranous. *Flowers* white to pale yellow, fragrant; calyx tubular, 3.9-4.45 by 0.4-0.5 cm, apex acute to 3-dented, hairy; corolla tube slender, 5-7.6 by 0.2-0.3 cm, 3-lobed, lobes linear, 3.6-4.6 by 0.4-0.6 cm, apex hooded, yellowish; lateral staminodes linear-oblong, 4.2-4.3 by 0.4-0.5 cm, base attenuate into a 1-1.2 by 0.3-0.4 cm claw, pale salmon; labellum elliptic-obovate, *ca.* 4.3 by 2.45-2.8 cm, base attenuate into a 1-1.1 by 0.4-0.5 mm claw, apex deeply divided, 2.2-2.5 cm, white with pale salmon red patch at base; filament 3.2-3.35 cm long, salmon red; anther dorsified, 1.3-1.5 by 0.2-0.3 cm, base divaricate, yellowish; ovary 5-6 by 3-4 mm, 3-loculed, placentation axile, villose; epigynous glands 2, slender, 3-4 by 2-3 mm yellowish; stigma densely ciliate, green. *Fruits* not seen.

Thailand.—NORTHERN [Chiang Mai; Doi Angkhang; Mae Hong Son, Doi Keiw Lom].

Distribution.—Endemic to Thailand.

Ecology.—Lower montane scrub at the altitude of 1,000-1,500 m.

Phenology.—Flowering from August-September, fruiting from October-November.

Etymology.—The specific epithet is named in honor of Prof. Dr. Payaw Muanwongyathi, Thailand, a leading pharmaceutical botanist.

Vernacular name.—Ta Hoen Pa (ตาเหินป่า).

Note.—Four taxa of *Hedychium* in Thailand, *H. muanwongyathiae*, *H. phuluangense*, *H. spicatum* var. *acuminatum* and *H. spicatum* var. *spicatum* possess white elliptic-obovate labellum and filament shorter or as long as labellum. *H. muanwongyathiae* is distinguished by 2–4 flowers per bract, hairy calyx tubes and villous ovaries.

Specimen examined.—*Picheansoonthon & Wongsuwan* 052, (paratype BKK).

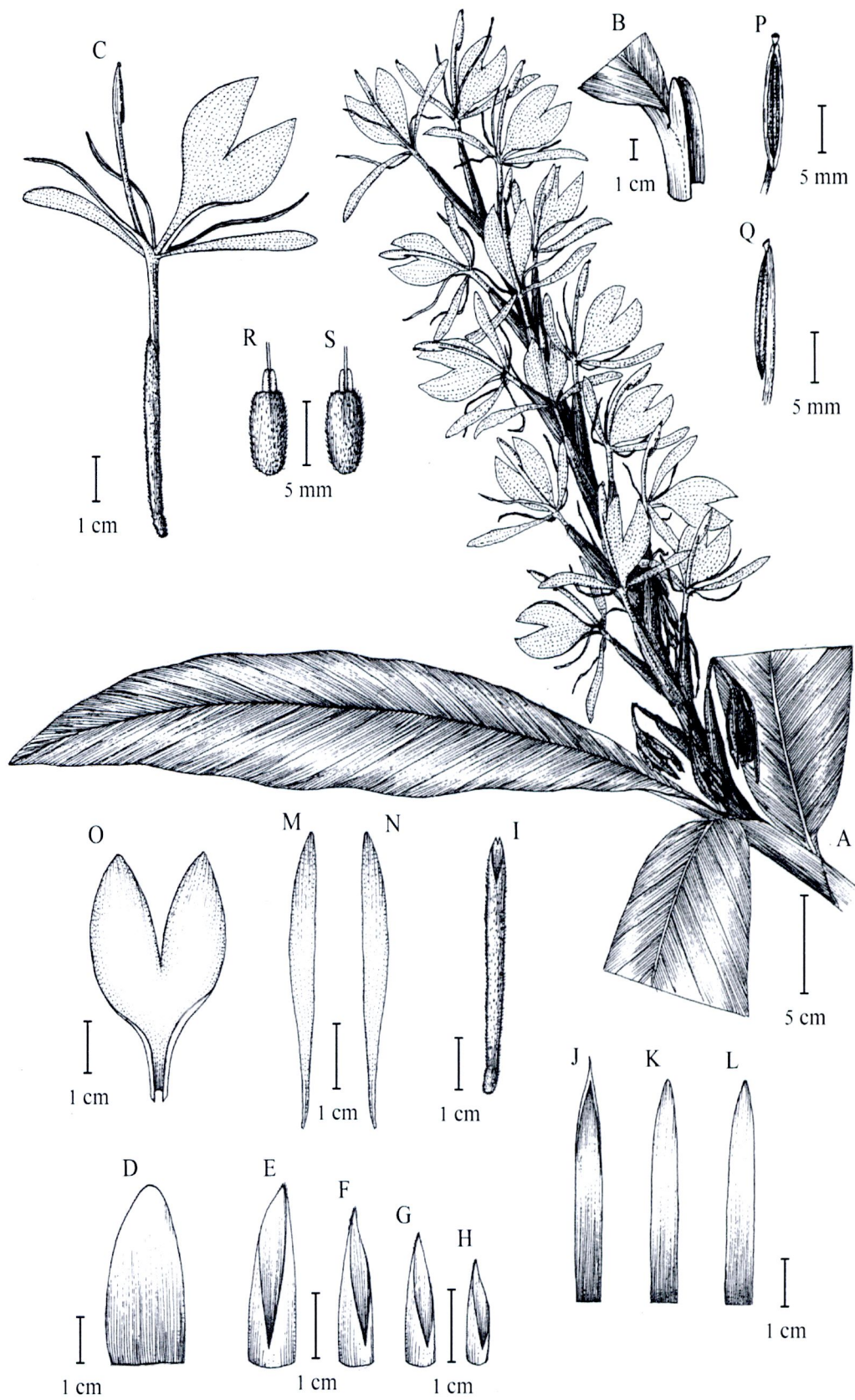


Figure 3.28



Figure 3.29 Photograph illustration of *H. muanwongyathiae* Picheans. & Wongsuwan: A. habit; B. ligule; C. & D. inflorescence; E. & F. close-up of flower.

Figure 3.28 Illustrations of *H. muanwongyathiae* Picheans. & Wongsuwan.:
A. a leaf and an inflorescence; B. part of a leaf with a ligule C. a flower;
D. bract; E. first bracteole; F. second bracteole; G. third bracteole;
H. fourth bracteole; I. calyx tube and ovary; J. dorsal corolla lobe;
K. & L. lateral corolla lobes; M. & N. staminodes; O. labellum;
P. & Q. anther and stigma(front and side views); R. & S. ovary
and epigynous glands (front and rear views).

12. *Hedychium neocarneum* T.L. Wu, K. Larsen & Turland, Novon 10: 91. 2000 [Type: China: Yunnan, Simao, alt. 1000-1900 m; Y.Y. Qian 1832 (holotype SMAO)]; T.L. Wu & K. Larsen in Z.L. Wu & P.H. Raven, Fl. China 24: 376. 2000.—*H. carneum* Y.Y. Qian, Acta Bot. Austron Sin. 9: 48. 1994; Not Loddiges, Bot. Cab. 7: t. 693. 1823.

Terrestrial, perennial herb. *Pseudostems* 0.6-1.5 m high, leaf sheaths greenish, bladeless sheaths 2-4. *Ligule* oblong, 2.3-4.0 by 1.3-2.8 cm, apex bilobed-rounded, membranous, pubescent, greenish. *Leaves* sessile; blade elliptic-oblong, 16.5-32.4 by 7.2-12.0 cm, base cuneate, apex acute-acuminate, margin entire-slightly undulate, upper surface glabrous, lower surface pubescent. *Inflorescence* a terminal spike, erect, 11.2-24.5 cm long; peduncle 3.3-4.8 cm long, hairy; bracts, folded, green, obovate-lanceolate, 3.4-4.2 by 1.6-2.8 cm, apex acute, pubescent, each subtending a cincinnus of 2-4 flowers; first bracteole ovate-broadly ovate, 2.3-3.0 by 0.6-0.7 cm, apex acute, pubescent, greenish; second bracteole ovate, 1.3-1.6 by 0.4-0.8 cm, apex acute, pubescent; *Flowers* white to pale yellow, fragrant; calyx tubular, 3.9-4.6 by 0.3-0.4 cm, apex 3-dented, pubescent except apex; corolla tube slender, 5.3-5.8 by ca. 0.3 cm, 3-lobed, lobes linear, 3.7-5 by 0.2-0.3 cm, apex hooded, yellowish; lateral staminodes oblanceolate, 2.8-3.3 by 0.4-0.5 cm, base attenuate into a 3-5 by 2-3 mm claw, apex rounded; labellum elliptic-suborbicular, 2.4-2.6 by 1.5-2.4 cm, base attenuate into 6-8 by 3-4 mm claw, white with yellow-red patch at base, apex 2-cleft, 0.4-1 cm; filament pale salmon red, 4.1-5.3 cm long; anther dorsifixed, base divaricate, 1.1-1.2 by 0.2-0.3 cm, yellowish; ovary 4-5 by 3-4 mm, 3-loculed, placentation axile, pubescent; epigynous glands 2, slender, ca. 3 by 1 mm, yellowish; stigma densely ciliate, green. *Fruits* ovoid to oblong, 2.7-3.0 by 2.1-2.2 cm, pubescent, green. *Seeds* numerous, ellipsoid to globose, 4-9 by 4-6 mm, reddish orange.

Thailand.—NORTHERN [Nan, Doi Phu Ka; Pitsanulok, Phu Hin Rong Kla]; NORTEASHERN [Loei, Phu Ruea, Phu Luang].

Distribution.—China (Simao Xian) and Laos (Champasak).

Ecology.—Lower montane scrub, at the altitude of 1,000-1,500 m.

Phenology.—Flowering from June-August, fruiting from July-September.

Etymology.—The specific epithet is referred to the new name for *H. carneum*.

Vernacular name.—

Note.—This species can be recognized by oblanceolate staminodes, elliptic-suborbicular labellum with yellow-red patch at the base, 2-cleft apex and pale salmon red filament, twice as long as the labellum.

Specimen examined.—*P. Triboun* 837-in spirit (BK); *P. Srisanga* 1660 (QBG), 2152 (QBG); *P. Srisanga & C. Maknoi* 2003 (QBG); *P. Srisanga & Puff.* 1090 (QBG); *P. Wongsuwan* 59 (KKU), 60 (KKU), 73 (KKU), 112 (KKU), 13-in spirit (KKU), 22-in spirit (KKU).

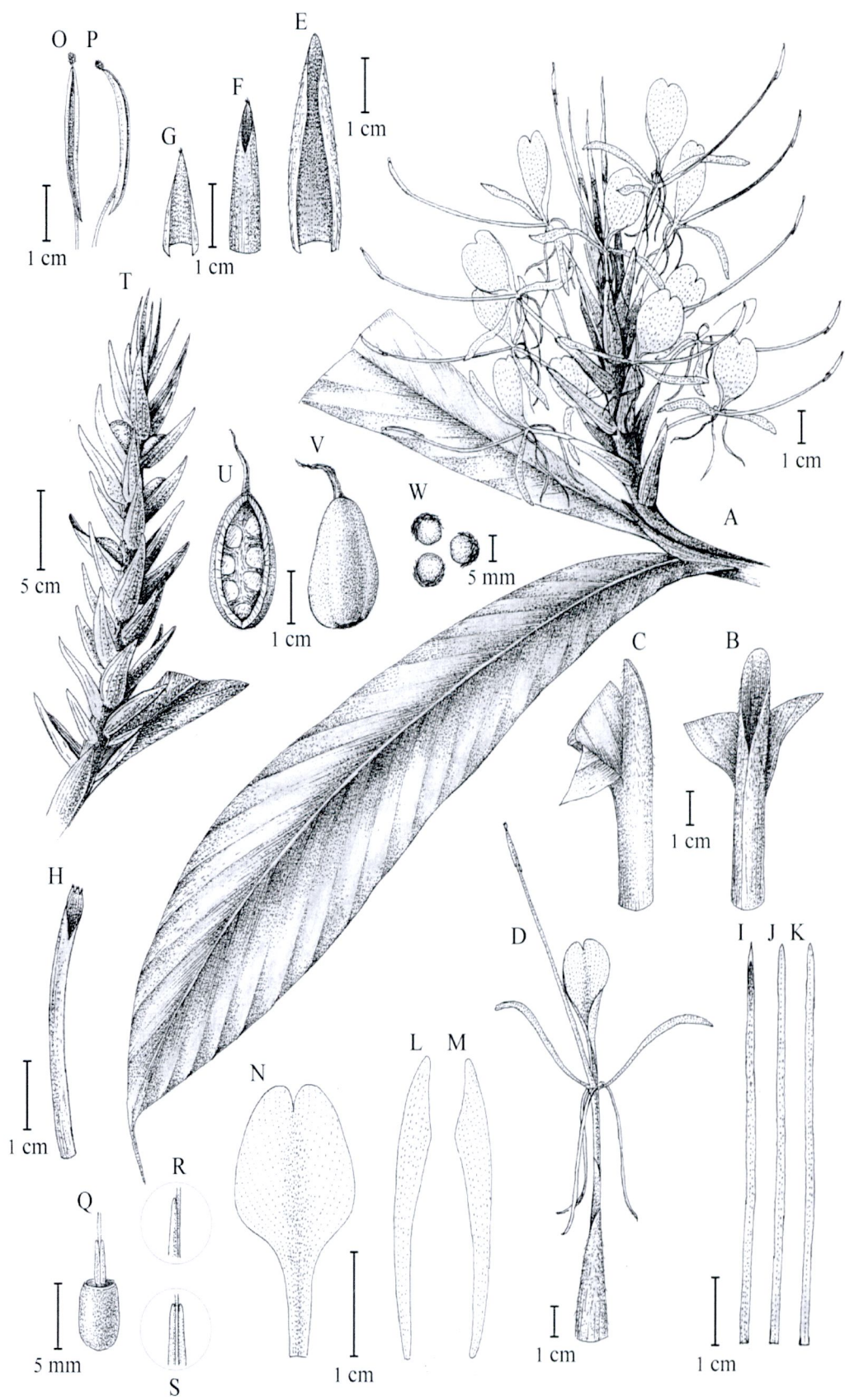


Figure 3.30



Figure 3.31 Photograph illustration of *H. neocarneum* T.L. Wu, K. Larsen & Turland:
A. habit; B. ligule; C. inflorescence; D. & E. close-up of flowers;
F. infructescence.

Figure 3.30 Illustrations of *H. neocarneum* T.L. Wu, K. Larsen & Turland:

A. a leaf and an inflorescence; B. & C. part of a leaf with a ligule (front and side views); D. a flower with bract; E. bract; F. first bracteole; G. second bracteole; H. calyx tube; I. dorsal corolla lobe; J. & K. lateral corolla lobes; L. & M. staminodes; N. labellum; O. & P. anther and stigma (front and side views); Q. ovary and epigynous glands; R. & S. epigynous glands (side and rear views); T. infructescence with a dehiscent fruit and a partially dehiscent fruit; U. a partially dehiscent fruit with seeds inside; V. fruit; and W. seeds.

13. *Hedychium pauciflorum* S.Q. Tomg, Acta Bot. Yunnan. 8: 43. 1986; T.L. Wu & K. Larsen in Z.L. Wu & P.H. Raven, Fl. China 24: 55. 2000.—*H. thianum* Mookamul & Pichans., Folia Malaysiana 6: 18-19, 21, 24-25; Figs. 1, 3-6. 2005 [Type: Thailand: Chiang Mai, Doi Inthanon; *Mookamul & Pichansoonthon* 588 (holotype BKF, paratypes SING, PEK)].

Epiphytic, perennial herb. *Pseudostems* 35.5-60.0 cm high, leaf sheaths green, bladeless sheaths 2-3. *Ligule* shortly oblong, 2-7 mm long, apex bilobed, lobe rounded, membranous, glabrous, greenish. *Leaves* sessile, blade elliptic-oblong, 24.9-31.7 by 7.0-7.2 cm, base cuneate, apex acuminate, margin slightly undulate, both surfaces glabrous. *Inflorescence* terminal spike, erect, 7.4-15.3 cm long, laxly few-flowered; peduncle 3.7-5.1 cm long, glabrous; bract lanceolate-oblong, 1.6-2.0 by 0.9-1.0 cm, apex acute or rounded, glabrous, green, each subtending a cincinnus of 1 flower; bracteole oblong, 1.3-1.5 by 0.5-0.6 cm, apex acute, membranous. *Flowers* white to pale yellow; calyx tubular, 1.7-1.8 by 0.2-0.3 cm, apex emarginate-acute membranous; corolla tube, 3.9-4.1 cm long, 3-lobed, lobe linear, 2.1-2.4 by 0.2-0.3 cm; lateral staminodes narrowly lanceolate-oblong, 1.6-1.7 by 0.2-0.4 cm; labellum narrowly elliptic-oblong, 1.5-1.7 by 0.3-0.4 cm, apex deeply divided to the base, lobe narrowly oblong, *ca.* 0.2 cm wide; filament yellowish, 1.9-2.0 cm long; anther dorsifixed, 0.8-1.0 cm long, base divaricate, yellowish; ovary, *ca.* 3 by 2 mm, glabrous, green; epigynous glands 2, *ca.* 2 mm long, yellowish; stigma densely ciliate, orange. *Fruits* globose, 1.2-1.5 by 1.2-1.3(-1.5) cm, trilocular, glabrous, green. *Seeds* numerous, aril reddish.

Thailand.—NORTHERN [Mae Hong Son, Pai, Pang Mapha; Chiang Mai, Doi Suthep-Pui, Doi Inthanon; Tak, Mae Moei], NORTEASTERN [Loei, Phu Luang].

Distribution.—China (W Yunnan).

Ecology.—Lower montane pine-oak forest or lower montane scrub, at the altitude of *ca.* 1,000 m.

Phenology.—Flowering from June-July, fruiting from July-September.

Etymology.—The specific epithet is referred to few-flowered.

Vernacular name.—

Note.—This species can be easily distinguished by laxly few-flowered, 1-flower in each bract; deeply divided to the base labellum with narrowly oblong lobes and the thoroughly glabrous plant.

Specimen examined.—*K. Chayamarit et. al.* 1656 (BKF); *J.F. Maxwell* 88-963 (CMU); *P. Triboun* 841-in spirit (BK), 1192-in spirit (BK), 1354-in spirit (BK), 1381-in spirit (BK); *P. Wongsuwan* 69 (KKU), 94 (KKU), 119 (KKU), 19-in spirit (KKU), 52-in spirit (KKU).

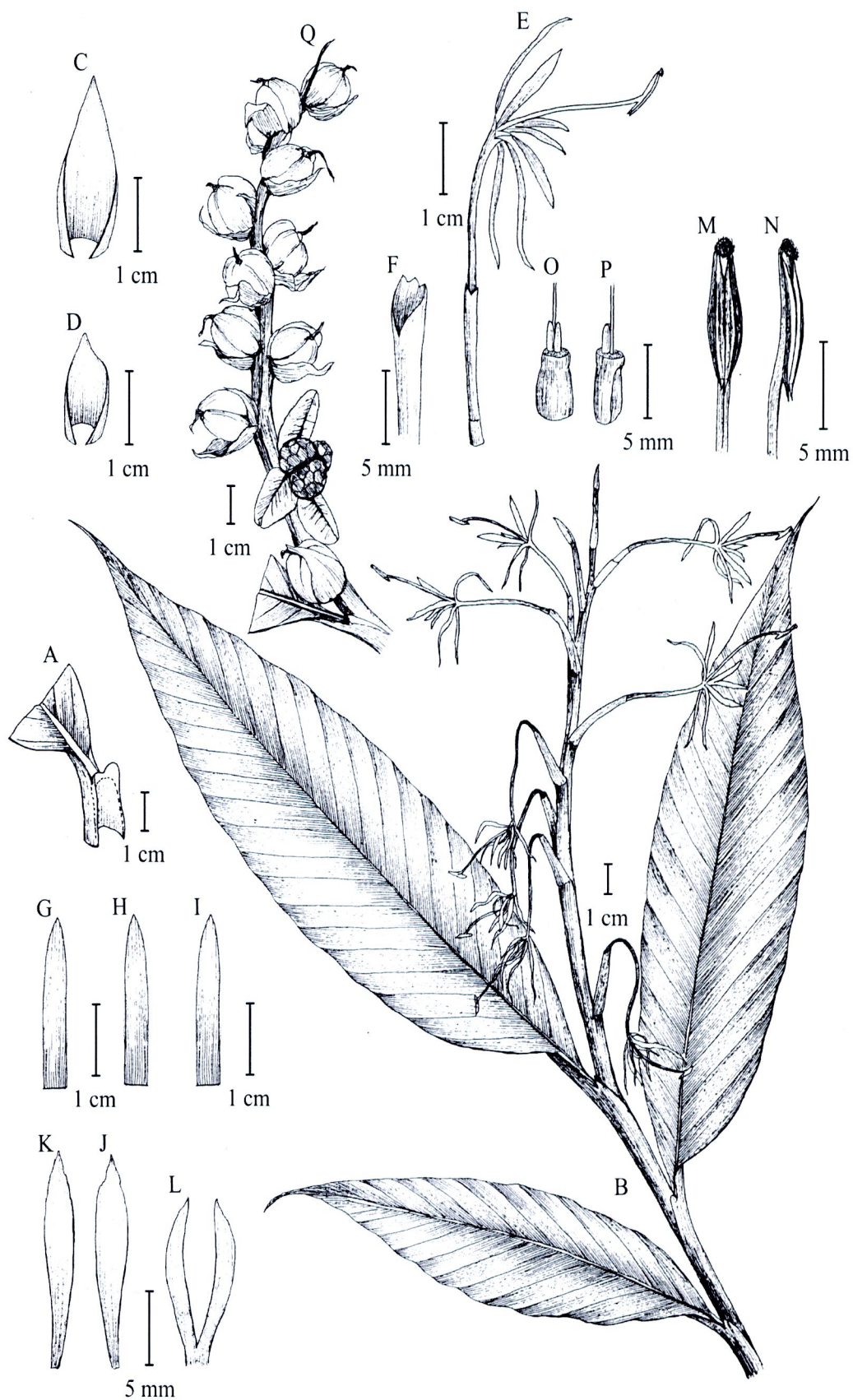


Figure 3.32



Figure 3.33 Photograph illustration of *H. pauciflorum* S.Q. Tomg:

A. habit; B. ligule; C. young inflorescence; D. close-up of flowers;
E. infructescence; F. infructescence with a mature and dehiscing fruits.

Figure 3.32 Illustrations of *H. pauciflorum* S.Q. Tomg:

A. part of a leaf with a ligule; B. a leaf and an inflorescence; C. bract;
D. bracteoles; E. a flower with calyx and ovary; F. apex of calyx tube;
G. dorsal corolla lobe; H. & I. lateral corolla lobe; J. & K. staminodes;
L. labellum; M. & N. anther and stigma (front and side view); O. & P. ovary,
epigynous glands and part of a style stigma (front and side view);
Q. infructescence.

14. *Hedychium phuluangense* Picheans. & Wongsuwan, J. Jpn. Bot. 84: 330-337. 2009
 [Type: Thailand: Northeastern, Changwat Loei, Phu Luang Wildlife Sanctuary, N 17° 16'36.18", E 101° 31'5.70", alt. 1,474 m, 26 July 2007; *Picheansoonthon & Wongsuwan* 060, (holotype BKF, isotypes BK, SING).

Terrestrial, perennial herb. *Pseudostems* 1.14-1.56 m high, bladeless sheaths 2-4. *Ligule* oblong, 1.8-2.1 by 1.2-1.6 cm, apex acute, membranous, pubescent, reddish. *Leaves* sessile, blade lanceolate-oblong, 42.1-50.3 by 9.8-13.4 cm, base cuneate, apex acute-acuminate, margin entire, both surfaces glabrous. *Inflorescence* a terminal spike, erect, 11.6-18.2 cm long; peduncle 5.4-10.6 cm long, glabrous; bracts lax, folded, oblong, 2.9-3.1 by 0.8-1.1 cm, apex acute, glabrous, greenish, each subtending a cincinnus of 1 flower; bracteole, oblong, 1.4-1.6 by 0.9-1.1 cm, apex acute, membranous. *Flowers* white to pale yellow, fragrant; calyx tubular, 2.65-2.75 by 0.3-0.4 cm, apex 3-lobed, glabrous; corolla tube slender, 5.2-6.1 by 0.2-0.3 cm, 3-lobed, lobes linear, 3.4-4.7 by 0.4-0.5 cm, apex hooded, yellowish; lateral staminodes oblanceolate-linear, 3.8-4.8 by 0.4-0.5 cm, base attenuate into a 1.6-1.9 by 0.2-0.3 cm claw; labellum elliptic, 2.9-3.5 by 1.5-1.55 cm, base attenuate into a 1.1-1.3 by 0.3-0.4 cm claw, apex bifid, 6-7 mm, white with pale salmon red patch at base; filament 3.3-4.1 cm long, salmon red; anther dorsifixed, 1.5-1.6 by 0.3-0.4 cm, base divaricate, salmon red; ovary 2-4 by 2-3 mm, 3-loculed, placentation axile, glabrous; epigynous glands 2, slender, 2-3 by ca. 0.5 mm, yellowish; stigma densely ciliate, green. *Fruits* suborbicular, 1.2-1.6 by 1.2-1.5 cm, glabrous, green. Seeds numerous, ellipsoid to orbicular, 4-5 by ca. 3 mm, reddish orange.

Thailand.—NORTHEASTERN [Loei, Phu Luang].

Distribution.—Endemic to Thailand.

Ecology.—Lower montane scrub, at the altitude of 1,000-1,500 m.

Phenology.—Flowering from July-August, fruiting from August-September.

Etymology.—The specific epithet is referred to the type locality, Phu Luang.

Vernacular name.—Hong Hoen (หงส์เหิน).

Note.—

Specimen examined.—*P. Wongsuwan* 51 (KKU), 111 (KKU), 121 (KKU), 14-in spirit (KKU), 34-in spirit (KKU).

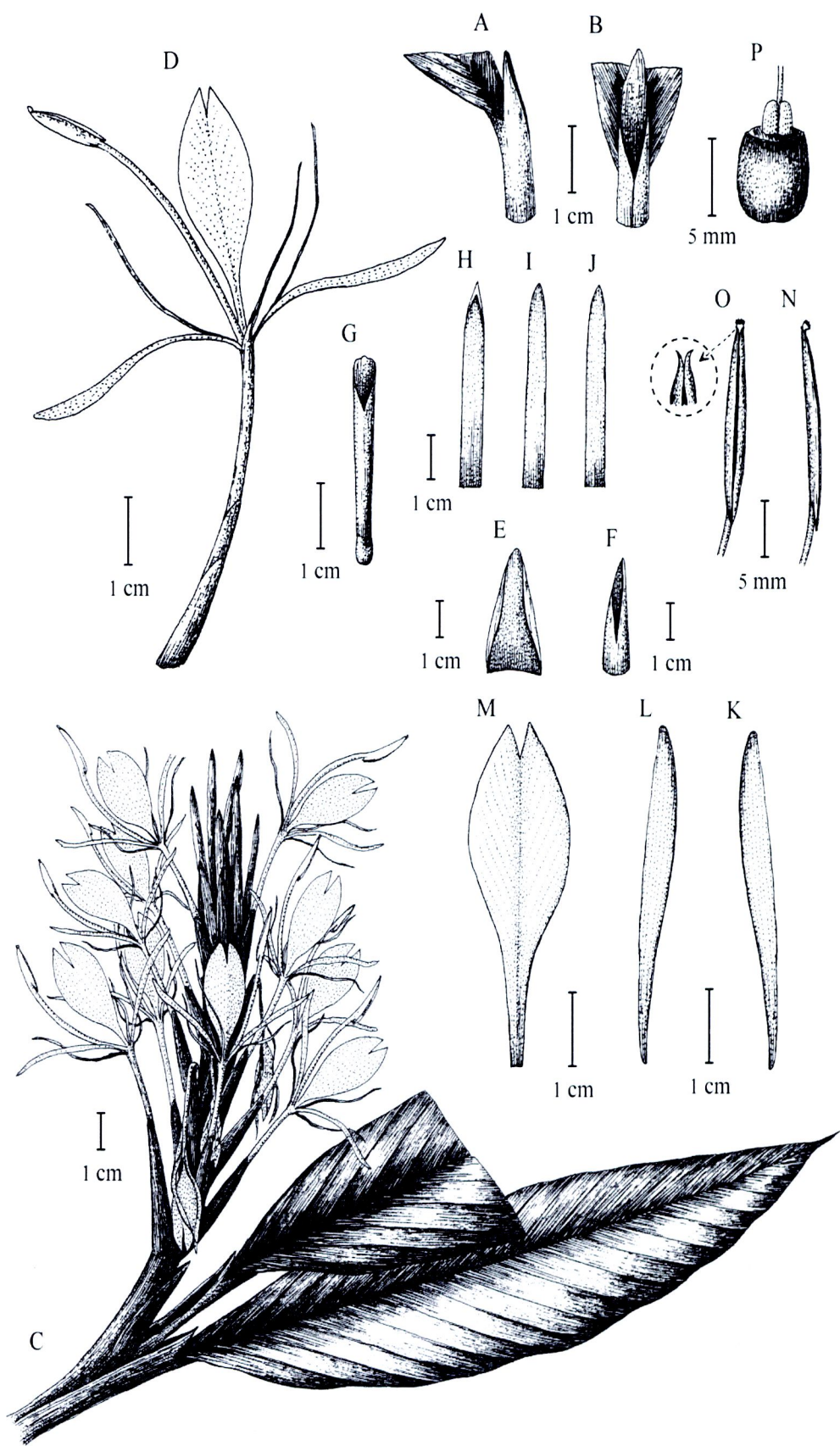


Figure 3.34



Figure 3.35 Photograph illustration of *H. phuluangense* Picheans. & Wongsuwan:

A. habit; B. ligule; C. inflorescence; D. close-up of flowers; E. infructescence; F. infructescence with a mature and dehiscing fruits.

Figure 3.34 Illustrations of *H. phuluangense* Picheans. & Wongsuwan:

A. & B. part of a leaf with a ligule (side and front views); C. leaves and an inflorescence; D. a flower with bract and calyx tube; E. bract; F. bracteole; G. calyx tube and ovary; H. dorsal corolla lobe; I. & J. lateral corolla lobes; K. & L. staminodes; M. labellum; N. & O. anther and stigma (side and front views); P. ovary and epigynous glands.

15. *Hedychium roxburghii* Blume, Enum. Pl. Javae, 1: 57. 1827 [Type: Indonesia: Java; *C.L. Blume* s.n. (Type L)]; Miq. Fl. Ind. Bat. 3: 609. 1854; Horan. Monogr. 26. 1862; K. Schum. in Engl., Bot. Jahrb. 27: 340. 1899, in Engl., Pflanzenr. 4(46): 58. 1904; Fl. Java 3: 64-67. 1968.—*H. spanogheanum* Wall., in Hook. J. Bot. Kew Gard. Misc. 5: 375. 1853.—*Gandasulium roxburghii* (Blume) Kuntze, Revis. Gen. Pl. 2: 690. 1891.—*G. spanogheanum* (Wall.), Kuntze, Revis. Gen. Pl. 2: 690. 1891.—*H. samuiense* Sirirugsa & K. Larsen, Nord. J. Bot. 15: 301, Fig. 1 A-D. 1995. [Type: Thailand: Sura Thani, Koh Samui, on rocks in stream through evergreen forest, alt. *ca.* 100 m, 8 April 1927, *Kerr* 12540 (holotype K, isotypes AAU, BM, C, L)]

Lithophytic or epiphytic, perennial herb. *Pseudostems* 50.1-133.5 cm high, leaf sheaths green, bladeless sheaths 1-2. *Ligule* oblong, 5.7-6.9 by 2.1-3.4 cm, apex obtuse-acute, membranous, pubescent, greenish. *Leaves* sessile to petiole, 0.7-2.2 cm; blade oblong, 38.9-49.7 by 8.6-14.2 cm, base cuneate, apex acute, margin slightly undulate, lower surface glabrous. *Inflorescence* a terminal spike, erect, 10.6-45.2 cm long; peduncle 3.5-9.2 cm long, pubescent; bracts lax, folded, triangular 2.2-2.5 by 1.1-1.4 cm, apex acute, pilose, green, each subtending a cincinnus of 2-4(-8) flowers; primary bracteole, triangular, 1.5-1.8 by 1.1-1.2 cm, apex acute, membranous, pubescent, yellowish to brownish; second bracteole, triangular, 1.4-1.6 by 0.7-0.8 cm, apex acute to 2-dentate, membranous, pubescent, yellowish or brownish; third bracteole, triangular, 1.2-1.3 by 0.5-0.6 cm, apex acute, membranous, pubescent, yellowish or brownish; fourth bracteole, triangular, 0.8-1 by 0.2-0.4 cm, apex acute, membranous, pubescent, yellowish or brownish. *Flowers* white to pale yellow, fragrant; calyx tubular, 3.8-5.3 by 0.3-0.4 cm, apex acute to 3-dentate; corolla tube slender, 6.5-8.3 by *ca.* 0.3 cm, 3-lobed, lobes linear, 4.7-5.3 by 0.3-0.4 cm, apex hooded, yellowish; lateral staminodes narrowly lanceolate-oblong or spatulate, 4.8-5.2 by 0.5-0.8 cm, base attenuate into a 0.6-1.4 by 0.2-0.3 cm claw; labellum ovate to suborbicular, white with pale greenish patch at base, 4.1-4.3 by 1.9-2.2 cm, base attenuate into *ca.* 7.5 by 3-4 mm claw, apex 2-cleft, 2.5-2.6 cm; filament 5.2-8.9 cm long, salmon red; anther dorsifixed, 6-8 by 3-4 mm, base divaricate, salmon red; ovary oblong, 3.5-5 by 2-3 mm, 3-loculed, placentation axile, pubescent; epigynous glands 2, slender, *ca.* 3 by 0.5 mm, yellowish; stigma densely ciliate, green. *Fruits*

obovoid to oblong, 2.8-3.2 by 1.3-1.5 cm, pubescent, scarlet. *Seeds* numerous, ellipsoid to oblong, 0.4-1.0 by 0.4-0.5 cm, aril reddish.

Thailand.—PENINSULAR [Ranong, Khlong Naka Wildlife Sanctuary; Surattani, Ko Samui].

Distribution.—Indonesia (Java).

Ecology.—On rocks or trees near stream in tropical evergreen rain forest, at the altitude of *ca.* 141 m.

Phenology.—Flowering from April-May, fruiting from May-June.

Etymology.—The specific epithet is named after Roxburgh who collected the type specimens.

Vernacular name.—Wan Chai Dam (ว่านใจดำ)

Note.—The flowers of this plant appear earlier in summer to early rainy season.

Specimen examined.—*P. Triboun* 190- in spirit (BK); *P. Wongsuwan* 116 (KKU).

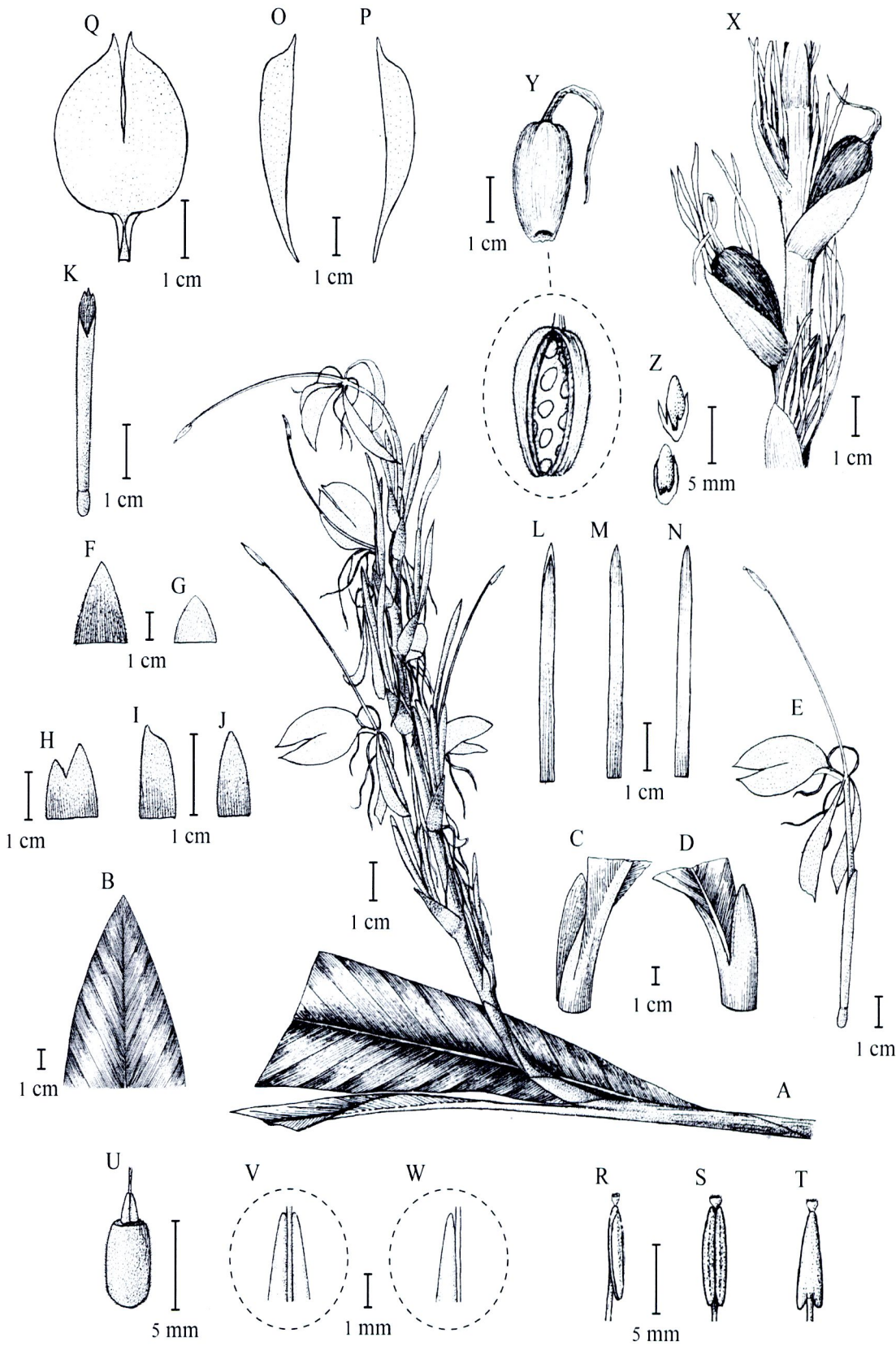


Figure 3.36

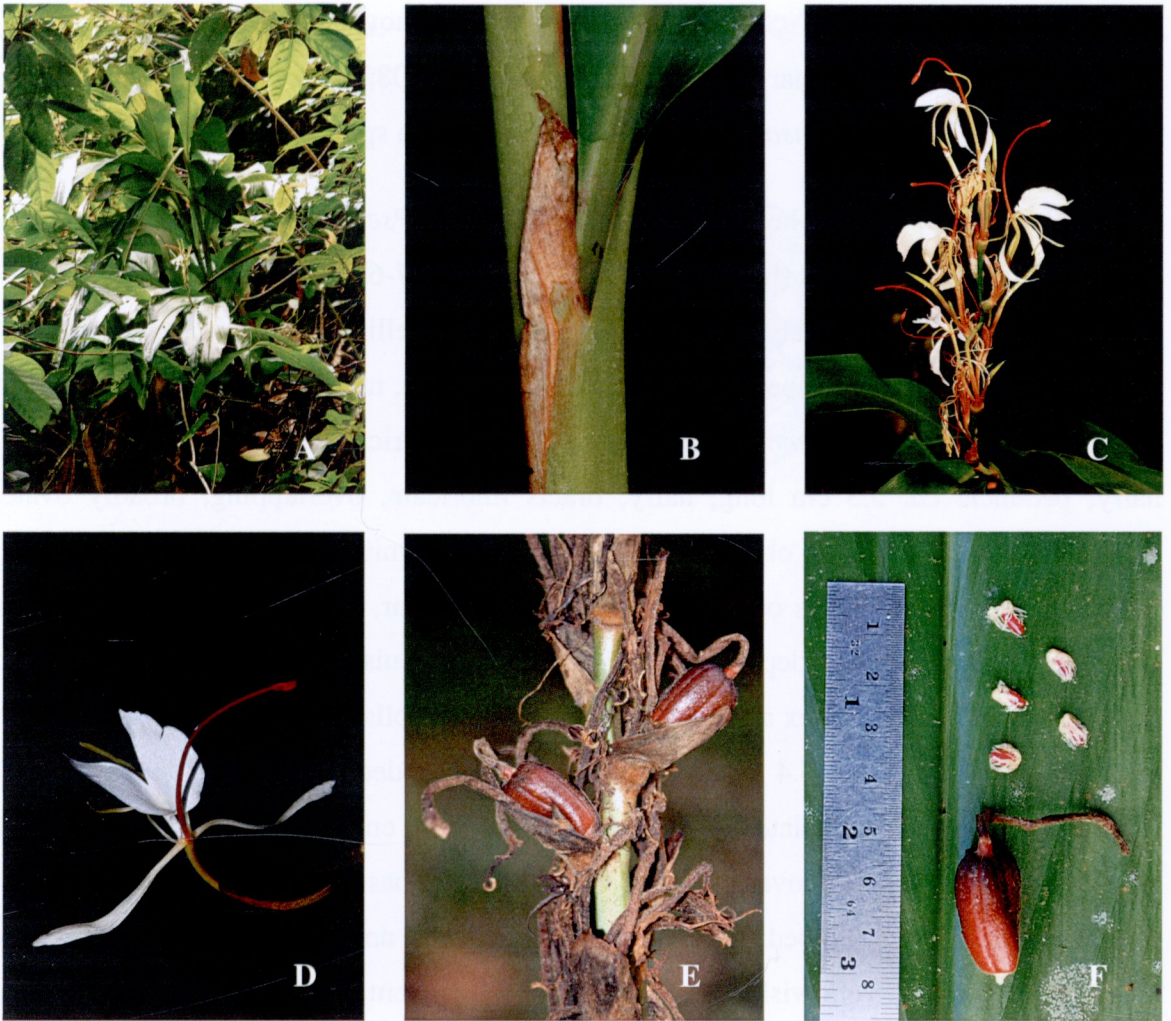


Figure 3.37 Photograph illustration of *H. roxburghii* Blume:

A. habit; B. ligule; C. inflorescence; D. close-up of flower; E. infructescence; F. fruit and seeds.

Figure 3.36 Illustrations of *H. roxburghii* Blume:

A. a flowering top with a leaf and an inflorescence; B. leaf apex; C. & D. ligule (side and rear views); E. flower; F. bract; G. first bracteole; H. second bracteole; I. third bracteole; J. fourth bracteole; K. calyx tube and ovary; L. dorsal corolla lobe; M. & N. lateral corolla lobes; O. & P. staminodes; Q. labellum; R., S. & T. anther and stigma (side, front and rear views); U. ovary and epigynous glands; V. & W. epigynous glands (rear and side views); X. infructescence; Y. fruit; Z. seeds.

16. *Hedycium siamense* Picheans. & Wongsuwan sp. nov. [Type: Thailand: Ranong, Klong Naka Wildlife Sanctuary, Mueng Chone, N 09° 19.082', E 98° 30.943', alt. 943 m, 21 November 2008; *Picheansoonthon & Wongsuwan* 73, in spirit no. 32 (holotype BKF)].

Epiphytic, perennial herb with tuberous rhizomes. *Pseudostems* 48.0-81.1 cm high, leaf sheaths green, bladeless sheaths 1-2. *Ligule* oblong, 5.7-6.4 by 2.2-2.8 cm, apex acute-acuminate, membranous, glabrous, pale greenish. *Leaves* elliptic-lanceolate, 22.2-27.5 by 9.9-10.5 cm, base cuneate, apex acute to shortly acuminate, margin slightly undulate, both surfaces glabrous. *Inflorescence* a terminal spike, cylindrical, erect, *ca.* 14.5 cm long, hairy; peduncle *ca.* 5.3 cm long, hairy; bracts imbricate, overlapping, broadly ovate, 5.5-5.6 by 3.7-4.1 cm, apex obtuse-acute, green with brownish, lower half sparsely hairy, each subtending a cincinnus of 1 flower; bracteoles tubular, 5.2-5.4 by 2.1-2.3 cm, apex acute, split on one side to a depth of 1.3-1.5 cm, hairy, greenish. *Flowers* white; calyx tube slender 4.4-4.6 cm long, apex acute or 2-dented, hairy; corolla tube 9.4-10.5 by 0.3-0.4 cm, 3-lobed, lobe linear, 4.4-5.4 by 0.4-0.5 cm, apex hooded, lower half hairy; lateral staminodes narrowly lanceolate-oblong, 3.8-4.5 by 0.5-0.6 cm, apex emarginate; labellum shorter than staminodes, obovate, 3.2-3.4 by 1.9-2.2 cm, base attenuate into a 0.8-1.2 by *ca.* 0.3 cm claw, apex bilobed; filament 4.6-5.5 cm long, anthers dorsifixed, 0.9-1.0 cm long, base divaricate, yellowish; ovary *ca.* 1.3 by 0.7-0.8 cm, brownish, hairy; epigynous glands 2, *ca.* 3 mm long, yellowish; stigma densely ciliate, greenish. *Fruits* broadly ellipsoid to broadly ovoid, (3.1-)3.3-4.4 by (1.9-)2.2-2.8 cm, trilobed, hairy, greenish; seed numerous, oblong *ca.* 5 by 2-3 mm, reddish aril, crowned with persistent calyx.

Thailand.—NORTHERN: [Tak, Mae Sot], PENINSULAR [Ranong, Khlong Naka Wildlife Sanctuary, Mueng Chone].

Distribution.—Peninsular Malaysia, Indonesia (Sumatra).

Ecology.—Tropical evergreen rain forest, at the altitude of *ca.* 943 m.

Phenology.—Flowering in November, fruiting from November-December.

Etymology.—The specific epithet is referred to Siam.

Vernacular name.—

Note.—This species can be recognized by cylindrical imbricate bract, strictly 1-flowered bract and hairy ovary.

Specimen examined.—*C. Maknoi* 51-inspirit (QBG); *P. Wongsuwan* 130, 49-inspirit, 57-inspirit (KKU).



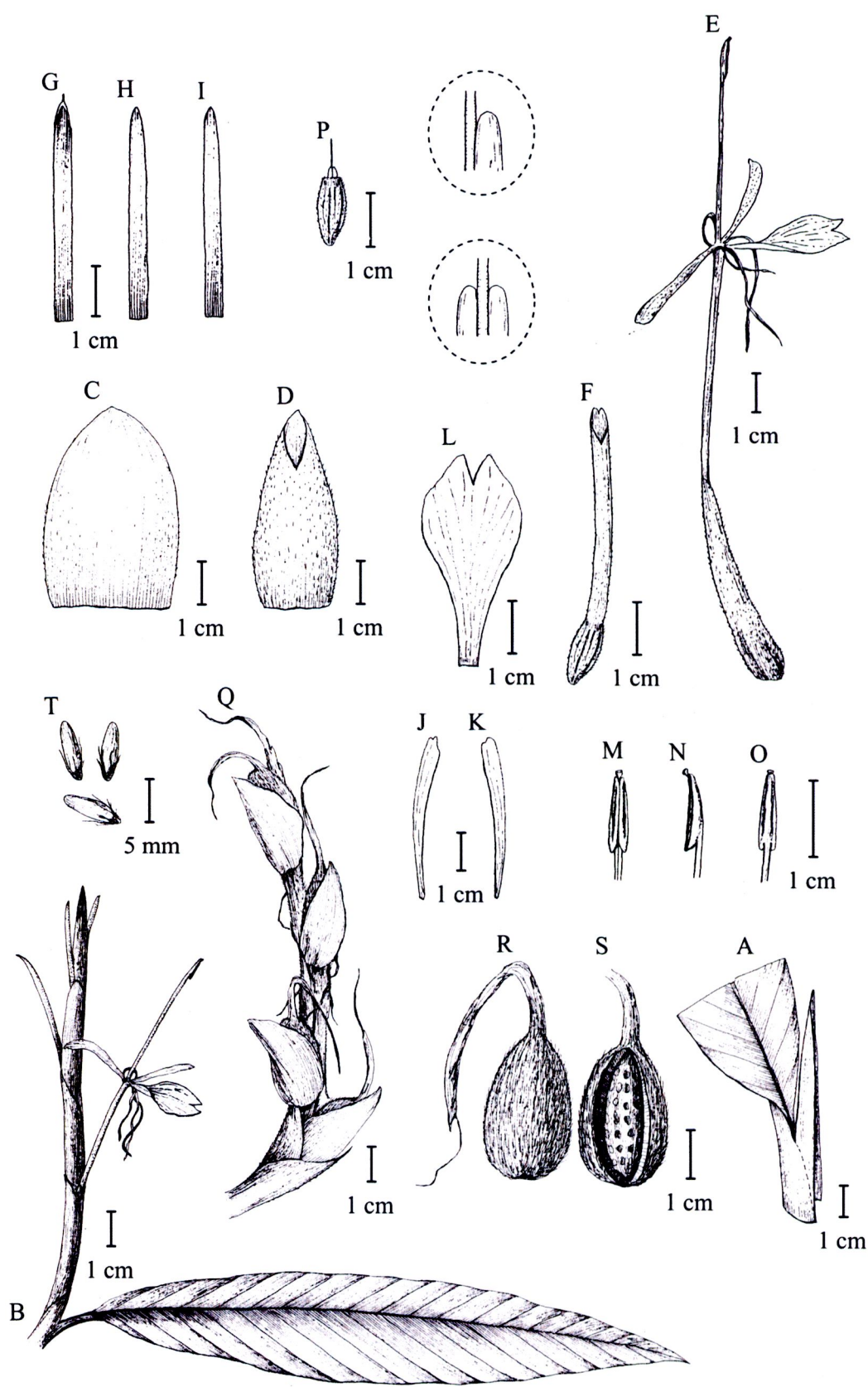


Figure 3.38



Figure 3.39 Photograph illustration of *H. siamense* Picheans. & Wongsuwan:
 A. habit; B. ligules; C. inflorescence; D. close-up of flower;
 E. infructescence; F. fruit red arillate.

Figure 3.38 Illustrations of *H. siamense* Picheans. & Wongsuwan:

A. part of a leaf with a ligule; B. a leaf and an inflorescence; C. bract;
 D. bracteole; E. bract and a flower; F. calyx tube and ovary; G. dorsal corolla
 lobe; H. & I. lateral corolla lobes; J. & K. staminodes; L. labellum;
 M., N. & O. anther and stigma (front, side and rear views); P. ovary and
 epigynous glands; Q. infructescence; R. fruit; S. a partially dehiscent fruit
 with seeds inside; T. seeds.

17. *Hedychium speciosum* Wall. in Roxb., Fl. Ind. 1: 13. 1820 [Type: India: Silhet, Gomez; in Wallich Cat. no. 6550 (lectotype K)]; in Pl. As. Rar. 3: 51. t. 285. 1832; Baker in Hook.f., Fl. Br. Ind. 6: 231. 1894; K. Schum. in Engl., Pflanzenr. 4(46): 54. 1904.—*H. gardnerianum* Wall. in Kew J. Bot. 5: 369. 1853.—*H. gardnerianum* var. *bitoran* Monogr. 25. 1862.—*Gamochilus speciosus* (Wall.) Lestib. in Ann. Sc. Nat. 2. ser. 15: 341. 1841.—*Gandasulium speciosus* (Wall.) Kuntze, Revis. Gen. Pl. 2: 690. 1891.

Terrestrial, perennial herb. *Pseudostems* 1.1-1.5 m high, bladeless sheaths 2-3. *Ligule* oblong, 2.4-2.8 by 1.9-2.3 cm, apex obtuse-acute, membranous, hairy, reddish. *Leaves* sessile or petiolate 1.5-2.0 cm; blade lanceolate-oblong, 35.7-41.9 by 10.9-11.4 cm, base cuneate, apex acuminate, margin slightly undulate, upper surface glabrous, lower surface hairy along midrib. *Inflorescence* a terminal spike, erect, 6.6-9.8 cm long; peduncle 3.4-3.7 cm long, glabrous; bracts dented, folded, oblong, 2.5-2.8 by 0.8-1.0 cm, apex acute, pubescent, greenish, each subtending a cincinnus of 1-2 flowers; bracteole oblong, 1.2-1.5 by ca. 0.8 cm, apex acute, membranous, pubescent, second bracteole oblong, 1.0-1.2 by ca. 0.4 cm, apex acute, membranous, pubescent. *Flowers* white; calyx tubular, 3.1-3.2 by 0.3-0.4 cm, apex acute to 2-3-dented, pubescent; corolla tube slender, ca. 4.4 by 0.3 cm, 3-lobed, lobes linear 4.4-4.7 by 0.2-0.3 cm, apex hooded, yellowish; lateral staminodes oblanceolate, 3.6-3.7 by ca. 0.5 cm; labellum elliptic, 3.7-3.9 by 1.1-1.3 cm, base attenuate into a 7-1.0 by ca. 0.2 cm claw, apex bifid ca. 9 mm; filament 6.0-6.3 cm long, yellowish; anther dorsifixed, 1.4-1.6 by 0.3-0.4 cm, base divaricate, yellow; ovary 3-4 by ca. 2 mm, 3-loculed, placentation axile, hairy; epigynous glands 2, slender, ca. 2 by 1-2 mm yellowish; stigma densely ciliate, green. *Fruits* subglobose, 1.1-1.3 by ca. 1.2 cm, glabrous, green. *Seeds* numerous, ellipsoid, 3-4 by ca. 2 mm, aril reddish.

Thailand.—NORTHERN [Chiang Mai, Doi Suthep-Pui; Nan, Doi Phu Ka].

Distribution.—India (Silhet).

Ecology.—Lower montane scrub, at the altitude of 1,000-1,750 m.

Phenology.—Flowering from July-August, fruiting from August-September.

Etymology.—The plant name is referred to showy flowers.

Vernacular name.—

Note.—*H. speciosum* is recognized by its 1-2-flowered bracts, hairy calyx tubes, elliptic labellum with emarginate-bifid apex, filament twice as long as the labellum and ovary hairy.

Specimen examined.—*P. Srisanga*, *S. Watthana* & *W. La-ongsri* 870 (QBG); *P. Wongsuwan* 103 (KKU), 115 (KKU).

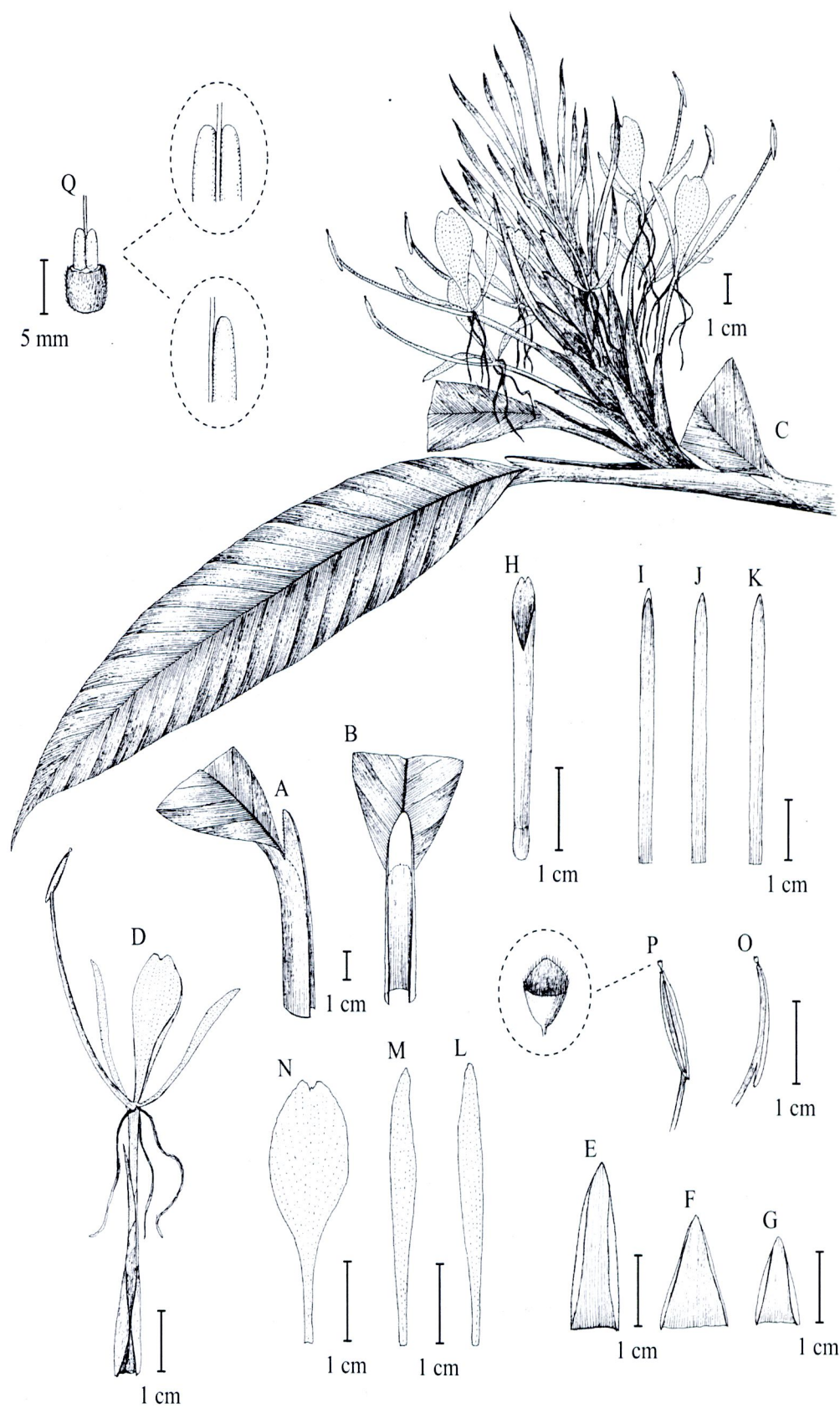


Figure 3.40



Figure 3.41 Photograph illustration of *H. speciosum* Wall.:

A. habit; B. ligule; C. inflorescence; D. & E. close-up of flowers; F. infructescence.

Figure 3.40 Illustrations of *H. speciosum* Wall.:

A. & B. part of a leaf with a ligule (side and front view); C. leaves and an inflorescence; D. a flower with folded bract; E. bract; F. first bracteole; G. second bracteole; H. calyx tube and ovary; I. dorsal corolla lobe; J. & K. lateral corolla lobe; L. & M. staminodes; N. labellum; O. & P. anther and stigma (side and front view); Q. ovary, epigynous glands and part of a style.

18. *Hedychium spicatum* Sm. in A. Ress Cycl. 17: 8. 1811 [Type: Nepal; *Wallich* s.n.]; Monandr. Pl. t. 48. 1828; Wall. in Kew J. Bot. 5: 328. 1853; Horan., Monogr.: 24. 1862; Baker. in Hook.f., Fl. Br. Ind. 6: 227. 1892; K. Schum. in Engl., Pflanzenr. 4(46): 50. 1904; T.L. Wu & K. Larsen in Z.L. Wu & P.H. Raven, Fl. China 24: 54. 2000.— *H. roxburghii* Sieb. ex Lindl. in J. Hort. Soc. 7: 281. 1852;—*H. sieboldii* Wall. in Kew J. Bot. 5: 371. 1853;—*H. album* Buch.-Ham. ex Wall. in Kew J. Bot. 5: 328. 1853;—*H. flavescens* Lodd. ex Lindl., J. Hort. Soc. London, 7: 281. 1852;—*H. tavoyanum* Horan., Prodr. Monogr. Scitam.: 26. 1862.—*Gandasulium sieboldii* (Wall.) Kuntze, Revis. Gen. Pl. 2: 690. 1891;—*G. simile* (Blume) Kuntze, Revis. Gen. Pl. 2: 690. 1891.

KEY TO THE VARIETIES

- | | |
|---|------------------------|
| 1. Inflorescences densely many-flowered | var. spicatum |
| 1. Inflorescences laxly few-flowered | var. acuminatum |

var. **spicatum**

Terrestrial, perennial herb. Pseudostems 48.6-166.3 cm high, bladeless sheaths 2-4. *Ligule* oblong, 1.0-2.2 by 2.2-2.8 cm, membranous, pubescent to sparsely pubescent, apex emarginate or acute. *Leaves* elliptic-oblong, 28.1-46.4 by 9.4-12.2 cm, base cuneate, apex acute-acuminate, margin slightly undulate, uppersurface glabrous, lower surface glabrous or sparsely hairy,. Inflorescence a terminal spike, erect, 23.1-34.2 cm long; peduncle 6.6-12.2 cm long, glabrous; bracts lax, folded, greenish, lanceolate-oblong, 2.4-4.6 by 1.0-1.9 cm, apex acute, glabrous or sparsely hairy, each subtending a cincinnus of 1 flower; bracteole tubular, (1.3-)2.1-2.9 by 0.4-0.6 cm, apex acute, membranous, glabrous or sparsely hairy. *Flowers* white to pale yellow, fragrant; calyx tubular, (2.8-)3.1-4.9 by 0.4-0.5 cm, apex acute to 3-lobed, glabrous or sparsely hairy; corolla tube slender, 5.2-7.3(-8.1) by 0.2-0.3 cm, 3-lobed, lobes linear, 3.5-4.8 by 0.3-0.6 cm apex hooded, yellowish; lateral staminodes oblanceolate-oblong, (4.6-)5.4-5.9 by 0.3-0.6(-0.7) cm, base attenuate into a 0.9-1.2 by 0.2-0.3 cm claw; labellum obovate, 5.0-5.3(-6.0) by (1.9-)3.0-3.1 cm, base attenuate into a 0.9-2.0 by 0.3-0.4 cm claw, apex bilobed, each lobe elliptic, white with pale salmon red patch at base; filament 1.9-2.4 cm long, salmon red; anther dorsifixed, 1.2-1.8 by 0.3-0.4 cm base divaricate, salmon red; ovary 4-5 by

3-5 mm, 3-loculed, placentation axile, hairy; epigynous glands 2, slender, *ca.* 2 by 1 mm, yellowish; stigma densely ciliate, green. *Fruits* ellipsoid-oblong, 1.8-2.9 by 1.3-1.9 cm, hairy, greenish. *Seeds* numerous, ellipsoid-orbicular, 4-5 by *ca.* 3 mm, reddish orange.

Thailand.—NORTHERN [Mae Hong Son, Pai, Doi Kiew Lom, Doi Phak Kood; Chiang Mai, Doi Chiang Dao; Chiang Rai, Doi Hua Chang].

Distribution.—Nepal, Bhutan, India (Sikkim; Nagaland, Zunheboto, Naltoqa), China (Guizhou, Sichuan, Xizang, Yunnan) and Myanmar.

Ecology.—Upper montane scrub or lower montane scrub at the altitude of 900-2,084 m.

Phenology.—Flowering from July-August, fruiting from September-November.

Etymology.—The specific epithet is referred to spicate inflorescence.

Vernacular name.—

Note.—*H. spicatum* has distinctive filament shorter than the labellum, white flower with pale salmon red patch at base, obovate labellum with deeply divided apex.

Specimen examined.—*P. Wongsuwan* 90 (KKU), 100 (KKU), 109 (KKU), 129 (KKU), 131 (KKU), 41-in spirit (KKU), 43-in spirit (KKU).

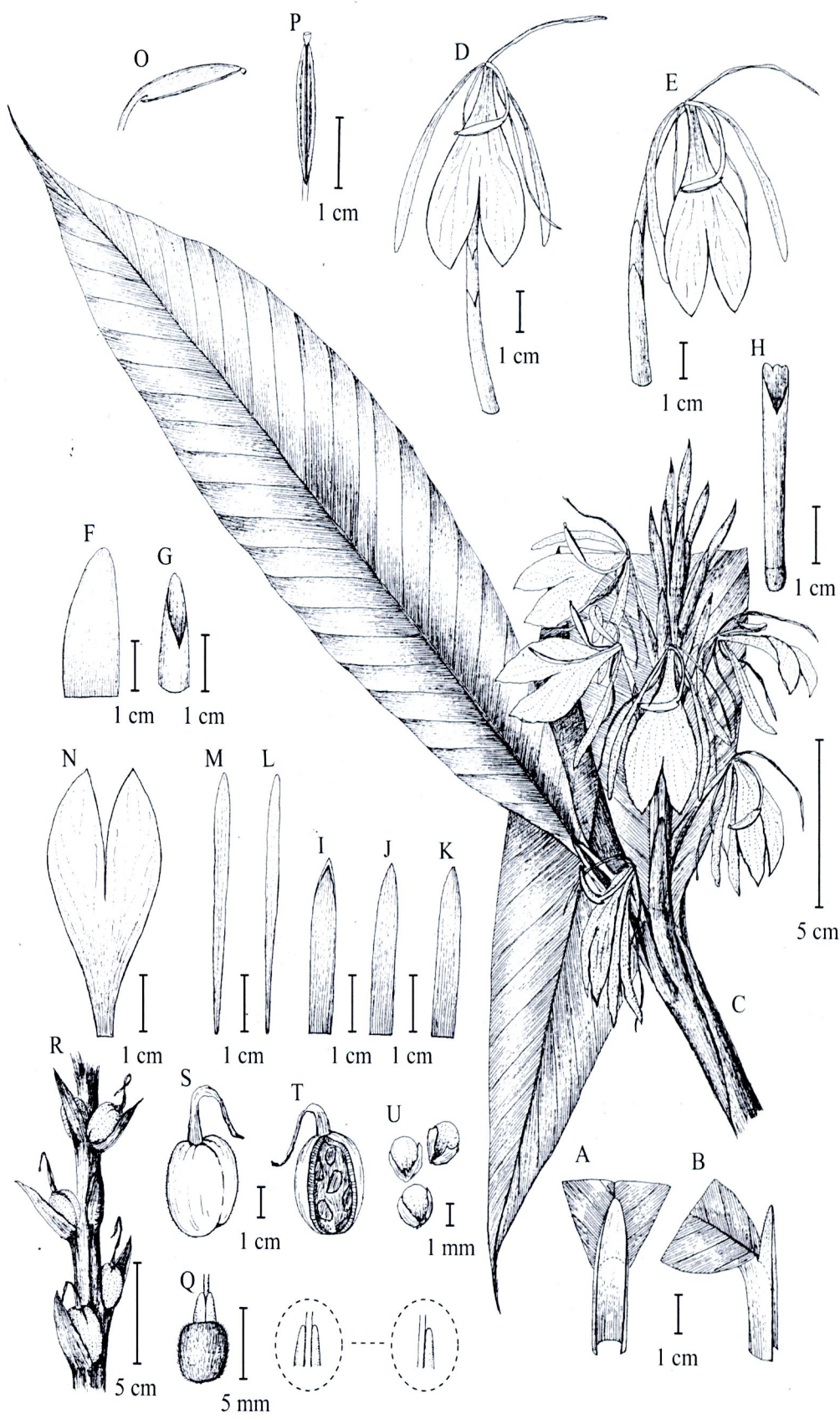


Figure 3.42

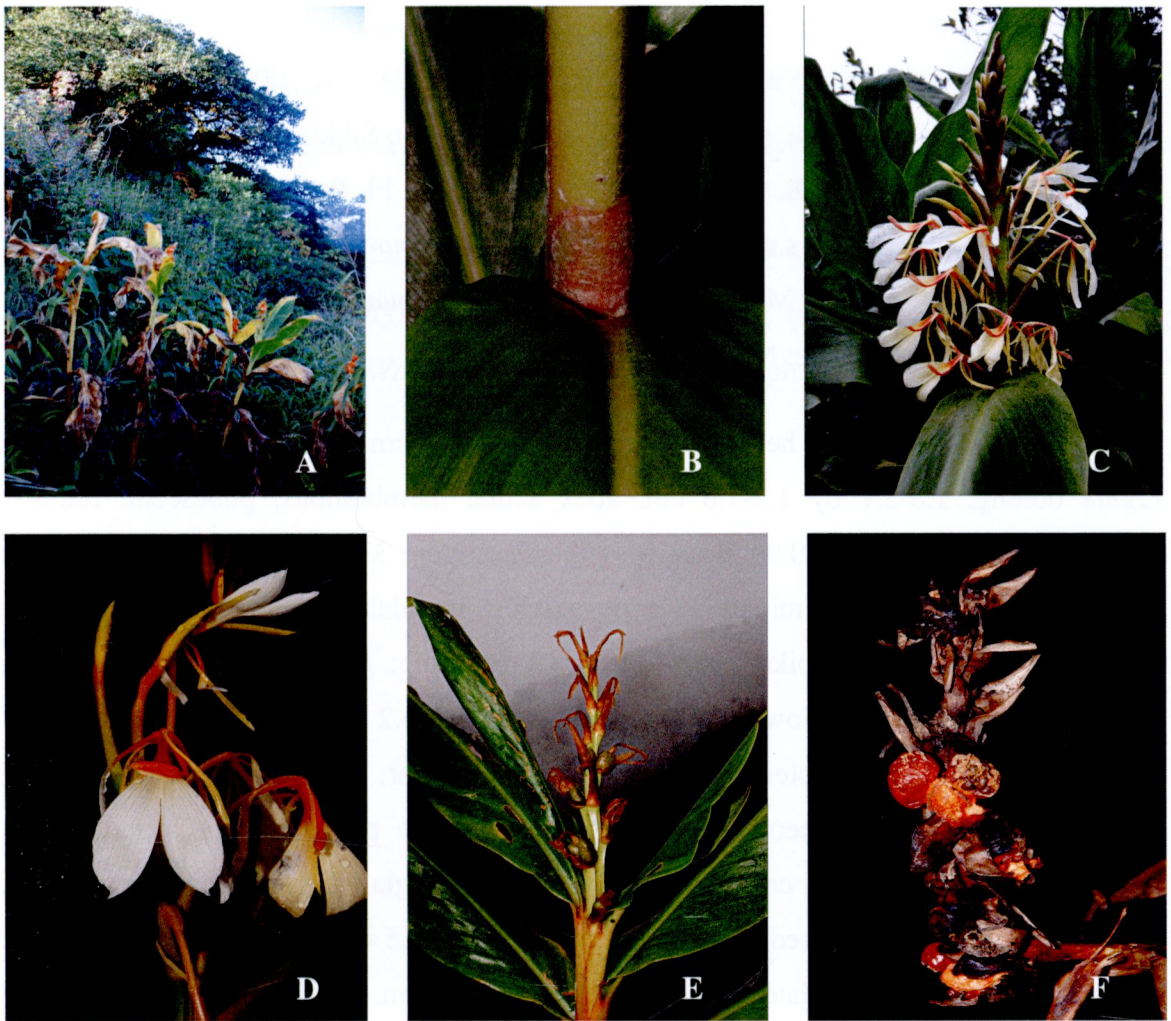


Figure 3.43 Photograph illustration of *H. spicatum* Sm. var. *spicatum* Sm.:

A. habit; B. ligule; C. inflorescence; D. close-up of flower; E. infructescence; F. infructescence with dehiscent fruit.

Figure 3.42 Illustrations of *H. spicatum* Sm. var. *spicatum* Sm.:

A. & B. part of a leaf with a ligule (front and side views); C. leaves and an inflorescence; D. & E. a flower with bract and calyx tube; F. bract; G. tubular bracteole; H. calyx tube and ovary; I. dorsal corolla lobe; J. & K. lateral corolla lobe; L. & M. staminodes; N. labellum; O. & P. anther and stigma (side and front views); Q. ovary and epigynous glands; R. infructescence; S. fruit; T. a partially dehiscent fruit with seeds inside; U. seeds.

var. **acuminatum** (Roscoe) Wall. in Hooker's J. Bot. Kew Gard. Misc. 5: 328. 1853; T.L. Wu & K. Larsen in Z.L. Wu & P.H. Raven, Fl. China 24: 54. 2000.—*H. acuminatum* Roscoe, Monandr. Pl. Scitam. t. 47. 1824 [Type: Kumnon to Sikkim, alt. ca. 2300 m];—*H. spicatum* var. *hasianum* C.B. Clarke ex Baker. in Hook.f., Fl. Br. Ind. 6: 227. 1894 [Type: India: Khasia Hills; Clarke s.n.];—*H. spicatum* var. *trilobum* (Wall. ex Roscoe) Wall. in Hooker's J. Bot. Kew Gard. Misc. 5: 328. 1853;—*H. trilobum* Wall. ex Roscoe, Monandr. Pl. Scitam. t. 48. 1826 [Type: Nepal; Wallich s.n.].

Epiphytic, perennial herb. *Pseudostems* 63.4-86.6 cm high, bladeless sheaths 2-4. *Ligule* oblong, 1.8-2.1 by 1.2-1.6 cm, apex acute, membranous, pubescent, reddish. *Leaves* sessile or petiolate, 0.9-1.3 cm long; blade elliptic, 33.1-34.3 by 8.3-8.6 cm, base oblique-cuneate, apex acuminate, margin slightly undulate, both surfaces glabrous. *Inflorescence* a terminal spike, erect, 11.6-18.2 cm long; peduncle 5.4-10.6 cm long, glabrous; bracts lax, few-flowered, folded, oblong, 1.7-4.2 by 1.1-1.7 cm, apex acute, glabrous, greenish, each subtending a cincinnus of 1 flower; bracteole oblong, 1.3-2.9 by 0.4-0.6 cm, apex acute, membranous. *Flowers* white to pale yellow, fragrant; calyx tubular, 3.1-5.8 by 0.4-0.5 cm, apex acute to 3-lobed, glabrous; corolla tube slender, 5.2-8.6 by 0.2-0.3 cm, 3-lobed, lobes linear 4-5.6 by 0.4-0.5 cm, apex hooded, yellowish; lateral staminodes oblanceolate-linear, 3.8-4.8 by 0.4-0.5 cm, base attenuate into a 1.6-1.9 by 0.2-0.3 cm claw; labellum obovate-elliptic, 2.9-3.5 by 1.5-1.5 cm, base attenuate into a 1.1-1.3 by 0.3-0.4 cm claw, apex deeply divided, 6-7 mm, white with pale salmon red patch at base; filament 3.3-4.1 cm long, salmon red; anther dorsifixed, 1.5-1.6 by 0.3-0.4 cm, base divaricate, salmon red; ovary 2-4 by 2-3 mm, 3-loculed, placentation axile, glabrous; epigynous glands 2, slender, 2-3 by ca. 0.5 mm yellowish; stigma densely ciliate, green. *Fruits* suborbicular, 1.2-1.6 by 1.2-1.5 cm, glabrous, greenish. *Seeds* numerus, ellipsoid-orbicular, 4-5 by ca. 3 mm, reddish- orange.

Thailand.—NORTHERN [Mae Hong Son, Pai, Pang Mapha; Chiang Mai, Doi Suthep-Pui; Nan, Doi Phu Ka, Doi Phu Wae].

Distribution.—Nepal, Bhutan, India (Sikkim), China (Xizang, Yunnan).

Ecology.—Lower montane scrub, at the altitude of 900-1,000 m.

Phenology.—Flowering from August-September.

Etymology.—The variety epithet is referred to acute apex the labellum.

Vernacular name.—

Note.—This species is similar to *H. spicatum* var. *spicatum* but differs in lax, few flowers and epiphytic habit.

Specimen examined.—*P. Srisanga* 2117 (QBG); *W. Nanakorn et. al.* 9657 (QBG); *P. Srisanga & C. Maknoi* 2000 (QBG); *M. Bhaumik* 2851 (CAL); *Brandis* 3371 (CAL); *J.S. Gamble* 699 (CAL); *P. Wongsuwan* 99 (KKU), 20-in spirit (KKU).

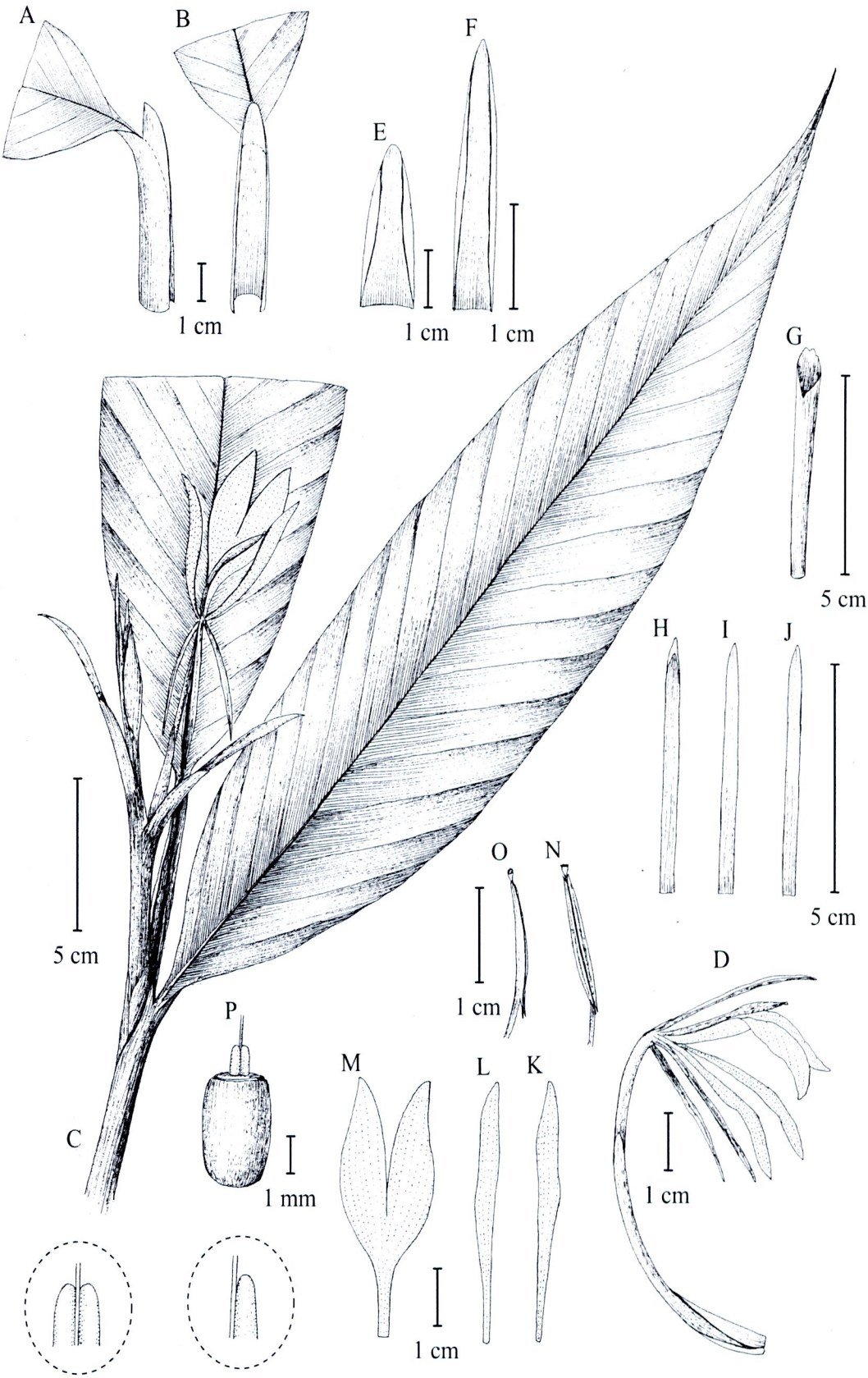


Figure 3.44



Figure 3.45 Photograph illustration of *H. spicatum* Sm. var. *acuminatum* (Roscoe) Wall.:
A. flowering plant in the habit; B. ligule; C. & D. inflorescence;
E. & F. close-up of flower.

Figure 3.44 Illustrations of *H. spicatum* Sm. var. *acuminatum* (Roscoe) Wall.:
A. & B. part of leaf with a ligule (side and front view); C. leaves and an
inflorescence; D. a flower with bract and calyx; E. bract; F. bracteoles;
G. calyx tube; H. dorsal corolla lobe; I.& J. lateral corolla lobe;
K. & L. staminodes; M. labellum; N. & O. anther and stigma (front and side
view); P. ovary, epigynous glands and part of a style.

19. *Hedychium stenopetalum* Lodd., Bot. Cab. 20: t. 1902. 1833 ; Baker in Hook.f., Fl. Br. Ind. 6: 231. 1894; K. Schum. in Engl., Pflanzenr. 4(46): 58. 1904.—*H. barbatum* Wall. in Kew J. Bot. 5: 373. 1853.—*H. elatum* Horan. Monogr. 25. 1862.—*H. coccineum* Wall. in Kew J., l.c.—*H. elatum* R. Br. var. *oryale* Horan., Monogr 25. 1862.

Terrestrial, perennial herb. *Pseudostems* 0.7-2.5 m high, leaf sheaths greenish, bladeless sheaths 2-4. *Ligule* oblong, 4.3-5.9 by 5.0-5.8 cm, apex rounded-emarginate, membranous, hairy, greenish or reddish. *Leaves* petiolate, blade lanceolate-oblong, 36.2-48.3 by 24.1-32.4 cm, base cuneate, apex acuminate to caudate, margin entire to slightly undulate, upper surface glabrous, lower surface hairy. *Inflorescence* a terminal spike, erect, 36.7-52.3 cm long, hairy; peduncle 12.5-21.1 cm long, hairy; bracts lax, folded, green, lanceolate to obovate, 6.0-6.9 by 2.3-3.0 cm, hairy, each subtending a cincinnus of (2-3)-7-11 flowers, apex acute; first bracteole, triangular, 4.9-5.3 by 1.7-2.2 cm, apex acute, membranous, pubescent; second bracteole triangular, 3.5-3.8 by 1.3-1.5 cm, apex acute, membranous, pubescent; third bracteole triangular, 2.7-2.9 by 1.5-1.7 cm, apex acute, membranous, pubescent; fourth bracteole triangular, 2.7-2.8 by 1.4-1.6 cm, apex acute, membranous pubescent; fifth bracteole triangular, 2.2-2.8 by 1.3-1.4 cm, apex acute, membranous pubescent; sixth bracteole triangular, 2.2-2.7 by 0.8-0.9 cm, apex acute, membranous pubescent; seventh bracteole triangular, 1.9-2.5 by 0.7-0.9 cm, apex acute, membranous pubescent. *Flowers* white; calyx tubular, 6.0-6.2 by 0.3-0.4 cm, pubescent, apex 3-dent; corolla tube slender, 6.2-6.4 by *ca.* 0.3 cm, 3-lobed, lobes linear, apex hooded, thorn-liked, white, 5.4-5.6 by 0.4-0.5 cm; lateral staminodes oblanceolate-oblong, 3.2-4.2 by 0.5-1.0 cm; labellum sub-orbicular to orbicular, 3.0-4.2 by 2.5-3.4 cm, base attenuate into a 0.7-1.4 by 0.4-0.6 cm claw, white with pale greenish patch at base, apex 2-cleft, 1.3-1.5 cm; filament 4.9-7.4 cm long, yellowish; anther dorsified, 1.2-1.5 by 0.2-0.3 cm base divaricate, yellowish; ovary pubescent, 4-5 by 6-8 mm, 3-loculed, placentation axile, epigynous glands 2, slender, 5-6 by *ca.* 1 mm, yellowish; stigma densely ciliate, green. *Fruits* ovoid to oblong, 3.2-3.9 by 1.4-1.8 cm, green, hairy. *Seeds* numerous, ellipsoid to sub-globose, 5-6 by 4-5 mm, reddish orange.

Thailand.—NORTHERN [Mae Hong Son, Pai, Pang Mapha; Chiang Mai, Doi Suthep-Pui, Doi Angkhang, Doi Chiang Dao, Doi Pahom Pok, Doi Inthanon].

Distribution.—Nepal, Bhutan, India (Assam), China (Yunnan), Myanmar, Vietnam.

Ecology.—Lower montane scrub or lower montane pine-oak forest, at the altitude of 1,000-1,500 m.

Phenology.—Flowering from August-September, fruiting from September-November.

Etymology.—The specific epithet is referred to narrow petal.

Vernacular name.—Kaw Ya-ea (คอกยาอี), (Mae Hong Son).

Note.—This plant is one of the *Hedychium* species which can grow well up to 1.5-2.5 m high. The inflorescence is exceptionally long up to 52.3 cm with a hairy rachis and 7-11 white flowers per bract. Young inflorescence is edible as vegetable in upcountry.

Specimen examined.—*K. Larsen, S.S. Larsen, C. Tange & D. Sookchaloem* 46651 (BKF); *J.F. Maxwell* 02-279 (BKF); *C. Niyomdham* 3146 (BKF); *S. Mitsuta et. al.* 46486 (BKF); *P. Sirirugsa* 1177 (PSU); *C. Niyomdham* 914 (K); *A.F.G. Kerr* 2632 (K), 2699 (K); *H.B.G. Garrett* 696 (K); *T. Santisuk* 1525 (K); *J.E. Vidal* 5287 (P); *I.H. Burkill* 37216 (CAL); *J. Joseph* 48802 (CAL); *A.S. Rao* 48274 (CAL); *P. Wongsuwan* 48 (KKU), 78 (KKU), 80 (KKU), 96 (KKU), 114 (KKU), 36-inspirit (KKU), 40-inspirit (KKU), 47-inspirit (KKU).

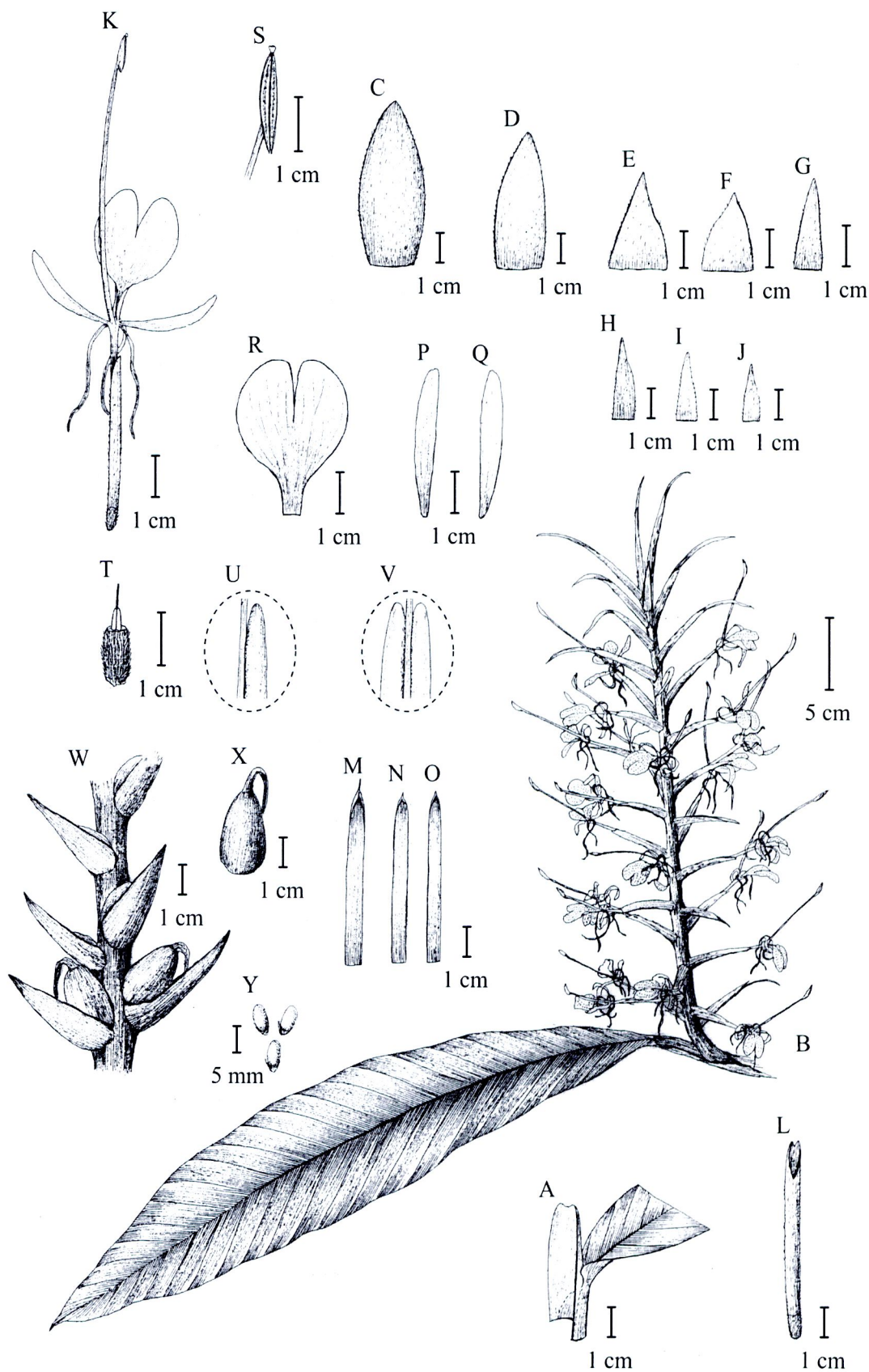


Figure 3.46



Figure 3.47 Photograph illustration of *H. stenopetalum* Lodd.:

A. habit; B. ligule; C. & D. inflorescence; E. close-up of flowers; F. infructescence.

Figure 3.46 Illustrations of *H. stenopetalum* Lodd.:

A. part of a leaf with a ligule; B. leaf and an inflorescence; C. bract; D. first bracteole; E. second bracteole; third bracteole; G. fourth bracteole; H. fifth bracteole; I. sixth fifth bracteole; J. seventh bracteole; K. a flower; L. calyx tube and ovary; M. dorsal corolla lobe; N. & O. lateral corolla lobes; P. & Q. staminodes; R. labellum; S. anther and stigma; T. ovary and epigynous glands; U. & V. epigynous glands (side and front views); W. infructescence; X. fruit; Y. seeds.

20. *Hedychium tomentosum* Sirirugsa & K. Larsen, Nord. J. Bot. 15: 303, Fig. 1 E-I. 1995 [Type: Thailand: Chiang Mai, Doi Chiang Dao; *Beusekom & Phengkhai* 1348 (holotype C)].

Epilithic, perennial herb. *Pseudostems* 15.0-58.4 cm high, leaf sheaths red, bladeless sheaths 2-3, tomentose. *Ligule* oblong, 1.4-2.2 by 1.2-3.1 cm, apex rounded, membranous, tomentose, reddish. *Leaves* sessile, blade elliptic-broadly elliptic, 18.9-32.8 by 9.2-15.1 cm, base cuneate-obtuse, apex acute-acuminate, margin entire-slightly undulate, upper surface glabrous, lower surface tomentose. *Inflorescence* a terminal spike, erect, 9.4-16.2 cm long, glabrous-pubescent; peduncle 5.2-6.8 cm long, glabrous-pubescent; bracts dense, folded, reddish or greenish, lanceolate-oblong, 2.3-2.9 by *ca.* 0.8 cm, apex acute-rounded, tomentose, each subtending a cincinnus of 1 flower; bracteole lanceolate-oblong, 1.3-1.7 by 0.7-0.9 cm, apex acute, tomentose, greenish or reddish. *Flowers* white to pale yellow, fragrant; calyx tubular, 3.2-3.7 by 0.3-0.4 cm, apex 2-3-dented, tomentose; corolla tube slender, 7.2-7.9 by 0.2-0.3 cm, 3-lobed, lobes linear, 3.0-3.2 by 0.4-0.5 cm, apex hooded, white-yellowish, sometime reddish; lateral staminodes lanceolate-oblong, 2.8-3.3 by 0.4-0.5 cm; labellum elliptic-lanceolate, 2.9-3.1 by 1.1-1.3 cm, apex deeply divided, margin entire to slightly undulate, white-yellowish; filament 3.0-3.2 cm long, white-pale yellow; anther dorsifixed, 7-8 by 3-4 mm, base divaricate, yellowish; ovary 4-5 by 2-3 mm, 3-loculed, placentation axile, tomentose; epigynous glands 2, *ca.* 3 mm long, yellowish; stigma *ca.* 1 by 1 mm, densely ciliate, green. *Fruits* ovoid-oblong, 2.1-2.5 by 1.5-1.8 cm, hairy, scarlet. *Seeds* numerous, ellipsoid, 3-4 by *ca.* 2 mm, aril white.

Thailand.—NORTHERN [Chiang Mai, Doi Chiang Dao].

Distribution.—Endemic to Thailand.

Ecology.—Lower montane oak forest or upper montane scrub at the altitude of 1,500-2,084 m.

Phenology.—Flowering from June-July, fruiting from July-August.

Etymology.—The specific epithet is referred to the tomentose plant.

Vernacular name.—Ta Hoen Chiang Dao (ตาเหินเชียงดาว).

Note.— This plant can be easily recognized by tomentose lower leaf surface, elliptic-lanceolate labellum with deeply divided apex, entire to slightly undulate margin and white-yellowish flower.

Specimen examined.—*P. Suksathan* 390 (QBG), 1129(QBG); *A.F.G. Kerr* 5597 (K); *C.F. van Beusekom & C. Pheng Klai* 1348 (K); *P. Wongsuwan* 108 (KKU), 127 (KKU), 50-in spirit (KKU), 51-in spirit (KKU).

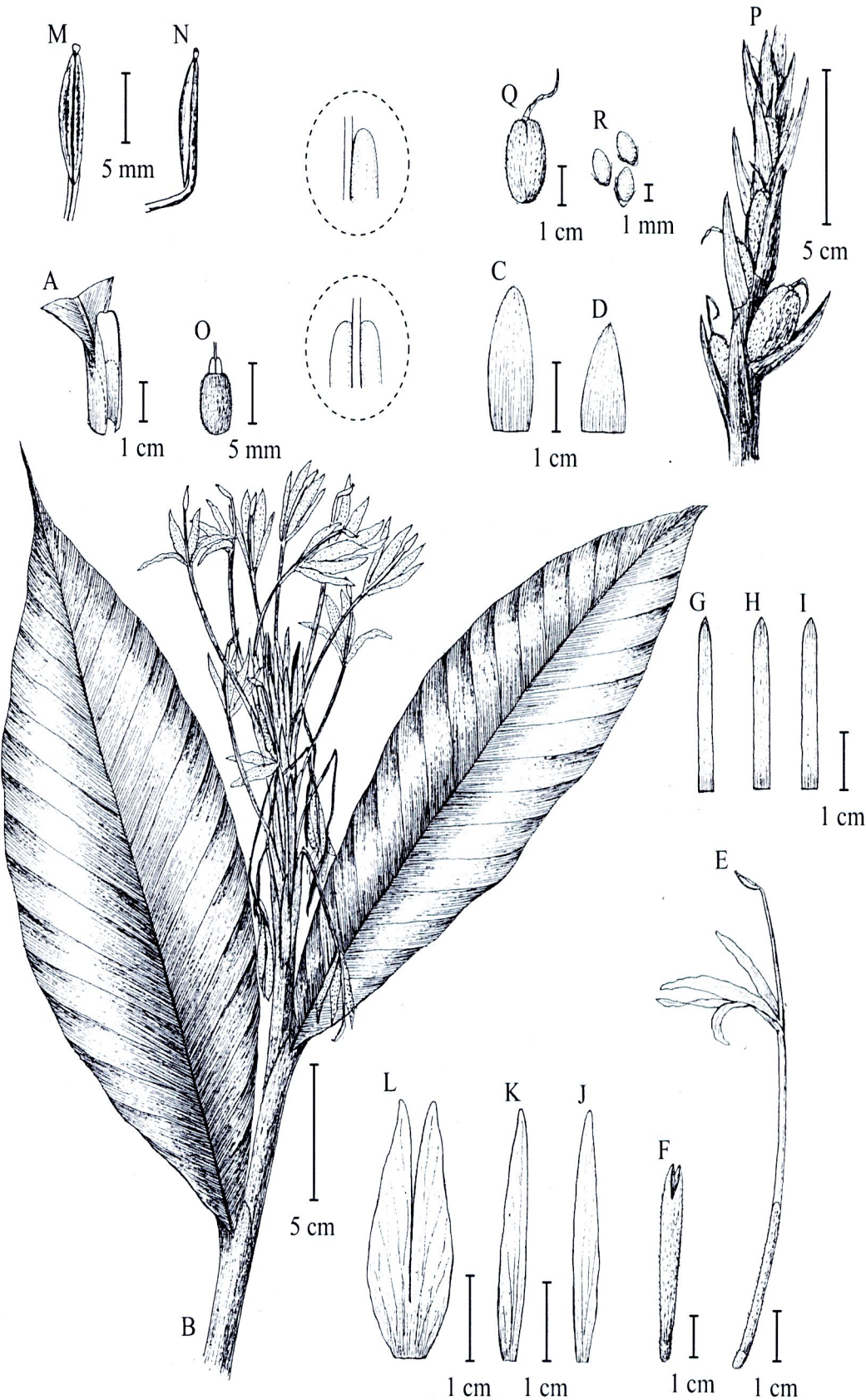


Figure 3.48



Figure 3.49 Photograph illustration of *H. tomentosum* Siriruga & K. Larsen:

A. habit; B. ligule; C. inflorescence; D. close-up of flower; E. infructescence; F. fruit.

Figure 3.48 Illustrations of *H. tomentosum* Siriruga & K. Larsen:

A. part of a leaf with a ligule; B. leaves and an inflorescence; C. bract; D. bracteoles; E. a flower with calyx and ovary; F. calyx tube and ovary; G. dorsal corolla lobe; H. & I. lateral corolla lobe; J. & K. staminodes; L. labellum; M. & N. anther and stigma (front and side views); O. ovary, epigynous glands and part of a style; P. infructescence; Q. fruit; R. seeds.

21. *Hedychium villosum* Wall. in Roxb., Fl. Ind. 1: 12. 1820; Monandr. Pl. 6: 54. 1828; Wall. in Kew J. Bot. 5: 329. 1853; Horan., Monogr.: 25. 1862; Baker in Hook.f., Fl. Br. Ind. 6: 228. 1894; K. Schum. in Engl., Pflanzenr. 4(46): 51. 1904; Gagnep. in Lecomte, Fl. Gén. I.-C. 6: 74. 1908; T.L. Wu & K. Larsen in Z.L. Wu & PH. Raven, Fl. China 24: 375. 2000.

Terrestrial, epilithic or epiphytic, perennial herb. *Pseudostems* 24.1-143.0 cm high, leaf sheaths red, bladeless sheaths 3-5. *Ligule* oblong, 3.3-8.3 by 1.1-1.8 cm, apex acute, membranous, pubescent, reddish. *Leaves* sessile or shortly petiolate, 4-7 mm long; blade lanceolate-oblong, 13.8-37.5 by 4.2-8.8 cm, base cuneate-oblique, apex acute, margin entire to slightly undulate, upper surface glabrous, lower surface pubescent along midrib. *Inflorescence* a terminal spike, erect, 8.3-28.3 cm long; peduncle 1.8-2.6 cm long, hairy; bracts lax, folded, elliptic, 4.6-6.4 by 1.5-1.9 cm, apex acute, pubescent, reddish, each subtending a cincinnus of 1-3 flowers; first bracteole ovate-broadly ovate, 2.6-4.8 by 1.6-1.8 cm, apex acute, greenish or reddish; second bracteole ovate, 2.8-2.9 by 1-1.5 cm, apex acute; tertiary bracteole ovate, 2-2.6 by 0.8-0.9 cm, membranous. *Flowers* white to pale yellow, fragrant; calyx tubular, 4-4.4 by 0.3-0.4 cm, apex acute; corolla tube slender, 5.2-8.4 by 0.2-0.3 cm, 3-lobed, lobes linear, 3-4.1 by 0.2-0.3 cm, apex hooded, yellowish; lateral staminodes narrowly lanceolate-oblong, 3.3-3.5 by 0.6-0.8 cm, base attenuate into a 5-7 by 2-3 mm claw; labellum suborbicular to orbicular, 2.2-2.8 by 2.3-2.9 cm, base attenuate into a 5-9 by ca. 4 mm claw, apex 2-cleft, 4-7 mm, white with pale greenish patch at base; filament 3.9-5.0 cm long, salmon red; anther dorsifixed, 5-6 by 3-4 mm base divaricate, yellowish; ovary 3-4 by ca. 3 mm, 3-loculed, placentation axile, pubescent; epigynous glands 2, slender, ca. 3 by 0.5 mm yellowish; stigma densely ciliate, green. *Fruits* ovoid-oblong, 1.3-1.6 by 1.3-1.4 cm, pubescent, greenish. *Seeds* numerous, ellipsoid-orbicular, 0.4-1 by 0.4-0.5 cm, aril reddish orange.

Thailand.—NORTHERN [Chiang Mai, Doi Inthanon, Doi Chiang Dao; Chiang Rai, Doi Khun Nam Nang Non; Nan, Doi Phu Wae; Pitsanulok, Phu Hin Rong Kla, Phu Soi Dao]; NORTEASHERN [Loei, Phu Kradueng, Phu Ruea, Phu Luang].

Distribution.—India, China (Guangdong, Guangxi, Hainan, Yunnan), Myanmar, Vietnam.

Ecology.— In lower montane rain forest or lower montane scrub on sand stone, at the altitude of 1,000-1,500 m.

Phenology.—Flowering from November-February.

Etymology.—The specific epithet is referred to villous plant.

Vernacular name.—

Note.—*H. villosum* is related to *H. collinum* in a small anther (0.3-0.5 cm long) but differs in villous ligule, bract and bracteole.

Specimen examined.—*P. Sirirugsa* 1990 (BK); *P. Triboun* 1445-in spirit (BK); *TH. Wongprasert & S. Khaoiam* 031-27 (BKF); *P. Suksathan* 1574 (QBG), 1797 (QBG), 1803 (QBG), 2121 (QBG), 2257 (QBG), 2314 (QBG); *W. Nanakorn et. al.* 5730 (QBG); *P. Srisanga with Sasirat, W. Pongamornkul, S. Sukiam and P. Ponyachan* 2432 (QBG), 2433 (QBG); *P. Srisanga* 2118 (QBG); *M. Wongnak* A1 (QBG); *Hans Banziger* 778 (CMU); *J.F. Maxwell* 88-402 (CMU); *Put* 2875 (K); *A.F.G. Kerr* 20057 (K); *A. Sanyal* 9 (CAL); *I.H. Burhill* 36708 (CAL); *A. Merlold* 10315 (CAL); *M. Bhaumik & M.K. Pathek* 1902 (CAL); *G.K. Murthy* 12939 (CAL); *D.B. Deb* 26547 (CAL); *R. Seshagiri Rao* 1392 (CAL); *P. Wongsuwan* 62 (KKU), 122 (KKU), 30-in spirit (KKU), 31-in spirit (KKU), 32-in spirit (KKU).

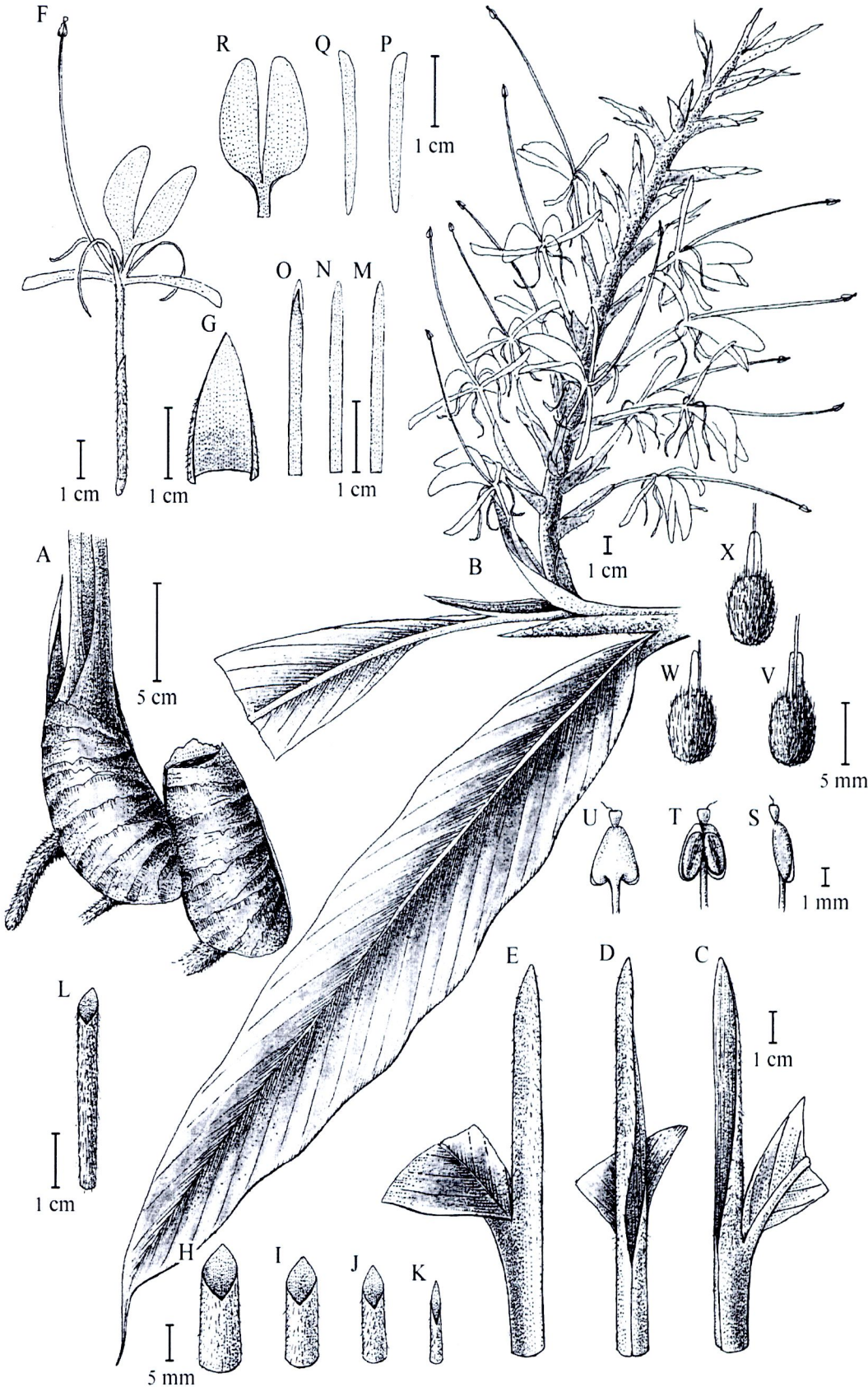


Figure 3.50



Figure 3.51 Photograph illustration of *H. villosum* Wall.:
A. & B. habit; C. ligule; D. young inflorescence; E. inflorescence;
F. close-up of flower.

Figure 3.50 Illustrations of *H. villosum* Wall.:
A. rhizome; B. leaves and an inflorescence; C., D. & E. part of a leaf with
a ligule (side and rear views); F. a flower; G. bract; H. first bracteole;
I. second bracteole; J. third bracteole; K. fourth bracteole; L. calyx tube;
M. & N. lateral corolla lobes; O. dorsal corolla lobe; P. & Q. staminodes;
R. labellum; S. & U. anther and stigma (side, front and rear views);
V. & X. ovary and epigynous glands (rear, front and side views).

Distribution of *Hedychium* in Thailand

The genus *Hedychium* is distributed throughout the country. The native taxa of Thai *Hedychium* excluding cultivars are mapped (Fig. 3.51-3.54). Six species have been reported only from Thailand, *H. biflorum*, *H. siamense*, *H. khaomaenense*, *H. muanwongyathiae*, *H. phuluangense* and *H. tomentosum*. Hence, they are currently endemic to Thailand.

Hedychium can be found in diverse habitat types from lowland zone near sea level up to montane zone of 2,000 m or more in various regions in Thailand as follows:

NORTHERN: *H. aureum*, *H. biflorum*, *H. coccineum*, *H. ellipticum*, *H. gomezianum*, *H. muanwongyathiae*, *H. neocarneum*, *H. pauciflorum*, *H. siamense*, *H. speciosum*, *H. spicatum* var. *acuminatum*, *H. spicatum* var. *spicatum*, *H. stenopetalum*, *H. tomentosum* and *H. villosum*.

NORTH-EASTERN: *H. ellipticum*, *H. neocarneum*, *H. pauciflorum*, *H. phuluangense* and *H. villosum*.

SOUTH-EASTERN: *H. gomezianum*.

PENINSULAR: *H. collinum*, *H. gomezianum*, *H. khaomaenense*, *H. longicornutum*, *H. malayanum*, *H. roxburghii* and *H. siamense*.

Various types of forest habitats in which the *Hedychium* species have been recorded are as follows:

1. Lower montane scrub from alt. ca. 900-2,000 m is found in highlands, particularly in the northern and north-eastern regions. Most of Thai *Hedychium* species (12 taxa) are found in lower montane scrub; *H. biflorum*, *H. coccineum*, *H. ellipticum*, *H. muanwongyathiae*, *H. neocarneum*, *H. pauciflorum*, *H. phuluangense*, *H. speciosum*, *H. spicatum* var. *acuminatum*, *H. spicatum* var. *spicatum*, *H. stenopetalum* and *H. villosum*.

2. Tropical evergreen rain forest is common habitat in the peninsular region. This type of forest harbours 6 taxa; *H. collinum*, *H. siamense*, *H. gomezianum*, *H. longicornutum*, *H. malayanum* and *H. roxburghii*.

3. Lower montane pine-oak forest is found in the northern and north-eastern regions in which 3 taxa have been recorded namely; *H.coccineum*, *H. pauciflorum* and *H. stenopetalum*.

4. Upper montane scrub from alt. *ca.* 1,900-2,200 m or more is found in highlands, particularly in the northern regions. This type of forest harbours 3 taxa; *H. aureum*, *H. spicatum* var. *spicatum* and *H. tomentosum*.

5. Lower montane oak forest is found in the northern region in which 2 taxa have been recorded namely; *H. aureum* and *H. tomentosum*.

6. Lower montane rain forest in the northern and the north-eastern regions harbours *H. villosum* whereas the peninsular region *H. khaomaenense* has been recorded.

7. Peat swamp forest in the peninsular region harbours only 1 taxon, *H. longicornutum*.

Moreover, *H. coronarium* var. *coronarium*, *H. coronarium* var. *chrysoleucum*, *H. coronarium* var. *flavescens*, *H. coronarium* var. *forrestii* are widely cultivated in gardens as ornamentals throughout Thailand.

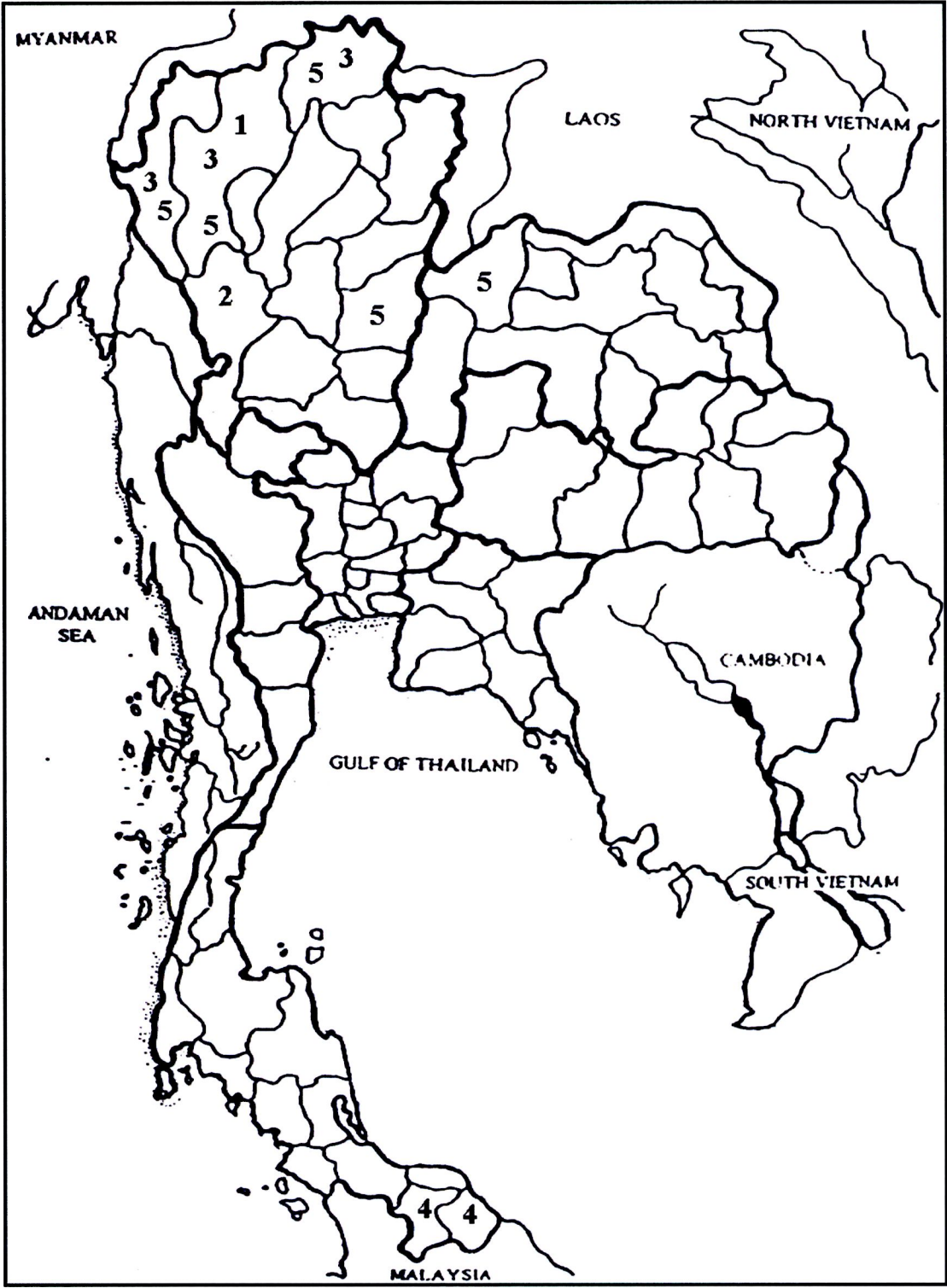


Figure 3.52 Distribution of *Hedychium* in Thailand 1.

1. *H. aureum*, 2. *H. biflorum*, 3. *H. coccineum*, 4. *H. collinum*
and 5. *H. ellipticum*.

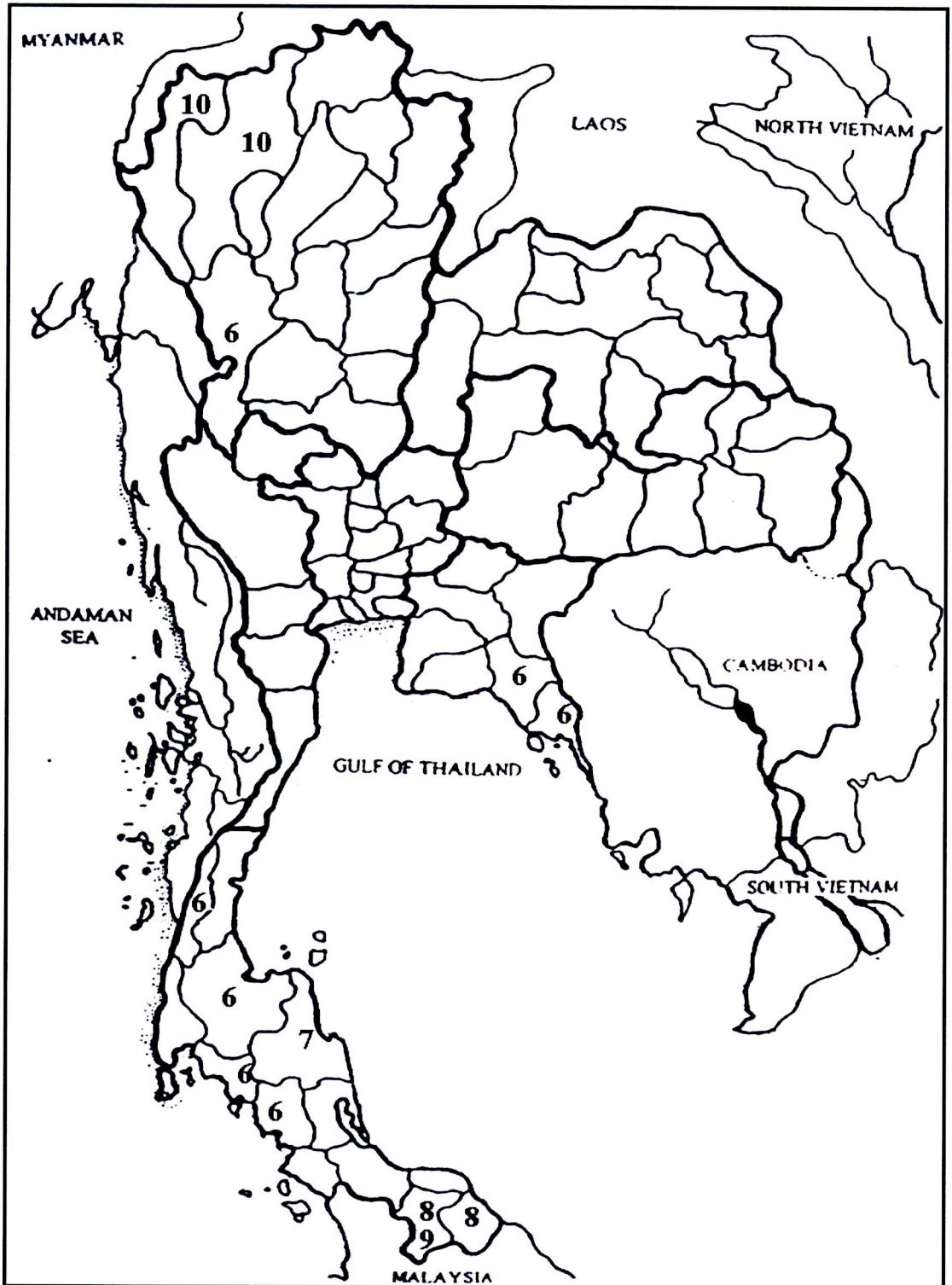


Figure 3.53 Distribution of *Hedychium* in Thailand 2.

6. *H. gomezianum*, 7. *H. khaomaenense*, 8. *H. longicornutum*,
9. *H. malayanum* and 10. *H. muanwongyathiae*.

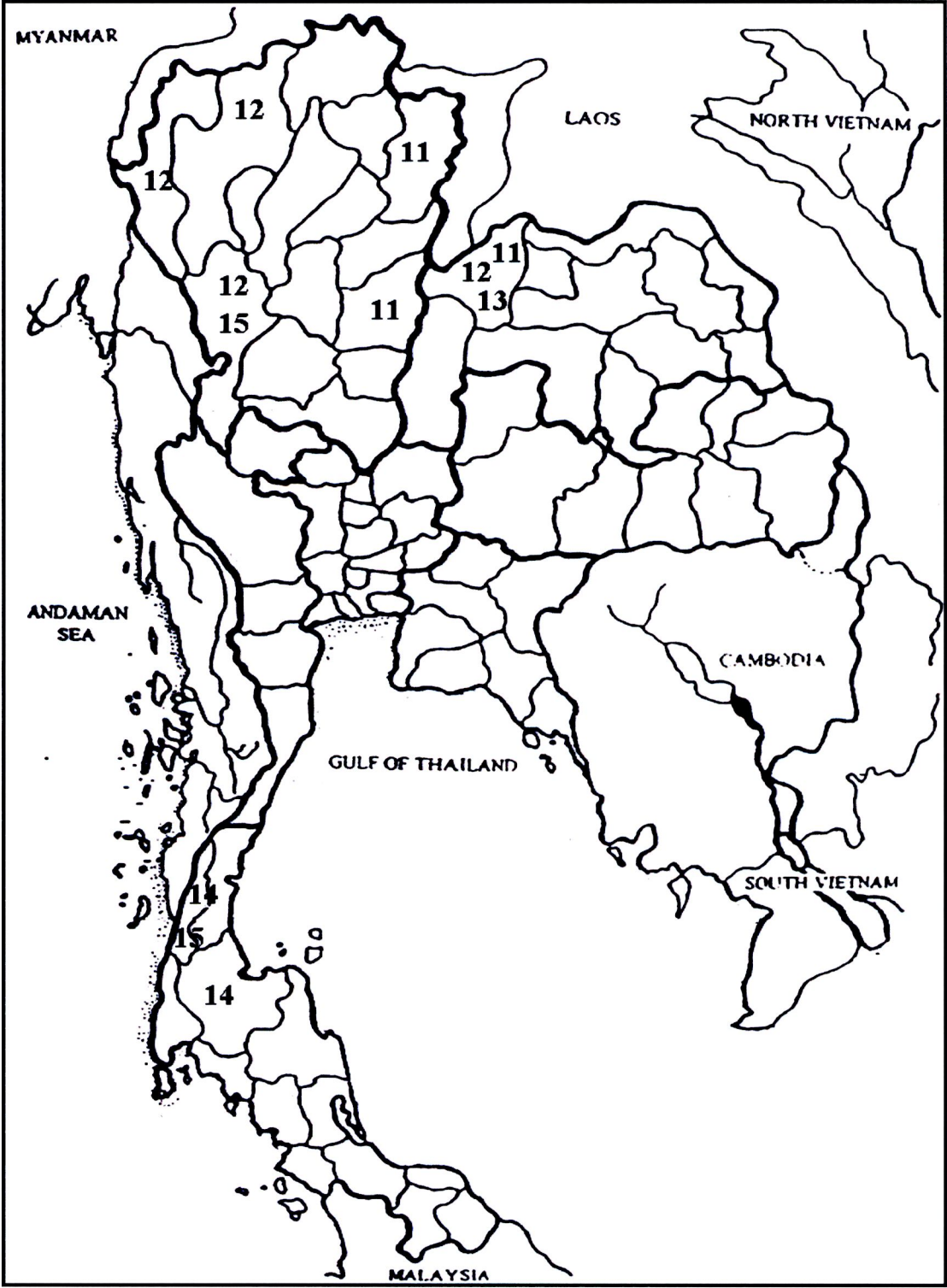


Figure 3.54 Distribution of *Hedychium* in Thailand 3.
11. *H. neocarneum*, 12. *H. pauciflorum*, 13. *H. phuluangense*,
14. *H. roxburghii* and 15. *H. siamense*

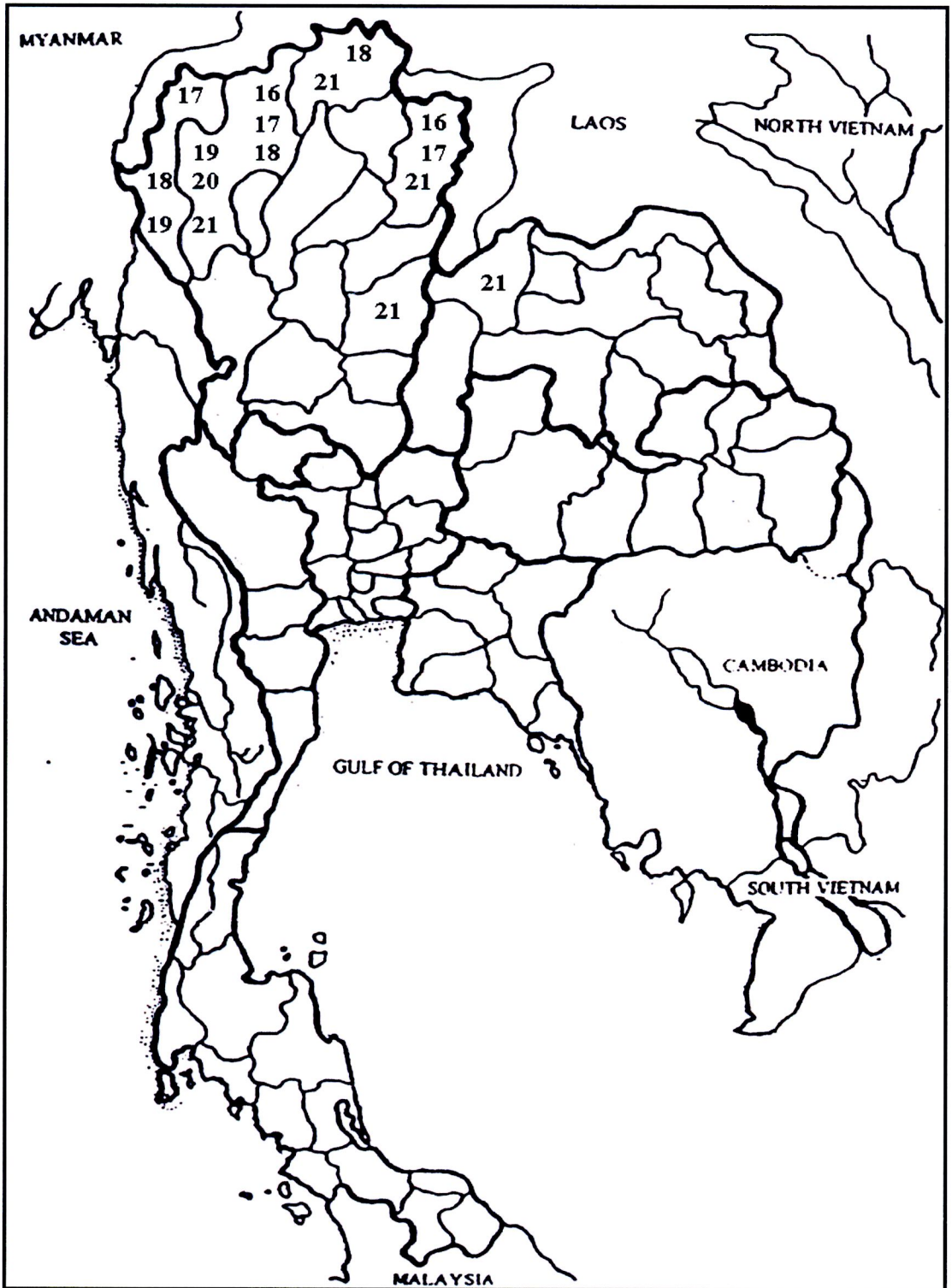


Figure 3.55 Distribution of *Hedychium* in Thailand 4.

16. *H. speciosum*, 17. *H. spicatum* var. *acuminatum*,
 18. *H. spicatum* var. *spicatum*, 19. *H. stenopetalum*, 20. *H. tomentosum*
 and 21. *H. villosum*

Discussions and conclusions

Twenty one species and 6 varieties of the genus *Hedychium* are currently recognized for Thailand. Three species, *H. muanwongyathiae* and *H. phuluangense* and *H. siamense* are new to science. One species, *H. neocarneum* is first recorded for Thailand. *H. forrestii*, *H. samuiense* and *H. thianum* are reduced to be synonymous with *H. coronarium* var. *forrestii*, *H. roxburghii* and *H. pauciflorum*.

The genus can be divided in to 2 groups based on bract characteristics as follows:

1) Group with imbricate bracts

This group can be divided in to 2 subgroups based on characteristic of imbricate bracts. The first subgroup is recognized by cylindrical or elliptic imbricate bracts, *H. ellipticum*, *H. khaomaenense*, *H. longicornutum*, *H. malayanum* and *H. siamense*, there are 1 or 2-4 flower(s) per bract and all taxa are glabrous or sparsely pubescent on lower leaf surface, long anther (0.8-1.7 cm long), filament twice as long as the labellum. However, *H. ellipticum* is in this group but distinct with elliptic imbricate bracts, lanceolate labellum with acute-emarginate apex and distributed from northern to northeastern, not found in peninsular Thailand (all of taxa, cylindrical imbricate bracts found in peninsular Thailand). The second subgroup is conspicuous with conical imbricate-elongate bracts, *H. coronarium* var. *chrysoleucum*, *H. coronarium* var. *coronarium*, *H. coronarium* var. *flavescens*, *H. coronarium* var. *forrestii*, there are 4-6 flowers per bract and all taxa are pubescences of lower leave surface, elliptic-oblong staminodes and sub orbicular-orbicular labelum.

2) Group with lax (not imbricate) bracts

This group can be divided in to 2 subgroups based on number of flower(s) per bract. The first subgroup is distinct in 1 flower per bract, *H. aureum*, *H. gomezianum*, *H. pauciflorum*, *H. phuluangense*, *H. spicatum* var. *acuminatum*, *H. spicatum* var. *spicatum* and *H. tomentosum*. Of these only one species, *H. phuluangense* is a bifid apex the labellum differs from other (labellum deeply divided at the base). The second subgroup has flowers more than 1 per bract, *H. biflorum*, *H. coccineum*, *H. collinum*, *H. muanwongyathiae*, *H. neocarneum*, *H. roxburghii*, *H. speciosum*, *H. stenopetalum* and *H. villosum*. Two species *H. collinum* and *H. villosum* are small anther (3-5 mm long).

The morphology, vegetative and reproductive characteristics are distinctive and easily recognized in the genus *Hedychium*. The key to the species and varieties is constructed is based on all available morphological characters which are of taxonomical characteristics for identification. Some *Hedychium* species can be easily identified solely by the vegetative parts, habit or ligule shapes, e.g. *H. aureum* and *H. coccineum*. However, in some complex groups with high variation, vegetative parts are more difficult to employed for identification because they usually exhibit many characters in common e.g. *H. khaomaenense*, *H. malayanum* and *H. siamense*.

The distribution of *Hedychium* species are found in 4 regions in Thailand, northern region belongs to the Indo-Burmese floristic region, whereas north-eastern region is in transition between Indo-Chinese and Indo-Burmese floristic regions. Most of northern and north-eastern regions harbor Himalayan species e.g. *H. aureum*, *H. ellipticum* and *H. spicatum* var. *spicatum*. South-eastern region consists of floristic elements from Cochinchina and Malaya, in this region 1 taxon of Malayan element, *H. gomezianum* is found. Peninsular region mostly harbors Malayan floristic elements, especially near the Thai-Malay border e.g. *H. longicornutum*, *H. malayanum* and *H. roxburghii*. Moreover, from this study, *H. siamense*, a Malayan element, is found northerly to Tak province in northern Thailand.

