

CHAPTER 4

RESULTS – TAXONOMIC STUDY

Thirty-eight species of *Curcuma* have been found in Thailand (table 3). The genus description, key to species as well as description, distribution, basic ecological information, vernacular name and examined specimens of each species are provided.

Table 3 List of *Curcuma* species found in Thailand and distribution.

Species	Floristic regions*							
	N	NE	E	SE	C	SW	PEN	Cult
<i>C. aeruginosa</i> Roxb.								*
<i>C. alismatifolia</i> Gagnep.		*	*	*				*
<i>C. amada</i> Roxb.	*	*						
<i>C. angustifolia</i> Roxb.	*	*	*	*	*	*	*	
<i>C. aromatica</i> Roxb.								*
<i>C. aurantiaca</i> van Zijp							*	*
<i>C. bicolor</i> J. Mood & K. Larsen	*							*
<i>C. cochinchinensis</i> Gagnep.	*					*		
<i>C. comosa</i> Roxb.	*							
<i>C. ecomata</i> Craib	*							
<i>C. flaviflora</i> S.Q. Tong	*							
<i>C. glans</i> K. Larsen & J. Mood	*							
<i>C. gracillima</i> Gagnep.		*	*		*			
<i>C. harmandii</i> Gagnep.			*	*	*			*
<i>C. latifolia</i> Roxb.	*							*
<i>C. leucorhiza</i> Roxb.								*
<i>C. longa</i> L.								*
<i>C. mangga</i> Val.								*
<i>C. parviflora</i> Wall.	*	*	*	*	*	*	*	
<i>C. petiolata</i> Roxb.	*		*		*			*
<i>C. pierreana</i> Gagnep.			*					
<i>C. rhabdota</i> Sirirugsa & M. Newman			*					*
<i>C. roscoeana</i> Wall.	*					*		*
<i>C. rubescens</i> Roxb.								*
<i>C. rubrobracteata</i> Skornickova, Sabu & Prasanthk.	*					*		
<i>C. singularis</i> Gagnep.	*	*	*	*				
<i>C. sparganiiifolia</i> Gagnep.		*	*	*		*		*
<i>C. stenochila</i> Gagnep.	*	*	*	*				
<i>C. viridiflora</i> Roxb.	*							
<i>C. xanthorhiza</i> Roxb.								*

Table 3 (cont.)

Species	Floristic regions*							
	N	NE	E	SE	C	SW	PEN	Cult
<i>C. zedoaria</i> (Christ.) Rosc.								*
<i>C. maehongson</i> C. Maknoi	*							
<i>C. nakornsawan</i> C. Maknoi	*							
<i>C. pitsanulok</i> C. Maknoi	*							
<i>C. ranong</i> C. Maknoi						*	*	
<i>C. saraburi</i> C. Maknoi					*			
<i>C. tak</i> C. Maknoi	*							
<i>C. ubonratchathani</i> C. Maknoi			*					
Taxa in region	20	8	12	7	6	7	4	17

*Floristic regions are according to the Flora of Thailand.

***Curcuma* L.**

nom. con. [Gen. Pl. ed. 1. 332 n. 829. (1737)] Sp. Pl. 2. (1753); Roxb. in Coromand. Pl. t. 151. 201. (1798), Asiat. Research. 11. 518. (1812), Fl. Ind. ed. 1. 1. 20. (1820); Wall. Pl. As. Rar. t. 10. 57. (1830); Blume, Enum. Pl. Javae 45. (1827); Miq. Fl. Ind. Bat. 3. 595. (1859); Horan. Monogr. 22. (1862); Wight, Icon. t. 2005, 2006. (1863); Benth. & Hook. f. Gen. Pl. 3. 643. (1862-1883); Bak. in Hook. f. Fl. Brit. Ind. 6. 209. (1890); Trim. Handb. Fl. Ceylon 240. (1898); Schuman., Pflanzenr. Zingib. 101. (1904); Gagnepain, Fl. Gen. Indo-china. 6. 57. (1908); Ridley, Fl. Malay Pen. 4. 253. (1924); Holttum, Gard. Bull. Sing. 13. 65. (1950); van Steenis, Fl. Java 3. 69. (1968); Telin and Larsen, Fl. China. 24: 360. (2000); – *Kua*, Medic. in Act. Theod. Palat. vi. Phys. (1790) 394.; – *Erndlia* Giseke, Prael. Linn. 199, 209. (1792); – *Stissera*, Giseke, Prael. Linn. 207, 209 (1792); – *Hitcheniopsis* Ridl. & Valetton, Bull. Jard. Bot. Buitenz. Ser. 2. 27. 104. (1918). – *Hitcheniopsis* (Baker) Ridl., Fl. Mal. Penins. 4. 233, in clavi, 252. (1924); – *Hitcheniopsis* (Bak.) Val., Loes. in Emgl. & Prantl, Nat. Pflanzenfam. ed. 2, 15. a. 572. (1930). Type species: *C. longa* L. *type con.*

Plant 20-180 cm high, clumped or well spaced. Corm ovoid, fleshy, with or without branched rhizome, white, pale brown, yellow, bright yellow orange, deep orange, bluish green or grayish blue internally, pungent or young mango-like fragrant, 3.0-11.0 by 1.5-6 cm. Rhizome, if occurs, slender, colour as in corm, 0.8-2.5 cm thick. **Roots** fibrous, sometimes ended with ellipsoid tuber. **Bladeless sheath** green or

reddish brown, broad linear, rounded, mucronate at apex, glabrous or glabrescent to pubescent, sometimes hairy on its edge, the outer one shorter than the inner one, c. 4.0-35.0 cm long. **Leaf-sheath** green or reddish brown, glabrous or pubescent, c. 5.0 or to more than 40 cm long. **Ligule** bilobed, auriculate or sometime indistinct, lobe apices acute to obtuse, glabrous or pubescent, ciliate or not, c. 1.0-3.0 mm by 1.2 to 3.0 cm. **Petiole** long slender or absent, the inner one usually longer, furrow with various depth, green or brownish red, upto 22.0 cm long, glabrous or glabrescent. **Blade** linear, lanceolate, obovate to broadly elliptic, green, with or without purplish brown flush on distal half of the leaves on upper or on both surfaces, midrib usually green, sometime dark red brown on upper surface, apex acute or acuminate, base slightly cordate, rounded, obtuse to narrowly cuneate, upper surface glabrous or hairy at tip, sometime with hairs scattered along secondary nerves, lower surface glabrous, pubescent or hairy on edge at apex, c. 16.5-85.0 by 5.0-23.0 cm. **Inflorescence** terminal or lateral. **Scape** white or green, slightly glabrescent or pubescent, c. 5.0-50.0 cm long. **Spike** cylindrical or subsphaerical, c. 5.0-30.0 by 3.5-9.0 cm. **Bladeless sheath** on scape c. 4.0-24.0 cm long, green or purplish red, glabrous to densely pubescent. **Fertile bract** orbicular, broad elliptic, oblong to obovate, pure green, green tipped with purplish or reddish, white, pink with colour stripes, apex caudate, acute, obtuse, rounded or slightly emarginate, attached to adjacent bracts to form a pouch in various depth, glabrous or pubescent on both surfaces, c. 3.5-6.5 by 1.6-5.2 cm. **Coma bracts** lanceolate, broad lanceolate to broad elliptic, orange, red, pink with green tip, white with pink red or purple tips, green or green with dull white towards base, or absent, apex acute, obtuse, rounded or mucronate, glabrous or pubescent on both surfaces, c. 3.5-8.4 by 0.9-4.5 cm. **Flowers** in cincinnus in axile of bracts. **Bracteoles** broadly elliptic, with side inflexed, sparsely shortly hairy with dense hairs at apex, translucent white, white pellucid or white with pink top, c. 1.6-3.5 by 0.9-2.6 cm, the inner one smaller, absent in some species. **Calyx** tubular, c. 0.5-1.4 cm long and c. 1.35 cm wide, three-lobed, split down one side, hairy along ridge or at tips, lobe apices acute to truncate, white pellucid and pinkish at tips. **Corolla tube** c. 1.6-3.2 cm long, white, pale yellow, yellowish, pink with white base, pinkish at apex. **Corolla lobes** pale orange, white, red, glabrous, sometime with few hairs at mucronate tip. **Dorsal corolla-lobe** elliptic, ovate, hooded with cucullate apex, c. 1.0-

1.5 by 0.6-1.4 cm. **Lateral corolla-lobes** oblong, elliptic, slightly concave, apex rounded, c. 1.0-1.5 by 0.7-1.1 cm. **Staminodes** unequally elliptic, oblong or linear, with rounded or obtuse to acute apex, c. 1.0-1.6 cm long and 6.0-9.0 mm wide at base, c. 8.0-18 mm at the widest part, white, light yellow, light orange, orange or dark purple, glabrous or glandular hairy on inner surface. **Labellum** broadly obovate to orbicular, shallowly or deeply bifid at apex, white, pale yellow, citrine, yellow, light orange, orange, blue or white and violet, mid-band lighter or darker yellow, absent in *Hitcheniopsis*, sometime with red or yellow streaks or purple spot in the centre, with short glandular hairs along either sides of mid-band or hairy in the center, c. 1.4-2.0 by 1.2-1.8 cm and c. 1.0-1.2 cm wide at base. **Anther** thick, c. 3.5-4.0 mm long, c. 2.0-2.5 mm thick, thecae c. 1.5-2.0 mm wide. **Crest** rounded, glabrous, less than 1 mm long. **Spurs** flat triangular and point downwards or very short filamentose and incurved or thick blunt-ended and point forwards, c. 2.0-4.0 mm long (absent in subgenus *Hitcheniopsis*). **Filament** flat or concave, glabrous or pubescent, c. 3.5-8.0 by 4 mm, widest at base. **Style** thin and slender, absent in *Hitcheniopsis*. **Ovary** barrel-shaped or subspherical. **Stylodes** cylindrical, apex acute or blunt, 5.0-7.0 mm long (absent in subgenus *Hitcheniopsis*). **Stigma** lobed or funnel-shaped, ciliate, terminally or laterally opened, 1-2 mm wide.

Key to species of *Curcuma* L. in Thailand

- | | |
|---|--------------------------------|
| 1 Stylode absent; anther ecalcarate | subgenus Hitcheniopsis |
| 2. Coma bracts absent | |
| 3. Bracts pink with colored tip | 27. <i>C. sparganiiifolia</i> |
| 3. Bracts green | |
| 4. Bract caudate, cauda 5 cm long or more | 14. <i>C. harmandii</i> |
| 4. Bract rounded or acute | |
| 5. Labellum deeply divided, yellow or orange with red stripes | 38. <i>C. sp.</i> (Ubon) |
| 5. Labellum, labellum bifid, pink with yellow median band | 34. <i>C. sp.</i> (Pitsanulok) |
| 2. Coma bracts white, pink or striped | |
| 6. Coma bracts white | |

7. Labellum deeply bi-lobed 13. *C. gracillima*
7. Labellum fringed at edge 19. *C. parviflora*
6. Coma bracts pink or white with reddish brown stripes
8. Coma bracts pink 2. *C. alismatifolia*
8. Coma bracts white with reddishbrown stripes 22. *C. rhabdota*
- 1 Stylodes occur; anther calcarate, rarely ecalcarate subgenus **Curcuma**
9. Anther spurs filamentose, 2 mm long
10. Staminodes pure white 8. *C. cochinchinensis*
10. Staminodes white, tipped with dark pink 21. *C. pierreana*
9. Anther spurs not as above or absent
11. Anther spurs large, conical, forward-pointed; flower opened-form
12. Inflorescence terminal
13. Leaf narrowly lanceolate, 1.5- 2.5 cm wide 33. *C. sp.*(Nakornsawan)
13. Leaf much broader, at least 5 cm wide
14. Staminodes pure yellow 28. *C. stenochila*
14. Staminodes yellow with red base 7. *C. bicolor*
12. Inflorescence lateral
15. Flowers pink or dark purple 10. *C. ecomata*
15. Flowers yellow or white with
16. Whole flowers bright yellow 11. *C. flaviflora*
16. Flowers white with yellow median band
17. Staminodes tipped with yellow 12. *C. glans*
17. Staminodes white or tinged with pink 26. *C. singularis*
11. Anther spurs flat, acute, downward-pointed or absent;
flowers closed-form
18. Bracts apex truncate, rounded or emarginate
19. Anther ecalcarate
20. Bracts green, coma pink 6. *C. aurantiaca*
20. Bracts orange, coma absent 23. *C. roscoeana*
19. Anther calcarate
21. Coma bracts lilac, pink or orange-brown

22. Coma bracts orange-brown 35. *C. sp.* (Ranong)
22. Coma bracts lilac or pink
23. Leaves glabrous; bracts apex rounded; coma pink
20. *C. petiolata*
23. Leaves pubescent ; bracts apex emarginate; coma lilac,
tipped with dark purple, 32. *C. sp.*(Maehongson)
21. Coma bracts absent
24. Bracts white 36. *C. sp.* (Saraburi)
24. Bracts pink, orange or red
25. Bract apex acute 25. *C. rubrobracteata*
25. Bract apex rounded or truncate 37. *C. sp.* (Tak)
18. Bracts acute
26. Leaf narrowly lanceolate, upto 6 cm wide; branched rhizome not
produced 4. *C. angustifolia*
26. Leaf lanceolate to broadly lanceolate, 7 cm wide or more;
branched rhizome present
27. Leaf pubescent on lower surface
28. Leaf with red patch along midrib 15. *C. latifolia*
28. Leaf without red patch along midrib
29. Corolla lobes red 5. *C. aromatica*
29. Corolla lobes pale yellow *C. elata*
27. Leaf glabrous
30. Leaf sheath reddish brown
31. Rhizome white 24. *C. rubescens*
31. Rhizome yellow with blue ring *C. amarissima*
30. Leaf sheath green
32. Leaf with red patch along midrib
33. Rhizome blueish
34. Rhizome bluish green 1. *C. aeruginosa*
34. Rhizome bluish grey *C. caesia*
33. Rhizome white or yellow
35. Rhizome yellow 30. *C. xanthorhiza*

35. Rhizome white or pale brown
36. Corolla lobes white 16. *C. leucorhiza*
36. Corolla lobes red 31. *C. zedoaria*
32. Leaf without red patch
37. Inflorescence lateral
38. Inflorescence subsessile 9. *C. comosa*
38. Scape 20 cm long 18. *C. manga*
37. Inflorescence terminal
39. Rhizome white 3. *C. amada*
39. Rhizome yellow or orange
40. Coma bracts white or very pale pink
17. *C. longa*
40. Coma bracts green, sometime with
white streaks 29. *C. viridiflora*

Curcuma aeruginosa Roxb. Asiat. Research. 11. 335. 1810, Fl. Ind. ed. 1. 1. 27. 1820; Roscoe. Monandr. Pl. t. 106. 1828; Salisb. Trans. Hort. Soc. I. 285. 1812; Horan. Monogr. 22. 1862; Bak. in Hook.f. Fl. Brit. Ind. 6. 212. 1890. Schuman., Pflanzenr. Zingib. 112. 1904.; Gagnep. Fl. Gen. de Indo-china. 6: 68. 1908; Valet., Bull. Buitenz. Ser. 2. 27: 65. 1918; Holtt. Gard. Bull. Sing. 13: 70. 1950; van Steenis. in Backer & Bakhuizen van der Brink. Fl. Java. 3: 71. 1968. Figure 2, plate 1.

Type: Roxburgh's plate no. 1924 (K!)

Corm ovoid, inside bluish green, 4-7 x 3-5 cm; **rhizome** branched, bluish green, 2 cm thick. **Leafy shoot** 80-90 cm tall; **bladeless sheath** green or reddish, glabrous, 8-30 cm long. **Leaf-sheath** glabrous, green with red streak; **ligule** membranous, bi-lobed, 2 mm long; **petiole** glabrous, 1-15 cm long; **blade** obovate-lanceolate, green with red patches on either sides of midrib, glabrous on both surfaces, base cuneate, apex acute, 35-45 x 9-12 cm. **Inflorescence** lateral, 30-35 cm tall; **scape** 15-20 cm long. **Bracts** obovate, short hairs on both surfaces, apex acute, 4.5x2.5 cm; **coma bracts** narrowly

obovate to lanceolate, short hair on both surfaces, 5x1.5 cm; **bracteoles** boat-shaped, minute-hairy, apex rounded, with few hairs on ridge at tip, 16x10 mm. **Corolla tube** 25 mm long, minute-hairy, hair-ring in throat, lower half white, upper half red; **lobes** red, 13x10-12 mm; **dorsal lobe** concave, hooded, apex acute-mucronate, hairy at tip; **lateral lobes** shallowly concave, apex rounded, glabrous. **Staminodes** rectangular, pale yellow, glandular hairy, apex truncate, 12x8 mm. **Labellum** 3-lobed, mid-lobe retuse, glandular hairy along side of yellow mid-band, 16x18 mm. **Filament** flat, 3x4 mm; **theca** 4.5 mm long; **crest** less than 1 mm long, apex rounded; **spurs** flat, triangular, point downwards, apex acuminate, 2.5 mm long. **Ovary** barrel-shaped, densely hairy, 4 mm long; **stylodes** cylindrical, apex acute, 5-6 mm long; **stigma** 2-lobed, laterally opened, ciliate, 1.5 mm wide.

Thailand: cultivated.

Ecology: cultivated.

Distribution: India, Myanmar, Indochina and Malaysia.

Use: rhizome use as medicinal plant.

Vernacular: Waan Mahamek

Critical remarks: This species is easily recognized by its bluish green rhizome, as suggested by epithet. The other species with color of rhizome look alike is *C. caesia* which is bluish gray.

Specimens examined:

Maknoi 532, cult. QSBG, 9-May-2004 (AAU, BKF, PSU, QSBG).

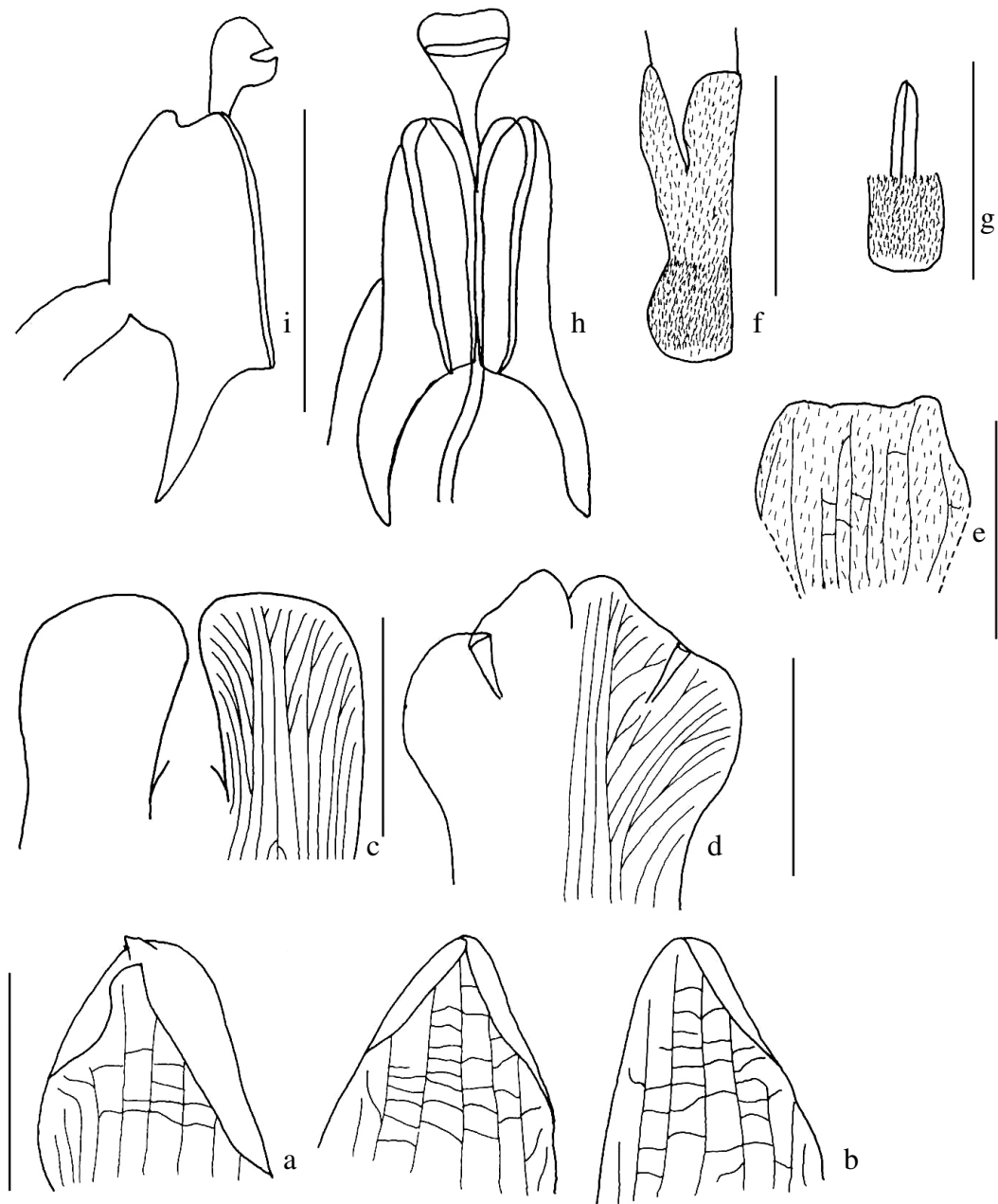


Figure 2 *Curcuma aeruginosa* Roxb. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stylodes and ovary; h stamen – front view; I stamen – side view (scale = 5 mm)

Curcuma alismatifolia Gagnep. in Bull. Soc. Bot. France 4. serie. II. (1903) 259., Fl. Indo-china. (1918) 60; K. Schum. Zingiberaceae in Das Pflanzenreich (1904) 104; Flora Gen. de Indo-china. VI. 60. Figure 3, plate 1.

Type: *Schomburgk* 285, Siam, 1859 (K!, P!) syntype!

Corm ovoid, white inside, 3-4 x 2-3 cm; **rhizome** very short. **Leafy shoot** 30-60 cm tall; **bladeless sheath** 5-20 cm long. **Leaf sheath** glabrous, 10-25 cm long; **ligule** glabrous, apex truncate, 1 mm long; **petiole** short or absent; **blade** narrowly lanceolate, glabrous on both surfaces, base narrowly attenuate, apex acuminate, 20-35 x 2-4 cm. **Inflorescence** terminal; **scape** glabrous, 25-65 cm long; **spike** 10-15 cm long. **Bracts** broadly ovate, glabrous on both surfaces, apex obtuse to rounded, 2.5-4 x 2-3 cm; **coma bracts** obovate-lanceolate to broad obovate, glabrous, apex acute, 6-9 x 1.5-4.5 cm; **bracteoles** ovate, glabrous, apex acute, 1-1.5 cm long. **Calyx** tubular, glabrous, apex shallowly 3-lobed, 7-9 mm long. **Corolla tube** glabrous, 20 mm long; **lobes** glabrous, mm; **dorsal lobe** hooded, apex mucronate; **lateral lobes** concave, apex rounded. **Labellum** 3-lobed, glabrous, violet with white base, x mm. **Filament** concave, glabrous, x mm; **anther** glabrous, ecalcarate, mm long; **crest** oblong, apex rounded, glabrous, 3 mm long. **Ovary** barrel-shape, glabrous, 3 mm long; **stylode** absent; **stigma** terminally opened, ciliate, 1 mm wide.

Thailand: Northeastern – Loei, Mahasarakam, Nakorn Panom, Sakon Nakorn; Eastern – Chaiyaphum, Srisaket, Surin; Southeastern – Chantaburi, Chonburi, Prachinburi.

Ecology: in open area in pine forest, deciduous forest, shallow swamp on sandy soil from near sea level to 1300 m above sea level. Flower in May – October.

Distribution: Laos, Cambodia.

Use:

Vernacular Name:

Critical remarks: The large pink coma bracts of this species are distinguished.

Specimens examined:

Northeastern – Loei [*Dee Bunpheng* 26, Phu Kradung, Wang Sapung, 26-Jun-1948 (BKF, P); *Dee Bunpheng* 177, same locality, 15-Aug-1948 (BKF); *Dee Bunpheng* 293, same locality, 22-Jun-1949 (BKF); *Dee Bunpheng* 817, same locality, 12-Jul-1955 (BKF, K, P)], Mahasakam [*Maknoi* 511, Ban Nong Daeng, Nachueak, 27-Aug-2003 (AAU, BKF, PSU, QSBG)], Nakorn Panom [*Lakshnakara* 991, Ban Hua Pr..., , 23-Jun-1932 (BK, BM, K)], Sakon Nakorn [*Newman* 944, Phu Pan NP, 31-Jul-1999 (BKF, E); *Yuktathat* 135, Phu Phan NP, 7or8/1987 (E)]; **Eastern** – Chaiyaphum [*Larsen et al.* 31870, Nong Bua Daeng, 15-Aug-1972 (AAU, P)], Srisaket [*Aoa* 43, Between Kantralak and Ban Kanun, 13-Jul-1946, (C)], Surin [*Murata et al.* T37659, 50 kms SW of Sangkha, 6-Oct-1984 (AAU, BKF)]; **Southeastern** – Chantaburi [*Larsen et al.* 10044, Makham, 13-Jun-1963 (AAU, BKF); *Murata et al.* T17720, between Chantaburi and Pong Namron, 5-Aug-1973 (BKF); *Smitinand* 12007, Makham, 1-Jun-1974 (BKF); *Smitinand & H. St. John* 6856, Makham, 18-Jun-1960 (BKF, C, K)], Chonburi [*Maxwell* 75-551, Khao Kieo, Siracha, 22-May-1975, (AAU, BK); *Maxwell* 75-984, same locality, 4-Sep-1975 (AAU, BK, L)]; Prachinburi [*Paisooksantivatana & Sangkhachan*, Ban Nongkung, Watananakorn, 23-Jul-1987 (BK)]

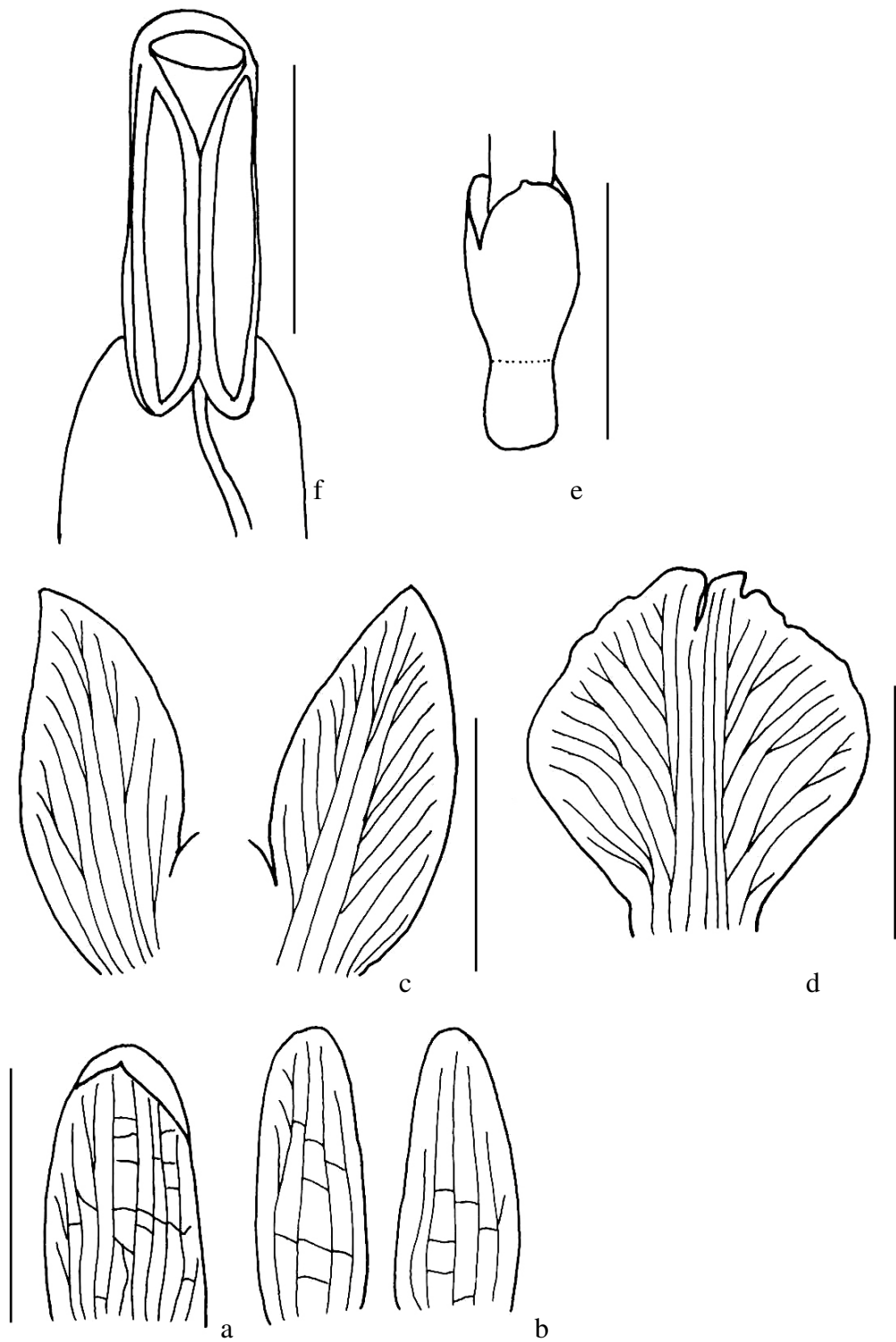


Figure 3 *Curcuma alismatifolia* Gagnep. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx and ovary; f stamen – front view; (scale = 5 mm)

Curcuma amada Roxb. in Asiat. Research XI. (1860) 341; Fl. Ind. ed. 1. I. (1820) 33; Roscoe, Monandr. Pl. (1828) t. 99; Royle Illustr. Himal. Pl. (1839) 359; Horan. Monogr. (1862) 23; Bak. in Hook.f. Fl. Brit. Ind. VI (1890) 213.; K. Schum. Zingiberaceae in Das Pflanzenreich (1904) 108. Figure 4, plate 2.

Type: Roxburgh's plate no. 1764 (K!)

Corm ovoid, white inside, 3-4 x 2-3 cm; **rhizome** long, slender, white inside, 1 cm thick. Leafy shoot 90-120 cm tall; bladeless sheath pilose, 10-30 cm long. Leaf sheath pilose, 40-65 cm long; **ligule** membranous, bi-lobed, 2 mm long; **petiole** pilose, 1-10 cm long; **blade** lanceolate, green, glabrous on both surfaces, base cuneate, apex acuminate 75x19 cm. **Inflorescence** terminal, 50-85 cm long; **scape** pilose, 35-65 cm long. **Bracts** obovate, white to very pale green, pilose on both surfaces, apex acute, 4.5x2 cm; **coma bracts** white with pink tip, pilose on both surfaces, apex acute to obtuse, 6x2.2 cm; **bracteoles** boat-shaped, minute-hairy, apex acute to obtuse, 30x20 mm. **Calyx** 12-15 mm long, hairy, apex 3-lobed, lobe apices truncate, split down one side 7-9 mm. **Corolla tube** minute-hairy, 25 mm long; **lobes** 12 x 8-13 mm; dorsal one hooded, apex acute-mucronate, hairy at tip; lateral ones shallowly concave, apex rounded, glabrous. **Staminodes** oblique broadly obovate, glandular hairy, apex rounded to obtuse, 14x9 mm. **Labellum** 3-lobed, mid-lobe apex bifid, glandular hairy on either side of mid-band, 18x20 mm. **Filament** flat, glabrous, 4x5 mm; theca 4.5 mm long; spurs triangular, flat, point downwards, 3.5 mm long; crest less than 1 mm long. **Ovary** barrel-shaped, hairy, 4 mm long; **stylodes** conical, apex acute, 4 mm long; **stigma** 2-lobed, laterally opened, ciliate, 1 mm wide.

Thailand: Northern – Mae Hong Son, Northeastern - Nongkai

Ecology: flower in June.

Distribution: Myanmar.

Use:

Vernacular Name:

Critical remarks: This species has mango scented as *C. mangga* Val. but differs in produce terminal inflorescence in stead of lateral one.

Specimens examined:

Northern – Mae Hong Son [*Maknoi* 376, Ban Pang Pake, Pai, 24-Jul-2003 (AAU, BKF, PSU, QSBG)]; **Northeastern** – Nongkai [*Niyomdham* 5048, Bungklaa, Phutok Noi, 21-Jun-1997 (AAU, BKF)]

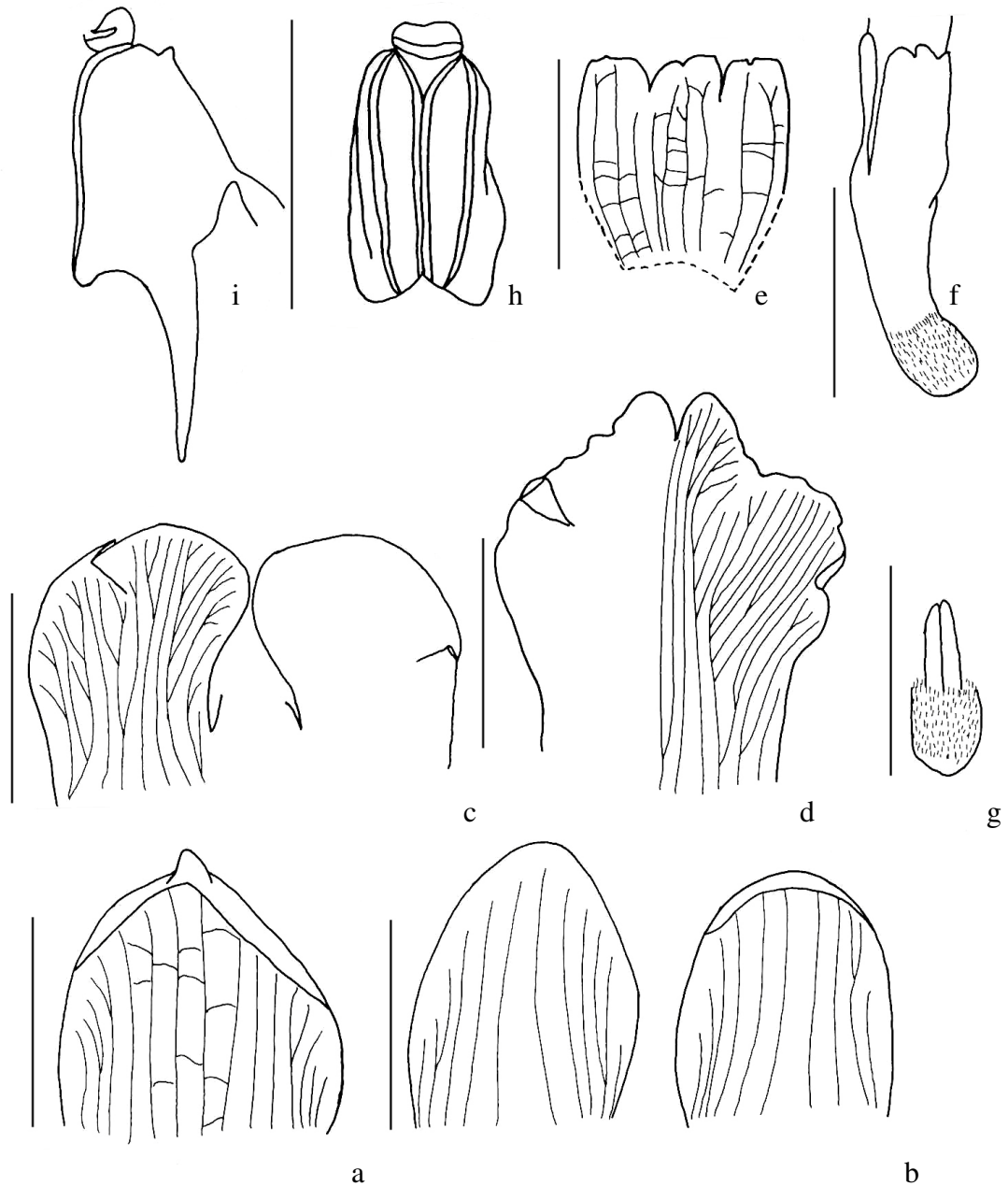


Figure 4 *Curcuma amada* Roxb. a dorsal corolla lobe; b lateral corolla lobes; c stamines; d labellum; e calyx – dissected; f calyx and ovary; g stylodes and ovary; h stamen – front view, spurs removed; i stamen – side view (scale = 5 mm)

***Curcuma angustifolia* Roxb.** in Asiatic Research XI (1810) 338 t. 3; Fl. Ind. ed. 1. I. (1820) 31; Royle, Illustr. Himal. Pl. 357, 359 (1839); Horan. Monogr. (1862) 22; Bak. in Hook.f. Fl. Brit. Ind. 6 (1890) 210.; K. Schum. 1904. Zingiberaceae in Das Pflanzenreich 4. 46: 109.; Gagnep. 1918. Fl. Indo-china. 4. 69.; *C. sessilis* Gage. *Rec. Bot. Surv. India*, 3. 106.; *C. kwangsiensis* S.G.Lee & C.F.Liang *Acta Phytotax. Sin.*, 15(2): 110(1977); Fl. China (2000) 363. Figure 5, plate 2.

Type: Roxburgh's plate no. 1511 (K!)

Corm ovoid, pale brown to white inside, 3-5 x 3-4 cm; **rhizome** very short. Leafy shoot 20-70 cm tall; **bladeless-sheath** 2-3, 5-15 cm long, dense short hairy, ciliate. **Leaf** sheath 10-40 cm long, hairy, ciliate; **ligule** 2-lobed, 2 mm long, hairy, ciliate; **petiole** 10 cm long or non, glabrous or hairy; **blade** 25-60 x 3-6.5 cm, glabrous or pubescent on both surface, base attenuate, apex acuminate. **Inflorescence** terminal or lateral; scape 5-20 cm long, hairy; spike 10-12 cm long; **bracts** 25-40 x 15-25 mm, glabrous or hairy, apex rounded or obtuse; **coma** bracts 30-40 x 7-10 cm, hairy, apex acute or obtuse; **bracteole** triangular, 8-10 x 3-8 mm, sparsely hairy or glabrous, apex obtuse to acute. **Calyx** tubular, 7-8 mm long, glabrous, split down one side 3-4 mm long or not, apex 3-lobed, with ridges from base of each lobe and ended by small beak-like structure just below the apex of lobe; **corolla tube** 20-25 mm long, glabrous outside, hairy inside; **corolla lobes** 6-10 x 5-10 mm, glabrous; dorsal one hooded, apex acuminate cucullate, with few hairs; lateral ones shallowly concave, apex rounded. **Staminodes** obovate, 10-12 x 4-7 mm, with short hairs at the middle of apical half, apex rounded or truncate; **labellum** 3-lobed, 10-13 x 12-13 mm, hairy at base and along either side of mid-band, mid-lobe emarginate. **Filament** flat, 1-2.5 x 3-4 mm, glabrous or sparsely short hairy; **anther** 3-4 x 2 mm, glabrous; **spurs** flat, triangular, 1-2 mm long, straight, point downward, apex acuminate; **crest** none. **Ovary** barrel-shaped, 2-3 mm long, hairy; **stylodes** cylindrical or clavate, 3-4 mm long, apex obtuse; **stigma** 1 mm wide, ciliate, open laterally.

Thailand: Northern –Chiang Mai, Kamphaeng Phet, Lampang, Lamphoon, Mae Hong Son, Nan, Phitsanulok, Tak; Northeastern – Khon Kaen, Loei, Petchabun; Eastern –

Chaiyaphum, Kalasin, Nakorn Ratchasima, Ubon Ratchathani; Southeastern – Chantaburi; Peninsular – Chumphon, Surat Thani; Central – Lop Buri, Nakorn Sawan, Saraburi; Southwestern – Kanchanaburi; Peninsular – Chumphon, Suratthani.

Distribution: India, Burma, China, Indochina and Malaysia.

Ecology: in open areas of deciduous forest, grassland, roadside and sometime in partly shaded area. Flower in April-October.

Vernacular: Ao Daeng.

Uses: Young inflorescence is eaten as vegetable.

Critical remarks: This is the smallest species of subgenus *Curcuma*. It is most variable species and has widest range of distribution.

Specimens examined:

Northern – Chiang Mai [*Beusekom & Phengklai* 1174, Ob Luang tableland, along road from Bo Luang to Om Koi, 12-Jun-1968 (AAU, C, E, K, P); *BGO staff* 1435, Mae Taeng, 24-Aug-1994 (QSBG); *Kerr* 147, 29-Jul-1921 (K); *Kerr* 238, Hua Kao Falls, 12-Aug-1921 (K); *Kerr* 5640, Doi Sutep, 6-Jul-1921 (BK, BM, K); *Kerr* 634, Doi Sutep, 16-May-1909 (E, K, P); *Kerr* 634B, Doi Sutep, 17-May-1914 (BM, BM, C, K); *Larsen et al.* 3796 (AAU); *Maknoi* 211, San Pan Si, QSBG, 4-May-2002 (AAU, BKF, PSU, QSBG); *Maknoi* 214, Ban Paeksam, Wianghaeng, 8-May-2002 (AAU, BKF, PSU, QSBG); *Maknoi* 374, Ban Tam Glaeb, Chiang Dao, 23-Jul-2003 (AAU, BKF, PSU, QSBG); *Maxwell* 00-294, Mae Sanam Mai, Baw Sahlee subdistrict, Hod, 1-Jul-2000 (CMU); *Maxwell* 6, Doi Sutep NP, E side, between Huay Gayo and Wang Bua Ban, 19-Oct-2002 (CMU); *Maxwell* 88-776, Doi Sutep, east side, Kohntatahn Falls area, 18-Jun-1988 (AAU, BKF, CMU); *Maxwell* 90-491, Mae Soi valley, Mae Soi subdistrict, Jawm Tong, 11-May-1990 (CMU); *Maxwell* 90-654, summit of Doi Muang Awn, Sahngampang, 21-Jun-1990 (CMU); *Maxwell* 92-318, summit of Doi Muang Awn, Sahngampang, 25-Jun-1992 (CMU, E); *Maxwell* 95-453, Summit of Doi Chan Pah Dih, above Mae Jam river, Mae Jam, 25-May-1995 (BKF, CMU); *Maxwell* 96-690, Doi Lohn, W side, above Huay Gayo village, Sahngahmpang, 20-May-1996 (BKF, CMU); *Ngamriabsakul* 39, Doi Sutep-Pui NP, 9-Jul-1999 (BKF, E); *Phengklai et al.* 6573, Inthanon NP, 18-Jul-1988 (AAU, BKF, C, E, K, L); *Phuakam* 27, Palaht Temple, Doi Sutep-Pui, 1-Jun-1993 (CMU); *Phuakam* 29, Palaht Temple, Doi Sutep-Pui, 19-Jun-1993 (CMU); *Pongamornkul*

s.n., route to San Pan Si, QSBG, 6-May-1998 (QSBG); *Sorensen et al.* 3378, Doi Sutep, 12-May-1958 (AAU, C); *Sorensen et al.* 3724, Doi Sutep, 25-Jun-1958 (AAU, C); *Sorensen et al.* 4443, Doi Sutep, loc I, 26-Jul-1958 (C); *Sucheera* s.n., route to Mae Sa Mai from QSBG, 17-Apr-1998 (QSBG); *Suwannaratana* 5, Huai Hong Krai Royal Project, Doi Saket, 28-May-1993 (CMU), Kamphaeng Pet [*Ngamriabsakul* 34, Mae Wong NP, 7-Jul-1999 (BKF, E)], Lampang [*Panatkool* 307, Jae Hom Vittaya school, Jae Hom, 21-May-2000 (CMU); *Panatkool* 328, Jae Hom Vittaya school, Jae Hom, 18-Jun-2000 (CMU)], Lamphoon [*Maxwell* 93-534, Doi Khun Dahn NP, Mae Tah, 3-Jun-1993 (CMU); *Maxwell* 93-732, Doi Khun Dahn NP, Mae Tah, 3-Jul-1993 (BKF, CMU); *Sunthorn & Palee* 19, Doi Khun Dahn NP, Mae Tah, 19-May-1993 (CMU)], Mae Hong Son [*Larsen et al.* 2228, S of Mae Sariang, 8-Jul-1968 (AAU, C, E, K, P); *Larsen et al.* 34153, Khun Yuam, 5-Sep-1974 (AAU)], Nan [*Maknoi* 222, Route from Wiang Sa to Nan, 12-May-2002 (AAU, BKF, PSU, QSBG)], Phitsanulok [*Maknoi* 206, Thung Salaeng Luang, 30-Apr-2002 (AAU, BKF, PSU, QSBG)], Tak [*Geesink et al.* 5605, Doi Musoe, 31-May-1973 (AAU, BKF, C); *Murata et al.* T16982, between Tak and Ban Dan Lan Hoi, 5 kms E of Tak, 24-Jul-1973 (AAU, BKF); *Vidal et al.* 6107, Ban Phu Pae, Mae Sot, Tak, 28-May-1979 (P)];

Northeastern – Khon Kaen [*Rogerr* D32, Kaet Thang Luang, Ban Phai, 9-Jun-1976 (AAU); *Smitinand & Nalamphun* 10712, 21-Jul-1969 (BKF)], Loei [*Sorensen et al.* 2276, Phu Kradung, 19-Mar-1958 (AAU, C); *Tamura* T60410, near the entrance of Phu Kradung NP, 25-Aug-1988 (BKF)], Petchabun [*Maknoi* 202, Namnoa NP, route to Phu Kum Kao, 29-Apr-2002 (AAU, BKF, PSU, QSBG); *Maknoi* 218, Phuhin Rongkla NP, 10-May-2002 (AAU, BKF, PSU, QSBG); *Maknoi* 267, Namnoa NP, route to Dong Paek, 7-Jul-2002 (AAU, BKF, PSU, QSBG)];

Eastern – Chaiyaphum [*Geesink et al.* 7057, Thung Kramang, 29-May-1974 (AAU, BKF, K); *Larsen et al.* 31494, NW of Phu Khieo, 7-Aug-1972 (AAU); *Larsen et al.* 31904, Nong Bua Daeng, 15-Aug-1972 (AAU)], Kalasin [*Pradit* 355, Kuchinarai, 9-Aug-1963 (BK)], Nakorn Ratchasima [*Nai Noe* 293, Ban Chumseng, 26-May-1929 (BK, BM, C, K, L); *Put* 2822, Ban Chumseng, 14-May-1930 (BK, BM, K)], Ubon Ratchathani [*Maknoi* 503, Ban Kam Muang, Sirinthorn, 26-Aug-2003 (AAU, BKF, PSU, QSBG)];

Southwestern – Kanchanaburi [*Kostermans* 1271, Ku-jae, 150 km NW of Kanburi, 21-Jul-1946 (P)]; **Central** – Lopburi [*Maknoi* 487, Route to Sab Langka WF, 21-Aug-

2003 (AAU, BKF, PSU, QSBG)], Nakorn Sawan [*Put* 4036, Hua Wai, 27-Aug-1931 (BK, BM, K, L)], Saraburi [Kerr 7035, Maenam Sak, 1-Jun-1923 (BK, BM, C, K)]; **Southeastern** – Chantaburi [*Larsen et al.* 10046, Makhm, 13-Jun-1963 (AAU, BKF)]; **Peninsular** – Chumphon [*Larsen et al.* 1444, 14 kms N of Chumphon, 11-Aug-1966 (AAU)], Suratthani [*Ngamriabsakul* 49, Khao Sok NP, 21-Jul-1999 (E)]; **Laos** – Champasak [*Maxwell* 98-543, Huay Pah Peng stream area, S of Pah Peng Falls, 3-May-1998 (CMU)], Vientiane, [*Vidal* 4417 A, km 22, route to Paksan, 11-Nov-1965 (P)]

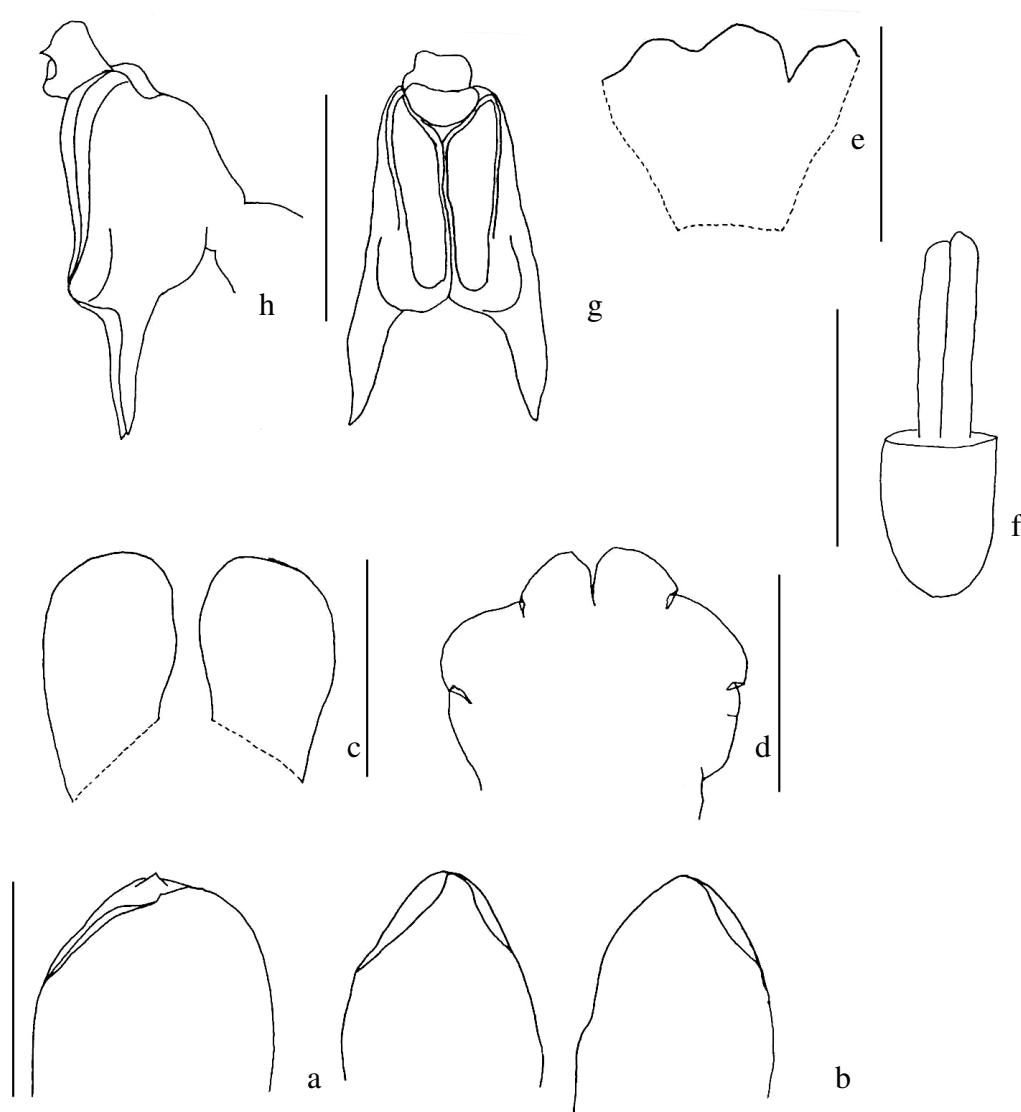


Figure 5 *Curcuma angustifolia* Roxb. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f stylodes and ovary; g stamen – front view; h stamen – side view; (scale = 5 mm)

***Curcuma aromatica* Salisb.** Parad. Lond. (1807) t. 96, in Trans. Hort. Soc. I. (1812) 285; Roscoe, Monandr. Pl. (1828) t. 103; Wight, Icon. (1863) t. 2005; Thwait. Enum. Pl. Zeyl. (1864) 316; Horan. Monogr. (1862) 23; Bak. in Hook.f. Fl. Brit. Ind. VI (1890) 210 ; Trim. Fl. Ceylon IV (1898) 241; K. Schum. Das Pflanzenreich Zingiberaceae (1904) – *C. zedoaria* Roxb. in Asiat. Research. XI (1810) 333; Fl. India. ed. 1. I. (1820) 23; Bot. Magaz. t. 1546. – 111. Figure 6.

Type:

Corm ovoid, bright yellow inside, 5x3 cm; **rhizome** branched, bright yellow inside, 1.5-2.0 cm thick. **Leafy shoot** 80-100 cm tall; **bladeless sheath** short hairy, 12-27 cm long. **Leaf-sheath** green, short hairy, 45-55 cm long; **ligule** membranous, 1.5 mm long, **petiole** glabrous, 0-5 cm long; **blade** oblanceolate, green with red patch along midrib, glabrous on both surfaces, base cuneate, apex acuminate, 30-50 x 7-11 cm. **Inflorescence** lateral, 30 cm tall; scape short hairy, 15 cm long. **Bracts** elliptic, short hairy on both surfaces, apex acute, 4.0-4.5 x 2.5-3.0 cm; **bracteoles** broad elliptic, 15-17 x 13 mm, hairy along ridges, apex obtuse. **Calyx** tubular 8 mm long, hairy at base and along ridges, split down one side 4 mm, apex shallowly 3-lobed. **Corolla** tube 27 mm long, glabrous; corolla lobes 13-15 x 7-8 mm, glabrous; dorsal one hooded, acute-mucronate, hairy at tip, lateral ones; slightly concave, apex obtuse. **Staminodes** broad obovate, 12 x 9 mm, glandular hairy on inner surface, apex truncate. **Labellum** 3-lobed, 20 x 20 mm, glandular hairy on inner surface, denser along either side of midband, side-lobes rounded, mid-lobe emarginate. **Filament** scattered hairy, 3 x 4 mm; anther 4 x 2.5 mm, hairy, pollen sac 4 mm long; spurs sharply acute, downward-pointed, 2.5 mm long. **Ovary** barrel-shaped, 4 mm long, hairy on upper half; sylodes cylindrical, 5 mm long, apex acute; stigma 1 mm wide, laterally opened, ciliate.

Thailand: Cultivated.

Ecology: Cultivated.

Distribution: Myanmar, India.

Use:

Vernacular: ว่านนางคำ

Critical remarks: Rhizome of this species is bright yellow and pungent.

Specimens examined:

cultivated – *Maknoi 197*, PSU, Songkhla, 17-Apr-2002 (PSU).

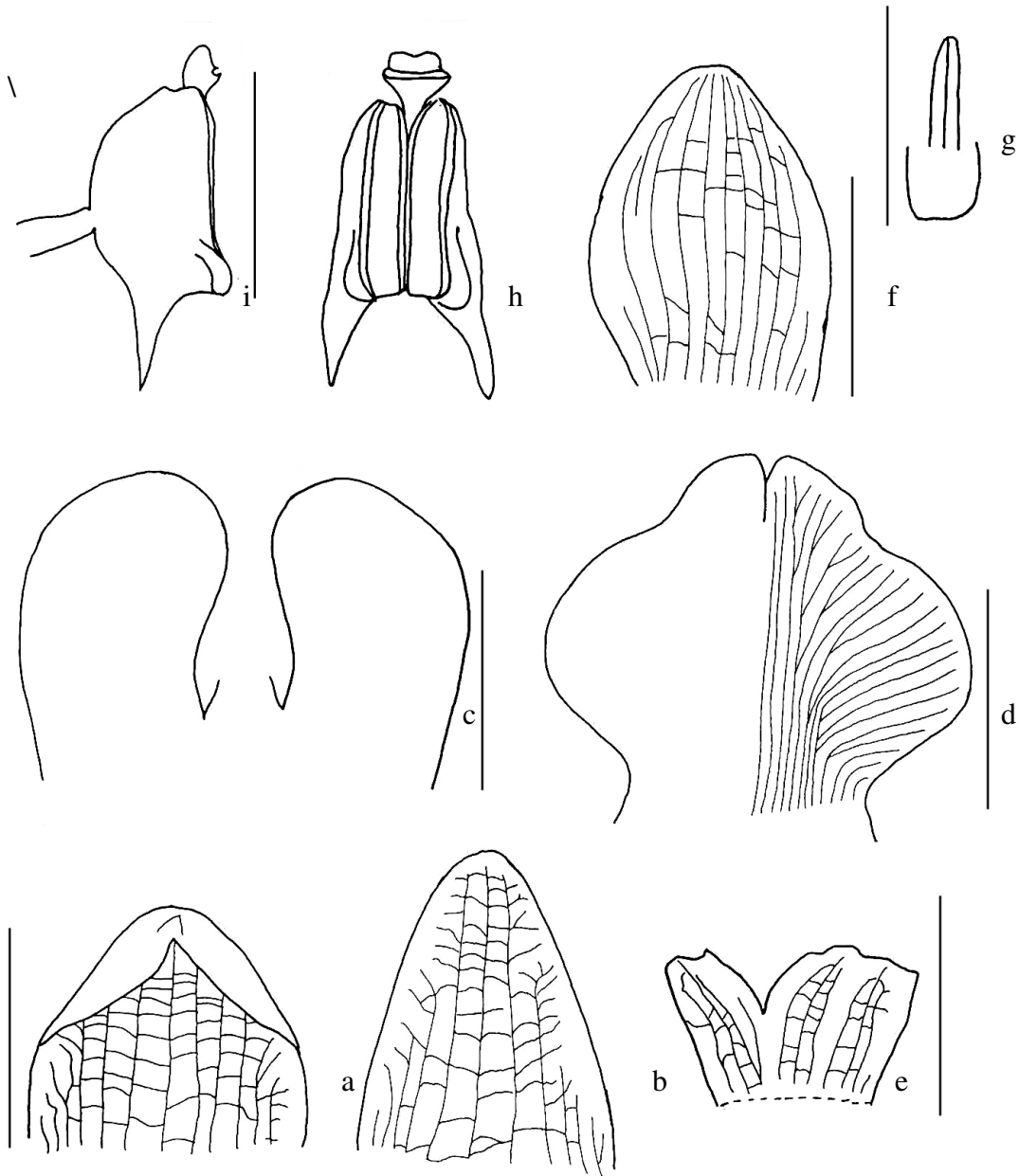


Figure 6 *Curcuma aromatica* Salisb. a dorsal corolla lobe; b lateral corolla lobe; c staminodes; d labellum; e calyx – dissected; f bracteole; g stylodes and ovary; h stamen – front view; i stamen – side view (scale = 5 mm)

***Curcuma aurantiaca* van Zijp** in. Rec. Trav. Bot. Neerl. xii. (1915) 345.; Valetton (1918). Bull. Jard. Buitenzorg. Serie 2, 27: 1-81.; Holttum The Garden's Bulletin Singapore vol. 13 p. 65-72. 1950.; van Steenis - Flora of Java vol. 3 p. 69-72. 1967. Figure 7, plate 3.

Type:

Corm ovoid, pale yellow inside, 4x3 cm; **rhizome** very short; **leafy shoot** 30-50 cm tall. **Bladeless-sheath** 3-4, green, hairy, apex mucronate, 5-25 cm long. **Leaf-sheath** green, hairy, 12-25 cm long; **ligule** 2-lobed, densely hairy, ciliate, lobe apices obtuse, 3-6 mm long; **petiole** hairy, 5-20 cm long; **blade** obovate to lanceolate, green, lower surface pubescent, upper one hairy along secondary nerves, base broad cuneate to slightly cordate, apex acuminate or caudate, 15-45 x 10-15 cm. **Inflorescence** terminal; **scape** densely hairy, 10-15 cm long; **spike** 9-20 cm long. **Bracts** ovate, green, pubescent on both surfaces, apex rounded to obtuse, 3-7 x 2-4 cm; **coma bracts** lanceolate, pink, pubescent on both surfaces, apex rounded, 3-7 x 1.2-2 cm. **Bracteoles** triangular, hairy, apex obtuse, 7x7 mm. **Calyx** tubular 12 mm long, hairy, split one side 5 mm, apex 3-lobed, lobe apices rounded to obtuse. **Corolla tube** glabrous, 25 mm long; **lobes** 7-10 x 15 mm; dorsal one hooded, hirtellous (softly or minutely hirsute), apex mucronate; lateral ones shallowly concave, glabrous, apex obtuse. **Staminodes** obliquely obovate, sparsely minute-hairy, apex rounded to truncate, 12-25 x 9-10 mm. **Labellum** 3-lobed, mid-lobe apex bifid, hairy along both sides of mid-band, 18x18 mm. **Filament** flat, glabrous, 3x3 mm; theca 6 mm long; spur absent, crest 1 mm long, grooved. **Ovary** barrel-shaped, sericeous, 4 mm long; **stylodes** 4 mm long; **stigma** 2-lobed, laterally opened, 2 mm wide.

Thailand: PEN – Satun, Trang.

Ecology: in clearing in evergreen forest and rubber plantation, from 100-150 m above sea level. Flower in August – October.

Distribution: Malay Peninsula, Java.

Use:

Vernacular name:

Critical remark: The anther spurs are absent in this species. Flowers are orange yellow.

Specimens examined:

Peninsula – Satul [*BGO staff* 132, route to Ta-le Ban NP, Kuandon, 23-Aug-1996 (QSBG); *Maknoi* 265, Ta-le Ban, Kuandone, 24-Jun-2002 (AAU, BKF, PSU, QSBG); *Maknoi* 514, route to Ta Le Ban, Kuandone, 14-Sep-2003 (AAU, BKF, PSU, QSBG); *Maknoi* 515, Ban Kampaeng, La Ngu, 14-Sep-2003 (AAU, BKF, PSU, QSBG); *Larsen et al.* 42118, Thale Ban, 20 kms NE of Satun, 3-Oct-1991 (AAU, BKF); *Sorensen & Smitinand* 1201, On the way to Thale Ban, 3-Aug-1977 (BKF); *Vacharee* 802, Chalung, 13-Aug-1987 (BK)], Trang [*Maknoi & Pongpipatsattaya* 321, Khaochong, 12-Sep-2002 (AAU, BKF, PSU, QSBG); *Maknoi* 516, Ban Nongjed, Palean, 14-Sep-2003 (AAU, BKF, PSU, QSBG)].

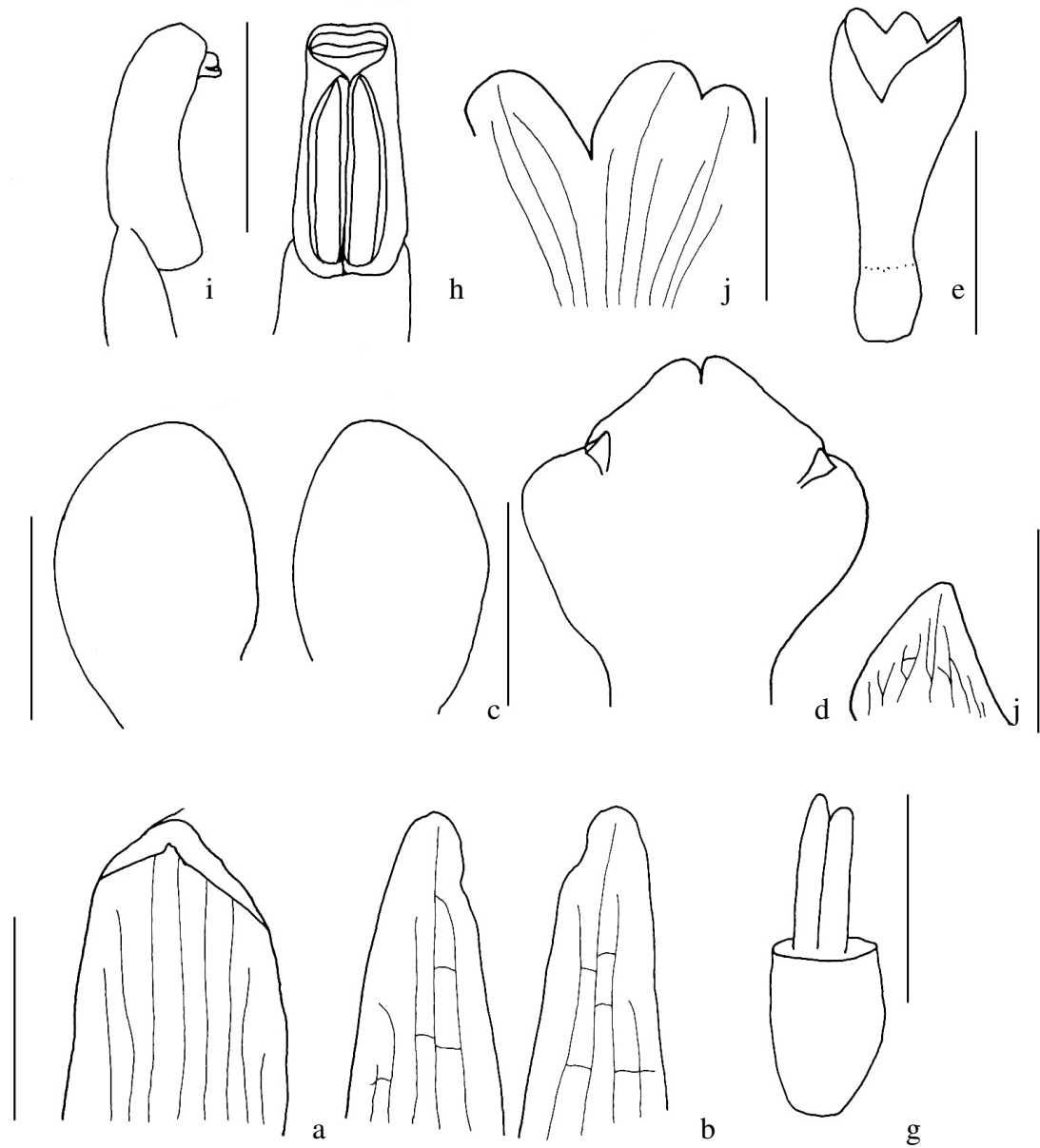


Figure 7 *Curcuma aurantiaca* Zijp a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stylodes and ovary; h stamen – front view; I stamen – side view; j bracteole (scale = 5 mm)

Curcuma bicolor J. Mood & K. Larsen, New Plantsman 8(4): 216 (2001). Figure 8, plate 3.

Type: KES, cult. in Lyon Arboretum, Hawaii, 9-Jan-2000.

Corm ovoid, white inside, 2-3 x 3-5 cm; **rhizome** very short. **Leafy shoot** 40-60 cm tall; **bladeless sheath** glabrous, 8-25 cm long. **Leaf-sheath** glabrous, 12-30 cm long; **ligule** bi-lobed, ciliate, 3-8 mm long; **petiole** slender, glabrous, 2-25 cm long; **blade** elliptic, glabrous on both surfaces, base round to cordate, apex acuminate, 18-30 x 8-15 cm. **Inflorescence** terminal, 8-20 cm tall; **scape** glabrous, 4-10cm long. **Bracts** lanceolate, glabrous on both surfaces, apex acuminate, 3.5-4 x 1.5-2 cm. **Bracteoles?** **Calyx** 20 mm long, apex 3-teethed, densely hairy, split down one side 9 mm. **Corolla tube** hairy, 38 mm long; **lobes** 15 x 5-7 mm; dorsal one hooded, hairy at tip, apex acute-mucronate; lateral ones shallow concave, apex rounded, glabrous. **Staminodes** ovate, glandular hairy, apex obtuse, 15x8 mm. **Labellum** 3-lobed, mid-lobe apex deeply bifid, sinus 5 mm deep, glandular hairy on either side of mid-band, 16x12 mm. **Filament** flat, glabrous, 4x3 mm; theca 8 mm long; spurs conical, point forwards, apex acuminate, 3 mm long; crest thick, blunt, 1.5x1.5 mm. **Ovary** barrel-shaped, densely hairy, 5 mm long; **stylodes** cylindrical, apex blunt, 4 mm long; **stigma** not lobed, laterally opened, ciliate, 1 mm wide.

Thailand: Chiang Mai, Mae Hong Son.

Ecology: in deciduous forest with limestone outcrop. Flower in July – September.

Distribution: endemic to Thailand.

Use: cultivated as ornamental plants.

Vernacular:

Critical remarks: This species is similar to *C. stenochila* Gagnep. but differs in size and pattern of flower color.

Specimens examined:

Northern – Chiang Mai [*Maknoi* 344, Ban Nam Ok Hu, Chaiprakarn, 21-Jul-2003 (AAU, BKF, PSU, QSBG); *Maknoi* 375, Ban Tam Glaeb, Chiang Dao, Chiang Mai, , 23-Jul-2003, (AAU, BKF, PSU, QSBG); *Maknoi* 461, Ban Sinchai, Fang, Chiang

Mai, , 14-Aug-2003, (AAU, BKF, PSU, QSBG)], Mae Hong Son [*Maknoi* 379, Ban Tam Lod, Mueang, 24-Jul-2003, (AAU, BKF, PSU, QSBG); *Srisanga & Puff* 1066, Ban Bo Khai, Pang Mapha, 56 kms from Pai, 12-Sep-1999, (QSBG)]

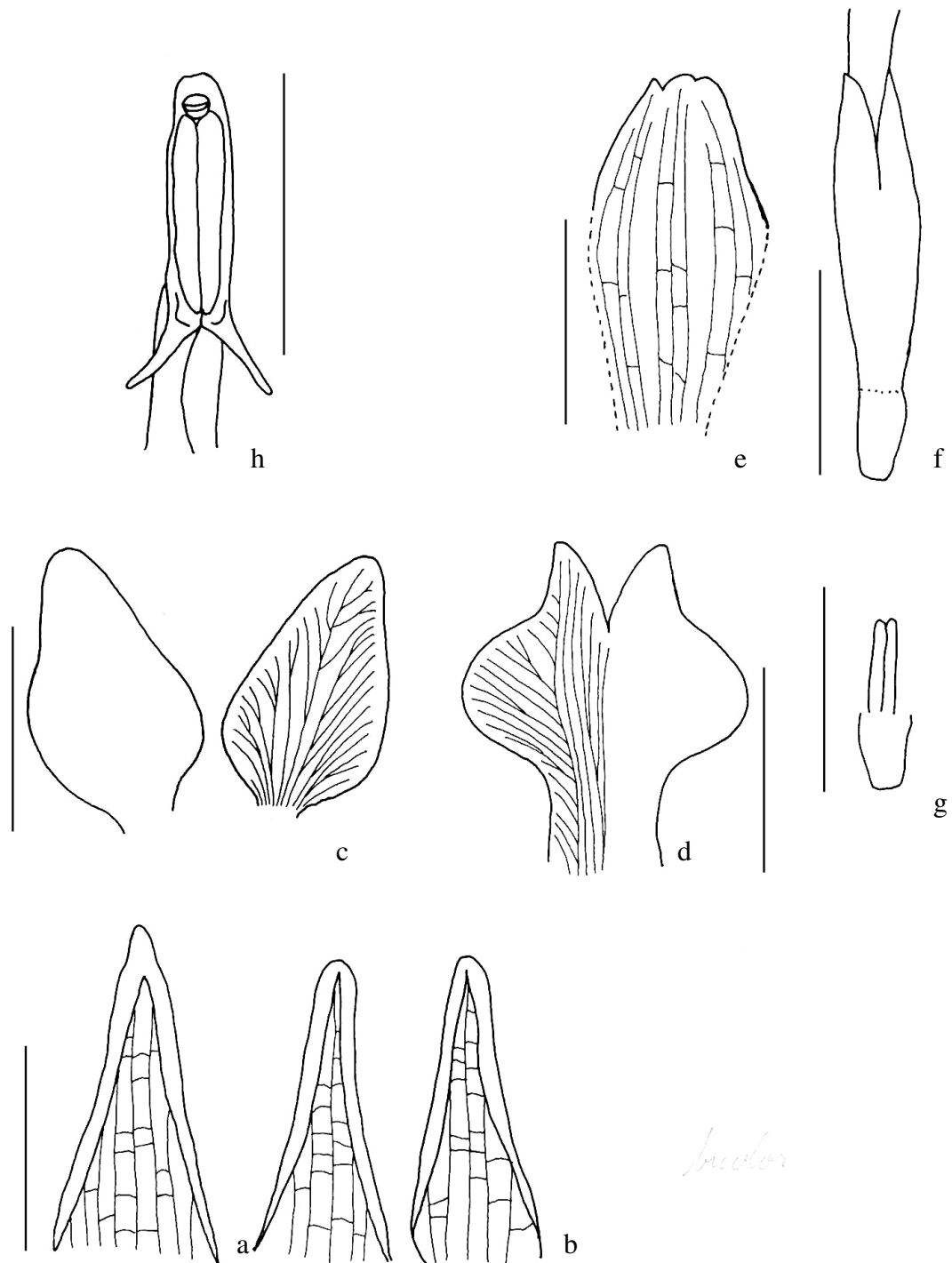


Figure 8 *Curcuma bicolor* Mood & Larsen a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stylodes and ovary; h stamen – front view (scale = 5 mm)

Curcuma cochinchinensis Gagnep. Bull. Soc. Bot. France, liv. 404 (1907); Flora Gen. de Indo-china. VI. (1908) 64. Figure 9, plate 3.

Type: *Talmy* 122, Baria, Cochinchina, ca. 1867 (syntype – P!); Thorel s.n. and Pierre s.n. same locality (syntype – P!).

Corm ovoid, inside whitish, 1-2 x 2-3 cm; **rhizome** very short. Leafy shoot 20-35 cm tall; bladeless sheath. **Leaves** 4; **leaf-sheath** 8-15 cm long, with densely fine hairs; **ligule** 5-11 mm long, with densely fine hairs, apex obtuse; **petiole** 2-17 cm long, glabrous or with densely short hairs; **blade** ovate to obovate-lanceolate, 12-35 x 6.5-11 cm, upper surface glabrous, lower one with densely short hairs, with rounded or cuneate base, with acuminate apex. **Inflorescence** terminal; **scape** 2-5 cm long, with densely fine hairs; **spike** 4-6 cm long. **Bracts** 3-4 x 1.7-3 cm, pale yellow to pink, glabrous or hairy, apex obtuse or acute; **bracteole** 8x4 mm, elliptic? (Widest at base), with hairs along mid-vein, apex hooded. Flowers white, except mid-band on lip yellow. **Calyx** 16 mm long, with scattered fine hairs, apex 3-lobed, mid-lobe apex hooded with fin-like structure in the middle, split down one side 7 mm; **corolla** tube 32 mm long, with scattered fine hairs; lobes 12 x 7-9 mm, glabrous, dorsal one hooded, with acuminate-mucronate apex, lateral ones shallowly boat-shaped, with rounded to truncate apex. **Staminodes** broadly elliptic, 15x12 mm, with short hairs, with obtuse apex; **labellum** broadly obovate, 15x12 mm, with short hairs, denser along edges of mid-band, with deeply 2-lobed apex, cleft 5 mm deep. **Filament** 2x5 mm, with short hairs on both sides; **anther** 6 mm long; **spurs** 1 mm long, filamentose, incurved; **crest** quadrangular, 1x1 mm, apex truncate. **Ovary** subglobose, pilose, 3 mm long; **stylodes** cylindrical, apex acute, 5 mm long; **stigma** laterally opened, 1 mm wide.

Thailand: Northern – Kamphaeng Phet, Tak; Southwestern – Kanchanaburi, Ratchaburi, Prachuap Kirikhan.

Ecology: found in mixed evergreen forest, from 50 – 300 m, flower in July – August.

Distribution: Indochina.

Use:

Vernacular name:

Critical remarks: This species has short filamentose anther spurs as in *C. pierreana* but differs in staminodes are pure white.

Specimens examined:

Northern – Kamphaengpet [*Maknoi* 521, Wangchao WF, 4-Oct-2003 (AAU, BKF, PSU, QSBG); *Ngamriabsakul* 31, Mae Wong NP, Kamphaengpet, 6-Jul-1999 (BKF, E); *Ngamriabsakul* 33, same locality, 7-Jul-1999 (BKF, E); *Ngamriabsakul* 43, same locality, 11-Jul-1999 (BKF, E)], Tak [*Geesink et al.* 5546, Larnsarng NP, 29-May-1973 (BKF, C)]; **Southwestern** – Kanchanaburi [*Geesink et al.* 6072, between Huai Ban Kao and Kritee, 2-Jul-1973; *Kasem* 566, Lum-sum, Sai Yok, 14-Aug-1967 (BK); *Kerr* 10586, Kao Den, 9-Mar-1926 (BM, K); *Kerr* 19507, Ta Salao, 10-Jul-1930 (BK, BM, C, K); *Larsen et al.* 34016, Erawan, SE of Kanchanaburi, 2-Jul-1974 (AAU); *Maknoi* 520, Erawan WF, Srisawas, 3-Oct-2003 (AAU, BKF, PSU, QSBG); *Marcan* 943, rocky hill, 12-Jul-1922 (BM, E, K); *Put* 1810, Sai Yok, 1-Aug-1928 (BK, BM, K); *Wongprasert* s.n., Meklong Watershed Research Station, 24-Aug-1999 (BKF)], Ratchaburi [*Kerr* 9032, 18-Jul-1924 (BK, BM, C, K); *Larsen et al.* 10440, Thung Kang Yang, 7-Feb-1963 (BKF)], Prachuab Khirikant [*Kerr* 20543, Puls.. Lawan, 2-Aug-1931 (BK, K); *Larsen et al.* 1567, S of Prachuap, 13-Aug-1966 (AAU, BKF); *Marcan* 359, Hua Hin, 1-Aug-1920 (BM, K); *Middleton et al.* 1220, Kui Buri NP, Prachuapkhirikhan, , 8/19/2002 (AAU); *Niyomdham* 2990, Sam Roi Yod NP, 14-Aug-1992 (AAU, BKF)], Cultivated [*Kerr* 19746, cult., Bangkok, 24-Aug-1930 (BM, K); *Maknoi* 465, cult. QSBG, Chiang Mai, 19-Aug-2003 (AAU, PSU, QSBG)].

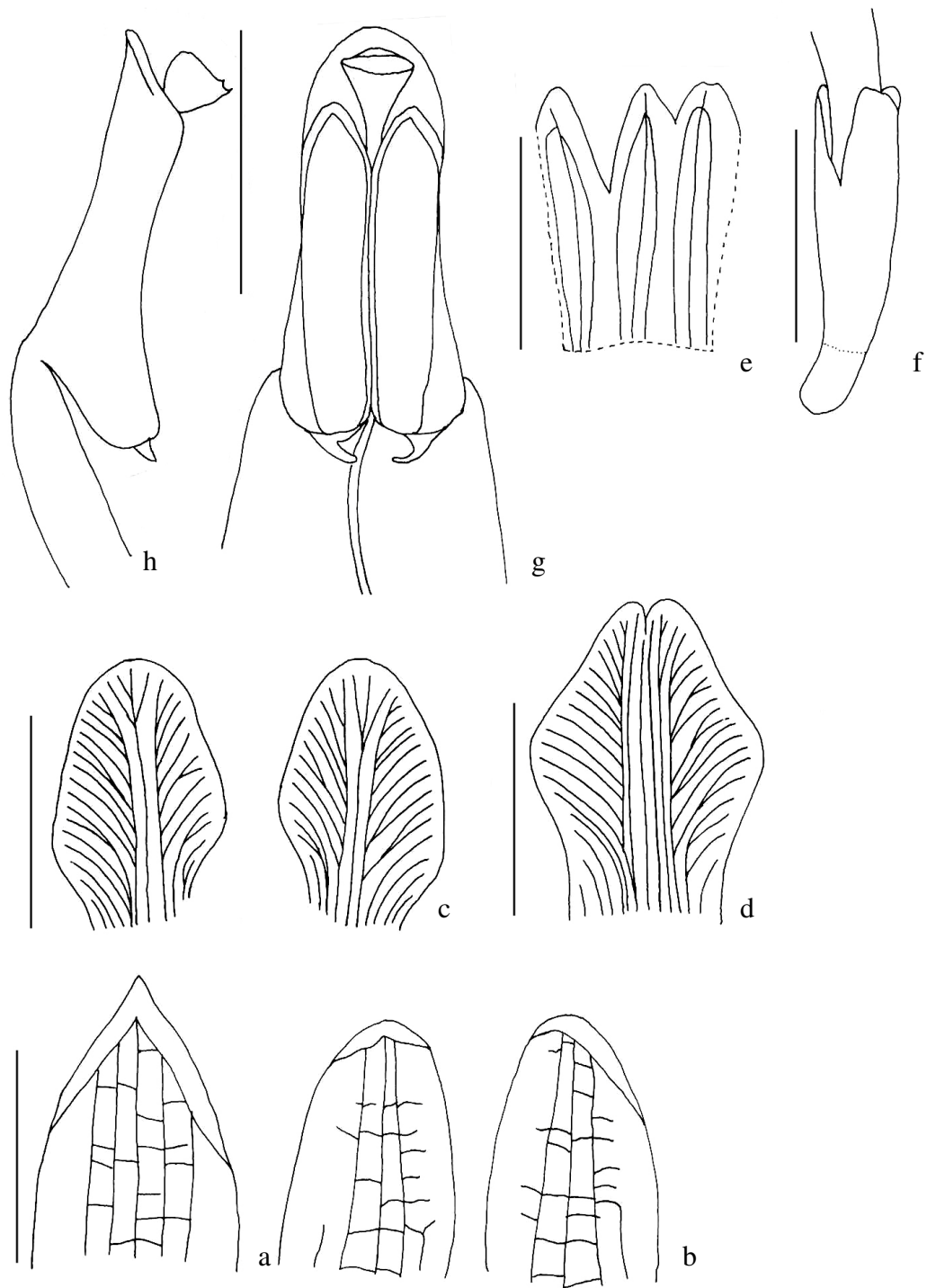


Figure 9 *Curcuma cochinchinensis* Gagnep. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stamen – front view; h stamen – side view (scale = 5 mm)

Curcuma comosa Roxb. in Asiat. Research. (1810) 336, Fl. Ind. ed. 1. I. (1820) 29; Horan. Monogr. (1862) 23; Bak. in Hook.f. Fl. Brit. Ind. VI (1890) 211; K. Schum. Das Pflanzenreich Zingiberaceae (1904) 112. Figure 10, plate 4.

Type: Roxburgh's plate no. 1925 (K!)

Corm ovoid, pale brown to white inside, 5-6 x 8-10 cm; **rhizome** very short. **Leafy shoot** 60 cm tall; **bladeless-sheath** cm long. **Leaf-sheath** 25-40 cm long; **ligule** indistinct; **petiole** 0-5 cm long; **blade** green with red patches on either sides of mid-vein when young, glabrous on both surfaces, base cuneate, apex acute, 20-40 x 14-17 cm. **Inflorescence** lateral; **scape** 10 cm long, glabrous; **spike** 20 cm long. **Bracts** ovate, white with green patch in center, tipped with pink, glabrous on both surfaces; coma bracts pinkish, apex acute, cm. **Bracteoles** broadly obovate, glabrous, apex acute to retuse, 18x15 mm. **Calyx** tubular, glabrous, 8 mm long, apex 3-lobed, split one side 4 mm. **Corolla** tube white, glabrous, 25 mm long; lobes white, glabrous, 9 x 5-8 mm; dorsal one concave, hooded, apex acute-mucronate, with few hair on tip; lateral ones shallowly concave, apex rounded. **Staminodes** broadly obovate, margin irregular lobed, glandular hairy, 10x7 mm. **Labellum** obovate, 3-lobed, mid-lobed retuse, glandular hairy along sides of yellow mid-band, 10x12 mm. **Filament** flat, glabrous, 3x2.5 mm; anther glabrous; theca 4 mm long; spurs flat, triangular, acuminate, 2 mm long; crest less than 1 mm long, apex rounded. **Ovary** barrel-shaped, glabrous, 4 mm long; **stylodes** cylindrical, acute, 5 mm long; **stigma** 2-lobed, laterally opened, ciliate.

Thailand: Northern – Pitsanulok; Cultivated.

Ecology: Grow in deciduous and bamboo forest.

Distribution: India and Myanmar.

Use: Cultivated for medicinal purposes.

Vernacular: Waan chak mod look.

Critical remarks: This species produces subsessile inflorescence. Bracts white tipped with pink.

Specimens examined:

Maknoi 540 (Kaeng Ched Kwae, Pitsanulok, 27-May-2004)

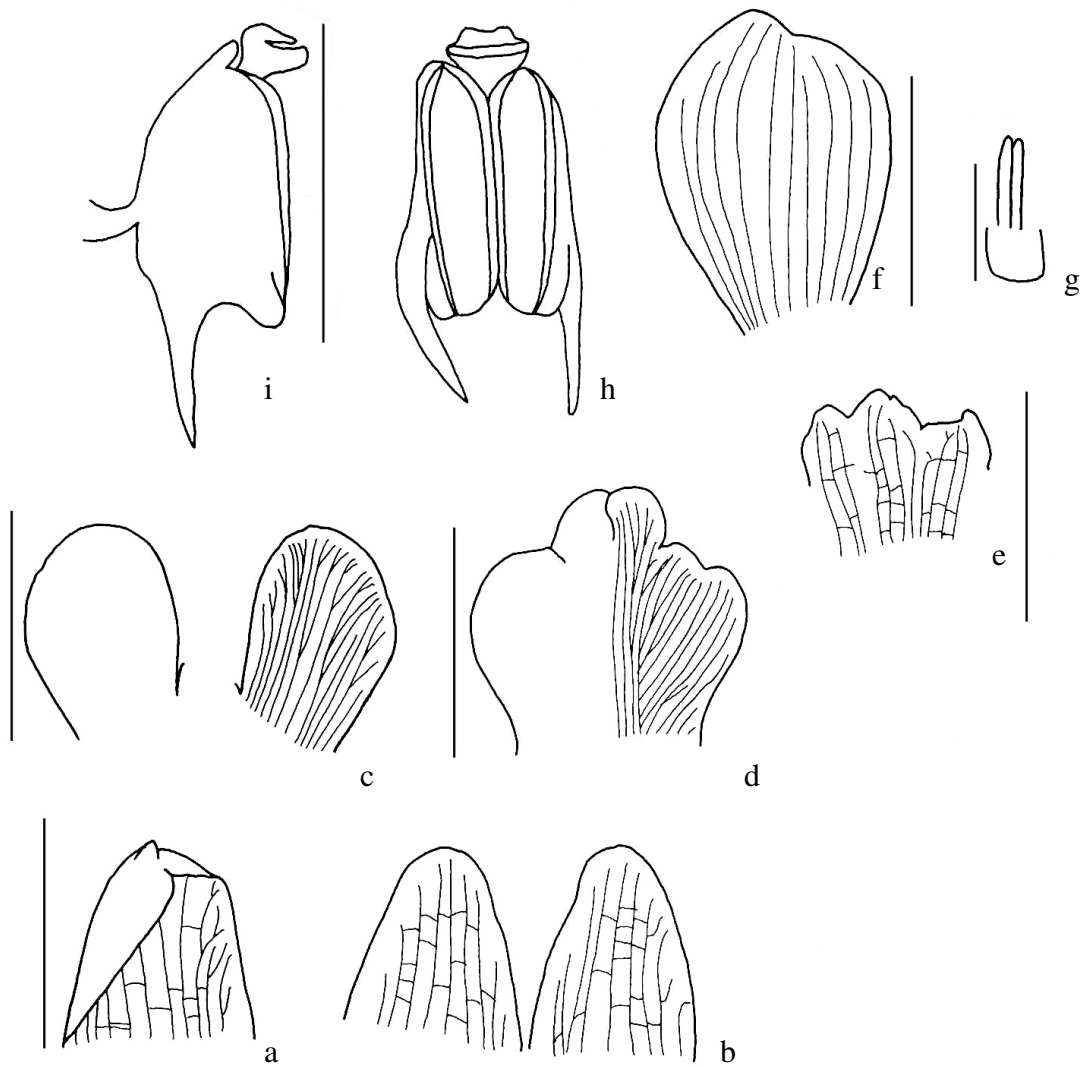


Figure 10 *Curcuma comosa* Roxb. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f bracteole; g stylodes and ovary; h stamen – front view; I stamen – side view (scale = 5 mm)

Curcuma ecomata Craib, Kew Bull. 1912, 301. Figure 11, plate 4.

Type: *Kerr* 1155, Doi Sutep, 2-May-1910 (BM, E, K, TCD).

Corm ovoid, pale brown inside, 3-5 x 3-4 cm; **rhizome** very short. **Leafy shoot** 30-50 cm tall; **bladeless-sheath** pubescent, 5-30 cm long. **Leaf sheath** pubescent, 8-30 cm long; **ligule** 2 mm long; **petiole** 4-8 cm long; **blade** obovate-lanceolate, 15-45 x 5-12 cm, glabrous or pubescent on both surfaces, base cuneate, apex acuminate with or without red patch along midrib. **Inflorescence** terminal or lateral, 8-25 cm long; **scape** 3-15 cm long, glabrous. **Bracts** 3.5x1.5 cm, glabrous, apex acute; **coma bracts** absent. **Calyx** tubular, 17 mm long, glabrous, apex unequally 3-lobed. **Corolla** tube hairy on upper half, 25 mm long; lobes white or pale pink, glabrous, 16x7 mm; dorsal one hooded, apex acute cucullate; lateral ones shallowly concave, apex rounded. **Staminodes** obliquely ovate, pale pink to dark purple, apex obtuse, 15-16 x 9 mm. **Labellum** obovate, pale pink to dark purple with yellow band in the middle, hairy along mid-band, apex bifid, 19x14 mm. **Stamen** white; filament flat, glandular hairy, 3 mm long; anther 10 mm long; spurs cylindrical, forward-pointed, apex acute, 4-5 mm long. **Ovary** barrel-shaped, hairy, 4x3 mm; stylodes narrowly cylindrical, apex acute, 7 mm long; stigma open laterally, apex bi-lobed, ciliate, 1 mm wide.

Thailand: Northern – Chiang Mai, Chiang Rai, Mae Hong Son.

Ecology: found in deciduous forest and dry evergreen forest, from 400 to 1300 m above sea level; flower in April –July.

Distribution: endemic to northern Thailand.

Use:

Vernacular name:

Critical remarks: This species is recognized by light or dark purple flowers with yellow median band on labellum.

Specimens examined:

Northern – Chiang Mai [*Geesink et al.* 5734, Chiang Dao Watershed Station, 6-Jun-1973 (AAU, BKF, C, E, P); *Kerr* 5369, Mae Ya, Chawm Tong, 7-May-1921 (BK, BM, K); *Maknoi* 210, San Pan Si, QSBG, 4-May-2002 (AAU, BKF, PSU, QSBG);

Maknoi 341, Sri Sangwan WF, Chiang Dao NP, Chaiprakarn, 21-Jul-2003 (AAU, BKF, PSU, QSBG); *Maxwell* 87-675, Doi Sutep, 18-Jul-1987 (CMU); *Maxwell* 88-541, Doi Sutep, 28-Apr-1988 (CMU); *Maxwell* 88-591, Doi Sutep, 8-May-1988 (CMU, E); *Maxwell* 88-745, Doi Sutep, 9-Jun-1988 (AAU, BKF, CMU, E); *Maxwell* 95-462, Doi Cham Bah Bih, above Mae Jam river, Mae Jam, 25-May-1995 (BKF, CMU); *Maxwell* 95-495, Doi Chiang Dao WS, Chiang Dao, 14-Aug-1995 (CMU); *Maxwell* 97-539, S side of Doi Sahng Liang, Mae Dtang, 27-May-1997 (BKF, CMU); *Ngamriabsakul* 28, Doi Sutep-Pui NP, 9-Jul-1999 (BKF); *Ngamriabsakul* 38, Doi Sutep-Pui NP, 9-Jul-1999 (E); *Phengkklai* 1031, Fang, 27-Apr-1965 (BKF); *Phengkklai et al.* 4054, Doi Sutep, 22-Jul-1978 (BKF); *Phuakam* 24, Palaht Temple, Doi Sutep-Pui, 13-May-1993 (CMU); *Phuakam* 28, Palaht Temple, Doi Sutep-Pui, 10-Jun-1993 (CMU); *Sorensen et al.* 2919, Doi Sutep, 20-Apr-1958 (C); *Sorensen et al.* 3297, Doi Inthanon, 8-May-1958 (C); *Suvarnakoses* 1176, Doi Chiang Dao, 24-Apr-1956 (BKF, C); *Wangworn* 220, (CMU)], Chiang Rai [*Maxwell* 98-565, Doi Luang NP, W side, summit ridge of Doi Muak, Wiang Pa Pao, 24-May-1998 (BKF, CMU)], Mae Hong Son [*Santisuk* 996, Huai Chompoo Arboretum, Mae Sariang, 16-May-1977 (BKF)], Lampoon [*Maxwell* 93-538, Doi Khun Dahn NP, Mae Tah, 3-Jun-1993 (CMU)].

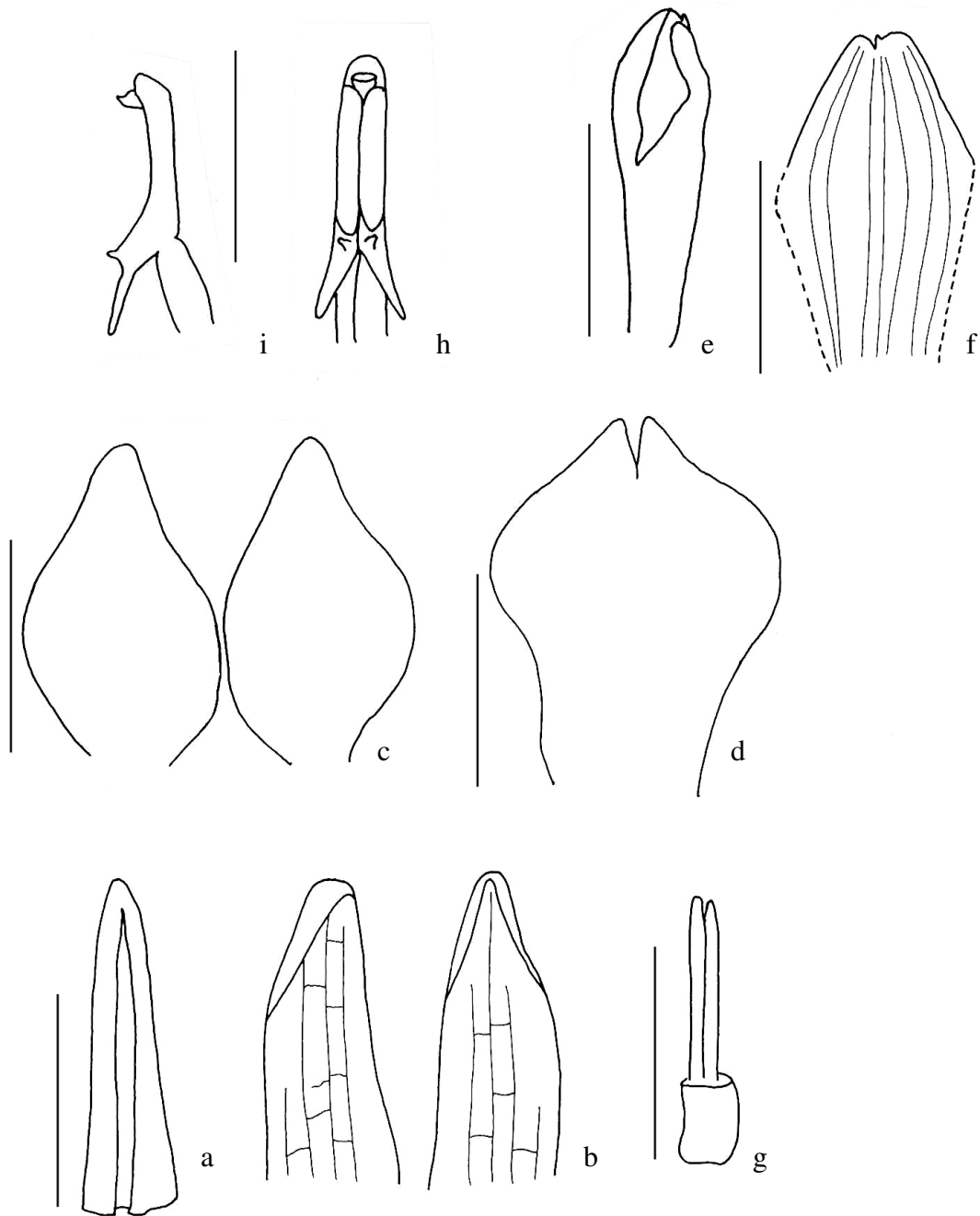


Figure 11 *Curcuma ecomata* Craib a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx; f calyx – dissected; g stylodes and ovary; h stamen – front view; I stamen – side view (scale = 5 mm)

Curcuma flaviflora S.Q. Tong, Acta Bot. Yunnanica, 8(1): 37 (1986); Wu & Larsen. Flora of China. 24 (2000?) 363. Figure 12, plate 5.

Type: S.Q. Ting & A.M. Li 32855, Menhai, Xian, 23-April-1982 (Holo-YNTBI, Iso-KUN!).

Corm ovoid, white inside, 3x2 cm; **rhizome** very short. **Leafy shoot** 30-50 cm tall; **bladeless-sheaths** 4-5, pubescent, apex mucronate, 3-23 cm long. **Leaf-sheaths** pubescent, 20-30 cm long; **ligules** 2-lobed, glabrous, lobe apices rounded to obtuse, ciliate, 2-4 mm long; **petiole** pubescent, 2-5 cm long; **blades** oblanceolate, green, sometime with red patch on either side of midrib, upper surface glabrous, lower surface pubescent, with or without red patch along midrib, base cuneate, apex acuminate, 18-30 x 6-8.5 cm. **Inflorescence** lateral, appear before vegetative shoot; **scape** pubescent, 5-15 cm long; **sheath** linear-lanceolate, pubescent, 10 cm long; **spike** 3-5 cm long. **Bracts** 3-4.5 x 1.3-1.5 cm, lanceolate, apex acuminate, pubescent on both surfaces, connate part 1.5 cm, free part 3.0 cm; **coma bracts** and **bracteole** absent. **Calyx** tubular, hairy along ridges, apex 3-lobed, 21 mm long, split down one side 7 mm. **Corolla** tube pubescent, 3.8-4.2 cm long; corolla lobes 15-17 x 5-7 mm, scattered hairy; dorsal one concave, hooded, apex acute-cucullate; lateral ones shallowly concave, hooded, apex rounded. **Staminodes** ovate, glandular hairy on inner surface, apex obtuse, 20x12 mm. **Labellum** obovate, yellow with bright yellow mid-band, glandular hairy, denser on either side of mid-band, apex deeply bifid, cleft 7 mm deep, 20x15 mm. **Stamen** pubescent; **filament** shallowly concave, 5x4 mm; **crest** emarginated, 1 mm long; **spurs** acute conical, point forwards, diverse at apex, glabrous, 5 mm long. **Ovary** barrel-shaped, pubescent, 5 mm long; **stylodes** slender, apex acute, 7 mm long; **stigma** laterally opened, ciliate, 1.5 mm wide.

Thailand: Northern – Chiang Mai, Mae Hong Son.

Ecology: in open area and pine forest, 1400 m above sea level. Flower in June – July.

Distribution: South China (Yunnan).

Uses:

Vernacular:

Critical remarks: The flowers of this species are similar to *C. ecomata* but differ in yellow color instead of purple.

Specimens examined:

Northern – Chiang Mai [*Maknoi* 356, Doi Angkang, Fang, 21-Jul-2003 (AAU, PSU, QSBG); *Norsaengsri* 1476, Chiang Dao, (QSBG); *Srisanga* 721, Doi Angkang, Fang, 12-Jun-1999 (QSBG); *Wongprasert* 015-05, Khun Huay Mae Kok, Chiang Dao, 5-Jun-2001 (BKF)], Mae Hong Son [*Geesink, Panichapol & Santisuk* 5960, 15 km NW of Mae Hong Son, 18 June 1973 (C, E); *Maknoi* 382, Doi Pui, Huai Hee, Mueang, 25-Jul-2003 (AAU, BKF, PSU, QSBG)].

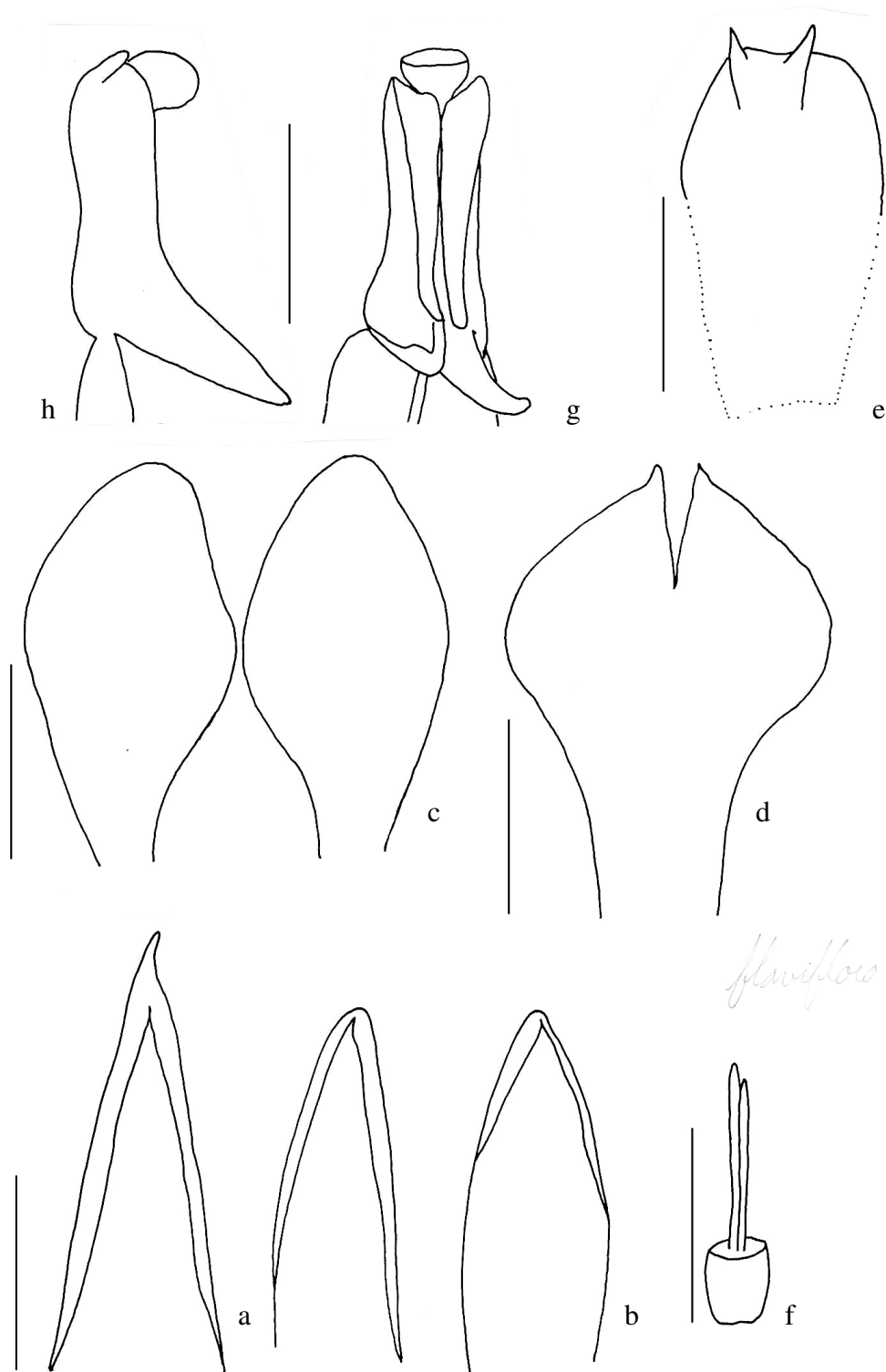


Figure 12 *Curcuma flaviflora* S.Q. Tong a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f stylodes and ovary; g stamen – front view; h stamen – side view; (scale = 5 mm)

Curcuma glans K. Larsen & J. Mood, New Plantsman 8(4): 216 (2001). Plate 5.

Type: Mood & Larsen 1455B, cult in Lyon Arboretum, Hawaii; 9-Jan-2000 (AAU)

Corm ovoid, pale brown inside, 3-4 x 1.5-2 cm; **rhizome** very short. **Leafy shoot** 30-40 cm tall; **bladeless sheath** hirsute, apex mucronate, 4-8 cm long. **Leaf sheath** hirsute, 3-8 cm long; **ligule** shallowly bi-lobed, membranous, glabrous, 1mm long; **petiole** glabrous, 2-7 cm long; **blade** lanceolate, glabrous on both surfaces, base cuneate, apex acuminate, 11-18 x 5-7.5 cm. **Inflorescence** terminal or lateral, 4-12 cm long; **scape** 1-5 cm long; **bracts** 2.5-4.5 x 1.5-2 cm, apex acuminate; **coma bracts** absent; bracteoles broadly ovate, glabrous, apex acute, 4x1 mm. **Calyx** tubular, with few hairs, apex 3-lobed, 10-14 mm long. **Corolla** tube densely hairy, 35 mm long; lobes glabrous, 13-16 x 6-7 mm; dorsal lobe hooded, apex acute cucullate; lateral lobes concave, apex blunt cucullate. **Staminodes** elliptic, white, base pale violet, tip pale yellow, glandular hairy, apex rounded, 14x7 mm. **Labellum** obovate, white with orange-yellow band in the middle, apex bifid, 19x14 mm. **Stamen:** filament 5x2 mm, dense glandular hairy; anther 8 mm long; spurs acute cylindrical, forwards-pointed, 4 mm long; crest small, apex rounded. **Ovary** barrel-shaped, densely hairy, 3 mm long; stylodes cylindrical, 7 mm long; stigma dorsal opening, ciliate, 2 mm wide.

Thailand: Northern – Lampang.

Ecology: in bamboo forest. Flower in March – October.

Distribution: endemic to northern Thailand.

Use:

Vernacular:

Critical remarks: The color pattern of flower of this species is unique.

Specimens examined:

Northern –Lampang [*Maknoi* 517, Jae Son WF, Jae Hom, 1-Oct-2003 (AAU, BKF, PSU, QSBG); *Maxwell* 96-514, Jae Sawn NP, Muang Bahn (Pan), 1-Apr-1996 (CMU); *Maxwell* 96-555, same locality, 22-Apr-1996 (CMU); *Maxwell* 96-728, same locality, 27-May-1996 (BKF, CMU); *Maxwell* 97-237, Doi Luang NP, SW side, Wang Gayo Falls, Wang Nua, 26-Mar-1997 (CMU)].

***Curcuma gracillima* Gagnep.** in Bull. Soc. Bot. France 4. serie. III. (1903) 161. – var. *elatior* Gagnep. Bull. Soc. Bot. France 4. serie. III. (1903) 161; K. Schum. Das Pflanzenreich Zingiberaceae. (1904) 103. Flora Gen. de Indo-china. VI. 59. Figure 13, plate 6.

Type: *Harmand* s.n., river gauche du Mekong, Laos central, 1875-1877 (P!).

Corm ovoid, white to pale brown inside, 2x1 cm; **rhizome** very short. **Leafy shoot** 15-50 cm tall; the whole plant glabrous; **bladeless sheath** 4-15 cm long. **Leaf sheath** 4-20 cm long; **ligule** 1-2 mm long; **petiole** 1.5-30 cm long; **blade** lanceolate, glabrous on both surfaces, base cuneate to rounded, apex acuminate, 7-40 x 2.5-14 cm.

Inflorescence terminal; **scape** 7-30 cm long; **spike** 3.5-8 cm long. **Bracts** 1.5-3 x 1.2-1.8 cm, apex rounded to acute; **coma bracts** white, apex acute, 1.5-2 x 0.8-2 cm; **bracteoles** broadly ovate, concave, glabrous, apex acute, 10x7 mm. **Calyx** tubular, glabrous, 7 mm long, apex unequally 3-lobed. **Corolla tube** glabrous, 15 mm long; **lobes** glabrous, white, 6x4-5 mm; **dorsal lobe** concave, apex mucronate; **lateral lobes** shallowly concave, apex obtuse. **Staminodes** obovate, glabrous, white with pale or dark blue tip, margin erose, apex rounded, 7x4 mm. **Labellum** obovate, white with dark violet tip, edge fringed, apex deeply bifid, sinus 4 mm deep, 8x7 mm. **Filament** flat, glabrous, 1.5x2 mm; anther 3 mm long, glandular hairy, ecalcarate; crest with obtuse apex, 1 mm long. **Ovary** subglobose, glabrous, 2 mm long; stylodes absent; stigma terminally opened, ciliate, 1 mm wide.

Thailand: Northeastern – Sakon Nakorn; Eastern – Ubon Ratchathani; Central – Lopburi.

Ecology: in deciduous forest. Flower in August.

Distribution: Indochina.

Use:

Vernacular:

Critical remarks: The vegetative characters of this species are much similar to those of *C. parviflora*. It is difficult to recognize this species from herbarium sheath without flowers preserved in alcohol.

Specimens examined:

Northeastern – Sakon Nakorn [*Ngamriabsakul* 62, Phu Pan NP, 1-Aug-1999 (BKF, E); *Yuktathat* 136, Phu Phan NP, -/8/1987 (E)]; **Eastern** – Ubon Ratchathani [*Maknoi* 510, Khong Chiam, 26-Aug-2003, (AAU, BKF, PSU, QSBG)]; **Central** – Lopburi [*Maknoi* 485, Route to Sab Langka WF, 21-Aug-2003, (AAU, BKF, PSU, QSBG)]; **Cultivated** – *Maknoi* 506, Chong Mek, Laos, 26-Aug-2003, (AAU, BKF, PSU, QSBG).

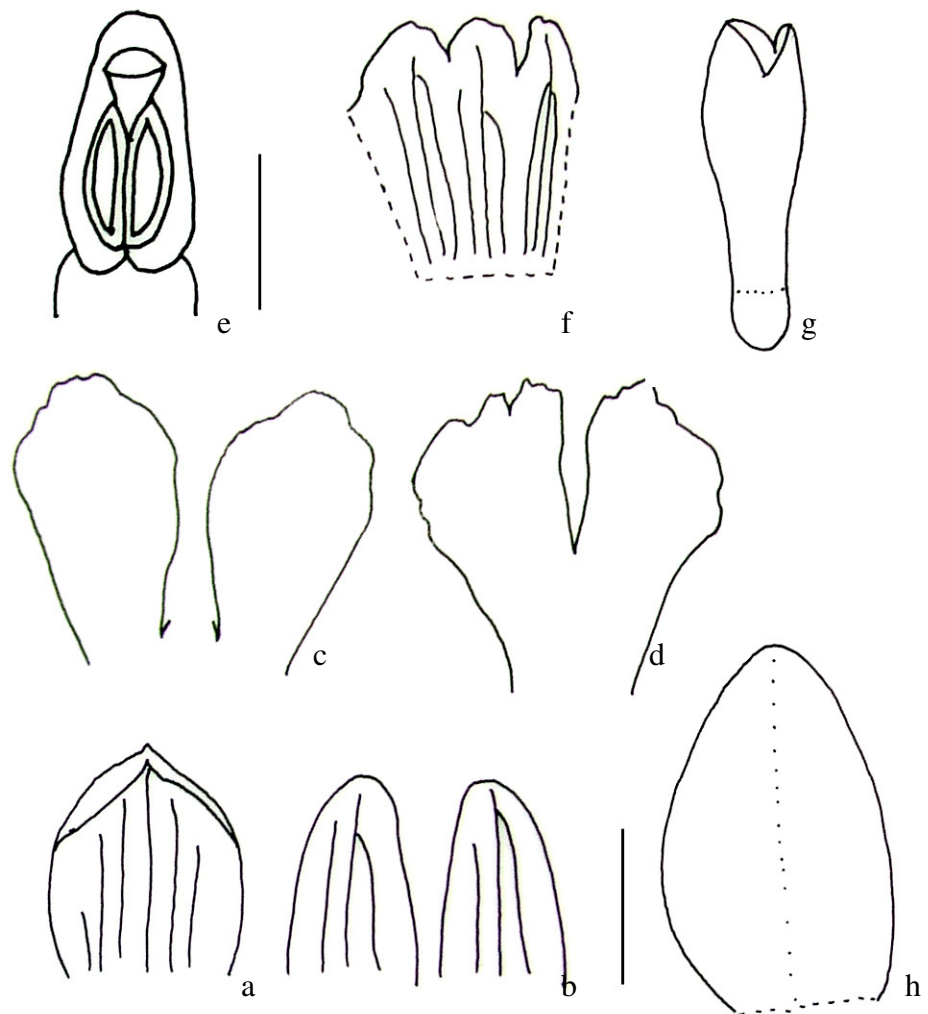


Figure 13 *Curcuma gracillima* Gagnep.; a) dorsal corolla lobe; b) lateral corolla lobes; c) staminodes; d) labellum; e) stamen; f) calyx – dissected; g) ovary and calyx; h) bracteole. (scale = 5 mm)

***Curcuma harmandii* Gagnep.** in Bull. Soc. Bot. France, liv. 404 (1907), Flora Gen. de Indo-china. VI. 63. Figure 14, plate 6.

Type: *Pierre* s.n., Cochinchine, April 1870 (P!); *Harmand & Godefroy* 555, Mount de Pursat, Cambodge, 20-June-1856 (P!).

Corm ovoid, pale brown inside, 1.5x1 cm; **rhizome** very short. **Leafy shoot** 40-60 cm tall; **bladeless sheath** 10-15 cm long. **Leaf sheath** glabrous, 12-22 cm long; **ligule** 2-lobed, membranous, glabrous, 1-2 mm long; **petiole** glabrous, 6-15 cm long; **blade** elliptic, glabrous on both surfaces, base cuneate, apex acuminate, 15-25 x 4.5-12 cm. **Inflorescence** terminal, 25-50 cm tall; **scape** 20-35 cm long, glabrous. **Bracts** ovate, glabrous on both surface, apex acute or obtuse, 4.5-10 x 2-3 cm; **coma** bracts none, the uppermost bract sterile in some plants; bracteoles concave, xxcm. **Calyx** tubular, 12 mm long, split down one side 4 mm, glabrous, apex shallowly 3-lobed. **Corolla** tube glabrous, 20 mm long; lobes glabrous, 10 x 6-7 mm; dorsal one hooded, apex cucullate; lateral ones concave, apex rounded. **Staminodes** narrowly oblong, glabrous, apex acuminate, 10x1 mm. **Labellum** obovate, white with yellow midband and red line on either side, hairy along midband, apex emarginate, 15x10 mm. **Filament** sparsely hairy, 2x2 mm; anther sparsely hairy, ecalcarate, 4 mm long; crest shallowly emarginate, 2 mm long. **Ovary** subglobose, glabrous, 2 mm long; stylodes absent; stigma terminally opened, ciliate, 1 mm wide.

Thailand: Eastern – Nakorn Ratchasima; Southeastern – Chachong Sao, Chantaburi, Chonburi, Nakorn Nayok; Central – Saraburi.

Ecology: found in deciduous forest and dry evergreen forest, from 100 to 500 m above sea level; flower in May–October.

Distribution: Indochina.

Use:

Vernacular name:

Critical remarks: This species has a very long and slender inflorescence. Its green and elongate bracts apex are easily to recognize.

Specimens examined:

Eastern – Nakorn Ratchasima [*Larsen et al.* 3196, Khao Lotung, S of Pak Thong Chai, 9-Aug-1968 (AAU, BKF, E, P); *Smitinand & Sleumer* 8366, Phu Luang, Wang Namkhieo, 9-Jun-1963 (BKF)], Srisaket [*Maknoi* 284, Ban Natrao, Phusing, 15-Jul-2002 (AAU, BKF, PSU, QSBG)]; **Central** – Chachong Sao [*Ngamriabsakul* 46, Khao Ta Krub, Wang Namyen, 19-Jul-1999 (BKF, E); *Ngamriabsakul* 48, 21-Jul-1999 (BKF, E); *Suksathan* 3030, Ang Rue Nai WS, 6-Jul-2001 (QSBG)], Nakorn Nayok [*Floto* 7792, 30-Jul-1959 (AAU, BKF, C)], Saraburi [*Maxwell* 73-464, Sam Lahn forest, Muang, 13-Oct-1974 (BK); *Maxwell* 74-468, same locality, (AAU); *Maxwell* 74-531, same locality, 19-May-1974 (AAU); *Maxwell* 75-1010, same locality, 21-Sep-1975 (AAU, BK); *Larsen et al.* 43733, same locality, 3-Aug-1992 (AAU)]; **Southeastern** – Chantaburi [*Larsen et al.* 32108, Khao Phra Bat, N of Chantaburi, 27-Aug-1972 (AAU)], Chonburi [*Maxwell* 75-592, Khao Kiew, Sriracha district, 21-Jun-1975 (AAU, BK)]; **Cultivated** – *Collins* oi, Bangkok, 5-Nov-1935 (BM); *Collins* OI, Bangkok, 2-Nov-1934 (K); *Maknoi* 320, PSU, Songkhla, 26-Aug-2002 (PSU).

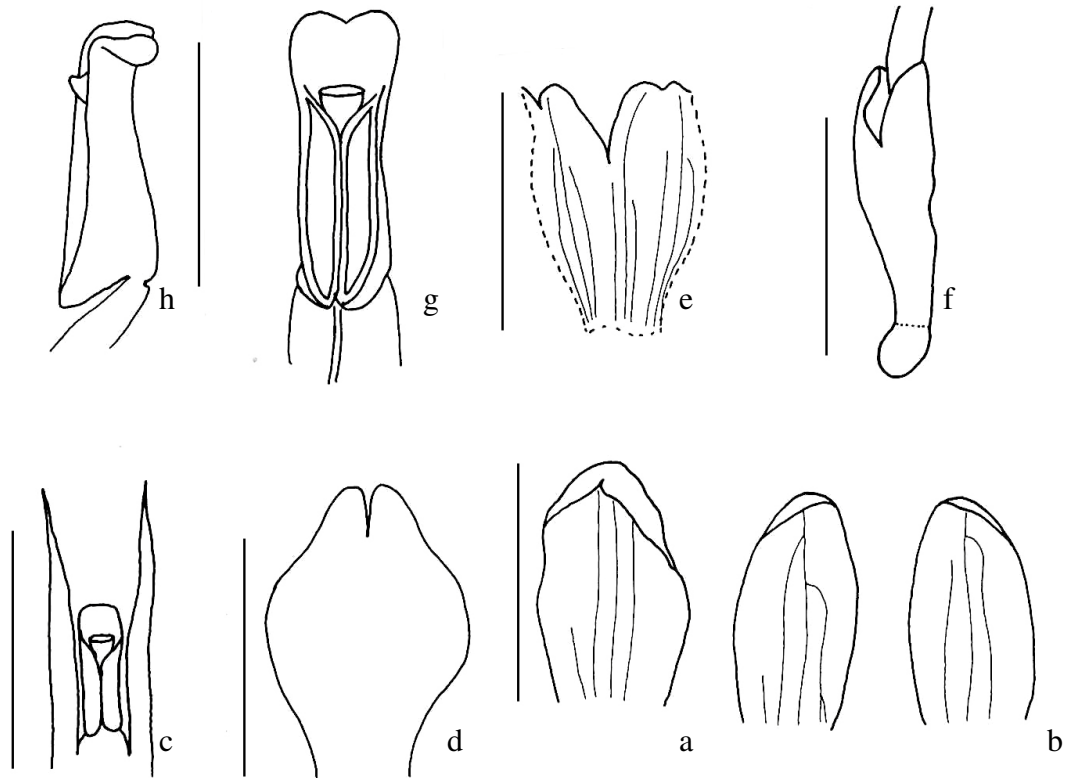


Figure 14 *Curcuma harmandii* Gagnep. a dorsal corolla lobe; b lateral corolla lobes; c stamen and staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stamen – front view; h stamen – side view; (scale = 5 mm)

***Curcuma latifolia* Rosc.** Monandr. Pl. t. 108, 1828; Horan. Monogr. 23. 1862; Bak. in Hook.f. Fl. Brit. Ind. 6. 211. 1890; Schuman., Pflanzenr. Zingib. 111. 1904. Figure 15, plate 7.

Type:

Corm ovoid, pale brown inside, 10-12 x 5-8 cm; **rhizome** very short. **Leafy shoot** 150-180 cm tall; **bladeless sheath** 20-30 cm long. **Leaf sheath** 50-80 cm long; **ligule** membranous, truncate, 5 mm long; **petiole** 5-20 cm long, sparsely short hairy; **blade** almost glabrous on both surfaces, except along midrib and margin on lower surface, green with reddish brown patch along midrib, base cuneate, apex acuminate, 70x24 cm. **Inflorescence** terminal or lateral; **scape** 20 cm long; **spike** 15 cm long; **lateral inflorescence** 25-35 cm tall; **scape** 12-20 cm long, hairy, **sheath** up to 15 cm long, hairy. **Bracts** 3.5-6 x 3 cm, short hairy on both surfaces, apex rounded to obtuse; **coma** bracts 6-6.5 x 2.5-3 cm, with short hairs on both surfaces, apex rounded or obtuse; **coma** bracts 4.5-5 x 2-2.5 cm, hairy on both surfaces, apex acute to obtuse; **bracteoles** concave, glabrous, apex rounded or obtuse, 2.5x2.0cm. **Calyx** tubular, 10 mm long, split one side 6 mm, few hairs along veins, apex shallowly 3-lobed. **Corolla tube** glabrous, 20 mm long; **lobes** glabrous, 10-13 x 10-12 mm; **dorsal** one hooded, apex acute mucronate; **lateral** ones concave, apex rounded. **Staminodes** obovate, glandular hairy, apex rounded, 12x8 mm. **Labellum** 3-lobed, midlobe emarginate, yellow with bright yellow midband, glandular hairy along side of midband, 13x15 mm. **Filament** flat, 3x3 mm; **anther** 4 mm long; **spurs** sharply acute, downward-pointed, 2.5-3 mm long. **Ovary** barrel-shaped, densely hairy, 4 mm long; **stylodes** cylindrical, 4 mm long; **stigma** laterally opened, ciliate, 1 m wide.

Thailand: Northern – Chiang Mai; Southeastern – Chantaburi.

Ecology: found in deciduous forest, from 200 m to 1000 m above sea level, flower in May – September.

Distribution: Burma, India.

Use:

Vernacular name:

Critical remarks: This is the largest species of *Curcuma* found in Thailand. This species produces both lateral and terminal inflorescence in late summer and mid of rainy season respectively.

Specimens examined:

Northern – Chiang Mai [*Larsen et al.* 46704, Doi Sutep, above Mae Sa Valley, on the premise of QSBG, 19-Sep-1995 (AAU); *Maknoi* 183, QSBG, 16-Aug-2001, (AAU, BKF, PSU, QSBG); *Maknoi* 231, same locality, 20-May-2002, (AAU, BKF, PSU, QSBG)]; **Southeastern** – Chantaburi [*Jeppesen*, Schantabun, 1-May-1947, (C)].

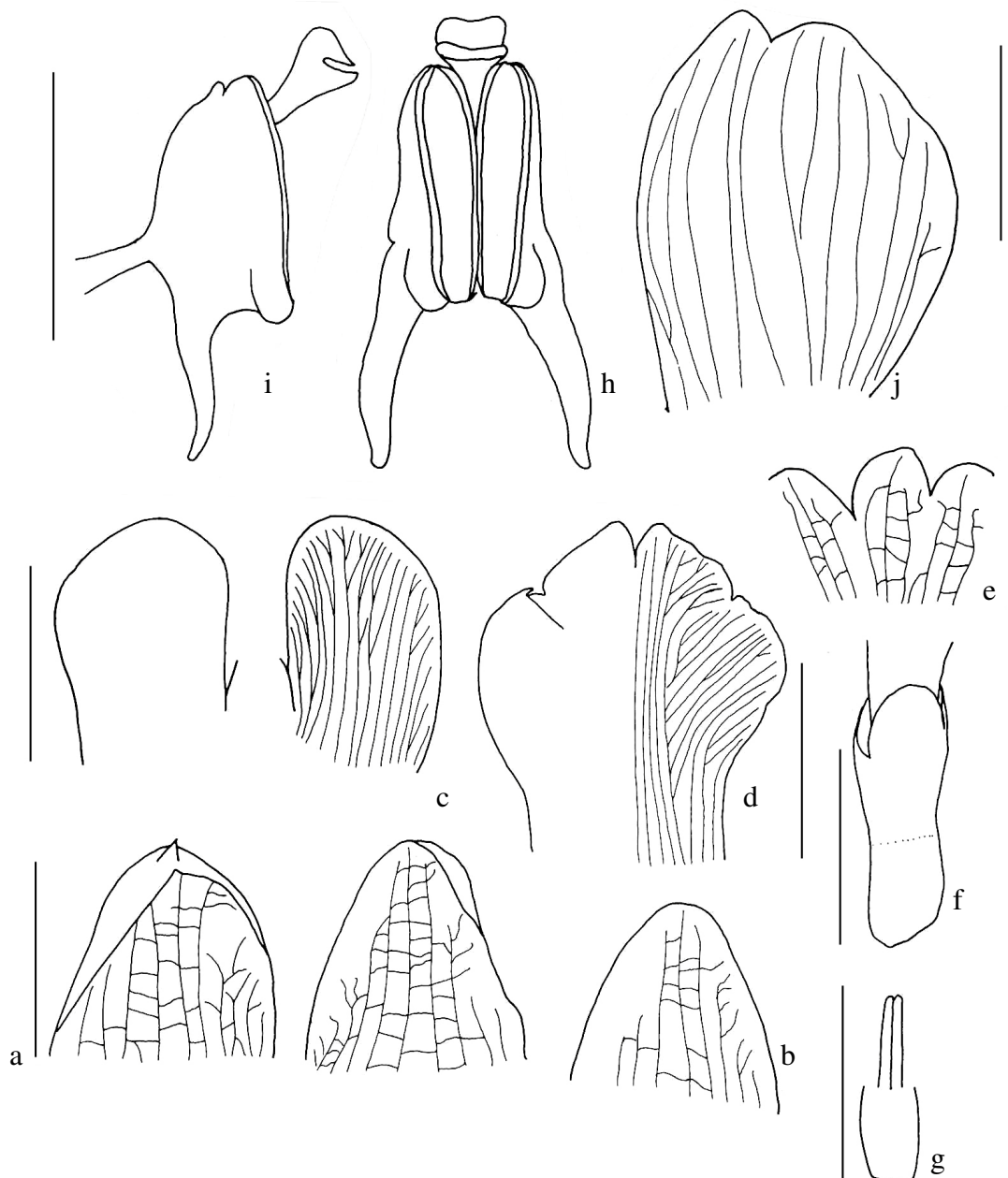


Figure 15 *Curcuma latifolia* Roxb. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stylodes and ovary; h stamen – front view; I stamen – side view; j bracteole (scale = 5 mm)

***Curcuma leucorhiza* Roxb.** Asiat. Research 11. 337. 1810; Fl. Ind. ed. 1. 1. 301. 1820; Roscoe, Monandr. Pl. t. 102. 1828; Horan. Monogr. 22. 1862; Bak. in Hook.f. Fl. Brit. Ind. 6. 212. 1890; Schuman., Pflanzenr. Zingib. 110. 1904. Figure 16, plate 7.

Type: Roxburgh's plate no. 1926 (K!)

Corm ovoid, white with pale brown core, 6x5 cm; **rhizome** branched, white with brownish white center, 8-10 cm long, 2-2.5 cm in diameter; tuberous root threat-like ended with ovoid structure, white with pale brown center, ovoid structure 3x2 cm. **Leafy shoot** 50-60 cm tall; **bladeless-sheath** 3, green, sparsely hairy, apex mucronate, 10-30 cm long. **Leaf-sheath** green, glabrous, apex mucronate, 30 cm long; **ligule** membranous, 2 mm long; **petiole** very short or absent; **blade** lanceolate, green, glabrous on both surfaces, base cuneate, apex acuminate; 30-40 x 8-9 cm. **Inflorescence** lateral; **scape** hairy, 12-15 cm long; **spike** 17 cm long. **Sheath** 4-5, hairy at tip, apex mucronate, 3-15 cm long. **Bracts** broadly obovate, green, hairy on both surfaces, apex obtuse, 4.5x3.5 cm; **coma bracts** obovate, red, hairy on both surfaces, 7x2.5 cm. **Bracteoles** boat-shaped, white, glabrous, apex obtuse, 12x8 mm. **Calyx** 8 mm long, hairy along ridges, apex 3-lobed, lobe apices obtuse to acute. **Corolla tube** glabrous, 30 mm long; **lobes** scattered short-hairy, 14-15 x 8-9 mm; **dorsal one** hooded, apex acute-mucronate, hairy at tip; **lateral ones** shallowly concave, apex rounded, glabrous. **Staminodes** oblique, broadly obovate, glandular hairy, apex obtuse, 14x9 mm. **Labellum** 3-lobed, mid-lobed apex bifid, glandular hairy on either sides of mid-band, 15x17 mm. **Filament** flat, glabrous, 2x4 mm; **theca** 4 mm long; **spurs** triangular, flat, point downwards, apex acuminate, 3 mm long; **crest** less than 1 mm long. **Ovary** barrel-shaped, densely hairy, 5 mm long; **stylodes** cylindrical, apex acute, 6 mm long; **stigma** 2-lobed, laterally opened, ciliate, 1 mm wide.

Thailand: Cultivated.

Ecology: Cultivated.

Distribution: India and Myanmar.

Use: Rhizome is eaten as vegetable.

Vernacular: Kamin kaa0

Critical remarks: Rhizome of this species scent as mango like that of *C. amada*, but this species produces lateral inflorescence.

Specimens examined:

Cultivated – *Maknoi* 542, cult. PSU, songklha, 20-June-2004 (PSU).

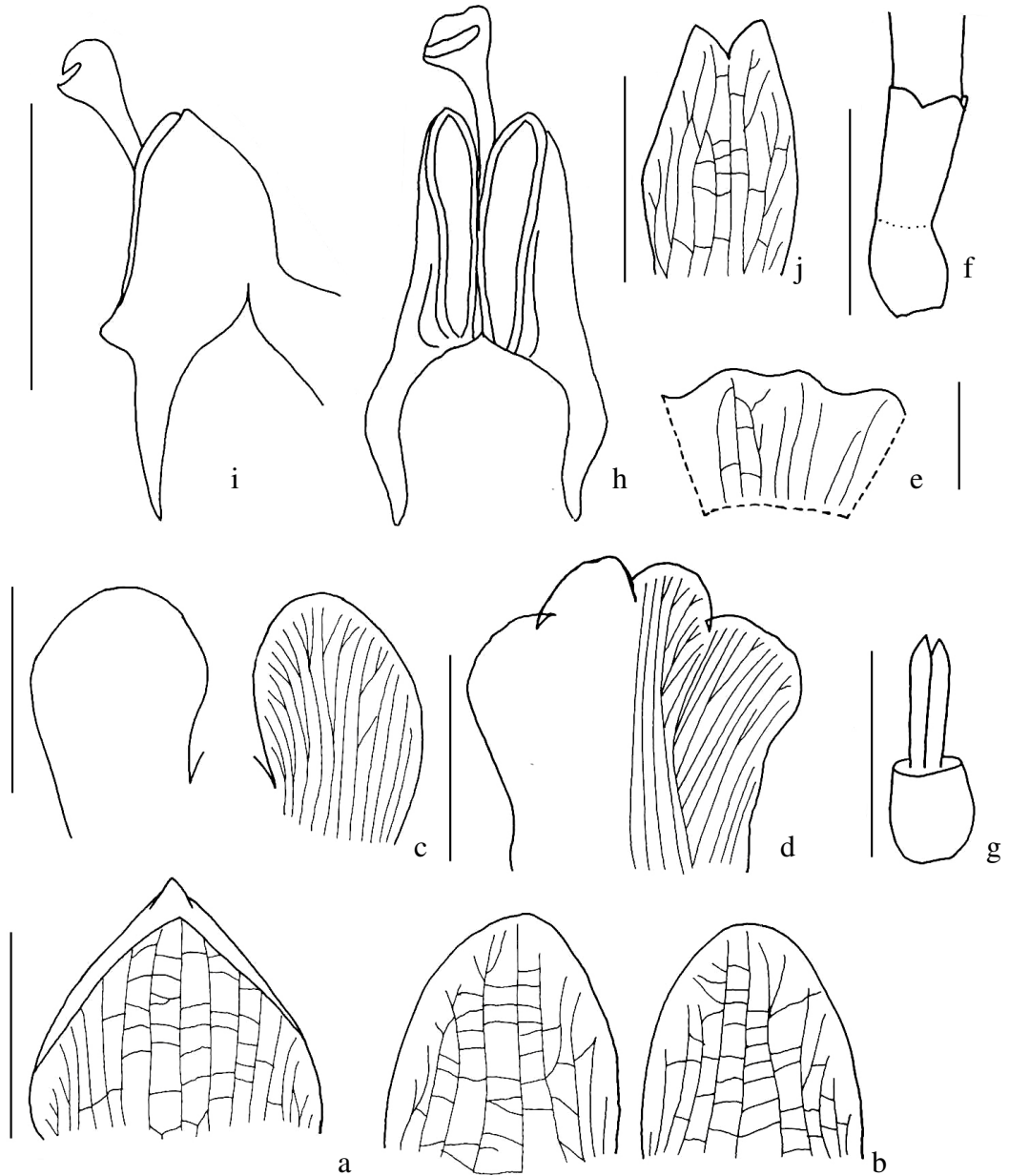


Figure 16 *Curcuma leucorhiza* Roxb. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stylodes and ovary; h stamen – front view; i stamen – side view; j bracteole (scale = 5 mm)

Curcuma longa L. Spec. Pl. ed. 1. 2. 1753; Koenig in Retz. Observ. 3. 71. 1783, Himal. Pl. 71. 1839; Roxb. in Asiat. Research 11. 340. 1810; Fl. Ind. ed. 1. 1. 32. 1820; Royle Illustr. Himal. Pl. 358. 1839; Horan. Mongr. 23. 1862; Bak. in Hook.f. Fl. Brit. Ind. 6. 214. 1890; Schuman., Pflanzenr. Zingib. 108. 1904; Gagnep. Fl. Gen. de Indo-china. 6: 63. 1908; Valet. Bull. Buitenz. Ser. 2. 27: 78. 1918; Telin & Larsen. in Wu & Raven, Fl. China. 24: 362. 2000. – *C. domestica* Lour. Fl. Cochinch. 10. 1790. – *Amomum curcuma* Jacq. Hort. Vindob. 3. t. 4. 1776. – *Stissera* Giseke, Parel. Linn. 207, 228. 1792. – *Stissera curcuma* Raeusch. Nomencl. ed. 3. 12. 1797; Rheede, Hort. Mal. 11.. t. 11. 1692; Rumph. Herb. Amb. 5. t. 67. 1749. Figure 17.

Type:

Corm ovoid, orange yellow inside, 6-8 x 3-4 cm; **rhizome** branched, orange yellow inside, 1.5-2 cm thick. **Leafy shoot** 80-120 cm tall; **bladeless sheath** 10-25 cm long. **Leaf-sheath** glabrous, 10-30 cm long; **ligule** membranous, glabrous, 3 mm long; **petiole** glabrous, 5-8 cm long; **blade** lanceolate to elliptic, glabrous on both surfaces, base cuneate, apex acuminate, 65-80 x 12-16 cm. **Inflorescences** terminal, 25-30 cm long; **scape** 10-15 cm long; **spike** cm long. **Bracts** oblong to obovate, pubescent on both surfaces, green, apex broadly acute to rounded, 4.5x3.0 cm; **coma bracts** lanceolate, pubescent on both surfaces, pure white or white tipped with pale pink, 6x2.5 cm; **bracteoles** obovate, keeled, glabrous, 12x8 mm. **Calyx** tubular, 10 mm long, split down one side 4 mm, glabrous, apex shallowly 3-lobed. **Corolla tube** glabrous, 32 mm long; lobes 13-14 x 8-10 mm; dorsal lobe hooded, apex acute cucullate; lateral lobes concave, apex rounded. **Staminodes** oblong, pale yellow, apex rounded or truncate, 13x9 mm. **Labellum** 3-lobed, mid lobe emarginate, pale yellow with yellow midband, 22x16 mm. **Filament** 5x3 mm; **anther** 3.5 mm long; **spurs** sharply acute, downward-pointed, 3 mm long; **crest** mm. **Ovary** barrel-shaped, hairy, 4 mm long; **stylodes** 3.5 mm long; **stigma** 2-lobed, laterally opened, ciliate, 1 mm wide.

Thailand: Cultivated.

Ecology: Cultivated.

Distribution: Cultivated throughout the tropics.

Uses: Cultivated for spice and medicinal purpose.

Vernacular: Kamin Chan

Critical remarks: The name *C. domestica* Lour. was used for turmeric cultivated in Southeast Asia. It has been reduced to synonyme of *C. longa* L. by Burtt and Smith (1982?).

Specimens examined:

Northern – Chiang Mai [*Kerr* s.n., Doi Intanon, 11-Sep-1920 (BM); *Bjornland*, Ban Pong Noi, Muang, 29-Aug-1978 (C); *Maxwell* 87-682, Above Pah Ngeub, Doi Sutep, 11-Jul-1987 (CMU); *Maxwell* 88-979, Puping Palace, Doi Sutep, 8-Aug-1988 (CMU); *Nai Noimao* s.n., Chaeng Huarin, 22-Aug-1921 (BK)] – Lampon [*Maxwell* 93-753, Doi Khun Dahn NP, Mae Tah, 15-Jul-1993 (CMU)]; Southwestern – Kanchanaburi [*Larsen* et al. 33889, W of Sri Sawat, 28-Jun-1974 (AAU)] – Tak [*Paisooksantivatana* y2262-88, Doi Muser Hort. Exp. Sta., 14-Jul-1988 (BK)]; Laos – [*Maxwell* 98-878, Khong Island, Champasak, 11-Sep-1998 (CMU)]; Cambodia – [*Monyrak* 228, Hep Island, Thala Barevath, Stoeng Treng, 27-Jul-2000 (CMU)] -
Cultivated – [*Collins* 1047, Sriracha, Chonburi, 3-Nov-1924 (K) ; *Collins* 1050, 3-Nov-1924 (K); *Marcan* 2217, Bangkok, 21-Aug-1927 (BM, C, K) ; *Maxwell* 87-882, cult. Fact. of Pharmacy, 28-Aug-1987 (BKF, CMU, L)]

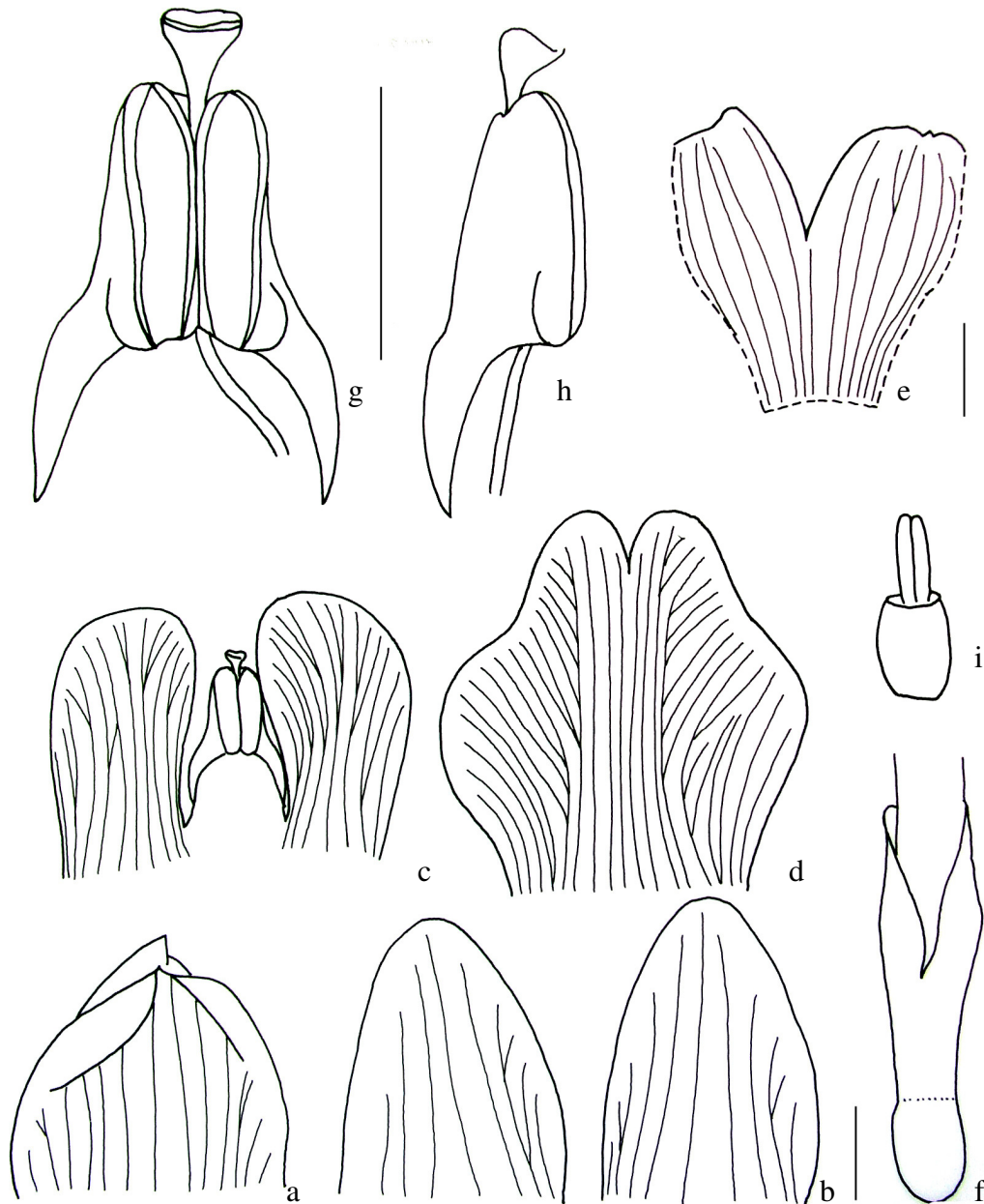


Figure 17 *Curcuma longa* L.; a) dorsal corolla lobe; b) lateral corolla lobes; c) staminodes; d) labellum; e) calyx – dissected; f) calyx and ovary; g) stamen – front view; h) stamen – side view; i) stylodes and ovary (scale = 5 mm).

Curcuma mangga Valeton & Zijp *Rec. Trav. Bot. Neerl.* 1917, xiv. 138, 141. Figure 18, plate 8.

Type:

Corm white with yellow center, mango-scented, 3-4 x 2-3 cm; **rhizome** white with yellow center, mango-scented, 1.5 cm diameter; **leafy shoot** 60-80 cm tall. **Bladeless sheath** ; **leaf-sheath** glabrous; **ligule** indistinct; **petiole** glabrous, cm long; **blade** green, glabrous on both surfaces, base cuneate, apex acute, 30-45 x 9-12 cm. **Inflorescence** lateral; **scape** 20 cm long, glabrous; **spike** 25-30 cm long. **Bracts** greenish white with green patch in center; **coma bracts** white with pink patch in center; **bracteole** obovate, folded, minute-hairy, apex acute, 25x15 mm. **Calyx** tubular, 8 mm long, minute-hairy, apex 3-lobed, split one side 3 mm. **Corolla tube** 25 mm long, minute-hairy; **lobes** 9-10 x 7-10 mm; dorsal one concave, hooded, minute-hairy, apex acute-mucronate; lateral ones shallowly concave, glabrous, apex rounded. **Staminodes** oblique obovate, glandular hairy, white, apex rounded, 12x8 mm. **Labellum** 3-lobed, mid-lobe bifid, glandular hairy along sides of mid-band, 12x14 mm. **Stamen** glabrous; filament flat, 2.5x3 mm; theca 4 mm long, crest less than 1 mm long, apex rounded; spurs flat, triangular, glabrous, point downwards, apex acuminate, 3 mm long. **Ovary** barrel-shaped, hairy, 3 mm long; **stylodes** cylindrical, glabrous, apex acute, 4 mm long; **stigma** bi-lobed, laterally opened, ciliate, 1 mm wide.

Thailand: Cultivated.

Ecology: Flower in May.

Distribution: Malay Peninsula, Java.

Use: Rhizome is eaten raw as vegetable.

Vernacular name: Kamin kao.

Critical remarks: This species has mango scented as in *C. amada* Roxb. but differs in produced lateral inflorescence.

Specimens examined:

Cultivated – *Maknoi 533*, cult. QSBG, 9-May-2004 (AAU, PSU, QSBG).

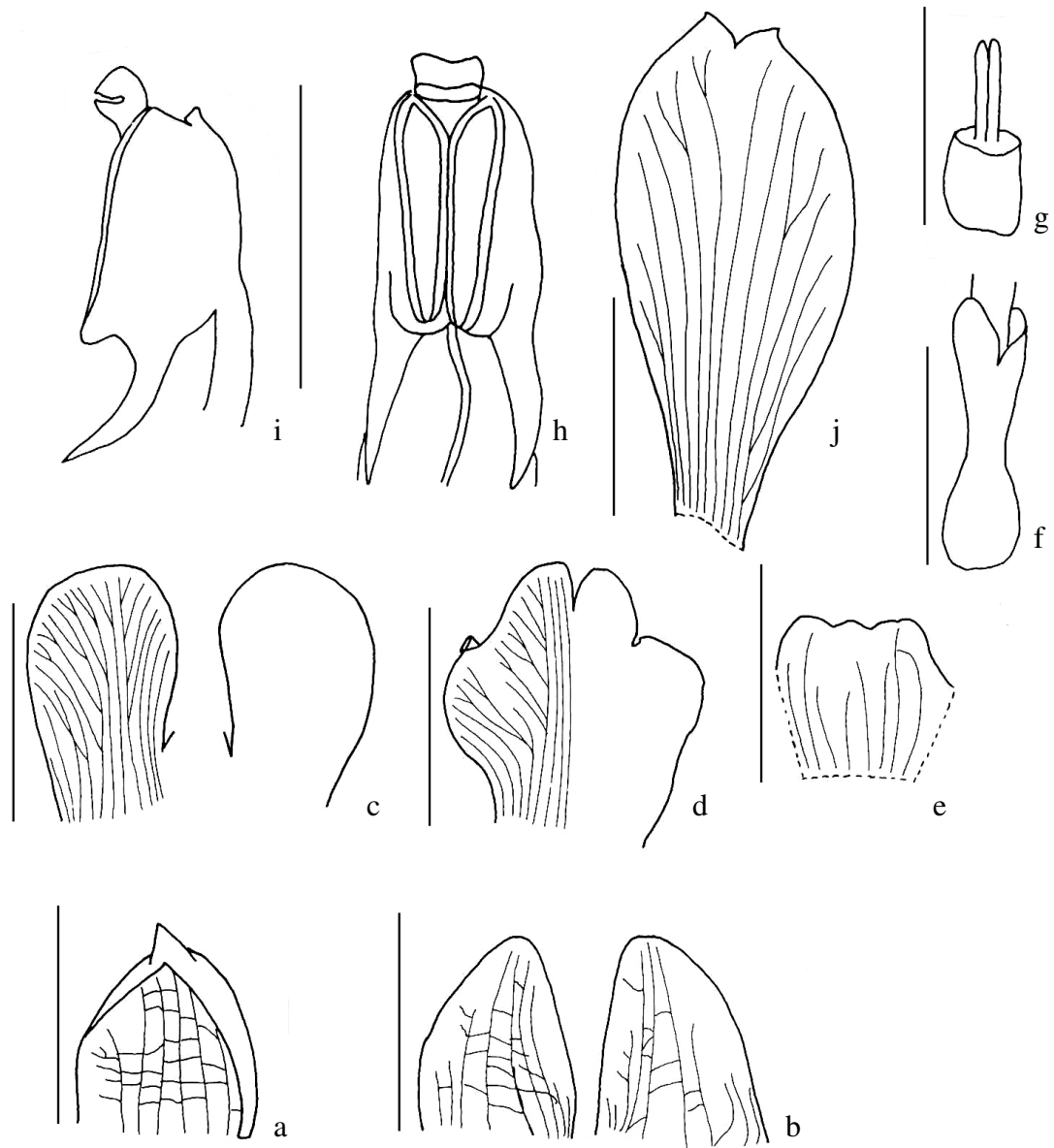


Figure 18 *Curcuma mangga* Val. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stylodes and ovary; h stamen – front view; I stamen – side view; j bracteole (scale = 5 mm)

Curcuma parviflora Wall. Pl. As. Rare. I (1830) 47. t. 57; Horan. Monogr. (1862) 24; Bak. In Hook.f. Fl. Brit. Ind. VI (1890) 215; K. Schum. Zingiberaceae in Das Pflanzenreich (1904) 102; Gagnep. Fl. Indo-china. (1918) 61.; R.E. Holttum The Garden's Bulletin Singapore vol. 13 p. 65-72. 1950. Figure 19, plate 8.

Type:

Corm ovoid, white to pale brown inside, 2x1 cm; **rhizome** very short. **Leafy shoot** 15-50 cm tall; the whole plant glabrous; **bladeless sheath** 4-15 cm long. **Leaf sheath** 4-20 cm long; **ligule** 1-2 mm long; **petiole** 1.5-30 cm long; **blade** lanceolate, glabrous on both surfaces, base cuneate to rounded, apex acuminate, 7-40 x 2.5-14 cm.

Inflorescence terminal; **scape** 7-30 cm long; **spike** 3.5-8 cm long. **Bracts** 1.5-3 x 1.2-1.8 cm, apex rounded to acute; **coma bracts** white, apex acute, 1.5-2 x 0.8-2 cm; **bracteoles** ovate, concave, apex obtuse, 4x2 mm. **Calyx** tubular, glabrous, 5 mm long, apex unequally 3-lobed. **Corolla tube** glabrous, 15 mm long; **lobes** glabrous, white, 5x4-5 mm; **dorsal lobe** hooded; **lateral lobes** shallowly concave, apex rounded. **Staminodes** obovate, glabrous, white to white with pale blue tip, margin undulate, 8x3.5 mm. **Labellum** obovate, white with bluish tip, edge fringed, apex bifid, 9x6 mm. **Filament** flat, hairy, 3x2 mm; anther 3 mm long, glandular hairy, ecalcarate; crest 1.5 mm long. **Ovary** subglobose, glabrous, 2 mm long; stylodes absent; stigma terminally opened, ciliate, 1 mm wide.

Thailand: Northern – Chiang Mai, Kamphaengpet, Lampang, Lamphoon, Mae Hong Son, Nakorn Sawan, Pitsanulok, Tak; Northeastern – Loei, Nongkai; Eastern – Buri Ram, Chaiyaphum, Nakorn Ratchasima; Southeastern - Chantaburi, Nakorn Nayok; Central – Saraburi, Uthaithani; Southwestern – Kanchanaburi, Prachuap Khirikhan, Petchaburi, Ratchaburi; Peninsula – Surat Thani.

Ecology: Found in dry area as in deciduous forest and dry evergreen forest from near sea-level to 1,250 m. Flower in March to December.

Distribution: India, Burma, China, Indochina, Malaysia.

Use: Young inflorescence is edible; cultivated as ornamental plants.

Vernacular: Krachieo kao, Hinghoi

Critical remarks: This species is very variable in plant size and inflorescence shape but flower characters are mostly constant. The color of staminodes varies from white to dark violet.

Specimen examined:

Northern – Chiang Mai [*Beusekom & Phengkklai* 1176, Obluang tableland, road to Omkoi, 12-Jun-1968 (BKF, K); *Geesink et al.* 5748, Fang, 7-Jun-1973 (AAU, BKF, C, E, K, P); *Iwatsuki & Fukuoka* T10289, Ban Luang, 17-Sep-1967 (AAU); *Jackson* 6134, Mae Sa Valley, N of Ban Mae Mae, 7-Sep-1974 (BKF); *Kanchai* 555, Ban Huay, Chiang Dao, 6-Jun-1957 (BKF, C); *Kerr* 100, Doi Sutep, 21-Jul-1921 (K); *Kerr* 5641, same locality, 7-Jul-1921 (BK, BM, C, K); *Kerr* 719, same locality, 13-Jul-1909 (BM, K); *Larsen et al.* 2022, 30 kms S of Bo Luang, 3-Jul-1968 (AAU, BKF, C, E, K, P); *Lung Ai* s.n., Doi Sutep, 1-Aug-1922 (BK); *Maknoi* 342, Sri Sangwan Wf, Chiang Dao NP, Chaiprakarn, 21-Jul-2003 (AAU, BKF, PSU, QSBG); *Maxwell* 87-647, Doi Sutep, 11-Jul-1987 (BKF, CMU); *Maxwell* 91-782, Mae Soi Valley, Jawm Tong, Chiang Mai, 29-Sep-1991 (E, P); *Murata et al.* T15519, Mae Klang Waterfalls, 1-Oct-1971 (BKF); *Palee* 397, Doi Muang Awn, 28-Aug-1998 (CMU); *Palee* 55, Doi Sutrp-Pui NP, 9-Jul-1992 (CMU, E, P); *Phengkklai* 4162, Omkoi, 28-Jun-1978 (BKF); *Phengkklai* 4171, same locality, 28-Jun-1978 (BKF); *Phengkklai* 6260, same locality, 20-Jul-1978 (BKF, K); *Phengkklai et al.* 6302, same locality, 20-Jul-1987 (BKF); *Phuakam* 35, Palaht temple, Doi Sutep, 7-Mar-1993 (BKF, CMU); *Pongamornkul* 222, Huai Whaii, 28-Jul-1998 (QSBG); *Potachanrahk* 83, Muang, 17-Aug-1981 (CMU); *Santisuk* 7002, Bo Luang - Omkoi route, 18-Sep-1989 (BKF); *Shimizu et al.* T10467, middle elevation of Doi Sutep, 18-Sep-1967 (BKF); *Shimizu et al.* T19033, N of Ban Om Koi, Bo Luang tableland, 17-Oct-1979 (AAU, BKF, C, K, P); *Shimizu et al.* T19354, N of Mae Tuen, Omkoi district, 18-Oct-1979 (BKF); *Sorensen et al.* 3598, Fang, 25-May-1958 (BKF, C, E); *Sorensen et al.* 3912, Doi Sutep, 5-Jul-1958 (C); *Srisanga & Puff* 1021, Bo Luang - Om Koi road, Om Koi, 10-Sep-1999 (QSBG); *Tamura* T60072, Panup, foothill of Doi Sutep, 16-Jul-1988 (BKF); *Tamura* T60377, Mae Klang WF, Inthanon NP, 3-Aug-1988 (BKF); *Vidal* 5149, Doi Chiang Dao, 25-Jul-1971 (P)], Kamphaengpet [*Butt* 13, Klong Lan, 1 km from HQ, Mae Wong NP, 27-Jul-1997 (BKF, CMU); *Maknoi* 522, Wangchao WF, 4-Oct-2003 (AAU, BKF, PSU, QSBG); *Ngamriabsakul* 32, Mae Wong NP, 7-

Jul-1999 (BKF, E); *Parnell et al.* 95-319, Khlong Lan NP, 21-Aug-1995 (AAU)],
 Lampang [*Hambanadg* 225, Huai Tak, 8-Sep-1964 (BKF); *Maknoi* 518, Jae Son WF,
 Jae Hom, 1-Oct-2003 (AAU, BKF, PSU, QSBG); *Maxwell* 90-593, Mae Mawh
 Lignite Mine area, 9-Jun-1990 (CMU); *Maxwell* 95-569, Jae Sawn Np, near falls and
 Mae Mown stream, Muang Pan, 24-Aug-1995 (BKF, CMU); *Panatkool* 52, Jae Sawn
 NP, Muang Pan, 27-May-1996 (CMU); *Shimizu et al.* T18538, 50 km S of Thoen, 13-
 Oct-1979 (BKF)], Lampoon [*Palee* 221, Doi Khun Dahn NP, Mae Tah, 2-Jul-1994
 (CMU)], Mae Hong Son [*Iwatsuki & Fukuoka* T10389, between Mae Sariang and
 Mae La Noi, (AAU); *Kress* 98-6216, E of Mae Sariang, 12-Jul-1998 (AAU); *Prayad*
 345, Mae Sariang, 4-Jul-1966 (BK); *Sankamethawee* 259, Ban Sanam Mai, Hod, 16-
 Oct-2001 (CMU)], Nakorn Sawan [*Marcan* 1114, Ban Taklee, (BM, K)], Pitsanulok
 [*Larsen et al.* 656, Thung Salaeng Luang NP, 21-Jul-1966 (AAU, BKF, P); *Maknoi*
 493, Kaeng Sopa WF, Wang Tong, 24-Aug-2003 (AAU, BKF, PSU, QSBG); *Murata*
et al. T38217, Thung Salaeng Luang NP, abt. 20 km E of Pitsanulok, 21-Oct-1984
 (BKF); *Murata et al.* T38705, Thung Salaeng Luang NP, 22-Oct-1984 (BKF)], Tak
 [*Boonchu* 741, Ban Na, Phumiphol Dam, -/5/59 (BK); *Husseus* 56, Wang Djao, 8-
 Oct-1904 (BM, E, K, P); *Murata et al.* T16873, Khao Phawo, c 70 kms W of Tak, 23-
 Jul-1973 (AAU, BKF, C, K); *Niyomdham* 900, Larnsarng NP, 20-Apr-1985 (AAU,
 BKF, C); *Paisooksantivatana* y2394-89, Wat Prataat Doi Dinkee, Mae Sod, 8-Aug-
 1989 (BK); *Shimizu et al.* T10776, Doi Pang La, Huay Tak, 25-Sep-1967 (AAU,
 BKF); *Tagawa et al.* T8662, Larnsarng NP, 1-Sep-1967 (AAU); *Tagawa et al.* T8663,
 Larnsarng NP, 1-Sep-1967 (AAU)]; **Northeastern** – Loei [*Bunpheng* 672, Phu
 Kradung, Wang Sapung, 8-Sep-1953 (C); *Prayad* 1035, Phu Kradung, 15-Oct-1967
 (BK); *Sangkachand* 2072, Phu Kradung, 5-Sep-1969 (BK); *Shimizu et al.* T8779, Phu
 Kardung, 3-Sep-1967 (AAU, BKF); *Lee* 672, Phu Kradung, Wang Sapung, 9-Aug-
 1996 (BKF)], Nongkai [*Adisai* 577, Dong Srichompoo, 28-Jun-1963 (BK)],
 Petchabun [*Ngamriabsakul* 60, Nam Nao NP, 28-Jul-1999 (BKF, E); *Maknoi* 268,
 Haew Sai WF, Namnao NP, 7-Jul-2002 (AAU, BKF, PSU, QSBG); *Maknoi* 299, Ban
 Namron, Mueang, 19-Jul-2002 (AAU, BKF, PSU, QSBG)]; **Eastern** – Buri Ram
 [*Murata et al.* T37363, Khao Phanom Rung, 10-Mar-1984 (BKF)], Chaiyaphum
 [*Geesink et al.* 6904, Ban Nam Phrom, 24-May-1974 (BKF, K); *Larsen et al.* 31326,
 Phu Khieo, E of Chaiyaphum, 3-Aug-1972 (AAU); *Larsen et al.* 31551, NW of Phu

Khieo, 7-Aug-1972 (AAU); *Ngamriabsakul* 59, Thung Lui Lai, 27-Jul-1999 (BKF, E)], Nakorn Ratchasima [*Larsen et al.* 94, Heo Suwat Falls, Khao Yai NP, 8-Jul-1966 (AAU, BKF, P); *Maxwell* 74-865, Heo Suwat Falls, Khao Yai NP, 31-Aug-1974 (AAU, BK, L); *Murata et al.* T16321, Khao Yai NP, 19-Jul-1973 (AAU, C, K); *Murata et al.* T16372, Khao Yai NP, 19-Jul-1973 (BKF); *Nai Noe* 291, Ban Chumseng, 26-May-1929 (BK, BM, K); *Phengklai* 567, National Park, 17-Dec-1962 (BKF, C, L); *Phengnaren* 26, Ban Tha Ang, 8-May-1965 (BKF)]; **Southwestern** – Kanchanaburi [*Bloembergen* 633, Kwa Noi River Basin, 23-May-1946 (BK, K, P); *Geesink et al.* 6070, between Huay Ban Kao and Kritee, 2-Jul-1973 (AAU, BKF, C); *Hoed & Kostermans* 478, Brangkasi, Kwa Noi River Basin, 19-Jun-1946 (BK, K, P); *Kasem* 209, Srisawadi, 2-Jun-1962 (BK); *Kerr* 19528, Ta Salao, 12-Jul-1930 (BK, BM, C, K); *Larsen et al.* 8125, Ban Kao, 10-Nov-1961 (C); *Larsen et al.* 8495, Sai Yok, 4-Dec-1961 (C); *Larsen et al.* 10539, Thung Kang Yang, 6-Jul-1963 (AAU); *Marcan* 2339, Lum Sum, 30-Jul-1928 (BM, C, K); *Marcan* 2507, Ta Salao, 11-Jul-1930 (BM, C, K); *Maxwell* 73-70, Tong Pha Poom, 3-Jul-1973 (AAU, BK); *Phengklai et al.* 2913, Srisawat, 12-Aug-1971 (BKF); *Put* 44, Hin Dat, 29-Jun-1926 (BK, BM, C, K); *Suvannakoses* 2113, Si Sawat, 17-Jul-1963 (BKF); *Suvannakoset* 2125, Khao Nomnang, Muang (Mong) Lai, 13-Jun-1957 (BKF); *Wongprasert et al.* 27, Nikulm streamlet, Meklong Watershed research station, Thong Pha Phum, 28-May-1994 (BKF); *Wongprasert et al.* 71, Linthin streamlet, Thong Pha Phum, 28-May-1994 (BKF)], Prachuap Khirikan [*Larsen et al.* 1547, S of Prachuap, 13-Aug-1966 (AAU, BKF); *Middleton et al.* 1242, Kui Buri NP, Pran Buri, 20-Aug-2002 (CMU); *Shimizu & Phengklai* T8844, Khao Lukchang, 18-Sep-1967 (AAU, BKF)], Petchaburi [*Larsen et al.* 45379, Kaeng Kra Chan NP, Khao Pakarang, 3-Aug-1995 (AAU)], Ratchaburi [*Paisooksantivatana & Sangkhachan* y2080-87, Ban Huai Nam Nak, Suen Pueng, 28-May-1987 (BK)]; **Central** – Lopburi [*Maknoi* 486, Route to Sab Langka WF, 21-Aug-2003 (AAU, BKF, PSU, QSBG)], Saraburi [*Kerr* 9087, Muak Lek, 31-Aug-1924 (BK, BM, C, K); *Laksanakara* 234, Kang Koi, 6-Oct-1926 (BK, K); *Nai Noe* 114, Khao Pang Sawaung, Muak Lek, 16-Jul-1925 (BK, BM, K, L); *Put* 1108, Ban Nawng Bua, 1-Oct-1927 (BK, BM, C, K); *Shimizu et al.* T17927, Ban Khrua, Na Pra Lan district, 6-Oct-1979 (BKF); *Smitinand et al.* 1308, Muak Lek, limestone hill W of Forest station, 2-Oct-1963 (BKF, L); *Maxwell* 75-683, Sam Lahn

forest, Muang, 12-Jul-1975 (AAU, BK)], Uthaithani [*Sutheesorn* 2995, Khao Pha-sae, Nong Chang, 28-May-1974 (BK)]; **Southeastern** – Chantaburi [*Beusekom & T. Smitinand* 2097, Foot of Khao Soi Dao, 10-Nov-1969 (AAU, BKF, E, P); *Larsen et al.* 9802, Khao Soi Dao, 6-Jun-1963 (AAU); *Larsen et al.* 9877, same locality, 8-Jun-1963 (AAU); *Smitinand* 3456, Hin Lat, Khlawng Lamphong, Pong Namrawn, , 30-Aug-1956 (AAU, BKF, C)]; **Peninsula** – Suratthani [*Kerr* 13042, Kanchanadit, 31-Jul-1927 (BK, BM, C, K)], lower Siam [*Kerr* 4257, Sapli, 23-May-1919 (K)]; **Cultivated** – *Collins* O VI, Bangkok, 1934 (K); *Collins* ov, Bangkok, 1-Nov-1934 (BM); *Collins* OVA, Bangkok, 1-Nov-1934 (K); *Collins* o iv, Bangkok, 2-Feb-1935 (BM); *Collins* ovi, Bangkok, 23-Mar-1935 (BM); *Maknoi* 185, QSBG, Chiang Mai, 16-Aug-2001 (AAU, BKF, PSU, QSBG); *Maknoi* 236, PSU, Songkhla, 12-Jun-2002 (AAU, BKF, PSU, QSBG); *Maknoi* 261, PSU, Songkhla, 20-Jun-2002 (AAU, BKF, PSU, QSBG); *Maknoi* 306, PSU, Songkhla, 23-Jul-2002 (AAU, BKF, PSU, QSBG).

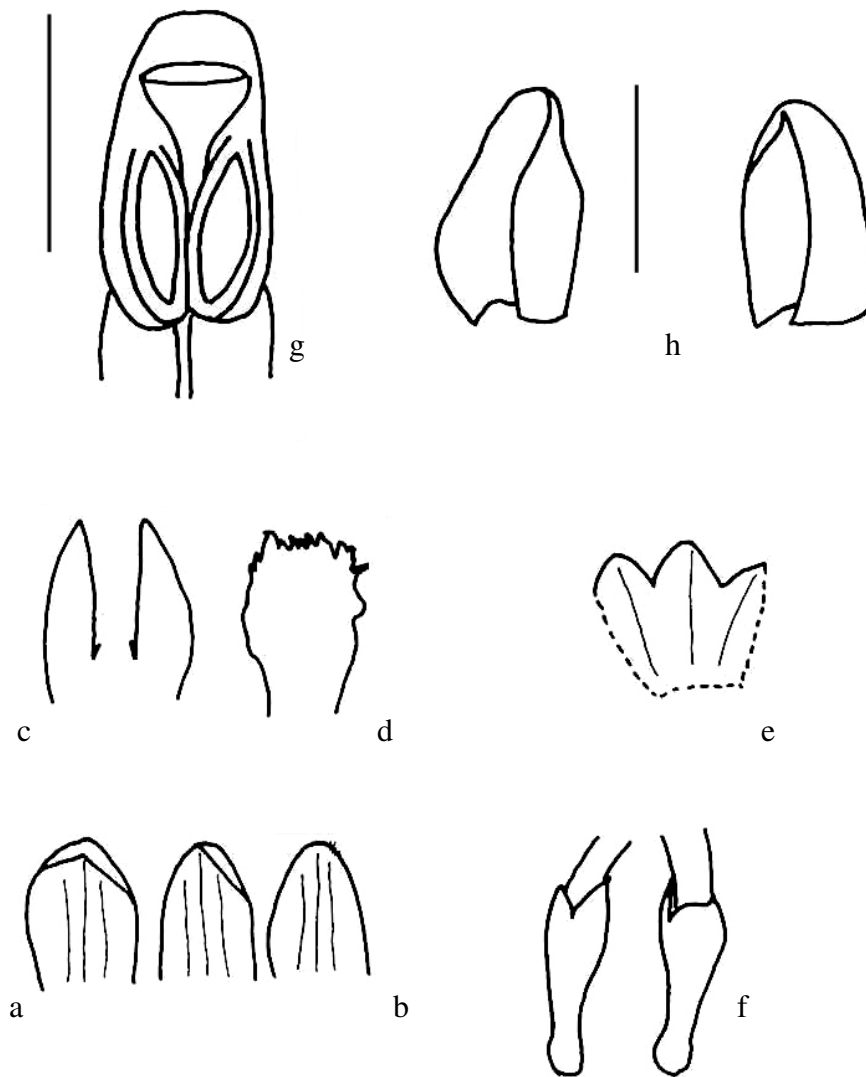


Figure 19 *Curcuma parviflora* Wall. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stamen – front view; h bracteole; (scale = 5 mm)

***Curcuma petiolata* Roxb.** Fl. India ed. 1. I. (1820) 37; Roscoe, Monandr. Pl. (1828) 100; Horan. Monogr. (1862) 23; Hook.f. in Bot. Mag. (1870) t. 5821; Bak. in Hook.f., Fl. Brit. Ind. 6 (1890) 217. Valetou.. Bull. Jard. Buitenzorg. Serie 2, (1918) 27: 72. – *C. cordata* Wall. Pl. As. Rare. I. (1830) 8. t. 10; Hook.f. Bot. Mag. (1849) t. 4435. – *C. cordifolia* Roxb. Hort. Beng. (1810) 1. Figure 20, plate 9.

Type: Roxburgh's plate no. 2156 (K!)

Corm ovoid, bright yellow inside, 3-5 x 5-8 cm; **rhizome** very short; **leafy shoot** 35-80 cm tall. **Leaf sheath** 20-30 cm long, densely pilose; **ligule** 4 mm long, sparsely hairy; **petiole** 8-25 cm long, glabrous; **blade** 35-45 x 16-22 cm, glabrous on both surfaces or with few hairs along the secondary nerves, base rounded to broad cuneate, apex acuminate. **Inflorescence** terminal; **scape** 22-35 cm long, densely pubescent; spike 13-20 cm long. **Bracts** 4-5.5 x 1.5-2 cm, pilose on both surfaces, apex rounded to truncate or slightly emarginate; **coma** bracts 4-4.5 x 2-2.5 cm, pilose on both surfaces, apex obtuse to acute. **Calyx** c 8 mm long, split down one side 3 mm, glabrous, apex 3-lobed; **corolla tube** c 2 cm long, glabrous outside, with dense long hair ring inside just below the throat; **corolla lobes** 12-15 x 6-8 mm, glabrous, dorsal one hooded, apex acute cucullate, lateral ones slightly concave, apex obtuse. **Staminodes** obovate, 12 x 8 mm, sparsely glandular hairy in the middle, apex obtuse; **labellum** 3-lobed, 12 x 15 mm, sparsely glandular hairy along mid-band and in throat, apex of mid-lobe emarginate. **Filament** concave, 3 x 5 mm, glabrous; **anther** oblong, 6 x 3 mm, glabrous; **spurs** triangular, 2 mm long, striaght, pointed downwards; **crest** quadrangular, concave, apex rounded, covering half of stigma. **Ovary** barrel-shaped, 3 mm long, hairy; **stylodes** clavate, 3 mm long, apex rounded; **stigma** 1 mm wide, ciliate, open laterally.

Thailand: Northern – Mae Hong Son, Pitsanulok; Eastern – Chaiyaphum; Central – Lopburi.

Ecology: found in deciduous forests, from 220 to 500 m above sea level. Flower in June – August.

Distribution: India, Burma, Laos, Java.

Use: Cultivated as ornamental plant and cut-flower.

Vernacular name:

Critical remarks: This species produces the largest inflorescence of *Curcuma*, 30 cm long or more. The bract with rounded apex and metallic pink color are distinguished characters.

Specimens examined: **Northern** – Pitsanulok [*Larsen* et al. 704, Thung Salaeng Luang NP, 22-Jul-1966 (AAU, BKF, P); *Maknoi* 153, Route from Chattrakarn to Ban Bo Pak, 20-Jul-2001 (AAU, PSU, QSBG); *Maknoi* 494, Route from Chattrakarn to Ban Bo Pak, 24-Aug-2003 (AAU, BKF, PSU, QSBG); *Murata* et al. T17047, Thung Salaeng Luang NP, 25-Jul-1973 (AAU); *Murata* et al. T17135, Thung Salaeng Luang NP c. 80 km E of Pitsanulok, 25-Jul-1973 (AAU, BKF)]; Mae Hong Son [*Larsen* et al. 2087, 20 kms W of Bo Luang towards Mae Sariang 18 08 N, 98 12, , 4-Jul-1986 (AAU, BKF); *Larsen* et al. 2240, S of Mae Sariang 18 10 N, 97 55 E, 8-Jul-1968 (AAU); *Larsen* et al. 2338, Ban Mae Pang, 30 kms N of Mae Sariang 18 28 N, 97 57 E, 11-Jul-1968 (AAU, BKF, C, E, K, P); *Geesink* et al. 5930, 20 km W of Mae Sariang (18 45 N, 98 0 E), Mae Hong Son, 13-Jun-1973 (BKF, C); *Panya & Pongamornkul* 462, Ban Ta Ruea, Sob Moei, Mae Hong Son, 5-Aug-1999 (QSBG)]; **Eastern** – Chaiyaphum [*Larsen* et al. 31801, Dat Don, 13-Aug-1972 (AAU)]; **Central** – Lopburi [*Maknoi* 488, Route to Sab Langka Wildlife Sanctuary, cult., 21-Aug-2003 (AAU, BKF, PSU, QSBG)]; **Cultivated** [*Maknoi* 305, PSU, Songkhla, 23-Jul-2002 (PSU); *Maknoi* 507, Sold in market at Chong Mek, Laos, 26-Aug-2003 (AAU, BKF, PSU, QSBG)]

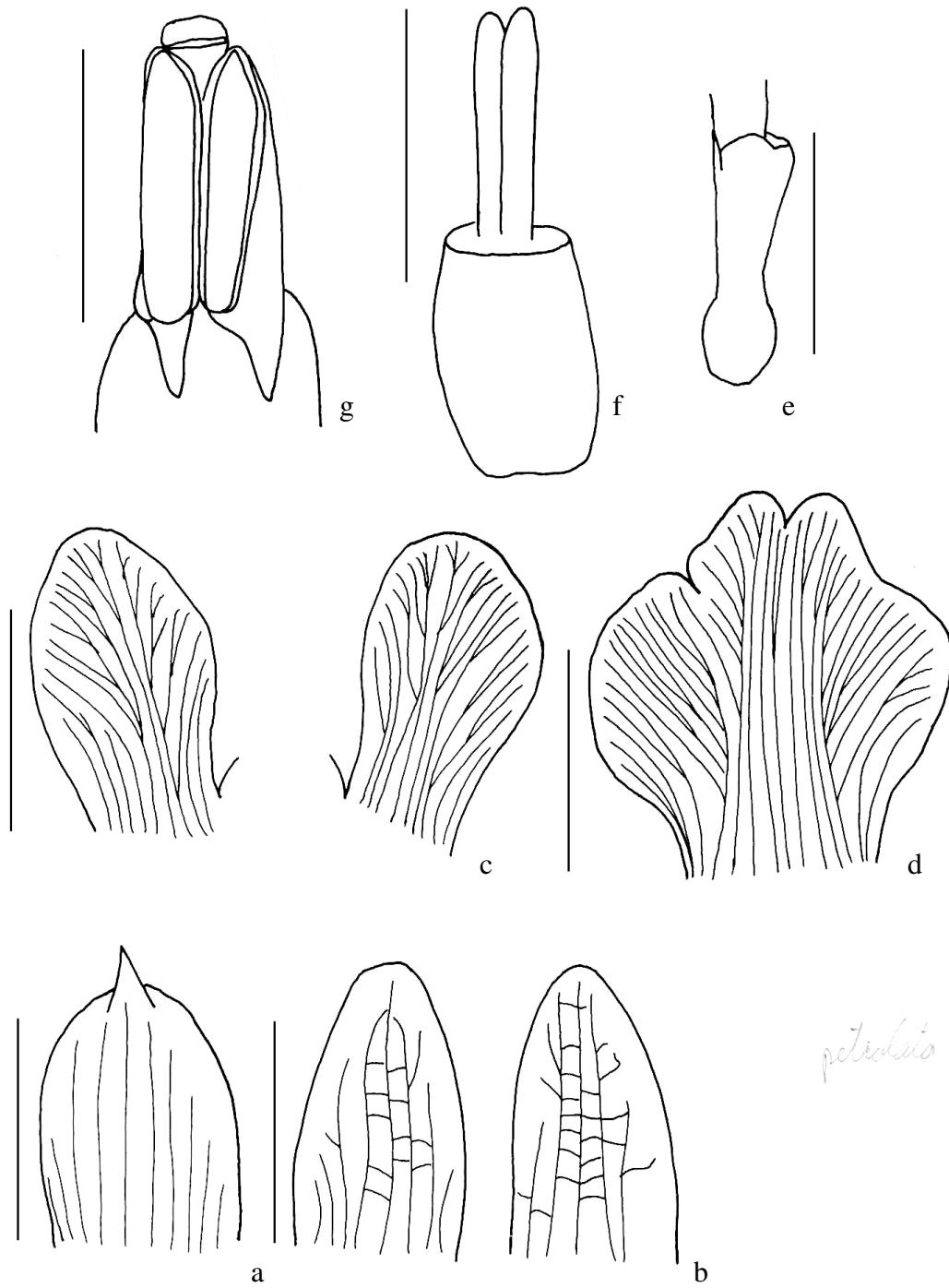


Figure 20 *Curcuma petiolata* Roxb. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx and ovary; f stylodes and ovary; g stamen – front view; (scale = 5 mm)

***Curcuma pierreana* Gagnep.** in Bull. Soc. Bot. France, 54. 405. (1907), Flora Gen. de Indo-china. 6. 65. (1908). Figure 21, plate 9.

Type: *Pierre* s.n., Cochinchine (syntype – P!); *Cadiere* s.n., Hue', Annam, 1904 (syntype – P!).

Corm ovoid, pale brown inside, 2x1 cm; rhizome very short. **Leafy shoot** 25-50 cm tall; **bladeless-sheaths** 4, dense short hairy, 2-12 cm long. **Leaf sheath** dense fine hairy, ciliate, 5-9 cm long; **ligule** 2-lobed, dense fine hairy, lobe apices obtuse, 2 mm long; **petiole** dense short hairy, 0-4 cm long; **blade** ovate-lanceolate to ovate-oblong, green with reddish brown patch along midrib on lower surface, upper surface glabrous, lower surface dense short hairy, base attenuate, apex acuminate, 20-25 x 3.5-7 cm. **Inflorescence** terminal; **scape** densely fine hairy, 2.5-5 cm long; **spike** 4.5 cm long. **Bracts** broad ovate, whitish with slight yellowish hue, scattered fine hairy, apex obtuse, 3-4 x 3-3.5 cm; **bracteole** elliptic (widest at base), hairy along mid-vein, apex hooded, 8x4 mm. **Calyx** 16 mm long, with scattered fine hairs, apex 3-lobed, mid-lobe apex hooded with fin-like structure in the middle, split down one side 7 mm; **corolla tube** white, scattered fine hairy, 32 mm long; lobes 12 x 7-9 mm, glabrous, dorsal one hooded, with acuminate-mucronate apex, lateral ones shallowly boat-shaped, with rounded to truncate apex. **Staminodes** broadly elliptic, white with maroon tip, short hairy, apex obtuse, 15x12 mm. **Labellum** broadly obovate, white with yellow mid-band, with short hairs, denser along edges of mid-band, with deeply 2-lobed apex, 15x12 mm, cleft 5 mm deep. **Filament** 2x5 mm, with short hairs on both sides; **anther** 6 mm long; **spurs** 1 mm long, filamentose, curved; **crest** quadrangular, 1x1 mm, with truncate apex. **Ovary** subglobose, 3 mm long, with fine hairs; **stylodes** cylindrical, 5 mm long, with acute apex; **stigma** laterally opened.

Thailand: Eastern – Srisaket, Ubon Ratchathani.

Ecology: Found in deciduous forest, 550 m above sea level. Flower in July August.

Distribution: Indochina.

Use:

Vernacular name:

Critical remarks: This species has short filament anther spurs like *C. cochinchinensis* but differs in color of staminodes which are white with dark red apex instead of pure white. Leaves are densely hairy on lower surface not glabrous as in original description. Leaf-base is also variable from broadly cuneate to slightly cordate.

Specimens examined:

Eastern – Ubon Ratchathani [*Maknoi* 295, Phuchong Nayoi NP, 16-Jul-2002 (AAU, PSU, QSBG); *Ngamriabsakul* 68, Phuchong Nayoy NP, 6-Aug-1999 (BKF, E)], Srisaket [*Maxwell* 76-545, Dong Rak Range, at Chong Bat Lak, Kantaralak, 18-Aug-1976 (AAU, BK, L)].

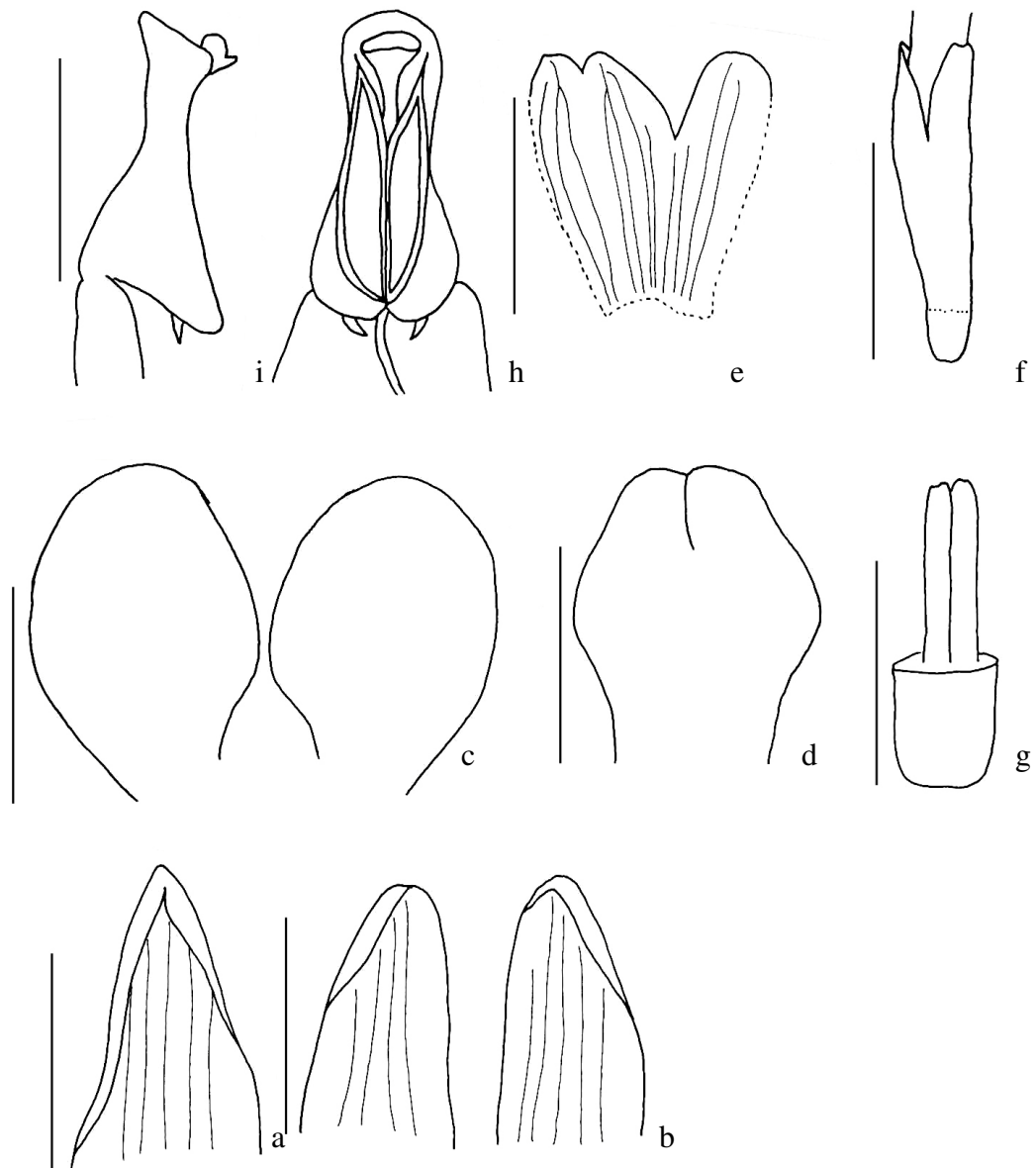


Figure 21 *Curcuma pierreana* Gagnep. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stylodes and ovary; h stamen – front view; I stamen – side view (scale = 5 mm)

Curcuma rhabdota P. Sirirugsa & M.F. Newman, New Plantsman. 7(4): 196. 2000.

Figure 22, plate 10

.

Type: *Newman* 1201, unknown locality, Laos, 24-October-2000 (holotype – BKF!, isotype – E!).

Corm ovoid, pale brown inside, 2x1 cm; **rhizome** very short. **Leafy shoot** 25-40 cm tall; **bladeless sheath** glabrous, 3-5 cm long. **Leaf sheath** glabrous, 6-10 cm long; **ligule** membranous, shallowly bi-lobed, 2-5 mm long; **petiole** glabrous, 6-10 cm long; **blade** elliptic, glabrous on both surfaces, base rounded to cordate, apex acuminate, 15-22 x 7-12 cm. **Inflorescence** terminal, 30-35 cm long; scape glabrous, 25-30 cm long. **Bracts** ovate, pink with longitudinal brown stripes, apex rounded, 3-4 x 1.5-2 cm; **coma** bracts white with reddish brown longitudinal stripes, apex acute, 4x2 cm; **bracteoles** concave, glabrous, apex acute, 4x3 mm. **Calyx** funnel-shaped, glabrous, apex 3-lobed, 7-8 mm long. **Corolla** tube glabrous, 14-17 mm long; lobes 8-10 x 4.5-5 mm; dorsal lobe hooded, apex cucullate; lateral lobes concave, apex rounded. **Staminodes** obovate, glabrous violet with red lines along margin at base, apex rounded, 10 x 7 mm. **Labellum** narrowly elliptic, apex bifid, violet with red streak along margin at base, 10 x 5 mm. **Filament** glabrous, 3x3 mm; anther 4 mm, ecalcarate; crest rounded, 2x2 mm long. **Ovary** subglobose, glabrous, 2 mm long; stylodes absent; stigma terminally opened, ciliate, 1 mm wide.

Thailand: Eastern – Ubon Ratchatani.

Ecology: along small stream in deciduous forest.

Distribution: Laos, Vietnam.

Use: ornamental plant.

Vernacular:

Critical remarks: The white with reddish brown stripes bracts are the unique character of this species.

Specimens examined:

Eastern – Ubon Ratchathani [*Maknoi* 508, Ban Chong Meg, Sirinthorn, 26-Aug-2003, (AAU, BKF, PSU, QSBG)]; **Laos** – *Maknoi* 505, Chong Mek, 26-Aug-2003,

Sold in market, (AAU, PSU, QSBG); **Vietnam** – Khu Bao Tin s.n., Dak Na, 2-Oct-1989 (HN); **Cultivated** – *Maknoi* 197, PSU, Songkhla, , 26-Apr-2002 (PSU)

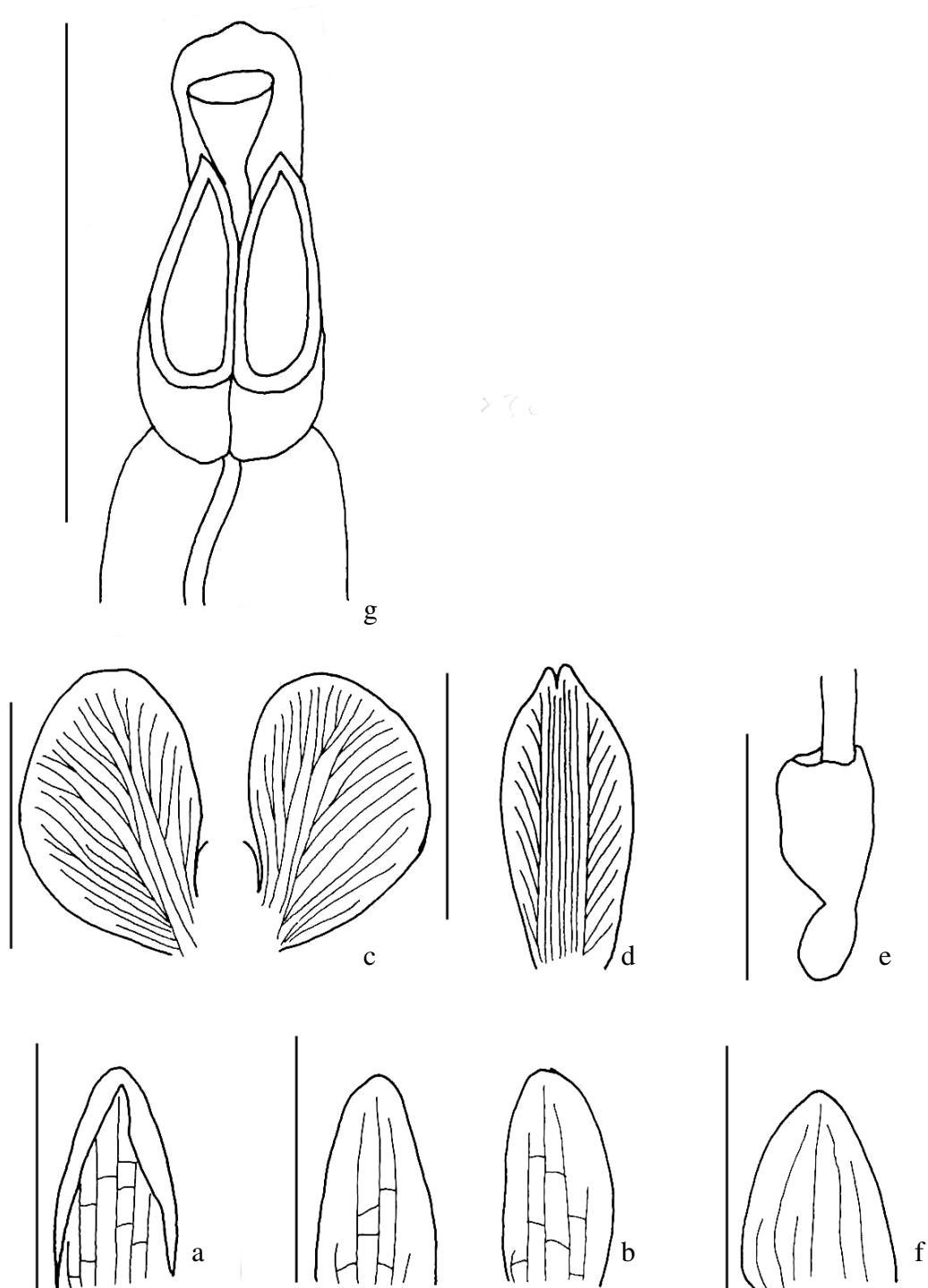


Figure 22 *Curcuma rhabdota* P. Sirirugsa & M.F. Newman a) dorsal corolla lobe; b) lateral corolla lobes; c) staminodes; d) labellum; e) calyx and ovary; f) bracteole; g) stamen – front view; (scale = 5 mm)

***Curcuma roscoeana* Wall.** Pl. As. Rare. I. (1830) 8 t. 9; Hook.f. in Bot. Magaz. (1852) t. 4667; Horan. Monogr. (1862) 24; Bak. Hook.f. Fl. Brit. Ind. VI (1890) 216.; K. Schum. 1904. Zingiberaceae in Das Pflanzenreich. IV. 46: 103. – *C. coccinea* Wall. ms. In Bak. l.c. (!Bak. In Hook.f. Fl. Brit. Ind. VI (1892). Figure 23, plate 10.

Type: Wallich 6597 (K!).

Corm ovoid, inside, 2-2.5 x 1-1.5 cm; **rhizome** very short. **Leafy shoot** 30-45 cm tall; **bladeless sheath** pilose, 12-28 cm long. **Leaf sheath** 20-22 cm long, sparsely pilose; **ligule** 1-2 mm long, with few hairs; **petiole** 17-20 cm long, pilose; **blade** ovate, upper surface with some hairs along secondary nerves, lower surface glabrous, base rounded to broadly cuneate, apex acuminate, 17-33 x 10-12 cm. **Inflorescence** terminal; **scape** 24-26 cm long, pilose; **spike** 12-15 cm long. **Bracts** 4.5 x 2-2.5 cm, sparsely pilose, apex rounded; **coma** bract absent; **bracteoles** cm. **Calyx** tubular, 20 mm long, dilate towards apex, glabrous, split down one side 7 mm, apex 3-lobed. **Corolla tube** 40 mm long, s-curved, glabrous; **lobes** 13x6-7 mm, glabrous, apex rounded; dorsal lobe hooded; lateral lobes concave. **Staminodes** ovate, 15x8 mm, glabrous, apex obtuse. **Labellum** very broadly elliptic, hairy along either side of mid-band, 2-keeled at base, apex of mid-lobe bifid, 18x22 mm. **Filament** flat, sparsely hairy, 3x4 mm; **anther** 5x2 mm, incurved, sparsely hairy, ecalcarate; **crest** fleshy, apex rounded, 2.5x2 mm. **Ovary** barrel-shaped, 4 mm long (or more), glabrous; **stylodes** narrowly cylindrical, 5 mm long, apex acuminate; **stigma** 2-lobed, terminally opened, ciliate, 1.5 mm wide.

Thailand: Northern – Chiang Mai, Lampang, Mae Hong Son, Prae, Tak;
Southwestern – Kanchanaburi.

Ecology: found in deciduous forest in limestone area, from 200 m to 700 m above sea level; flower in March – November.

Distribution: Myanmar.

Use:

Vernacular name: Krachieo som

Critical remarks: The orange bracts of this species make it easy to recognize.

Specimens examined:

Northern – Chiang Mai [*Maxwell* 89-960, Muang Awn Cave area, Sangampang, 29-Jul-1989 (CMU); *Maxwell* 90-1045, Doi Chiang Dao WS, Chiang Dao, 22-Sep-1990 (CMU); *Sutheesorn* 2299, Doi Chiang Dao, 14-Jan-1973 (BK)], Lampang [*Put* 3996, Muang Ngao, 15-Jul-1931 (BK, K)], Tak [*Maxwell* 94-889, Mae Sot, , 18-Aug-1999 (BKF, CMU); *Murata et al.* T16872, Khao Phawo, c 70 kms W of Tak, 23-Jun-1973 (BKF), *Paisooksantivatana* y2292-88, Doi Dunki, Mae Sod, 9-Nov-1988 (BK)], Mae Hong Son [*Larsen et al.* 34161, Khun Yuam, 5-Sep-1974 (AAU, BKF, K); *Maknoi* 378, Ban Pang Pake, Pai, 24-Jul-2003 (AAU, BKF, PSU, QSBG); *Palee* 223, Ban Tahm Lawd, Bang Mah Pah, 9-Jul-1994 (CMU); *Srisanga & Puff* 1068, Ban Bo Khai, Pang Mapha, 56 kms from Pai, 12-Sep-1999 (QSBG)], Prae [*Frank* 346, Me Ban Nord Siam, 23-Sep-1929 (C)]; **Southwestern** – Kanchanaburi [*Bunchuai* 73, Sangkha Buri, 12-Mar-1961 (AAU, BKF); *Geesink et al.* 6102, between Huai Ban Kao and Kritee, 4-Jul-1973 (BKF, C); *Kostermans* 799, Kha Ta Lai in Pan Paung river valley, 4-Jun-1946 (BK, K, P); *Phengklay et al.* 2953, Dong Yai, 14-Aug-1971 (AAU, BKF); *Put* 73, Hin Dat, 2-Jul-1926 (BK, BM, C, K); *Wongprasert* s.n., Meklong Watershed Research Station, 24-Aug-1999 (BKF); *Wongprasert* s.n., same locality, 25-Aug-1999 (BKF)]; **Cultivated** – *Maknoi* 184, QSBG, Chiang Mai, 16-Aug-2001 (AAU, BKF, PSU, QSBG); *Ngamriabsakul* 41, Queen Sirikit Botanic Garden, 10-Jul-1999 (BKF, E); **Burma** - *Maxwell* 98-1219, 5 km E of Kanbauk, Tawer, Tenasserim division, 20-Oct-1998 (CMU).

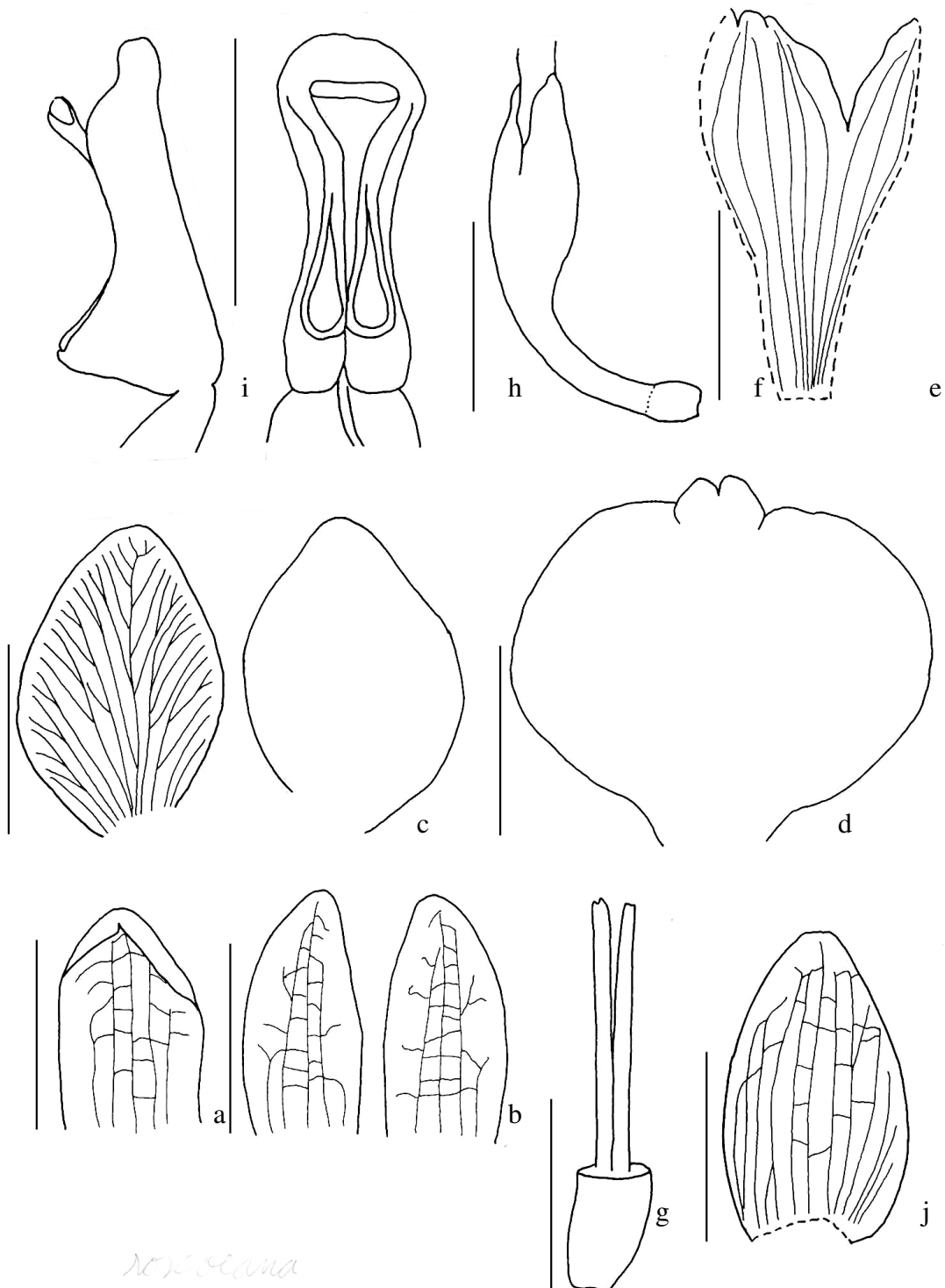


Figure 23 *Curcuma roscoeana* Wall. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stylodes and ovary; h stamen – front view; i stamen – side view; j bracteole (scale = 5 mm)

***Curcuma rubescens* Roxb.** in Asiat. Research. 11. 336. 1810; Fl. Ind. ed. 1. 1. 28. 1820; Roscoe, Monandr. Pl. t. 107. 1828; Horan. Monogr. 23. 1862; Bak. in Hook.f. Fl. Brit. Ind. 6. 213. 1890; Schuman., Pflanzenr. Zingib. 113. 1904. – *C. erubescens* Wall. Cat. n. 6608. – *C. longiflora* Salisb. Trans. Hort. Soc. I. 286. 1812. – *C. rubricaulis* Link, Enum. Pl. hort. Berol. I. 3. 1821. Figure 24, plate 11.

Type: Roxburgh's plate no. 1763 (K!)

Corm ovoid, white with pale brown center, 8x5 cm; **rhizome** white with brownish white center, 6-8 cm long, 1.5-2.0 cm in diameter; tuberous roots threat-like, ended with ovoid structure, white with pale brown center, ovoid structure 6x2.5 cm. **Leafy shoot** 80-100 cm tall; **bladeless-sheath** 3-5, purplish red, glabrous, apex mucronate, 5-40 cm long. **Leaf-sheath** glabrous, apex mucronate, 35 cm long; **ligule** membranous, 2 mm long; **petiole** glabrous, purplish red, very short to 10 cm long; **blade** oblanceolate, green with red patch on either side of midrib, hairy at tip, base cuneate, apex acuminate, 45-50x10-14 cm. **Inflorescence** lateral; **scape** glabrous, 13-20 cm long; **sheath** 3-5, purplish red, glabrous, apex mucronate, 6-17 cm long; **spike** 15-20 cm long. **Bracts** broadly obovate, glabrous on both surfaces, apex obtuse or mucronate, 4-4.5 x 2.5-3.5 cm; **coma bracts** obovate, reddish, hairy on both surfaces, apex obtuse, 5-5.5 x 2-3 cm; **bracteoles** boat-shaped, white, hairy at tip, apex obtuse, 17x14 mm. **Calyx** 9 mm long, hairy along ridges, apex 3-lobed, lobe apices obtuse to acute. **Corolla tube** glabrous, 32 mm long; **lobes** scattered short-hairy, 12 x 11-14 mm; dorsal lobe hooded, apex acute-mucronate, hairy at tip; lateral lobes shallowly concave, apex rounded, glabrous. **Staminodes** oblique, broadly obovate, glandular hairy, apex obtuse, 10x8 mm. **Labellum** 3-lobed, mid-lobed apex bifid, glandular hairy on either sides of mid-band, 15x17 mm. **Filament** flat, glabrous, 2.5x3 mm; **anther** 4 mm long; **spurs** triangular, flat, point downwards, apex acuminate, 2 mm long; **crest** less than 1 mm long. **Ovary** barrel-shaped, densely hairy, 4 mm long; **stylodes** cylindrical, apex acute, 4 mm long; **stigma** 2-lobed, laterally opened, ciliate, 1 mm wide.

Thailand: cultivated.

Ecology: cultivated.

Distribution: India and Myanmar.

Use: cultivated for ornamental purpose.

Vernacular:

Critical remarks: This species has reddish brown leaf-sheath as *C. ferruginea* and *C. amarissima* but differs in rhizome color. *C. rubescens* has white rhizome, while *C. amarissima* has yellow with blue green edge rhizome and *C. ferruginea* has pale brown rhizome.

Specimens examined:

Cultivated - *Maknoi* 543, cult. PSU, 20-June-2004.

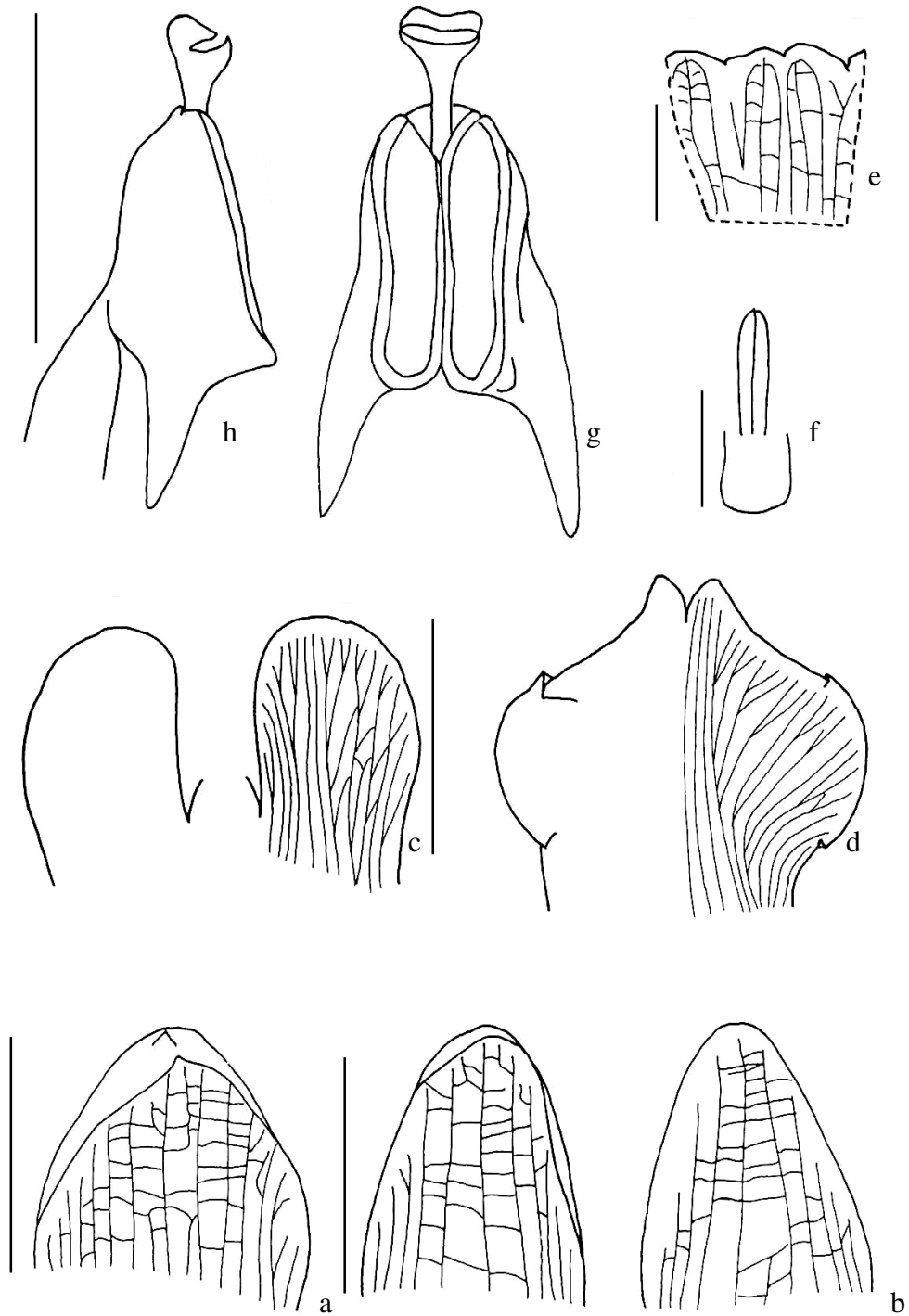


Figure 24 *Curcuma rubescens* Roxb. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f stylodes and ovary; g stamen – front view; h stamen – side view; (scale = 5 mm)

***Curcuma rubrobracteata* Skornickova, M. Sabu & M. Prananthkumar**, Gard.

Bull. Singapore. 55(1): 89. 2003. Plate 11.

Type: *Skornickova & Prasanthkumar* 86241, Lawngtlai, Mizoram, India, 10-November-2002 (holotype – MH; isotype – CALI, K, SING!).

Corm ovoid, white inside, 2x1.5 cm; **rhizome** slender, white inside, 1 cm thick.

Leafy shoot 30-80 cm tall; bladeless sheath 2, 12-27 cm long, glabrous; **Leaf** sheath 20-30cm long, glabrous or densely hairy; **ligule** 2-lobed, 2 mm long, sparsely hairy, with rounded apex; **petiole** 6-14 cm long, glabrous; **blade** ovate, 25-40 x 11-17 cm, upper surface with hairs along secondary nerves, lower surface glabrous, base broad cuneate, apex acuminate. **Inflorescence** terminal; **scape** 3-12 cm long, densely hairy; **spike** 7-10 cm long; **bracts** 4.5-5 x 2-3 cm, hairy on both surfaces, apex rounded to obtuse; **coma** bract absent. **Bracteoles** broadly ovate, 32x27 mm, hairy, apex obtuse. **Calyx** tubular, 8-10 mm long, hairy, apex indistinct 3-lobed, not split down one side; **corolla tube** 30-35 mm long, sparsely hairy outside, with hairy ring inside; **lobes** 15-16 x 7-15 mm, glabrous; dorsal one hooded with acuminate-cucullate apex, lateral ones concave, with rounded apex. **Staminodes** broadly obovate, 15-17 x 11-12 mm, glandular hairy, apex obtuse; **labellum** 3-lobed, 20 x 17-20 mm, glandular hairy near base, apex retuse. **Filament** flat, 4 x 4-5 mm, glandular hairy; **anther** 5x2 mm, connective glandular hairy; **spurs** flat, triangular, 2.5-3 mm long, apex acuminate, s-shaped; **crest** c. 1 mm long, apex rounded; **ovary** barrel-shaped, 2-3 m long, hairy; **stylodes** clavate or cylindrical, 4 m long, apex obtuse; **stigma** 1.5 mm wide, ciliate, open laterally.

Thailand: Northern – Chiang Mai, Lampang, Mae Hong Son, Pitsanulok, Tak; Southwestern – Kanchanaburi.

Ecology: Found in deciduous and dry evergreen forest, from 220 m to 700 m above sea level; flower in May – August.

Distribution: India, Myanmar.

Use: Cultivated as ornamental plants.

Vernacular name: Waan Ngu-hao

Critical remarks: The bright red bracts with short scape are easily to recognize. This species is very common along Thai-Burmese border. It should be found in Myanmar too.

Specimens examined:

Northern – Chiang Mai [*Garrett* 1334, Doi Chiang Dao, Me Na Liao, 12-Jul-1950 (K); *Larsen et al.* 2586, Mae Rim, 15 kms N of Chiang Mai, 17-Jul-1968 (AAU, BKF); *Larsen et al.* 2766, along the road Fang-Chiang Mai, 27-Jul-1968 (AAU, BKF); *Maknoi* 337, Mae Sa Noi WF, QSBG, 18-Jul-2003 (AAU, BKF, PSU, QSBG); *Maknoi* 358, Mae Mao reservoir, Fang, 22-Jul-2003 (AAU, BKF, PSU, QSBG); *Maxwell* 89-1019, Doi Nawng Hoy, Maerim-Samoeng road, 10-Aug-1989 (CMU, E); *Maxwell* 89-807, Doi Chiang Dao, SE foot hill, 25-Jun-1989 (CMU); *Maxwell* 90-890, Mawk Fa Falls, along Mae How stream, 18-Aug-1990 (CMU); *Maxwell* 91-619, Ban Wieng Pa, Sidongyen subdistrict, Fang, 8-Jul-1991 (AAU, CMU, E, P); *Palee* 74, n part of Wahng Hahng Falls, Doi Sutep-Pui, 10-Sep-1992 (CMU)], Lampang [*Maxwell* 94-821, Doi Khun Dahn NP, Hang Chat, 29-Jul-1994 (CMU); *Maxwell* 95-576, Jae Sawn NP, near HQ, Muang Pan, 24-Aug-1995 (BKF, CMU); *Maxwell* 96-1137, Jae Sawn NP, Pah Ngahm (Nahn Kaht) cave, 25-Aug-1995 (BKF, CMU); *Maxwell* 96-781, Jae Sawn NP, Wahng Nua, 2-Jun-1996 (CMU); *Maxwell* 96-918, Jae Sawn NP, Wahng Nua, 27-Jun-1996 (CMU); *Panatkool* 53, Jae Sawn NP, Muang Bahn (Pan), 24-May-1996 (CMU); *Put* 3998, Muang Ngao, 15-Jul-1931 (C, K, L)], Mae Hong Son [*Kress* 98-6213, 19-24 kms E of Mae Sariang, 17-Jul-1998 (AAU); *Maknoi* 377, Ban Pang Pake, Pai, 24-Jul-2003 (AAU, BKF, PSU, QSBG)], Pitsanulok [*Larsen et al.* 878, Thung Salaeng Luang NP, 25-Jul-1966 (AAU, BKF, P), Tak [*Kerr* 6145, Thung Yai (Burmese side), 17-Jun-1922 (BK, BM, C, K); *Kerr* 6145A, Me Mue, Muan, 20-Jun-1922 (BK, BM, K); *Maknoi*??, Umphang, ?-Aug-2004 (AAU, BKF, PSU, QSBG); *Maxwell* 94-893, Mu Kee Haw (Karen) village, Pawaw, Mae Sot, 18-Aug-1994 (BKF, CMU); *Murata et al.* T16871, Khao Phawo, c 70 kms W of Tak, 23-Jul-1973 (AAU, BKF); *Ngamriabsakul* 45, Mae Sot, 14-Jul-1999 (BKF, E); *Smitinand & Seidenfaden* 11621, Chedi Ko, Mae Sot, 11-Jul-1972 (AAU, BKF, L)]; **Southwestern** – Kanchanaburi [*Geesink et al.* 6071, Between Huay Ban Kao and Kritee, 2-Jul-1973 (C); *Kostermans* 798, Ka Tha Lai, 25 km E of Wangka, 4-Jun-1946 (BKF, K, P); *Larsen et al.* 10431, Thung Kang Yang, 2-Jul-1963

(AAU); *Larsen et al.* 10441, Thung Kang Yang, 2-Jul-1963 (AAU); *Larsen et al.* 10538, Thung Kang Yang, 6-Jul-1963 (AAU); *Larsen et al.* 33800, W of Srisawat, 26-Jun-1974 (AAU, K, QSBG); *Maknoi* 453, Tong Pha Phum to Sangkla Buri, 11-Aug-2003 (AAU, BKF, PSU, QSBG); *Maxwell* 73-174, Thong Pha Poom, 6-Jul-1973 (AAU, BK); *Maxwell* 73-293, Huay Ban Gow, Kanchanaburi, 13-Jul-1973 (AAU, BK); *Maxwell* 93-645, Thoong Yai Naresuan WS, Sangklaburi, 17-Jun-1993 (CMU); *Put* 32, Klu Nam Rawn, 27-Jun-1934 (K); *Put* 39, Hin Dat, 29-Jun-1926 (K)].

Curcuma singularis Gagnep. in Bull. Soc. Bot. France, liv. 404 (1907)., Fl. Indochina. Figure 25, plate 12.

Type: Thorel 3194, Pissay, Laos, flowers in March – April (holotype – P!).

Corm ovoid, white inside, 2x1.5 cm; **rhizome** slender, white inside, 5-6 mm thick. **Leafy shoot** c 50 cm tall; **bladeless sheaths** purplish, 6-25 cm long, glabrous, apex mucronate and hooded. **Leaves** few, usually appear after the inflorescence; **leaf sheaths** purplish, 13-22 cm long, glabrous; **ligules** inconspicuous, truncate, c 2 mm long, glabrous; **petiole** 3-8 cm long, glabrous; **blades** elliptic oblong, 19-34 x 6-8 cm, upper surface glabrous, lower surface pubescent, base acute or cuneate, apex acuminate. **Inflorescences** lateral or terminal, with several bladeless sheaths; **peduncle** 5-12 cm long, densely pubescent; **spike** 5 cm long. **Bracts** lanceolate, 4.5-6 x 2.2 cm, apex acuminate and often reflexed backward, both sides glabrous; coma bracts none. **Bracteoles** narrowed, linear, folded, 18x1.5 mm, apex hooded. **Flowers** white. **Calyx** 2.5 cm long, 3-lobed, deeply divided along one side, glabrous; **corolla-tube** 3.8 cm long, hairy; dorsal lobe oblong, 27x7 mm, apex cuspidate, hooded; lateral lobes oblong, 20x7 mm, apex shortly mucronate, hooded. **Staminodes** elliptic, 2.8x1.3 cm, apex rounded, inside hairy; **labellum** white, with a yellow median band, elliptic, 2.7x1.8 cm, apex emarginate, inside hairy. **Stamen:** filament broad and short, c 2x3 mm; **anther** linear, c 6 mm long; **crest** very short or none, **spurs** c 5 mm long, petaloid. **Ovary** 4x1.5 mm, glabrous; **stylodes** linear, acute, c 6 mm long; **stigma** 1mm wide, open, ciliate or not?. **Fruits** obovoid, calyx persistent, 15x8 mm; **seeds** arillate, ellipsoid, c 4x1.5 mm; aril white.

Thailand: Northern – Chiang Mai, Chiang Rai, Lampang, Lamphoon, Utaradit; Northeastern – Loei, Mukdahan, Nakorn Panom, Petchabun, Sakon Nakorn; Eastern – Chaiyaphum, Kalasin, Nakorn Ratchasima, Ubon Ratchatani; Southeastern – Chantaburi, Chonburi, Trat.

Ecology: found in deciduous forest and mixed evergreen forest, from 80 m to 1300 m above sea level; flower in February- June.

Distribution: Indochina.

Use: Young inflorescence is eaten as vegetable.

Vernacula name:

Critical remarks: This is one of the widest distribute species. Its flowers is white with yellow median band on labellum, sometimes tinged with pale pink on staminodes.

Specimens examined:

Northern – Chiang Mai [*Bunnak* 372, Chiang Dao, 21-Feb-1957 (BKF); *Kanchai* 86, Doi Chiang Dao, 31-May-1955 (BKF); *Maknoi* 212, San Pan Si, QSBG, 4-May-2002 (AAU, BKF, PSU, QSBG); *Maxwell* 89-432, Doi Chiang Dao, 8-Apr-1989 (BKF, CMU); *Maxwell* 90-612, Doi Saget, Huay Hawng Cry, 13-Jun-1990 (CMU); *Maxwell* 91-498, Ban Wieng Pa Pattana, Chaipragan, 25-May-1991 (AAU, CMU, E); *Maxwell* 96-1213, Doi Lohn W side, Sahngahmpang, 18-Sep-1996 (CMU); *Maxwell* 97-428, Mae Dtaman, Mae Dtang, 1-May-1997 (BKF, CMU); *Santisuk* 1154, near Kiew Kho Ma, Mae Tang, 6-Feb-1977 (BKF)], Chiang Rai [*Garrett* 782, Doi Hua Mot, Mae Lao, 27-May-1933 (BKF, BM)], Lampang [*Maxwell* 92-469, Ban Kuk-rit, Doi Kuhn Dahn NP, Mae Tah, 22-Aug-1992 (CMU, E, P); *Ngamriabsakul* 35, Mae Prik, Mable Quarry, Thoen, 8-Jul-1999 (BKF, E); *Winit* 1978, Huai Luang, 16-Jun-1928 (K)], Lamphoon [*Maxwell* 93-689, Doi Khun Dahn NP, Mae Tah, 27-Jun-1993 (BKF, CMU)], Utaradit [*Kerr* 5896, 25-Apr-1922 (BK, BM, K)]; **Northeastern** – Loei [*Chermsirivathana* 938, Phu Rua, 17-Apr-1968 (BK); *Kerr* 8829, Phu Luang, 27-Mar-1924 (BK, K); *Sorensen et al.* 2457, Pha Nok Khao, 22-Mar-1958 (C); *Suvatabandhi* 159, Kao Krading, 20-Mar-1948 (K); *Tamura* T60438, Phu Kradung, 27-Aug-1988 (BKF)], Mukdahan [*Kerr* 21814, Pu Manao, , 13-May-1932 (K)] , Nakorn Panom [*Kerr* 21454, route to Mukdahan, 14-May-1932 (BK, K)], Petchabun [*Maknoi* 203, Namnoa NP, 29-Apr-2002 (AAU, BKF, PSU, QSBG)], Sakon Nakorn [*Kerr* 8503, Wa Naure, 18-Feb-1924 (BM, C, K)]; **Eastern** – Chaiyaphum [*Hansen et al.* 11384, Khao Khio ridge, 8-Mar-1964 (BKF, C); *Smitinand & T Santisuk* s.n., Thung Lui Lai, 24-May-1980 (BKF); *Suddee* s.n., Pa Hin Ngam, (AAU)], Kalasin [*Widmer* 0112, market, 12-Apr-1980 (BKF)], Nakorn Ratchasima [*Santisuk* s.n., Khao Yai NP, 3-Jun-1979 (BKF)], Ubon Ratchatani [*Greijmans* 76, Gene conservation station, Ban Bahai, 23-May-2001 (CMU)]; **Southeastern** – Chantaburi [*Sorensen et al.* 7225, Pl. of Makam, 9-Apr-1959 (C)], Trat [*Sorensen et al.* 7112,

Koh Chang, Klong Mayom, 2-Apr-1959 (C)], Chonburi [*Collins* 1086, Ang Hin Boo, Sriracha forest, 1-Apr-1924 (C, K); *Maxwell* 75-413, Khao Kieo, Sriracha 10-Apr-1975 (AAU, BK, L?); *Maxwell* 75-625, same locality, 23-Jun-1975 (AAU, BK, L?); *Maxwell* 76-161, same locality, 27-Mar-1976 (AAU, BK, L?)], Prachinburi [*Paisooksantivatana & Sangkhachand*, Ban Nong Kung, Watana Nakorn, 23-Jul-1987 (BK)], Trat [*Suksatan* s.n., Koh Chang]; **Cultivated** – *Collins* 014, Bangkok, 1-Oct-1934 (K); *Collins* OIII, Bangkok, 11-Oct-1934 (K); *Maknoi* 235, PSU, Songkhla, 3-Jun-2002 (PSU)]; **Laos** – Champasak [*Maxwell* 98-472, Pah Peng Falls, Mekong river, 26-Apr-1998 (CMU)]

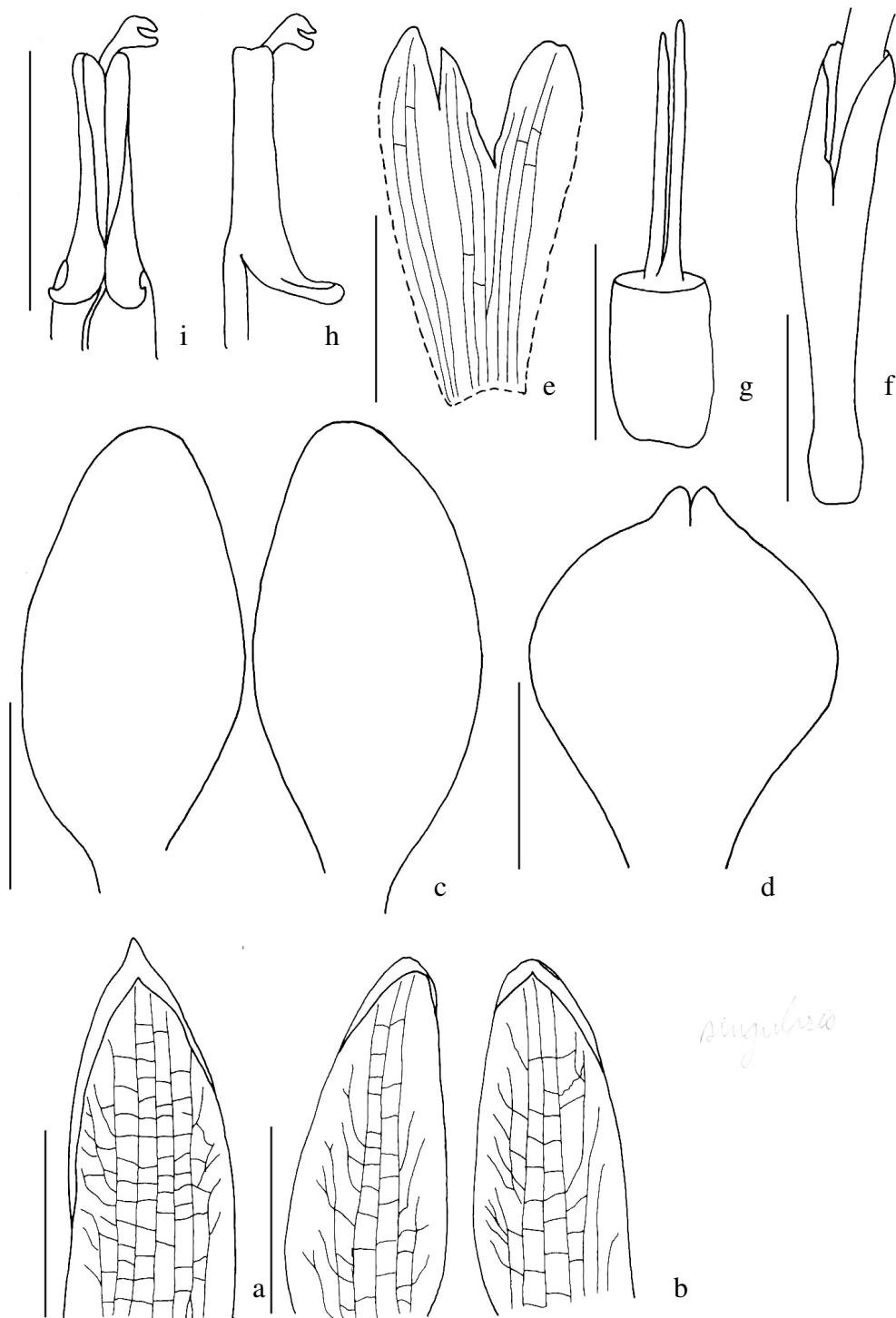


Figure 25 *Curcuma singularis* Gagnep. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stylodes and ovary; h stamen – front view; I stamen – side view (scale = 5 mm)

***Curcuma sparganifolia* Gagnep.** in Bull. Soc. Bot. France 4. serie. II. (1903) 260., Fl. Indo-china.; K. Schum. 1904. Zingiberaceae in Das Pflanzenreich. IV. 103. Figure 26.

Type: *Hahn* 30, Cambodge (P!)

Corm ovoid, white or pale brown inside, 1-2 x 1-2 cm; **rhizome** very short. **Leafy shoot** 15-30 cm tall; **bladeless sheath** 2-21 cm long. **Leaf sheath** 10-25 cm long, glabrous; **ligule** 2-lobed, 1-2 mm long, glabrous; **petiole** 2-10 cm long, glabrous; **blade** lanceolate to narrowly lanceolate, green, glabrous on both surfaces, base attenuate, apex acuminate, 15-35 x 1-3 cm. **Inflorescence** terminal; **scape** 10-50 cm long, slender, rigid, glabrous; **spike** 3-5 cm long. **Bracts** 1.5- 2.1 x 1.0-2.1 cm, glabrous, apex rounded to obtuse, **coma** bract none; **bracteoles** keeled, oblong, 5x 3-4 mm, glabrous. **Calyx** 4 mm long, glabrous, apex 3-lobed; **corolla tube** 7 mm long, glabrous; **lobes** 6-7 x 4-5 mm, glabrous, dorsal one hooded, with short mucronate, lateral ones slightly concave with rounded apex. **Staminodes** obovate-oblong, 10x4 mm, glabrous, apex rounded; **labellum** clawed-obovate, apex emarginate, blade 4-5 x 6-8 mm; **anther** 2 mm long; **spurs** none; **crest** 1-1.5 mm long, apex broadly acute. **Ovary** 1.5-2 mm long, glabrous; **stylodes** absent; **stigma** terminally opened, ciliate, 1 mm wide.

Thailand: Northeastern – Ubon Ratchathani; Eastern – Nakorn Ratchasima, Srisaket; Southeastern – Trat; Southwestern – Kanchanaburi.

Ecology: in deciduous forest from 150 m to 600 m above sea level. Flower in May – Aug.

Distribution: Indochina.

Use:

Vernacular name:

Critical remarks: The scape of inflorescence is very slender. Its small spike with pink bracts is distinctive.

Specimens examined:

Eastern – Nakorn Ratchasima [*Phengkklai* 567, National Park, 17-Dec-1962 (K)], Srisaket [*Maxwell* 76-513, Dong Rak Range, at Chong Bat Lak, Kantaralak, 16-Aug-1976 (AAU, BK, L)], Ubon Ratchathani [*Ngamriabsakul* 69, Phu Chong Nayoy NP, 6-Aug-1999 (BKF, E)]; **Southwestern** – Kanchanaburi [*Kerr* 19483, Ta Salao, 10-Jul-1930 (BK, BM, C, K); *Marcan* 2491, Ta Salao, 10-Jul-1930 (BM, K); *Marcan* 919, rock cleft, hillfoot, 11-Jul-1922 (K, BM); *Put* 1793, Sai Yok, 31-Jul-1928 (BK, BM, C, K, L)]; **Southeastern** – Trat [*Dee Bunpheng* 35, Khao Bantad, 13-Jun-1946 (C); *Dee Bunpheng* 78, Khao Bantad, 13-Jun-1946 (BK); *Geesink et al.* 6541, Klong Kut, 5-May-1974 (AAU, BKF, C, E, K); *Put* 2874, Khao Kuap, 20-May-1930 (BK, BM, C, K, L)]; **Cultivated** – *Collins* OV, Bangkok, 1-Oct-1934 (E, K, P); *Kerr* 19483A, Bangkok, 28-Sep-1930 (K); *Larsen et al.* 47394 (AAU); *Larsen et al.* 47395 (AAU); *Mood* M94P17 (AAU).

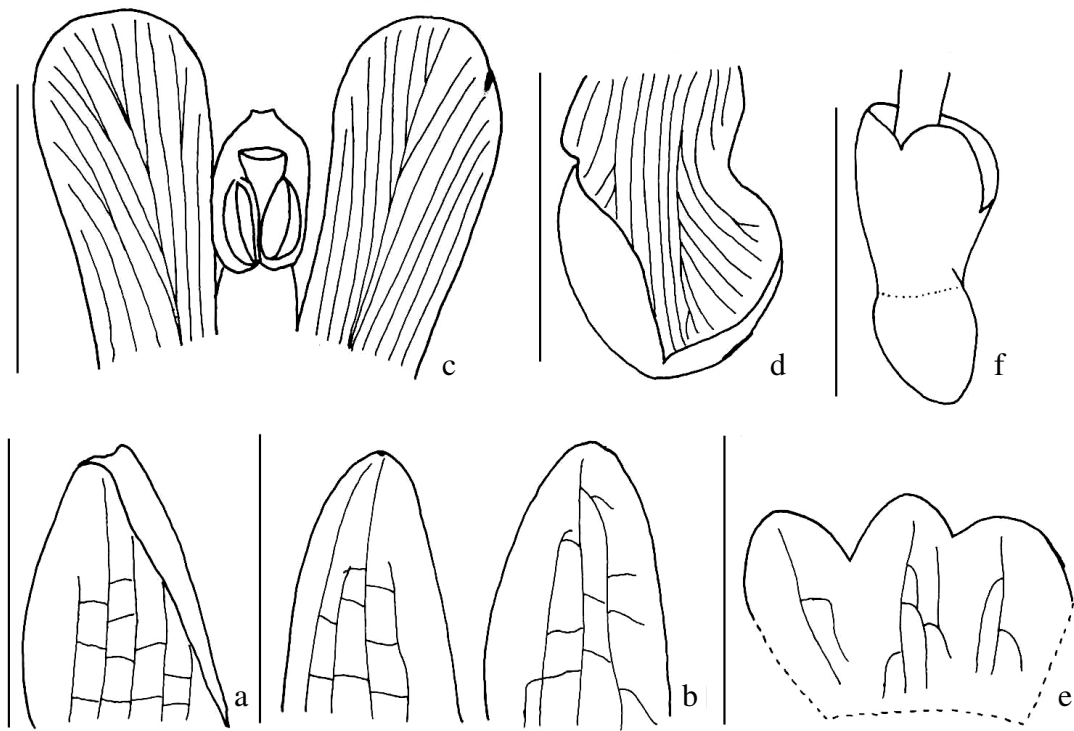


Figure 26 *Curcuma sparganiiifolia* Gagnep. a dorsal corolla lobe; b lateral corolla lobes; c staminodes and stamen; d labellum; e calyx – dissected; f calyx and ovary; (scale = 5 mm)

***Curcuma stenochila* Gagnep.** in Bull. Soc. Bot. Fr. (1905) 543, Fl. Indo-china (1918) 64. Figure 27.

Type: Geoffroy 479, Kampot, Kamchay, Cambodge, 12-July-1904 (holotype – P!).

Corm ovoid, inside white, 2x1 cm; **rhizome** very short. **Leafy shoot** 30-50 cm tall; **bladeless sheath** pubescent, 3-15 cm long. **Leaf sheath** 10-19 cm long, hairy; **ligule** 2-lobed, 2-5 mm long, densely hairy, ciliate; **petiole** 12-20 cm long, hairy; **blade** oblong to lanceolate, 21-28 x 6.5-12 cm, upper surface with hairs along secondary nerves, lower surface glabrous, base broad cuneate to slightly cordate, apex acuminate. **Inflorescence** terminal; **scape** 3-5 cm long, densely hairy; **spike** 4 cm long; **bracts** lanceolate, 4x1.5 cm hairy, apex acute; **coma** bract none. **Calyx** tubular, 20 mm long, hairy along veins, split down one side 12 mm, apex 3-lobed; **corolla tube** 35 mm long, hairy; **corolla lobes** 20 x 5-6 mm, glabrous; dorsal one hooded, apex acuminate cucullate; lateral ones concave, apex rounded. **Staminodes** ovate, 20x10 mm, densely glandular hairy, apex obtuse; **labellum** obovate, 20x15 mm, hairy along either side of mid-band, shallowly 3-lobed, apex of mid-lobe emarginate. **Filament** flat, 7x4 mm, glandular hairy; **anther** 10x3 mm, glandular hairy; **spurs** conical, 2 mm long, point forward, apex acute; **crest** 3x2 mm, side-folded, fleshy, apex rounded. **Ovary** barrel-shaped, 3 mm long, densely hairy; **stylodes** narrowly cylindrical, 9 mm long, surface rugose(rough), apex acuminate; **stigma** terminally opened, ciliate, 2 mm wide.

Thailand: Northern – Chiang Rai, Pitsanulok; Northeastern – Khonkean, Loei, Sakon Nakorn; Eastern – Chaiyaphum; Southeastern – Chantaburi.

Ecology: found in evergreen forests, from 220 m to 600 m above sea level; flower in July – September.

Distribution: Cambodia, Laos.

Use: Cultivated as ornamental plant.

Vernacular name:

Critical remarks: This species is closely allied with *C. bicolor* but differs in color pattern of flower.

Specimens examined:

Northern – Chiang Rai [*Maxwell* 92-440, Koon Gohn Falls, Muang, 20-Aug-1992 (AAU, CMU, P); *Iwatsuki et al.* T13271, Doi Tung, 26-Sep-1967 (BKF)], Pitsanulok [*Larsen et al.* 703, Thung Salaeng Luang NP, 22-Jul-1966 (AAU, P); *Larsen et al.* 902, same locality, 25-Jul-1966 (AAU)]; **Northeastern** – Loei [*Bunchuai* s.n., Phuang Luang, (BKF); *Phusomsaeng* 26, Phu Luang, 1-Sep-1966 (BKF)], Sakon Nakorn [*Ngamriabsakul* 63, Phu Pan NP, 1-Aug-1999 (BKF, E)]; **Eastern** – Chaiyaphum [*Larsen et al.* 31438, near Chulaporn Dam, 5-Aug-1972 (AAU, K, P) ; *Smitinand* 11871, Phu Khieo, 22-Jul-1973 (BKF)]; **Southeastern** – Chantaburi [*Pudjaa & Cholkulchana* 590, Khao Kum Pang, 14-Jul-1999 (BKF); *Smitinand* 3458, Hin Lat, Khlawng Lamphong, Pong Namrawn, 30-Aug-1956 (AAU, BKF)].

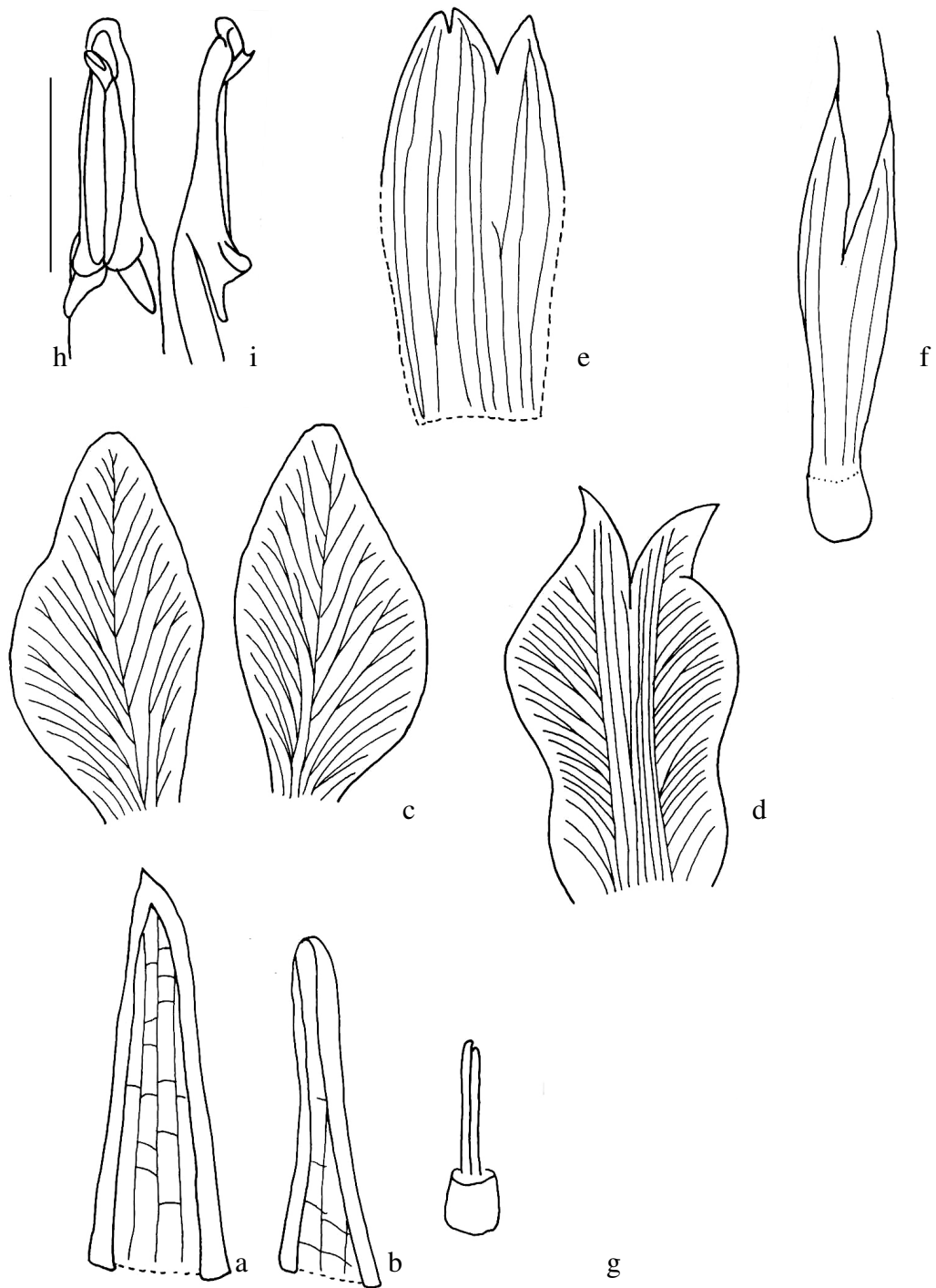


Figure 27 *Curcuma stenochila* Gagnep. a dorsal corolla lobe; b lateral corolla lobe; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stylodes and ovary; h stamen – front view; I stamen – side view (scale = 5 mm)

***Curcuma viridiflora* Roxb.** As. Res. xi. 341. (1810); Valetton, Th. Bull. Jard. Buitenzorg. Serie 2, 27: 1-81 (1918); Holttum, The Garden's Bulletin Singapore (13) 65-72. (1950); van Steenis, Flora of Java (3) 69-72. (1967). Figure 28.

Type: Roxburgh's plate no. 2005 (K!)

Corm ovoid, inside yellow, 4x3 cm; **rhizome** very short. **Leafy shoot** 90-120 cm tall; **bladeless sheath** pubescent, 8-50 cm long. **Leaf sheath** and **petiole** pilose, 40-60 cm long; **ligule** indistinct; **blade** lanceolate, upper surface hairy along margin on upper half, lower surface hairy along midrib, base cuneate, apex acuminate, 42-50 x 14-16 cm. **Inflorescence** terminal, 65 cm tall; **scape** pilose, 50 cm long;. **Bracts** broadly ovate, green, pilose on both surfaces, apex acute to obtuse, 4.5-5.0 x 2.0-2.5 cm, lowest one 7 cm long; **coma bracts** narrowly ovate, greenish white, pilose, apex acute, 2.5-4 x 1-2 cm; **bracteoles** broadly obovate, 20 x 14 mm, sparsely hairy, apex obtuse. **Calyx** tubular, 8-9 mm long, hairy, split down one side 4 mm, apex 3-lobed; **corolla tube** outside glabrous, inside with hair-ring, 35 mm long; **corolla lobes** glabrous, 13-15 x 8-11 mm; **dorsal lobe** hooded, apex acuminate-cucullate, few hairs at apex; **lateral lobes** slightly concave, apex rounded. **Staminodes** obliquely broad obovate, glandular hairy, apex obtuse, 12 x 8 mm; **labellum** indistinctly 3-lobed, hairy along both sides of mid-band, apex retuse, 13-14 x 14-15 mm. **Filament** concave, 2 x 5 mm, glabrous; **anther** 4x2 mm, glabrous; **spurs** flat, triangular, 2 mm long, point downwards, slightly incurved, apex acute. **Ovary** subglobose, 2 mm long, hairy; **stylodes** clavate, 4-5 mm long, apex acute; **stigma** laterally opened, ciliate, 1 mm wide.

Thailand: Northern - Mae Hong Son, Chiang Mai.

Ecology: found in deciduous forest, at about 800 m above sea level; flower in September.

Distribution: Myanmar

Use:

Vernacular name:

Critical remarks: This species has white coma bracts tipped with green.

Studied specimens:

Northern – Mae Hongson [*Larsen* et al. 46848, Doi Pui, SE of Mae Hong Son, 23-Sep-1995 (AAU)]; Chiang Mai [*Maknoi* 452, Chiang Dao, 3-Jul-2003 (AAU, BKF, PSU, QSBG)]

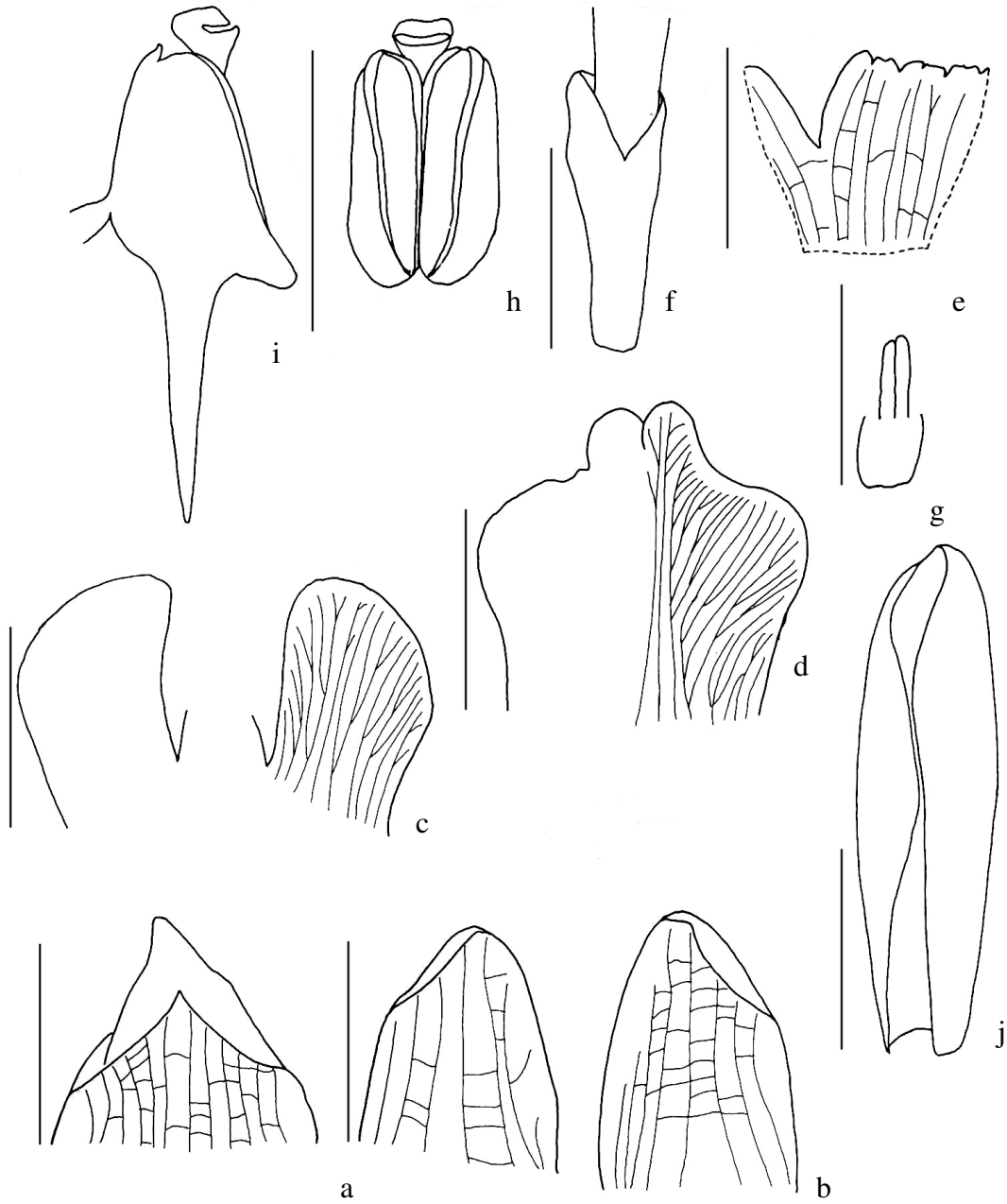


Figure 28 *Curcuma viridiflora* Roxb. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stylodes and ovary; h stamen – front view; I stamen – side view; j bracteole (scale = 5 mm)

***Curcuma xanthorrhiza* Roxb.** Fl. Ind. ed. 1. 1. 25. 1820; Miq. Fl. Ind. bat. 3. 596. 1859; Horan. Monogr. 23. 1862; Schuman., Pflanzenr. Zingib. 112. 1904; Valet., Bull. Buitenz. Ser. 2. 27: 61 .1918; Holtt. Gard. Bull. Sing. 13: 72. 1950; van Steenis. in Backer & Bakhuizen van der Brink. Fl. Java. 3: 71. 1968; Telin & Larsen in Wu & Raven, Fl. China. 24: 362. 2000. Figure 29.

Type: Roxburgh's plate no. 2003 (K!)

Corm ovoid, inside dark yellow or orange, 10-12 x 6-8 cm; **rhizome** 1.5-2 cm thick. **Leafy shoot** 100-120 cm tall; **bladeless sheath** glabrous, 4-20 cm long. **Leaf sheath** glabrous, 45 cm long; **ligule** indistinct; **petiole** very short or sessile; **blade** lanceolate, upper surface glabrous, lower one pubescent, base cuneate, apex acuminate, 65x18 cm. **Inflorescences** lateral; scape scattered hairy, 30 cm long; spike 20 cm long. **Bracts** ovate, apex, 6-7 x 5 cm; coma bracts narrowly ovate, pink, apex acute, 6-7 x 3 cm; bracteoles elliptic, keeled, glabrous, apex acute, 24-27 x 14-18 mm. **Calyx** tubular, 10 mm long, split down one side 4 mm, hairy, apex shallowly 3-lobed. **Corolla** tube hairy, 26-30 mm long; lobes pinkish red, 13-16 x 9 mm; dorsal lobe hooded; lateral lobes concave, apex rounded. **Staminodes** obliquely obovate, apex rounded to truncate, 18x8 mm. **Labellum** 3-lobed, midlobe emarginate, yellow with bright yellow midband, hairy along both side of midband, 20x17mm. **Filament** 5x4 mm; anther 4 mm long; spurs sharply acute, downward-pointed, 3 mm long. **Ovary** barrel-shaped, densely hairy, 5 mm long; stylodes cylindrical, 5 mm long; stigma 2-lobed, laterally opened, ciliate, 1 mm wide.

Thailand: Cultivated.

Ecology: Cultivated.

Distribution: India, Myanmar, China, Indo-china, Malaysia, Indonesia.

Uses: Cultivated for medicinal purposes.

Vernacular: Waan Chakmodlook.

Critical remarks:

Specimens examined:

Northern – Pitsanulok [*Maknoi* 226, Route from Romklao to Chattrakarn, 12-May-2002 (AAU, BKF, QSBG, PSU)]; **Southeastern** – Trat [*Maxwell* 74-417, Salakawk, Chang Island, 8-May-1974 (AAU, BK)]

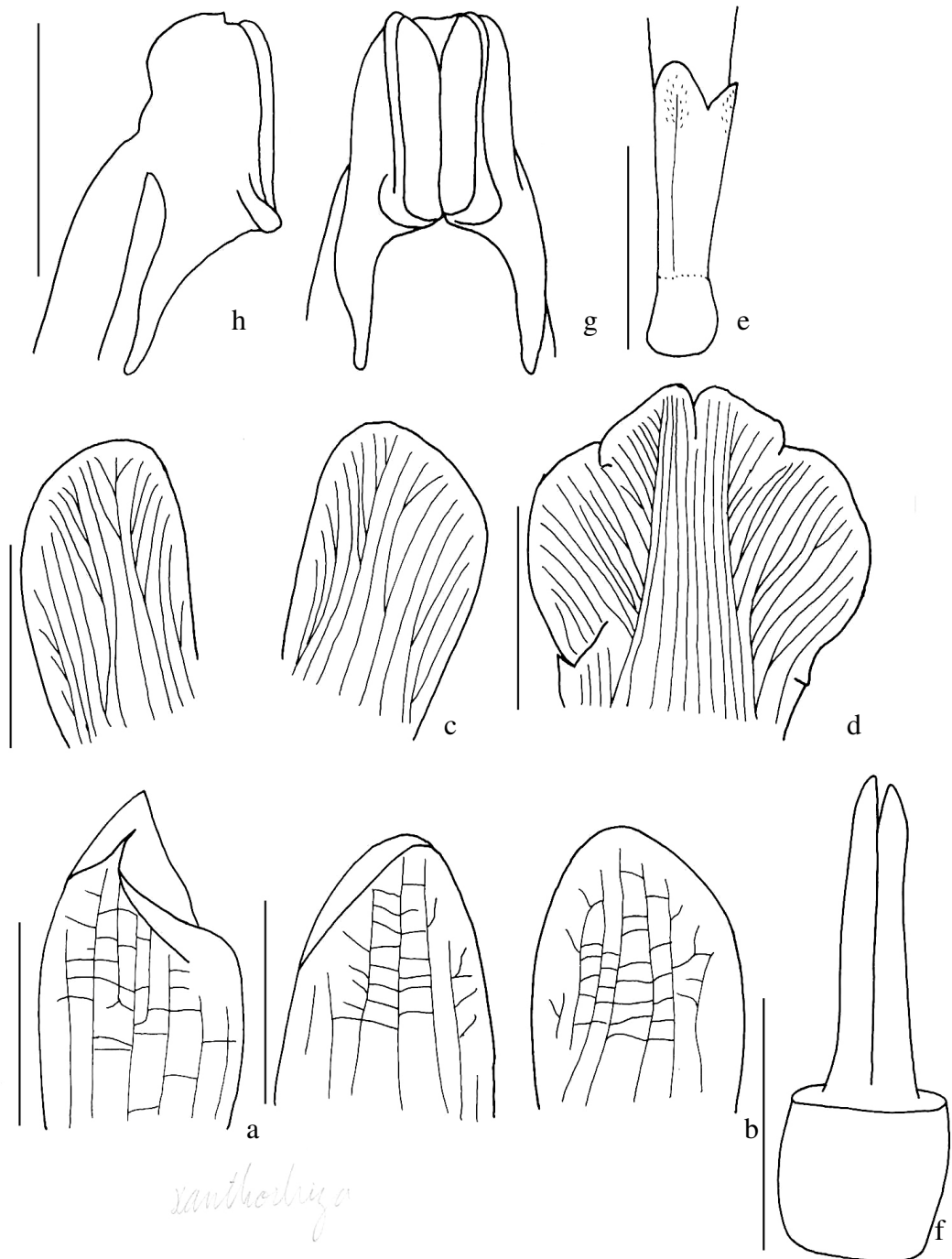


Figure 29 *Curcuma xanthorrhiza* Roxb. a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stylodes and ovary; h stamen – front view; i stamen – side view (scale = 5 mm)

Curcuma zedoaria (Bergius) Roscoe, Monandr. Pl. t. 109. 1828; Horan. Monogr. 23. 1862; Bak. in Hook.f. Fl. Brit. Ind. 6. 210. 1890; Schuman. in Berg und Schmidt, Mediz. Atlas 1890; Trim. Fl. Ceylon 4. 241. 1898; Schuman., Pflanzenr. Zingib. 110. 1904; Ridl. Material Malay. Penin. 3: 21. 1907; Gagnep. Fl. Gen. de Indo-china. 6: 67. 1908; Valet., Bull. Buitenz. Ser. 2. 27: 57. 1918; Holtt. Gard. Bull. Sing. 13: 71. 1950; van Steenis. in Backer & Bakhuizen van der Brink. Fl. Java. 3: 71, 72. 1968. – *Amomum zedoaria* Bergius, Mat. Med. 41. 1788. – *Amomum zerumbet* Koen. In Retz. Observ. 3. 55. 1783. – *Curcuma zerumbet* (Koenig) Roxb. Coromand. Pl. 2. t. 101. 1798, in Asiat. Research. 11. 333. 1810; Fl. Ind. ed. 1. 1. 23. 1820; Royle, Illustr. Himal. Pl. 859. 1839; Thwait. Enum. Pl. Zeyl. 316. 1863. – *Curcuma longiflora* Salisb. in Trans. Hortic. Soc. 1. 285. 1812. – *Amomum latifolium* Lam. Encycl. 1. 134. 1783. – *Curcuma speciosa* Link, Enum. Pl. Hort. Berol. 1. 3. 1821. – *Erndia* Giseke, Prael. Linn. 209, 229; Rumph. Herb. Amb. 5. 108. 1749. Figure 30.

Type: Roxburgh's plate no. 1010 (K!)

Corm ovoid, pale brown, 6-8 x 4-5 cm; **rhizome** short. **Leafy shoot** 80-120 cm tall; **bladeless sheath** glabrous, 5-20 cm long. **Leaf sheath** glabrous, 28 cm long; **ligule** ciliate, 2 mm long; **petiole** very short or sessile; **blade** lanceolate, base cuneate, apex acuminate, 28-35 x 9 cm. **Inflorescences** lateral; **scape** glabrous, 18-22 cm long; **spike** 10-14 cm long. **Bracts** broadly ovate, glabrous, green with pink tip, apex obtuse to acute, 4-4.5 x 2-3 cm; **coma bracts** ovate, reddish pink, apex acute to broadly acute, 5-6 x 2 cm; **bracteoles** ovate, shallowly concave, hairy on outer surface, apex obtuse, 7x3.5 mm. **Calyx** tubular, 6 mm long, split down one side 3 mm, hairy, apex shallowly 3-lobed. **Corolla tube** hairy on upper half, 20 mm long; **lobes** glabrous, 8-9 x 6-9 mm; dorsal one hooded, apex cuculate; lateral ones shallowly concave, apex rounded. **Staminodes** obliquely obovate, yellow, glandular hairy, apex rounded to truncate, 11x5 mm. **Labellum** 3-lobed, yellow with bright yellow midband, hairy along sides of mid-band, midlobe emarginate, 9x11 mm. **Filament** flat, pilose, 1x3 mm; anther 2.5 mm long; spurs sharply acute, downward-pointed, 1.5 mm long. **Ovary** barrel-shaped, pubescent, 3 mm long; **stylodes** cylindrical, 3 mm long; **stigma** 2-lobed, laterally opened, ciliate, 1 mm wide.

Thailand: cultivated throughout the country.

Distribution: Cultivated throughout East, Southeast and South Asia; India, Myanmar, China, Indo-china, Malaysia, Indonesia.

Ecology: Cultivated.

Vernacular: Kamin Oi

Uses: medicinal plant.

Critical remarks: This species is recognized by its bright red coma and pale brown rhizome.

Specimens examined:

Cultivated – *Maknoi* 198, PSU, Songklha, 17-Apr-2002 (PSU).

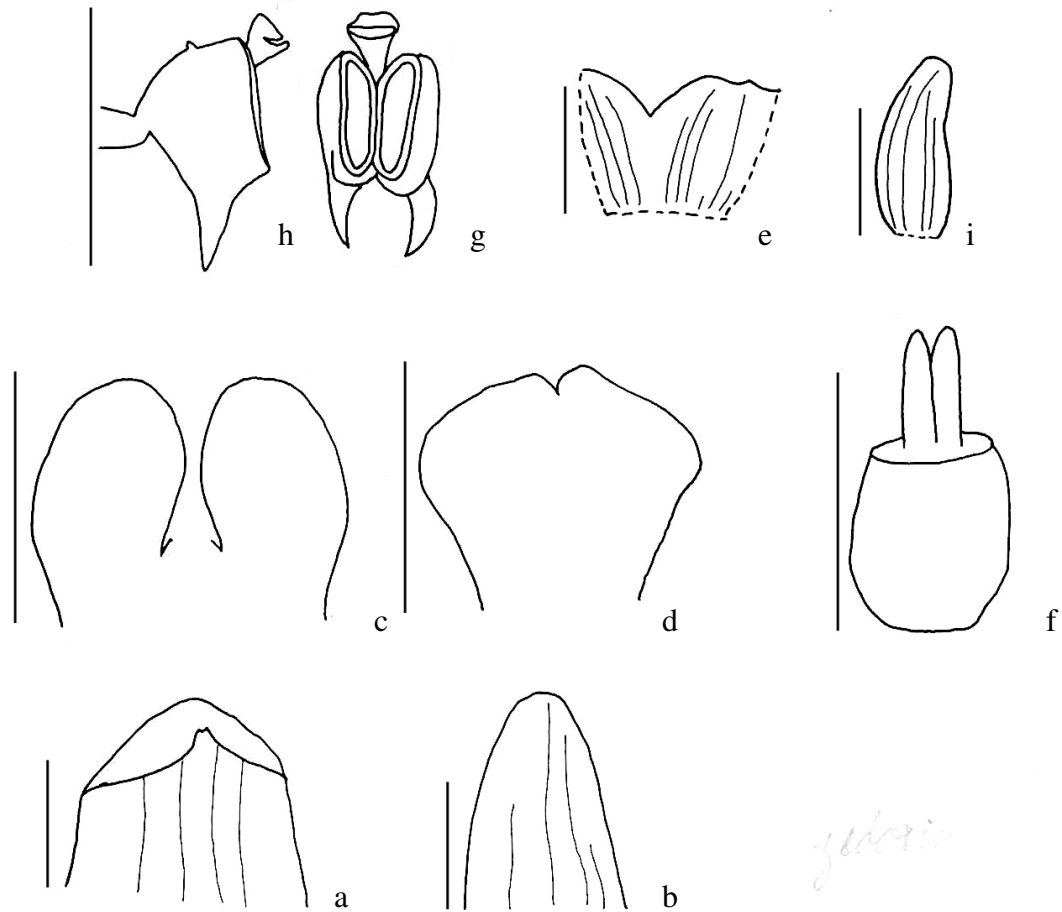


Figure 30 *Curcuma zedoaria* (Berg.) Rosc. a dorsal corolla lobe; b lateral corolla lobe; c staminodes; d labellum; e calyx – dissected; f stylodes and ovary; g stamen – front view; h stamen – side view; i bracteole (scale = 5 mm)

Curcuma sp. (Mae Hong Son) Figure 31, plate 12.

Corm ovoid, yellow inside, 4-6 x 3-5 cm; **rhizome** very short. **Leafy shoot** 35-70 cm tall. Bladeless-sheath 0-2, up to 38 cm long, pilose. **Leaf-sheath** 16-30 cm long, pilose; **ligule** bilobed, 2-8 mm, hairy; **petiole** 12-28 cm long, pilose; **blade** obovate to obovate-lanceolate, 25-50 x 9-22 cm, base cordate to broad cuneate, apex acuminate, lower surface pilose, upper surface hairy along secondary veins and margin.

Inflorescence terminal, narrowly cylindrical, very variable in size; peduncle pilose, 8-18 cm long; **spike** 10-20 cm long; **bracts** 2.5-4 cm long, pilose on both surfaces, connate 2-3.5 cm long, forming a deep and narrow porch, free part side-expanded, 1.0 x 2.0 – 1.5 x 2.5 cm, gradually increase in size upwards, apex rounded to truncate, green; **coma bracts** 2.0-3.5 x 1.5-2.0 cm, 1.5-3.0 cm free, pilose, apex acute to obtuse. **Bracteoles** broadly ovate, 20x16 mm, folded, hairy, apex acute. **Calyx** tubular, 12 mm long, glabrous, split down one side 4 mm, apex 3lobed; **corolla tube** 35 mm long, glabrous, with dense long hairy ring inside just below the throat; **lobes** 12-15 x 4-5 mm, glabrous; dorsal one hooded, apex acute cucullate; lateral ones concave, apex rounded. **Staminodes** obovate, 10x6 mm, with dense glandular hairs, apex rounded. **Labellum** 3-lobed, 20x15 mm, with glandular hairs, apex of mid-lobe shallowly emarginate. **Filament** 5x4 mm, flat, glabrous; anther 6x3 mm, glabrous; spurs triangular, flat, 2 mm long, apex acute, point downwards; crest 1x1 mm, apex rounded. **Ovary** barrel-shaped, 4 mm long, glabrous; **stylodes** connate, clavate, 4 mm long, apex rounded; **stigma** 1 mm wide, open laterally, ciliate.

Thailand: Northern – Mae Hong Son (Mae Sariang district).

Ecology: in deciduous forest, from 220-1100 m above sea level, flower in July.

Distribution: known only from type locality.

Use:

Vernacular name:

Critical remarks: This species produced very slender inflorescence. Its lilac coma bracts tipped with dark purple are unique.

Specimens examined:

Northern – Mae Hong Son [*Larsen et al.* 2087, 20 kms W of Bo Luang towards Mae Sariang, 1100 m, 4-Jul-1986 (AAU, BKF); *Larsen et al.* 2240, S of Mae Sariang, 220 m, 8-Jul-1968 (AAU); *Maknoi* 386, Mae Sariang, Mae Hong Son; 26 July 2003 (AAU, BKF, PSU, QSBG); *Maknoi* 562, same locality, 25-Jul-2004 (AAU, BKF, PSU, QSBG)].

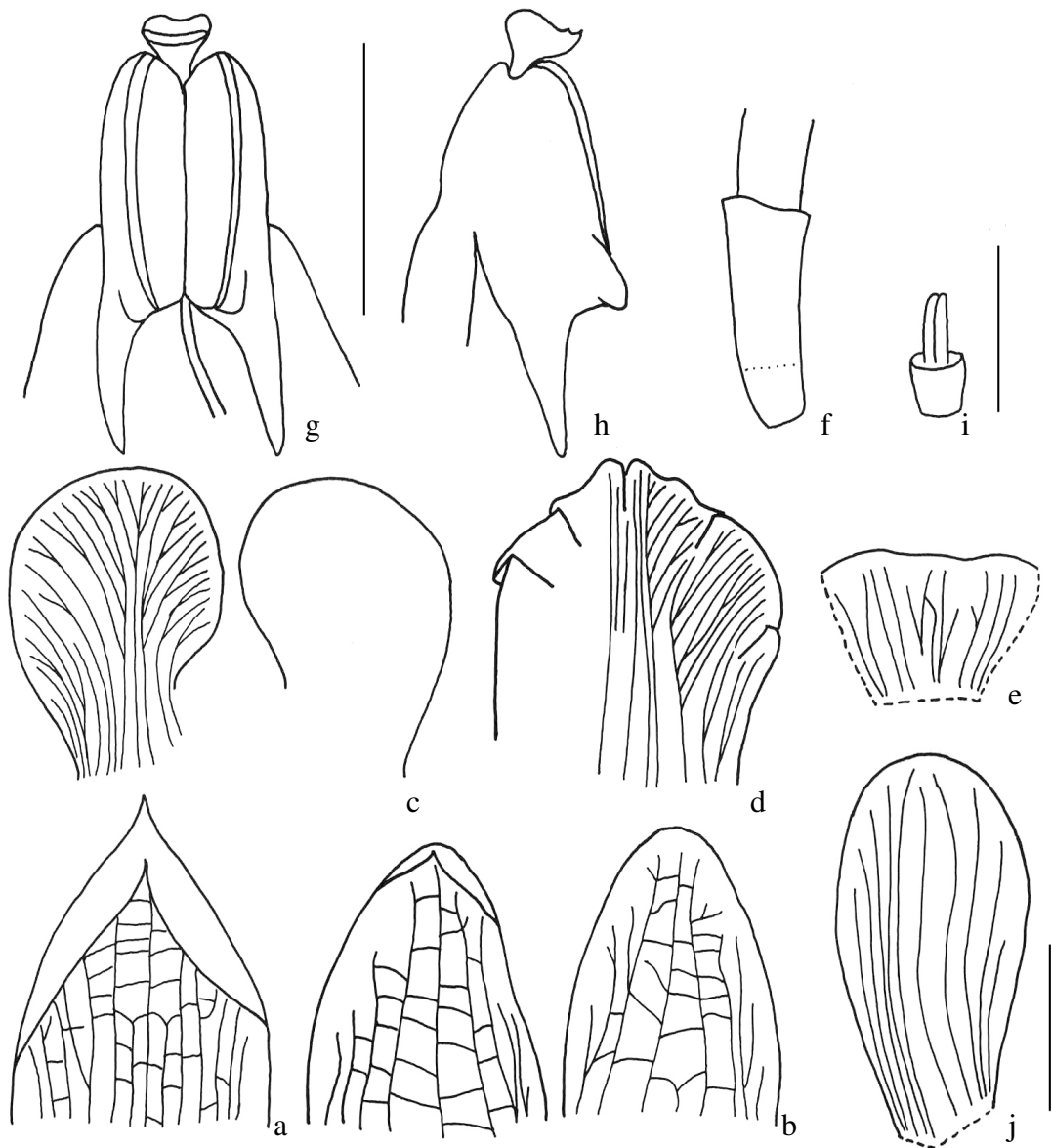


Figure 31 *Curcuma* sp. (Maehongson); a) dorsal corolla lobe, b) lateral corolla lobes, c) staminodes; d) labellum; e) calyx – dissected; f) calyx and ovary; g) stamen – front view; h) stamen – side view; i) stylodes and ovary; j) bracteole (scale = 5 mm).

***Curcuma* sp.** (Nakorn Sawan).

Plant c 70 cm tall; basal sheathes few, 8-12 cm long, minutely pubescent. **Leaves** 4-5; **sheath** 10-25 cm long, minutely pubescent; **ligule** 2-lobed, 1-2 mm long, densely pubescent, ciliate; **petiole** nearly sessile to 8 cm long or more, pilose; **blade** narrowly lanceolate, 10-35 x 1.5-2.5 cm, densely pubescent on both surfaces, base attenuate, apex acute to acuminate. **Inflorescence** terminal; scape 10-12 cm long, glabrous or pubescent, with or without sterile bracts attached near base of spike; spike 7-12 cm long; **bracts** broad ovate, (green), 3-4 x 2-3 cm, glabrous or sparsely hairy, ciliate, apex acute to obtuse; coma absent, but uppermost bracts much smaller and sterile; **bracteoles** narrowly triangular, 3 mm long. **Calyx** tubular, 1 cm long, split down one side 3.5 mm, glabrous, apex unequally 3-lobed; **corolla** tube 2 cm long, sparsely hairy; dorsal corolla lobe cuculate, 11 x 5 mm, almost glabrous except few hairs at the beak-like tip; lateral corolla lobes 8x4 mm, glabrous, hooded with acute tip. **Staminodes** broadly obovate to subrhomboid, 14x7 mm, glabrous, apex acute. **Labellum** broadly obovate, 10x6 mm, deeply bifid, cleft 5 mm deep, lobe apices acuminate, yellow with dark yellow median band. **Filament** 4x1.5 mm, flat, glabrous; **anther** 7x1.5 mm, spurs filamentose, 3 mm long, crest 1 mm long. **Ovary** 2x2 mm, with short hair; stylodes; stigma.

Thailand: Lopburi, Nakorn Sawan.

Ecology: Flowers in August.

Distribution: endemic to Thailand. Known only from type locality in Nakorn Sawan, Central Thailand. Plants sold in market said collected from Lopburi.

Critical remarks: This species is similar to *C. flaviflora* S.Q. Tong in floral characters of but differ in vegetative characters as follow: leaves narrowly lanceolate, the whole plant pubescent.

Specimen examined: Central – Nakorn Sawan [*Put* 4052; Hua Wai, 27-Aug-1931 (BK, BM, C, K, L, P)], **Cultivated** [K. Larsen s.n., Thailand (cultivated, flower in Aarhus) 1-Aug-1999 (AAU)]

Curcuma sp. (Pitsanulok) Figure 32, plate 13.

Corm ovoid, white inside, 2x1 cm; **rhizome** very short. Leafy shoot 15 cm tall.

Bladeless sheath 2-3, brownish, glabrous, apex rounded, 2-4 cm long. **Leaf-sheath** glabrous, apex rounded, cm long; **ligule** indistinct; **petiole** glabrous, 2-5 cm long;

blade ovate, glabrous on both surfaces, base rounded, apex acute, green with red patches on either sides of mid-vein, 5-17 x 3-7 cm. **Inflorescence** terminal; **scape** 6 cm long, glabrous; **spike** 5 cm long. **Bracts** broadly ovate, glabrous, reddish brown, apex rounded, 3x4 cm; **bracteoles** broadly ovate, glabrous, white, apex acute, 8x5 mm.

Calyx tubular, 7 mm long, glabrous, apex 3-lobed, split one side 3 mm. **Corolla** tube 14 mm long, glabrous, white; lobes glabrous, 8x3 mm, dorsal one, concave, hooded, lateral ones shallowly concave, apex rounded. **Staminode** narrowly obovate-lanceolate, apex irregularly lobed, glabrous, white with pale pink apex, 11x4 mm.

Labellum obovate, white with yellow band in center, hairy on mid-band, apex deeply bifid, lobes pink, 12x9 mm, sinus 3 mm. **Filament** flat, glabrous, 2x1.5 mm; anther glabrous, ecalcarate; theca 2.5 mm long; crest rectangular, apex rounded, 2.5x2 mm.

Ovary subspherical, glabrous, 2 mm long; **stylodes** absent; **stigma** terminally opened, 1 mm diameter.

Thailand: Northern – Pitsanulok.

Ecology: Found in deciduous and bamboo forest, 300 m above sea level. Flower in May – June.

Distribution: Endemic to northern Thailand.

Vernacular:

Use:

Critical remarks: This species is affinity to *Curcuma parviflora* but differs in the following characters: leaf blade with red patch on either of midrib, bracts broad with rounded apex and reddish brown in color, staminodes with pale pink apex, labellum larger with bifid apex and pink in color.

Specimens examined:

Northern – Pitsanulok [*Maknoi* 541, Kaeng Chet Kwea, 27-May-04 (PSU)]

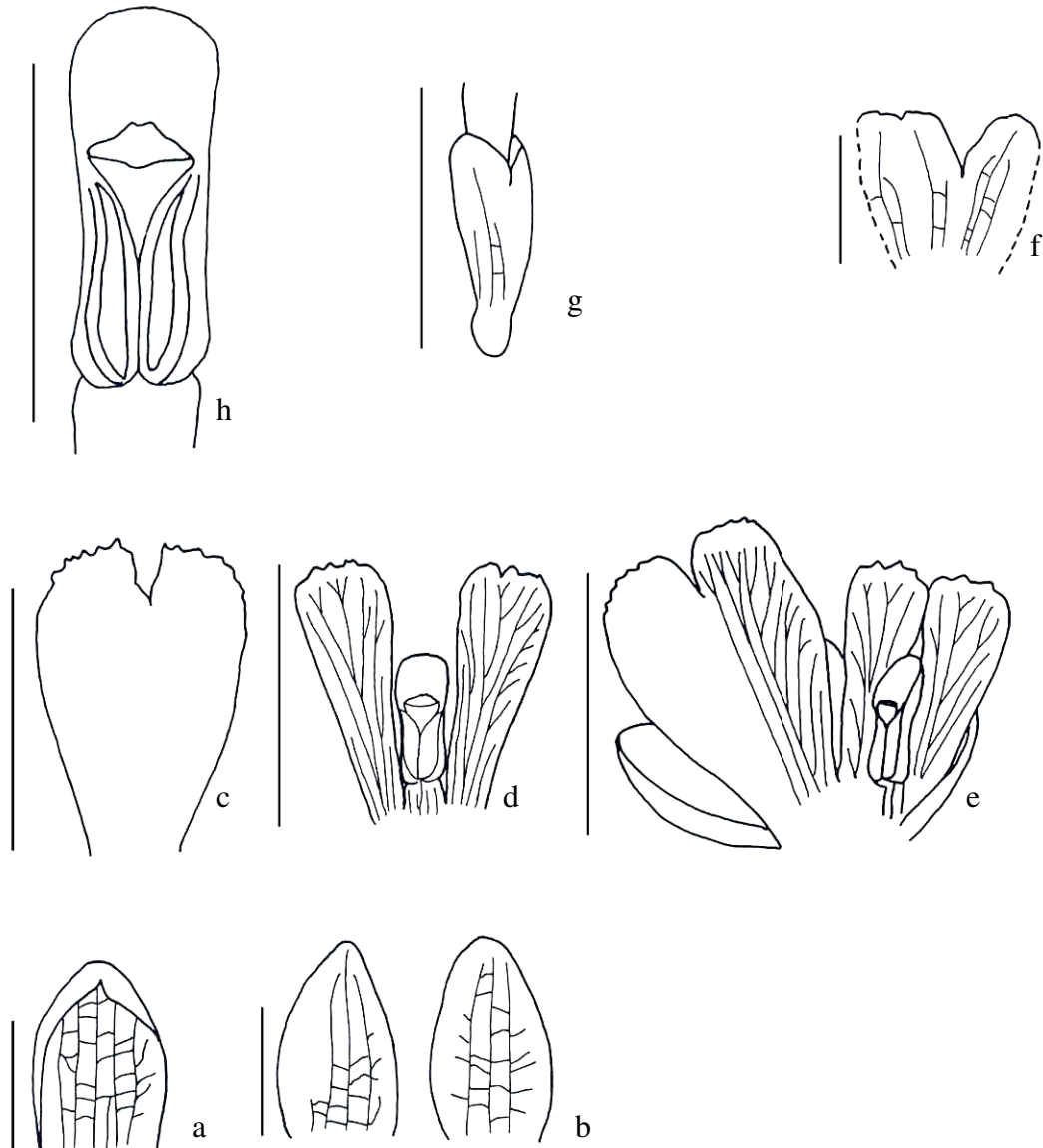


Figure 32 *Curcuma* sp. (Pitsanulok) a dorsal corolla lobe; b lateral corolla lobes; c labellum; d staminodes and stamen; e staminodes, labellum and stamen; f calyx – dissected; g calyx and ovary; h stamen – front view; (scale = 5 mm)

***Curcuma* sp.** (Ranong) Figure 33, plate 13.

Corm ovoid, yellow inside, 2-3 x 1.5-2 cm; **rhizome** very short. **Leafy shoot** 80-120 cm tall; **bladeless sheath** 10-20 cm long. **Leaf sheath** 19-50 cm long, densely hairy; **ligule** bilobed, 4-12 mm long, densely hairy, lobe apex rounded; **petiole** 11-30 cm long, densely hairy; **blade** broad elliptic, 38-65 x 13-30 cm, hairy along midvein and secondary nerves on both surfaces, base rounded to cordate, apex acuminate.

Inflorescence terminal; **scape** 15-25 cm long, densely hairy, almost covered by leaf sheaths; **spike** 14-25 cm long; **bracts** 4.5-6 x 2-2.5 cm, pilose on both surfaces, free part dark brown to orange brown, apex rounded to retuse; **coma bracts** 4-6 x 1.8-2.7 cm, pilose on both surfaces, white with pink tip, apex acute. **Calyx** tubular, 11 mm long, hairy at base, apex shallowly 3-lobed, dilate towards apex; **corolla tube** 33 mm long, glabrous; **corolla lobes** 15 x 10-13 mm long, glabrous, dorsal one hooded, apex acute-cuculate, lateral ones slightly concave, apex obtuse. **Staminodes** broadly obovate, 11 x 13 mm, hairy on inner surface; **labellum** indistinct 3-lobed, 15 x 18 mm, glandular hairy, mid-lobe emarginate. **Filament** 2 x 6 mm, glabrous; **anther** 5 x 3 mm, glabrous, pollen sac continue to base of spur; **spurs** narrowly triangular, 2 mm long, apex blunt. **Ovary** barrel-shaped, 3 mm long, hairy; **stylodes** club-shaped, 4 mm long, apex blunt; **stigma** 1.5 mm wide, laterally opened, bilobed.

Thailand: Southwestern – Kanchanaburi; Peninsula – Ranong, Suratthani, Phangnga.

Ecology: found in evergreen forest, from near sea level to 350 m. Flowers in June – November.

Distribution: endemic to Thailand.

Use:

Vernacular name:

Critical remarks: This species similar to *C. petiolata* Roxb. in leaf and inflorescence characters but plant is much larger and differs in bracts color.

Specimens examined:

Southwestern – Kanchanaburi [*Marcan* 2382, Sai Yok, 1-Aug-1928 (BM, K, L);

Maknoi 519, Tong Pha Phum to Sangkla Buri, 2-Oct-2003 (AAU, BKF, PSU,

QSBG); *Beusekom et al.* 3869, Erawan National Park, 19-Nov-1971 (BKF, C, K, P);

Maxwell 73-78, Thong Pha Poom, 1-Jul-1973 (AAU, BK); *Maxwell* 93-1153, Thoong Yai Naresuan, Sangklaburi, 7-Oct-1993 (CMU); *Maxwell* 93-608, Thoong Yai Naresuan, Sangklaburi, 15-Jun-1993, (BKF, CMU); *Larsen et al.* 10559, Thung Kang Yang, 7-Jul-1963 (AAU); *Wongprasert* s.n., Meklong Watershed Research Station, 25-Aug-1999 (BKF); **Peninsula** – Ranong [*Maknoi* 73, Klong Naka Wildlife Sanctuary, Suksamran, 7-Nov-1999 (QSBG), *Maknoi* 253, Wangkum, Banghin, Kapur, Ranong, 15-Jun-2002 (AAU, BKF, PSU, QSBG)], Phangnga [*Niyomdham* 1246, Klong Saeng Non-hunting Area, 25-Nov-1986 (AAU, BKF, K); *Larsen et al.* 30750, Foothill of Khao Pra Mi, 8-Jul-1972 (AAU, K, P); *Larsen et al.* 30750, Koh Kaw Kao, 15-Jul-1972 (AAU)], Suratthani [*Kerr* 13130, Kanchanadit, 3-Aug-1927 (BK, BM, C, K, P); *Rabil* 165, Thung Song, Suratthani, 23-Jul-1929 (BK, BM, K)]; **Cultivated** – *Maknoi* 116, cult. PSU, Songkhla, 20-Sep-1999 (QSBG)

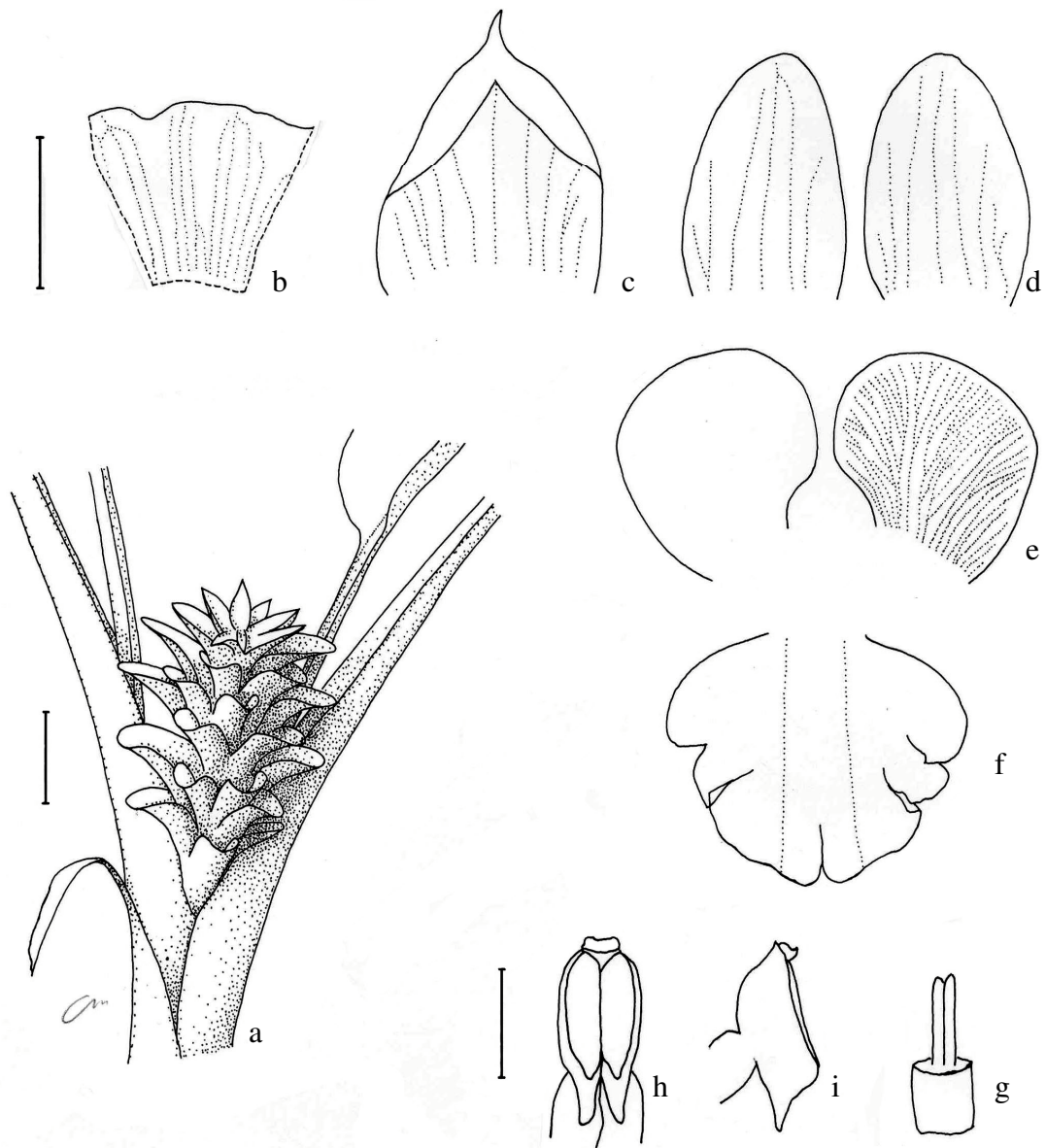


Figure 33 *Curcuma* sp. (Ranong) a inflorescens; b calyx - dissected; c dorsal corolla lobe; d lateral corolla lobes; e staminodes; f labellum; g stylodes and ovary; h stamen – front view; i stamen – side view (scale = 5 mm)

Curcuma sp. (Saraburi) Figure 34.

Corm ovoid, 3x2 cm; rhizome very short. **Leafy shoot** 60-80 cm tall; **bladeless sheath** few, glabrous except few hairs at tip, 8-15 cm long. **Leaf sheath** glabrous, 15-30 cm long, pubescent; **ligule** 2-lobed, 2-5 mm long, hairy along margin, apex rounded; **petiole** 6-10 cm long, glabrous; **blade** elliptic, glabrous on both surfaces except few hairs at apex, base cuneate to slightly cordate, apex acuminate, 25-60 x 7-17 cm. **Inflorescence** terminal; **scape** 7-15 cm long, glabrous or pilose; sheath 5-11 cm long, pilose; **spike** 8-16 cm long. **Bracts** 3-4 x 3-3.5 cm, white, pilose on outer surface, apex rounded; **coma** bracts none. **Calyx** tubular, 12-15 mm long, split down one side 6-10 mm, glabrous, apex 3-lobed, with 3 ridges from middle towards lobe apex, each with small beak just below lobe apex; **corolla** tube 25-35 mm long, with scattered fine hairs; corolla lobes 10-15 x 6-11 mm, glabrous, dorsal one concave, apex hooded; lateral ones ovate, with rounded apex. **Staminodes** ovate, 10-14 x 7-9 mm, with fine hairs, apex rounded; **labellum** ovate, 10-15 x 14-15 mm, hairy along sides of mid-band, apex deeply emarginate, cleft to 4 mm deep, lobe apices retuse. **Filament** flat, 3-4 x 5-6 mm, finely hairy; **anther** 5x2 mm, hairy, connective finely hairy; **spurs** 1.5-2 mm long, acuminate with broad base, point downward, pollen sac continue on spur to half of spur's length; **crest** 1 mm long, as wide as anther, apex rounded. **Ovary** subglobose, 2-3 mm long, glabrous; **stylodes** cylindrical, 3-4 mm long, glabrous, apex obtuse; **stigma** 1 mm wide, ciliate, laterally opened.

Thailand: Central – Saraburi.

Ecology: in moist area in deciduous forest, 100-220 m above sea level. Flower in June – October.

Distribution: known only from type locality in Saraburi, central Thailand.

Use:

Vernacular name:

Critical remarks: This species is similar to *C. petiolata* but differ in the following characters: inflorescence smaller, bracts white and coma absent. It was repeatedly collected during 1973-1975 from Sahn Lahn forest in Saraburi province, Central Thailand. No more collection of this species appears in any herbarium.

Specimens examined:

Central – Saraburi [*Maxwell* 73-480, Sahm Lahn forest, Muang district, Saraburi, 13-Oct-1973 (AAU, BK), *Maxwell* 74-629, same locality, 29-Jun-1974 (AAU, BK); *Maxwell* 74-649, Same locality, 30-Jun-1974 (AAU, BK, L); *Maxwell* 74-699, same locality, 13-Jul-1974 (AAU, BK, L); 75-692, same locality, 15-Jul-1975 (AAU, BK, L)].

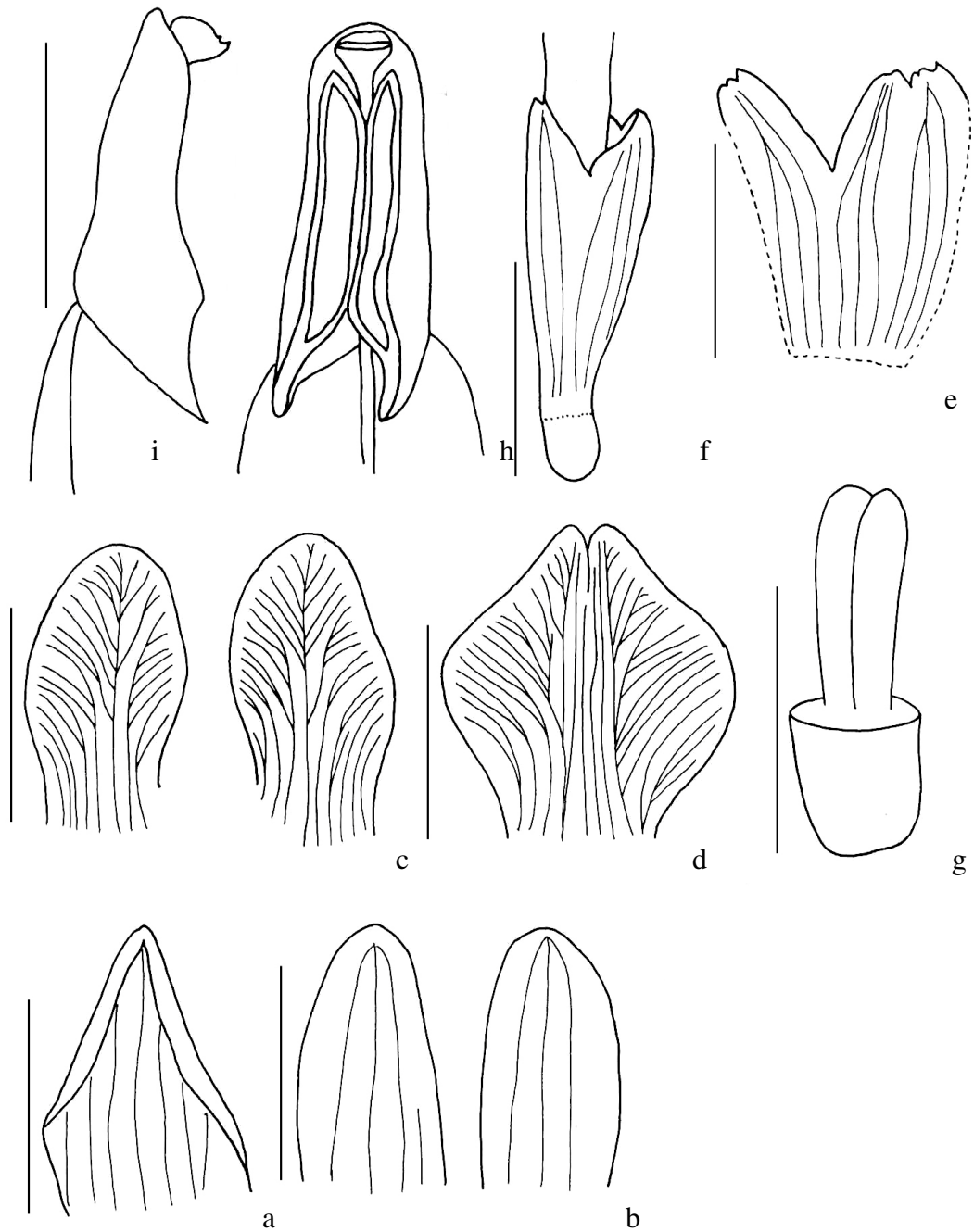


Figure 34 *Curcuma* sp. (Saraburi) a dorsal corolla lobe; b lateral corolla lobes; c staminodes; d labellum; e calyx – dissected; f calyx and ovary; g stylodes and ovary; h stamen – front view; I stamen – side view (scale = 5 mm)

***Curcuma* sp.** (Tak) Figure 35, plate 13.

Corm ovoid, lemon yellow inside, 3-4 x 2-3 cm; **rhizome** very short. Leafy shoot 30-60 cm tall; bladeless sheathes 2-3, 7-25 cm long, pubescent. **Leaf sheath** 8-35 cm long, pilose; **ligule** bilobe, 2 mm long, lobe apices rounded, membranous, densely hairy; **petiole** glabrous, 10-30 cm long; **blade** elliptic to lanceolate, scattered hairy on lower surface, hairy along veins on upper surface, base broadly cuneate to cordate, apex acuminate, 18-35 x 7.5-15 cm. **Inflorescence** terminal; **scape** 5-20 cm long, pilose; **spike** 6-12 cm long. **Bracts** 3-5 x 2.5-3.5 cm, connate 2-3 cm, scattered hairy on both surfaces, rose color with green base, apex rounded to obtuse; **coma** bracts absent; **bracteoles** cm. Calyx tubular, mm long. Corolla tube mm long; lobes mm; dorsal lobe; lateral lobes. **Staminodes** mm. **Labellum** mm. **Filament** mm; **anther** mm; **spurs** flat, triangular, point downward, mm long; **crest** mm long. **Ovary** mm long; **stylodes** mm long; **stigma** 2-lobed, laterally opened, ciliate, 1 mm wide.

Thailand: Northern – Tak

Ecology: in open to partly shaded area along small stream

Distribution: known only from type locality in Western Thailand.

Use:

Vernacular:

Critical remarks:

Specimens examined:

Northern – Tak [*Maknoi* 388, Tha Song Yang District, Tak, 27 July 2003, (AAU, BKF, PSU, QSBG); *Maknoi* 564, same locality, 26 July 2004 (AAU, BKF, PSU, QSBG)]

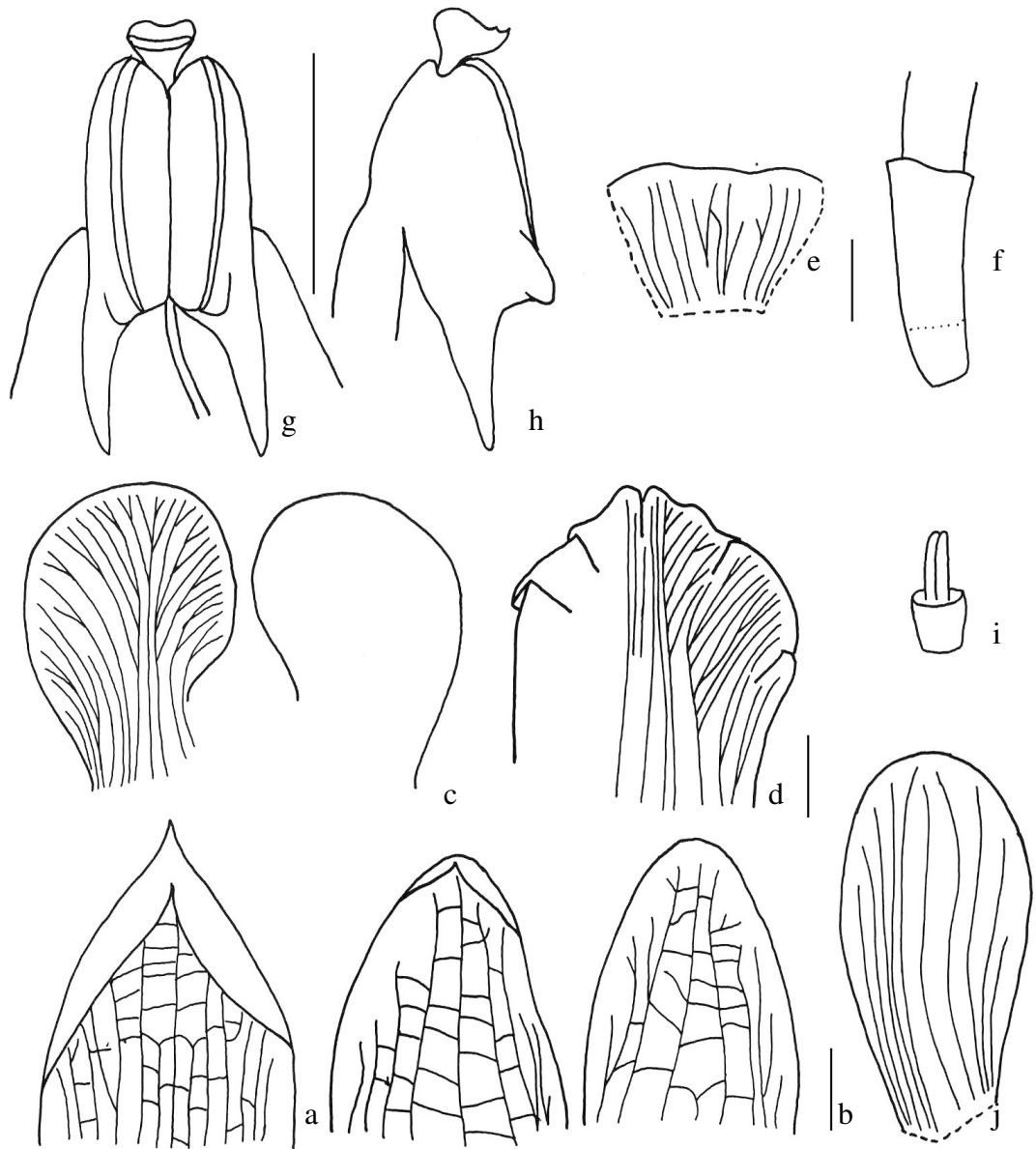


Figure 35 *Curcuma* sp. (Tak); a) dorsal corolla lobe; b) lateral corolla lobes; c) staminodes; d) labellum; e) calyx – dissected; f) calyx and ovary; g) stamen – front view; h) stamen – side view; i) stylodes and ovary; j) bracteole (scale = 5 mm).

Curcuma sp. (Ubonratchathani) Figure 36, plate 13.

Type: C. Maknoi 496, Ban Sanamchai, Piboon Mangsahan, Ubon Ratchathani, 26-Aug-2003 (holotype – PSU, isotype – AAU, BKF, QSBG)

Perennial herb, 30-40 cm tall. **Corm** globose, 2-3 cm in diameter, with yellowish flesh; rhizome very short. **Basal leaf-sheaths** 2, 1-6.5 cm long, pale yellow or green to dull red with red veins, apex acute or with minute beak. **Leaves** 2; **sheath** at least 4 cm long, glabrous; petiole furrowed, 5-7 cm long, glabrous; **ligule** 1 mm long, membranous, glabrous, truncate; **blade** lanceolate, 21x3 cm, green, sometime with purple midrib, glabrous on both surfaces, except few short hairs at tip, base attenuate, apex acute. **Inflorescence** terminal; **peduncle** green, 5-10 cm long, glabrous; **spike** elliptic to elliptic-oblong, 6x3 cm; **bracts** obovate, 15x20 mm, subtend 5-7 flowers, glabrous, green with white margin, apex truncate, reflexed; **coma** bracts smaller and narrower, white or green with white stripes. **Bracteole** triangular ovate, concave, 8x5 mm, membranous, glabrous. **Calyx** funnel-shaped, 4-6 mm long, glabrous, apex unequally 3-lobed. **Corolla** tube 1 cm long, glabrous; dorsal corolla lobe concave, 5x4 mm, pale yellow, apex hooded, shortly cuculate; lateral lobes shallowly concave, 4x2.3 mm, pale yellow, apex obtuse. **Staminodes** rectangular, spreading, 4-6.5 x 1.8-2.5 mm, pale yellow, sparsely hairy at base near the margin, apex truncate and serrulate. **Labellum** broad obovate, 4.5-6 x 6.5-8 mm, apex bilobed, 2.5 mm deep, with broad sinus, pale yellow with few red stripes, thickened midband raised to half of lobe length; lobes spreading, oblong, apex truncate, serrate and lobulate. **Filament** 2.5x2 mm, glabrous. **Anther** 3x2 mm, long hairy near base; spur absent; crest rounded, 1 mm long, apex obtuse. **Ovary** oblong, 3x2.5 mm, glabrous; stylode absent; stigma appressed cup-shaped, 0.6 mm wide, mouth serrulate. **Fruits** subglobose, 1 cm in diameter, white; seeds obovate, 3.5 mm long, brown with white aril.

Thailand: Ubon Ratchathani.

Ecology: In open forest, moist sandy area. Flower in May – October.

Distribution: Laos, Vietnam.

Use:

Vernacular:

Critical remarks: This species is similar to *C. gracillima* Gagnep. in vegetative characters but differs in floral characters as follow: labellum deeply bifid with retangular lobes and yellow color with red lines instead of ovate and dark violet without color pattern as in *C. gracillima*. Corolla tube of *C. larsenii* is much longer, corolla lobes smaller and staminodes and labellum narrower. In dried specimen, the only hint is note of flower colour which is yellow with red line instead of dark purple or violet in *C. gracillima* Gagnep. Some old specimens from Indochina that look very similar to these species but don't have any note about flower colour still unidentified in P.

Specimens examined: Thailand – Maknoi ??, Sirindhorn District, Ubonratchathani, Aug-2003; *Ngamriabsakul* 67, Suan Pa Buntharik, Ubon Ratchathani, 5-Aug-1999 (BKF!, E!); *Larsen* 47387, plant from Ubon Ratchathani, Thailand, cultivated in Aarhus, 8-Oct-2001 (AAU); *Tiptabiankarn* 6604, Ubon Ratchathani, 29-May-2001; **Laos** – *Maxwell* 98-896, Khong Island, E side, base to the summit of Khong Hill, Mae Khong river, Champasak, Laos, 11-Sep-1998 (CMU!); *Evrard* 2324, Indochine, 3-Jul-1929 (P!); **Vietnam** – *Madris* s.n., km 97 route to Saigon, Indochine, 21-Oct-1920 (P!).

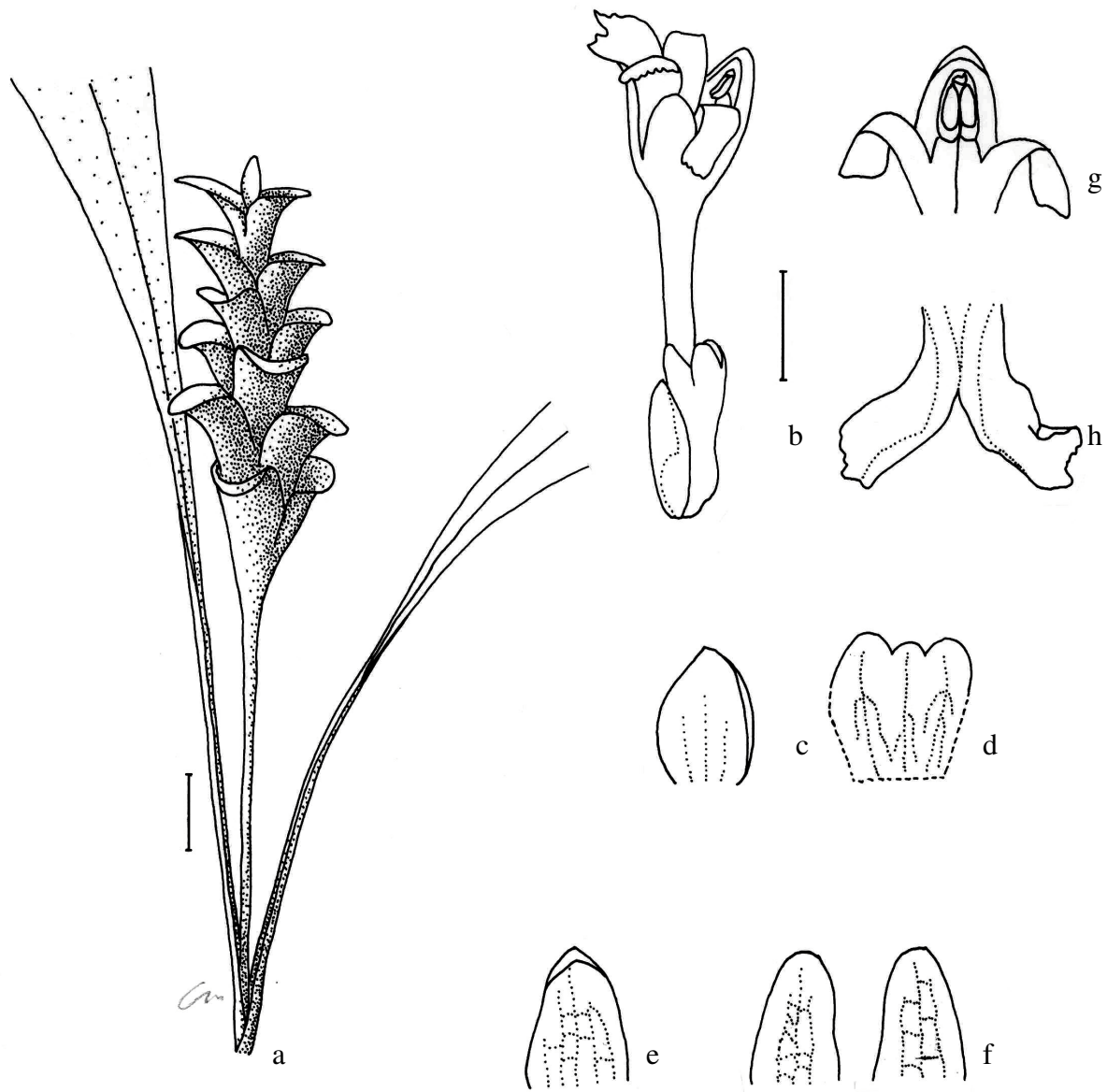


Figure 36 *Curcuma* sp. (Ubonratchathani), a inflorescence; b flower with bracteole at base; c bracteole; d calyx; e dorsal corolla lobe; f lateral corolla lobes; g staminodes and stamen with dorsal corolla lobe at background; h labellum. (scale a = 1 cm; b-h = 5 mm)