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.

<table>
<thead>
<tr>
<th>Species</th>
<th>Floristic regions*</th>
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<tbody>
<tr>
<td><em>C. aeruginosa</em> Roxb.</td>
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<tr>
<td><em>C. alismatifolia</em> Gagnep.</td>
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<tr>
<td><em>C. amada</em> Roxb.</td>
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<td><em>C. angustifolia</em> Roxb.</td>
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<td><em>C. aromatic</em> Roxb.</td>
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<tr>
<td><em>C. aurantiaca</em> van Zijp</td>
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<tr>
<td><em>C. bicolor</em> J. Mood &amp; K. Larsen</td>
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<tr>
<td><em>C. cochinchenisa</em> Gagnep.</td>
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<tr>
<td><em>C. comosa</em> Roxb.</td>
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<td><em>C. ecomata</em> Craib</td>
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<tr>
<td><em>C. flaviflora</em> S.Q. Tong</td>
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<td>*C. glans K. Larsen &amp; J. Mood</td>
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<tr>
<td><em>C. gracillima</em> Gagnep.</td>
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<td><em>C. harmandii</em> Gagnep.</td>
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<td><em>C. latifolia</em> Roxb.</td>
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<td><em>C. leucorhiza</em> Roxb.</td>
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<td><em>C. longa</em> L.</td>
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<td><em>C. mangga</em> Val.</td>
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<tr>
<td><em>C. parviflora</em> Wall.</td>
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<td><em>C. petiolata</em> Roxb.</td>
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<td><em>C. pierreana</em> Gagnep.</td>
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<td><em>C. rhabdota</em> Sirirugs &amp; M. Newman</td>
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<td><em>C. roscoea</em> Wall.</td>
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<td><em>C. rubescens</em> Roxb.</td>
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<td><em>C. rubrobracteata</em> Skornickova, Sabu &amp; Prasanthk.</td>
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<td><em>C. singularis</em> Gagnep.</td>
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<td><em>C. spargantifolia</em> Gagnep.</td>
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<td><em>C. stenochila</em> Gagnep.</td>
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<td><em>C. xanthorrhiza</em> Roxb.</td>
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**Table 3 (cont.)**

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<th>Species</th>
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<th>SE</th>
<th>C</th>
<th>SW</th>
<th>PEN</th>
<th>Cult</th>
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<tr>
<td><em>C. zedoaria</em> (Christ.) Rosc.</td>
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<td><em>C. maehongson</em> C. Maknoi</td>
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<td><em>C. nakornsawan</em> C. Maknoi</td>
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<td><em>C. pitsanulok</em> C. Maknoi</td>
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<td><em>C. ranong</em> C. Maknoi</td>
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<td><em>C. saraburi</em> C. Maknoi</td>
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<td><em>C. tak</em> C. Maknoi</td>
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<td><em>C. ubonratchathani</em> C. Maknoi</td>
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<td>Taxa in region</td>
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<td>7</td>
<td>6</td>
<td>7</td>
<td>4</td>
<td>17</td>
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*Floristic regions are according to the Flora of Thailand.

**Curcumula L.**


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.

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**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. *C. sparganiifolia*

3. Bracts green

4. Bract caudate, cauda 5 cm long or more 14. *C. harmandii*

4. Bract rounded or acute

5. Labellum deeply divided, yellow or orange with red stripes 38. *C. sp.* (Ubon)

5. Labellum, labellum bifid, pink with yellow median band 34. *C. sp.* (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 reddish brown stripes  22. *C. rhabdota*
1  Stylodes occur; anther calcarate, rarely ecalarate  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
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 ecalarate
   20. Bracts green, coma pink  6. *C. aurantiaca*
   20. Bracts orange, coma absent  23. *C. roscooeana*
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. (Mae Hong Son)
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, up to 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. aromatic a
      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. xanthorrhiza
35. Rhizome white or pale brown
36. Corolla lobes white 16. *C. leucorrhiza*
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*


**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 Pflanzereich (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:


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 & Sangkhchan, 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)

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 75 x 19 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, 4.5 x 2 cm; coma bracts white with pink tip, pilose on both surfaces, apex acute to obtuse, 6 x 2.2 cm; bracteoles boat-shaped, minute-hairy, apex acute to obtuse, 30 x 20 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, 14 x 9 mm. Labellum 3-lobed, mid-lobe apex bifid, glandular hairy on either side of mid-band, 18 x 20 mm. Filament flat, glabrous, 4 x 5 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 staminodes; 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)

**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, apx 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, straing, 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, Lampoon, 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, Surat Thani.

**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, Bav Sahllee 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)], Lampoon [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)];


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-

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)

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:** วัฒนสกุล

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

**Specimens examined:**
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)


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, Kuandon, 24-Jun-2002 (AAU, BKF, PSU, QSBG); Maknoi 514, route to Ta Le Ban, Kuandon, 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 cochinchenensis 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*, Larnsang 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, Pul.., 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, Prachuapkhirikan, , 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)

**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 wither 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); Phengklai 1031, Fang, 27-Apr-1965 (BKF); Phengklai 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 Chompuu 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** ob lanceolate, 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, glabour, 5 mm long. **Ovary** barrel-shaped, pubescent, 5 mm long; **styloides** 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)

**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)].

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:

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)

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:
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)

**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:**

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!)

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**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 to acute.

**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.

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**Thailand:** Cultivated.

**Ecology:** Cultivated.

**Distribution:** India and Myanmar.

**Use:** Rhizome is eaten as vegetable.
Vernacular: Kamin kaao

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

Specimens examined:

Figure 16 Curcuma leucorrhiza 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)

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:**


**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).

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)

**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, Lampoon, 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 & Phengklai 1176, ObBLuang 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 (BKF, 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); Phengklai 4162, Omkoi, 28-Jun-1978 (BKF); Phengklai 4171, same locality, 28-Jun-1978 (BKF); Phengklai 6260, same locality, 20-Jul-1978 (BKF, K); Phengklai 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); Sanitsuk 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, Nammao 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
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)

**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, striangled, 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)

**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:

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)

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. Sirirugs & 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)

**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:

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)

**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:

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.

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 clavateor 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 Tai (Burmese side), 17-Jun-1922 (BK, BM, C, K); Kerr 6145A, Me Mue, Muan, 20-Jun-1922 (BK, BM, K); Maknoi???, Umphang, 2-Jul-1922 (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 Naesuan 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, wth 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?. Flowers white, calyx persistent, 15x8 mm; seeds arillate, ellipsoid, c 4x1.5 mm; aril white.

**Thailand:** Northern – Chiang Mai, Chiang Rai, Lampang, Lampoon, Uttaradit; Northeastern – Loei, Mukdahan, Nakorn Panom, Petchabun, Sakon Nakorn; Eastern – Chaiyaphum, Kalasin, Nakorn Ratchasima, Ubon Ratchathani; 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.

Vernacular 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:

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)

**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 [Phengkhai 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 (BFK, 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 sparganiifolia* 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:** Geoffray 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(rought), 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:

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)

**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)

**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; lobespinkish 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, 20x17 mm. **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:**
Figure 29 *Curcuma xanthorhiza* 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)

**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:**
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.

Inflorescense 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 subsphaerical, 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 dark brown to orngish 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);
Figure 33 *Curcuma* sp. (Ranong) a inflorescens; b calyx - disected; 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; corolls 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 sbuglobose, 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 Sahm Lahn forest in Saraburi province, Central Thailand. No more collection of this species appears in any herbarium.
Specimens examined:

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, Piboong 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 munite 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 rised 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; styloide 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:**


**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)