

***Curcuma mutabilis* (Zingiberaceae): a New Species from South India**

JANA SKORNICKOVA, M. SABU & M.G. PRASANTHKUMAR

Department of Botany, Calicut University, 673 635 Kerala, India

Abstract

Curcuma mutabilis Skornickova, M.Sabu & M.G.Prasanthkumar, *sp. nov.* is described from Northern Kerala, South India, including illustrations and notes.

Introduction

The genus *Curcuma* L. is of great economic and ornamental importance and several species such as *C. longa* L., *C. aromatica* Salisb., *C. zanthorrhiza* Roxb., *C. alismatifolia* Gagnep., etc., can be found all over the tropics introduced, cultivated and sometimes naturalized. The genus is distributed mostly in tropical Asia with a few species extending to Australia and the South Pacific. Larsen *et al.* (1998) stated there are about 80 species, Sirirugsa (1996) estimated the number at around 100. Presently there are 103 validly published names (excluding those that have been transferred to other genera) and another 6 species were published only as *nomen nudum*. Without a doubt, a number of names will turn out to be synonyms, but as recent field exploration in India and SE Asia proceeds, the number of species will probably reach 120. Three new species were recently described from SE Asia (Sirirugsa & Newman, 2000; Mood & Larsen, 2001). In India, the genus is represented by 29 species (Karthykeyan *et al.*, 1989; Jain and Prakash, 1995) and has been revised for South India by Mangaly and Sabu (1993). Since then exploration of remote areas in India has brought to light another three new species (Tripathi, 2001; Skornickova *et al.*, 2003a, b).

While working for the project 'Revision of Indian Zingiberaceae', the authors encountered an interesting seed-setting *Curcuma* species from Nilambur, North Kerala. At the beginning of the monsoon season, the plant resembled *C. oligantha* Trimen in lacking an obvious coma, by the inflorescence appearing before the first leaf expands, the flowers being exerted from the bracts, and in rhizome shape. However, critical studies of the plants observed at different times in relation to the monsoon season revealed that the species is different from *C. oligantha*, especially in its general habit and size, shape and coloration of the bracts, and size and shape of flower parts.

Subsequently, we discovered that Velayudhan *et al.* (1999) had described this species as *C. nilamburensis* based on a collection from the same locality.

Unfortunately, this name is not validly published according to the St Louis Code (Greuter *et al.*, 2000) because the description lacked a Latin diagnosis and a type was not designated. In addition, the publication by Velayudhan *et al.* (1999) is of limited circulation, consequently, the species is described appropriately below.

Curcuma mutabilis Skornickova, M. Sabu & M.G. Prasanthkumar *sp. nov.* (Fig. 1, Plate 1.)

C. nilamburensis in Velayudhan K.C., V.K. Muralidharan, V.A. Amalraj, P.L. Gautham, S. Mandal & D. Kumar, *Curcuma Genetic Resources*. 1999. p. 42. *nom. illegit.*

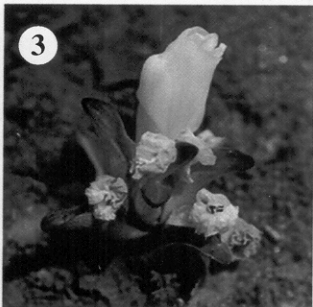
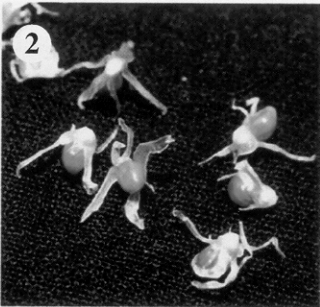
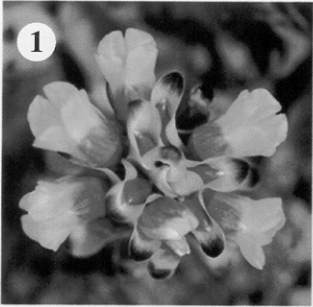
C. neilgherrensis *auct. non* Wt.: Sivar. & P. Matthew, *Fl. Nilambur*. 1996. p. 708.

Curcuma oliganthae Trimen in coma inconspicua rhizomatis figura magnitudo colorque similis, habitu maiore robustiore (60 cm longo), bracteis fertilibus ovato-ellipticis in dimidio inferiore connatis apice rodundato macula fusce brunneo-violacea proviso, floribus bracteis minus exsertis, labello minore (14–16 mm longo), staminodiis lateralibus brevioribus (13–16 mm longis) corollae lobo dorsali non multo excedentibus, antherarum calcaribus sursum versis differt. **Typus:** India, Kerala, Malappuram District, Nilambur, *Skornickova & Prasanthkumar* 84145 (holo MH; iso K, CALI, SING).

Rhizomatous herb, 10–60 cm tall. *Rhizome* ovoid without branches, cylindrical to conical, up to 5 x 2.5 cm, deeply buried in the ground, light brown externally, glabrous, sheathed by papery brown scales and bases of the leaf sheaths, which leave vertical scars after decaying, creamy yellowish internally, faintly aromatic. *Roots* fleshy ending in ovoid root tubers 2–4 x 1–2 cm distanced 2–15 cm from the main rhizome, externally light brown, glabrous, pearly white inside, non-aromatic. *Pseudostem* 5–30 cm long, deeply buried in the soil, formed by leaf sheaths and 3–4 sheathing bracts, green or with a red tinge, drying towards the end of season and becoming brown and papery, *ligule* 3–4 mm, bilobed, translucent greenish, hairy outside and on the margin, hairs 0.2–0.3 mm; *leafy shoot* 15–60 cm long. *Leaves* at the beginning of the season 1–2 with a short petiole or even almost sessile, later with up to 7 leaves, gradually with longer petioles up to 20 cm long, petiole green or with a red tinge, glabrous or shortly

Plate 1. *Curcuma mutabilis*

1. Inflorescence of a yellow-flowered plant (seen from above); 2. Detail of arillate seeds; 3. Inflorescence of a white-flowered plant; 4. Variability of inflorescences; 5. Habit at type locality; 6. The whole plant including rhizome. All photographs are of the type material *Skornickova & Prasanthkumar* 84145 with lateral inflorescences at the beginning of season. *Photos J. Skornickova.*



hairy; *lamina* ovate-elliptic, 14–35 x 7–11 cm, adaxially deep green, prominently veined, prominent veins quite closely arranged c. 5 mm apart, sulcate in between, hairy on the prominent raised veins and towards the margin especially in the upper half of the lamina, hairs c. 0.3 mm long (rarely almost glabrous on the upper surface), abaxially paler green, usually glabrous, rarely densely velvety pubescent; margin hyaline, translucent white, c. 0.2 mm wide, hairy in the apical part and glabrous in the distal part of lamina, tip c. 0.5 cm long, acuminate, densely hairy, base attenuate to slightly cordate, oblique, midrib green, glabrous. *Inflorescence* lateral at the start of the season, central later in the season. Peduncle 4–20 cm long, 2.5–8 mm diam., glabrous, whitish, light green or with a red tinge, peduncle of the vernal inflorescence sheathed by bracts, central one hidden within the pseudostem. *Spike* 3.5–15 x 2.5–5 cm, consisting of 6–70 bracts. *Coma* inconspicuous, usually only the uppermost 2 or 3 bracts are sterile and more linear than the fertile ones, 2.5–3.5 x 0.7–1.5 cm, light green or with a red tinge (sometimes deep red), upper side sparsely hairy, lower side glabrous, tips rounded with a deep violet brown patch. *Fertile bracts* ovate-elliptic with visible parallel veinlets, tip obtuse or slightly acuminate, both sides glabrous, connate in the lower half, 2.5–3.5 x 1.5–2.7 cm, whitish, light green, green or with a red tinge verging to brown red, but all bracts (including uppermost sterile ones) always with a dark violet mauve tip, which is usually larger in the upper bracts and less conspicuous in the lower ones. *Cincinni* with 2–4 flowers. *Bracteoles* one per flower, 5–7 x 2–4 mm, hyaline, translucent white or with a pink or a red tinge, almost glabrous or puberulus with a few hairs 0.2–0.3 mm long on the tip. *Flowers* 4.5–5 cm long, exerted from bracts. *Calyx* 8–11 mm long, 3-toothed, unilaterally split 3–4.5 mm deep, translucent white or tinged with pink or dark violet, quite glabrous, but with sparsely hairy teeth and sometimes along the upper part of the vein leading from teeth to the base. *Corolla tube* c. 2.5–3 cm, at the base white, yellowish or yellow, towards the lobes sometimes tinged with pink, red or violet, glabrous; *dorsal corolla lobe* c. 1.4–1.8 x 1–1.4 cm, triangular-ovate, concave, apex mucronate, mucro 1–2 mm long, glabrous, varying from white, yellowish or yellow, sometimes tinged pink red or deep violet-bluish, *lateral corolla lobes* 1.4–1.7 x 0.6–0.8 cm, triangular with rounded, slightly concave tip, glabrous, with the same coloration as the dorsal lobe but less intensive, usually overlapping in the tip portion on the ventral side of the flower. *Lateral staminodes* obovate-rhomboid, 1.3–1.6 x 1–1.2 cm, usually yellow or yellow with a reddish base, less frequently white or white with a yellow or reddish base, glandular hairs present on the raised middle portion. *Labellum* 1.4–1.6 x 1.5–1.9 cm, emarginate, split 3–6 mm long (opening wider as the flowers age and wilt), yellow or less frequently white, centre deep yellow or yellow, rarely also white, base of labellum usually yellowish, rarely with a deep red patch or tinge. *Anther* spurred, glandular hairs present on the sides and back part, anther

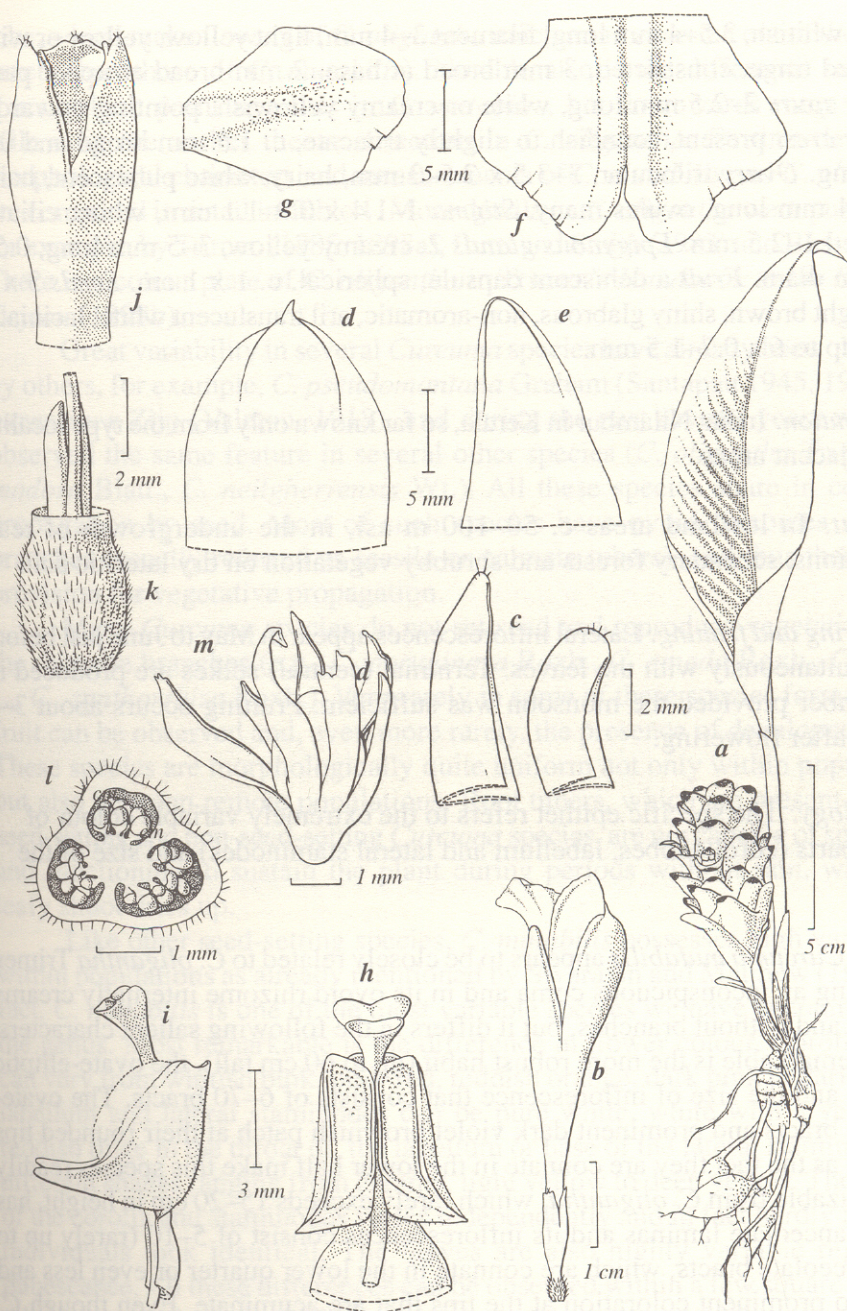


Figure 1. *Curcuma mutabilis*

a. Habit; b. Flower (side view); c. Bracteoles; d. Dorsal corolla lobe; e. Lateral corolla lobe; f. Labellum; g. Lateral staminode; h. Anther (front); i. Anther (side); j. Calyx; k. Ovary and epigynous glands; l. Ovary (cross section); m. Seed. Based on the type material Skornickova & Prasanthkumar 84145. Del. J. Skornickova.

thecae whitish, 3.5–4 mm long; filament 3–4 mm, light yellow, yellow or with deep red tinge, constricted, 3 mm broad at base, 2 mm broad at upper part. *Anther spurs* 2–2.5 mm long, white or creamy yellowish, pointing upwards. *Anther crest* present, roundish to slightly truncate, c. 1.5 mm broad and 0.5 mm long. *Ovary* trilocular, 3–3.5 x 2.5–3 mm, hairy, white pubescent, hairs 0.3–0.4 mm long, ovules many. *Stigma* 1–1.4 x 0.9–1.1 mm, white, ciliate, exserted 1–2.5 mm. *Epigynous glands* 2, creamy yellow, 3–5 mm long, 0.5–0.6 mm diam. *Fruit* a dehiscent capsule, spherical, c. 1 x 1 cm. *Seeds* 3 x 2 mm, light brown, shiny glabrous, non-aromatic, aril translucent white, lacinate, lobes up to 6 x 0.7–1.5 mm.

Distribution: India: Nilambur in Kerala, so far known only from the type locality and adjacent areas.

Habitat: In lowland areas c. 50–100 m asl, in the undergrowth of teak plantations, secondary forests and shrubby vegetation on dry lateritic soil.

Flowering and fruiting: Lateral inflorescences appear in May to June just before or simultaneously with the leaves. Terminal (central) spikes are produced in September provided the monsoon was sufficient. Fruiting occurs about 3–4 weeks after flowering.

Etymology: The specific epithet refers to the extremely variable colour of floral parts (corolla lobes, labellum and lateral staminodes) and size of the plants.

Notes: *Curcuma mutabilis* appears to be closely related to *C. oligantha* Trimen in having an inconspicuous coma and in its ovoid rhizome internally creamy yellow and without branches, but it differs in the following salient characters. Most remarkable is the more robust habit (up to 60 cm tall), the ovate-elliptic lamina and the size of inflorescence that consists of 6–70 bracts. The ovate-elliptic bracts and prominent dark violet brownish patch at their rounded tips as well as the fact they are connate in the lower half make this species readily recognizable from *C. oligantha*, which rarely exceeds 15–20 cm in height, has ovate-lanceolate laminae and its inflorescences consist of 5–10 (rarely up to 15) lanceolate bracts, which are connate in the lower quarter or even less and have no prominent coloration at the tips that are acuminate. Even though *C. mutabilis* is more robust in its vegetative parts, the flowers are overall smaller (up to 5 cm long with the calyx 8–11 mm long, lateral staminodes up to 1.6 x 1.2 cm and which do not protrude much beyond dorsal corolla lobe) compared with those of *C. oligantha* (5–7 cm long, calyx 15–21 mm long, lateral staminodes up to 3 x 1.4 cm prominently protruding beyond the dorsal corolla

lobe, which make flowers of *C. oligantha* much more exserted out of the fertile bracts than those of *C. mutabilis*). Notable also is the difference in anther spurs, which point upwards in *C. mutabilis*, but downwards more or less following the anther thecae direction in *C. oligantha*. Further details in morphological characters and measurements of *C. mutabilis* and *C. oligantha* are compared in detail in Table 1. More details on *C. oligantha* were published, for example, by Trimen (1885, 1898a), Burt and Smith (1983) and Bhat (1987). There is a colour plate of *C. oligantha* in Trimen's *Handbook to the Flora of Ceylon* (1898b).

Great variability in several *Curcuma* species have already been observed by others, for example, *C. pseudomontana* Graham (Santapau 1945, 1952), *C. aurantiaca* Zijp (Valeton, 1918), and during the past several years we have observed the same feature in several other species (*C. oligantha* Trimen, *C. inodora* Blatt., *C. neilgherrensis* Wt.). All these species share in common propagation by seed. Most of such species have ovoid rhizomes without branches (usually referred as sessile or palmate tubers), and thus there is no provision for vegetative propagation.

Many *Curcuma* species do not set seed and reproduce vegetatively by the rhizome branches (e.g., *C. aeruginosa* Roxb., *C. amada* Roxb., *C. longa* L., *C. zanthorrhiza* Roxb.). Very rarely in some of these species formation of fruit can be observed and, even more rarely, the presence of developed seeds. These species are morphologically quite uniform not only within population, but also between remote populations. Root tubers, which are present in both seed-setting and non-seed-setting *Curcuma* species, are not capable of sprouting and functioning to sustain the plant during periods without rain, when the leafy shoot dries up.

Like other seed-setting species, *C. mutabilis* possesses high variability within populations as already mentioned by Sivarajan and Matthew (1996). In fact, *C. mutabilis* is one of the most variable species we have encountered in the genus. Most remarkable is the difference in flower colour. Corolla lobes can vary from whitish pink, pink-red, reddish orange, dark pink to dark violet; labellum and lateral staminodes can be pure white, white with a yellow or reddish tinge in the throat of the labellum or base of the lateral staminodes or different shades ranging from creamy, light yellow to deep yellow. The colour of the corolla and staminodes varies independently and in fact hardly any two individuals look identical. The leaves are also highly variable regarding pubescence. All these differences can be observed within a few square metres. Also remarkable is the difference in size of the plants, which ranges from a few centimetres to about 60 cm tall, as well as in the number of the bracts, which can vary from 6–70. Size and number of bracts seems to be correlated with the age of the plant, which is a feature we have observed in some other seed-setting *Curcuma* species.

This great variability might suggest that hybridisation has occurred. However, it can be ruled out in the case of *C. mutabilis* because the pollen is fully formed (although it has not been tested yet for viability), seed is viable and readily germinates, and many seedlings are observed in wild populations, the range of variation is similar in the separate populations and there are no species within this area that could be putative parents.

The species that appeared under the name *Curcuma neilgherrensis* Wt. in the *Flora of Nilambur* (Sivarajan & Matthew, 1996) is *C. mutabilis* and not *C. neilgherrensis*, which is a completely different species that grows in high altitude grasslands (700–1200 m) and which is common on southwest slopes of the southern range of Neilgherries. Even though *C. neilgherrensis* is also seed-setting and quite a variable species, especially in size of the plant and inflorescence, coma colour (pinkish to deep pink) and indumentum of leaves, it can easily be distinguished from *C. mutabilis* by its lanceolate and firm leaves, spikes with a prominent coma, green fertile bracts with no dark violet patch and yellow flowers, which are not exerted out of the fertile bracts. In contrast, *C. mutabilis* is lowland species (growing at 50–100 m altitude) found in the undergrowth in shady places and it has rather thin, ovate-elliptic leaves, with prominent sulcate venation, an inconspicuous coma, bracts tipped by dark violet brown patch and the flowers (highly variable in colour) are exerted out of the fertile bracts. We have so far not observed such colour variability of flower parts in the *C. neilgherrensis*.

Table 1. Comparison of morphological characters of *Curcuma mutabilis* and its closest ally, *C. oligantha* Trim. Diagnostic characters are in bold.

	<i>C. mutabilis</i>	<i>C. oligantha</i>
Rhizome	<p><i>Main rhizome</i> ovoid, unbranched, up to 5 x 2.5 cm. Inwardly creamy-yellowish colour, faintly aromatic.</p> <p><i>Root tubers</i> 2–4 x 1–2 cm, pearly white inside.</p>	<p><i>Main rhizome</i> ovate-conical, unbranched, up to 5 x 1.5 cm. Inwardly creamy white-yellowish colour, no obvious aroma.</p> <p><i>Root tubers</i> 1.5–4 x 0.8–1.5 cm, pearly white inside.</p>
Leafy shoot	<p><i>Leafy shoot</i> to 60 cm tall with 2–7 leaves.</p> <p><i>Pseudostem</i> and peduncle sheathed by green or reddish green bracts.</p>	<p><i>Leafy shoot</i> to 20 cm tall with 2–6 leaves.</p> <p><i>Pseudostem</i> and peduncle sheathed by green or reddish green bracts.</p>

Table 1. Continued:-

Leafy shoot	<i>Ligule</i> 3–4 mm, 2-lobed, hairy along the margin, hairs 0.2–0.3 mm long.	<i>Ligule</i> 1–1.5 mm, obscurely 2-lobed, glabrous.
Lamina	<i>Lamina</i> ovate-elliptic, 14–35 x 7–11 cm, base attenuate-slightly cordate, oblique. Adaxially deep green, prominently sulcate , hairy along the main veins especially at the distal half of the lamina and near margins (rarely some individuals almost glabrous), abaxially pale green, usually glabrous, rarely individuals densely velvety hairy.	<i>Lamina</i> ovate-lanceolate, 7–19 x 3.2–7 cm, base attenuate-slightly cordate, oblique. Adaxially green, glabrous or sparsely hairy, always hairy along the main veins especially at the distal half of the lamina and near margins, abaxially pale green, glabrous.
Inflorescences	Vernal, lateral, later in season central. <i>Peduncle</i> 4–20 cm, spike c. 3.5–15 x 2.5–5 cm, comprised of 6–70 bracts. <i>Coma</i> inconspicuous, few uppermost bracts sterile and more linear. <i>Bracts</i> ovate-elliptic with rounded tip, light green, green or with red tinge with dark brownish-violet patch at the tips, c. 2.5–3.5 x 1.5–2.7 cm, connate in lower half. <i>Cincinni</i> with 2–4 flowers.	Vernal, lateral, later in season central. <i>Peduncle</i> 4–11 cm, spike c. 3–6 x 2–4 cm, comprised of 4–10 (rarely 15) bracts. <i>Coma</i> inconspicuous. <i>Bracts</i> lanceolate, erect with acuminate tip, light green or green, rarely with reddish tinge, no obvious patch at the tips, c. 2.5–4 x 1–2 cm, connate in lower quarter or even less. <i>Cincinni</i> with 2–3 flowers.
Flowers	<i>Flower</i> 4.5–5 cm long, exserted from the fertile bracts. <i>Bracteoles</i> 5–7 x 2–4 mm, hyaline, translucent white or pinkish with red tinge, almost glabrous.	<i>Flower</i> 5–7 cm long, highly exserted from the fertile bracts. <i>Bracteoles</i> 5–9 x 3.5–4 mm, hyaline, whitish translucent, usually hairy at the tip.

Table 1. Continued:-

Flowers	<p>Calyx 8–11 mm long, 3-toothed, unilaterally split 3–4.5 mm, translucent white or tinged with pink or tinged with dark violet, sparsely hairy.</p> <p><i>Corolla tube</i> 2.5–3 cm, glabrous, white or yellow at base, towards lobes sometimes tinged with red.</p> <p>Labellum 1.4–1.6 x 1.5–1.9 cm, emarginate, yellow. white with yellow center or white, with or without red tinge at the base.</p> <p><i>Lateral staminodes</i> 1.3–1.6 x 1–1.2 cm, yellow, white with yellow or white with or without red tinge at the base.</p> <p><i>Anther thecae</i> 3.5–4 mm long, anther spurs 2–2.5 mm white or creamy, pointing upwards.</p> <p><i>Ovary</i> 3–3.5 x 2.5–3 mm, hairy.</p> <p><i>Seeds</i> brown, glossy with lacinate aril.</p> <p><i>Epigynous glands</i>, c. 3–5 mm long, 0.5–0.6 mm diam., creamy yellow</p>	<p>Calyx 15–21 mm long, 3-toothed, unilaterally split 6–10 mm, translucent greenish-white or tinged with pink, shortly hairy.</p> <p><i>Corolla tube</i> 1.7–3.5 cm, shortly hairy, hairs 0.1–0.2 mm, appressed, yellow or white, with or without red tinge.</p> <p>Labellum 1.8–1.2 x 1.5–2.2 cm, emarginate, yellow. white with yellow center or pure white.</p> <p><i>Lateral staminodes</i> 2.2–3 x 1–1.4 cm, yellow or white greatly exceeding beyond dorsal corolla lobe.</p> <p><i>Anther thecae</i> 4–5 mm long, anther spurs c. 3mm white or yellow, pointing downwards following more or less anther thecae direction.</p> <p><i>Ovary</i> 3–3.5 x 2–3 mm, hairy.</p> <p><i>Seeds</i> brown, glossy with lacinate aril.</p> <p><i>Epigynous glands</i>, c. 2.5–4 mm long, c. 0.4 in diam., yellow or creamy.</p>
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References

- Bhat, K.G. 1987. *Curcuma oligantha* Trimen (Zingiberaceae)—A new record for India. *Indian Journal of Forestry*. **10**: 66–68.
- Burt, B.L. and R.M. Smith. 1983. Zingiberaceae. In: Dassanyake, M.D. and F.R. Fosberg (Eds.). *A Revised Handbook to the Flora of Ceylon*. Amerind. Pub. Co. New Delhi, India. **4**: 488–532.
- Greuter, W., F.R. Barrie, H.M. Burdet, W.G. Chaloner, V. Demoulin, T.S. Filgueiras, D.H. Nicholson, P.C. Silva, J.E. Skog, P. Treharne, N.J. Turland and D.L. Hawksworth. 2000. International Code of Botanical Nomenclature (St Louis Code) adopted by the Sixteenth International Botanical Congress St Louis, Missouri, July–August 1999. *Regnum Vegetabile*. **138**.
- Jain, S.K. and V. Prakash. 1995. Zingiberaceae in India: Phytogeography and Endemism. *Rheede*. **5**: 154–169.
- Karthikeyan, S., S.K. Jain, M.P. Nayar and M. Sanjappa. 1989. *Florae Indicae Enumeratio Monocotyledoneae*. Botanical Survey of India, Calcutta, India. pp. 289–299.
- Larsen, K., J.M. Lock, H. Maas and P.J.M. Maas. 1998. Zingiberaceae. In: K. Kubitzki (Ed.) *The Families and Genera of Vascular Plants IV*. Springer Verlag, Berlin, Heidelberg, Germany. pp. 474–495.
- Mangaly, J.K. and M. Sabu. 1993. A taxonomic revision of the South Indian species of *Curcuma* L. (Zingiberaceae). *Rheede*. **3**: 139–171.
- Mood, J. and K. Larsen. 2001. New *Curcumas* from South East Asia. *The New Plantsman*. **8**: 207–217.
- Santapau, H. 1952. On a common species of *Curcuma* of Bombay and Salsette Islands. *Journal of the Bombay Natural History Society*. **51**: 135–139.
- Sirirugsa, P. 1996. The genus *Curcuma* of Thailand. *Proc. 2nd Symposium on the Family Zingiberaceae*. Zhongshan University Press. Guangzhou, China. pp. 39–46.
- Sirirugsa, P. and M. Newman. 2000. A new species of *Curcuma* L. (Zingiberaceae) from S.E. Asia. *The New Plantsman*. **6**: 196–197.

- Sivarajan, V.V. and P. Matthew. 1996. Zingiberaceae. *Flora of Nilambur (Western Ghats, Kerala)*. Bishen Singh Mahendra Pal Singh, Dehra Dun, India. pp. 702–716.
- Skornickova, J. and M. Sabu. 2002. The genus *Curcuma* L. in India: Resume and Future Prospects. In: A.P. Das (Ed.) *Perspectives of Biology*, Bishen Singh Mahendra Pal Singh, Dehra Dun, India. pp. 45–51.
- Skornickova, J., M. Sabu and M.G. Prasanthkumar. 2003a. New species of *Curcuma* from Mizoram. *Gardens' Bulletin Singapore*. **55**: 89–95.
- Skornickova, J., M. Sabu and M.G. Prasanthkumar. 2003b. *Curcuma codonantha* (Zingiberaceae)—A new species from Andaman Islands, India. *Gardens' Bulletin Singapore*. **55**: 219–228.
- Trimen, H. 1885. *Curcuma oligantha*. Notes on the flora of Ceylon. *Journal of Botany*. **23**: 245.
- Trimen, H. 1898a. Scitamineae. *A handbook to the Flora of Ceylon*. **4**: 238–265.
- Trimen, H. 1898b. *Curcuma oligantha*. *A handbook to the Flora of Ceylon—Atlas of Plates*. Pl. XCII.
- Tripathi, S. 2001. *Curcuma prakasha* sp. nov. (Zingiberaceae) from North-eastern India. *Nordic Journal of Botany*. **21**: 549–550.
- Velayudhan, K.C., V.K. Muralidharan, V.A. Amalraj, P.L. Gautam, S. Mandal and D. Kumar. 1999. *Curcuma* genetic resources. *Scientific Monograph No. 4. National Bureau of Plant Genetic Resources*. ICAR. Thrissur, India. pp. 1–149.
- Valetton, T. 1918. New notes on the Zingiberaceae of Java and Malaya. *Bulletine Jardin de Botanique Buitenzorg*. **27**: 1–167.
- Wight, R. 1853. *Icones Plantae Indiae Orientalis*. **6**: 16, t. 2006.