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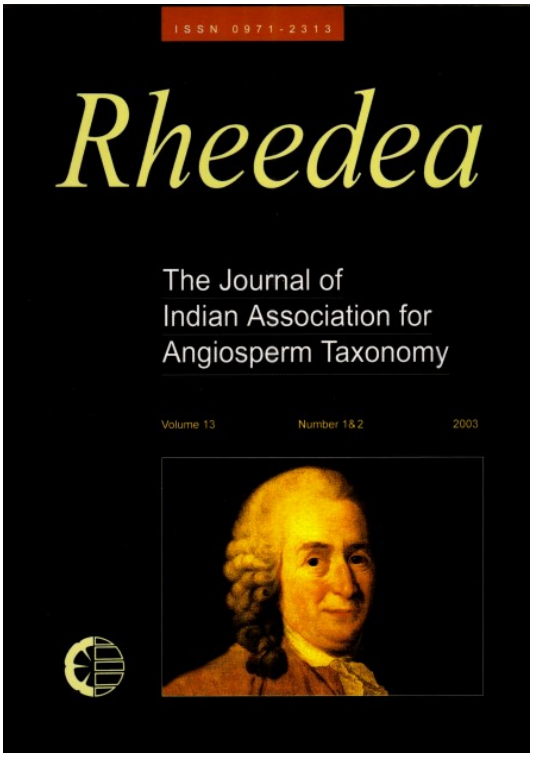

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Six New Cultivars of *Curcuma longa* L. (Zingiberaceae) from India

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Abstract

Six cultivars of *Curcuma longa* L. (Zingiberaceae) – the typical 'Alleppey', 'Bilaspur', 'Kasturi', 'PCT 13', 'Kattumanjal' and 'Himachal' – are recognised based on 568 indigenous germplasm collections from different agroclimatic regions of India. All the cultivars are described and floral parts are illustrated in detail except 'Himachal' for which flowers were not available. Based on subjective techniques, 21 morphotypic groups were identified. Sixty four descriptor status were observed and coefficient of correlation was worked out. Inter and intra group CEC values were used to substantiate six major subjective groups among the morphotypes.

Keywords: Morphotypic groups, Aboveground and underground parts, CEC values, Six new cultivars

Introduction

Curcuma longa L. (Zingiberaceae), the turmeric, is widely cultivated in India. It was lectotypified by Burtt (1977) with Rheede's (1692) *Manjella-kua* in *Hortus Malabaricus* (11: 21. t.11). About 50 local cultivars and their names associated with places of origin have been noticed in India and many of them are morphologically similar. No attempt has ever been made to identify and describe cultivars in *Curcuma longa* based on critical evaluation of morphological characters and application of International Code of Nomenclature for Cultivated Plants (ICNCP) (Trehane *et al.*, 1995). This report embodies the results of such an attempt.

Materials and Methods

A total of 1,410 accessions of turmeric (*Curcuma longa* L.) were collected. Of these, 568 accessions from different agro-climatic regions of India were maintained by annual regeneration in the field genebank in the research farm of NBPGR Regional station at Vellanikkara in Kerala. These were subjected to morphotypic classification based on the subjective technique (Mathews, 1962). This resulted in the identification of 21 distinct morphotypic groups, each containing several morphologically identical accessions. A total of 64 descriptor states on aboveground and underground parts of the plants were observed and coefficient of correlation among various morphotypes was worked out by converting the OTUs into an index based on the formula NS/(NS+ND) x100 as suggested by Sneath (1962). Among these morphotypes, certain specific morphological traits were similar in some and dissimilar in others. This resulted in the identification of six major subjective groups which were statistically substantiated by finding out inter and intra group CEC values.

These six major cultivar groups described include the typical 'Alleppey' turmeric and other five newly proposed ones. One representative standard specimen of each major cultivar group is described here. Local names originally associated or assigned by the breeders or the authors in relation to the geographic distribution of each cultivar are also given.

Results and Discussion

Turmeric exhibits very important qualitative characters. Plant type, leaf colour, disposition, venation, coma bract colour, rhizome colour, taste and aroma are prominent among them. They tend to collectively give a distinct subjective impression of

the type and this enables the observer to distinguish these entities in a population. There is hardly any continuity for these characters among the population of a particular cultivar group. However, quantitative characters vary considerably within the population of an individual group in *ex situ* condition and these data cannot be compartmentalised to key out the cultivars.

Table 1. Comparative average CEC of various turmeric morphotypes

Names of cultivars	*Morpho types*	*Mean CEC within varieties*	*Mean CEC between varieties*
'Alleppey'	1,2,3,4	81.33	25.31
'Bilaspur'	5,11,14,16,13 17,19,20,21	42.55	29.06
'Kasturi'	7,8,18	69.67	27.04
'PCT-13'	9	100.00	30.90
'Kattumanjal'	6,10,15	41.00	24.71
'Himachal'	12	100.00	32.68

Table 2. Local names of the cultivars

Cultivar	*Local names*
'Alleppey'	CLL-316, CLL-326, ST-2, S.T-12, ST-17, 'T-Sunder', 'Alleppey', 'V.K-5'
'Bilaspur'	Renuka-1, Shimla, Puzheppadi, Sulkera, Thalachira, Ranni, Bakankotta,
'Kasthuri'	CA-7, CA-72, Kasthuri, Anni-2, Bilaspur-2, Bilaspur-3, Saklapet-2, 'Kasturi pasupu', 'Kandmal haldi'
PCT=13	PCT-13
'Kattumanjal'	'Shimoga', 'Nadavayal', 'Midukkur', 'Kattumanjal'

Table I shows six cultivars recognised in the present study on the basis of numerical taxonomy. The higher mean CEC values among morphotypes of each major group as compared to lower values obtained among morphotypes of different major groups supported these classes quantitatively. Thus, in the first major group, morphotypes M-1, 2, 3 and 4 were closely related with high mean CEC value (81.33%). In the second major group with morphotypes M-5, 11, 13, 14, 16, 17, 19, 20 and 21, coefficient of correlation was moderate (42.45%) and it is higher than that between this group and other groups (29.06%). In the third major group, morphotypes M-7, 8 and 18 were closely correlated with higher CEC value (69.67%). The fourth major group contained only one morphotype (M-9). In the fifth major group the CEC value among morphotypes M-6, 10, and 15 was again moderate (41%). Morphotype M-12 represented the 6th major group. Thus, the results clearly indicated that 21 different morphotypes could be clustered into six subjective major groups and this grouping could be substantiated using the coefficient of correlation values. Hence these six major groups have been considered as six different cultivars.

Curcuma longa 'Alleppey'

Standard specimen: IC No. 88588, Collector's No. VK-5, V.A. Amalraj/102. Acc. No.376. (NHCP, New Delhi). Live specimens of 347 accessions belonging to morphotypes 1, 2, 3 and 4 (Velayudhan *et al.*, 1999) maintained at NBPGR, Vellanikkara. **Fig. 1, a-h.**

Main root stock spherical to oval, 1.8-9 cm long, 1.4-4 cm thick; secondary mothers 1-4 per root stock, 3.9- 9 cm long, 1. 3-3.3 cm thick; tubers palmate, flesh light orange-yellow to orange-yellow with a darker core inside, pleasantly sweet to bitter but not acrid in taste with turmeric aroma. *Plants* erect, 38-104 cm tall; suckers 2-17 per plant. *Leaves* erect, petiole 4-17.5 cm long, sheath 11.5-39.5 cm long, lamina lanceolate, not folding in open sun light, green to dark green on ventral side, dull green on dorsal side, 19-57 cm long, 6.3-16.9 cm wide, veins distant, not pronounced. *Peduncle* 4.5-12 cm long, spike central, 5-16 cm long, 3.5-7.9 cm wide; basal sterile bract elliptic-lanceolate, light green, 10-15 cm long, 2.5-6.2 cm wide; flower bract ovate, light green, tip acute, 2.5-6.2 cm long, 1.5-3.5 cm wide; coma bract whitish, ovate-lanceolate, 2.5-6 cm long, 1.2-3 cm wide. *Flowers* smaller, almost as long as the bracts or slightly exerting, 2-3 in number in inner bract, whitish, up to 5.5 cm long; calyx transparent white, 1 cm long; corolla transparent, main lobe 1x1.2 cm; lateral lobes 1.3x1 cm, .staminodes light orange-yellow, lip 3-lobed, mid-lobe emarginate, 1.4x1.3 cm in size, spur convergent and pointed downwards, 0.2-0.3 cm long; fruiting absent.

Note: "Manjella-kua" described by Rheede corresponds to the commercial 'Alleppey' cultivar. The local name 'Manjalkua' is a combination of two Malayalam words: 'manjal' meaning turmeric and 'kua' meaning a *Curcuma* plant. Since the commercial turmeric of southern part of India is mainly known as 'Alleppey turmeric', the cultivar name 'Alleppey' is maintained.

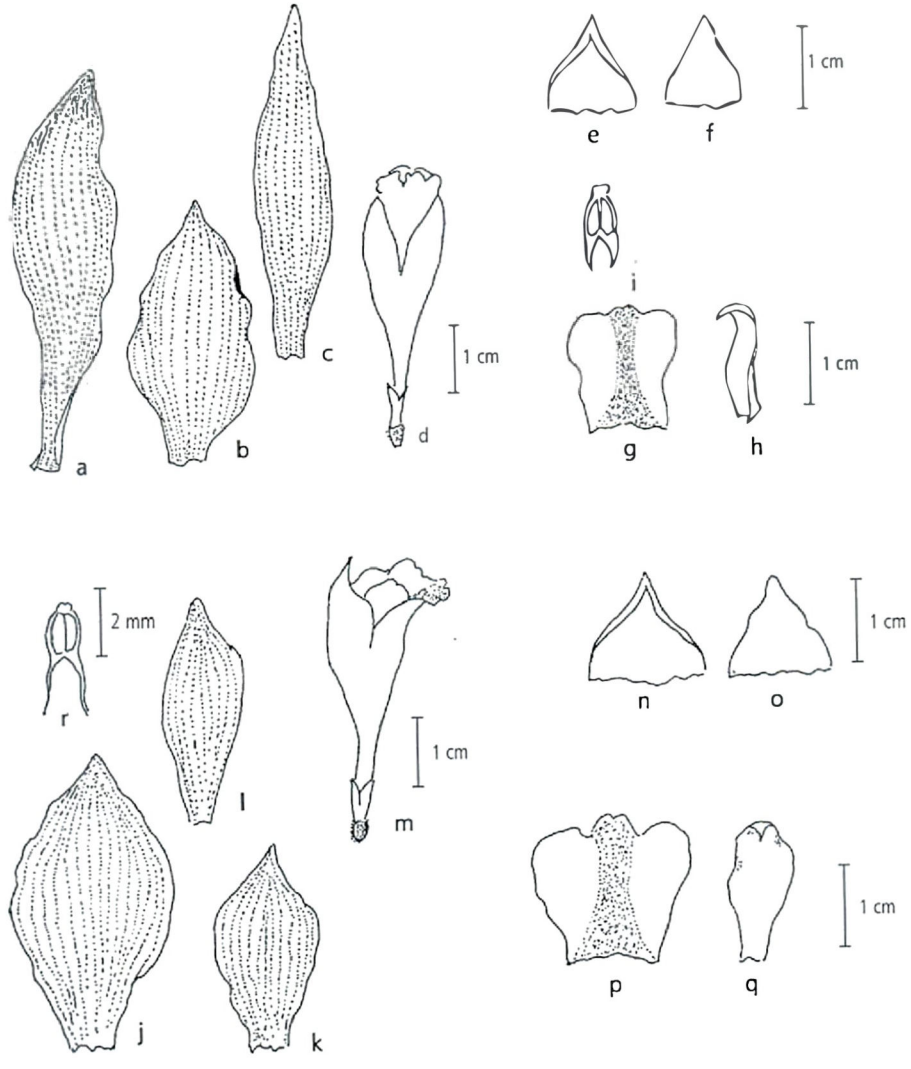

Figure 1. *Curcuma longa* 'Alleppey' – **a.** Sterile basal bract; **b.** Flower bract; **c.** Coma bract; **d.** Flower; **e.** Corolla, main lobe; **f.** Corolla, side lobe; **g.** Lip; **h.** Staminode, side lobe; **i.** Anther. *Curcuma longa* 'Bilaspur' – **j.** Sterile basal bract; **k.** Flower bract; **l.** Coma bract; **m.** Flower; **n.** Corolla, main lobe; **o.** Corolla, side lobe; **p.** Lip; **q.** Staminode, side lobe; **r.** Anther.

Flowering: September-November

Cultivation: Kerala, Tamil Nadu, Karnataka and Andhra Pradesh and very rarely in Northern, North eastern and Eastern regions; at times running wild in the Western Ghats.

Curcuma longa 'Bilaspur'

Standard specimen: Collector's No. Anni-4, IC No.88770, NBPGR/TCR – 426 AKI-31 (V-2/M-11/TCR-426): Acc.No.1430 (NHCP, New Delhi). **Fig. 1, j-r.**

Main root stock spherical to oblong, 1.8-8 cm long, 1.1-3.2 cm thick; secondary mothers 1-5 per root stock, 3.6-10.3 cm long, 1-4.1 cm thick; tubers slightly zigzag, colour varying from light orange-yellow to orange-yellow or mustard-yellow, slightly sweet to bitter and acrid with turmeric aroma. *Plants* erect, 38-112 cm tall; suckers 1-14 per plant. *Leaves* semi-erect, petiole 7-35.5 cm long, sheath 2.5-23.5 cm long, lamina lanceolate, green to dark green on dorsal side, dull green on ventral side, 18-58.5 cm long, 7.4-16.1 cm wide. *Peduncle* 4.5-12 cm long, spike 10-12.5 cm long, 6.1-7.5 cm wide; basal sterile bract ovate-elliptic, light green, 4.5-9.6 cm long, 3-3.2 cm wide; flower bract ovate, light green, tip acute, 3.8-4.7 cm long, 2.3-3.5 cm wide; coma bract whitish, ovate-lanceolate, 3.8-6.5 cm long, 2.3-3.5 cm wide. *Flowers* smaller, almost

as long as the bracts or slightly exerting, 2-3 in number in inner bract, inner bract 1.8-2 cm long, 1-1.1 cm wide, emarginate, flower whitish, 4.2-4.7 cm long; calyx transparent white, 1 cm long; corolla transparent, 1x1.2 cm; staminodes light orange-yellow, lip 3-lobed, mid-lobe emarginate, 1.5x1.5 cm in size, spur convergent and pointed downwards, 0.2-0.3 cm long; fruiting absent.

Flowering: September-October.

Locality: Ranni, Kerala.

Cultivation: Kerala, Tamil Nadu, Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, Himachal Pradesh, West Bengal and North East; at times running wild in the Western Ghats.

Note: Morphotypes 5,11,14,16,17,19,20,21 included under this cultivar group are maintained at NBPGR, Vellanikkara. The name 'Bilaspur' is given as it is very common in Bilaspur and other parts of Northern India.

Curcuma longa 'Kasturi'

Standard specimen: Collector's No. V89/0-104-A, IC No.137027, NBPGR/TCR - No.1050 AKI-30 (V-3/M-8/TCR-1050): Acc.No. 1432 (NHCP, New Delhi). **Fig. 2, a-i.**

Root stock small to large, spherical to oval, 3-9.5 cm long, 1.5-2.8 cm thick; secondary root stocks oblong, bent, 1-2 per main root stock, 4.5-10.1 cm long, 1-2.7 cm thick; primary fingers very long, thin, mostly straight, pointed or blunt, flesh mustard-yellow to orange-yellow, very pleasantly camphoraceous and aromatic when chewed, bitter in taste; tubers plenty, stipitate, large in size. *Plant* dwarf, 54-70 cm tall; suckers 1-10 per plant. *Leaves* horizontal in disposition, petiole 7-24 cm long, sheath 2.5-11.5 cm long, lamina large, folding, dark green on dorsal side and dull green below, elliptic-lanceolate, slightly caudate at base, veins distant and pronounced, margins undulating, 18.5-44 cm long and 7.6-13.9 cm wide. *Peduncle* 5-8 cm long, spikes very robust, 6-10.5 cm long, 4-6 thick; basal sterile bract ovate, light green, 5.5-8 cm long, 2.7-4 cm wide; flower bracts whitish green, ovate with rounded or blunt tip, 3.1-4.7 cm long, 2.3-4 cm wide; coma bracts ovate-oblong with acute or obtuse tip, whitish, thick coriaceous, 3.7-5.5 cm long, 1.4-3.3 cm wide. *Flowers* 2-3, slightly exerted, 4.5 - 5.1 cm long, one each in inner bracts, inner bracts widely emarginate, 1.8-2.3 cm long, 1-1.7 cm wide; calyx transparent white, 1.3 cm long; corolla transparent white, lobe 1.2x1.4 cm in size; staminodes yellowish, lip yellow, orange-yellow at middle, 3-lobed, mid-lobe emarginate, 1.6x2 cm in size; spur converging, pointed downwards, 0.2-0.3 cm long. *Fruits* a dry dehiscent capsule, globose with persistent calyx lobes, about 1.5 cm across; seeds dark brown, more than 1mm in size, conical and arillate.

Flowering & Fruiting: October-November.

Locality: Thenna Boddavaram, Vishakapatnam, Andhra Pradesh.

Cultivation: Plains and hills of Northeast extending south wards to West Bengal, Orissa and Andhra Pradesh; very rarely in Kerala.

Note: The name 'Kasturi' is assigned due to the pleasant aroma of tuber. Due to this aroma it is known sometimes as 'Kasturi pasupu' in Telugu. Morphotypes M7, 8 and 18 falling under this cultivar group are maintained at NBPGR, Vellanikkara.

Curcuma longa 'PCT-13'

Standard specimen: Collector's No. 126 DM., IC No. 137030, NBPGR/TCR - No. 122, Collector's No. AKI-34 (V-4/M-9/TCR-122): Acc.No.1654 (NHCP, New Delhi). **Fig. 2, j-r.**

Main root stock oblong, 3.2-6 cm long and 1-2.8 cm thick; secondary root stock varying from 1-3 per main stock, oblong, bent, 4.4-10 cm long and 1.4-2.7 cm thick; tubers with light mustard-yellow flesh, bitter in taste with slight turmeric aroma; stipitate tubers few. *Plants* erect, 38-80.5 cm tall, 1-9 suckers per plant. *Leaves* erect in disposition, 9-11 leaves per sucker, petiole 8.5-24 cm long; sheath 5-12 cm long; lamina small, slightly twisted, folding, elliptic-lanceolate, dorsal and ventral surface green, veins very prominent, closer, 24.5-45.5 cm long, 9-13.9 cm wide.

Flowering: October. Only once noticed in two plants in 1987.

Locality: Exact place not known, probably near Solan in Himachal Pradesh.

Cultivation: Northwestern hills at lower elevations in India.

Note: Leaves are slightly twisted. Vigour of the plant at Vellanikkara is poor. The name 'PCT-13' is assigned as per the collection number.

Curcuma longa 'Kattumanjal'

Standard specimen: Collector's No. 38/82-23, IC No. 69972, NBPGR/TCR – 473 AKI-33 (V-5/M-15/TCR-473): Acc.No.1435 (NHCP, New Delhi). **Fig. 3, a-i.**

Main root stock hemispherical to oblong, 2-7.5 cm long, 1.4-3.2 cm thick; secondary root stocks 1-2 per main root stock, 2-3.5 cm long, 1-2.6 cm thick; tuber bent,

thick, pointed or blunt, flesh orange-yellow to dark orange-yellow or mustard-yellow, slightly sweet and bitter, slightly aromatic; tubers stipitate or otherwise, a few. *Plants* erect, 62.5-107.5 cm tall; suckers 2-10 per plant. *Leaves* semi-erect in disposition; petiole 13.5-38 cm long; sheath 3.6-16.5 cm long; lamina large, resembling *Musa* leaves, plicate, green above, dull green below, 23.5-58.5 cm long, 8.6-16.1 cm wide, veins prominent, distant. *Peduncle* 12 cm long, spike beautifully crowned with purple coma, 9.5x5.5 cm in size; basal sterile bracts obovate, lanceolate, light green, 6.5x3.1 cm; flower bracts ovate, light green with or without light purple tinge above middle, 3.8x3 cm; coma bracts lanceolate, oblong, whitish with purple tinge above middle, 5x2.1 cm. *Flowers* 2-3 in the bract, enclosed by notched inner bracts, exerted or not, 4.5 cm long; calyx transparent, 1 cm long; corolla transparent white, lobe 1.5 cm long, staminodes cream

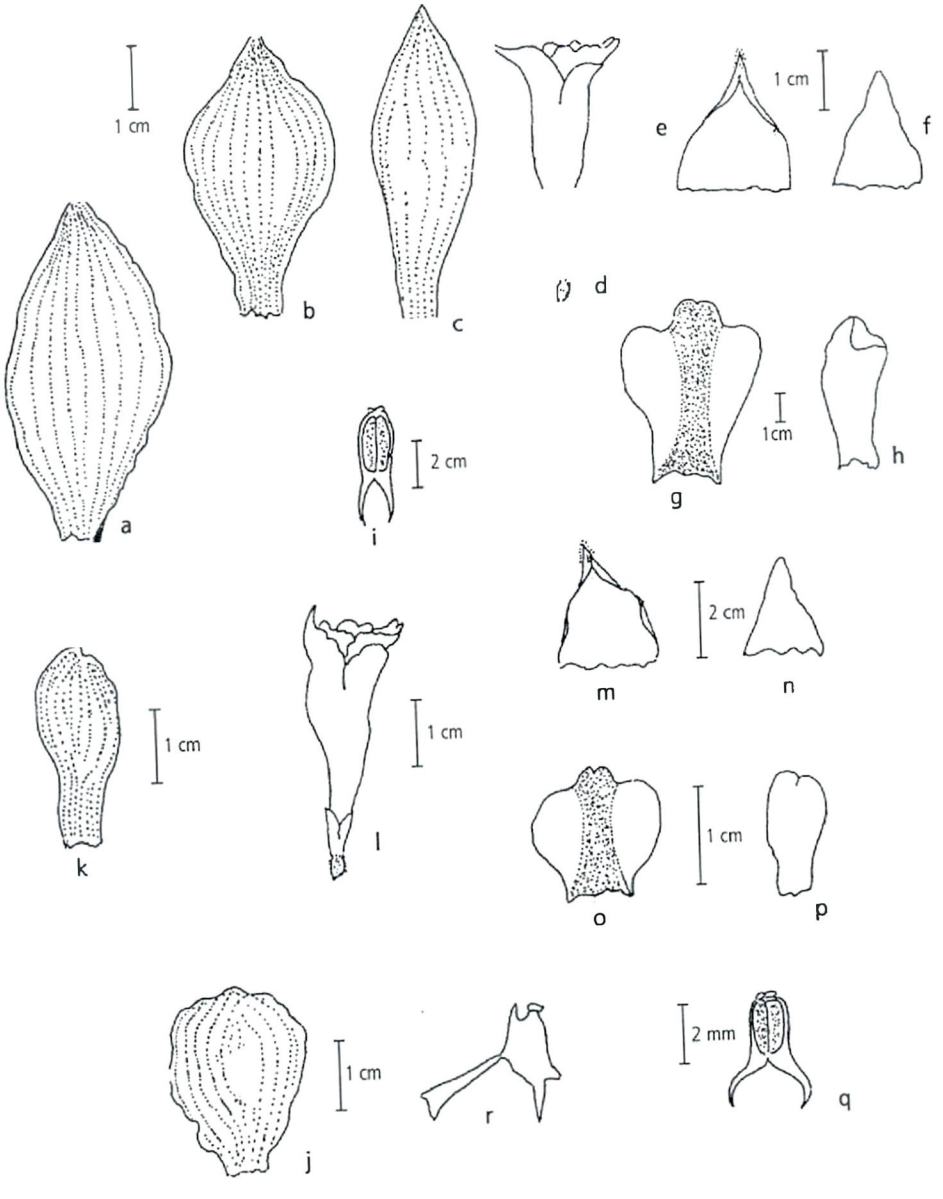

Figure 2. *Curcuma longa* 'Kasturi' – a. Sterile basal bract; b. Flower bract; c. Coma bract; d. Flower; e. Corolla, main lobe; f. Corolla, side lobe; g. Lip; h. Staminode, side lobe; i. Anther. *Curcuma longa* 'PCT-13' – j. Flower bract; k. Coma bract; l. Flower; m. Corolla, main lobe; n. Corolla, side lobe; o. Lip; p. Staminode, side lobe; q. Anther; r. Anther showing stamen disposition.

to pale yellow, lip yellow, 3-lobed, mid-lobe emarginate; spur convergent and horizontal; Fruit setting not observed.

Flowering: October ,rare.

Locality: Puttur, Karnataka.

Cultivation: Northern, North Western and Southern India; often running wild in the Western Ghats.

Note: The name 'Kattumanjal' meaning 'wild turmeric' is given to this cultivar as it is often found wild in the Western Ghats. Morphotypes M6, 10 and 15 representing this cultivar group are maintained at NBPGR, Vellanikkara.

stock, 5.1-7.5 cm long, 1.4-2.7 cm thick; tubers oblong, flesh mustard-yellow, bitter in taste with turmeric aroma. *Plants* erect, dwarf, 47-60 cm tall; suckers 3-5 per plant. *Leaves* semi-erect in disposition, 7-11 per sucker; petiole 14.8-20 cm long; sheath 5.5-9.5 cm long; lamina elliptic-lanceolate, less folding, green above, dull green below, 26.5-32 cm long, 10.4-12.6 cm broad, veins not prominent, close.

Flowering: Not observed.

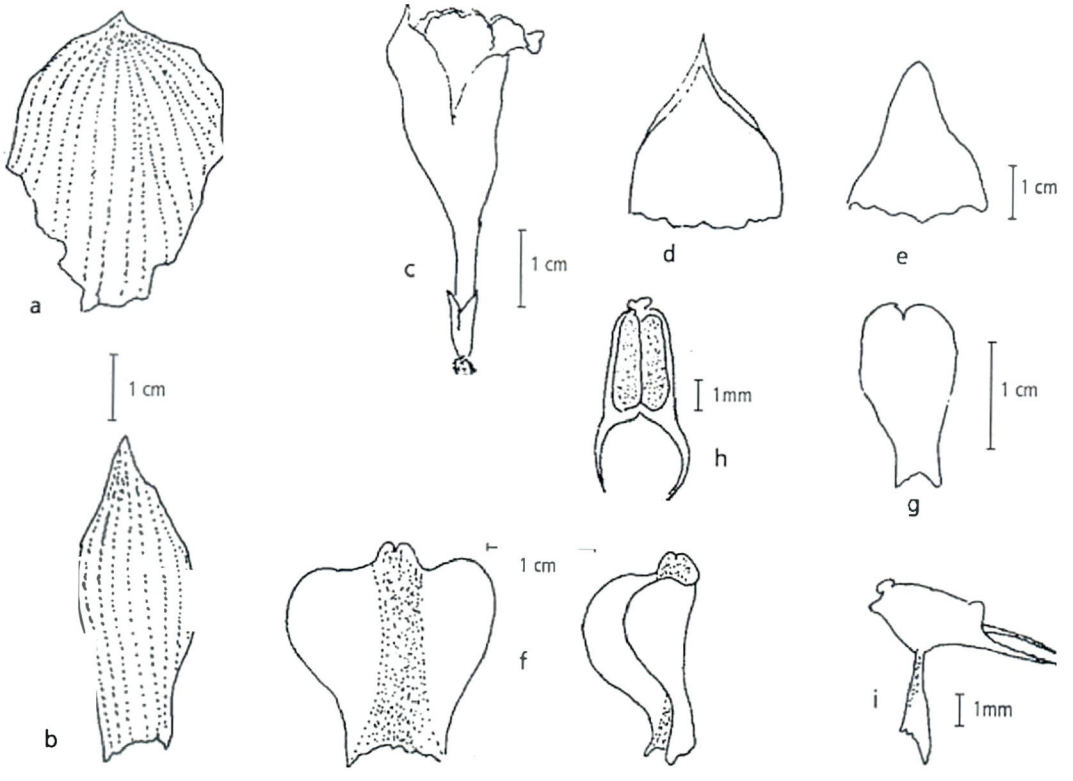

Figure 3. *Curcuma longa* 'Kattumanjal' – a. Flower bract; b. Coma bract; c. Flower; d. Corolla, main lobe; e. Corolla, side lobe; f. Lip; g. Staminode, side lobe; h. Anter; i. Anther disposition.

Curcuma longa 'Himachal'

Standard specimen: Collector's No. BDJ 11/91, IC No. 88872, NBPGR/TCR – 890 AKI-32 (V-6/M-12/TCR-890): Acc.No.1639 (NHCP, New Delhi).

Main root stock oblong, 3.5-5.6 cm long, 1.5-2.3 cm thick; secondary root stocks usually one per main

Locality: Shillong, Meghalaya.

Cultivation: Lower hills of North Western India; occasionally in North Eastern India and rarely in Andhra Pradesh. The name 'Himachal' is given to this cultivar as it is common in Himachal Pradesh.

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