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# Morphological and biochemical analysis of *Curcuma caesia* Roxy and *Curcuma longa* L. relating to their medicinal values

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**SUMMARY**

Curcuma species belongs to Zingiberaceae family. The genus is characterized by the presence of rhizomatous tubers. *Curcuma caesia* Roxb. (black zedoary) and *Curcuma longa* L. (turmeric) are widely used in indigenous medicines as a treatment for various diseases. Even though, they are in the same genus *Curcuma,* they showed marked differences in the colour of rhizomes, leaves and flowers. Therefore, a comparative study in its morphological characteristics and the biochemical components were analysed .

**Key words :** *Curcuma caesia, Curcuma longa,* Medicinal uses

*Curcuma caesia* Roxb. and *Curcuma longa* L. belong to Zingiberaceae family. The genus consists of rhizomatous herbs known for their medicinal values. The rhizomes of *Curcuma caesia* Roxb. is used in treating leucoderma, asthma, tumours, tuberculous glands of neck, piles, bronchitis and enlargement of spleen (Sinha, 2001). The paste is applied on bruises ,contusions and rheumatic pains. The rhizome is also used in dysentery, diarrhoea and cough (Kumar, 2002). Essential oils of *Curcuma caesia* Roxb. is also known for its antifungal activity (Banerjee and Nigam, 1976). *Curcuma longa* L. has been used for centuries as a spice to give flavour. It is equally important as household remedy for various illness including hepatic and biliary disorders, skin diseases, sinusitis and as a tropical application for wounds and cuts (Chopra *et al*., 1958). It has been reported to posses anti-inflammatory, hepatoprotective, antitumors, antiviral activities (Ammon and Wahl, 1991) and exhibits free radical scavenging /antioxidant property (Jayaprakashan *et al*., 2006). Because of the medicinal values of *Curcuma caesia* Roxb. and *Curcuma longa* L., the present study was to investigate the presence of biochemical metabolites in these two species.

## MATERIALS AND METHODS

The plants of *Curcuma caesia* Roxb.(Fig. 1a) and *Curcuma longa* L. (Fig. 2a) with their inflorescence were collected for observations The rhizomes of these two species were collected from different locations in Manipur. The fresh rhizomes were washed thoroughly under tap water to make them free from contaminants. The cleaned rhizomes were taken and then cut into small pieces and used for the estimations of total carbohydrates, total soluble proteins and amino acids. In order to assess its odour, colour and other physical characteristics, vertical sections were made of these fresh rhizomes (Fig. 1b, Fig. 2b). Again the fresh rhizomes were cut into thin slices and exposed to sun for drying. The sun dried thin slices rhizomes were then kept in an oven at $60^0$C for 12 hours and then grounded into fine powder, passed through a sieve and used for the analysis of total phenols and flavonoids.

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**Morphological characteristics:**

*Curcuma caesia* Roxb. is characterized by the presence of palmate and simple tubers; the bulbs are inwardly pale blue (Fig. 1c), verging towards grey. Leaves lanceolate (30-40cm), petioled (30-60cm) ; a deep ferruginous purple down the midribs, which penetrates to the under surfaces; every other part greens. Spike appearings before leaves; bract greenish. Coma bract tinge with pink; flower pale yellow with bright yellow throat; calyx translucent white; corolla red as in Fig. 1 (a).

*Curcuma longa* L. is characterized by the presence of rootstock ovoid; large; sessile tubers, cylindrical, bright yellow inside (Fig. 2c ), petiole as long as the plain green blade(50-60cm); leaves large(30-45cm x 10-20cm), oblong narrowed to the base; inflorescence spike, flowers bracts, pale green, ovate, those of the coma tinged with pink,

flowers pale yellow as in Fig. 2(a) .

**Biochemical analysis:**

Amino acids by Thin Layer Chromatography (TLC):

Extractions of the fresh rhizomes were done in 90% ethanol, centrifuged and the supernatants were subjected to thin layer chromatography (Stahl,1983) using n-butanol, glacial acetic acid and distilled water in the ratio 4 : 1: 5 as the running solvent. The standard amino acids (Amino acid kits having 24 amino acids) were dissolved in 5 ml distilled water each and subjected to TLC along with the screening samples as co-chromatography. The purple coloured spots developed were calculated with reference to their Rf values and tallied with that of the standard amino acids.

Analysis of total carbohydrate:

Total carbohydrate contents were determined by anthrone method (Sadasivam and Manickam, 1992) using anthrone in 20% concentration $H_2SO_4$. The samples were prepared in 50% ethanol. The samples and the standard glucose solutions were measured at wavelength 620 nm in a spectrophotometer.

Analysis of total soluble protein:

Estimations of phosphate buffer soluble proteins were done in fresh rhizomes by method described by Lowry's *et al*. (1951). Calculations were done from the standard curve prepared by using BSA (Bovine Serum Albumin) as the standard solution. The optical density was measured at 660 nm.

Analysis of total phenols:

The dried powdered rhizomes were extracted in 10ml of methanol by intermittent maceration up to 48 hours, centrifuged and the supernatants were used for the estimations of total phenols. Total phenolic contents were determined by folin-ciocalteu method with sodium carbonate solutions following Donald *et al*. (2001). The absorbance was measured at 765nm using chlorogenic acid as the standard.

**Total flavonoids content:**

The dried powdered rhizomes were extracted in 10ml of methanol by intermittent maceration up to 48 hours, centrifuged and the supernatants were used for the estimations of Flavonoids. Flavonoids content were

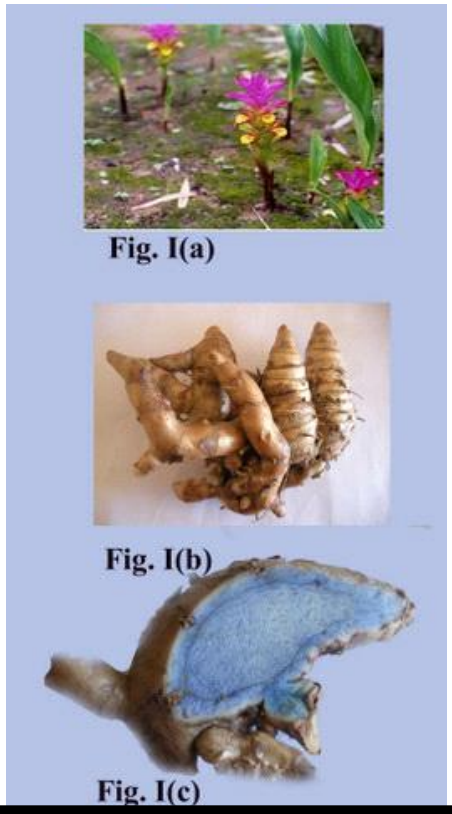


**Fig. 1 : (a) Infloresence of C.*caesia***
**(b) Rhizome of C. *caesia***
**(c) Cross section of C.*caesia***


**Fig. 2 : (a) Infloresence of C. *longa***
**(b) Rhizome of C. *longa***
**(c) Cross section of C. *longa***

**Table1: Amino acids present in the rhizomes of *Curcuma caesia* Roxb and *C. longa L* .**

| Mobile Phase | | Rf values | | |
|---|---|---|---|---|
| | | Standard sample | Test samples | |
| | | | *C. Caesia* | *C. longa* |
| Butanol : glacial acetic : $H_2O$ | Glycine | 0.22 | 0.21 | 0.22 |
| | Theronine | 0.25 | 0.25 | 0.25 |
| | Proline | 0.19 | NIL | 0.189 |
| | Methionine | 0.40 | NIL | 0.39 |
| | Gutamic acid | 0.27 | 0.27 | NIL |
| | Arginine | 0.21 | 0.21 | NIL |
| | Amino-n-butyric acid | 0.33 | 0.31 | NIL |

**Table 2 : The contents of total soluble proteins, carbohydrates, total phenols and flavonoids in the rhizomes of *Curcuma caesia* Roxb. and *C.longa* L.**

| Name of the species | Total Carbohydrates (mg/g) | Total soluble proteins (mg/g) | Total phenols (mg/g) | Total flavonoids (mg/g) |
|---|---|---|---|---|
| *Curcuma caesia* | 158.92±0.08 | 47.5±1.9 | 60±0.03 | 30±0.06* |
| *Curcuma longa* | 329.15±0.07 | 57.6±0.09 | 220±0.06 | 132±0.03 |

* Standard error of the mean(n=3)

determined by Aluminium chloride method following Chang *et al.* (2002). The calibration curved was prepared by different concentrations of Quercetin in methanol. The absorbance was measured at 415nm in a spectrophotometer.

## RESULTS AND DISCUSSION

Morphologically the two Curcuma species (*Curcuma caesia* Roxb and *Curcuma longa* L.) showed a marked differences in the colour of rhizomes, C. *longa* L.showed bright yellow inside and *C. caesia* Roxb.showed pale blue inside ,with distinctive leaves having deep ferruginous purple down the mid ribs penetrating to the undersurface.

The thin layer chromatography indicates that the amino acids glycine, glutamic acid, threonine, 2-amino n-butyric acid and arginine were present in *C. caesia Roxb.* Likewise glycine, threonine, proline, and methionine were present in *C. longa* L. (Table 1).

The biochemical analysis showed that total carbohydrates content in the rhizomes of *Curcuma caesia* Roxb. was 158.92 mg/g but *Curcuma longa* L. contain 329.15 mg/g fresh weight of the root tissue. Total soluble protein content in *Curcuma caesia* Roxb. 47.5 mg/g and *C. longa* L. was 57.6 mg/g; *C.* fresh wt. tissue as shown in Table 2. Total phenols and flavonoids in *C. caesia* Roxb.were 60 mg/g and 30 mg/g of the dry wt., respectively and that of *C. longa* L. were 220 mg/g, 132 mg/g of the dry wt. of the root tissue, respectively . The contents of phenolics compound in turmeric plays an important role in its antioxidant activity and effectiveness of the product (Reddy and Lokesh,1992). Turmeric has been reported to possess anti-inflammatory, hepato-protective, antitumors, antiviral activities (Ammon and Wahl, 1991). The content of phenolic compounds were related with their medicinal uses since phenolic compound can act as anti-oxidant by free radical scavengings/ antioxidant property (Kosem *et al.*, 2007).

The present findings provide basic information that make *Curcuma* species a suitable plant of economic importance having medicinal values, hence may be utilized as raw materials for pharmaceutical industries.

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