VARIABILITY IN TURMERIC (CURCUMA SPECIES) GERMPLASM FOR ESSENTIAL OIL AND CURCUMIN

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ABSTRACT

The rhizomes of 38 types of *Curcuma* species available in the germplasm were analysed for essential oil and curcumin. The types showed wide variability in the above constituents.

The turmeric of commerce is the tuberous rhizome of a herbaceous perennial plant, *Curcuma* sp., belonging to the family *Zingiberaceae*. It is indigenous to South Asia.

Turmeric has been used in the Orient since ancient times as a condiment and cosmetic. Even today, it is widely used in the Indian subcontinent as a condiment, cosmetic, depilatory and dye. Chinese use it for dyeing silk, paper, wood and food stuffs (Wealth of India, Vol. 2, 1950). In Europe it is employed chiefly as a dye and an ingredient in curry powder (Encyclopaedia Britannica, Vol. 22, 1969).

More recently some encouraging results have also been obtained with it as a substitute for insulin in diabetics (Srinivasan, 1972). Its essential oil is mildly antiseptic.

The yellow colour of turmeric is attributed to a crystalline colouring matter called curcumin. It is a diferuloyl methane of the formula $C_{21}H_{20}O_6$.

Turmeric is cultivated in India in about 6700 hectares. Several types are grown. They differ in size and colour of rhizomes and to a lesser degree in aroma also. No information is available in the literature on the variability present in turmeric for curcumin and essential oil. The present study was undertaken to assess this in the important cultivated types of India.

EXPERIMENTAL AND RESULTS

Freshly harvested mature rhizomes were used for analyses. The essential oil and curcumin content were estimated by using the methods recommended by the American Spice Trade Association (ASTA, 1968). For this, the

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rhizomes were sliced, dried in a cross flow air oven at 55° ± 2° C and powdered. The essential oil was determined as follows:

'1. Weigh accurately a sample sufficient to yield 2 to 5 ml. of oil and transfer to the flask, using water to aid quantitative transfer.
2. Add about 500 ml. of water and insert the stirring bar, if magnetic stirring is to be used. (See Note 7 for cassia)
3. Assemble the apparatus as shown on page 11 using the proper Clevenger trap.
4. Heat the flask with stirring and maintain a distillation rate of 1 to 1½ drops per second.
5. Distill until two consecutive readings taken at one hour intervals show no change of oil volume in the trap.
6. Cool to room temperature, allow to stand until the oil layer is clear, and read the volume of the oil collected, estimating to the nearest 0.02 ml.

$$\text{Volatile oil, \% (v/w)} = \frac{\text{Vol. of oil (ml.)}}{\text{Wt. of sample (g.)}} \times 100$$

Curcumin was estimated spectrophotometrically as follows (ASTA, 1968).

1. Weigh accurately ca. 0.1 g. of turmeric sample, prepared as directed in Method 1.0, in the extraction flask.
2. Add 30 ml. of the alcohol and reflux for 2½ hours.
3. Cool the extract and filter quantitatively into a 100 ml. volumetric flask. Transfer the extracted residue to the filter. Wash thoroughly and dilute to mark with the alcohol.
4. Pipette 20 ml. of the filtered extract into a 250 ml. volumetric flask and dilute to volume with the alcohol.
5. Measure the absorbance of the extract and the standard solution at 425 mμ in 1 cm. cells against an alcohol blank.

$$\text{Absorptivity of curcumin, a} = \frac{\text{Absorbance of standard solution at 425 m}\mu}{\text{Cell length (cm) X conc. (g./l.)}},$$

$$\text{Curcumin in turmeric, \%} = \frac{\text{Absorbance of extract at 425 m}\mu \text{ X 125}}{\text{Cell length (cm.) X a X Sample wt. (g.)}}$$

The results are given in Table I. The essential oil content varied from 2.8% (Sugandham CLL 328 and Mydukur CLL 326) to 6.0% (Jobedi CA 67 and Kuchipudi). Curcumin content varied from 2.5% (G.L. Puram I) to 8.1% (Duggirala CLL 325 and Vontimitta CLL 322). No relationship was seen between essential oil and curcumin contents. The present data could be made use of in planning improvement programmes in turmeric.

Table I. Essential oil and curcumin contents of turmeric types*

No.	Types	% Ess. oil	% Curcumin
1.	Amalapuram (CLI 320).	3.2 ± 0.1	5.0 ± 0.5
2.	Karhadi Local.	3.2 ± 0.4	5.0 ± 0.8
3.	Thekkurpetta (B. 33).	3.6 ± 0.4	4.0 ± 0.4
4.	Duggirala (B.9).	5.0 ± 0.5	5.0 ± 0.0
5.	Gorakhpur (CLI 316).	5.6 ± 0.5	5.5 ± 0.2
6.	Ethamukula (CLL 321, B.5).	4.0 ± 0.4	5.5 ± 0.1
7.	T. Sunder (B.12).	4.0 ± 0.2	3.5 ± 0.2
8.	Avanigadda (CLL 323, B.16).	3.2 ± 0.3	4.5 ± 0.0
9.	Wynad Local (B.75).	3.6 ± 0.1	4.0 ± 0.3
10.	Sugandham (CLL 328, B.39).	2.8 ± 0.4	4.0 ± 0.0
11.	Rajpuri Local (B.36).	3.2 ± 0.0	3.5 ± 0.1
12.	Nandyal Type (B.32).	3.6 ± 0.2	3.0 ± 0.2
13.	Rajpuri (CLI 390).	3.6 ± 0.1	5.5 ± 0.2
14.	Thekkurpetta (CLL 327, B.24)	2.4 ± 0.1	4.0 ± 0.0
15.	Mydukur (CLL 326, B.52).	2.8 ± 0.0	5.0 ± 0.1
16.	Amistapani.	3.2 ± 0.1	4.0 ± 0.2
17.	Duggirala (CLL 325, B.55).	4.0 ± 0.1	8.1 ± 0.3
18.	Amalapuram (CA 73).	5.6 ± 0.4	3.5 ± 0.0
19.	Kasturi Tanuka.	4.6 ± 0.1	3.5 ± 0.2
20.	Jobedi (CA 67).	6.0 ± 0.2	3.5 ± 0.1
21.	Kuchipudi	6.0 ± 0.6	6.0 ± 0.0
22.	Sugandham	3.2 ± 0.1	4.5 ± 0.2
23.	Chayapasupa	3.2 ± 0.2	6.0 ± 0.5
24.	Number 24.	4.4 ± 0.2	6.5 ± 0.2
25.	Ethamukula (B 22).	3.2 ± 0.1	4.5 ± 0.0
26.	G.L. Puram II.	3.6 ± 0.5	5.5 ± 0.2
27.	Dindigam (CA 69).	4.4 ± 0.2	4.0 ± 0.1
28.	Vontimitta.	3.2 ± 0.1	7.1 ± 0.1
29.	G.L. Puram (CA 66).	4.0 ± 0.1	6.5 ± 0.5
30.	Vontimitta (CLL 322).	4.4 ± 0.2	8.1 ± 0.4
31.	Udayagiri (CA 72).	4.8 ± 0.5	5.0 ± 0.0
32.	Katergia (CA 70).	5.2 ± 0.1	3.0 ± 0.1
33.	G.L. Puram I.	5.2 ± 0.4	2.5 ± 0.3
34.	Kodur Type.	4.0 ± 0.2	3.0 ± 0.0
35.	Kasturi.	7.2 ± 0.0	3.0 ± 0.5
36.	Dahgi (CA 68)	4.4 ± 0.0	5.0 ± 0.2
37.	Armoor.	5.6 ± 0.4	3.5 ± 0.2
38.	Armoor (CLL 324).	3.2 ± 0.1	6.6 ± 0.0

*Mean values of observations taken in duplicate.

CLI and CLL series indicate primary selections of *Curcuma longa* Linn. types. CA series indicate *Curcuma aromatica* Salisb. types. B series are from the secondary selections made at the Central Plantation Crops Research Institute, Kasaragod, Kerala State, India.

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