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Evaluation of Curcumin Content of Turmeric Accessions Collected from North East India

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ABSTRACT: The turmeric globes medicinal invaluable herb, possesses yellow colour pigment curcumin. It offers myriad benefits anticancer, anti-depressant, antioxidant, and antifungal properties. It is believed that turmeric with reddish yellow colour has health benefits, but no reliable proof is available to validate. Since it has high demand for various purposes, large quantity extraction with low-cost is necessary. Therefore, the study standardized a precise spectrophotometric method of curcumin content estimation at 425nm using absolute alcohol. The finding disclose spectrometric method is simple and easy and can used for quality control analysis. Also, study revealed direct association between rhizome colour and curcumin content, the higher curcumin content gives darker rhizome colour. The curcumin content studied in 17 accessions of North East India, discovered different range from 0.29-8.9%. The higher curcumin content observed in Lachin (8.9%) rhizome with reddish-yellow colour followed by Megha (8.3%) and Lakadong (7.7%) rhizome with bright-yellow colour. The lowest curcumin observed in Yaimu (0.26%) rhizome with white-yellow colour. We noted curcumin content variation among accessions may due to geographical variation like climatic condition, soil, environment, etc.

Keywords: Curcumin, Lakadong, North East India, Turmeric, Variation.

INTRODUCTION

India is one of the richest biodiversity countries where North Eastern part of India is recognized as biodiversity hotspots. Among the different regions of North Eastern states major spices like chilies, turmeric, ginger, cardamom, bay leaf, and black pepper are grown. The turmeric and ginger are prominently cultivated in jhum fields as a cash crop (Pandotra *et al.,* 2013). North-Eastern states have been blessed with tremendous diversity in turmeric cultivars. Meghalaya is one of the agrarian states, where more than 80% people depend on agriculture (Paul *et al.,* 2016). The agro-climatic condition of NEI is mostly suitable for the cultivation of horticulture crops at a greater extent. India is largest producer, consumer and exporter of curcumin which contributes more than 80% of global production (AMIC, ANGRAU, 2021). Turmeric ranks third in spices export of India. The turmeric export goes on increasing over years, in 2019-20 export was 1.36 lakh tones (Spice board of India-2020).

Curcuma longa is an important natural resource that provides a range of useful products namely, food, spices, medicines, dyes, and aesthetics (Adu *et al.,* 2021). The major economic plant part of turmeric is dried rhizomes (Braga *et al.,* 2018) which possess rich reserves of terpenoids and phenolic compounds such as curcuminoids, particularly curcumin which is majorly responsible for the yellow pigmentation of turmeric, it is grown in a humid, warm climates all over the globe (Aarthi *et al.,* 2020; Weber *et al.,* 2005). Turmeric has numerous health benefits, therefore used as medicine in ayurveda. It is beneficial to recover complexion, blood diseases, leukoderma, and scabies (Arora *et al.,* 1971). Curcumin studied against cancer, property to fight back cancer is a great discovery in science. It is a natural phenolic compound offering a broad spectrum of benefits to humans due to its anticarcinogenic, antifungal, anti-depressant and antioxidant properties (Manolova *et al.,* 2014). The deeper awareness of therapeutic power of curcumin is obtained from its ability to fight back cancer and thereby its use in preparation of anticancer drugs (Pal *et al.,* 2020**).**

Since turmeric utility varies, so choosing the correct genotype is crucial. Most of curcuma spp. are well characterized (Laloo *et al.,* 2020), but due to their similar morphological nature makes it difficult to distinguish. During flowering characterization is easy; however dried rhizomes are used most of time in different markets so it become difficult at later stage (Ramkumar *et al.*, 2020).

After the enlightenment on benefits of curcumin it comprehends that the price and value of turmeric rhizomes are determined by an accumulation of curcumin in rhizomes (Corcolon *et al*., 2014). Hence, standardization of crude turmeric rhizome is important to select appropriate genotype and this will be helpful to breeders and all researchers from different field related to curcuma spp. So, considering these views, the present investigation is formulated to estimate curcumin content from turmeric accession of North East India.

MATERIALS AND METHODS

Plant material. The present study evaluated 17 different turmeric accessions collected from different locations of North East India (Table 1). The study on curcumin content estimation was carried out in the laboratory of plant molecular biology and biotechnology, School of Crop Improvement, Central Agricultural University, Imphal.

Table 1: List if turmeric genotype used for study.

Sr. No.	Genotype	Collected From	Curcumin Percentage	MEAN±S.E.
1.	Lachin	Jaintia Hills	8.91 %	1.85±0.03
2.	Megha turmeric 1	CoA, CAU, Imphal	8.33 %	1.40±0.01
3.	Lakadong	CoA, CAU, Imphal	7.7 %	1.22±0.01
4.	Charmit	Jaintia Hills	6.79 %	1.14±0.03
5.	Nirguli turmeric	Papumpare,Arunachal Pradesh	6.98%	1.17±0.03
6.	Local III	CoA, CAU, Imphal	6.00 %	1.01±0.06
7.	Kedaram	CoA, CAU, Imphal	5.51 %	0.93±0.01
8.	Local II	Byrnihat RiBhoi	5.33 %	0.90±0.01
9.	Tripura II	AAU, Jorhat	5.13 %	0.86±0.01
10.	Assam II	AAU, Jorhat	4.71 %	0.79±0.03
11.	Tripura I	AAU, Jorhat	5.04 %	0.85±0.03
12.	Mizoram II	AAU, Jorhat	4.53 %	0.76±0.01
13.	Local I	CoA, CAU, Imphal	4.38 %	0.74±0.01
14.	Arunachal Pradesh I	AAU, Jorhat	3.09%	0.52±0.00
15.	Yai Henuman	CoA, CAU, Imphal	0.37 %	0.06±0.00
16.	Yaingou	CoA, CAU, Imphal	0.29 %	0.05±0.00
17.	Yaimu	CoA, CAU, Imphal	0.26 %	0.04±0.00

Sample preparation. In the present study quantitative curcumin estimation was done by a spectrophotometric modified method as given by Sadashivam and Manickam (2008). All samples were sliced and dried in a hot air oven. The samples were powdered using a grinder to use further in exaction. The spectrophotometric method was used for curcumin content estimation, absorbance was recorded at 425nm wavelength. A standard curcumin sample was purchased.

Preparation of solution. The dried rhizome powder 0.5gm weight accurately in conical flask (Round bottom, 500 ml with TS 24/29 ground joint). Add 250 ml of absolute alcohol and boil at 80°C for 4 hours, compensate for alcohol loss by adding alcohol in a flask. Cool the extract filter in a volumetric flask. Pipette 1 ml of filtered extract and dilute with 10 ml of absolute alcohol. The intensity of the extract and the standard solution was measured at 425 nm. The standard solution contains 0.0025gm of curcumin. The absorbance of 0.42 at 425nm corresponds to 0.0025gm curcumin.

Curcumin content estimation gm/100gm of turmeric powder was done by using standard formula

$$\frac{0.0025 \times \text{Absorbance at 425 nm} \times \text{volume made up} \times \text{Dilution factor} \times 100}{0.42 \times \text{weight of sample} \times 1000}$$

Apparatus: Flask (Round bottom, 500 ml with TS 24/29 ground joint). Condenser (Graham, coiled distillate type, drip tip, Interchangeable inner and outer joint. TS 24/29 ground joint, 500-650mm in length).

Instrument: Grinder, Spectrophotometer, Pan Balance, Water bath, Hot air oven, Shaker.

Sample: Turmeric powder.

RESULT AND DISCUSSION

In rhizomatous plant turmeric the rhizome having higher amount of curcumin which is preferred by consumers for different purposes. In present investigation the turmeric accession collected from North East region and analyzed for curcumin content. Result revealed that accession from Meghalaya has a comparatively higher percent of curcumin than other parts of North East India. Parallel observation was given by Geethanjali *et al*., (2016), they noted variation in curcumin content may due to geographical variation such as climatic condition, soil and environment. The curcumin content estimated in present study was observed in different range i.e., 0.29 – 8.9% according to their geographical area (Table 1). The curcumin is higher in Lachin turmeric (8.9%) followed by Megha turmeric (8.3%). Megha turmeric is developed from clonal selection of Lakadong turmeric (7.7%) of Meghalaya. The lowest curcumin content obtains in Yaimu (0.29%) collected from CoA, CAU, Imphal (Fig. 3). The curcumin content was higher in the present study as compared to the previous study given by Sahoo *et al.,* (2017). Sahoo observed lower curcumin percentage that may because of extraction conditions used acetone whereas, absolute alcohol was used in the present study. The different range of curcumin percent of turmeric observed as compare to Ramkumar *et al.,* (2020) study, as the geographical condition were different the samples used in previous study maintained in center for Biotechnology, Odisha. The researcher Kamble *et al.,* (2011) analyzed curcumin content in Krishna, Salem, Rajapuri, and Pratibha varieties of turmeric they extracted curcumin using absolute alcohol, acetone, hexane, and HPLC method and reported curcumin (3.9±0.0038) percent whereas, Arya *et al.,* (2016) described HPLC method for the curcumin percent determination in turmeric accession similarly present study curcumin estimated using absolute alcohol. The result from Arya *et al*., (2016) showed that curcumin percent was ranging from 1.51 ± 0.5 to 3.26 ± 0.4 whereas, in present study results showed difference in curcumin percent which may because of geographical condition and method used for extraction. Singh *et al.,* (2013) studied 11 turmeric varieties for curcumin content analysis using a spectrophotometric method and obtained curcumin percent for Megha (7.5%) and Kedaram (5.3%) genotype which was similar to our study (Fig. 3). As a general observation in present study, the colour of dried rhizome and its powder varied from white-yellow to reddish-yellow (Fig. 1). The Lachin rhizome has high pigmentation and curcumin content as compared to other turmeric accessions i.e., reddish yellow colour. The Megha and Lakadong observed with bright yellow colour rhizome. The lowest curcumin content accession Yaimu observed with white-yellow colour of rhizome. The variation in rhizome colour showed variation in curcumin content as the rhizome colour intensity increases from light yellow to reddish yellow the curcumin content of rhizome also increases (Fig. 2) similar study was done by Pal *et al.,* (2020). It revealed direct association of curcumin content and rhizome colour.

Fig. 1. Turmeric accessions powder showing colour difference: the colour of dried rhizome and its powder varied from light yellow to reddish yellow. Correlating the biochemical observations and colour, it reveals that more colour in general has higher curcumin content than observed in light colour rhizome.

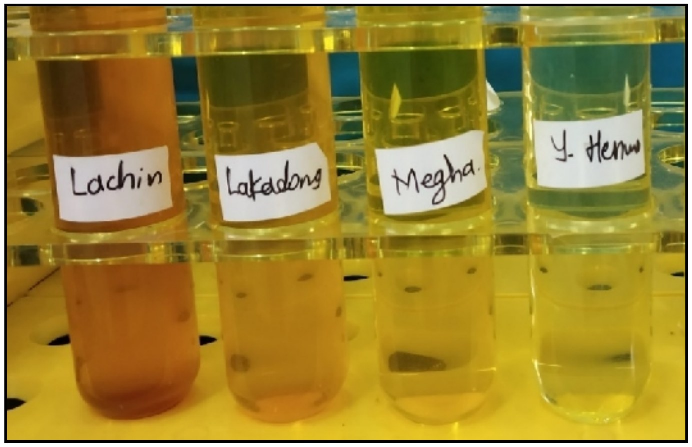

Fig. 2. The different colour intensity of the curcumin containing genotypes obtained after 4 hours of continuous heating with absolute alcohol by using condenser (Graham, coiled distillate type, drip tip, Interchangeable inner and outer joint. TS 24/29 ground joint, 500-650mm in length).

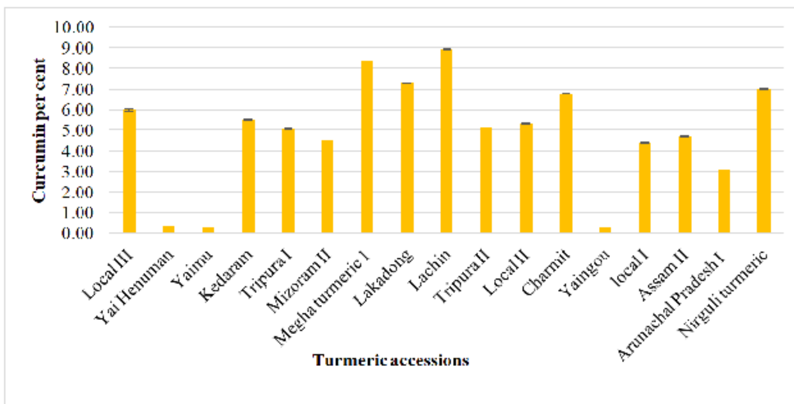

Fig. 3. Graphical representation of curcumin percentage in turmeric accessions.

CONCLUSION

In the present study, Lachin variety was identified with higher curcumin content which could be used as a valuable resource for further breeding programs for the improvement of the curcumin content in cultivars. The Lachin (8.9%) genotype has the highest curcumin percentage followed by Megha (8.3%) and Lakadong (7.8%). The turmeric accessions derive their quality mark depending on their curcumin content which could be judged by the appearance of their representative colour. A darker colour such as the reddish yellow observed in Lachin answered the higher percentage of curcumin found during the biochemical analysis while the white-yellow in Yaimu was found to be one of the least in this character. The present investigation concluded that Lachin genotype has highest curcumin content of 8.9 over the confirmed Lakadong species having 7.5 curcumin content. Yet, further evaluation is necessary to validate the present discovered results. However, further study needs to be carried out on this aspect.

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Conflict of Interest. As a corresponding author, I S.G. Magar, confirm that no-one else have any conflicts of interest associated with this publication.

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