Chapter 5

Qualitative phytochemical analysis of *Curcuma angustifolia* Roxb.

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Abstract

Qualitative phytochemical analysis is carried out using two extracts of *Curcuma angustifolia* rhizome, which is a less known nutraceutical plant of Odisha. Results revealed that the aqueous and ethanolic extracts have diverse secondary metabolites like tannin, saponin, flavonoids, alkaloids, etc. The present study revealed that *C. angustifolia* rhizome can be a future nutraceutical and pharmaceutical agent.

Keywords: Future medico-food, nutritious plant, pharmaceutical, secondary metabolites

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Introduction

India is perhaps the largest hub of medicinal plants and is called the botanical garden of the world. Medicinal plants are playing a very active role in traditional medicines for the treatment of various ailments (Sharma et al. 2019). However, a key obstacle that has hampered the promotion of the use of alternative medicines in developed countries is the lack of documentation and the absence of stringent quality control measures. There is a need for a record of all the research work carried out on traditional medicinal plants in the form of documentation. As only a few studies have been done on this plant, the purpose of the current investigation is to make accessible up-to-date information on the morphology, therapeutic uses, phytochemistry, and pharmacological

activities of the available parts of *Curcuma angustifolia* Roxb (*C. angustifolia*). *C. angustifolia* is a fast-growing annual rhizomatous herb. It is a perennial and a flowering plant with modest and small spiked inflorescences and belongs to the Zingiberaceae family (Sharma 2012). This species is distributed throughout central, southern, and eastern India, but is most reported from the northeast and western coastal plains and hills of India (Srivastava et al. 2006). The plant occurs as wild growth in hilly tracts of Maharashtra, Andhra Pradesh, Himachal Pradesh, Odisha, Chhattisgarh, West Bengal, and Tamil Nadu. It is often found at the edges or clearings of forests (Elias et al. 2015). *C. angustifolia* has edible properties and is used as a nutritional source of starch for Indian foods. It is easily digestible and highly nutritious, and it is recommended for infants and weak children. This species also has significant medicinal values, especially the essential oil of *Curcuma* species, which possesses a wide variety of pharmacological activities including anti-inflammatory, antibacterial, antidiabetic, antiulcerogenic, antimicrobial, antiproliferative, etc. (Sharma et al. 2019). The present study enumerates the morphological, ethnobotanical, and pharmacological importance of *C. angustifolia* for sustainable utilization and conservation measures.

Morphology

C. angustifolia is a rhizomatous, slender branched herb grows 90-180 cm in height with fleshy cylindrical rhizome and small rootstock. The stems are usually short, replaced by pseudo stems formed by leaf sheaths. Leaves are typically simple, glabrous, appear in an opposite arrangement and are deciduous (Sharma et al. 2019). The leaves also smell and taste similar to turmeric. It has small spiked inflorescence of three or four yellow, funnel-shaped flowers. The fruit is capsule, fleshy or dry, sometimes berrylike. The seeds are reddish-brown colour, small, and arillate. The rhizome of *C. angustifolia*, can grow up to 1.5 m in length (Brahmam and Saxena 1994).

Methodology

Collection of plant materials and preparation of extracts

The rhizomes of Palua were collected from the agricultural fields of Nayagarh district, Odisha in the February 2024. The collected rhizomes were thoroughly washed with distilled water and dried. Dried parts were powdered and stored for phytochemical analysis. Macerated method was adopted to get aqueous and ethanol extracts and qualitative analysis was carried out using standard method (Kumar et al. 2017). During field works,

food and economic values are noted down after discussion with local communities.

Qualitative analysis of bioactive components

Phytochemical tests were carried out of the different extracts (Figure 1), using standard procedure to identify the bioactive components present (Figure 3) (Devi et al. 2023).

Test for tannin

1 ml of filtrate of the rhizome extract was taken, 2-3 drops of 0.1% lead acetate solution was added. The creamy gelatinous precipitate confirmed the presence of tannin.

Test for saponin

1 ml of filtrate of the rhizome extract was taken and mixed with 1 ml of distilled water then shaked vigorously. The formation of persistent froth after shaking indicate the presence of saponin.

Test for terpenoids

1 ml of the filtrated plant extract was taken, added 6 drops of chloroform and placed it in water bath for few minutes. Then added 6 drops of sulphuric acid to it. The reddish-brown interface confirmed the presence of terpenoids.

Test for flavonoids

1 ml of filtrate of the plant extract was taken, added 2 % NaOH solution and 3 drops of sulphuric acid. The colour initially turned an intense yellow colour with NaOH solution and later became colourless. This colour change indicating the presence of flavonoids.

Test for phenolic compounds

1 ml of filtrate of the rhizome extract was taken. Few drops of Ferric chloride solution were added. The dark bluish black colour provides the confirmation of phenolic compounds presence.

Test for alkaloid

1 ml of filtrate of the rhizome extract was added with 3 to 4 drops of Dragendroff's reagent. The formation of reddish-brown precipitate confirmed the presence of alkaloids.

Test for reducing sugars

1 ml of filtrate of the rhizome extract was taken and 2 drops of Fehling's solution A followed by Fehling's solution B were added and kept it in water bath for some time. The formation of red orange precipitate confirmed the presence of reducing sugar.

Test for steroids

1 ml of filtrate of the rhizome extract was used. 1 ml chloroform and 1 ml of concentrated sulphuric acid were added into it. The presence of upper red and lower yellow with green fluorescence provides the positive result for the presence of steroid.

Test for carbonyl compounds

1 ml of filtrate of the rhizome extract was taken. Added 3 to 4 drops of 2,4-DNPH (Dinitrophenylhydrazine) reagent. The formation of yellow crystals confirmed the presence of carbonyl compounds.

Results and discussion

Field surveys in Nayagarh district of Odisha state revealed that the rhizomes of *C. angustifolia* are consumed by the local people. It is not much popular in the locality of urban areas. Therefore, the phytochemical analysis of rhizomes of *C. angustifolia* was carried out. It was noticed that the aqueous and ethanolic extracts showed the presence of diverse secondary metabolites (Table 1; Plate 3). It was noticed that tannin, saponin, flavonoids and alkaloids were detected in both extracts which reflects its nutraceutical potential.

Food values

The rhizomes of *C. angustifolia* are the primary source of its nutritive and medicinal properties. This species has nutritional value as a source of starch for Indian foods. It has been reported to be a rich source of proteins and carbohydrates and are used in culinary preparations as vegetables (Plate 1) and food appetizers (Rajkumari and Sanatombi 2017). Its rhizomes are typically ground into flour which can then be mixed together with milk or water to form a nutritious meal (Sharma et al. 2019).

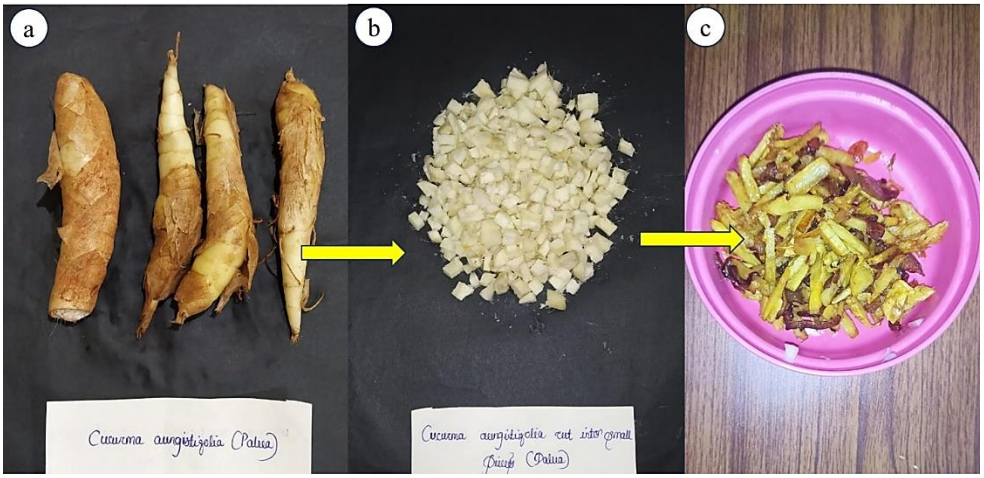


Plate 1: (a) rhizome of *C. angustifolia*, (b) cut into small pieces and (c) cooked dish of Palua



Plate 2: Economic values of Palua in Odisha, farmers sell it for livelihood

Table 1: Qualitative phytochemical analysis of *C. angustifolia* rhizome extracts

Bioactive compounds	Solvents	
	Aqueous	Ethanol
Tannin	+ve	+ve
Saponin	+ve	+ve

Flavonoids	+ve	+ve
Terpenoids	-ve	-ve
Phenolic compounds	-ve	-ve
Reducing sugars	-ve	-ve
Steroids	-ve	-ve
Alkaloids	+ve	+ve
Carbonyl compounds	-ve	-ve

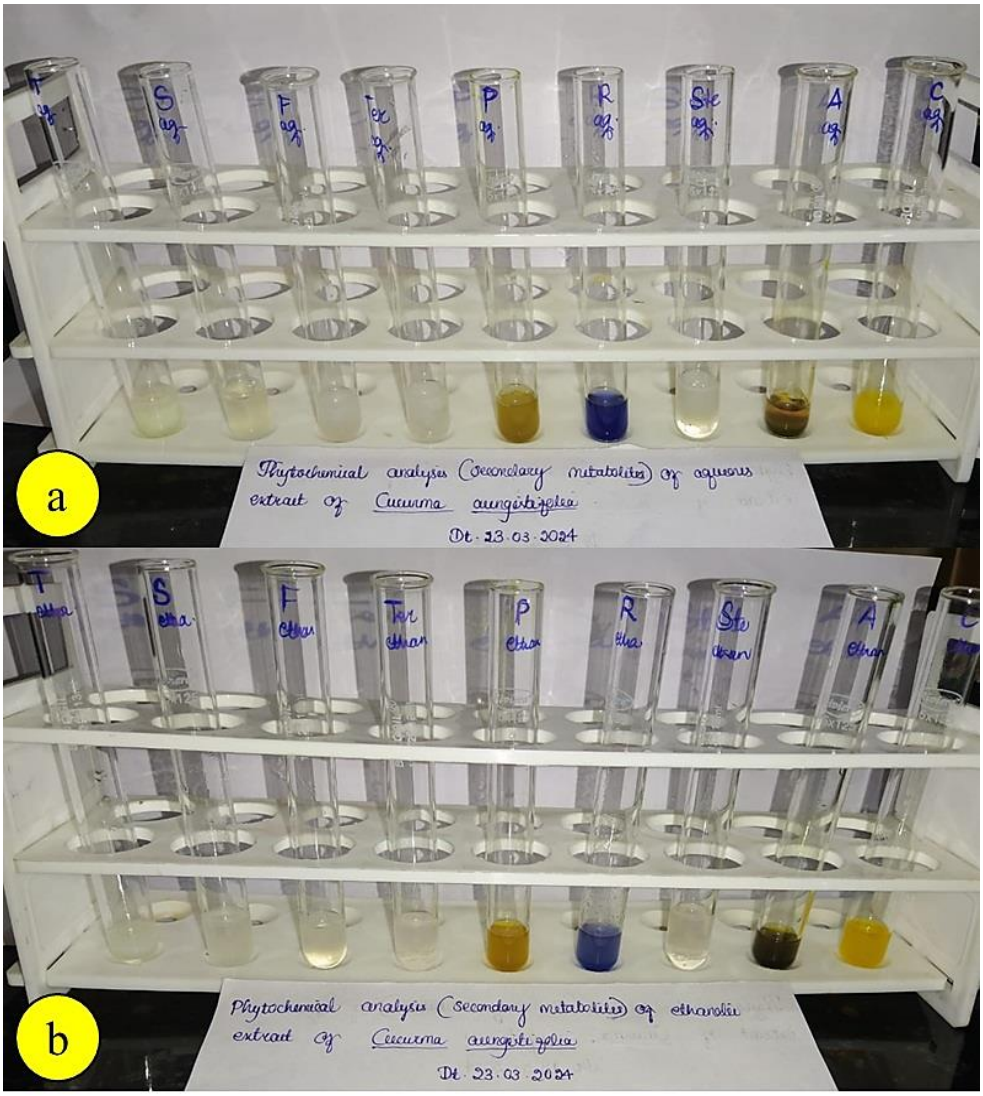


Plate 3: Phytochemical analysis of (a) aqueous & (b) ethanolic extract of rhizome of *C. angustifolia*

Folklore uses

In Ayurveda, it is used to improve strength, immunity, bleeding disorders, jaundice, liver diseases, asthma (Sharma et al. 2019). The root stock is used as tonic. It is useful in leprosy and burning sensation. The essential oil extracted from different parts of this species is used for antifungal, antibacterial activities, and antioxidant activity (Jena et al. 2017).

Pharmacological values

Rhizome has pharmacological significance. In 2014, Rajashekhara and his team evaluated the acute toxicity potential against hypothermia and gastric ulcer (Rajashekhara et al. 2014). In 2015, Sheikh and co-workers studied the antidiabetic activity of methanolic extract of *C. angustifolia* (Sheikh et al. 2015). In 2017, Jena and his team studied that the leaf oil showed more antioxidant potential as compared to rhizome oil (Jena et al. 2017). In 2017 Assumi and his team evaluated antioxidant activity and antiproliferative activity of aqueous extracts of budding flowers, leaves, full bloomed flowers, and mixture of all parts of *C. angustifolia* (Assumi et al. 2017). In 2017, Jadhao and his co-workers evaluated antibacterial properties of methanolic extract of *C. angustifolia* rhizomes against bacteria such as, *E. coli* and *S. aureus* (Jadhao et al. 2017).

Economic values

The rhizome of *C. angustifolia* has commercial value which is about 60 rupees per kilogram in the local markets of Odisha (Plate 2).

Conclusion

The present study concludes that *C. angustifolia* has food, medicinal, and economic values. In contemporary situations, a lot of health problems are observed, and in this context, food like Palua is fit for our daily requirements and should be encouraged for cultivation and value addition.

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