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Preliminary phytochemical analysis of the rhizomes and leaves of *Curcuma ecalcarata*

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Abstract
Plant phytochemicals have the potential to be used as pharmaceuticals to improve human health. The first step in the drug discovery process is to analyse these molecules. In this investigation, secondary metabolites were detected in the methanol extracts of *Curcuma ecalcarata*'s rhizomes and leaves. As a result of the investigation, the extracts were found to contain terpenoids, tannins, steroids, etc.

Keywords: *Curcuma ecalcarata*, phytochemicals, terpenoids, flavonoids, phytochemical screening

Introduction
In India, traditional Ayurvedic medicine remains crucial for health care, especially among rural communities. Secondary metabolites play a very crucial role in our health by suppressing free radicals and hence alleviating its damaging effects. Almost all of the Curcuma species belonging to the Zingiberaceae family have pharmacological potentials and exploitation of their secondary metabolites will provide enhanced bioactive compounds which can be further utilised for drug development [1].
Curcuma ecalcarata L. is an endemic species of Southern ghats of India. Few compounds had been reported from its rhizomes [2].

Materials and Methods
Plant collection and extraction
Plants were collected from medicinal plant seller. It was thoroughly cleaned, chopped, dried and then ground well. A small portion of the powdered material was extracted with methanol using Soxhlet apparatus for two days. The solvent was then removed from the combined extracts. Finally, they were appropriately diluted with methanol for the phytochemical screening tests.

Preliminary phytochemical analysis
Phytochemical screening tests
The presence of various phytoconstituents in the methanol extracts of the rhizomes and leaves of *Curcuma ecalcarata* were tested by using standard chemical methods [3-7].

Detection of carbohydrates
An aliquot of the extract was boiled with Fehling's solution.

Detection of cardiac glycosides
An aliquot of the extract was added to glacial acetic acid with a drop of $FeCl_3$ followed by the treatment with con. sulphuric acid.

Detection of terpenoids
An aliquot of the extract was mixed with chloroform and added to con. H_2SO_4.

Detection of alkaloids
An aliquot of the extract was mixed with acetic acid followed by adding Dragendorff's reagent.

Detection of flavonoids
An aliquot of the extract was added to ammonia solution and then concentrated H_2SO_4 was added.

Detection of quinones
An aliquot of the extract was shaken with sodium hydroxide.

Detection of tannins
An aliquot of the extract was mixed with alc. ferric chloride solution (10%).

Detection of resins
An aliquot of the extract was added to the distilled water.

Detection of anthraquinone
An aliquot of the extract was mixed with dil. sulphuric acid. Then added benzene and NH_3.

Detection of coumarin
An aliquot of the extract was mixed with NaOH (10%).

Detection of phytosterol:
An aliquot of the extract dissolved in chloroform was treated with a few drops of conc. sulphuric acid.

Detection of steroid
An aliquot of the extract is diluted with chloroform and then treated with acetic anhydride and through the sides conc. H_2SO_4 was added.

Detection of gums, mucilages
An aliquot of the extract was mixed with absolute alcohol.

Results and Discussion
Plants are vital for medicine and contribute significantly to global health. Medicinal herbs have long been used as therapeutic aids. An understanding of the phytochemicals present in the plants may result in the development of new drugs or drug leads.
The present study investigated the phytochemical profile of the rhizomes and leaves of *Curcuma ecalcarata* in their methanol extracts. Table 1 illustrates the results of phytochemical screening tests conducted during the study.
(+) represents presence and (-) represents absence of that specific phytochemical in the extract.
A yellow precipitate of red colour indicated the presence of carbohydrates. The formation of a brown ring at the junction indicated the presence of cardiac glycosides. The appearance of a reddish brown colour at the junction pointed to the presence of terpenoids. The appearance of an orange-red precipitate in the Dragendorff's test confirmed the presence of alkaloids. For the test of flavonoids, a yellow colour indicated its presence. Tannins were detected by the presence of blue or greenish colour. The occurrence of turbidity was the indication for resins. Rose pink colouration indicated the presence of anthraquinone. For the test of coumarins, a yellow colour confirmed its presence. Phytosterols were detected by the formation of a brown colour. A blue or green ring confirmed the presence of steroids. The appearance of precipitation indicates the presence of gums as well mucilages.

Table 1: Results of the preliminary phytochemical analysis of the methanol extracts of the rhizomes and leaves of *Curcuma ecalcarata*

Phytochemicals	Methanol extract of rhizomes	Methanol extract of leaves
Carbohydrates	+	-
Tannins	-	+
Alkaloids	+	-
Terpenoids	+	-
Flavonoids	+	+
Quinones	-	-
Cardiac glycosides	-	+
Resins	+	+
Anthraquinones	-	-
Coumarins	+	+
Phytosterols	+	+
Steroids	+	+
Gums and mucilages	-	-

The study revealed that phytochemicals like carbohydrates, terpenoids, alkaloids, flavonoids, resins, coumarins, phytosterols and steroids are present in methanol extracts of the rhizomes. It was also confirmed that the methanol extracts of the leaves contained flavonoids, tannins, resins, coumarins, cardiac glycosides, phytosterols, and steroids. These phytochemicals, which are secondary plant metabolites, contribute to the biological activity of the extracts. Several environmental factors influence the presence of secondary metabolites in plants. Tannins demonstrate anticancer activity [8]. Terpenoids and steroids are vital for synthesizing synthetic compounds related to sex hormones [9]. Additionally, cardiac glycosides have a significant impact on heart function by enhancing the strength and rate of contraction, especially in cases of heart failure [10].

Conclusion
The present study provided information on the phytochemical profile of the methanol extracts of the rhizomes and leaves of *Curcuma ecalcarata*. Future research should aim to isolate the chemical components and evaluate their biological activity. Understanding the mechanism of action of the bioactive compounds may contribute to the development of phytopharmaceutical drugs or formulations that can improve health.

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