



PHYTOCHEMICAL STUDIES OF STAR FRUIT AVERRHOA CARAMBOLA L.

Botany

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ABSTRACT

The paper deals with a phytochemical investigation on the fruit of *Averrhoa carambola* L. belonging to the family Oxalidaceae. Commonly known as "star fruit". Fruits and leaves are used widely in Ayurveda preparations to pacify impaired Kapha, pitta, skin diseases, pruritis, worm infestations, diarrhea, vomiting, hemorrhoids, intermittent fever, over-perspiration, and general debility. In the present study fruits of *Averrhoa carambola* L. were screened for their phytochemical constituents following hot continuous and successive extraction by Soxhlet apparatus. A qualitative assay was done using a range of solvents. The extraction process was carried using different solvents successively in the order of increasing polarity. Qualitative analysis of the extracts using standard procedures revealed the presence of alkaloids, flavonoids, tannins, saponins, glycosides, steroids & terpenoids, phenols, coumarins, and phytosterols. Preliminary screening of phytochemicals is a valuable step, in the detection of the bioactive principles present in medicinal plants and subsequently, may lead to drug discovery and development.

KEYWORDS

Averrhoa carambola, Oxalidaceae, Star fruit, Phytochemicals.

INTRODUCTION

After decades of serious obsession with the modern medicinal system, people have started looking at the ancient healing systems like Ayurveda, Siddha, and Unani. This is because of the adverse effects associated with synthetic drugs. Herbal drugs play an important role in health care programs especially in developing countries. Ancient Indian literature incorporates a remarkably broad definition of medicinal plants and considers 'all plant parts to be potential sources of medicinal substances'. *Averrhoa carambola* L. (Oxalidaceae) also known as star fruit, is cultivated extensively in India² for its edible fruits^{3,4}. In India, the ripe fruit or its juice may be taken to counteract fever. In Ayurveda, the ripe fruit is considered a digestive, tonic and causes biliousness. It is considered one of the best Indian cooling medicines^{5, 6}. Fruits and their juice are used as antioxidant and astringent⁷. Approximately 20% of known plants have been used in pharmaceutical studies, impacting the healthcare system in positive ways such as treating cancer and harmful diseases⁸. High concentrations of phytochemicals accumulated in fruits and vegetables may protect against free radical damage⁹. Plants containing beneficial phytochemicals may supplement the needs of the human body by acting as natural antioxidants¹⁰. The consumption of fruits and vegetables has been linked with several health benefits, a result of medicinal properties and high nutritional value¹¹.

BOTANICAL DESCRIPTION

Averrhoa carambola L is a slow growing species of woody plants; it is multi-stemmed with a short trunk and best grows up to 6 to 9 m in height. It has a bushy appearance with many branches producing a broad, rounded crown and a trunk base that can reach up to 15cm in diameter^{12,13}. Fruits are usually small and dark green when unripe; but, fruits turn yellow when they are fully ripe. Usually, star-fruits are fleshy with 5 longitudinal ridges or angles and are crunchy crisp in texture. Furthermore, the fruits are star shaped when cut horizontally (Figure 1); hence, the fruit is called as Star fruit^{14,15}.

Figure -1 *Averrhoa Carambola* L Plant With Star Fruit

MATERIALS AND METHODS

Collection Of Plant Material

The fruits of *Averrhoa carambola* L were collected from Rural Technology Park, Rajendra Nagar Hyderabad district of Telangana state India during the month of August / September in the year 2018. The plant was authenticated by the Department of Botany, Osmania University (O.U), and the specimen was submitted to the Herbarium, Hyderabad, Department of Botany, O.U, Hyderabad (Voucher No. OU-0148).

Drying And Extraction

After cleaning the fruit they were cut into pieces (0.5—1.5×1×0.2 cm³) with the help of scissors and knives. They were left for shade drying on the newspapers for ten days. After that the fruit pieces were dried in hot air oven at 40 °C for an hour just before starting the extraction process to remove the moisture content.

Dried fruit powder was obtained through a mechanical grinder and sieved through to get the powder of uniform size. The fruit powder was extracted successively in the Soxhlet apparatus with petroleum ether at 60° C, ethyl acetate at 77° C, chloroform at 61° C, acetone at 56° C and Methanol at 65° C. The Extraction temperatures were adjusted to boiling points of solvent to allow a faster rate of cycling of fresh solvent. Six hours of duration was allocated to each solvent for hot continuous and successive extraction. All the extracts obtained were then concentrated and dried in an oven at 45 °C. Then the dried extracts were used for the phytochemical screening^{16,17}.

SCREENING OF PHYTOCHEMICALS

Various tests have been conducted qualitatively to find out the presence or absence of bioactive compounds^{18,19,20,21 and 22}.

1. Detection of Alkaloids: Extracts were dissolved in dilute Hydrochloric acid and filtered

Mayer's Test: To a 2ml ml filtrate two to three drops of Mayer's reagent were added by the side

2. Test for Flavonoids: To the test solution magnesium turnings and few drops of concentrated HCl was added and Boiled for five minutes. A red colour indicates the presence of flavonoids.

3. Test for Saponins: About 0.5g of the powdered drug was boiled gently for 2min with 20mL of water and filtered while hot and allowed to cool. 5mL of the filtrate was then diluted with water and shaken vigorously. A frothing indicates the presence of saponins.

4. Detection of Steroids & Terpenoids: Liebermann-Burchard test: To 1ml of extract, 1ml of chloroform, 2 to 3ml of acetic anhydride, and 1 to 2 drops of concentrated sulfuric acid were added. Appearance of dark green color showed the presence of steroids.

5. Test for Phenolic compounds: Small quantity of powdered sample was tested with the following reagents and the colour produced indicates the presence of phenolic compounds.

A. 5% Ferric Chloride Solution- Deep Bluish Black Colour.

B. Lead Acetate Solution-white Precipitate.

6. Test for Tannins: A small quantity of the powdered drug was extracted with water. To the aqueous extract, few drops of ferric chloride solution were added. A bluish black color indicates the presence of tannins.

7. Test for Glycosides: The substance was mixed with a little anthrone on a watch glass. One drop of concentrated sulphuric acid was added, made into a paste and warmed gently over a water bath. A dark green coloration indicates the presence of glycosides.

8. Detection of Coumarins: 3ml of 10% NaOH was added to 2ml of aqueous extract. Yellow coloration of the contents indicated the presence of Coumarins.

9. Test for Phytosterols: A few drops of concentrated sulphuric acid were added to the extract solution, shaken well and set aside. The lower chloroform layer of the solution turning red indicates the presence of phytosterols.

10. Detection of Quinones: Dilute NaOH was added to 1ml of crude extract, blue green or red coloration indicated the presence of quinones.

11. Detection of Resins: To 2 ml of extract, 5-10 drops of acetic anhydride was added, dissolved by gently heating and then 0.5ml of Sulphuric acid was added. Bright purple color was produced indicating the presence of resins.

RESULTS AND DISCUSSION

Qualitative assay of the fruit of *Averrhoa carambola* L revealed the presence of diverse group of phytochemicals. The results are presented in table.1 and figure 2B to enable their comparative study with respect to the solvents used for extraction. Phytochemical screening revealed that the presence of alkaloids in ethyl acetate, acetone and methanol extracts where as saponins detected in acetone and methanol extracts, while steroids & terpenoids were positive in chloroform, ethyl acetate and methanol extracts, phenols and coumarins were identified in all the extracts, tannins were present only in ethyl acetate and methanol extracts, glycosides were identified in all the extracts but except petroleum ether and phytosterols present in ethyl acetate and acetone extracts only, while quinones and resins were absent in all extracts (Table - 1). Extraction process using the solvent, ethyl acetate could yield most of the phytochemicals, followed by methanol extract, acetone and chloroform.

The results differed depending upon the solvent used for extraction. Quite a number of biologically active phytochemicals were identified in the extraction by the method followed for extracts and screening tests done (Figure 2&3).



Figure: 2& 3 A. carambola L Phytochemical crude extracts and test tube tests

Table-1: Phytochemical Analysis Of *Averrhoa Carambola* L

S. NO	Pyto. Name	Pet. ether	Chloroform	Ethyl acetate	Acetone	Methanol
1	Alkaloids	-	-	+	+	++
2	Flavonoids	-	+	+++	+	+
3	Saponins	-	-	-	++	+++
4	Steroids & Terpenoids	-	++	++	-	+
5	Phenols	+	+	+++	+	++
6	Tannins	-	-	+	-	+
7	Glycosides	-	+	+	+	+
8	Coumarins	+	+	+	+	+
9	Phytosterols	-	-	+	+	-
10	Quinones	-	-	-	-	-
11	Resins	-	-	-	-	-

“+”= present; “-”= absent

CONCLUSIONS

Averrhoa carambola is a plant with diverse potentials. Numerous phytochemical studies have been conducted on fruit, the chemical constituents of the fruit attests that it can be a potential source of future drugs and vital for good health. The outcome of the analyses will certainly facilitate their quantitative estimation and isolation of pharmacologically active chemical compounds.

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