



## PHARMACOGNOSTIC EVALUATION AND PHYSICOCHEMICAL ANALYSIS OF *AVERRHOA CARAMBOLA* L. FRUIT

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**ABSTRACT:** In Ayurveda, the ripe fruit of *Averrhoa carambola* L. (commonly known as "Kamarakh") is considered as digestible, tonic strengthening, for bleeding piles and causing biliousness. The dried fruit is also used in fever; it is cooling and possesses antiscorbutic properties. It is considered as one of the best Indian cooling medicines. An attempt has been made to highlight this medicinal fruit through the pharmacognostic studies. The preliminary phytochemical analysis has also been performed on the powdered fruit. The presence of trichomes and large oval lysigenously formed cavities as seen in the transverse section of fruit were the distinguishing features and can be used as anatomical markers. During maturity stage the maximum increase in length and diameter was recorded and their external colour changes from green to golden yellow. The water-soluble and alcohol soluble extractive values decreased gradually with ripening of fruit. Preliminary phytochemical analysis indicated presence of saponins, tannins, alkaloids and flavonoids.

**Key words :** *Averrhoa carambola* L. fruit, pharmacognostic evaluation, preliminary phytochemical analysis.

### INTRODUCTION

After decades of serious obsession with the modern medicinal system, people have started looking at the ancient healing systems like Ayurveda, Siddha and Unnani. 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 [1]. However a key obstacle, which has hindered the acceptance of the alternative medicines in the developed countries, is the lack of documentation and stringent quality control. There is a need for documentation of research work carried out on traditional medicines [2]. With this backdrop, it becomes extremely important to make an effort

towards standardization of the plant material to be used as medicine. The process of standardization can be achieved by stepwise pharmacognostic studies [3]. These studies help in identification and authentication of the plant material. Correct identification and quality assurance of the starting materials is an essential prerequisite to ensure reproducible quality of herbal medicine which will contribute to its safety and efficacy. Simple pharmacognostic techniques used in standardization of plant material include its morphological, anatomical and biochemical characteristics [4]. *Averrhoa carambola* L. (Oxalidaceae) also known as star fruit, is cultivated extensively in India [5] for its edible fruits [6, 7]. In India, the ripe fruit or its juice may be taken to counteract fever. A salve made of the fruit is employed to relieve eye afflictions. In Brazil, the carambola is

recommended as diuretic in kidney and bladder complaints. In Chinese Materia Medica it is used to quench thirst, increase the salivary secretion, and in fever. In Ayurveda, the ripe fruit is considered as digestive, tonic and causes biliousness. The dried fruit is also used in fever; it is cooling and possesses antiscorbutic properties. It is considered as one of the best Indian cooling medicines [8, 9]. Fruits and its fruit juice are used as antioxidant and astringent [10]. However, available literature [11-18] revealed that no pharmacognostic study has been carried out on the fruit; hence the present investigation was undertaken. The objective of the present study is to evaluate various pharmacognostic standards like macroscopy and microscopy of fruit; ash values, extractive values, microscopical characteristics of powdered fruit and preliminary phytochemical analysis of *Averrhoa carambola* L. fruits.

## MATERIAL AND METHODS

The first step in standardization of herbal drugs is the correct identification of plant, macroscopic and microscopic characters. The plant was authenticated from Blatter Herbarium, St. Xavier's College, Mumbai. The specimen of plant has been submitted to the Department of Botany (Herbal Sciences), Birla College, Kalyan for future reference (Plate 1, A). Fresh fruits of *Averrhoa carambola* L. at various stages of ripening were collected, washed under running tap water and blotted dry for further study. The fruits were classified into three apparent maturities according to their firmness, size and skin colour into (Plate 1, B): (1). Young: Firm texture and skin colour 100% green; (2). Half ripe: Firm texture and skin yellowish green; (3). Ripe: Soft texture and

skin 100% yellow. A detailed macroscopical and microscopical study of the fruit and fruit powder was carried out. The anatomical section (transverse section) and powder of the fruit were examined microscopically using the compound microscope [19]. It was evaluated and photographed (10X, 45X). The fruits were cut into small pieces and air dried. The pieces were then oven dried at  $40 \pm 2^\circ\text{C}$ , ground into coarse powder and used for further analysis. Ash values are determined to evaluate quality and purity of the crude drug that contains inorganic radicals like phosphates, carbonates, potassium, magnesium and calcium. The determination of various extractive values of powdered fruit such as water soluble extractive value, alcohol soluble extractive value, total ash content, water soluble ash content and acid insoluble ash content were carried out according to the methods described by Mukherjee [20]. Preliminary phytochemical analysis of fruit was carried out using the methods as described in Khandelwal [21]. Fluorescence analysis was conducted using methods of Kokoski [22] and Chase and Pratt [23].

## RESULTS

Macroscopic characters of fruit: The carambola fruit is a large indehiscent berry. It is an oblong, longitudinally 5-angled fruit, 7.13 cm (young) to 10.17 cm (ripe) long and 4.08 cm (young) to 5.45 cm (ripe) in diameter. The fruit is greenish and firm when young. However, the ripe fruit has a thin, smooth, translucent golden yellow skin colour and is waxy in texture. In cross section have the form of a star. The fruit has aromatic odour and the taste varies from sour (young) to mildly sweet (ripe). There may be 2-3 flat, thin brown seeds, 6-10.5 mm long or none at all.

**Table.1: Microscopical features of the powdered fruit of *Averrhoa carambola* L.**

Sr. no.	Observations	Plate 2
1.	Simple trichomes	A
2.	Fragments of parenchyma showing large, oval lysigenously formed cavities	B
3.	Sclerenchymatous Fibers	C
4.	Tannin filled cells	D
5.	Spiral thickening	E
6.	Collenchymatous cells	F

**Table.2: Physico-chemical analysis of powdered fruit of *Averrhoa carambola* L.**

No	Physico-chemical constant	Percentage (%)		
		Young	Half ripe	Full ripe
<b>1.</b>	<b>Ash Values:</b>			
a.	Total ash	5.87	5.50	6.97
b.	Water soluble ash	1.03	0.97	0.77
c.	Acid insoluble ash	0.67	0.23	0.40
<b>2.</b>	<b>Extractive values</b>			
a	Water	39.40	32.80	25.20
b.	Alcohol	44.36	15.60	13.36

**Table.3: Fluorescence analysis of powdered fruit of *Averrhoa carambola* L.**

Sr. No.	Treatment	Observation under	
		Ordinary light	U.V. light
1.	Powder as such	Brown	Dark brown
2.	Powder + Nitrocellulose	Light brown	Green
3.	Powder + 1NaOH in Methanol	Brown	Green
4.	Powder + 1NaOH in Methanol + Nitrocellulose in amyl acetate	Yellow	Green
5.	Powder + 1N HCl	Orange	Dark brown
6.	Powder + 1N HCl + Nitrocellulose in amyl acetate	Dark brown	Dark brown
7.	Powder + 1N NaOH in water	Dark orange	Blue
8.	Powder + 1N NaOH in water, dried and mounted in Nitrocellulose in amyl acetate	Dark brown	Dark brown
9.	Powder + HNO <sub>3</sub> (1:1)	Light brown	Dark brown
10.	Powder + H <sub>2</sub> SO <sub>4</sub> (1:1)	Dark brown	Dark brown

Microscopic characters of fruit: The outline of transverse section shows star shape. The pericarp shows following two distinct regions (Plate-1):

**Exocarp:** It is the outermost layer of fruit made up of thin rectangular cells with simple (plate-1,C) and glandular (plate-1,C and D) trichomes in young fruits and simple trichomes in mature fruits and three to four layers of sub epidermal collenchyma (plate- 1,E).

**Endocarp:** In young fruit it is made up of many layers of thin compactly arranged parenchymatous cells (d),

in ripe fruits large lysigenously formed cavities (plate 1,E and F)are present in parenchyma; ill developed vascular tissue (plate 1,G)is also observed in parenchymatous region.

The characteristic microscopical feature of the powdered fruit is shown in Table-1 (Plate- 2).

Physico-chemical analysis of powdered fruit viz. ash values and extractive values are presented in Table-2. The fluorescence analysis of *Averrhoa carambola* L. fruit is recorded in Table-3.

## DISCUSSION

A maximum increase in length and diameter of fruit was observed with maturity and the colour also changes from green to golden yellow. Narian *et al.* [24] recorded larger diameter of ripe fruit (5.24 cm) than that of green mature fruit (4.69 cm). Bezerra *et al.* [25] reported a range of 6.8 cm to 9.6 cm for length and 4.1 cm to 5.5 cm for diameter of fruits. Oliveira *et al.* [26] also reported length of 7.74 cm and diameter of 4.51 cm, for ripe carambola fruits. The macroscopical characters of the fruit can serve as diagnostic parameters. The microscopical studies of the transverse section showed presence of simple and glandular trichomes, which is characteristic of the family Oxalidaceae [27]. The presence of trichomes and large oval lysigenously formed cavities as seen in the transverse section of fruit were the distinguishing features and can be used as anatomical markers. The extractive values are useful to evaluate the chemical constituents present in the crude drug and also help in estimation of specific constituents soluble in a particular solvent [3]. In the present investigation water-soluble and alcohol soluble extractive values decreased with maturity of fruit. Preliminary phytochemical analysis indicated presence of saponins, tannins, alkaloids and flavonoids. In last four decades the scientists are keen to evaluate many plant drugs used in medicinal folk lore. It is due to their specific healing properties, healthy action and non-toxic effects [28]. In this dimension pharmacognostic studies on *Averrhoa carambola* L. fruit is a substantial step and it further requires a long-term study to evaluate pharmacological action as well as therapeutic efficacy and toxicity of fruit to establish as the drug. The pharmacognostic study of the *Averrhoa carambola* L. fruit has been carried out for the first time. This could also serve in the identification and preparation of a monograph on the plant.

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