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RESEARCH ARTICLE

Pharmacognostical analysis of seeds of *Carica papaya* Linn. and *Momordica charantia* Linn.

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Abstract The use of botanical resources is on an increase all over the world. It is known that almost 80% of the populations in the developing countries rely on traditional medicine, mainly comprising herbal formulations and preparations. Various plant metabolites are being explored and utilized for treatment of diseases and ailments. Recently, efforts are being made to popularize and utilize whole plant parts, fruits, roots, bark, peel, seeds and pulp to maximize yield and avoid wastage. Also, the differences in their chemical composition and total amount of phyto-contistuents present allows us to shortlist and select the plant parts according to our needs and objectives for a particular study. In the current study, seeds of *Carica papaya* Linn. (Family: Caricaceae) and *Momordica charantia* Linn. (Family: Cucurbitaceae) are worked upon for their pharmacognostic and phytochemical characteristics. These characters like macroscopy, microscopy, and powder study can be employed for quality control of entire or powdered drugs that are available in the market. Also their physico-chemical constants like ash values, extractive values, fluorescence analysis and presence of phytochemical constituents are analyzed so as to put forth reliable standards for specific plant parts such as the seeds which have immense therapeutic benefits of their own. Every result is analyzed in triplicate and a standard range of readings is put forth for convenient future referencing.

Keywords: Ash values*,* *Carica papaya* seeds, *Momordica charantia* seeds, extractive values, fluorescence analyses

Introduction

The use of botanical resources and therapies is on the rise all over the world. Current estimates indicate that approximately 80 million people worldwide still depends on plants for their health & nutritional needs and about 95% of modern drugs have been isolated from traditional medicinal plants. Thus extensive and accurate work on the nature of these natural drugs, their physico-chemical constants, phytochemical constitution, variation in these parameters with respect to the part of the plant used, becomes indispensible.

Carica papaya Linn. (Family: Caricaceae) commonly called as 'Papaya' is found in all tropical and sub-tropical parts of the world. It is a rich source of Vitamin A, B, C and proteolytic enzymes like papain and chymopapain which have anti-fungal and anti-bacterial properties. It is used in the treatment of skin diseases like warts, corns, sinuses, eczema, cutaneous tubercles, glandular tumors and conditions such as high blood pressure, dyspepsia, constipation, and amenorrhoea. It is also used to expel worms and stimulate reproductive organs (Aravind *et al*. 2013). The seeds are especially said to inhibit spermatogenesis and suppress caudal sperm motility. They are also effective to control diabetes, hypertension and hypercholesterolemia. *Momordica charantia* Linn. (Family: Cucurbitaceae) commonly known as 'Bitter melon', grows widely throughout tropical and sub-tropical regions of India. The plant has been used extensively for treatment of diabetes, hypertension, obesity, cancer, bacterial and viral infections owing to the presence of various important chemical constituents such as cucurbitanes, cucurbitacines, other essential oils, fatty acids, amino acids and sterols (Bortolotti *et al*. 2019). The whole plant, especially the seeds and the fruits of *M. charantia* have significant pharmacological effects namely anti-diabetic, abortifacient, anthelminthic, anti-malarial, laxative and contraceptive. Fractions of *M. charantia*, such as fruits, vines, leaves and even roots have been used in folk medicine since ages.

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(Jia *et al.* 2017).

In the current study, seeds of *C. papaya* Linn. (Family: Caricaceae) and *M. charantia* Linn. (Family: Cucurbitaceae) are worked upon for their pharmacognostic and phytochemical characteristics. This study attempts to establish standardised pharmacognostic values for various aspects of further pharmacological and phytochemical investigations involving the seeds of *C. papaya* and *M. charantia*.

Materials and methods

Both the fruits were collected from local fruit and vegetable market in Mumbai. They were authenticated from Blatters Herbarium, Mumbai. (Accesion number for *C. papaya*: KGM-1079 and Accession number for *M. charantia*: 3800) The seeds of *C. papaya* were taken after separation from the ripe fruit pulp and were shade dried for 3-4 days. The seeds of *M. charantia* were removed by separation from the raw fruit pulp and were shade dried for 3-4 days. They were then powdered using a mixer grinder and stored in air tight glass containers for further analysis.

Transverse sections of the fresh seeds were studied for their microscopy using standard methodology by Johanson, D. A. O. (1940). For macroscopy studies, the measurements were taken using vernier callipers and ruled scales. Powder study was carried out using methods prescribed by Wallis (1984). Preliminary Phytochemical screening for detecting presence of various primary and secondary metabolites were carried out using standard methods suggested by Harborne (1973). Physico-chemical parameters like ash values, extractive values, moisture content were assessed using standard protocols from Indian Pharmacopoeia (1996). Fluorescence analyses were done using method prescribed by Chase and Pratt (1949), Kokoski (1958) and observed at the UV wavelength of 254 nm.

Observations

Microscopy:

a) T. S of *C. papaya* Linn. seed (Figure 2a.): It shows presence of epidermis which is made up of single layer of thin-walled polygonal cells which become slimy when in contact with water. Next is ridged epidermis of testa covered with thick cuticle underneath the ridge lies exotesta of dark brown coloured, suberised and thick walled polygonal cells of various sizes, each embedded with a small cavity in the wall at the corner, followed by a broad, continuously running band of small sized brown coloured isodiametric spherical cells of mesotesta; endotesta is composed of an outer layer of big sized somewhat squarish cells, each embedded with a large prismatic crystal of calcium oxalate. This is followed by a layer of compactly arranged thick walled sclereids and stone cells followed by 2 to 3 rows of tangentially running thick walled fibres. The cells of inner epidemis of the testa are isodiametric. Faintly striated and with dark brown contents; endosperm is wide, parenchymatous and is embedded with oil globules, aleurone grains and very few, occasional simple starch grains. Cotyledon is narrow consists of upper and lower epidermis enclosing 4 to 6 rows of mesophyll cells embedded with oil globules, small sized aleurone grains and at places small vascular bundles.

Table 1: Macroscopy of the seeds

Sr. No.			*C. papaya* Figure 1A	*M. charantia* Figure 1B
1	Size	Length	0.72 cm	1.54 cm
		Breadth	0.47 cm	0.84 cm
		thickness		0.43 cm
2	Shape		Spindle shaped	Ovoid, nearly flat with a pointed tip
3	Margin		corrugated	Wrinkled
4	Hilum		raised	raised
5	Surface		Rough somewhat slimy	rough
6	Weight of 100 seeds		1.63 g	11.52 g
7	Organoleptic characters	Colour	Dark brown	White to pale yellow
		Odour	odourless	Bitter
		Taste	tasteless	Very bitter

b) T. S. of *Momordica charantia* Linn. seed (Figure 3a.): It shows the compact cellular arrangement of aril, cotyledon, epidermis, embryo, endocarp, endosperm and perisperm. It consists of outer epidermis of palisade cells with thick cuticle; subepidermal layer consisting of 3 to 4 rows of small isodiametric cells, followed by thick-walled tangentially elongated sclerenchymatous layer. Spongy parenchyma containing starch grains is seen just beneath this layer. Perisperm is narrow and it consists of collapsed cells, endosperm is one layered containing oil and aleurone grains, followed by tissue of the cotyledon.

Powder study

a) Carica papaya Linn. (Figure 2b, 2c, 2d, 2e, 2f,2g): The powder shows presence of Fibres from endotesta, fragments of endotesta, exotesta and mesotesta in surface view; fragment of endosperm in surface view embedded with oil globules and aleurone grains; transversely cut fragment of cotyledon.

b) Momordica charantia Linn. (Figure 3b, 3c,3.d, 3e, 3f): The powder shows presence of simple starch grains scattered as such, palisade like cells of the epidermis of testa and spongy parenchymatous cells containing starch grains, hexagonal thick walled cells of testa and prismatic crystals of calcium oxalate scattered.

Table 2: Preliminary phytochemical study

No.	**test**	***C. papaya***						***M. charantia***					
	+ for present, - for absent.	w.e	e.e	c.e	p.e	b.e	h.e	w.e	e.e	c.e	p.e	b.e	h.e
1	Test for alkaloids												
a.	Dragendroff's reagent	-	+	-	-	-	-	-	+	-	-	+	-
b.	Wagner's reagent	-	+	-	-	-	-	-	+	-	-	+	-
c.	Mayer's reagent	-	+	-	-	-	-	-	+	-	-	+	-
2	Test for proteins												
a.	Ninhydrin test	-	-	+	-	-	-	-	-	+	-	-	-
b.	Millon's test	-	-	+	-	-	-	-	-	+	-	-	-
c.	Biuret's test	-	-	+	-	-	-	-	-	+	-	-	-
3	Test for tannins												
a.	Potassium dichromate test	+	-	-	-	-	-	+	-	+	+	-	-
b.	$FeCl_3$ test	+	-	-	-	-	-	+	-	+	+	-	-
4	Test for sugars												
a.	Benedict's test	+	+	+	-	-	-	+	+	+	-	-	-
b.	Fehling's test	+	+	+	-	-	-	+	+	+	-	-	-
c.	Mollish's test	+	+	+	+	+	-	+	+	+	+	+	-
5	Test for steroids												
a.	Salkowski's test	-	-	+	+	+	+	-	+	+	+	+	+
b.	Liebermann Burchard's test	-	-	+	+	+	+	-	+	+	+	+	+
6	Test for flavanoids												
	Lead acetate test	-	-	-	-	-	-	-	-	-	-	-	-
7	Test for glycosides												
a.	NaOH reagent	-	-	+	+	+	+	-	+	+	-	+	+
b.	Kellar Killani's test	-	-	+	-	-	-	-	-	+	-	+	+
8	Test for Quinones												
	Conc. H_2SO_4	-	-	-	-	-	-	-	-	-	-	-	-
9	Test for Terpenoids												
	Tin and Thionyl chloride	-	-	-	+	+	-	-	-	-	+	+	-
10	Test for Diterpenes												
	Copper Acetate test	-	-	-	-	+	-	-	-	-	-	+	-
11	Test for Saponins												
	Foam test	-	-	-	-	-	-	-	-	-	-	-	-
12	Test for triterpenoids												
a.	Salkowski's test	-	-	+	+	+	+	-	+	+	+	+	+
b.	Liebermann Burchard's test	-	-	+	+	+	+	-	+	+	+	+	+

Key: w.e.: Aqueous extract, e.e.: Ethanolic extract, c.e.: Chloroform extract, p.e.: Petroleum ether extract, b.e: Benzene extract, h.e: Hexane extract.

Physico-chemical studies

Table 3: Ash values of dried seed powders.

Sr. no	**Name**	**Total ash (not more than)**	**Acid insoluble ash (not more than)**	**Water soluble ash (not more than)**
1.	*C. papaya*	6.0%	1.0%	2.0%
2.	*M. charantia*	3.0%	1.0%	2.0%

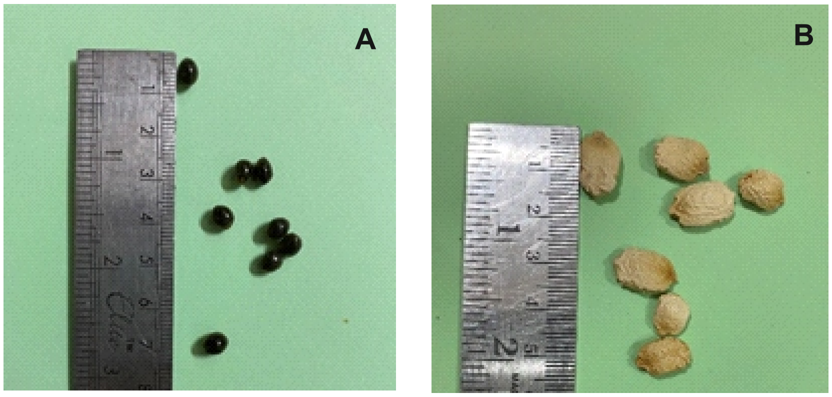

Figure 1 (A-B): A. *Carica papaya* seeds, **B.** *Momordica charantia* seeds

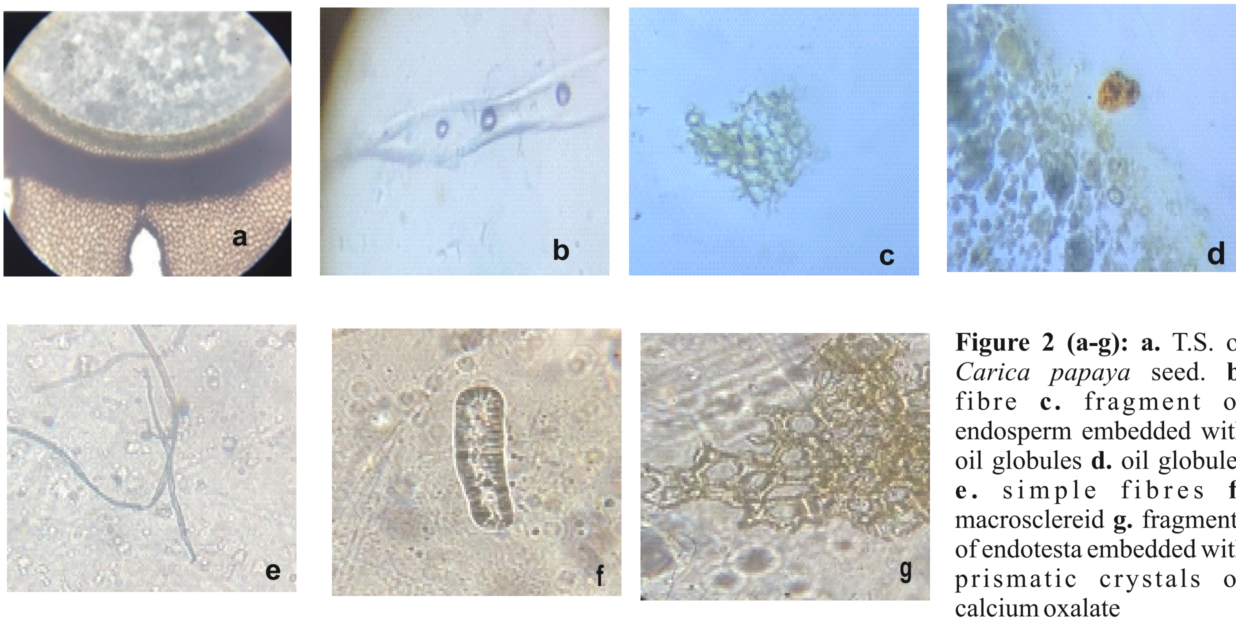

Figure 2 (a-g): a. T.S. of *Carica papaya* seed. **b.** fibre **c.** fragment of endosperm embedded with oil globules **d.** oil globules **e.** simple fibres **f.** macrosclereid **g.** fragments of endotesta embedded with prismatic crystals of calcium oxalate

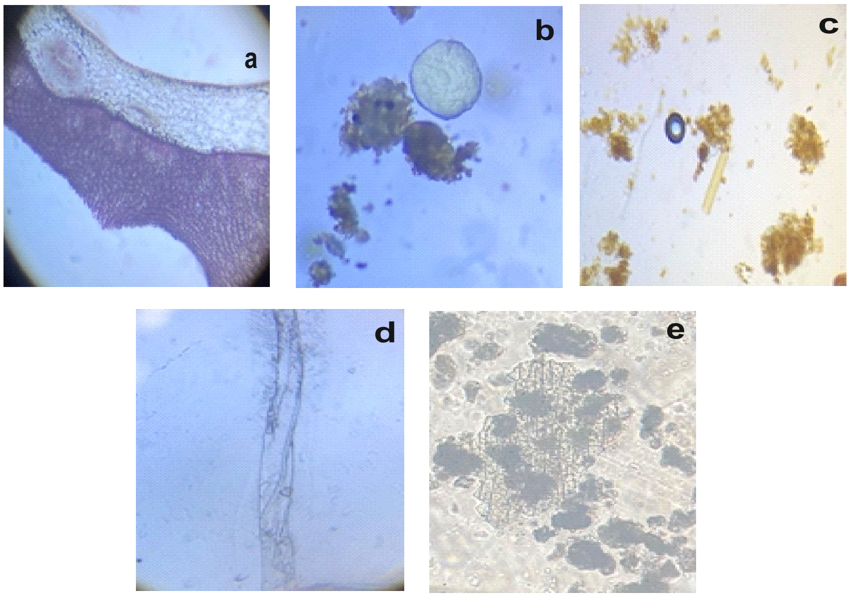

Figure 3 (a-e):a. T.S. of *Momordica charantia* seed.**b.** oil globule **c.** simple vessel and parenchyma **d.** fibres **e**. epidermal cells of pericarp

Table 4: Moisture content of the dried seed powders

Sr. no	Name	% moisture (not more than)
1.	*C. papaya*	2.0%
2.	*M. charantia*	1.0%

Table 5: Extractive values of the powdered drugs

Sr. no	Extraction solvent	***C. papaya*** **(not less than)**	***M. charantia*** **(not less than)**
1.	Water	20%	30%
2.	Ethanol	10%	50%
3.	Chloroform	10%	20%
4.	Petroleum ether	30%	30%
5.	Benzene	20%	20%
6.	Hexane	10%	20%

Table 6: Fluorescence analysis

Name	I	II	III	IV	V	VI	VII	VIII	IX
C. papaya	B 35	Bp36	By36	B 36	Bp36	B 34	By36	By25	By35
M. charantia	By27	Gb46	Yg36	Yb26	By26	By26	By36	Gb15	Bg36

Key

Prominent colours	Modifying colours	Quality of colours	Degree of radiance
Y- Yellow	y- yellowish	1- Very light	5-very bright
G- Green	g- greenish	2- Light	6- bright
B- Blue	b- bluish	3- Dark	7- dull
	p- purplish	4- Very dark	8- very dull

Discussion and conclusion

As these seeds of *C. papaya* and *M. charantia* are found to be very promising in various pharmacological and clinical studies, it calls for more systematic research of these plants and their active constituents. Studies on the seeds of *C. papaya* have earlier been carried out by Donga S. et. al, from Saurashtra, Gujarat and their analysis of the physicochemical parameters showed ash and extractive values in the same range. Pharmacognostic analysis of the seeds of *M. charantia* have been previously done by Rakh M. et. al., from Salem, Tamil Nadu and the standard values put forth for physicochemical parameteres showed slight variation from our studies. This difference in the ash values and moisture content values in the seed powders of same species can be attributed to the variation in the geographical and climatic factors on the sample materials. Extractive values of both the seed powder in solvents like ethanol, Benzene, Hexane, Chloroform and Petroleum ether in addition to commonly used water, ethyl acetate, toluene, etc determined by this study also gives us an idea of the feasibility of extraction procedures in case required for particular metabolites. Different pharmacognostical and phytochemical characteristics are said to work through specific and non-specific mechanisms. However, extensive and in-depth research is required to evaluate the precise mechanism, active principles, and the safety profile of the plant as a remedy for different health conditions. Pharmacopoeial standards help in determining the authenticity of the crude drugs, supplied to the manufacturers through dealers. These standards include morphological as well as anatomical details along with physicochemical constants. Macroscopic characters help in identifying the plant drug during collection itself, thus reducing chances of adulteration or species in appropriation. Microscopy is another tool of major importance in case of marketed samples, where the macro morphology of the dried and processed drug is destroyed. Availability of this data for a specific plant part such as the seeds gives us an idea about the active constituents and their composition present in there alone. Study of microscopic characters, especially in the dried seed powders along with entire seed microscopy holds importance from crude raw drug analysis point of view and thus carried out for correlated confirmation. This provides us the choice between the plant parts to be used to prepare a particular formulation and also improve the efficacy and reduce toxicity accordingly. As the pharmacopoeial standards for the authenticated specimens are put forth, the potential and significance of these medicinally important seeds can be further explored widely.

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