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RESEARCH ARTICLE

# Pharmacognostic Evaluation of Roots of *Benincasa Hispida* (Thunb.) Cogn.(*Cucurbitaceae*)

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**Abstract:**

***Background:***

Herbals have been proven to be offering a wide number of medicinal uses and are having multiple benefits when considered as a complete system of medicine. Benincasa plant is rich in phytoconstituents, present almost in every part of the plant. Roots are the parts on which minimum work has been done.

***Objective:***

An effort has been done for the complete pharmacognostic study of roots of *Benincasa hispida* (Thunb.) Cogn., belonging to the family *Cucurbitaceae*.

***Materials and Methods:***

The roots of *Benincasa hispida* (Thunb.) Cogn. were powdered and used for further pharmacognostic study. The study was conducted as per the guidelines of the World Health Organization which includes macroscopy, microscopy,physicochemical, phytochemical and fluorescence studies.

***Results:***

The roots are brownish yellow and exfoliating or striated with longitudinal striations. Microscopy showed the presence of plenty of starch grains, fragments of cork, prismatic crystals of calcium oxalate, a few xylem vessels with reticulate thickening and phloem fibres. The total ash was found to be 7.5% w/w. Moisture content was not more than 1%.The preliminary phytochemical studies showed the presence of alkaloids, tannins and glycosides.

***Conclusion:***

The results of the study could be useful in setting quality parameters for the identification of crude drug and preparation of the monograph.

**Keywords:** *Benincasa hispida* (Thunb.) Cogn, Physicochemical, Quantitative, Cucurbitaceae, Roots, Pharmacognostic.

## 1. INTRODUCTION:

Plants and plant-derived products have been utilized as a source of medicine for the treatment as well as prevention of various diseases from the advent of human civilization. Various traditional systems of medicine describe the role of plants in various forms of health care. Plants are a reservoir of potentially useful chemical compounds which serve as drugs and provides newer lead molecules for modern design and synthesis [1]. Benincasa, also called as ash gourd or white gourd melon is widely cultivated for its fruits in tropical Asia. It is used for its various medicinal purposes. It has

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antioxidant action due to presence of terpenes, flavanoid C, glycosides and sterols. It possesses potent antipyretic effect and is useful in fever. Its intake gives relief in constipation and urinary disorders such as its extract is used as a gastroprotective and also as an anti-oxidant. Its seed extract serves the purpose of anti-angionic agent. The methanolic extract of the plant is used as a bronchodilator. Kusmanda treated group showed decrease in ulcer index which was the result of reduction in damage to gastric mucosa by free radical scavengers [2]. The methanolic extract obtained from its fruit is used as an anti-diarrhoeal agent, while the ethanolic extract of its fruits has anti pyretic action. The leaves have a action. The seeds are used to treat intestinal worms. The fruits of Kusmanda are rich in contents as flavonoids and terpenoids, therefore is extremely useful in treatment of pitta-vikar, bleeding disorders, epilepsy, insanity and nervous disorders which is responsible for its anti-ulcer index [3]. A lot of work has been done on various parts of the plant, but there is no record of research work available on pharmacognostic parameters of the roots of the selected plant. There is a need to discover the active principles present in its roots and also the medicinal actions exerted by it. The present study was conducted to explore both morphological as well as microscopic features which will help in the identification and standardization of roots of *Benincasa hispida* (Thunb.) Cogn. The results will help in the preparation of the monograph so that the information can be used to explore the plant for its various therapeutic benefits.

## 2. MATERIALS AND METHODS

### 2.1. Plant Material

The plant material was obtained from the local rural areas of Kanpur. This plant flourishes well in the months of summer. The roots obtained were shade dried and then it was studied in its crude as well as coarsely powdered form.

### 2.2. Macroscopy

Various dried pieces of roots of the plant were taken in order to examine the macroscopic features of the roots of *Benincasa hispida* (Thunb.) Cogn (Fig. **1**). The morphological features were determined using the methods of Evans [4]. The use of simple microscope was done to study the external features present in the roots of Kushmanda.

**Fig. (1).** Roots of *Benincasa hispida* (Thunb.) Cogn.

### 2.3. Microscopy

For the purpose of microscopic evaluation, coarsely powdered samples were air dried. It was then stained with reagents like phloroglucinol and hydrochloric acid before treating them with clearing agents, such as lactophenol and chloral hydrate in order to remove the impurities adhered to the surface of roots, then finally mounted in glycerine for the study of microscopical characters. Glycerine being an emollient, prevents the sample from drying. Different reagents, which are freshly prepared according to the standard methods were used to study the different structural components. The stains should be just under the coverslip and not anywhere else for the purpose of exact focusing.The study was carried out according to the methods outlined by Brain and Turner [5, 6]. Different cell components were studied as per the standard methods [7].

### 2.4. Physicochemical and Phytochemical Analysis

Physicochemical parameters such as ash values, moisture content and extractive values (gives the idea about the nature of the chemical constituents present in a crude drug) were determined in the controlled conditions according to the well-established official methods and procedures. The preliminary phytochemical screening was carried out using the standard procedures described by Khandelwal [8].

### 2.5. Fluorescence Analysis

When the sample is exposed to ultraviolet radiation many crude drugs exhibit the phenomenon of fluorescence [9]. If the substances themselves are not fluorescent, they may often be converted into fluorescent derivatives by applying different reagents. Hence, some crude drugs are often assessed qualitatively in this way and it is an important parameter of pharmacognostical evaluation. The changes in appearance and color with freshly prepared special reagents under standard conditions were observed and recorded. Powdered plant material taken in minute amounts was treated with various chemical reagents and exposed to visible light to study their fluorescence behavior [10].

### 2.6. Rheology

In this, the flow of the coarsely powdered roots of the crude drug is studied for different parameters. Bulk density, angle of repose, compressibility, Hausner's ratio were calculated according to standard procedures.

#### *2.6.1. Bulk Density*

10g of powdered drug was taken in a graduated measuring cylinder and tapped on a wooden surface. Bulk density is calculated by using the formula.

Bulk density = weight taken / Bulk volume

Tapped density = weight of drug taken / volume (tapped)

#### *2.6.2. Angle of Repose*

Angle of repose was determined by using funnel method. The powder was allowed to flow through a funnel fixed on a stand to form a heap. The height and the radius give the angle of repose. The Angle of repose $\tan\theta = h/r$

$\theta = \tan^{-1} (h/r)$.

Where, h = height of heap

r = radius of heap

#### *2.6.3. Compressibility / Carr's Index*

This is calculated using the formula: Bulk density (Tapped) − Bulk density (Untapped)/ Bulk density (Tapped)

#### *2.6.4. Hausner's Ratio*

The formula used to determine Hausner's ratio = Bulk density (Tapped) x 100 /Bulk density (untapped) [11, 12].

## 3. RESULTS & DISCUSSIONS

### 3.1. Macroscopy

Organoleptic or morphological evaluation refers to the evaluation of drug with the help of estimation of the organoleptic features, such as length of the roots, along with width, colour, shape, odour, touch and appearance were looked after with the help of simple microscope. These parameters provide the information on the purity, quality and identity of the crude drug. The observations are recorded in the Table **1**.

**Table 1. Organoleptic features.**

| S.No | Feature | Results |
|---|---|---|
| 1. | Length | 7.4 cm |
| 2. | Width | 0.5 cm |
| 3. | Colour | Yellowish-brown |
| 4. | Odour | Muddy |
| 5. | Taste | Characteristic |
| 6. | Shape | Cylindrical |
| 7. | Appearance | Hard and brittle |

### 3.2. Powder Microscopy

The prepared powdered, pre-treated with clearing agents is used for the purpose of study. Powder microscopy showed the presence of phloem fibers with associated parenchyma, sclereids, parenchyma and pitted vessels. Fibers, sclereids and pitted vessels were stained pink with phloroglucinol and hydrochloric acid due to the presence of lignin in them. The presence of fibers is responsible for the observed striated or granular fracture. Spherical calcium crystals, calcium oxalate is a common biomineral in plants, occurring as crystals of various shapes. It can be found in any tissue or organ in plants and is often formed in the vacuoles of specialized cells called crystal idioblasts were also revealed on the treatment of treated powder with glycerine water. Plants of different species manufacture different starch grains. These differences are visible on a number of levels. The presence of starch grains was also observed with the help of Iodine water. Iodine water is used as it shows the presence of cell wall as well as nucleus. The powdered drug, which was dirty brown in colour shows numerous fragments of thin-walled, tangentially elongated and circular parenchymatous cells, numerous sclereids in groups and singles and a few of xylem vessels having spiral thickenings.

### 3.3. Physiochemical Study

The ash values usually represent the inorganic residues such as phosphates, carbonates and silicates present in herbal drugs. The ash values are important indices to illustrate the quality as well as purity of herbal medicine. The objective of ashing vegetable drugs is to remove all traces of organic matter, which may otherwise interfere in an analytical determination. Ash value is used further to calculate the acid insoluble and water soluble ash values. Loss on drying is the parameter to keep the moisture content under check as larger amount of moisture can promote hydrolytic reactions and can initiate the microbial growth. Physiochemical parameters were evaluated and the results are represented in Table **2**.

**Table 2. Summary of physicochemical analysis.**

| S.No | Parameter | Result |
|---|---|---|
| 1. | pH | 8 |
| 2. | LOD | 1.4% |
| 3. | Ash value | 0.9% |
| 4. | Extractive value | 9.4% |

### 3.4. Fluorescence

It is an essential parameter for first line standardization of the crude drug. Fluorescence is the emission of light by a substance that has absorbed light or other electromagnetic radiation. It is a form of luminescence. In most cases, the emitted light has a longer wavelength, and therefore lower energy, than the absorbed radiation. It is the phenomenon exhibited both in visible and UV- light by various chemical constituents present in the plant material. Some crude drugs are often assessed qualitatively in this way and it is an important parameter of pharmacognostical evaluation. This is the phenomenon exhibited by various chemical constituents present in the plant material. Some show fluorescence in the visible range in daylight. The ultraviolet light produces fluorescence in many natural products (*e.g.* alkaloids like berberine) which do not visibly fluoresce in daylight. Some of the substances may be often converted into fluorescent derivatives by using different chemical reagents though they are not fluorescent, hence we can often assess qualitatively some crude drugs using fluorescence as it is the most important parameter of pharmacognostical evaluation [13, 14]. The powder exhibited brown, green colours. The observations are given in Table **3**.

**Table 3. Summary of fluorescence analysis.**

| S.No | Reagent | Colour(daylight) |
|---|---|---|
| 1. | Picric acid soln. | Brownish yellow |
| 2. | Ferric chloride | Yellowish green |
| 3. | Water | Dark brown |
| 4. | Molisch reagent | Reddish brown |
| 5. | Fehling soln. | Dark brown |

### 3.5. Phytochemical Screening

Most of the pharmacological activities possessed by the crude drugs are attributed to the presence of active principles. Among these active principles, pentacyclic triterpenoids and bryonolic acid (characteristic triterpenoid

present in Cucurbitaceae family) play a major role. Phytochemical investigation of aqueous extract of roots, obtained after defatting of it with petroleum ether was performed for the presence of alkaloids, glycosides, carbohydrates, tannins, sugars and lipids. The screening was performed for triterpenes/steroids, alkaloids, saponins, tannins, and phenolic acids. The color intensity or the precipitate formation was used as analytical responses to these tests. The observations showed the presence of alkaloids, flavonoids, steroids, triterpenoids and glycosides. The results of phytochemical screening and rheology are summarized in Tables **4** and **5** respectively.

**Table 4. Summary of phytochemical analysis.**

| S.No | Experiment | Observation | Inference |
|---|---|---|---|
| 1. | With picric acid soln. | Slight yellowish brown | Mild amount of Alkaloids present |
| 2. | With water | On shaking, less persistent froth | Saponin glycoside |
| 3. | With Molisch reagent | No purple or violet colour is obtained | Carbohydrates absent |
| 4. | With $FeCl_3$ | Yellowish green colour is obtained | Condensed tannins are present |
| 5. | With Fehling soln. | No brick red colour is produced | Sugars are absent |
| 6. | With filter paper | On pressing, no oily stain produced | Lipids are absent |

**Table 5. Rheological parameters.**

| S.No | Parameter | Results |
|---|---|---|
| 1. | Tapped density | 0.4 |
| 2. | Untapped density | 0.33 |
| 3. | Angle of Repose | 0.66 |
| 4. | Compressibility | 0.425 |
| 5. | Hausners ratio | 121 |

## PROPERTIES AND ACTION

| |
|---|
| Rasa: Madhura, Amla |
| Guna: Laghu |
| Virya: sita |
| Vipaka: Madhura |
| Karma: Balya [15] |

## CONCLUSION

As there were no reports on pharmacognostic parameters of the roots of *Benincasa hispida* (Thunb.) Cogn.,the results obtained from the above study will help in the quality control and standardization of the crude drug material. Further research can be carried out to isolate the active principles and evaluate them for the pharmacological efficacy of the crude drug. The phytoconstituents can be tested for their therapeutic efficacy for establishing the medicinal significance of the plant. The plant is used as tonic, brain tonic, carminative, refrigerant, anthelmintic, haemostatic, vitaliser, pacifies rakta pitta. The reported pharmacognostic parameters can be considered as distinctive enough for authentification of this drug in herbal industry and can be included as microscopic standards in Indian herbal pharmacopoeia. The results will help as reference standards in quality control researches carried over this plant.

## CONSENT FOR PUBLICATION

Not applicable.

## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

## ACKNOWLEDGEMENTS

Declared none.

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