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Pharmacognostical Investigation on Fruits of *Apium graveolens* L.: An Ayurvedic Herb

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ABSTRACT

Herbs are the resources of biologically or pharmacologically active components that are conventionally used to treat various ailments. *Apium graveolens* is being significantly used in "Ayurvedic system of medicine". Since these medicinal herbs are collected by untutored personals on the basis of their Sanskrit/ local names, there occurs a great chance of confusion or misidentification due to unawareness and related vernacular names. To assist exact and effortless recognition of drugs, Pharmacognostical characters involving macroscopical, microscopical and physiochemical parameters were studied. This helped in studying quality control parameters for sample identification with determination of their quality and purity.

Keywords: *Apium graveolens*, Pharmacognostical, Identification.

INTRODUCTION

Herbs as medicines are being used traditionally since prehistoric times. Secondary metabolites are the compounds usually synthesized by different plants for performing different functions [1, 2]. *Apium graveolens* L. - family Apiaceae, is called 'Ajmoda' in Hindi and 'celery' in English. It is hardy, biennial, annual and generally cultured or cultivated for its fleshy leaf-stalk and seeds. Usually, essential oil is obtained from its seed and its leaf is commonly used as vegetable. Fixed oil is also a component of seeds.

The crop is grown in winter for its seed oil which is used especially as a flavouring agent in food like sauces, pickle etc. It is also used as a condiment [3, 4]. Ajmoda is a small, oval shaped seed like fruits are brown schizocarps. The seeds are actually the fruits of the plant. This type of fruit is known as schizocarp. Inside each fruit are the actual tiny seeds.

Seeds are used as carminative and have nervine stimulant properties. The leaves are used as vegetable especially in salad. It's a herbaceous plant having a height of 60-120 cm. and white colored umbel flowers. Annual cultures are grown in India mainly for seed purpose. Root is succulent, well developed with numerous lateral roots. Stems are angular, jointed and branched having green color. Leaves are pinnate and oblong in shape with a size of 7-18 cm. The flowers are white in color having sessile compound umbels. Fruit is formed of two umbels which are united, each bearing seeds. Seeds are small, oval, greenish brown in colour and are about 1-2 mm. in length. Celery seeds have a crisp texture with a subtle flavor and bitter taste [5, 6]. Celery crops are cultivated mainly in Punjab, Haryana and Uttar Pradesh.

The phytoconstituents of celery includes phenolic compounds like furanocoumarins, flavones etc., phytosterols, glycosides; the leaves are rich source of calcium, phosphorus, iron, vitamin A and vitamin C for which it is consumed in salad. The dried and ripe seeds used as spice to flavour food and liquids. Celery seeds are a stimulant, carminative and used as a nerve tonic in indigenous medicine systems. It's also used in rheumatic disorders. Seed oil is used in perfumery and pharmaceutical industries as well.

Fatty oil from fruit used as a nervine stimulant and antispasmodic [7, 8]. Research studies showed that *Apium graveolens* exhibit anticonvulsant, tranquilizing, hypolipidemic, hepatoprotective, antioxidant, anticancer and anti bacterial properties. Seeds are also used in different pathological conditions like bronchitis, asthma, spleen and liver disorders [9, 12].

Since these medicinal herbs are collected by untutored personals on the basis of their Sanskrit/ local names, there occurs a great chance of confusion or misidentification due to unawareness and related vernacular names. The present study was aimed to develop standards for proper identification of crude

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drugs. This study involved different parameters like macro and microscopical, physico-chemical and fluorescence analysis for the purpose of identification.

MATERIALS AND METHODS

Plant materials

The *Apium graveolens* seeds were procured from Vindhya Herbals, MFP-PARC, Bhopal, M.P.

Macromorphology

Apium graveolens seeds were assessed by observing color, odor, taste, extra-macroscopical characters for their sensory profile analysis as per standard WHO guidelines.

Microscopy

For microscopic study seed like fruits were taken and were allowed to boil in caustic alkali solution in a test tube foe 1-2 min. (outer coat specimens with intensive pigmentation are boiled for longer period). After boiling, the pieces were placed on the slide; coat layers were removed and mounted in glycerol for examination. The seeds were positioned in a potato slit for sectioning or cutting small seeds. The transverse sections of the seeds were taken, cleaned with clearing agent and further mounted with glycerine. Microscopy of seeds was done for analyzing various parts of given plant material. The detailed microscopical characters were observed under Leica Compound Microscope Model DM 3000B with DFC2420 Camera & LAS Software digital microscope.

Powder Microscopy

Desired amount of powdered material was taken on a slide in glycerol for powder microscopy and then covered by a cover-slip to determine the cellular structure.

Physico-chemical Parameters

Different physicochemical values like moisture content, percent total ash, water soluble ash, acid- insoluble ash, water and alcohol soluble extractives were calculated. Crude drug evaluation helps in proper identification of drug followed by assessment of quality and purity of drugs. The need for this assessment is because of biochemical variations, effects of treatment, storage and adulteration of the raw material. Standardization of plant materials should be developed to ensure the quality and purity of crude drugs.

Preliminary Phytochemical Screening

Preliminary qualitative phytochemical tests were performed for determination of various phytoconstituents present in crude drugs [13-17].

Fluorescence Analysis

Fluorescence analysis is one of the evaluation methods that is implemented for the identification of authentic samples and recognition of adulterants.

Fluorescence analysis was performed as per the method of Kokoski *et al*. Fluorescence analysis of plant material can be examined as such, in powdered form, in extracts or in the form of solution. It's a valuable analytical tool in the authentication of plant samplesand crude drugs. [18].

RESULTS

Macroscopic Examination

Color- Brownish yellow / creamy

Odour- Aromatic

Taste- Slightly bitter

Fruits are schizocarp with two mericarps, suborbicular to ellipsoid in shape, Oblong to conical, laterally compressed, with a rounded base; separated mericarps not curved; About 1.5 mm long, and about 1mm wide at the middle; smallest of the three; Glabrous to naked eye, but rough surface and minute projections at 10 to 20x; valleculae narrow and dark; ridges often wavy.

Microscopic Examination

Transverse sectioning of fruits showed a wavy alongwith curvy outline. Each mericarp have 5 ridges and six to nine vittae. Epicarp is divided into exocarp, mesocarp and endocarp. Exocarp is made up of single layered, thin walled parenchymal cells which are rectangular in shape. Cuticle coats the outer part of exocarp. Mesocarp and endocarp are also composed of oval or polygonal parenchymatous cells. Testa is composed of elongated cells while endosperm is having calcium oxalate crystals and aleurone grains. Parquetry arrangement present sporadically over small areas epidermal cells, wavy walled particularly in the vallecular region; Each ridge is held by a vascular bundle, with tracheids, spiral and reticulate vessels and sclerenchyma cells showing oblong pits; narrow xylem fibres are also present.

Endospermous, convex on dorsal side and flat on the commissural side; testa is found as a single layer on the dorsal side, but with some more tissue layers on the commissural side; testa cells are oblong to rectangular, thin walled; embryo embedded in the endosperm; cell walls of the endosperm uniformly thick, cells packed with aluerone grains (Figure 1-5).

Figure 1: T.S. of *A. graveolens* seeds (10 X) view

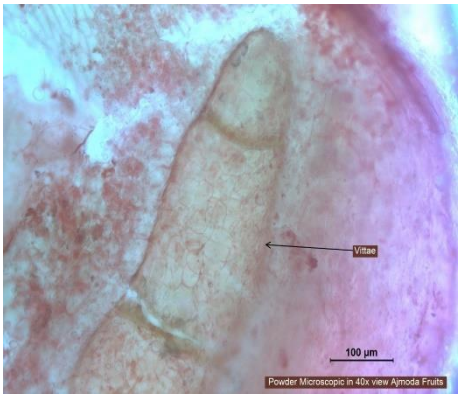

Figure 2: Powder microscopy (40 X) view of *A. graveolens* seeds

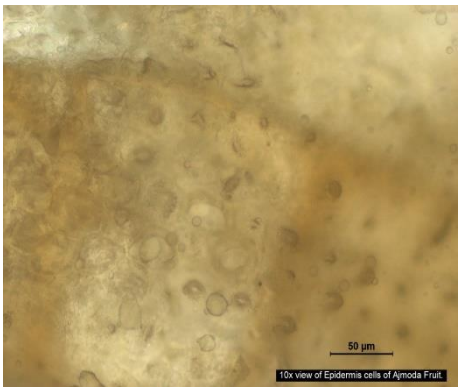

Figure 3: Epidermal cells of *A. graveolens* seeds

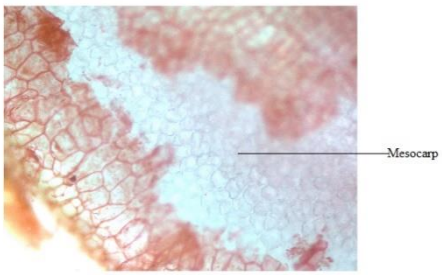

Figure 4: Mesocarpic cells of *A. graveolens* seeds

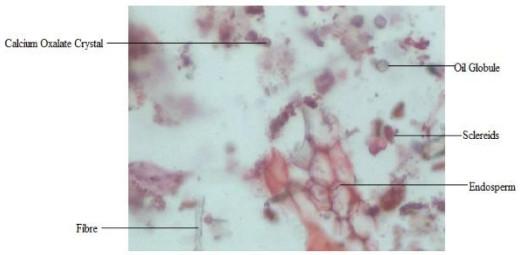

Figure 5: Powder microscopic characteristic features of *A. graveolens* seeds

Powder microscopy

A. graveolens powder microscopic study showed unclear fragments, presence of stomata, epicarpic colorless with small protuberances, brown vittae cells, polygonal thin walled cells with slight thickening at the corners; Mesocarpic innermost layer composed of yellowish brown elongated cells with long axes with moderately thickened, groups of sclereids are marked with pits which are ovoid or elongated like cells; various oil globules, calcium oxalate crystals, thin walled vessels and fibres, aleurone grains and endospermic cells (Figure 1-5).

Physicochemical Evaluation

Moisture content indicates whether the crude drug was appropriately dried and stored or not. The ash- value determination is used for detecting low grade products, exhausted drugs and excess of sandy or earthy matter. The extractive values determination is very much beneficial while suitable selection of solvents for the purpose of extraction and also to understand the nature of major present in the crude drug phytocomponents.

Different physicochemical values like moisture content, percent total ash, water soluble ash, acid- insoluble ash, water and alcohol soluble extractives were calculated (Table-1).

Table 1: Physicochemical Parameters of *A. graveolens* seeds

Parameters	
Total ash (w/w)	4.649±0.97
Water soluble ash (w/w)	0.436± 0.66
Acid- insoluble ash (w/w)	0.110±0.31
Water soluble matter (%)	7.375±0.09
Alcohol soluble matter (%)	9.512±1.04
Moisture content (%)	5.403±1.15
Foreign Matter	Nil

Preliminary Phytochemical Qualitative Test

Qualitative phytochemical screening tests were done to identify the presence or absence of different phytochemicals. The tests revealed the presence of alkaloids, glycosides, sterols, tannins, flavonoids, proteins, resins, fats and oil (Table-2).

Table 2: Qualitative chemical tests of Ethanolic Extract of *A. graveolens* seeds

S.No.	**Test**	**Inference**
1.	Glycosides	+ve
2.	Alkaloids	+ve
3.	Sterols	+ve
4.	Flavonoids	+ve
5.	Phenolic Compounds	+ve
6.	Tannins	+ve
7.	Carbohydrates	-ve
8.	Proteins	+ve
9.	Resins	-ve

Fluorescence Analysis

The characteristic fluorescence properties or colours recorded through this study are showed in Table-3.

Table 3: Fluorescence Properties of *A. graveolens* seeds

S.No.	Treatment	Fluorescence
1.	Powder as such	Dark Brown
2.	Powder treated with n-hexane	Yellow
3.	Powder treated with chloroform	Greenish yellow
4.	Powder treated with methanol	Pale yellow
5.	Powder treated with acetone	Brownish yellow
6.	Powder treated with 1 N NaOH	Yellow
7.	Powder treated with 1 N HCl	Greenish Yellow
8.	Powder treated with H2SO4 (50%)	Greenish Brown

DISCUSSION

Organoleptic analysis of a crude drug or raw material is mainly used for qualitative evaluation on the basis of observation so obatined from morphological and sensory profile. Various macro and microscopical characters, physico-chemical parameters have studied in the present research.

Hence, the study was undertaken to explore the standardization methods for the proper identification, purity and quality of *A. graveolens* fruits/seeds. Microscopy is still one of the easiest and cheapest methods for the evaluation of crude drugs despite the presence of different sophisticated modern tools for the correct identification of plant material.

Adulteration and substitution with improper identification of plant materials can prove to be harmful related to the health issues of the consumers and legal issues for the pharmaceutical industries. Evaluation can be done via different techniques in terms of morphology, microscopy and phytochemical analysis. The observation at morphological and cellular level is the main criteria of drug authentication.

These characters or diagnostic features are lost while dealing with powdered drugs. Moisture content evaluation is important because high moisture content may cause the decomposition of plant drug. Total ash is performed to determine the presence and absence of inorganic constituents such as silica or metallic salts.

This includes both 'physiological-ash' derived from tissues of plant and 'non-physiological ash' which is due to the extraneous matter residue sticking to the surface of crude drugs. Water soluble portion of total ash is known as water soluble ash. Non-physiological ash due to the adherence of extraneous matter forms acid insoluble ash. These ash values are indicative of the extent of adulteration [19].

CONCLUSION

The present investigation showed that *A. graveolens* seed like fruits contains flavonoids, phytosterols, alkaloids, glycosides and tannins. This shows majority of the components in medicinal plants. Biological or pharmacological actions of plants are mainly due to these secondary metabolites constituents present in a complex form that exerts a synergistic or antagonistic activity. The combinations of such phytochemicals show a wide range of biological or effects and pharmacological properties.

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Disclosure statement

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