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Pharmacognostic and phytochemical evaluation of the *Solanum sisymbriifolium* Lam. (Litchi Tomato) fruit

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Abstract

The present investigation aimed to establish the qualitative, quantitative parameters for *Solanum sisymbriifolium* (Family: Solanaceae) fruit through pharmacognostical, physicochemical and phytochemical studies. It is commonly known as Litchi tomato. This plant is perennial under shrub with maximum height of 2 meter. Stem is sub erect with glandular hairs and prickled, bearing small, white, actinomorphic flowers. The pharmacognostical evaluation results showed useful characters for the recognition of *S. sisymbriifolium* fruit. Transverse section showed presence of lignified, non-lignified fibers, scalariform vessels and oil globules in mesocarp region. Lignified stone cells, endosperm and endocarp are observed in powder microscopy. Physicochemical studies of fruit powder shows, total ash (6.4%), acid insoluble ash (0.5%), alcohol soluble extractive values (23.37%), and water soluble extractive values (26.52%) respectively. Phytochemical analysis revealed the presence of alkaloids, saponins, phenols, terpenoids, carbohydrates and glycosides.

Keywords: *Solanum sisymbriifolium*, scalariform vessels, total ash, extractive values

1. Introduction

The solanaceae family contains some of the poisonous plants, some of the most valuable medicinal plants, which provide the most nutritive foods. Most of the plants possessing alkaloids, therapeutically narcotic, some are stimulating; others are tonic, diuretic, and diaphoretic [1]. In India, the genus *Solanum* is represented by 42 species among that few are cultivated and most of the plants are wild. *S. sisymbriifolium* is one of the wild plants distributed mostly in the southern part of India and also it has been reported in Odisha, Jharkhand, Uttar Pradesh, Tripura and other northeast states [2, 3, 4]. Various parts of *S. sisymbriifolium* were scientifically reported for its medicinal properties. The crude hydroalcoholic roots extract shown antihypertensive action in anaesthetized normotensive rats [5]. Butanol fraction of roots was reported for its cardio tonic, anti-hypertensive action [6]. Alcoholic extract of leaves possessing antinociceptive, anti-diarrheal neuropharmacological and cytotoxic activity [7, 8]. An alkaloid solasodine was isolated from fruits and reported for its anticonvulsant activity in rodents [9]. Volatile oil of the flowers and fruits was reported to possess antibacterial and antioxidant activities [10]. Despite the great significance of *Solanum sisymbriifolium* much work has not been reported on pharmacognostical analysis of fruits. Hence pharmacognostical standardization including macroscopy, organoleptic characters, transverse section, powder microscopy, physicochemical parameters and preliminary phytochemical standards of *Solanum sisymbriifolium* fruits were determined.

2. Materials and Methods

Chemicals and Instruments

Photomicrographs were taken with using Leica DM 1000 LED microscope attached with Leica EC3 camera. Compound microscope, simple microscope, watch glass, glass slides, cover slips and other common glassware's were used in this experiment. All the solvents used for the study were of laboratory grade. Chloral hydrate was procured from Tokyo Chemical Industry Co., Ltd; Tokyo, Japan. Phloroglucinol, iodine, picric acid and all other reagents were procured from Sisco Research Laboratories Pvt. Ltd; Maharashtra, India.

Collection of Plant Materials

The fruits of *Solanum sisymbriifolium* were collected from Bidhannagar, Kolkata, India. Authentication of plant was done in Department of Pharmacognosy, Central Ayurveda Research Institute for Drug Development, Kolkata.

Fresh fruits were used to study the macroscopic and anatomical parameters; whereas shade dried fruit powder was used for the microscopical, physico-chemical and preliminary phytochemical investigations.



Fig 1: Morphology of fruits of *Solanum sisymbriifolium*

Macroscopy

Macroscopical evaluation was done by observing the fruits under simple microscope and with the naked eyes and taking note of the colour, size, odour and other diagnostic parameters. Different macroscopic parameters of the fruits were noted [11].

Histological Studies

For qualitative microscopic analysis, freehand transverse sections of the fruit were made using razor blade. Lignified, cellulosic and other identifying features were studied by staining the sections with phloroglucinol in concentrated HCl and 0.02N iodine reagent. Photomicrographs of all the sections in different magnifications were taken [12].

Powder microscopy

The coarse powder of *S. sisymbriifolium* fruits was studied under the microscope. The fruit powder was macerated in chloral hydrate reagent. The macerated powder was then stained with phloroglucinol, iodine reagents separately. Small quantities of the various stained powders were mounted on a slide with glycerin. Photomicrographs of the different cellular structures and inclusions were taken [13].

Physicochemical Studies

Physicochemical parameters such as foreign organic matter, total ash, acid insoluble ash, alcohol and water soluble extractives of fruits powder was determined according to standard methods [14].

Phytochemical Screening

Preliminary phytochemical screening was performed by using standard procedures. The aqueous, alcohol soluble extracts of fruit powder obtained were diluted with respective solvents and subjected to chemical tests for the detection of different phyto constituents like alkaloids, glycosides, phenols, volatile oils, flavonoids etc [15].

3. Results and Discussions

Macroscopy

Fruit berry, bright red in colour, globose, 0.5–1.6 cm in diameter. At first green coloured prickly calyx entirely covers the fruit, after ripening when they turn bright red, the calyx peels backward to expose the fruit. Seeds reniform (kidney

shaped), bright yellow and 0.2 cm diameter. Odour characteristic; taste bitter.

Histological Studies

The pericarp comprises three clearly distinguishable zones: the epicarp, mesocarp, and endocarp.

Epicarp: The cuticle is highly variable and usually thick and smooth. Epidermis contains isodiametric cells with dense content. 2-3 layers of compactly arranged thick walled sub-rectangular collenchyma cells are observed in hypodermis region.

Mesocarp: The external zone of mesocarp is absent. In internal region of mesocarp there are 9-12 juicy parenchymatous layers composed of thin walled round cells with internal spaces. Some cells contain calcium oxalate crystals. Inner cells are much bigger than outer cells. Sclereid cells are present towards outer region of mesocarp, just below the hypodermis.

Endocarp: Vascular bundles (scalariform vessels) are observed in this region. The endosperm of polyhedral cells contains fixed oil. Oil globules are distributed profusely with oil cavity. Lignified and non-lignified fibers are present.

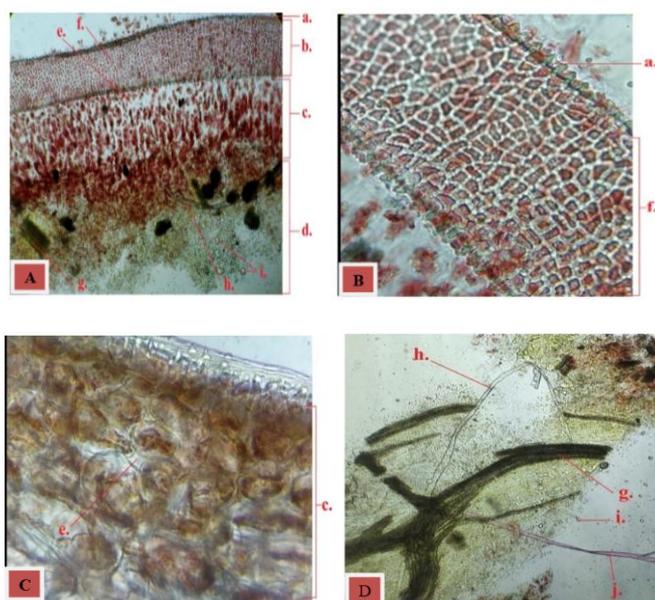


Fig 2: Transverse section of fruit

A. Whole TS, B. Upper portion- Epicarp
C. Middle portion- Mesocarp D. Inner portion- Endocarp
a. Epidermis; b. Epicarp; c. Mesocarp; d. Endocarp; e. Internal space in mesocarp; f. Hypodermis; g. Vessel; h. Non-lignified fiber; i. Oil globule; j. Lignified fiber;

Powder microscopy

Brownish orange color powder with characteristic pungent odour and bitter taste. Powder sample shows endocarp having rectangular cells arranged parquetry. Fragments of endosperm composed of polygonal thick walled cells with fixed oil globules and crystals of calcium oxalate. Lignified fibers are long, thin walled and having narrow lumen. Non-lignified fibers are thick walled, rod shaped with oblique end. Scalariform vessels, group of thick walled stone cells also observed.

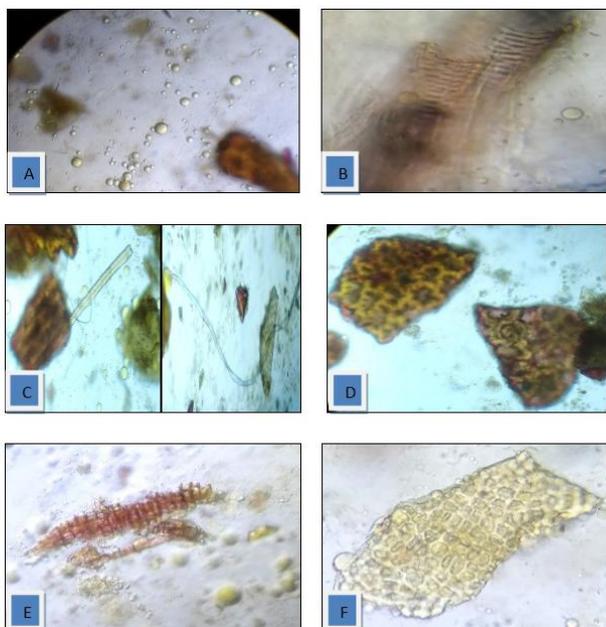


Fig 3: Powder microscopy of fruit

A- Oil globules; B- scalariform vessels; C- Lignified & non lignified fibers;

B- D- Stone cells; E- Epicarp; F- Endosperm;

Physicochemical Studies

The results of physico-chemical parameters such as extractive values, ash values and foreign matter are shown in Table 1.

Table 1: Physico chemical parameters

S. No	Parameters	Values obtained in percentage (%)
1	Foreign matter	0.2
2	Total ash	6.4
3	Acid insoluble ash	0.5
4	Water soluble extractives	26.52
5	Alcohol soluble extractives	23.37

Phytochemical Screening

The results of phytochemical screening are shown in Table 2. Preliminary phytochemical screening revealed that aqueous extract is rich source of alkaloids, saponins, proteins and phenols. Terpenoids, steroids are mainly present in alcohol soluble extracts of fruits.

Table 2: Preliminary phytochemical analysis

S. No	Chemical test for	FAE	FEE
1	Carbohydrates	++	++
2	Proteins	+++	++
3	Alkaloids	+++	++
4	Glycosides	+	+
5	Phenols	+++	++
6	Flavonoids	-	-
7	Terpenoids	-	++
8	Steroids	-	++
9	Saponins	+++	-

FAE- Fruit aqueous extract

FEE-Fruit ethanolic extract

4. Conclusion

The present investigation established the qualitative and quantitative diagnostic features of fruits of *S. sisymbriifolium* through anatomical, powder microscopical, physico chemical and phytochemical analysis. Phytochemical analysis revealed

that aqueous and alcoholic extracts are rich sources of alkaloids, phenols, carbohydrates and proteins. These results will help in standardization, identification and in carrying out further research in *S. sisymbriifolium* fruits.

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