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Phytochemical evaluation and powder microscopy of medicinal and nutritional fruits of P*hysalis peruviana* L

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Abstract
For centuries fruits have been an integral part of human consumption for medicinal and nutritive purposes. Fresh fruits can be useful to nourish our body, acts as good cleansers and protects our body from toxic metal. The present study communicates on the preliminary phytochemical analysis, powder microscopy of fruits of *Physalis peruviana*. The Powder microscopical studies showed the presence of abundant oil globules on the surface of epidermal cells and in the mesocarp region, (Parenchymatous cells) and group of elongated stone cells. Simple, oval to rounded starch grains with prominent hilum in the centre of the starch grains, reddish content of tannin in the parenchymatous tissue, reticulate type of xylem vessel, group of elongated stone cells. Preliminary phytochemical analysis revealed the presence of alkaloids, carbohydrates, flavonoids, phenols, proteins, saponins, tannins, glycosides and starch.

Keywords: Phytochemical, Powder microscopy, *Physalis peruviana*, Nutritive, Physicochemical studies.

1. Introduction
Physalis peruviana L. belonging to the family Solanaecae is an erect branching, densely villous perennial, native of tropical America, introduced into India and other countries, grown both in the plains and hills. Leaves ovate acuminate; flowers with five large purple spots near the base within; berry globose, 2-3 cm diameters, enclosed in the inflated calyx. The plant is widely grown in India for its edible fruits. The chief source of commercial supply is reported to be Uttarpradesh, Rajasthan and Punjab and Andrapradesh. It is frequently found wild as an escape from cultivation. In India, the fruits are available from January to April. Maturity of the berries is indicated by change of color of the calyx from green to pale brown or yellowish orange [1].
It is widely used medicinal herb for treating cancer, malaria, asthma, hepatitis, dermatitis and rheumatism [2]. It is commonly known cape gooseberry. It has potential anti-hyperglycemic activity [3]. Antioxidant activity and anion scavenging activity [2]. Anti-hepatotoxic [4]. Anti-inflammatory effect [5]. The major bioactive compounds, physalins (A, B, D and F) and glycosides (such as myricetin-3-O-neohesperidoside) showed anticancer activity [6].

2. Regional names in India
Sanskrit: Avagutha, Kunthali, Parpotika, Tankari; English: Cape goose berry, Wintercherry; Hindi: Macao, Tepariya, Timpari, Tipari; Kannada: Bondoola, Buddehannu, Doddabuddegida; Konkani: Chirput, Chiriputla; Malayalam: Mottaampuli, Nittaayinduna; Marathi: Chirbot, Phopati, Thanmori; Tamil: Perungunni, Pottipallam; Telugu: Budama, Paambudda; Tulu: Bondoli; Punjabi: Rasbhary [7].

3. Therapeutic & Folk uses
P. peruviana L has been widely used in folk medicine for anticancer, antimycobacterial, antileukemic, antipyretic, immunomodulatory, and for treating diseases such as malaria, asthma, hepatitis, dermatitis, diuretic and rheumatism purposes [8]. Leaves and dried seeds are used in treatment of jaundice and glaucoma in among the tribes of thiashola, manjoor, nilgiris south division, Western Ghats, India [9]. The oleaginous fruit by-products may become one of the important oil sources. The oil is rich in essential fatty acids, antioxidants, phytosterol [10]. It is used as a folk medicine in Tamil Nadu (Pitlannu) the treatment of Vomiting [11].

4. Nutritional values
The fruits are good source of protein, fibre, carbohydrates, carotene and ascorbic acid, thiamine, riboflavin, nicotinic acid, Minerals like Ca, K, Mn, Mg, Fe, Na, Cu, Mn and Zn,

phosphorus and vitamins like vitamin-C, vitamin-E, vitamin-K1, carotenes, flavonoids and polyphenols and gooseberry, quercetin, myricetin and kaempferol, physalins, polyunsaturated fatty acids, carbohydrates, withanolides, phytosterols, glycosides. The husk of the fruits has a bitter taste. It contains a mixture of potassium chloride and potassium citrate, a phytosterol, a bitter amorphous glucoside, trace of a pungent alkaloid, tannins and phlobaphenes [1, 12-14].

5. Materials and Methods

Fruits were collected from local market of Agra, Uttar Pradesh, India and, authenticated by Survey of Medicinal Plants Unit, National Ayurveda Dietetics Research Institute, Bangalore, India. The fruits were washed thoroughly and shade dried, pulverized by mechanical grinder, passed through 40 mesh sieves and stored in a closed vessel, to carry out microscopical, Physico-chemical, preliminary phytochemical analysis. Fruit powder used to extract with different solvents with the help of Soxhlet extraction apparatus. Physicochemical and preliminary phytochemical screening of the fruit were carried out to the coarse powder according to the standard methods and recorded.

5.1. Macroscopic and Microscopy: Macro and microscopical studies were carried out as per the standard methods [15].

5.2. Physico-chemical analysis: The physico chemical parameters like Moisture content, loss on drying, total ash, acid-insoluble ash, alcohol and water-soluble extractive values were carried out as per the standard Procedures [15].

5.3. Phytochemical analysis: The crude powder or crude drugs extracted in different solvents are tested for various phytoconstituents present in them by standard procedures. They are generally tested for the presence of alkaloids, flavonoids, tannins, phenols, steroids and saponins by using stand procedures [16].

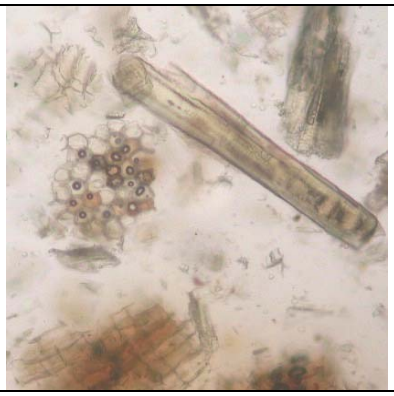
5.4. Thin Layer Chromatography (TLC): Dried fruit powder was extracted with Petroleum ether (60-80 ^{0}C), Chloroform and Ethanol by using Soxhlet extraction apparatus. TLC studies of these extracts were carried out by using, commercially available precoated plates with standardized adsorption layers, i.e. Silica gel 60 F_{254}, (Merck, Germany) at room temperature as per the standard procedures [17].

5.5. Fluorescence analysis: Fluorescence analysis has been carried out by using different chemical reagents as per the standard procedures. A small quantity of dry plant powder is placed on clean microscopic slide and 1-2 drops of freshly prepared reagent solution is added, mixed by gentle tilting the slide and wait for few minutes. Then the slide is placed inside the UV chamber and observe the color in visible light, short (254 nm) and long (365 nm) ultra violet radiations. The color observed by application of different reagents in different radiations is recorded [18].

6. Results

6.1. Powder Microscopy: Fruit powder brown in colour, slightly rough to touch, sweetish in taste, with agreeable odour. When treated with chloral hydrate and water, observed under the microscope, following different fragments of tissues were observed (Plate I).

- Different fragments of tissues showing group of fibers, stone cells, epidermal cells, parenchymatous cells filled with brown content of tannin.
- Thin walled, tangentially elongated parenchymatous cells.
- Simple starch grains with prominent hilum in the centre.
- Parenchymatous cells.
- Thin walled parenchymatous cells, rounded parenchymatous cells, and elongated parenchymatous cells.
- Epidermal cells in surface view.
- Oil globules.
- Epidermal cells covered with cuticle.
- Reticulate xylem vessel.
- Single elongated fiber.
- Epidermal cells showing oil globules in surface view.
- Abundant oil globules in the surface view of epidermal cells
- Elongated stone cells with narrow lumen.
- Groups of fibers.

		
Macroscopical characters- Fruit without calyx	Macroscopical characters- Fruit covered with calyx	Thin walled, elongated & rounded parenchymatous cells 10 Xx 10X

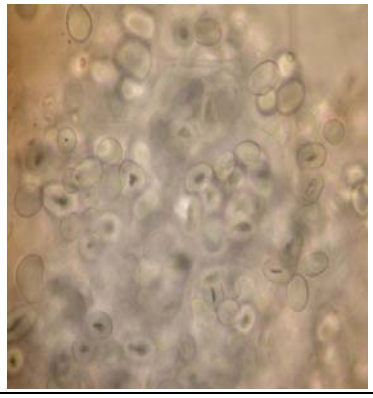
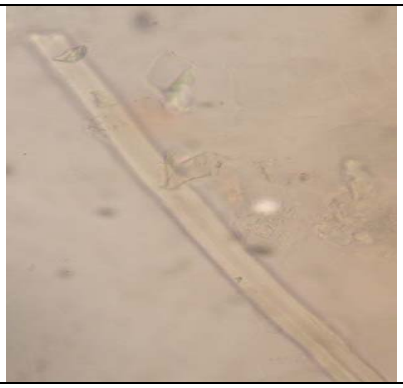
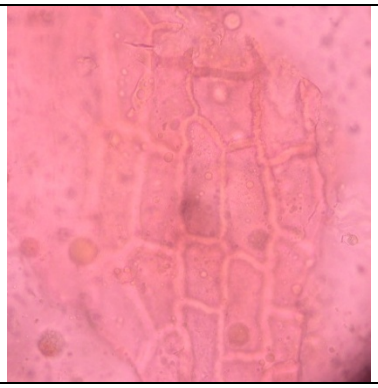
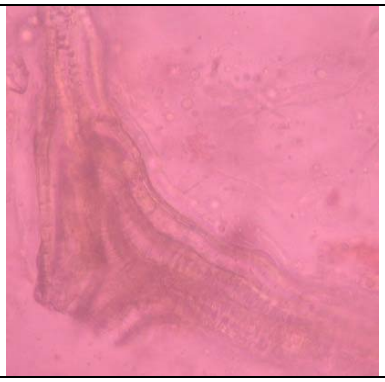
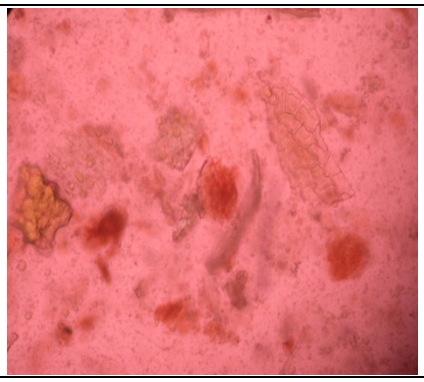
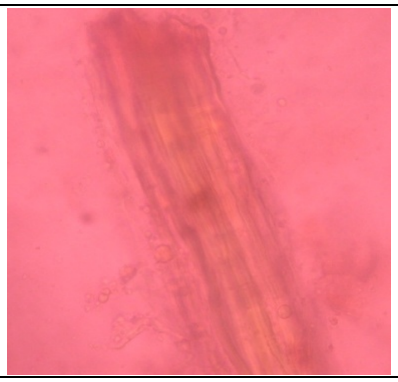
		
Simple starch grains with prominent hilum in the centre 10 Xx 10X	Epidermal cells in surface view 10 Xx 10X	Parenchymatous cells 10 Xx 40X
		
Reticulate xylem vessel 10 Xx 40X	Single elongated fibre 10 Xx 40X	Epidermal cells showing oil gloubles in surface view 10 Xx 40X
		
Elongated stone cells with narrow lumen 10 Xx 40X	Different fragments of tissues 10 Xx 10X	Groups of fibers 10 Xx 40X

Plate I: Powder Microscopic studies of *Physalis peruviana* L.

6.2. Diagnostic Characters

- Presence of abundant oil globules on the surface of epidermal cells and in the mesocarp region (Parenchymatous cells).
- Presence of group of elongated stone cells.
- Presence of simple, oval to rounded starch grains with prominent hilum in the centre of the starch grains.
- Presence of reddish content of tannin in the parenchymatous tissue.
- Presence of Reticulate type of xylem vessel.

6.3. Physico-chemical analysis: The physico chemical parameters like Moisture content, loss on drying, total ash, acid-insoluble ash, alcohol and water-soluble extractive values were carried and recorded the values in Table 1.

6.4. Phytochemical analysis: The phytochemical parameters in different solvents were tested for the presence of various phyto-constituents such as proteins, carbohydrates, saponins, starch, phenols, flavonoids present in them by standard procedures and the values have been recorded in the Table 2.

6.5. Thin Layer Chromatography: The TLC was carried out for thee different extracts i.e. Hexane: Ethyl acetate (9:1) for Petroleum ether extract (PE); Hexane: Ethyl acetate (8:2) for Chloroform extract and Hexane: Ethyl acetate (2:8) for Ethanol extract of fruit powder. After developing the plates were dried under room temperature for 5-10 minutes and observed under UV-254 & UV-366. Photographs were taken and recorded the Rf Values. Table 3 **(Plate II)**

6.6. Rf values: PE extract- under 254nm: 0.47, 0.38, 0.31, 0.26, 0.21, under 366: 0.13, 0.17, 0.25, 0.5, 0.61, 0.73, 0.81; Chloroform extract-under 254nm: 0.41, 0.77, 0.82, 0.87, under 366nm: 0.12, 0.16, 0.25, 0.4, 0.56, 0.71, 0.76 and Ethanolic extract-under 254nm: 0.33, 0.78, 0.81 under 366 nm: 0.45, 0.71, 0.88.

6.7. Fluorescence studies: The fluorescence analysis has been carried out by treating with different chemical reagents. The different colour reactions were observed under day light, UV-254 and UV-366nm and recorded the colour reactions in Table 4.

Table 1: Physicochemical parameters

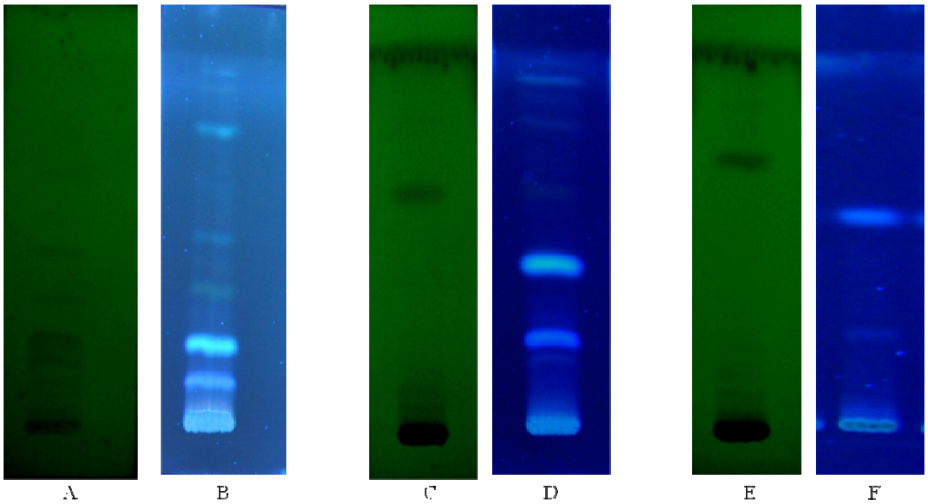
S.No.	Name of the parameter	Values (%) w/w
1	Description	Fruit powder brown in color
2	Foreign matter	Less than 1.0%
3	pH (1% w/v aq. solution)	3.19
4	Loss on drying at 105^0C	10.0
5	Total ash	5.87
6	Acid-insoluble ash	0.88
7	Water-soluble extractive	0.88
8	Alcohol-soluble extractive	22.5

Table 2: Preliminary Phytochemical tests for fruit of *Physalis peruviana* L.

S.No.	Natural product group	Test for natural products	Extract used for the test	Presence (+)/ Absence (-)
1	Alkaloids	(a)Dragendorff's test	Alcohol	+
		(b) Hager's test	Aqueous	-
		(c) Mayers's test	Alcohol	+
		(d) Wagner's test	Alcohol	+
		(b) Benedict's test	Alcoholic	+
		(c) Fehling's test	Aqueous	+
		(d) Molisch's test	Alcoholic	+
2	Carbohydrates	(a) Anthrone test	Aqueous	+
		(b) Benedict's test	Aqueous	+
		(c) Fehling's test	Aqueous	+
		(d) Molisch's test	Aqueous	+
3	Flavonoids		Alcohol	+
4	Phenols	(a) Ferric chloride test	Alcohol	+
5	Proteins	(a) Biuret's test	Aqueous	+
		(b) Ninhydrin	Aqueous	+
6	Saponins		Aqueous	+
7	Steroids	Salkowski reaction	Chloroform	-
8	Tannins	(a) Ferric chloride test	Aqueous	+
		(b) Lead acetate test	Aqueous	+
9	Fixed oils/ volatile oils		Petroleum ether	+
10	Glycosides		Aqueous	+
11	Starch		Aqueous	+

Table 3: Extractive values by Soxhlet extraction

S. No.	Solvent	Values (%) w/w
1	Petroleum ether (40-60^0C)	5.79
2	Chloroform	8.38
3	Ethanol	6.12



A and **B** – Petroleum ether extract UV-254 nm, UV-366 nm; **C** and **D** – Chloroform extract UV-254 nm, UV-366 nm; **E** and **F** – Ethanol extract UV-254 nm, UV-366 nm.

Plate II: TLC Fingerprint of *Physalis peruviana* L.

Table 4: Fluorescence analysis of fruit powder

Sl. No.	Powder + Reagent	Ordinary light	U.V long wavelength 366 nm	U.V short wavelength 254 nm
1.	Powder as such	Dull purple	Dull yellow	Green
2.	Powder + water	Dull purple	Yellow	Green
3.	Powder + Conc. H_2SO_4	Black	Black	Black
4.	Powder + Conc. HCl	Purple	Light yellow	Light green
5.	Powder + Conc. HNO_3	Dark brown	Dark brown	Light green
6.	Powder + Picric acid	Light yellow	Light yellow	Light yellow
7.	Powder + 10% KI solution	Purplish black	Light brown	Light green
8.	Powder + 3% $CuSO_4$	Dull green	Light green	Green
9.	Powder +50% HNO_3	Dark brown	Light brown	Dark green
10.	Powder + 50% H_2SO_4	Dark brown	Light brown	Dark green
11.	Powder + 50% KOH	Light brownish black	Light yellow	Light green
12.	Powder + $FeCl_3$	Dull grey	Light grayish green	Light green

7. Conclusion

The studies carried out revealed that the fruit contains different types of phyto, nutritive constituents and oil content which posses many bioactive phytosterol contents. Because of these components the fruits of *Physalis peruviana* L. is considering as a natural functional food. It can also say that it is a store house of therapeutic and nutritive components. It can also be included in nutritional supplements to serve the today's world malnutrition problems too. The findings in this paper may be useful to supplement the existing information with regard to the identification and standardization of Physalis peruviana – Fruit, even in the powder form. This type of study helps in the identification of *Physalis peruviana*, fruit in powder form and also to differentiate between the other species of *Physalis* and to popularize the fruit among the scientific community as well as in general public.

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