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Preliminary Pharmacognostical And Phytochemical Evaluation Of *Physalis Minima* Linn. (*Ṭankārī*)

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Abstract

Background: *Physalis minima* Linn. Which belongs to Solanaceae family is a very common drug seen all over India. It grows as a weed in wastelands and is seen growing along the roadsides. It is traditionally used as a medicine in various diseases for its diuretic, purgative, analgesic, anti-helminthic properties. Previous researches have already proved that it has Antioxidant action, Free radical scavenging action, Diuretic action, hypoglycemic action, Anti-cancer action, Anti-inflammatory action and Anti-ulcer action.

Aim: To determine the authenticity of the plant using Pharmacognostical and Phytochemical analysis.

Methods: Microscopic studies, Macroscopic study, powder analysis (organoleptic and powder microscopy), physicochemical properties, phytochemical analysis TLC and HPLC analysis of fine powder of whole plant was done.

Results and Conclusion: Microscopy of root, stem and leaves showed all typical features of the species Physalis. The phytochemical study showed the highest extractive value with water extract. Results indicate presence of Flavonoids, Phenolic compounds, Saponins, glycosides, Steroids and Tannins in various extracts.

Keywords: Physalis minima, Standardization, Pharmacognostical, Physicochemical, Phytochemical.

Introduction

Medicinal plants are increasingly recognized as valuable sources of therapeutic agents in both developed and developing nations and countries like India. With the growing global interest in herbal remedies, the pharmaceutical industry is also focusing more on developing formulations derived from natural sources. Although traditional knowledge forms the foundation of plant-based treatments, many medicinal plants still lack proper scientific standardization.

Standardization involves both **pharmacognostical** and **phytochemical** evaluations. Pharmacognostical analysis supports the accurate identification and authentication of plant materials, while phytochemical

studies help determine the bioactive compounds present in the species. Together, these processes are crucial for ensuring that herbal products are of high quality, pure, safe, and effective.

Physalis minima, a member of the Solanaceae family, is a small, delicate annual herb that grows upright and typically reaches about one meter in height. The leaves are soft and smooth with intact or serrated edges, 2.5-12 cm long. Flowers are cream to yellowish. This fruit has a cherry tomato-like flavour, which is delicious when ripe or ripe In English, it is referred to as **Wild Cape Gooseberry**[1]. The species is commonly found in waste areas and along roadsides across India, Bangladesh, Afghanistan, Baluchistan, tropical regions of Africa, and Australia [2].

Traditional medicinal practices describe this plant as a general tonic with diuretic and purgative properties. The leaf juice, when combined with water and mustard oil, is traditionally used to relieve earache. Decoctions prepared from the root, leaves, or fruits are consumed with tea for managing conditions such as hypertension, diabetes mellitus, and malaria [3,4]. Several of these ethnomedicinal claims have been supported by scientific investigations [5,6].

Phytochemical studies on the aerial parts of *P. minima* have revealed the presence of diverse bioactive constituents, including saponins, tannins, alkaloids, alkenyl phenols, glycoalkaloids, flavonoids, sesquiterpene lactones, and terpenoids [7]. However, despite the documented therapeutic potential, comprehensive quality-control parameters for the whole plant have not been established.

Therefore, the present study aims to develop a detailed monograph for *Physalis minima*, focusing on its pharmacognostic characteristics as well as its physicochemical and phytochemical profiles.

Materials and Methods

The plant material used in this investigation was self-collected from its natural growing site in Dombivli, Mumbai. Identification and authentication of the specimen were carried out at the research laboratory, Department of Botany at Mithibai College of Arts, Chauhan Institute of Science and Amrutben Jivanlal College of Commerce and Economics, Vile Parle, Mumbai.

The sample consisted of the **entire plant**, classified botanically as **Physalis minima Linn.**, belonging to the **family Solanaceae**.

Macroscopy

Macroscopic analysis was carried out by examining the leaves, stems, flowers, fruits, and roots both visually by naked eyes and with the help of magnifying glass. Observations were recorded for characteristics such as colour, dimensions, odour, and other texture. All notable external morphological traits of each plant part were carefully documented.

Microscopy

Healthy, mature green stems, roots, flowers, fruits, and leaves of *Physalis minima* Linn. were self-collected from their natural growing site. The entire plant material was thoroughly rinsed under running tap water to eliminate surface impurities. A straight, cylindrical portion of suitable length was chosen for sectioning. Multiple sections were prepared and subsequently stained. The stained sections were then carefully

mounted onto clean glass slides and examined under a compound microscope for histological analysis. Photomicrographs of the sections were captured using a digital camera.

Powder Microscopy[8]

A small amount of fine powdered material was placed on a clean glass slide. A drop of water or mounting medium was added, and the sample was spread evenly. A coverslip was gently placed over the sample to avoid air bubbles. The sample was observed under a microscope, starting with low power and progressing to high power.

TLC:

Thin-layer chromatography (TLC) is a method where a substance divides between two phases: a stationary phase on a flat plate and a moving liquid phase. The stationary phase is a thin, even layer of fine powder coated on glass, plastic, or metal. Most TLC plates are bought already precoated. Substances separate based on how strongly they adsorb to the stationary layer or how they partition between the layers, depending on the support and solvent used. To identify a substance, the Rf value and the appearance of its spot are compared with those of a known sample run on the same plate. The size and darkness of the spots can also give a rough idea of the amount present.

HPLC

A precisely weighed 100 mg portion of the finely powdered whole-plant material of *Physalis minima* was transferred into 5 ml of an acetonitrile–methanol–water mixture (2:2:1, v/v). The mixture was allowed to stand for 12 hours at room temperature in an airtight, HPLC-grade container. After this extraction period, the sample was placed in a water bath at 55 °C for 10 minutes, followed by ultrasonication for an additional 10 minutes to enhance solid–liquid extraction. The resulting solution was then passed through a 0.45 µm nylon membrane filter. A freshly prepared 20 µl aliquot of the filtrate was injected into the HPLC-DAD system for the analysis of phytoconstituents present in *Physalis minima*.

Preliminary Physico-chemical Analysis

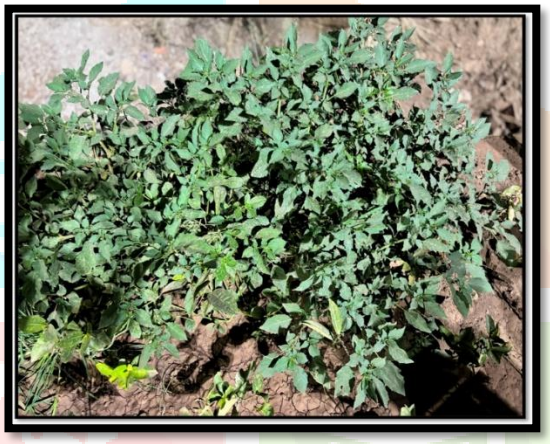
The preliminary Physico-chemical analysis included Foreign matter, Total ash, water soluble ash, Acid insoluble Ash, moisture content, Water soluble extractives, alcohol soluble extractives and Successive solvent extractives were also done.

Preliminary Phyto-chemical Analysis

Determination of Phytochemical constituents - These tests were performed on Aqueous extract (WE), Alcohol extract (AE), chloroform extract, Ether extract and *Kwatha* of *Panchanga* of *Physalis minima* Linn. powder.

RESULTS

General Appearance




Habit: A small, soft, annual herb that stands upright. It is delicate, usually grows to about 1–1.5 meters tall, and often has fine hairs on its surface.


Stem: The stem grows straight and may have a few branches or droop slightly. It is green or sometimes slightly purple and covered with tiny white hairs.

Leaves:

- Arrangement: Leaves are simple and grow alternately on the stem, sometimes appearing in unequal pairs.
- Shape: Mostly egg-shaped, heart-shaped, or oval.
- Size: Usually between 4–11 cm long and 2–6 cm wide.
- Margin: Edges may be toothed, slightly wavy, or sometimes smooth.
- Apex: Ends in a pointed tip.
- Base: Often uneven or slanted.
- Surface: Covered with fine hairs. The upper side is darker green, while the underside is lighter.
- Petiole: Leaves have long stalks.
- Venation: Shows a net-like pattern of veins.

Flowers:

- Type: Small, single flowers that hang down and have a bell-like shape.
- Color: Usually yellow or pale yellow with dark spots inside the corolla.
- Calyx: Enclosed in a green, long-lasting calyx that starts small.

Fruit (Berry) and Calyx:

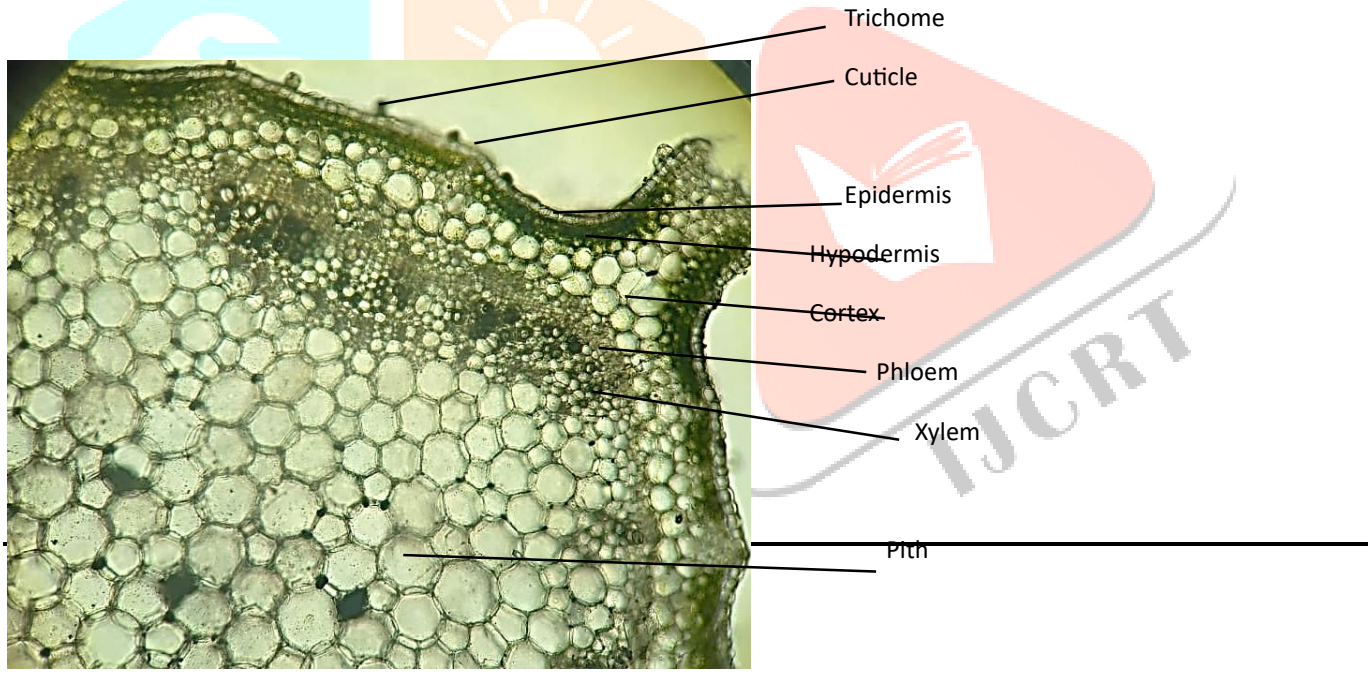
- Calyx (Fruiting Husk): A key identifying feature. As the fruit grows, the calyx becomes large, balloon-like, and papery. It fully covers the fruit. It is green with net-like veins and turns straw-colored or slightly yellow when dry. It has 5 angles or 10 ribs.
- Berry**:** The fruit inside the husk is soft and fleshy.
- Shape: Round or slightly oval.

- Color: Starts green and turns yellow or pale yellow when ripe.
- Taste: Juicy, mildly sweet, sometimes slightly salty or sour.

Seeds: Many small, flat, yellow seeds are present inside the berry.

Microscopy: the following characters were observed. fig.1 Microscopic features of T.S. of Physalis minima Linn.

T.S. of Physalis Stem



T.S. of Physalis Stem:

Epidermis: the epidermis is tangentially elongated and covered with cuticle. The epidermis is interrupted by trichomes.

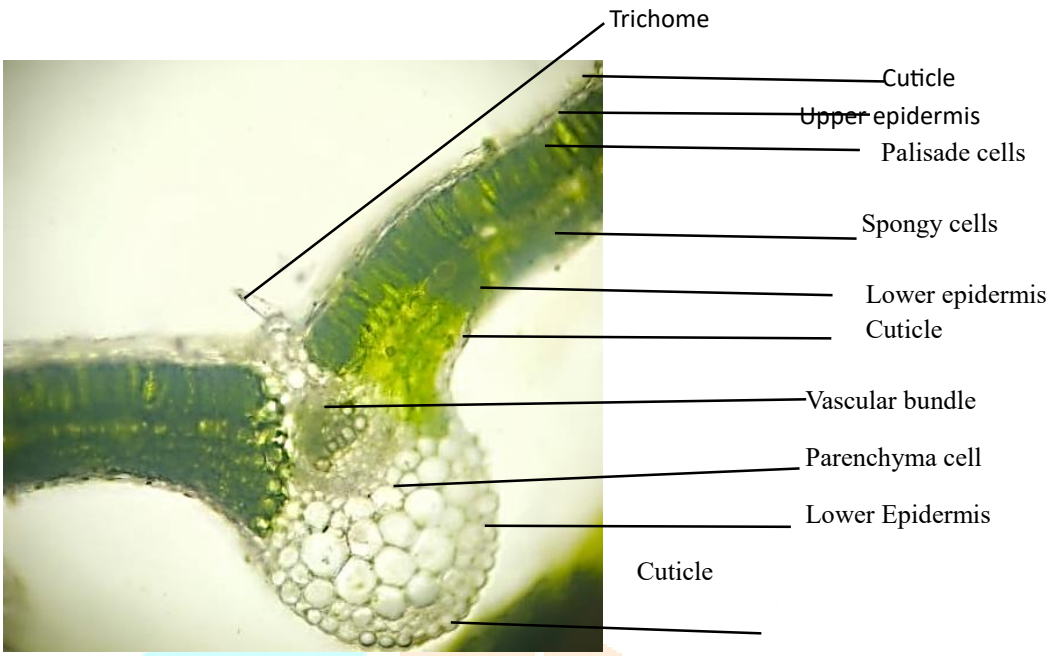
Hypodermis: The hypodermis lays below the epidermis and is made of two layers of chlorenchyma cells.

Cortex: Epidermis is followed by 2 layers of parenchymatous cortex.

Vascular bundle: The pericyclic ring is developed in the region of vascular bundle. Phloem is continued by a layer of xylem traversed by medullary rays.

Pith: A large pith made of parenchyma cells are observed in the center region.

T.S. of Leaf passing through midrib and lamina



T.S. of Leaf passing through midrib and lamina

Upper Epidermis: It is tangentially elongated and covered by cuticle. Trichome is present in the midrib region of Upper epidermis.

Mesophyll: it consists of two layers of palisade cells and 3-4 layers of spongy cells. These cells are filled with chloroplast. Poorly developed vascular bundles are observed within the mesophyll region.

Vascular Bundle: The Vascular bundle is arch shaped. Xylem facing towards the upper side and phloem towards the lower side. The vascular bundle is surrounded by the parenchyma cells.

Lower epidermis: Is similar to the upper epidermis but shows absence of stomata.

Leaves:

Leaf shows all the typical characters of leaf. Lamina part shows – epidermis, upper palisade and middle spongy parenchyma. Laminar portion consists of cluster crystals of calcium oxalate and vascular strands are present. Mid rib shows upper and lower epidermis, Lower epidermal cells of mid rib region is collenchymatous and stomata is present in the lower side. Upper epidermis –Unicellular and glandular trichomes are present. Centrally vascular bundles as phloem above and below the xylem.

Microscopic features of T.S. of *Physalis minima* Linn. Stem: Outline of stem was quadrangular. Epidermis was single layered and chlorenchymatous hypodermis. Cortex was 3-4 layered collenchyma cells and then parenchymatous cells. Some cells were filled with chloroplasts. Vascular bundles were clearly visible in the quadrangular ends of the stem. Phloem cells were found as condensed cells above the xylem. Pith region was wide with parenchyma cells; cells are larger in size and are loosely arranged.

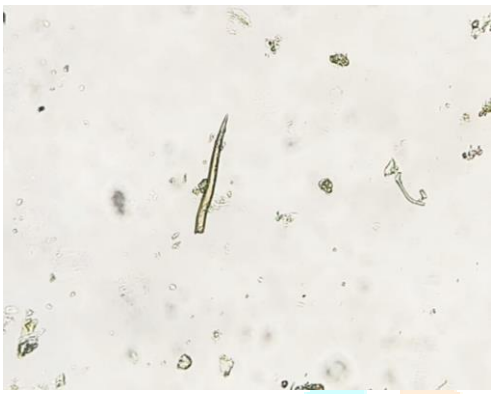
Microscopic features of T.S. of Physalis minima Linn. Root:

Outer epidermis consists of 3- 4 layers of parenchyma cells. The transverse section of root is circular with outer cortex, stellar regions. Xylem vessels of varying size are scattered throughout the stellar region. Xylem vessels were seen as solitary or groups of 2- 4. Phloem cells consist of 2-4. Layers.

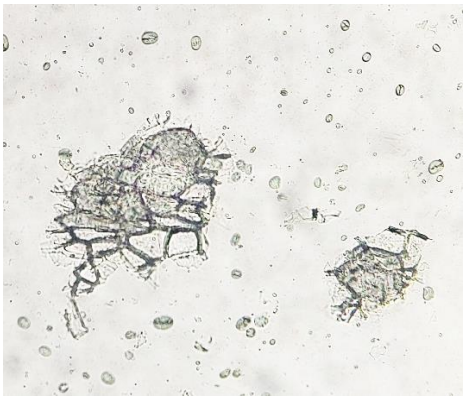
Powder analysis:

Organoleptic study; coarsely powdered with greenish grey colour bitter in taste and having unpleasant odor. Powder microscopy; the following characters were observed.

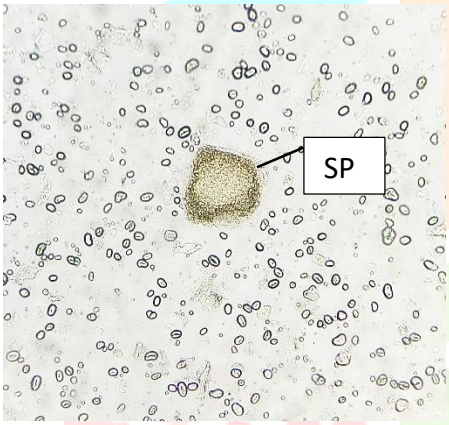
Powder study of Physalis entire plant



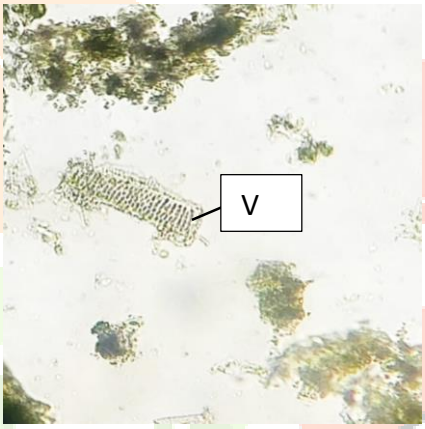
Trichome



Epidermal cells



Starch grain & SP - spongy tissue



V- Pitted vessel

Powder study

Trichome: Unicellular trichome is observed at intervals in the powder.

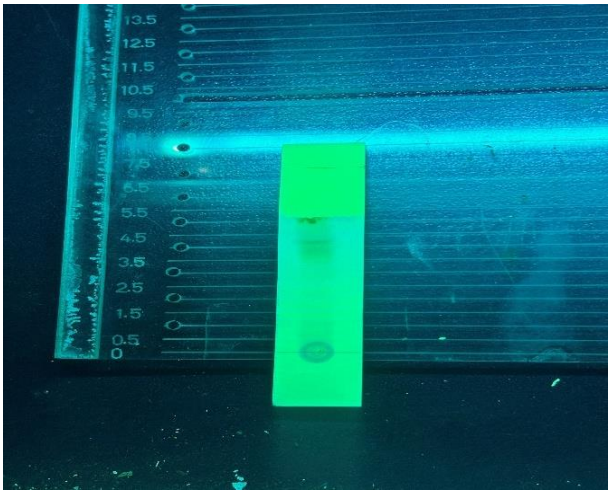
Epidermal cells: patches of epidermal cells are observed.

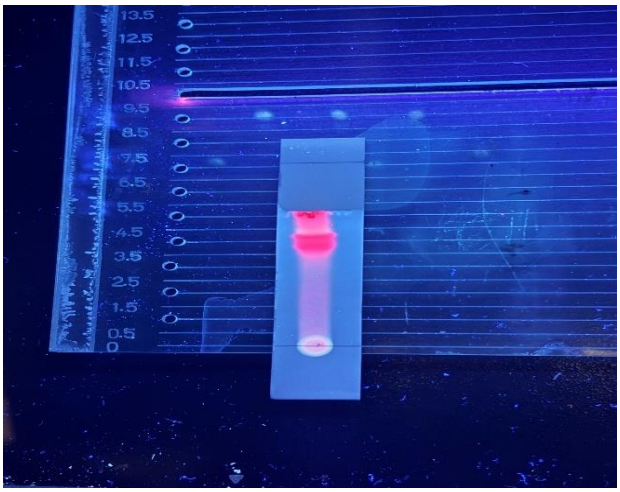
Starch grains: Simple type of starch grains are observed in abundance.

Spongy tissue: circular to polygonal chlorenchymatous cell is observed

Vessels: pitted type of vessels are also observed.

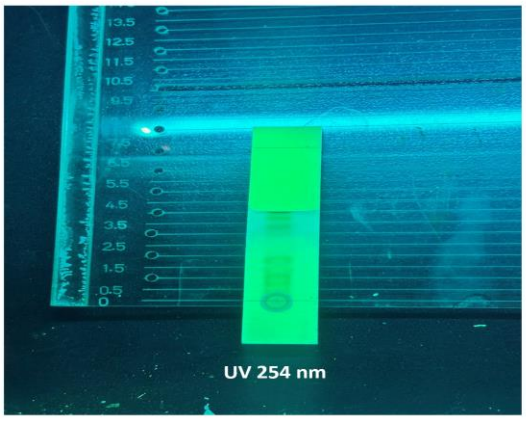
TLC:

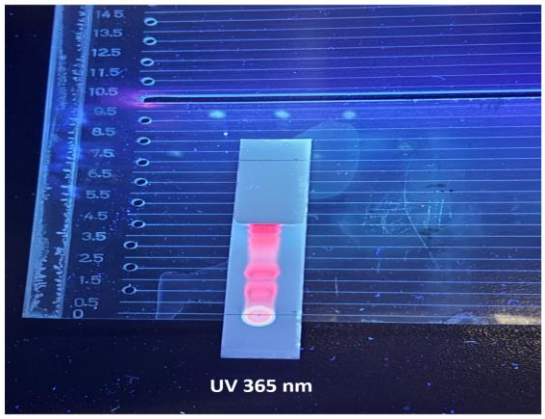




Solvent 1
TLC plate viewed under UV light at 254 nm & 365 nm

Solvent 2
TLC plate viewed under UV light at 254 nm & 365 nm



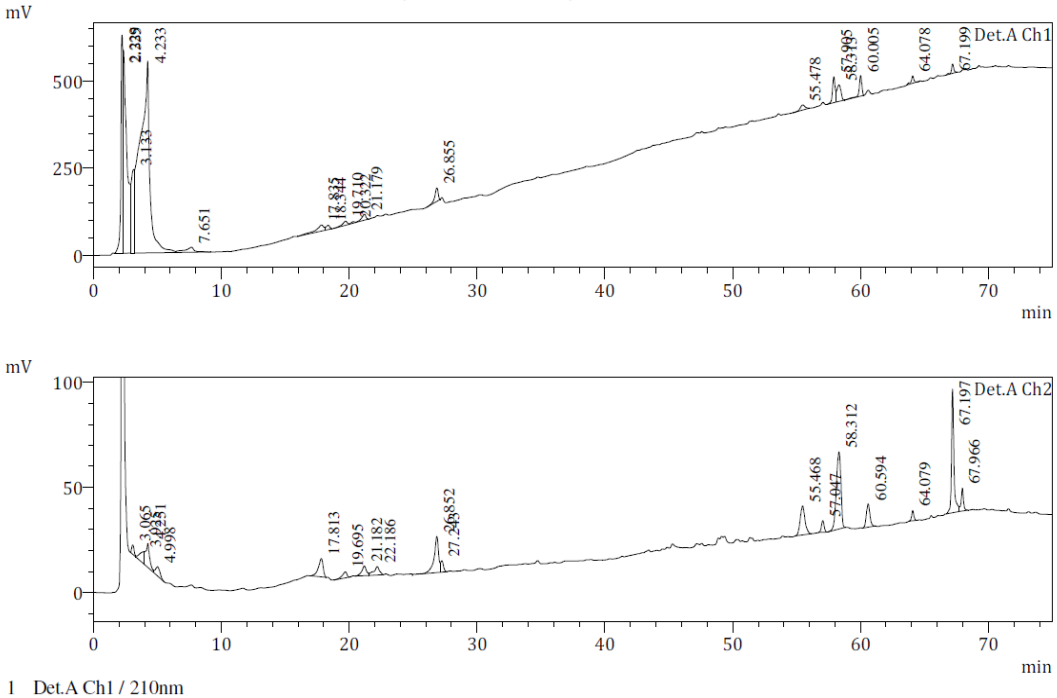


1. HPLC-DAD Interpretation Report (RP-HPLC)

TEST FOR DETERMINATION	CONFIRMATION	NUMBER OF COMPONENTS	CONTRIBUTION %	ANY REMARKS
Aliphatic/Phenolic/Polyphenolic Acids	☑	1	49 %	similar to Gallic acid
Phytoamines/Alkaloids	☐			
Polyphenols/Flavonoids/Antioxidants	☑	4	4 %	
Glycosides/Sugar-Conjugated Steroids	☑	1	1.60 %	withanolides
Terpinoids/Tocopherols/Antioxidants	☑	5	5 %	
Phytosterols/Steroids	☑			
Miscellaneous Category	☐			

3. Specific Components Identification/Characterisation

TEST FOR DETERMINATION	NAME OF COMPONENTS IDENTIFIED	CONTRIBUTION %
Aliphatic/Phenolic/Polyphenolic Acids	Similar to Gallic acid	49 %
Phytoamines/Alkaloids	Not Detected	
Polyphenols/Flavonoids/Antioxidants	Few flavonoids detected	4 %
Glycosides/Sugar-Terpinoids	Detected; might be withanolides	1.60 %
Terpinoids/Tocopherols	detected	5 %
Phytosterols/Steroids		



1 Det.A Ch1 / 210nm
2 Det.A Ch2 / 254nm

PeakTable

Detector A Ch1 210nm

Peak#	Ret. Time	Area	Area %	Height	Height %
1	2.229	6840010	11.603	625628	26.551
2	2.335	11645551	19.754	582021	24.701
3	3.133	4255374	7.218	239831	10.178
4	4.233	28952337	49.112	549946	23.339
5	7.651	786384	1.334	14478	0.614
6	17.835	742537	1.260	17525	0.744
7	18.344	254564	0.432	12263	0.520
8	19.710	294635	0.500	11579	0.491
9	20.322	85185	0.144	4238	0.180
10	21.179	395882	0.672	17171	0.729
11	26.855	700928	1.189	38390	1.629
12	55.478	398674	0.676	15035	0.638
13	57.905	1080352	1.833	74278	3.152
14	58.313	1042566	1.769	47077	1.998
15	60.005	832494	1.412	58917	2.500
16	64.078	297395	0.504	20833	0.884
17	67.199	346544	0.588	27078	1.149
Total		58951412	100.000	2356289	100.000

PeakTable

Detector A Ch2 254nm

Peak#	Ret. Time	Area	Area %	Height	Height %
1	3.065	56610	1.369	4357	2.071
2	3.925	134733	3.258	5834	2.774
3	4.251	238202	5.760	11444	5.440
4	4.998	108962	2.635	4343	2.065
5	17.813	229813	5.558	8768	4.168
6	19.695	73219	1.771	2872	1.366
7	21.182	113005	2.733	4501	2.140
8	22.186	124518	3.011	3962	1.884
9	26.852	414987	10.036	17136	8.146
10	27.243	84432	2.042	5402	2.568
11	55.468	358630	8.673	13815	6.568
12	57.047	81737	1.977	5563	2.645
13	58.312	930509	22.502	36656	17.426
14	60.594	214740	5.193	10988	5.224
15	64.079	59037	1.428	4903	2.331
16	67.197	774578	18.732	58829	27.968
17	67.966	137443	3.324	10975	5.217
Total		4135153	100.000	210346	100.000

Table 1: Physicochemical parameters of the plant *Physalis minima* Linn.

Table 2: Percentage of water soluble and alcohol soluble extractives

No.	Name of extract	Percentage of extract
1.	Alcohol soluble	21.43%
2.	Water soluble	32.85%

Sr No	Experiments	Percentage
1	Total ash	16.60%
2	Water insoluble ash	7.60%
3	Acid insoluble ash	1.59%
4	Moisture content	5.74%
6	Ph	4.93
7	Foreign matter	nil

Table 3: Qualitative Phytochemical analysis of the extractives

Sr. no.	Phytochemical test for -	Methods used	Alcohol	Aqueous	Chloroform	Ether	Kwatha
A	ALKALOIDS	1) Dragandroff	-ve	-ve	-ve	-ve	-ve
		2) Hagers	-ve	-ve	-ve	-ve	+ve
		3) Wagners	-ve	-ve	-ve	-ve	+ve
		4) Mayers	-ve	-ve	-ve	-ve	-ve
B	CARBOHYDRATES	1) Anthrone	+ve	-ve	-ve	-ve	-ve
		2) Benedicts	-ve	-ve	-ve	-ve	-ve
		3) Fehlings	+ve	+ve	+ve	-ve	+ve
		4) Molish	-ve	-ve	-ve	-ve	-ve
C	FLAVANOIDS	1) Shinoda	-ve	-ve	-ve	-ve	-ve
D	GLYCOSIDE	1) Molish	+ve	-ve	-ve	-ve	-ve
E	TRITERPENOIDS	1) Liberman-Buchards	-ve	-ve	-ve	-ve	-ve
F	RESINS		-ve	-ve	-ve	-ve	+ve
G	PHENOLS		+ve	+ve	+ve	-ve	+ve

H	SAPONINS		+ve	-ve	+ve	-ve	+ve
I	STEROIDS	1) Liberman-Buchards	+ve	+ve	+ve	+ve	-ve
		2) Sallowaski	-ve	-ve	-ve	-ve	-ve
J	TANNINS		+ve Brown clr (Pseudotannins)	-ve	-ve	-ve	+ve Browm clr (Pseudotannins)

INTERPRETATION:

1. Alkaloids are present only in Kwatha.
2. Carbohydrates are present in Alcoholic extract, Aqueous extract, Chloroform extract and Kwatha.
3. Glycosides are present in Aqueous extract.
4. Resins are present in Kwatha.
5. Phenols are present in Alcoholic, Aqueous, Chloroform extracts and Kwatha.
6. Saponins are present in Alcoholic, Chloroform extract and Kwatha.
7. Steroids are present in Alcoholic, Aqueous, Chloroform, Ether extracts.
8. Tannins in the form of Pseudo-tannins are present in Alcoholic extract and Kwatha.

Discussion:

Microscopy

Microscopy shows normal structures of root, stem and leaves.

TLC : rf values are tabulated in respective section.

HPLC Chromatogram Interpretation Report:

~~HPLC did not showed the presence of alkaloids, while preliminary Phyto-chemical analysis showed the~~ presence of alkaloids. This is because the HPLC was done of alcoholic extract of the study drug. Preliminary Phyto-chemical analysis was done of 5 different extracts of the study drug, out of which Kwatha made out of Physalis minima showed the presence of Alkaloids.

Physico-chemical analysis:

Physicochemical parameters of *Physalis minima* Linn. whole plant is tabulated in respective section. The Churna of the shade dried drug was subjected to physicochemical analysis. No foreign matter was detected as the drug was self-collected. Deterioration time of the plant material depends upon the amount of water present in plant material. If water content is high, the plant can be easily deteriorated due to contamination by microbes. In present study moisture content was 5.74% in dried sample showing it can be stored for a period of time without spoilage and it will be less susceptible to microbial growth.

The percentage of total ash, acid insoluble and water-soluble ash was determined and results are tabulated. Ash value is the general criterion to ascertain the purity of the drug. Total ash value of the drug was found to be 16.60%. Water soluble ash mainly gives the percentage of organic matter present in the ash and this

was found to be 7.60%. Acid soluble ash, which mainly gives the percentage of the sand and impurities that remain insoluble in HCl and it was found to be 1.59%. Extractive values were also determined. Water soluble extract was found to be 32.85%, highest among all the extracts, which show high water-soluble contents in plant in present study. Water soluble extracts of the drug mainly represent the percentage of organic constituents such as tannins, sugars, plant acids, mucilage and glycosides. Alcohol soluble extracts mainly represent the percentage of organic constituents such as alkaloids, phenols, flavonoids, steroids, sugars etc. present in the drug. The whole plant powder was collected and extracts were prepared separately thus prepared extracts were subjected to preliminary phytochemical studies. Results indicate presence of Flavonoids, Phenol, Saponins, and Tannins in various extracts.

Conclusion:

Preliminary pharmacognostical and phytochemical analysis of *Physalis minima* Linn. was done. In HPLC analysis the maximum number of peaks is observed in the methanol extract and maximum area is observed in the alcohol extracts suggests the presence of more chemical constituents in the extract. Qualitative phytochemical analysis showed the presence of alkaloids, flavonoids, tannins, saponins, steroids, phenols and glycosides.

Acknowledgement:

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