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PHARMACOGNOSTICAL ASSESSMENT &PHYSICO-CHEMICAL SCREENING OF SELECTED INDIAN MEDICINAL PLANT

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Abstract: Medicinal plants are one of the sources of natural products for the treatment and management of debilitating diseases. Plants that have one or more of their parts containing substances that can be used for the treatment of diseases are called medicinal plants. Medicines derived from plants are widely famous due to their safety, easy availability, and low cost. More and more people throughout the world are starting to hear about the negative impacts of synthetic medications. More and more, people are looking for natural, plant-based solutions that work without harmful side effects or toxins. Pharmacognostical study includes parameters like organoleptic,microscopy,physico chemical characters like moisture content,extractive value,ashvalue,fluroscence analysis,phytochemical screening etc.

Index terms: Pharmacognostical study, synthetic medications, plant-based solutions, phytochemical screening.

I. INTRODUCTION: Traditional healthcare systems are struggling to keep up with the increasing number of people suffering from chronic lifestyle disorders. These include conditions including diabetes, hypertension, obesity, cancer, and neurodegenerative illnesses. Treatment for these disorders must take a multi-targeted strategy because of their complex nature. Nevertheless, the majority of synthetic medications utilized in modern medicine are mono-targeted, which frequently leads to side effects, drug resistance, and cumulative toxicity over time. In order to bridge the gap between the complexity of diseases and the availability of effective treatments, there is a pressing need for multi-component medicines that have holistic and synergistic effects. Increasing interest in alternative medicine According to WHO, around 80% of the world's population relies on traditional medicine for their main health care needs.

Negative reactions to synthetic medications In industrialized nations, ADRs (Adverse Drug Reactions) rank among the leading killers. The burden of chronic health conditions According to the World Health Organization, noncommunicable diseases (NCDs) such as diabetes, cardiovascular disease (CVD), and cancer account for the vast majority of illnesses-related deaths (74% of all deaths, or around 41 million per year).A crisis in drug resistance AMR is considered a top 10 public health issue worldwide by the World HealthOrganization.

Worldwide herbal industry It is projected that the global herbal medicine market would reach 430 billion USD by 2028, growing at a CAGR of more than 10%.Disparity in approaches There is a lack of regulation or standardization for more than 70% of herbal formulations in developing nations. Disparity in integration Clinical validation to meet modern pharmacological and toxicological requirements is lacking in less than 15% of herbal medications.

II. MATERIALS AND METHODS: The Materials and Methods section is essential in any scientific study or experimental report, offering a precise and comprehensive description of the research methodology to guarantee reproducibility and transparency. The document delineates the materials utilized, encompassing chemicals, reagents, equipment, and additional resources, along with their origins and specifications, thereby facilitating precise replication by other researchers.

2. I Collection And Plant Authentication: The study involved the selection and collection of medicinal plants. The plants were chosen based on their therapeutic relevance, ethnobotanical evidence, and scientific literature. They were collected from their natural habitats and local markets in Kerala, ensuring proper identification of morphological features. Dr. Ratheesh Narayanan, M.Sc., Ph.D., Assistant Professor & Research Guide, Department of Botany, Payyanur College, Payyanur, affiliated with Kannur University, Kerala, verified the authenticity of the plant materials utilised in the study. Submitted the plant specimens.The specimen voucher numbers are listed in Voucher specimens were deposited once the following plant specimens were recognised and verified.

Table1.1.

Sl. No.	Scientific Name	Family	Plant Part Used	Voucher No.
1	Punica granatum L.	Punicaceae	Rind	P16902023G
2	Passiflora edulis Sims	Passifloraceae	Leaf	P16902024E
3	*Mimosa pudica* L.	Fabaceae subfamily Mimosoideae	Whole plant	M16902025P
4	Phyllanthus emblica L.	Euphorbiaceae	Fruit	P16902026E
5	Cuminum cyminum L.	Apiaceae	Seed	C16902027C

2.2 Pharmacognostic information of selected medicinal plants

Table1.2

SL. No.	Botanical Name	Common Name	Family	Parts Used	Phytoconstituents	Medicinal Uses	Photo of plant
1	*Mimosa pudica* Linn.	Touch-me-not	Fabaceae	Whole plant, roots, leaves	Mimosine, tannins, flavonoids (quercetin), saponins, sterols	Anti-inflammatory,wound healing, antioxidant, antimicrobial, anti-diarrheal	 FIG: 1
2	*Passiflora edulis* Sims	Passion fruit	Passifloraceae	Leaves, fruits, seeds	Flavonoids (vitexin, isovitexin), alkaloids (harmine), cyanogenic glycosides	Anxiolytic, sedative, antioxidant, anti-inflammatory, anticonvulsant	FIG:2 
3	*Punica granatum* Linn.	Pomegranate	Lythraceae	Peel, seeds, flowers, bark	Punicalagin, punicalin, gallic acid, ellagic acid, flavonoids, tannins	Antioxidant, antimicrobial, cardioprotective, anti-inflammatory, antidiabetic	FIG:3 
4	*Emblica officinalis* Gaertn. (*Phyllanthus emblica*)	Amla	Phyllanthaceae	Fruit	Vitamin C, gallic acid, ellagic acid, flavonoids, tannins	Potent antioxidant, hepatoprotective, immunomodulator, anti-inflammatory, antidiabetic	FIG:4 
5	*Cuminum cyminum* Linn.	Cumin	Apiaceae	Seeds (dried fruits)	Volatile oils (cuminaldehyde, thymol), flavonoids, alkaloids, tannins	Carminative,antioxidant, anti-inflammatory, antimicrobial	FIG:5 

2. 3 Organoleptic evaluation: To guarantee the effectiveness and safety of the polyherbal formulation, the chosen medicinal plants—Mimosa pudica, Passiflora edulis, Punica granatum, Emblica officinalis, and Cuminum cyminum—were the subjects of comprehensive pharmacognostic investigations to determine their identity, purity, and quality. Color, smell, taste, and texture were some of the important organoleptic traits noted during the examination of each plant componentThe purpose of the studies was to assess the sensory characteristics of herbal drughs which were used in study. The evaluation parameters included description, color, taste, texture, and appearance.Using the senses of sight, smell, taste, touch, and hearing, as well as other organoleptic traits, this technique evaluates the crude medicinal ingredients. Size, form, surface features, exterior markings, cracks, and foreign matter were among the macroscopic qualities examined under daylight when visually inspecting samples of crude narcotics retrieved from verified sources.

2. 4 Microscopical evaluation: The study involved drying and grinding selected plant parts into a powder, which was then mounted and stained using various reagents . The material was then covered with a coverslip and excess stain removed. At both low and high magnifications, the slides were examined using a compound microscope, and distinctive characteristics were noted. Emblica officinalis, Cuminum cyminum, Mimosa pudica, Punica granatum, Passiflora edulis, and Mimosa pudica are some of the medicinal plants that were powder-microscopically evaluated. These traits are important diagnostic markers for authentication and quality control. Chloral hydrate was used as a mounting medium and glycerin as a clearing agent to analyze dried and finely powdered plant components under a compound microscope.

2. 5 Qualitative phytochemical evaluation: Each extract was dissolve in an appropriate solventsuch as distilled water or methanol and subjected to the following standard phytochemical tests:To begin assessing the bioactive components in plant extracts, qualitative phytochemical screening is a necessary initial step. The main types of secondary metabolites, which are frequently responsible for the pharmacological effects of the plant, can be better identified by this procedure.

2. 6 Determination of Moisture Content in Plant Materials : To eliminate any free or bound water without decomposing thermolabile components, the sample is heated to a constant weight at a predetermined temperature (often 105 °C). Alternate techniques for determining moisture content include loss on drying (LOD), infrared moisture analyzers for quick testing, and Karl Fischer titration for accurate water quantification. Pharmacopoeias, like the Indian Pharmacopoeia or the World Health Organization's standards, specify maximum allowable moisture contents for herbal pharmacognosy. The crude plant extract moisture content is a critical parameter in evaluating its stability, shelf life, and susceptibility to microbial contamination. In this study, the moisture content was determined for different solvent extracts (water, methanol, ethanol, pet-ether, chloroform, and ethyl acetate) of five selected medicinal plants: *Mimosa pudica*, *Passiflora edulis*, *Punica granatum*, *Emblica officinalis*, and *Cuminum cyminum*.

2. 7 Determination of Ash Values of Selected Plant Materials: An essential pharmacopeial test for determining the inorganic content and purity of plant materials is the evaluation of ash values. This test helps to reveal contamination levels (soil, sand, metallic salts) and processing quality. The standard practice is to measure four ash parameters. To acquire total ash, a known weight of dried plant material is burned in a muffle furnace at temperatures between 500 and 600 °C until all organic matter is burned out. The residue is then cooled in a desiccator and weighed. The relative percentage of ash to the original sample is then computed.

2.8 Determination of Extractive Values

When evaluating crude medications, especially those in herbal formulations, the extraction values are an important metric to consider. This method is useful for estimating the concentration of active phytoconstituents in a specific amount of plant material that is soluble in a particular solvent, such as water or alcohol. An indicator of the type and amount of phytochemicals that can be extracted using these solvents, reflecting the compounds' polarity and solubility profile, are the extractive values that are alcohol-soluble and water-soluble.

2. 9 Determination of PH Values: To determine the pH of 1% and 10% w/v solutions of a given substance with the use of an adjusted digital pH meter. After turning on the pH meter, the electrode was cleaned with distilled water and patted dry. In compliance with the instrument's instructions, calibration was carried out using standard buffer solutions, beginning with pH 7.0 (neutral) and progressing to pH 4.0 and pH 10.0 as needed. Following calibration, distilled water was used to rinse the electrode once again. To guarantee uniformity, the 1% solution was gently swirled before the pH was measured. After the reading steadied, the electrode was submerged in the solution, and the pH was noted. After that, distilled water was used to rinse the electrode. For the 10% solution, the identical process was carried out again.

2. 10 Fluorescence Analysis of Poly herbal Powder: When it comes to preliminary identification and quality control of herbal formulations, fluorescence analysis is a quick, easy, and successful procedure. Characteristic fluorescence can be noticed when a polyherbal powder is treated with different chemical reagents and then examined under both short- and long-wavelength ultraviolet (UV) light. This fluorescence can be used as a diagnostic tool to detect the presence of distinct phytoconstituents.

3. RESULTS AND DISCUSSION

3. I Organoleptic Evaluation of Powdered Plant Materials

Table 1.3

Sl no	Plant name	Plant part	nature	colour	odour	taste	Image of powder
1	Punica granatum	Rind	Coarse powder	Dark brown	odourless	sore	**FIG:6** 
2	*Mimosa pudica*	Entire plant	Coarse powder	Pale green	odourless	Slightly bitter	**FIG:7** 
3	Passiflora edulis	leaf	Coarse powder	Pale green	Odourless	bitter	**FIG:8** 
4	Cumin cymimum	fruit	Coarse powder	Light brown	pleasant	aroma	**FIG:9** 
5	Embelica officianalis	epicarp	Coarse powder	Pale to dark brown	odourless	Astringent, acrid	**FIG:10** 

3.2 MICROSCOPICAL EVALUATION

Powder microscopic characters of *Punica granatum*

FIG:11

Stone cells	Single or clusters
Calcium oxalate crystals	Prism type
Starch grains	Present
Vascular bundles	Xylem and phloem

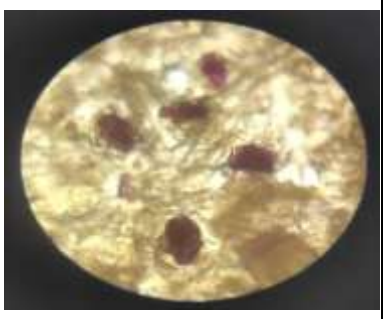


FIG:11

3. 3 Powder microscopic character of *Mimosa pudica*

Trichomes	Glandular
Stomata	Paracytic
Starch grains	Present
Crystals	Prismatic crystals
Brownish matter	Present

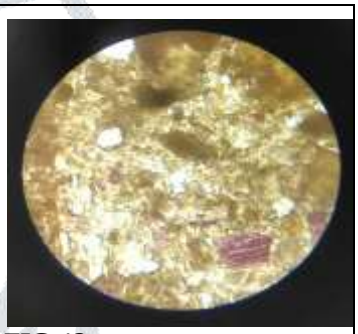


FIG:12

3.4 Powder microscopic character of *Passiflora edulis*

Epidermal cells	Present
Stomata	Paracytic stomata

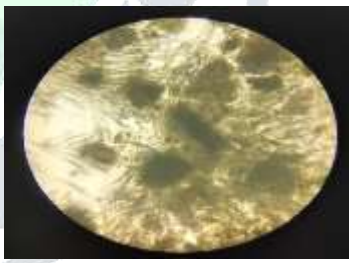


FIG:13

3.5 Powder microscopic character of *Cuminum cyminum*

Epicarp	Single layer of elongated cells
Mesocarp	Parenchymatous cells
Vittae	Reddish brown
Calcium oxalate crystals	Microspheroidal
Oil globules	Present

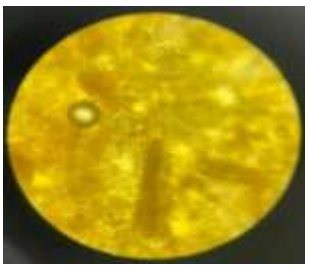
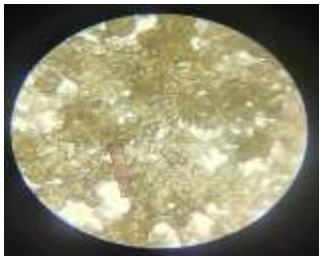


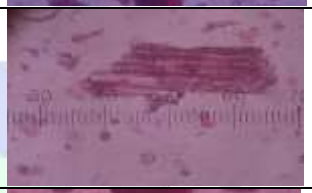
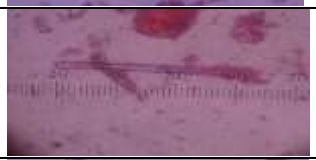
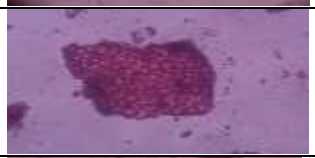
FIG: 14

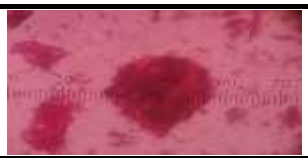
3.6 Powder microscopic character of *Embellica Officianalis*

Lignified tissue	Brown colour	 **FIG: 15**
Aleurone particles	Transition from green to brown hue	
Prismatic in shape crystals	Brown colour	
Calcium oxalate crystals	present	
Pitted vessals	Present	

3.6 Quantitative Powder Microscopy

FIG: 16

Sl.No.	Powder Characters	Microscopical Diagram
1	**Broken piece of fibre**	
2	**Bunch of parenchma**	
3	**Bundle of vessels-measure**	
4	**Cell wall of pitted vessel**	
5	**Trichome with epidermal base**	
6	**Bundle of xylem fibres**	
7	**Cortical parenchyma cells**	
8	**Vessel element with spiral thickening**	
9	**Oil globules**	

10	**Piece of epidermal tissue**	

3. 7 Preliminary Phytochemical Screening

Table 1.4

Phytoconstituent	*Mimosa pudica*	Passiflora edulis	Punica granatum	Emblica officinalis	Cuminum cyminum
Alkaloids	+++	++	+	+	++
Flavonoids	+++	+++	+++	++	++
Tannins	++	++	+++	+++	+
Phenolic compounds	+++	++	+++	+++	++
Glycosides	++	+	++	+	++
Saponins	+++	++	+	++	+
Terpenoids	++	++	++	++	++
Steroids	+	+	++	++	+

(+++) = Strongly Present, (++) = Moderately Present, (+) = Slightly Present, (-) = Absent. Presence (+), absence (–) of each constituent was recorded.The data were used to create a phytochemical profile for each extract, aiding in correlating traditional uses with chemical constituents.This screening provides preliminary evidence of therapeutic compounds present in the selected plants. The results guide was, bioactivity studies& standardization.

3. 8 Determination of Moisture content

Table 1.5

Plant Name	Water Extract (%)	Methanol Extract (%)	Ethanol Extract (%)	Pet-ether Extract (%)	Chloroform Extract (%)	Ethyl Acetate Extract (%)
Mimosa pudica	5.10	4.65	4.90	3.20	3.50	3.80
Passiflora edulis	4.80	4.25	4.60	2.95	3.40	3.75
Punica granatum	5.25	4.90	4.70	3.10	3.45	3.90
Emblica officinalis	4.60	4.30	4.55	2.85	3.10	3.50
Cuminum cyminum	4.75	4.10	4.45	3.00	3.25	3.60

3. 9 Ash Value Determination

Table 1.6

Plant	Total Ash (%)	Acid-Insoluble Ash (%)	Water-Soluble Ash (%)	Sulphated Ash (%)
Mimosa pudica	8.90	1.45	6.70	9.20
Passiflora edulis	7.85	1.20	5.90	8.05
Punica granatum	6.80	1.05	4.75	7.00
Emblica officinalis	6.25	1.10	4.50	6.55
Cuminum cyminum	7.10	1.35	5.20	7.45

3. 10 Extractive Values

Table 1.7

Plant	Alcohol Soluble (%)	Water Soluble (%)	Pet-ether Soluble (%)	Chloroform Soluble (%)
Mimosa pudica	18.20	24.75	5.10	4.60
Passiflora edulis	16.90	23.30	4.90	4.25
Punica granatum	19.40	25.60	5.25	4.85
Emblica officinalis	17.80	26.10	4.75	4.50
Cuminum cyminum	18.10	22.90	5.00	4.70

3.1.1 Determination of Ph (1% and 10% aqueous solutions).

Table 1.8

Plant	1% Solution (pH)	10% Solution (pH)
Mimosa pudica	5.80	5.60
Passiflora edulis	6.10	5.85
Punica granatum	4.90	4.60
Emblica officinalis	3.90	3.65
Cuminum cyminum	5.50	5.30

3 .I.2 FLUORESCENCE ANALYSIS OF PLANT MATERIALS

Table 1.9

Name of plants	Before Treatment			After Treating With 50% Hcl			After Treating With 50%NaoH		
	Ordinary Light	Short Uv	Long Uv	Ordinary Light	Short Uv	Long Uv	Ordinary Light	Short Uv	Long Uv
Punica granatum	Dark brown	brown	Brown	brown	Greenish brown	brown	Brown to yellow	Brown to yellow	Dark brown
Mimosa pudica	Pale green	green	Dark green	green	Greenish yellow	green	Yellow to green	greenish	Dark green
Passiflora edulis	Pale green	Light green	Brownish green	green	Pale green	green	Dark green	Yellow to green	Dark green
Cumin cyminium	Dull brown	Pale brown	Brown to red	Dark brown	Grey to brown	Yellowish brown	Dark brown	Light brown	Dark brown
Embelica officianalis	Pale to dark brown	Light brown	Brown to grey	brown	Light brown	brown	Dark brown	Yellow brown	Red brown

IV. DISCUSSION

Organoleptic evaluation provides a quick, cost-effective, and primary quality control check to confirm the identity and purity of herbal materials. It also ensures to detect early signs of degradation or adulteration. Powder microscopy serves as a reliable and rapid diagnostic tool in the standardization of herbal raw materials for avoiding adulteration and guaranteeing the dependability and consistency of herbal medicine compositions.

The powder of Mimosa pudica showed lignified xylem arteries, paracytic stomata, and unicellular covering trichomes. Crystals of calcium oxalate, multicellular trichomes, and pieces of palisade cells were observed in Passiflora edulis. The peel of Punica granatum displayed stone cells, calcium oxalate crystals in a rosette shape, and parenchyma cells with thick walls and high tannin content. Powdered Emblica officinalis fruit exhibited a plethora of starch grains, twisted blood vessels, and wavy-walled epidermal cells. Powdered cuminum cyminum seeds showed sclerenchymatous cells, reticulate xylem arteries, oil globules, and vittae (oil ducts). Confirming the authenticity and purity of crude medicinal ingredients, particularly in powdered form when macroscopic identification becomes problematic, relies heavily on these microscopic diagnostic traits.Water extracts consistently exhibited the highest moisture content across all plant samples, ranging from 4.60% (*Emblica officinalis*) to 5.25% (*Punica granatum*). This is expected, as water is highly polar and may retain more residual moisture during the drying process.The pet-ether extracts showed the lowest moisture content, varying from 2.85% (*Emblica officinalis*) to 3.20% (*Mimosa pudica*), reflecting the low polarity of pet-ether, which shows in the extraction of non-polar constituents that generally hold less water.Methanol and ethanol extracts showed intermediate moisture levels, with methanol ranging from 4.10% to 4.90%, and ethanol from 4.45% to 4.90%. These solvents are polar but less so than water, explaining their moderate moisture retention.Chloroform and ethyl acetate extracts also presented moderate moisture contents. Chloroform extracts ranged from 3.10% to 3.50%, and ethyl acetate extracts ranged from 3.50% to 3.90%. These semi-polar solvents tend to extract components with lower hygroscopic nature, thereby retaining less water.*Punica granatum* exhibited the highest overall moisture content in water and methanol extracts (5.25% and 4.90%, respectively), suggesting a higher concentration of hydrophilic constituents.The comparative phytochemical profile indicates that *Mimosa pudica* is particularly rich in alkaloids, saponins, flavonoids, and phenolic compounds, while *Punica granatum* and *Emblica officinalis* exhibit high levels of tannins and various phenolic compounds. These findings gives a scientific rationale for the traditional medicinal and uses of these plants and justify further pharmacological and toxicological investigations to validate their bioactivities.Numerous phytoconstituents originating from plants, including alkaloids, flavonoids, coumarins, essential oils, and some glycosides, inherently demonstrate fluorescence either in

their native form or when interacting with particular chemical reagents. Upon exposure to ultraviolet (UV) light at specified wavelengths—generally short-wave (254 nm) and long-wave (365 nm)—these substances generate visible light of diverse colors and intensities as a result of electronic changes inside their molecular architecture. This effect results from the absorption of high-energy ultraviolet photons, subsequently emitting lower-energy visible photons, so generating distinctive fluorescence signatures. In crude drug analysis, the fluorescence characteristics can be augmented or modified by treating the sample with various reagents, including acids, alkalis, organic solvents, or metallic salts, which may induce chemical alterations or complex formation, consequently affecting the electronic environment of the molecules. Fluorescence analysis is a valuable qualitative technique used to detect and characterize phytoconstituents based on their behavior under different lighting conditions, particularly under ultraviolet (UV) light.

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