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Analytical Study of Padmaka (Prunus cerasoides D. Don.)

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Abstract:

Background: The quality, safety, and efficacy of herbal medicines rely heavily on proper identification and standardization. Even after accurate botanical identification, herbal drugs can be of substandard quality due to faulty collection practices, incorrect storage conditions, or improper preparation methods.

Objectives: The present study aimed to establish the physico-chemical standards, perform qualitative phytochemical screening, and develop a Thin Layer Chromatography (TLC) fingerprint for the heartwood of Padmaka (*Prunus cerasoides* D. Don.) to ensure its quality, purity, and authenticity.

Methods: The physico-chemical analysis of the *Prunus cerasoides* sample was conducted at the drug testing laboratory (ISM), Joginder Nagar. The sample was evaluated for foreign matter, loss on drying, total ash, acid-insoluble ash, water-soluble extractive (WSE), and alcohol-soluble extractive (ASE) values according to standard pharmacopoeial methods. Qualitative phytochemical screening was performed on the heartwood powder to detect the presence of primary and secondary metabolites, including alkaloids, flavonoids, steroids, and saponins. Furthermore, TLC was utilized as a qualitative separation technique to establish a characteristic chemical fingerprint using a Toluene:Ethylacetate (9:1) mobile phase.

Results: The sample was completely free from foreign matter. Physico-chemical evaluation revealed a total ash value of 0.54% and an acid-insoluble ash value of 0.38%, both well below the maximum limits set by the Ayurvedic Pharmacopoeia of India (API). The extractive values were notably high, with a WSE of 30.34% and an ASE of 15.79%.

Conclusion: The analyzed sample of *Prunus cerasoides* D. Don. meets all standard physico-chemical parameters laid out in the API, indicating its high purity and quality. The rich presence of therapeutic secondary metabolites (flavonoids, steroids, and alkaloids) strongly correlates with its traditional Ayurvedic indications for skin and bleeding disorders.

Keywords: *Prunus cerasoides*, Padmaka, Physico-chemical analysis, Phytochemical screening

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Introduction:

The primary objective of this analytical study is to establish the quality standards for *Prunus cerasoides* D. Don. (Padmaka) through comprehensive physico-chemical evaluation, qualitative phytochemical screening, and Thin Layer Chromatography (TLC). These parameters are essential for authenticating the raw material and ensuring its safety and efficacy for therapeutic use. In Ayurveda, Padmaka is highly valued for its astringent (*Kashaya*), cooling (*Sheeta*), and complexion-enhancing (*Varnya*) properties, widely used in treating skin diseases, burning sensations, and bleeding disorders (*Raktapitta*).[1-2]

Objective

Analyse the *Prunus cerasoides* D. Don. using several key physico-chemical parameters.

Methodology[3]

- **Foreign Matter:** Foreign matter in herbal drugs includes parts of the medicinal plant, organisms, or products other than what is specified, as well as stones, soil, dust, and inorganic contaminants. The sample was purchased personally and inspected.
- **Loss on Drying:** 1 gm of the drug sample was placed in a pre-weighed dried petri dish. It was dried in an oven at 105°C until a constant weight was reached. The dish was cooled and weighed immediately. The weight loss was calculated and expressed as % w/w.
- **Total Ash:** 2 gm of the drug was accurately weighed into a pre-weighed, dried silica crucible. It was incinerated in a muffle furnace at a temperature not exceeding 450°C, then cooled and weighed. The ash value was calculated based on the air-dried sample and expressed as % w/w.
- **Acid Insoluble Ash:** The ash obtained from the total ash analysis was boiled for five minutes with 25 ml of dilute hydrochloric acid. The insoluble matter was collected on an ash-less filter paper, washed with hot water, and incinerated to a constant weight. The percentage was calculated with reference to the air-dried sample.
- **Water Soluble Extractive (WSE):** 5 gm of the sample was mixed with 100 ml of distilled water, kept covered overnight, and stirred intermittently initially. The next day, it was filtered. 25 ml of the filtrate was evaporated in a weighed dish on a water bath, dried in an oven, cooled, and weighed. The percentage of WSE was calculated as % w/w.
- **Alcohol Soluble Extractive (ASE):** The method was identical to the WSE procedure, but methanol was used as the solvent instead of water. The percentage was calculated as % w/w.

Results of Physico-chemical Analysis

The obtained values were compared against the reported standard values from *The Ayurvedic Pharmacopoeia of India, Part I, Vol. 3*.

Sr. no.	Physico-chemical parameters	Values obtained	Reported values
1.	Foreign matter	Nil	Not more than 1%*
2.	Total ash	0.54%	Not more than 1%*
3.	Acid insoluble ash	0.38%	Not more than 0.5%*

4.	Water soluble extractive	30.34%	Not less than 1%*
5.	Alcohol soluble extractive	15.79%	Not less than 3%*

**Reference: The Ayurvedic Pharmacopoeia of India, Part I, Vol. 3*

The sample was free from foreign matter as it was personally purchased. All other obtained values fall well within the acceptable limits specified by the Pharmacopoeia, indicating the sample is of standard quality.

Phytochemical Screening (Qualitative)

Qualitative tests were performed on the heartwood powder of *Prunus cerasoides* D. Don. to determine the presence or absence of specific primary and secondary metabolites.[4]

1 Screening Methodology[5]

- **Iodine test for starch:** The sample was treated with a drop of iodine.
- **Dragendorff's test for Alkaloids:** The sample was treated with 0.5 ml of Dragendorff's reagent.
- **Fehling test for Carbohydrates:** Equal volumes of Fehling's A and Fehling's B reagents were mixed, a few drops of the sample were added, and the mixture was boiled.
- **Millons test for Amino acids:** The test solution was mixed with 2ml of Millon's reagent and gently heated.
- **Salkowski test for Steroids:** The sample was treated in Chloroform with a few drops of concentrated Sulphuric acid, shaken well, and allowed to stand.
- **Borntrager's test for Anthraquinone Glycosides:** The test material was boiled with 5ml of ferric chloride for 5 min, an equal amount of benzene was added, shaken, allowed to stand, and the separated benzene layer was treated with ammonia solution.
- **Alkaline reagent test for Flavonoids:** A few drops of sodium hydroxide solution were added to the test solution, followed by a few drops of dilute acid.
- **Foam test for Saponins:** 5ml of the aqueous extract was shaken vigorously with 2 ml of water.

2 Results of Phytochemical Screening

Test for Phyto-compound	Powder of P. cerasoides	Phytocompounds
Iodine test	+	Starch present (grains turned blue)
Dragendorff's test	+	Alkaloid present (reddish-brown precipitate)
Fehling's test	+	Reducing sugars present (brick red precipitate)
Millon's test	+	Proteins (amino acids) present (white precipitate turning red on heat)
Salkowski test	+	Steroids present (red color at the lower layer)
Borntrager's test	+	Anthraquinones glycosides present (rose pink to red color)

Alkaline reagent test	+	Flavonoids present (intense yellow turning colorless with acid)
Foam test	-	Saponins absent (no foam produced)

(+ indicates presence, - indicates absence)

Thin Layer Chromatography (TLC)

Thin Layer Chromatography (TLC) was adopted as a qualitative separation technique. TLC is widely used to separate individual components from a mixture based on their polarity, aiding in both qualitative and quantitative evaluation of drugs.

1 Methodology

- **Stationary Phase:** Silica gel "G" plate.
- **Mobile Phase (Solvent System):** Toluene : Ethylacetate (9:1 ratio).
- **Sample:** Alcoholic extract of the drug.
- **Calculation:**
  Rf value = (Distance travelled by the solute) / (Distance travelled by the solvent)

2 TLC Results

The alcoholic extract run on the Silica gel "G" plate yielded the following observations:

1. **Under UV light (366 nm):** A single fluorescent zone was visible at Rf 0.64 (blue).
2. **On exposure to Iodine vapor:** Seven distinct spots appeared at Rf 0.15, 0.32, 0.42, 0.53, 0.59, 0.64, and 0.76 (all yellow).
3. **Post-derivatization:** After spraying the plate with Vanillin-Sulphuric acid reagent and heating it for ten minutes at 105°C, four spots appeared at Rf 0.15, 0.32, 0.53, and 0.59 (all violet).

Discussion

The process of standardization is a vital prerequisite in herbal medicine to ensure batch-to-batch consistency, therapeutic efficacy, and safety. The present analytical study successfully established the quality parameters for the heartwood of Padmaka (*Prunus cerasoides* D. Don.).[6]

Physico-chemical Analysis:

The evaluation of ash values is a crucial indicator of purity. The total ash value was found to be exceptionally low (0.54%), which is well within the API limit of Not More Than (NMT) 1%. Furthermore, the acid-insoluble ash, representing siliceous matter like sand and soil, was only 0.38%. These low values reflect the absence of inorganic adulteration and confirm that the drug material was collected and handled with high hygienic standards.

Extractive values are indicative of the amount of active constituents present in a specific solvent. The Water-Soluble Extractive (WSE) value was remarkably high at 30.34%, signifying a rich concentration of water-soluble polar components such as sugars, acids, and inorganic compounds. The Alcohol Soluble Extractive (ASE) was 15.79%, indicating a substantial presence of semi-polar to polar secondary metabolites like flavonoids, alkaloids, and steroids.[7-8]

Phytochemical Profile and Therapeutic Correlation:

The qualitative phytochemical screening revealed a robust secondary metabolite

profile. The prominent presence of **flavonoids** and **steroids** strongly correlates with the traditional Ayurvedic use of Padmaka for managing *Raktapitta* (bleeding disorders) and *Kushtha* (skin diseases). Flavonoids are well-documented for their potent antioxidant, anti-inflammatory, and wound-healing activities. The presence of **alkaloids** may contribute to mild analgesic and antispasmodic properties. The absence of saponins provides a negative marker that can be useful in distinguishing *P. cerasoides* from potential adulterants that might test positive for saponins.[9]

Chromatographic Fingerprinting:

TLC provides a semi-analytical fingerprint that is indispensable for the routine quality control of herbal drugs. The mobile phase of Toluene:Ethylacetate (9:1) provided excellent separation of the methanolic extract. The appearance of seven distinct spots upon iodine vapor exposure (ranging from Rf 0.15 to 0.76) and four prominent violet spots post-derivatization with Vanillin-Sulphuric acid (Rf 0.15, 0.32, 0.53, 0.59) serves as a unique chemical signature. This signature can be employed as a reference standard in pharmaceutical industries to rapidly detect sub-standard or substitute materials claiming to be genuine Padmaka.[10]

Conclusion

The analytical study of Padmaka (*Prunus cerasoides* D. Don.) confirms that the sample analyzed strictly adheres to the standard physico-chemical parameters laid out in the Ayurvedic Pharmacopoeia of India. The low ash values and high extractive values highlight its pristine quality and high active-principle content. Qualitative phytochemical screening verified the presence of essential therapeutic metabolites including alkaloids, flavonoids, steroids, and anthraquinone glycosides. The distinct TLC profiling further establishes a characteristic fingerprint for the drug. Collectively, these parameters provide a reliable scientific framework for the future identification, authentication, and quality control of this important Ayurvedic raw material.

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