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Pharmacognostical And Physiochemical Evaluation Of *Embelia Tsjerium Cottam*

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Abstract: *Embelia tsjeriam-cottam is a medicinal shrub native to the Western Ghats and traditionally used for its therapeutic properties. The purpose of this study was to determine the best extraction solvent and assess phytochemical and pharmacognostic traits. Fruits were collected, shade-dried, and powdered. Macroscopic and microscopic analyses were performed, revealing reddish-brown oval fruits and the presence of aleurone grains and starch granules. Extractive values were assessed using 9 solvents. Ethanol showed the highest extractive value at 18% and gave a Soxhlet yield of 6.4%. The ethanol extract was subjected to phytochemical screening, which confirmed the presence of alkaloids, flavonoids, phenols, and proteins. These findings suggest that the plant has significant medicinal potential. Ethanol proved to be the most suitable solvent for extraction, supporting its use in future pharmacological and phytochemical research aimed at validating the plant's traditional medicinal applications and exploring its therapeutic potential*

Keywords: *Embelia tsjeriam-cottam, Vidanga, Phytochemical screening, Ethanol extract, Medicinal plant.*

1. INTRODUCTION:

Embelia tsjeriam-cottam, a well known plant occurs in the biodiverse regions of the Western Ghats, especially in areas of Kerala, Karnataka, and along the Malabar Coast [1] . It belongs to the *Myrsinaceae* family, which comprises over a thousand species across more than 30 genera, many recognized for their pharmacological benefits [4]

This species has drawn attention in both ethnomedicine and modern pharmacology due to its wide range of bioactive effects, such as antifertility, estrogen-modulating, and antiparasitic activities. These effects are primarily attributed to embelin, a quinone derivative known for its potent antioxidant, anti-inflammatory, and anticancer properties [2,3] . As a result, *Embelia tsjeriam-cottam* is being investigated as a potential source for developing therapeutic compounds.

Botanically, the plant is a small, woody vine that produces round, reddish fruits and small pale-yellow flowers [4] . The fruits, which are rich in embelin, represent the main part used for medicinal extraction.. This taxonomic confusion can result in mistaken substitutions, affecting treatment outcomes and conservation strategies [1,4] .

To make matters more complicated, the fruit of *Embelia tsjeriam-cottam* is mistakenly called "False Black Pepper" because it looks a lot like black pepper (*Piper nigrum*). Sometimes, this similarity has led to inadvertent or dishonest merging with commercial black pepper, raising concerns over quality assurance in the herbal and spice trade [4] . Moreover, this plant is listed as threatened in certain areas, such as Odisha, due to excessive harvesting and habitat loss, making it a subject of ecological concern [3] Considering these factors, the present study aims to carry out a comprehensive investigation into the Pharmacognostical and physicochemical characteristics of *Embelia tsjeriam-cottam*. By establishing clearer identification criteria and evaluating its bioactive profile, this research supports the validation of traditional knowledge, aids species authentication, and encourages sustainable usage through standardized quality control practices.

2. LITERATURE REVIEW:

- **Ananth V. et al. (2018)** studied *Embelia tsjeriam-cottam* to examine its structural and chemical characteristics. The plant was identified as a woody shrub with distinctive leaves and fruits. Anatomical sections of leaf and stem showed clear tissue organization, including vascular bundles, oil glands, and storage cells, useful for plant identification. Phytochemical tests on different extracts revealed the presence of compounds like alkaloids, flavonoids, tannins, glycosides, and terpenoids. These are known for their medicinal importance. FT-IR analysis

showed several active functional groups, with major peaks confirming the presence of alcohols, phenols, amines, and aromatic compounds. The results support the traditional use of the plant in herbal practices and suggest further research into its potential therapeutic value.[5]

- **Chandrappa et al. (2013)** studied fungal endophytes isolated from the leaves and buds of *Embelia tsjeriam-cottam* to examine their phytochemical content and antibacterial activity. The researchers identified four main endophytes: *Cladosporium cladosporioides, Penicillium sp., Aspergillus niger, and Alternaria sp.* Extracts obtained using solvents like hexane and ethyl acetate were tested, revealing phytochemicals such as phenols, flavonoids, tannins, and glycosides. Among the fungi, *Aspergillus niger* exhibited the strongest antibacterial activity, inhibiting various pathogens including Pseudomonas aeruginosa and *Klebsiella pneumoniae. Alternaria* and *Penicillium* extracts also showed similar effects, while *Cladosporium* was not tested for antibacterial action. The findings point to the potential role of endophytic fungi from this plant as sources of natural bioactive agents. [6]
- **Sara MM et al. (2014)** evaluated the pharmacological and toxicological potential of *Embelia tsjeriam-cottam* leaf extract in experimental rats. The study focused particularly on its antidiabetic activity, where oral administration of the extract produced a significant reduction in blood glucose levels, suggesting its hypoglycemic efficacy. In addition, preliminary safety assessments indicated no major toxicological effects, thereby supporting its therapeutic application. The findings highlight that beyond the fruit, the leaves of *E. tsjeriam-cottam* also possess bioactive compounds of pharmacological relevance, justifying further exploration of the plant's diverse medicinal parts for drug development [7]
- **Pandey A.K. and Ojha V. (2011)** conducted a focused study titled "Estimation of embelin in *Embelia tsjeriam-cottam* fruits by HPLC to standardize harvesting time", highlighting the importance of accurate phytochemical analysis to enhance the therapeutic potential of the plant. *Embelia tsjeriam-cottam*, a member of the *Myrsinaceae* family, is widely recognized in traditional Indian medicine for its rich embelin content, a benzoquinone compound known for antioxidant, antimicrobial, anti-inflammatory, and anticancer activities. This research aimed to determine the optimal harvesting stage of the fruits to ensure maximum yield of embelin, there by improving quality control and standardization in herbal preparations. Using High- Performance Liquid Chromatography (HPLC), the study revealed that fruits collected during November–December contained the highest concentration of embelin. The findings underscore the necessity of establishing scientifically validated harvesting protocols to preserve bioactive compound potency and ensure consistent pharmacological efficacy of herbal formulations derived from this plant. [8]
- **Warrier et al. (1993)** compiled an extensive multi-volume reference on Indian medicinal plants, offering detailed insights into the taxonomy, distribution, traditional uses, and phytochemical constituents of over 500 species. Among them, *Embelia tsjeriam-cottam* was noted for its traditional applications in treating a variety of ailments, including intestinal worms, skin disorders, and inflammation. The text documents both the ethnomedicinal relevance and the plant's phytochemical profile, including the presence of embelin, a quinone derivative with reported antibacterial, antifungal, and anti-inflammatory properties. This foundational compendium remains a critical resource for researchers in the field of pharmacognosy and herbal drug development [9]

3. OBJECTIVES:

- To evaluate pharmacognostical and physiochemical evaluation of *embelia tsjerium cottam*

4. MATERIALS AND METHOD:

- **Collection, Authentication, and Preparation of Plant Materials**

Plant materials were collected from Mannuthy and Attapady and it was authenticated by Dr. Ranjusha A. P, HOD, Botany, N.S.S. College, Ottapalam. The plant part, specifically the fruit, was dried under shade for 15–30 days until the red color turned black and then finely powdered.

PHARMACOGNOSTICAL EVALUATION:

• MACROSCOPICAL STUDIES:

Fruits of *Embelia tsjeriam-cottam* underwent comprehensive macroscopic analysis as part of Pharmacognostical evaluation. Organoleptic characteristics such as color, surface texture, shape, odor, taste, hardness, and consistency were examined. Color was observed in natural light to record pigmentation, aiding in crude drug identification [10] Surface texture was assessed by touch, classifying the surface as smooth, rough, or wrinkled [10, 11]. Odor was evaluated by gently

smelling the sample, and taste was checked using a tiny amount of the material, following safety and Pharmacognostical norms [12]

Hardness was tested by applying hand pressure to assess resistance, and consistency was judged by touch to determine whether the material was brittle, firm, leathery, or soft [10, 13] .These macroscopic features are vital in the preliminary identification and quality evaluation of the material [13]

• MICROSCOPIC STUDIES:

Microscopic evaluation was performed using a LABOMED 300X microscope, at 40x and 10x magnifications, to observe the internal structures of Embelia tsjeriam-cottam fruits. A free-hand transverse section was prepared and placed in water to retain cell structure for observation. This allowed the study of tissue layers such as the epidermis, cortex, and vascular bundles, important for anatomical analysis.

Phloroglucinol HCl stain was applied to identify lignified cell walls, aiding visualization of vascular structures and sclerenchyma cells, which support plant architecture. The section also displayed elements like starch grains and aleurone grains, which provide insight into the fruit's biochemical content [12]

Powder microscopy was conducted on the fruit material in its powdered form to examine its diagnostic microscopic features. Further, comparison with standard reference features contributed to accurate identification and supported the pharmacognostical quality control process [14]

- **PHYSIOCHEMICAL EVALUATION**
  - Determination of Moisture Content

A carefully measured 2 grams of the powdered fruit were added to a crucible that had been previously weighed. A hot air oven set to 100 to 105°C was used to dry the sample until its weight stopped fluctuating, indicating that all of the moisture had been removed. Following drying, the crucible was carefully moved to a desiccator to cool in order to stop it from reabsorbing moisture from the air. Only after the sample had settled completely and reached room temperature was the weight noted [15]

- Total Ash Determination

A clean, previously weighed crucible was filled with roughly 1 gram of the dried powdered sample. To allow the organic material to burn slowly and avoid abrupt loss, it was first heated gradually over a low flame. Then the muffle furnace placed at a temperature of 550-600 for 3 hours. To prevent moisture absorption, the heated crucible was removed and allowed to cool in a desiccator. After that, it was precisely weighed. In order to verify that the ashing had finished, this procedure was repeated until the weight stayed consistent [15]

- Determination of Acid-Insoluble Ash

Dissolve acid-soluble components, 25 milliliters of diluted 2 M hydrochloric acid were added to the ash, which was then gently heated for five minutes. To get rid of any remaining acid, the remaining insoluble material was filtered using ash-less filter paper (such as Whatman No. 41) then rinse with hot water. After cooling in a desiccator, the filter paper containing the residue was weighed, burned to eliminate organic material, and then returned to the original crucible. [15]

- Estimation of Water-Soluble Ash

A crucible containing all of the ash residue was filled with 25 milliliters of distilled water. To dissolve the water-soluble ingredients, the mixture was gently boiled for five minutes. After being filtered and thoroughly cleaned with hot water, the residual insoluble material was burned for a short while at a temperature of no more than 450°C in a different crucible. The residue was weighed once it had cooled. [15]

- Extraction and percentage Yield Estimation

An accurately weighed 1 g sample of the powdered drug was immersed in 20 ml of selected solvents—such as distilled water, n-hexane, petroleum ether, diethyl ether, chloroform, acetone, ethanol, benzene—for maceration over a 24-hour time period at ambient temperature. To enhance extraction efficiency, the mixture was gently agitated at intervals during the initial 6 hours. After the full duration, the solvent layer was decanted, and the extract was concentrated by drying in a hot air oven at 105°C until a stable weight was reached and further the percentage yield was calculated [15]

- Examination for Foreign Matter

An accurately weighed quantity of crude drug, between 250g, was evenly distributed into a thin, visible layer on a clean inspection surface. The sample was carefully observed for unwanted materials such as dirt, stones, or parts of other plants using the naked eye and a 6× magnifying lens when finer detail was required. All foreign components identified were separated from the main sample, individually weighed, and expressed as a percentage of the total sample weight to assess contamination. [15]

- Swelling Index Evaluation

A 25 ml stoppered cylinder was filled with 1 g of the medication, which had been coarsely powdered. Distilled water was added till 25 ml mark. The cylinder was intermittently agitated over the course of 23 hours to aid in uniform

absorption and expansion of the material. Following this period, it was allowed to remain undisturbed for an additional hour to ensure complete swelling. The final volume occupied by the swollen mass was noted, and the swelling index was calculated as an indicator of the drug's water absorption and expansion characteristics. [15]

•Foaming index

A 1 g coarse powder with 100ml of water has been transfer to 500ml conical flask. The mixture was kept under a gentle boil for 30 minutes to facilitate extraction. After cooling to room temperature, the solution was filtered, and the filtrate was carefully transferred into a 100 ml volumetric flask and the final volume was adjusted to 100ml. This decoction was then dispensed into 10 stoppered test tubes, with varying volumes starting from 1 ml and increasing incrementally up to 10 ml. The liquid in each tube was topped up with distilled water to a total volume of 10 ml. The tubes were tightly sealed and shaken vigorously in a longitudinal direction for 15 seconds, maintaining a frequency of two shakes per second. Only 15 minutes after shaking, the test tubes' foam height was measured to determine the foaming index [15].

- **PHYSIOCHEMICAL STUDIES:**

- EXTRACTION:

A total of 12.5 g of coarsely powdered Embelia tsjeriam-cottam was accurately weighed and subjected to extraction using ethanol as the solvent. The extraction process was carried out for approximately 8–10 hours using soxhlet extraction, while maintaining the temperature between 45°C and 70°C, ensuring it did not exceed this range to preserve the integrity of the phytoconstituents. [16]

After the completion of extraction, the solvent evaporated, and ethanoic extract was dried.

- **PRELIMINARY PHYTOCHEMICAL SCREENING** [17]

Several common assays were used to find out whether the ethanolic fruit extract contained alkaloids. . Mayer's, Hager's, and Wagner's reagents were used with the extract, followed by observation of color changes or precipitate formation. Flavonoids were identified using the ferric chloride test, Shinoda test with magnesium and hydrochloric acid, and a reaction involving sodium hydroxide—all based on characteristic color development.

Carbohydrate detection involved Molisch's test, which included sulfuric acid layering, along with Fehling's and Benedict's tests that required heating with respective reagents to observe color or precipitate changes. Phenolic compounds and tannins were examined through the use of ferric chloride and lead acetate reagents, which revealed distinctive colors or precipitates upon interaction.

For terpenoids, the Salkowski reaction was conducted by mixing the extract with chloroform and layering sulfuric acid to detect a color shift at the interface. Saponins were evaluated through a foam test involving vigorous shaking with water and observing the persistence of froth. Lastly, the presence of proteins and amino acids was tested using the ninhydrin reaction and Millon's test, both involving heating the extract with specific reagents to detect color changes indicative of these compounds.

5. RESULT:

- **PHARMACOGNOSTICAL STUDIES**

- **MACROSCOPIC STUDIES**

FEATURE	OBSERVATION
Color	Reddish or brownish black with yellowish brown speckles
Surface	Speckled seed surface
Shape	Oval to elliptical
Odor and taste	No specific odor and taste on dried fruits and a slight sweeten taste in ripped fruit
Hardness	Likely firm or hard
Consistency	Presence of oil bodies and starch grains implies a solid, possibly oily interior.

Table 1: Macroscopic Studies

- **MICROSCOPIC STUDIES:**

Transverse section of fruit is circular in outline. It displays the epicarp, which is made up of a single row of tabular epidermis cells that are typically obliterated.. It is followed by Mesocarp, which consists of a number of layers of

reddish-brown coloured cells, with stone cells. Endocrap consists of large, multi-layered, radially arranged, thick-walled, palisade-like stone cells.A layer of thin, reddish-brown cells that run tangentially makes up the testa. Endosperm cells are thick-walled, irregularly shaped aleurone grains.

Fig 1: Transverse section of Embelia tsjerium cottam

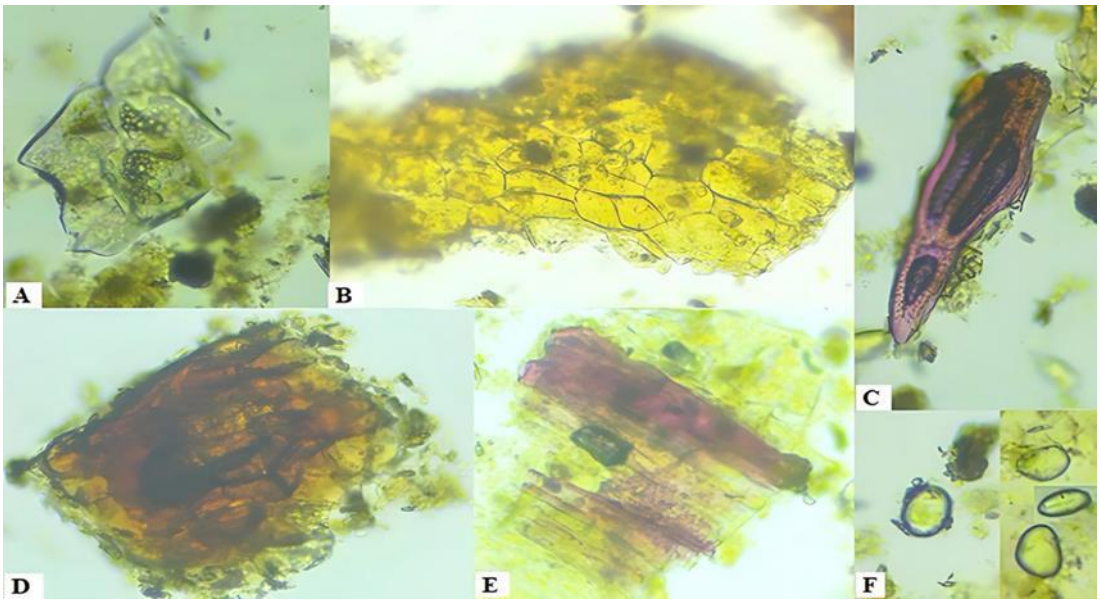

Fig 2: Powder microscopy of Embelia tsjerium cottam
A : Aleurone Grain With Starch, B : Surface Of Epidermis, C : Stone Cells D : Coloured Contant , E : Vascular Element F : Starch Grains

Aleurone grain containing starch, a surface-viewing epicarp fragment, and thick-walled, lignified stone cells of the endocarp with a constricted lumen are all visible in powder microscopy of Embelia tsjeriam cottam. Reddish brown coloured contents, lignified vascular element and round to oval simple starch grains are also present.

- **PHYSIOCHEMICAL STUDIES**

Si.no	Physiochemical evaluation	Result (%w/w)
1	Moisture content	0.3
2	Ash value	
2.1	Total ash	6.2
2.2	Water soluble ash	0.42

2.3	Acid insoluble ash	0.29
3	Foreign matter	Less than 1
4	Swelling	No swelling
5	Extractive value	
5.1	N-hexane	0.01
5.2	Petroleum ether	4
5.3	Benzene	3
5.4	Diethyl ether	4
5.5	Chloroform	2
5.6	Ethyl acetate	0.02
5.7	Acetone	12
5.8	Ethanol	18
5.9	Water	0.08

Table 2 : Physiochemical Studies

- **PRELIMINARY PHYTOCHEMICAL SCREENING**

PHYTOCONSTITUENTS	TEST	OBSERVATION
Alkaloids	Mayer's test	+
	Hager's test	+
	Wagner's test	+
Flavonoids	Ferric chloride test	+
	Shinoda test	+
	Aq. Sodium hydroxide Test	+
Carbohydrate	Molisch test	+
	Fehling's test	+
	Benedict'stest	-
Phenols and tannins	Ferric chloride test	+
	Lead acetate test +	+
Terpinoids	Salkowski test	-
Saponin	Foam	-
Proteins and amino acids	Ninhydrin	+
	Millions	+

Table 3 :Preliminary Screening

6. DISCUSSION:

The study of *Embelia tsjeriam-cottam* (Vidanga) revealed several important physicochemical and phytochemical characteristics. Macroscopic and microscopic evaluations showed that the plant's seeds are reddish-brown with speckles, indicating its characteristic appearance. The physicochemical analysis indicated a low moisture content (0.3%) and minimal foreign matter, suggesting high quality. The plant's extractive yield was highest in ethanol (18%) and acetone (12%), reflecting the presence of bioactive compounds soluble in these solvents. The phytochemical screening identified key compounds such as alkaloids, flavonoids, and phenols, all of which are associated with medicinal properties. The results confirm the plant's therapeutic potential and support its traditional use.

7. CONCLUSION:

This investigation thoroughly assessed the physicochemical and phytochemical characteristics of Embelia tsjeriam-cottam (Vidanga), highlighting its notable potential for therapeutic applications. "The analysis of moisture content, ash value, and extractive yield demonstrates the plant's high quality and suitability for medicinal use. The ethanol extract, with the highest yield, indicates the presence of bioactive compounds that could be harnessed for pharmacological applications. The phytochemical screening revealed essential compounds such as alkaloids, flavonoids, phenols, and tannins, all of which contribute to the plant's reputed medicinal benefits, including antioxidant, anti-inflammatory, and antimicrobial activities. Furthermore, the absence of foreign matter and the negligible swelling index underline the plant's purity and stability, which are crucial for ensuring the safety and efficacy of its medicinal use.

These results reinforce the traditional medicinal applications of Embelia tsjeriam-cottam and highlight its potential as a source of bioactive compounds for the development of novel therapeutic agents. In conclusion, the findings support the need for standardized quality control measures and further pharmacological investigations to explore the full therapeutic potential of this plant and establish its place in modern healthcare systems.

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