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Pharmacognostical and Phytochemical Evaluation of Houttuynia Cordata Thunb., A Folklore Plant Found in East Khasi Hills, Meghalaya: A Preliminary Study

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KEYWORDS

Houttuynia cordata, pharmacognosy, phytochemical screening, TLC, ethnomedicine, herbal standardization.

ABSTRACT:

Introduction: Houttuynia cordata Thunb. (family Saururaceae), an indigenous plant to Northeast India and China, is a rhizome-bearing aromatic medicinal herb belonging to the family Saururaceae and is restricted to specialized moist habitats. In the northeastern states of India, locally known as Jaymrdoh, it is traditionally valued for its antimicrobial, anti-inflammatory, and detoxifying properties. Despite its therapeutic relevance, systematic pharmacognostical and phytochemical evaluations are limited.

Objectives: To perform a preliminary pharmacognostical and phytochemical evaluation of H. cordata leaves and roots for standardization and quality control.

Methods: Houttuynia cordata Thunb. was collected from the herbal garden of NEIAH, Shillong, authenticated by the Botanical Survey of India, and subjected to organoleptic, macroscopic, and powder microscopic analyses. Physicochemical parameters (extractive values, ash values, loss on drying), preliminary phytochemical screening, and thin-layer chromatography (TLC) were performed using standard protocols.

Results: Macroscopic analysis revealed heart-shaped green leaves and brownish irregular roots with fishy odor. Powder microscopy showed lignified vessels, trichomes, calcium oxalate crystals, and starch grains. Hydroalcoholic extracts exhibited higher extractive values in roots (25%) than leaves (9.65%), whereas aqueous extracts were higher in leaves (23%) compared to roots (15%). Phytochemical screening confirmed the presence of alkaloids, glycosides, tannins, phenolics, and flavonoids in hydroalcoholic extracts, while flavonoids were absent in aqueous extracts. TLC of hydroalcoholic extracts revealed Rf values of 0.46 (leaves) and 0.40 (roots).

Conclusions: The study establishes key pharmacognostical and phytochemical markers for H. cordata, supporting its traditional uses and providing baseline data for future standardization and pharmacological research.

1. Introduction

Medicinal plants have been integral to traditional healthcare systems and continue to serve as a foundation for modern drug development. Among these, Houttuynia cordata Thunb. (family Saururaceae) is a perennial, aromatic herb widely distributed in East and Southeast Asia, including Northeast India.[1] Locally known as Jamyrdoh in Meghalaya, this plant is traditionally consumed as a leafy vegetable and used for managing various ailments such as dysentery, cholera, blood disorders, and inflammatory conditions.[2] Its pharmacological potential has been attributed to a rich array of bioactive compounds, including alkaloids, flavonoids, essential oils, and phenolic compounds, which exhibit antimicrobial, anti-inflammatory, antioxidant, and antiviral properties.[3][4]

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Despite its ethnomedicinal relevance, there is limited pharmacognostical and phytochemical standardization of H. cordata in the context of quality assurance and herbal drug development. Standardization is crucial for ensuring authenticity, preventing adulteration, and establishing therapeutic efficacy of plant-based medicines. While previous studies have explored the pharmacological and phytochemical aspects of this species, comprehensive analyses integrating macroscopic, microscopic, physicochemical, and chromatographic evaluations remain scarce.

The present study aims to fill this gap by conducting a preliminary pharmacognostical and phytochemical evaluation of H. cordata leaves and roots. This work provides baseline data that can serve as a reference for the development of monographs, quality control parameters, and future pharmacological investigations.

Taxonomical Classification

Kingdom: Plantae;
Phylum: Magnoliophyta;
Class: Magnoliopsida;
Subclass: Magnoliidae;
Order: Piperales;
Family: Saururaceae;
Genus: Houttuynia Thunb.;
Species: H. cordata [5]

Vernacular names

Sanskrit: Matsygandhi
English: Chameleon plant
Assamese: Muchandri
Khasi: Jamyrdoh
Garo: Macha Duribak.
Nepali: Gwande
Manipuri: Toningkhok [6]

Ethnomedicinal uses –

Houttuynia cordata Thunb. has been extensively utilized in traditional medicine systems across Northeast India and other Asian regions for both dietary and therapeutic purposes. In local cuisine, fresh leaves are consumed as salads or used as garnishes with meat and fish dishes, owing to their distinctive aroma and taste.[7] Traditionally, leaf extracts are administered orally for managing dysentery, particularly post-partum, as well as for treating indigestion, urinary disorders, and liver ailments.[8][9] Root decoctions are employed for alleviating gastrointestinal complaints, while fresh leaf juice is used as a remedy for cholera, blood purification, and anaemia. [10] Plant decoctions have been indicated in conditions such as cough, enteritis, fever, and certain cancers, reflecting its broad therapeutic scope in folklore practices. [11]

Topical applications include its use in treating snake bites, skin infections, sores, and boils. The leaves are also consumed raw to help lower blood glucose levels, supporting its use in traditional diabetes management.[12] Recent studies suggest that H. cordata may play a role in modulating immune responses by enhancing mucosal barriers in the oral cavity, vagina, and intestinal tract. Combined with its documented antibacterial and antiviral activities, these properties substantiate its ethnopharmacological applications in infectious and inflammatory disorders.[13] Pharmacologically, the plant is attributed with cooling, resolvent, and emmenagogue properties, enhancing its relevance in reproductive and systemic health. [14]

Traditional Use	Plant Part Used	Therapeutic Indication	References
Leaf juice	Leaves	Dysentery (especially post-partum), cholera	[8,10]
Decoction	Whole plant	Fever, enteritis, cough, certain cancers	[11]
Fresh leaf consumption	Leaves	Lowering blood glucose levels	[12,13]
Raw leaves as salad/garnish	Leaves	Dietary supplement; general health tonic	[7]
Root decoction	Roots	Stomach disorders, indigestion	[9]
Topical application	Leaves	Snake bites, skin infections, boils, sores	[11]
Fresh juice	Leaves	Blood purification, anaemia, detoxification	[10]
Whole plant (powder/paste)	Whole plant	Anti-inflammatory, cooling, emmenagogue properties	[14]

Table No. 01: Summarizing the traditional utility of various parts of Houttuynia cordata Thunb.

2. Objectives

To perform a preliminary pharmacognostical and phytochemical evaluation of H. cordata leaves and roots for standardization and quality control.

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3. Methods

Plant Material Collection and Authentication

Fresh plant material of Houttuynia cordata Thunb. was collected from the herbal garden of the North Eastern Institute of Ayurveda and Homoeopathy (NEIAH), Shillong, Meghalaya (East Khasi Hills district, India). The species was authenticated by the Botanical Survey of India, Eastern Regional Centre, Shillong, and a voucher specimen was deposited for future reference.

Preparation of Plant Material

The collected leaves and roots were thoroughly washed with distilled water to remove debris, shade-dried at room temperature (25 ± 2°C) until constant weight, and pulverized into coarse powder using a mechanical grinder. The powdered material was sieved through a 40-mesh sieve and stored in an airtight container for analysis. These uniform powders were subjected to standardization for different parameters. [Figure: 1]

Pharmacognostical Evaluation:

Macroscopic Analysis

Organoleptic and morphological characteristics, including color, odor, taste, texture, and shape, were recorded using standard pharmacognostic protocols. [15]

Microscopic Analysis (Powder Microscopy)

Powdered samples of leaves and roots were subjected to microscopic examination for identifying diagnostic features such as lignified vessels, trichomes, calcium oxalate crystals, and starch grains. Staining was performed using phloroglucinol and concentrated hydrochloric acid for lignified tissues and iodine solution for starch grains. [16] Observations were made using a compound microscope equipped with a digital imaging system.

Physicochemical Parameters

Standard procedures recommended by the Ayurvedic Pharmacopoeia of India (API) were followed to measure various physicochemical: Extractive Values: Hydroalcoholic (ethanol 70%) and aqueous extracts were prepared using Soxhlet extraction, and percentage yield (% w/w) was calculated; Loss on Drying (LOD): Determined by heating the sample at 105°C to constant weight; Ash Values: Total ash, water-soluble ash, and acid-insoluble ash were calculated as per standard monographs and Foreign Matter: Determined visually by manual inspection.[17]

Preliminary Phytochemical Screening

Qualitative analysis of hydroalcoholic and aqueous extracts was performed for the presence of major phytoconstituents, including alkaloids, glycosides, flavonoids, tannins, saponins, steroids, proteins, and phenolics, following standard phytochemical tests. [18]

Chromatography Analysis (Thin Layer Chromatography)

TLC was performed on silica gel G-coated plates (Merck) activated at 110°C for 30 min. Extracts were applied as spots and developed in a solvent system consisting of n-propanol:formic acid:water (90:1:9). Plates were visualized under UV light (366 nm) and exposed to iodine vapor for spot detection.[19] The retention factor (Rf) was calculated using the formula:

Calculation of the Rf Value for each spot using the following formula -

RF Value= Distance travelled by the solute/ Distance travelled by the solvent front.

4. Results

Macroscopic Characteristics

The leaves of Houttuynia cordata were observed to be green, heart-shaped, and smooth in texture, with a characteristic fishy odor and bitter taste. Roots were brownish, irregular, long, and rough in texture. Detailed organoleptic features are presented in Table 2.

Microscopic Characteristics (Powder Microscopy)

Microscopic examination of powdered leaves revealed lignified vessels, trichomes, calcium oxalate crystals, stomata, and pericycle fibers. Root powder showed lignified vessels, rosette and prismatic crystals of calcium oxalate, elongated cork cells, parenchymatous cells with starch grains, and brown resin masses. Diagnostic features are summarized in

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Tables 3 and 4, and representative microphotographs are shown in Figures 1 and 2.

Physicochemical Parameters

Physicochemical analysis indicated variations between leaves and roots (Table 5). Hydroalcoholic extractive value was significantly higher in roots (25% w/w) compared to leaves (9.65% w/w), whereas aqueous extractive value was higher in leaves (23% w/w) than in roots (15% w/w). Loss on drying was 6.93% (leaves) and 3.8% (roots). Total ash content was 7.6% (leaves) and 7% (roots), suggesting minimal inorganic contaminants.

Phytochemical parameters

Qualitative analysis confirmed the presence of carbohydrates, glycosides, alkaloids, tannins, and phenolic compounds in both hydroalcoholic and aqueous extracts of leaves and roots. Flavonoids were detected only in hydroalcoholic extracts, absent in aqueous extracts. No mucilage, volatile oil, proteins, steroids, or amino acids were detected (Tables 6 and 7).

Thin-Layer Chromatography (TLC) Analysis

TLC profiling of hydroalcoholic extracts produced distinct spots under UV light at 366 nm. Leaves exhibited an Rf value of 0.46, while roots showed 0.40 (Figure 3). These profiles serve as potential markers for standardization of the plant. [Table:7]

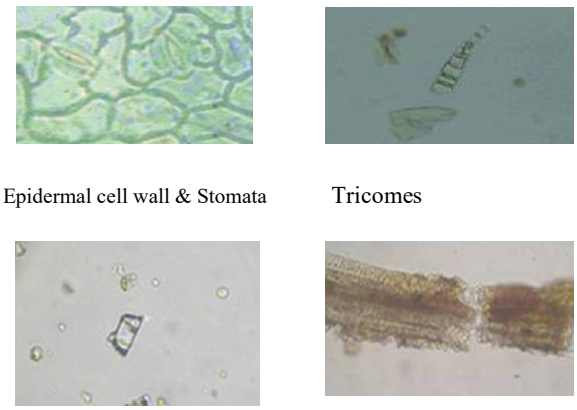
S. No.	Parameters	Observation	
		Leaves	Root
1	Nature	Dark scabrous	Dark scabrous
2	Color	Green	Brownish
3	odour	Fishy	Fishy
4	Taste	Bitter	Bitter
5	Shape & Size	Heart-Shaped & 1-2 m long	Long Irregular Or Curved
6	Texture	Smooth	Rough

Table No. 2: Macroscopic evaluation of leaves and root of Houttuynia cordata Thunb

Figure 1: Leaves and Roots and flower of *Houttuynia cordata* Thunb.

S.No	Reagents	Observations	Characterstics
1.	Phloroglucinol+Conc. Hcl(1:1)	Red	Lignified vascular bundles
2.	Acetic acid	Crystal insoluble	Calcium oxalate crystals
3.	Dil. Iodine Solution	Blue	Endodermis
4.	Sudan Red	Red	Trichomes

Table No. 3: Powder microscopy of Houttuynia cordata Thunb. leaves.



Epidermal cell wall & Stomata

Tricomes

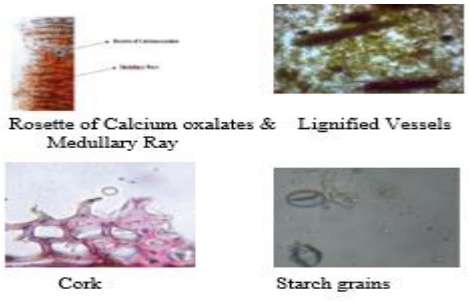
Calcium oxalate crystals

Lignified vessels

Figure 2: Powder microscopy of *Houttuynia cordata* leaves

S.No.	Reagents	Observations	Characterstics
1.	Phloroglucinol+ Conc. Hcl	Pink	Lignified Vessels
2.	Dil.Hcl	Orange	Rosette of Calcium oxalates & Medullary Ray
3.	Phloroglucinol+ Conc.Hcl	Pink	Cork

Table No. 4: Powder microscopy of Houttuynia cordata Thunb. Root



Rosette of Calcium oxalates & Medullary Ray

Lignified Vessels

Cork

Starch grains

Figure: 3 Powder microscopy of *Houttuynia cordata* Thunb. root

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S. No.	Parameters	Observations	
		Leaves	Root
I	**Extractive Value (%w/w)**		
	Hydro-alcoholic	9.65	25
	Aqueous	23	15
II.	**Loss on Drying (%w/w)**	6.93	3.8
III.	**Ash values (%w/w)**		
	Total ash	7.6	7
	Acid insoluble ash	3.1	6
	Water soluble ash	6.2	4
IV.	**Foreign Matter**	**Nil**	**Nil**

Table 5: Physicochemical parameters of leaves and root of Houttuynia cordata Thunb.

S.No.	Chemical Test	Hydro alcoholic Extracts	
		Leaves	Root
1.	Carbohydrate Test	+	+
2.	Glycosides Test	+	+
3.	Alkaloids Test	+	+
4.	Tannins and Phenolic Compounds Test	+	+
5.	Flavonoids Test	+	+
6.	Mucilage Test	-	-
7.	Volatile Oil	-	-
8.	Protein Test	-	-
9.	Steroids Test	-	-
10.	Amino Acid	-	-

Table 6: Phytochemical screening of Hydroalcoholic Extracts of Houttuynia cordata Leaves and Root

S.No.	Chemical Test	Aqueous Extracts	
		Leaves	Root
1.	Carbohydrate Test	+	+
2.	Glycosides Test	+	+
3.	Alkaloids Test	+	+
4.	Tannins and Phenolic Compounds Test	+	+
5.	Flavonoids Test	-	-
6.	Mucilage Test	-	-
7.	Volatile Oil	-	-
8.	Protein Test	-	-
9.	Steroids Test	-	-
10.	Amino Acid	-	-

Table 7: Phytochemical screening of Aqueous Extracts of *Houttuynia cordata* Leaves and Roots

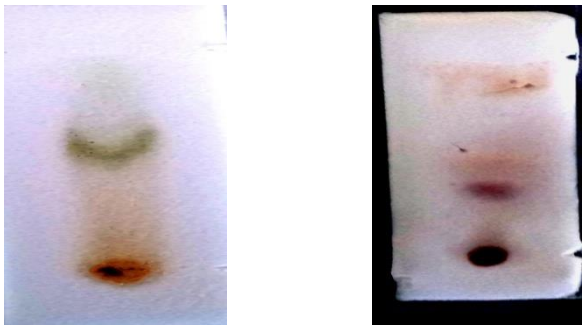

Figure 3: Thin Layer Chromatography of Hydro alcoholic extracts of Leaves and Roots respectively.

S.No.	Hydro alcoholic Extracts	Distance travelled by Mobile Phase (Spots) (Cm)	Distance travelled by Stationary Phase (Cm)	R_f Values
1.	leaves	2.3	5.0	0.46
2.	Roots	2.0 2.3	5.0	0.40

Table 8:- R_f Values and Distance travelled by Hydro alcoholic extracts of Leaves and Roots respectively.

5. Discussion

Pharmacognostic analysis plays a pivotal role in the authentication and standardization of herbal drugs, which is essential for ensuring safety, efficacy, and reproducibility in therapeutic applications. Although it is not mentioned in any volume of the Ayurvedic Pharmacopoeia of India, an attempt is still made to explore its phytochemical and pharmacognostical properties. The macroscopic characteristics observed in the present study—heart-shaped leaves with a fishy odor and bitter taste—are consistent with previous reports describing the organoleptic features of H. cordata. These distinctive tr aits can serve as primary identification markers in crude drug authentication. Microscopic analysis revealed lignified vessels, calcium oxalate crystals, and trichomes in leaves, and starch grains in roots, which corroborates findings from earlier pharmacognostic studies. Such anatomical markers are significant for detecting adulteration and ensuring quality control in herbal formulations.

The extractive values provide insight into the nature and polarity of phytoconstituents present in the plant material. The higher aqueous extractive value in

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leaves (23%) compared to roots (15%) indicates the predominance of water-soluble compounds such as glycosides and phenolics, while the higher hydroalcoholic extractive value in roots (25%) suggests greater abundance of semi-polar constituents like flavonoids and alkaloids. Similar trends have been reported in studies on medicinal herbs where solvent polarity significantly influences extraction yield. The low acid-insoluble ash value (<6%) confirms minimal contamination with siliceous material, indicating good quality plant material.

Qualitative phytochemical screening confirmed the presence of alkaloids, glycosides, tannins, and phenolic compounds in both extracts, while flavonoids were exclusively present in hydroalcoholic extracts. This aligns with prior reports suggesting that flavonoids exhibit higher solubility in alcoholic solvents due to their structural polarity. These phytoconstituents are pharmacologically relevant, as alkaloids and glycosides have been associated with antimicrobial and cardioprotective effects, whereas flavonoids and tannins contribute to antioxidant and anti-inflammatory activities.

TLC analysis generated distinct Rf values (0.46 for leaves and 0.40 for roots), which can serve as quality control markers for standardization. Previous phytochemical profiling of H. cordata has reported similar TLC patterns for flavonoid-rich fractions. Establishing such fingerprints is crucial for maintaining batch-to-batch consistency in herbal formulations and for developing pharmacopoeial standards.

The findings of this study validate traditional claims regarding the therapeutic use of H. cordata and provide baseline data for pharmacognostic standardization. Future work should focus on quantitative estimation of active phytoconstituents, high-performance thin-layer chromatography (HPTLC) fingerprinting, and bioactivity-guided fractionation to correlate chemical profiles with pharmacological activities. Additionally, toxicological evaluations and clinical studies are necessary to establish safety and efficacy for potential inclusion in contemporary herbal pharmacopeia's.

6. Conclusion

The present study provides baseline pharmacognostical and phytochemical data for Houttuynia cordata Thunb., an ethnomedicinal plant of Northeast India. The observed macroscopic and microscopic features, along with physicochemical constants and TLC profiles, establish diagnostic markers essential for authentication and quality control. Preliminary phytochemical screening confirmed the presence of therapeutically significant constituents such as alkaloids, glycosides, tannins, phenolics, and flavonoids, validating its traditional use in various ailments.

The high aqueous extractive value of leaves and the exclusive presence of flavonoids in hydroalcoholic extracts highlight the influence of solvent polarity on phytoconstituent extraction. TLC fingerprints (Rf values 0.46 for leaves and 0.40 for roots) provide a preliminary standardization reference. These findings support the inclusion of H. cordata in evidence-based herbal drug development and encourage further research toward its clinical application and potential inclusion in pharmacopeial monographs.

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9. Conflicts of interest

There are no conflicts of interest.

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