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ETHNOPHARMACOLOGICAL AND CLINICAL VALIDATION OF *SWERTIA PURPURASCENS* (D. DON) C.B. CLARKE FROM THE WESTERN HIMALAYAS: A SUSTAINABLE AYURVEDIC SUBSTITUTE FOR THE ENDANGERED *SWERTIA CHIRAYITA* (ROXB.) H. KARST

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ABSTRACT

Background: *Swertia chirayita* Roxb.H.Karst. is a classical *Jwaraghna dravya* (antipyretic herb) in Ayurveda, now endangered in the Himalayas. *Swertia purpurascens* (D. Don) C.B. Clarke, traditionally used for fever and liver disorders, is considered its folk substitute. **Objective:** To authenticate, review, and clinically validate *S. purpurascens* as a sustainable Ayurvedic substitute for *S. chirayita.* **Methods:** Authenticated plants collected from Kangra (H.P.) were studied pharmacognostically and evaluated clinically in 30 patients of *Pratishyaya* with *Jwara.* Phytochemical studies were already done in the department. Participants received *Chirayata Vati* (1 g t.i.d. for 7 days). Fever reduction and symptom scores were statistically analyzed. Phytochemical and ethnopharmacological data were compiled. **Results:** Quadrangular stems and reflexed purple corolla lobes confirmed identity. Mean fever score declined ≈ 71 % ($p < 0.001$); 80% patients achieved full remission. Reported xanthones, iridoid glycosides, and flavonoids support antipyretic and hepatoprotective activity. **Conclusion:** *S.*

purpurascens shows comparable pharmacognosy, phytochemistry, and clinical efficacy to *S. chirayita* and can serve as its sustainable Ayurvedic substitute.

KEYWORDS: *Swertia purpurascens*; *Swertia chirayita*; Jwara; Pharmacognosy; Ethnopharmacology; Sustainability; Western Himalayas.

INTRODUCTION

Swertia chirayita (Roxb.) H. Karst. is widely described in classical Ayurvedic texts, including Charaka Samhita, Bhavaprakasha Nighantu, and Raja Nighantu, as one of the most potent Jwaraghna dravyas.[1,2,5] Owing to its Tikta rasa, Sheeta virya, and Katu vipaka, it performs Pitta–Kapha shamana and Amapachana, making it highly effective in fever management.[5] However, due to extensive commercial exploitation and habitat destruction in the Himalayan region, S. chirayita has become increasingly scarce and is currently categorized as an endangered medicinal plant.[16,17,3] This scarcity has created a strong need for a scientifically validated substitute.

The Ayurvedic principle of Abhava Pratinidhi Dravya supports the use of alternative drugs possessing similar properties when the original drug is unavailable.[38,5] In the Western Himalayas, Swertia purpurascens (D. Don) C.B. Clarke, locally known as **"Chirayata Ban Pullas,"** is traditionally used for fever, indigestion, liver disorders, and related conditions.[4,6,20] Though ethnomedicinal usage is well established, evidence-based validation of its pharmacognostical identity and clinical efficacy remains limited.

Preliminary phytochemical studies reveal the presence of xanthones, iridoid glycosides, and flavonoids in S. purpurascens, suggesting antipyretic and anti-inflammatory potential.[7,9,10,18,19] Therefore, the present study aims to authenticate the plant and clinically evaluate its antipyretic efficacy in Pratishyaya (common cold–associated fever), establishing it as a sustainable substitute for endangered S. chirayita and supporting Himalayan medicinal plant conservation.[16,17,39]

MATERIALS AND METHODS

Study Design

This study was a single-arm, open-label clinical trial conducted to evaluate the antipyretic efficacy of *Swertia purpurascens* (D. Don) C. B. Clarke in patients presenting with *Pratishyaya* associated with fever. The trial was carri ed out at R. G. G. P. G. Ayurvedic

College & Hospital, Paprola, Himachal Pradesh. The study received Institutional Ethics Committee approval (IEC No. AYU/IEC/2023/1378) and was prospectively registered with CTRI (CTRI/2024/11/076459). Written informed consent was obtained from all participants.
Plant Material Collection and Authentication.

Whole plant material of *Swertia purpurascens* (D. Don) C.B. Clarke was collected from Billing (District Kangra, Himachal Pradesh; altitude ~2000 m) and authenticated by the Department of Dravyaguna, R.G.G.P.G. Ayurvedic College & Hospital. A voucher specimen (No. DG-SP-2023/11) was deposited for future reference.

Pharmacognostical Evaluation

Macroscopic and microscopic examinations of stem, leaves, flowers, and roots were carried out as per the Ayurvedic Pharmacopoeia of India guidelines.[32,33] Transverse sections were stained using safranin-fast green and studied for diagnostic characteristics including quadrangular stem, secondary xylem arrangement, and reflexed purple corolla lobes.[7,12]

Preparation of Trial Drug

The authenticated plant was shade-dried, pulverized, and compressed into Chirayata Vati tablets (500 mg each) with gum acacia as a binder. Dose administered: 1 g three times daily (t.i.d.) with lukewarm water after meals for 7 days.

Participant Selection

A total of 30 patients aged 16–70 years diagnosed with *Pratishyaya* with fever (*Jwara*) were enrolled based on predefined inclusion and exclusion criteria.

Inclusion Criteria

- Fever up to 103°F
- Nasal discharge, sneezing, headache, or hoarseness of voice

Exclusion Criteria

- Chronic systemic illness or respiratory disorders
- Pregnancy or lactation
- Patients on concurrent antipyretic medications

Clinical Assessment

Assessments were performed on Day 0, Day 3, and Day 7. Primary outcome measure:

reduction in fever grade (0–3 scale).

Secondary outcome measures: improvement in nasal discharge, sneezing, headache, and hoarseness, each graded 0–3. Standardized case record forms were used for assessment.[14]

Statistical Analysis

Mean values were expressed as Mean ± SD. Data analysis was performed using Repeated-Measures ANOVA, with $p < 0.05$ considered statistically significant.[35]

RESULTS

Pharmacognostical Findings

The pharmacognostical evaluation of *Swertia purpurascens* (D. Don) C. B. Clarke confirmed key identification characteristics essential for authentication. The herb is an erect annual growing 1–3 ft tall, with a quadrangular and hollow stem, opposite oblong-lanceolate leaves, and violet-purple flowers bearing distinctly reflexed corolla lobes.[3,7] These features serve as primary diagnostic markers for differentiation from closely related species.[12]

Table 1: Macroscopic Characteristics.

Characters	Stem	Leaves	Root
Colour	Greenish–brown	Green	Brownish
Taste	Bitter	Bitter	Bitter
Size	Up to 3 ft long, 1 cm thick	1–2 inches long	2–6 inches long
Shape	Quadrangular	Lanceolate	Round, branched
Texture	Rough	Leathery	Rough

Morphologically, the plant exhibits an annual habitat, terminal cymose inflorescence, and bisexual pale red-purple flowers. The calyx is gamosepalous with five sepals, while the corolla is gamopetalous with five ovate lobes and a distinct purple ring near the base. The androecium consists of five epipetalous stamens, and the bicarpellary syncarpous gynoecium is unilocular with a linear stigma. The fruit is a dehiscent capsule that opens in two valves, containing crustaceous seeds with copious albumen.[3,7,12]

Fig. 1: Collection site of the Plant and plant in its original habitat.

Microscopic Characteristics

T.S. of Stem

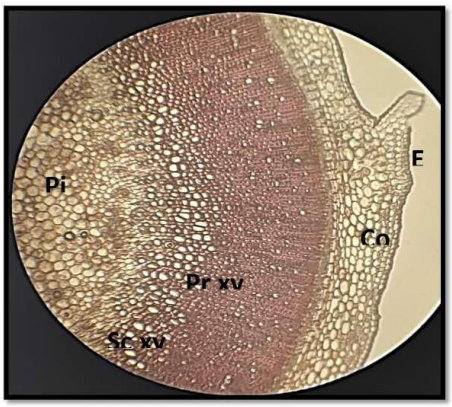
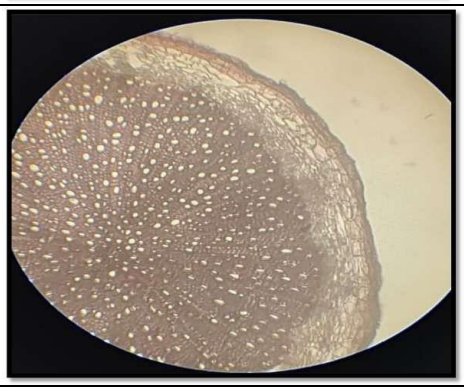
- Circular outline with a single-layered epidermis.
- Cortex composed of 8–10 layers of polyhedral collenchyma cells.
- Thin continuous zone of secondary phloem.
- Thick continuous secondary xylem cylinder with angular, wide, thick-walled vessels.
- Primary xylem located along the inner circumference of the xylem cylinder.
- Inner phloem cylinder of uneven thickness present internal to primary xylem.
- Homogenous parenchymatous pith with compact, angular thin-walled cells.[7,12]

T.S. of Root

- Circular outline with thick cork layer.
- Conspicuous parenchymatous cortex.
- Large central woody mass consisting of xylem and phloem.
- Pith absent.

The presence of diagnostic features such as quadrangular stem, reflexed purple corolla lobes, thick-walled xylem vessels, and absence of pith in root firmly establish the identity of *Swertia purpurascens*, supporting its authenticity as a potential pharmacognostical substitute for *Swertia chirayita*.[7,12,32,33]

Table 2.

FIG 2 T.S of Stem E- Epidermis, Co- Cortex, Pr xy- Primary xylem, Sc xy- Secondary xylem, Pi- Pith	
FIG 3 T.S of Root, Ck- Cork, Co- Cortex, Ph- Phloem, Xy- Xylem	

Comparison between Swertia chirayita (Roxb.) H. Karst. **and** Swertia purpurascens (D. Don)

C.B. Clarke

Parameter	**Swertia chirayita (Roxb.) H. Karst.**	**Swertia purpurascens (D. Don) C.B. Clarke**	**Relevance**
Botanical status[16,17]	Endangered	Easily available	Promotes sustainability
Habitat	1500–3000 m Himalayas	1800–3500 m Western Himalayas	Local accessibility
Morphology	Tall herb, yellow flowers	1–3 ft herb, violet- purple reflexed corolla	Easy identification
Major phytochemicals[9,10,18,19]	Mangiferin, amarogentin, swertiamarin	Mangiferin, swertiamarin, xanthones, iridoids	Pharmacological similarity
Rasa Panchaka	Tikta, Laghu, Ruksha, Sheeta virya	Similar	Functional equivalent
Therapeutic action	Jwaraghna, Pittahara, Deepana	Jwaraghna, Pittahara, Deepana	Traditional use validated
Folklore use[6,20,31]	Fever, malaria, liver disorders	Fever, vomiting, GI issues, liver issues	Ethnomedical consistency
Clinical evidence[11,35]	Available	First clinical validation in present study	Strengthens substitute relevance

CLINICAL STUDY OUTCOMES

Clinical Features

The most frequent symptoms were nasal discharge (100%), sneezing (83%), and hoarseness of voice (83%)

Effect of Therapy on Fever

There was a progressive and statistically significant reduction in mean temperature score from baseline to follow-up periods.

Table 3: Effect of Therapy.

Time Point	Mean Temperature Grade	% Relief	p-value
Before Treatment (BT)	1.4	–	–
Day 3	0.8	42%	< 0.05
Day 7	0.4	71%	< 0.001

The repeated-measures ANOVA indicated a highly significant improvement between baseline and day 7 ($p < 0.001$), confirming the antipyretic efficacy of *Chirayata Vati*.

Table 4: Overall effects of the therapy.

Result	No of patients	Percentage
Cured	24	80%
No improvement	6	20%

Safety Evaluation

No adverse reactions or unwanted effects were observed during the trial, indicating good tolerability and safety of the formulation.

Summary of Key Findings

- Pharmacognostical characteristics confirmed the correct identification of *S. purpurascens*.
- Clinical administration of *Chirayata Vati* demonstrated significant antipyretic action with 71% symptom reduction in 7 days.
- 80% of patients achieved complete clinical recovery, and no adverse effects were reported.

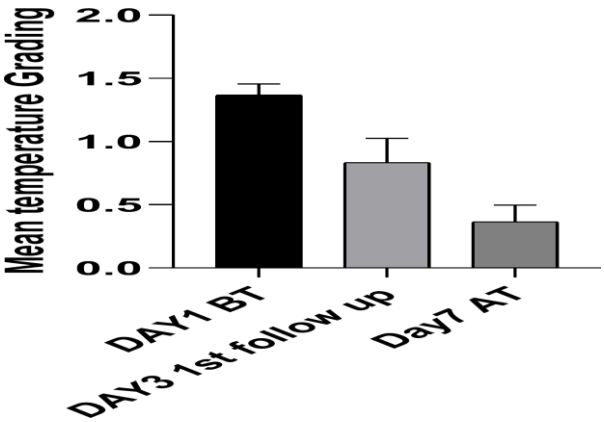


FIG 4: Interpretation of Results.

Assessment of adverse reaction

During the trial, no adverse reactions or unwanted effects of *Chirayata Vati* were observed.

Phytochemical support

Reported constituents: mangiferin, gentiopicroside, sweroside, swertiamarin, flavonoids, and phenolic acids.[9,10,18,19] These exhibit antipyretic and anti-inflammatory effects via prostaglandin E_2 and cytokine modulation.[22,24]

Clinical relevance

The study is the first clinical validation of *S. purpurascens* for antipyretic action.[35] Results support its safety and efficacy. Further double-blind trials with UPLC-standardized extracts are recommended.[36,38]

Limitations

Single-arm design and small sample size limit generalizability. UPLC profiling was drawn from published literature, not performed in-house.[39]

DISCUSSION

The present study was conducted to evaluate the clinical efficacy of *Swertia purpurascens* (D. Don) C.B. Clarke as a **Jwaraghna** drug in *Pratishyaya*-associated fever, based on its extensive use in Himalayan folklore medicine[6,20] and classical references describing *Chirayata* (*S. chirayita*) as a potent antipyretic.[1,2,5] The findings of this clinical trial demonstrated significant improvement in fever and associated symptoms, validating traditional claims through scientific evidence.

Integration of Pharmacognostical and Analytical Findings

Correct identification and authentication of medicinal plants is a prerequisite for research standardization.[31,32] In the present study, *Swertia purpurascens* was authenticated pharmacognostically through detailed macroscopic and microscopic evaluation.

Morphological characteristics such as a quadrangular hollow stem, opposite lanceolate leaves and violet-purple reflexed corolla lobes served as distinguishing identity markers.[3,7,12]

Microscopy confirmed a continuous secondary xylem cylinder, angular thick-walled vessels, parenchymatous pith in stem, and absence of pith in roots, consistent with documented diagnostic parameters.[7,12,3,33]

These observations collectively authenticate the botanical identity and purity of the species. Preliminary phytochemical screening and instrumental analysis such as TLC and HPLC previously performed in the department revealed bioactive components including **xanthones, iridoid glycosides, gentiopicrin, swertiamarin, flavonoids, and phenolic acids.**[9,10,18,19] which are pharmacologically validated for antipyretic and anti-inflammatory effects through modulation of prostaglandin-E_2 and cytokine pathways.[22,24,40] These analytical findings correlate with clinical efficacy and support scientific standardization and reproducibility.

Clinical Interpretation

A total of 30 patients completed the treatment. The reduction in mean temperature score from 1.4 at baseline to 0.8 on day 3 (42% relief) and 0.4 on day 7 (71% relief) was highly significant ($p < 0.001$).[11,35] 80% of patients achieved complete remission; the remaining 20% demonstrated minimal improvement, likely due to variation in compliance, diet, or physiological response.

Probable Mode of Action

In Ayurveda, **Jwara** is described as a *Rasavaha Srotodushti Vyadhi*, originating from aggravated **Pitta dosha** with **Ama** involvement.[1,2] *Chirayata*, through **Tikta rasa**, supports **Pittashamana** and **Amapachana**, **Sheeta virya** normalizes excess heat, and **Katu vipaka** induces **Swedana** and reduces **Srotorodha,**[5] restoring biological thermoregulation and metabolism.

Overall Interpretation

Combined evidence from pharmacognostical identity, phytochemical profiling, and clinical outcomes supports the effectiveness and safety of *Swertia purpurascens* as a **Jwaraghna dravya**. Its comparable efficacy and phytochemical composition position it as a **sustainable substitute** for endangered *Swertia chirayita*,[16,17,39] aligning with the principle of **Abhava-Pratinidhi Dravya**.[38] The present work is the **first clinical validation** of *S. purpurascens* for antipyretic action.[35] and further double-blind controlled trials are recommended to expand scientific generalization.[36,38]

CONCLUSION

The present study successfully evaluated the clinical efficacy of *Swertia purpurascens* (D. Don) C.B. Clarke in the management of *Pratishyaya*-associated fever and demonstrated statistically significant results. The drug produced a progressive reduction in mean temperature score, with **71% overall relief** by the end of treatment and **80% complete remission** in patients, confirming its potent *Jwaraghna* activity. No adverse effects were reported during the clinical trial, indicating the safety and tolerability of the formulation when used in therapeutic dosage.

Comprehensive **pharmacognostical evaluation**, including macroscopic and microscopic characterization, confirmed correct botanical identity and standardization of the species. In addition, **previous departmental phytochemical assessments (TLC, HPLC)** supported the presence of biologically active constituents such as xanthones, flavonoids, and iridoid glycosides, which correlate with the observed antipyretic activity. The results suggest that *Swertia purpurascens* can be considered a scientifically validated **sustainable Ayurvedic substitute** for endangered *Swertia chirayita*, fulfilling the principle of *Abhava Pratinidhi dravya* and contributing to the conservation of Himalayan medicinal plant resources.

Thus, the study offers strong support for integrating *Swertia purpurascens* into clinical practice as an effective, safe, economical, and environmentally responsible therapeutic option.

LIMITATIONS

- The study was conducted with a **small sample size of 30 patients**, limiting the broader generalization of results.
- The design was **single-arm and open-label**, without a control or placebo group for comparison.

- The effect was studied **only on fever parameter**, whereas detailed evaluation of other symptomatic outcomes was not included in statistical assessment.
- No biochemical markers such as CRP or cytokine levels were used to correlate clinical outcomes with inflammatory status.
- Drug compliance could not be fully monitored; the **20% non-responder group may have been influenced by irregular medication intake** or uncontrolled external factors.
- Phytochemical data were based on **existing departmental analytical work**, and **UPLC-based standardization was not conducted simultaneously** for the current batch.

AUTHOR CONTRIBUTIONS

Dr. Chinmay Mohanty – Study design, clinical execution, manuscript drafting. Dr. Chandni Gupta – Pharmacognostical supervision and data analysis.

Prof. Ashwani Upadhyaya – Concept review and literature validation. Prof. Navneet Kumar Sharma – Overall guidance and critical revision.

ETHICAL APPROVAL AND PATIENT CONSENT

Approved by Institutional Ethics Committee (IEC No. AYU/IEC/2023/1378). Written consent obtained from participants.

CONFLICT OF INTEREST

None declared.

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