

Abhava Pratinidhi Dravya in Ayurveda: *Patala* (*Stereospermum suaveolens*) as a Case Study for Evaluating Potential Drug Substitutes

1. Swati Bhatia*

¹Department of Life Science, Sharda School of Bio-Science and Technology,
Sharda University, Greater Noida UP-201310, India

ABSTRACT

Abhava Pratinidhi Dravya denotes the Ayurvedic use of a substitute when a desired drug is unavailable. This concept has practical relevance to medicinal-plant availability and crude-drug authentication, but an Ayurvedic substitute should not automatically be equated with modern therapeutic interchangeability. *Patala* provides a useful case study because *Stereospermum suaveolens* is a widely recognized botanical source, while *S. colais*, *S. tetragonum*, *Radermachera xylocarpa*, and alternative plant parts have also been investigated in the *Patala* literature. This mini-review critically examines evidence at four levels: Ayurvedic rationale, botanical/pharmacognostic identity, phytochemical concordance, and pharmacological activity. Comparative studies demonstrate that materials associated with *Patala* may share traditional or biological attributes while remaining distinguishable by microscopy, chromatographic fingerprints, and quantitative chemical characteristics. Comparative anti-arthritic evidence for *S. colais* and *S. suaveolens* further shows that similar biological direction does not necessarily imply equal potency. A recent comparison of *Patala* root and stem bark similarly found activity in both preparations but greater activity for root bark. Institutional research on *S. campanulata* and *Kigelia pinnata* illustrates a broader strategy for evaluating candidate substitutes. Collectively, the literature supports a graded approach in which classical rationale, authentication, quantitative chemical comparison, pharmacological concordance, and safety are considered together. Current evidence identifies promising candidates for further investigation but does not establish universal therapeutic equivalence.

Keywords: *Abhava Pratinidhi Dravya*; *Patala*; *Stereospermum suaveolens*; pharmacognosy; phytochemistry

Correspondence:

Swati Bhatia

Email: swatibhatia1995@gmail.com

1. Introduction

The authenticity of medicinal raw materials is fundamental to the quality and reproducibility of Ayurvedic medicines. Ayurvedic literature recognizes Pratinidhi Dravya, or substitute drugs, particularly when the preferred drug is unavailable. Modern reviews describe the selection in relation to the similarity of properties and therapeutic action and discuss practical drivers such as scarcity, habitat loss, and overexploitation [1-3]. Substitution should nevertheless be distinguished from adulteration: a Pratinidhi Dravya is intended as a deliberate therapeutic replacement, whereas adulteration may introduce an incorrect material without an appropriate therapeutic rationale.

Modern pharmacognosy provides complementary tools for evaluating proposed substitutes. Macroscopy and microscopy establish identity, physicochemical and chromatographic methods compare chemical profiles, DNA methods can distinguish closely related taxa, and pharmacological models test biological concordance. However, evidence at one level does not establish equivalence at the other. A shared marker does not necessarily predict equal pharmacological potency, and activity in preclinical models does not establish clinical interchangeability.

Patala is particularly informative because it is a member of the great five-root group (Mahat Panchamula) and therefore of Dashamoola in the Sushruta tradition. Sushruta lists Patala among Bilva, Agnimantha, Tuntuka, Patala and Kashmari in Mahat Panchamula and describes the combined Dashamoola group as therapeutically useful in disorders including asthma and difficult respiration. [4] Contemporary pharmacognostic studies commonly use *S. suaveolens* as the botanical source, while *S. colais* and other species have also appeared in the Patala literature. [5-8] This makes Patala a practical case through which classical substitution and modern quality assessment can be considered together.

The present review is deliberately narrower than general reviews of Pratinidhi Dravya and Patala. It asks what level of evidence should be required before a proposed substitute can reasonably be considered comparable to authentic Patala. The objective is not to declare a particular candidate therapeutically interchangeable, but to organize the available evidence and identify the remaining limitations.

2. Ayurvedic Basis of Abhava Pratinidhi Dravya and Patala

Pratinidhi Dravya is a broader concept of replacement, whereas Abhava

Pratinidhi Dravya specifically concerns substitution in the setting of non-availability. Recent reviews note that the concept is particularly elaborated in later Ayurvedic texts and commentaries. [1-3] The 2015 Ativisha-Musta study is an important modern precedent: *Aconitum heterophyllum* was discussed as the unavailable drug and *Cyperus rotundus* as its classical substitute, and the authors evaluated whether modern phytochemical evidence could provide biomedical support for the traditional substitution [9]. This example also shows that Ayurvedic substitution is not necessarily restricted to botanically related species.

Classical textual evidence places Patala within Mahat Panchamula and Dashamoola [4]. The Bhavaprakasha Nighantu also provides a distinct Patala entry, with synonyms and therapeutic descriptions. Modern secondary compilations identify properties, including Tikta-Kashaya rasa, and actions associated with Shotha and respiratory complaints [5,6]. In the present review, these classical descriptions are treated as traditional therapeutic contexts rather than direct equivalents of modern pharmacological endpoints.

An additional complexity is botanical nomenclature. A 2013 comparative study treated *S. chelonoides* as the authentic

Patala source and evaluated *S. tetragonum* and *R. xylocarpa* as recommended substitutes, whereas a 2023 study compared *S. colais* and *S. suaveolens* as materials known as Patala in Ayurveda [7,8]. Therefore, caution is warranted: Patala is a classical drug identity with a documented botanical history, but modern species-level authentication is essential before discussing substitution.

3. Pharmacognostic and Phytochemical Evidence

Latha *et al.*, compared *S. colais* and *S. suaveolens* roots using macroscopic and microscopic examination, physicochemical and elemental analysis, qualitative and quantitative phytochemistry and comparative HPTLC fingerprinting. The study identified diagnostic anatomical differences and distinguishable chromatographic profiles and proposed these parameters as reference standards for identification and detection of adulterants or substituents [8]. Thus, use of the same Ayurvedic name does not eliminate the need for species-level authentication.

Sumanth *et al.* [7] provide an especially useful comparative example because they examined *S. chelonoides*, *S. tetragonum*, and *R. xylocarpa* using pharmacognostic parameters, physicochemical and phytochemical

analysis, HPTLC fingerprinting, and quantification of p-coumaric acid. The HPTLC profiles differentiated three species, while *S. tetragonum* showed greater similarity to *S. chelonoides* than to *R. xylocarpa* [7]. This demonstrates why a candidate should be assessed quantitatively rather than accepted solely on morphological resemblance.

Chemical characterization of *S. suaveolens* roots has also identified cycloolivil, lapachol, and β -sitosterol. Sab

Abdul Wahab *et al.* isolated these constituents and characterized them using spectroscopic methods; cycloolivil was reported for the first time from this plant in that study [10]. Such work provides a basis for marker-oriented quality assessment. Nevertheless, chemical similarity alone cannot establish therapeutic equivalence, particularly when extraction method, plant part, and marker concentration differ between materials.

Table 1. Selected evidence relevant to scientific evaluation of Patala and proposed substitutes

Comparison	Evidence	Key finding	What it means	Ref.
<i>S. colais</i> vs <i>S. suaveolens</i>	Macro/microscopy; physicochemical; elemental; phytochemical; HPTLC	Diagnostic anatomical and chromatographic differences	Same Patala name does not establish identical botanical/chemical identity	[8]
<i>S. chelonoides</i> vs <i>S. tetragonum</i> vs <i>R. xylocarpa</i>	Pharmacognosy; physicochemistry; phytochemistry; HPTLC; p-coumaric acid	Distinct fingerprints; <i>S. tetragonum</i> more similar to <i>S. chelonoides</i> than <i>R. xylocarpa</i>	Candidate similarity can be graded analytically	[7]
<i>S. suaveolens</i> root chemistry	Isolation and spectroscopy; HPLC	Cycloolivil, lapachol and β -sitosterol identified	Potential marker basis, not proof of substitute equivalence	[10]
<i>S. colais</i> vs <i>S. suaveolens</i>	CFA-induced arthritis; standardized ethanolic extracts	Both active; <i>S. colais</i> more potent in reported model	Shared activity $\neq$ equal potency	[11]
<i>S. campanulata</i> vs <i>S.</i>	Institutional multi-parameter	Reported similarities and	Promising candidate, but annual-report evidence	[12]

<i>suaveolens</i>	evaluation	differences in pharmacognosy, chemistry and pharmacology	is grey literature	
<i>Kigelia pinnata</i> vs <i>S. suaveolens</i>	Institutional comparative evaluation	Candidate evaluated across pharmacognostic, physicochemical, phytochemical and pharmacological parameters	Requires peer-reviewed independent validation	[12]
<i>S. suaveolens</i> root bark vs stem bark	Standardized aqueous Kwatha; carrageenan paw oedema	Both active; root bark more potent	Even same-species plant-part replacement requires validation	[13]

Table note: Reference [12] is an institutional annual report and is therefore treated as grey literature, not equivalent to a peer-reviewed primary study.

4. Pharmacological Comparability: Similarity Is Not Equivalence

The strongest direct pharmacological comparison in the Patala literature is the 2020 Journal of Ethnopharmacology study of *S. colais* and *S. suaveolens*. Both were tested using a complete Freund's adjuvant-induced arthritis model. Ethanolic extracts were standardized using lapachol, and both extracts showed significant anti-arthritis activity; *S. colais* was reported to be more potent. The study also reported changes in CD4 cells, interleukin-2, and TNF- α [11]. Because the two materials were assessed under a common experimental framework, this study provides meaningful comparative evidence. However, the difference in potency directly argues against assuming interchangeability from shared activity alone.

Plant part substitution provides a second test of this principle. Patel *et al.*, compared standardized aqueous decoctions of *S. suaveolens* root and stem bark in a carrageenan-induced paw edema model. Both preparations reduced edema compared with the control, but root bark showed greater inhibition, whereas stem bark showed measurable activity. The authors

described stem bark as a possible sustainable alternative but recommended clinical evaluation before drawing stronger conclusions [13]. This is particularly relevant because the botanical species was held constant, while the medicinal part changed.

ITRA's 2024-25 annual report describes a completed PhD study evaluating *S. campanulata* as a substitute for *S. suaveolens* using pharmacognostic, physicochemical, phytochemical, DNA-barcoding, LC-MS, and pharmacological approaches; the report records both similarities and differences and notes limited antitussive activity for *S. campanulata* bark. The same report describes a comparative study of *K. pinnata* as a Patala substitute [12]. These projects demonstrate the value of a multi-dimensional strategy; however, because the evidence is institutional rather than a fully published peer-reviewed comparative dataset, it should be considered preliminary.

5. A Graded Evidence Framework for Pratinidhi Dravya

The Patala literature supports a graded rather than a binary approach to substitution. Level 1—Classical rationale: the candidate should have an Ayurvedic basis for selection and, where applicable, similarity in relevant properties and therapeutic action. Level

2—Botanical authentication: the candidate and authentic drug should be unequivocally identified, including the correct plant part. Level 3—Chemical concordance: validated chromatographic or spectroscopic fingerprints and quantitative markers should be compared. Level 4—Pharmacological concordance: authentic and candidate materials should ideally be prepared and tested under the same conditions, with dose-response assessment. Level 5—Safety and translational validation: contaminant and toxicity profiles, formulation performance, and, when clinical replacement is intended, clinical evidence should be considered.

These levels are complementary and not interchangeable. Morphological similarity does not establish chemical identity, a shared marker does not guarantee equal potency, and a positive animal model does not establish clinical interchangeability. The Ativisha-Musta literature demonstrates that an Ayurvedic substitute can be botanically unrelated to the original drug while still being investigated through pharmacochemical and pharmacological reasoning [9]. Patala adds a different lesson: even closely related or historically associated materials can remain chemically and pharmacologically distinguishable [7,8,11]. Accordingly, incompletely

validated materials should be termed potential or candidate substitutes, rather than equivalent drugs.

6. Research Gap, Limitations and Future Directions

General reviews have already discussed Pratinidhi Dravya, while the Patala literature contains separate pharmacognostic, phytochemical, and pharmacological studies [1-3,6-8].

Therefore, the specific gap is not the absence of literature but its fragmentation: evidence on botanical identity, marker chemistry, and comparative pharmacology has rarely been synthesized in one Patala-focused framework that explicitly tests whether the evidence is sufficient to infer therapeutic interchangeability.

Current evidence is limited by heterogeneity in species identity, plant part, extraction method, standardization, dose, and experimental model. Pharmacological evidence is predominantly preclinical, and clinical comparative evidence is absent. Institutional annual reports are useful for identifying ongoing research but are grey literature and should not be weighted like peer-reviewed studies. Safety and pharmacovigilance evidence for proposed substitutes is also limited. Future studies should use authenticated voucher specimens, identical preparation

procedures, quantitative chemical fingerprints, standardized pharmacological models, dose-response analysis, and safety testing. For use in a classical formulation, the complete formulation should ultimately be evaluated rather than assuming that the activity of an isolated crude extract predicts formulation-level interchangeability.

8. Conclusion

Patala illustrates both the value and complexity of Abhava Pratinidhi Dravya. Modern evidence shows that materials associated with Patala may share traditional or pharmacological attributes while differing in botanical characters, chemical fingerprints, or potency. Comparative studies of *S. colais*, *S. tetragonum*, *R. xylocarpa*, *S. campanulata*, and different *S. suaveolens* plant parts demonstrate why substitution should not be judged by a single criterion. A scientifically defensible assessment should integrate classical rationale, authentication, quantitative chemical concordance, comparative pharmacology and safety, followed where appropriate by formulation and clinical validation. At present, the literature supports several candidates for further investigation but does not establish universal therapeutic equivalence. Therefore, the Patala case

provides a focused example of how classical Ayurvedic substitution can be examined using contemporary evidence

DECLARATIONS

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA

No new datasets were generated or analyzed in this study. Information discussed in this mini-review was obtained from publicly available scientific literature and cited appropriately in the manuscript.

COMPETING INTERESTS

Not applicable.

without reducing Pratinidhi Dravya to a simple botanical replacement.

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AUTHOR CONTRIBUTIONS

Swati Bhatia conceptualized the review, defined its scope, and contributed to the literature analysis and preparation of the manuscript.

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