



SHANPUSHPI (*CROTALARIA VERRUCOSA* LINN.) A SYSTEMATIC REVIEW OF CLASSICAL AYURVEDIC LITERATURE AND CONTEMPORARY PHARMACOLOGICAL EVIDENCE

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<p>Article Info</p> <p>Article Received: 05 January 2026, Article Revised: 25 January 2026, Article Accepted: 15 February 2026.</p> <p>DOI: https://doi.org/10.5281/zenodo.18817612</p>	<p>ABSTRACT</p> <p>Medicinal plants form the cornerstone of traditional healthcare systems, including <i>Ayurveda</i>, where therapeutic efficacy is interpreted through the principles of <i>Rasa</i>, <i>Guna</i>, <i>Veerya</i>, and <i>Vipaka</i>. <i>Shanpushpi</i>, botanically identified as <i>Crotalaria verrucosa</i> Linn. (Family: Fabaceae), is described in classical <i>Ayurvedic</i> lexicons as a <i>Kapha-Pitta</i> pacifying drug indicated in <i>Jwara</i>, <i>Krimi</i>, <i>Kandu</i>, and certain inflammatory conditions. Despite its traditional relevance, comprehensive scientific consolidation of its pharmacological and toxicological profile remains limited.</p>
<p>*Corresponding author:</p> <p>Dr. Abhaykumar Kulkarni</p> <p>Professor and HOD, Department of Dravyagun Vigyan, Ashokrao Mane Ayurvedic Medical College and Hospital Vathar Tarf, Vadgaon, Kolhapur.</p>	<p>KEYWORDS: <i>Shanpushpi</i>, <i>Ayurveda</i>, <i>Dravyaguna Vigyan</i>, Pharmacology.</p>

AIMS AND OBJECTIVES

Therefore, the present systematic review aims to:

1. Compile and analyze classical Ayurvedic references related to Shanpushpi.
2. Examine contemporary phytochemical and pharmacological evidence.
3. Evaluate toxicological concerns, particularly regarding pyrrolizidine alkaloids.
4. Identify research gaps and future directions for clinical validation.

Such integrative evaluation may facilitate rational standardization and evidence-based incorporation of *Crotalaria verrucosa* into modern phytotherapeutic practice while ensuring safety and authenticity.

INTRODUCTION

Medicinal plants have served as foundational therapeutic agents across traditional medical systems and continue to contribute substantially to modern pharmacology.^[1,2] Approximately 25–30% of contemporary pharmaceuticals are either directly derived from plant sources or developed from phytochemical prototypes.^[2] Within the Indian system of *Ayurveda*, medicinal plants are categorized based on *Dravyaguna* principles that integrate sensory attributes (*Rasa*), physicochemical properties (*Guna*), metabolic potency (*Veerya*), and post-digestive effect (*Vipaka*) to determine therapeutic application.^[3]

Shanpushpi, botanically identified as *Crotalaria verrucosa* Linn. (Family: Fabaceae), is described in classical *Ayurvedic* lexicons such as *Bhavaprakasha Nighantu* and *Dhanvantari Nighantu* under names

including *Shanapushpi* and *Brihatapushpi*.^[3,4] The genus *Crotalaria* comprises more than 600 species distributed across tropical and subtropical regions, many of which possess documented ethnomedicinal importance.^[5] In India, *C. verrucosa* is commonly known as Blue Rattlepod due to the characteristic sound produced by its mature seed pods.

Given the growing global emphasis on integrative medicine and phytopharmaceutical standardization, it is imperative to critically evaluate *Shanpushpi* within both classical *Ayurvedic* and modern biomedical paradigms.

MATERIALS AND METHODS

A structured literature review was conducted using PubMed, Scopus, AYUSH Research Portal, and classical *Ayurvedic* texts. Search terms included: “*Crotalaria verrucosa*,” “*Shanpushpi*,” “Fabaceae medicinal plants,” “pyrrolizidine alkaloids toxicity,” “anti-inflammatory activity,” and “antipyretic medicinal plants.”

Morphology of *Crotalaria verrucosa* Linn

Crotalaria verrucosa Linn. (Family: Fabaceae) is an erect to sub-erect, short-lived perennial or sometimes annual herb widely distributed in tropical regions. It exhibits the characteristic papilionaceous floral morphology typical of the Fabaceae family.

• Habit

Erect or diffusely branched herb, Height: approximately **0.6–1.5 meters**, Growth form: Annual or short-lived perennial, Often cultivated as an ornamental plant due to its attractive blue flowers.

• Root

Taproot system, moderately developed, Root cylindrical, pale brown externally, Shows lateral root branches, In classical references, root is therapeutically important.

• Stem

Erect, branched, Cylindrical, slightly angular when young, Surface smooth or faintly pubescent, Green when

young, becoming somewhat woody at the base on maturity.

• Leaves

Arrangement: Alternate, **Type:** Simple, petiolate, **Shape:** Ovate to broadly elliptic or orbicular, **Size:** Approximately 5–12 cm long, **Margin:** Entire, **Apex:** Acute to obtuse, **Base:** Rounded to slightly cordate, **Surface:** Glabrous or slightly pubescent, Stipules small and linear. Leaves are relatively broad compared to many other *Crotalaria* species, aiding in species identification.

• Inflorescence

Type: Terminal or axillary raceme, Flowers borne singly or in short clusters, Pedicels slender.

• Flower

Type: Papilionaceous (typical Fabaceae structure), **Color:** Bright blue to violet (rarely white), **Calyx:** Campanulate, 5-lobed, **Corolla:** Composed of standard (vexillum), wings, and keel, Standard petal large and showy, Keel curved and enclosing reproductive organs, **Androecium:** 10 stamens, diadelphous (9 fused + 1 free), **Gynoecium:** Monocarpellary, superior ovary, Flowering generally occurs during warm seasons.

• Fruit

Type: Inflated, oblong or ovoid pod (legume), Surface slightly warty (hence the epithet “*verrucosa*”), Pods become papery and produce a rattling sound when seeds dry — giving the genus name *Crotalaria* (Greek *krotalon* = rattle)

• Seeds

Numerous, Kidney-shaped to reniform, Smooth, yellowish to brown, Hard seed coat.

• Diagnostic Morphological Features

Large blue papilionaceous flowers, Inflated, warty pods, Broad ovate leaves, Rattling mature fruits. These features help differentiate *C. verrucosa* from other *Crotalaria* species and from morphologically distinct *Shankpushpi* species such as *Convolvulus prostratus*.



Crotalaria verrucosa Linn (Leaves)



Crotalaria verrucosa Linn (Flower)



Crotalaria verrucosa Linn (Pods)



Crotalaria verrucosa Linn (Seeds)

Botanical and Pharmacognostic Overview

Crotalaria verrucosa is a perennial herb characterized by papilionaceous blue flowers and inflated pods. The genus

Crotalaria comprises over 600 species globally.^[6] Morphological and microscopic identification standards are described in API.^[1]

Pharmacodynamic Attributes as per Ayurveda

Parameter	Description
Rasa	Tikta, Katu, Kashaya
Guna	Laghu, Ruksha, Tikshna
Veerya	Ushna
Vipaka	Katu
Doshaghnata	Kapha-Pitta Shamaka

Classical indications include Jwara, Krimi, Kandu, and Mukharoga.^[3,4]

Phytochemical Profile

Phytochemical investigations reveal:

- Pyrrolizidine alkaloids.^[7,8]
- Flavonoids and phenolics.^[9,10]
- Sterols (β -sitosterol).^[11]
- Triterpenoids and saponins.^[12]

Pharmacological Evidence

Anti-inflammatory Activity

Protein denaturation and membrane stabilization models demonstrate significant inhibition comparable to NSAIDs in vitro.^[15,16] Flavonoids are known mediators of anti-inflammatory pathways via COX and LOX inhibition.^[17]

Antipyretic Activity

Brewer's yeast-induced pyrexia models show temperature reduction following administration of plant extract.^[18] Herbal antipyretic mechanisms are often mediated via prostaglandin inhibition.^[19]

Antioxidant Activity

Methanolic extracts exhibit dose-dependent DPPH and FRAP activity.^[20] Polyphenolic compounds contribute to oxidative stress modulation.^[21]

6.4 Antimicrobial Activity

Extracts demonstrate antibacterial activity against gram-positive and gram-negative strains.^[22,23] Fabaceae

members often possess antimicrobial secondary metabolites.^[24]

6.5 Cytotoxic and Nanoparticle Studies

Plant-mediated ZnO nanoparticle synthesis has demonstrated in-vitro anticancer activity.^[25] Phytochemical-reduced nanoparticles show enhanced bioactivity.^[26]

Toxicology and Safety

Pyrrolizidine alkaloids are associated with hepatic veno-occlusive disease and genotoxicity.^[13,27] Chronic exposure risk has been documented in experimental models.^[28,29]

WHO guidelines emphasize safety monitoring of herbal medicines containing alkaloids.^[30]

DISCUSSION

The present review integrates classical *Ayurvedic* descriptions and contemporary pharmacological evidence of *Shanpushpi* (*Crotalaria verrucosa* Linn.), highlighting both therapeutic promise and safety concerns. The convergence between traditional *Dravyaguna* principles and experimental pharmacology provides a rational framework for evaluating this medicinal plant in an evidence-based context.

Classically, *Shanpushpi* is characterized by *Tikta*, *Katu*, and *Kashaya Rasa* with *Ushna Veerya* and *Kapha-Pitta* pacifying action. In modern pharmacological interpretation, bitter and astringent phytoconstituents—primarily flavonoids and phenolic compounds are frequently associated with anti-inflammatory, antimicrobial, and antioxidant activities.^[17,21,22] The *Ushna Veerya* described in *Ayurveda* may correspond mechanistically to enhanced metabolic or circulatory activity, which aligns with experimental evidence demonstrating anti-inflammatory and antipyretic effects in preclinical models.^[15,18]

The *Vamaka* (emetic) property attributed to the root is pharmacologically plausible in light of alkaloidal content. Many alkaloids interact with central or peripheral neurotransmitter pathways, influencing gastrointestinal motility and emetic reflexes.^[7,13] This suggests a biochemical basis for classical therapeutic indications involving *Kapha*-related disorders, where expulsion of accumulated *dosha* is therapeutically intended.

Phytochemical investigations reveal the presence of pyrrolizidine alkaloids, flavonoids, triterpenoids, sterols, and phenolics. These compound classes are well documented for diverse biological activities.^[9,24] Flavonoids modulate inflammatory pathways through inhibition of cyclooxygenase (COX), lipoxygenase (LOX), and NF- κ B signaling cascades.^[17] Phenolic antioxidants reduce oxidative stress by scavenging reactive oxygen species and modulating endogenous antioxidant enzymes.^[21]

A major concern regarding *Crotalaria* species is the presence of pyrrolizidine alkaloids (PAs), compounds associated with hepatotoxicity, veno-occlusive disease, and potential genotoxicity.^[9,27,28] PAs undergo hepatic bioactivation to reactive pyrrolic metabolites capable of inducing endothelial damage and liver injury.^[29] Therefore, while classical texts describe therapeutic benefits, they do not provide quantitative toxicological parameters by contemporary standards.

The safety profile of *Shanpushpi* must be carefully contextualized. Traditional use often involved controlled dosing and short-term administration under supervision. Modern pharmacotherapy demands standardized alkaloid quantification, validated extraction protocols, and sub-chronic toxicity assessments. WHO guidelines emphasize pharmacovigilance in herbal medicines containing bioactive alkaloids.^[30] Future investigations must incorporate HPLC-based alkaloid profiling and establish permissible exposure limits.

Confusion between *Shanpushpi* (*Crotalaria verrucosa*) and *Shankhpushpi* (*Convolvulus prostratus*) remains a critical pharmacognostical issue. The latter is officially recognized as a *Medhya Rasayana* with established neuropharmacological research support.^[1] In contrast,

Shanpushpi is not classically emphasized for cognitive enhancement. Substitution or misidentification could lead to therapeutic inconsistency and safety concerns, particularly given the presence of hepatotoxic alkaloids in *Crotalaria* species.

Pharmacognostic authentication through macroscopic, microscopic, and phytochemical markers is therefore essential for ensuring raw drug quality and preventing adulteration in the supply chain.

Research Gaps and Future Directions

Despite promising preliminary findings, several limitations persist:

1. Lack of randomized controlled clinical trials
2. Absence of standardized extract studies
3. Limited toxicokinetic data
4. Insufficient long-term safety evaluation
5. Minimal molecular mechanism studies

CONCLUSION

Shanpushpi (*Crotalaria verrucosa* Linn.) is a traditionally described *Ayurvedic* drug possessing *Tikta–Katu–Kashaya Rasa* and *Ushna Veerya*, primarily indicated in *Kapha-Pitta* dominant disorders such as *Jwara*, *Krimi*, and *Kandu*. Contemporary phytochemical studies demonstrate the presence of alkaloids, flavonoids, phenolics, sterols, and triterpenoids, which may account for experimentally observed anti-inflammatory, antipyretic, antioxidant, and antimicrobial activities. However, the occurrence of pyrrolizidine alkaloids necessitates careful toxicological evaluation and standardized dosing. Current evidence remains largely preclinical, with a notable absence of well-designed human clinical trials. Additionally, botanical differentiation from *Shankhpushpi* species is essential to avoid therapeutic misapplication.

In summary, *Crotalaria verrucosa* exhibits pharmacological potential consistent with certain classical *Ayurvedic* claims, yet its clinical integration requires rigorous phytochemical standardization, safety profiling, and controlled clinical validation.

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