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PHARMACOLOGICAL VALIDATION OF NIRMALI BEEJA (STRYCHNOS POTATORUM): EXPLORING ITS ROLE IN AYURVEDIC AND MODERN THERAPEUTICS"

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ABSTRACT

Introduction

Nirmali Beeja (*Strychnos potatorum*), a medicinal plant traditionally used in *Ayurvedic* medicine, is well-known for its diverse therapeutic properties, particularly in water purification and gastrointestinal health. This study aims to evaluate the phytochemical profile, pharmacological activities, and traditional applications of *Strychnos potatorum* seeds. **Materials and Methods:** A thorough physico-chemical analysis was conducted using a 50-gram sample of *Nirmali Beeja* seeds. Parameters such as foreign matter, total ash value, and extractive values were analyzed, adhering to the *Ayurvedic* Pharmacopoeia of India. Preliminary phytochemical screening of both water and alcohol extracts revealed the presence of carbohydrates, reducing sugars, alkaloids, tannins, glycosides, and saponins. Thin-layer chromatography (TLC) further confirmed the diversity of phytoconstituents.**Results:** The study explored the plant's medicinal properties, including its antimicrobial, anti-inflammatory, antidiarrheal, and diuretic actions, supported by experimental studies in vivo and in vitro. Additionally, its role in treating eye disorders (*netra roga*), urinary issues (*mutra roga*), and skin diseases (*tvak roga*), as described in classical *Ayurvedic* texts, was validated. **Discussion:** Despite the presence of potentially toxic alkaloids in related *Strychnos* species, *S. potatorum* was found to be

relatively safe. The plant's diverse pharmacological activities, such as *ātisāra hara* (anti-diarrheal), *śopha hara* (anti-inflammatory), and *krimi hara* (vermifuge), corroborate itstraditional uses in *Ayurveda*.**Conclusion:**This research emphasizes the potential of *Strychnos potatorum* as a promising candidate for integrative medicine, with a strong foundation in traditional use and modern pharmacological validation. Future studies focusing on clinical trials and toxicological assessments are essential to ensure its safe therapeutic application.

KEYWORDS: *Nirmali Beeja*, *Strychnos potatorum*, traditional, phytochemicals.

INTRODUCTION

Nirmali Beeja, scientifically known as *Strychnos potatorum*, is a well-known medicinal plant in Ayurveda, primarily used for its seed part.[1] It is commonly referred to as the "clearing nut" due to its traditional use in water purification.[2] The seeds are attributed with numerous therapeutic benefits in classical Ayurvedic texts and are still widely used in various herbal preparations.[3,4] According to a phytochemical screening conducted by the Central Research Facility, Shri B.M. Kankanawadi Ayurveda Mahavidyalaya, the water and alcohol extracts of *Nirmali Beeja* seeds showed the following key constituents . *Strychnos potatorum* L. f. (Loganiaceae), commonly known as *Nirmali Beeja* or *Kataka*, is a medium-sized deciduous tree reaching 8–12 m in height, characterized by glossy opposite leaves (4–12 cm), axillary clusters of cream-green flowers, and globose drupes (~15–20 mm diameter) each enclosing two smooth seeds traditionally employed for water purification and various medicinal applications.[5] Taxonomically, it belongs to the pantropical genus *Strychnos* (~200 species), several of which yield indole alkaloids; its synonyms include *S. heterodoxa* Gilg and *S. stuhlmannii* Gilg.[6] The species is native to India, Sri Lanka, and Myanmar, and extends into parts of southern Africa (Zimbabwe, Malawi, Botswana), where it thrives along riverbanks and moist deciduous forests.[7] Classical Ayurvedic compendia—*Bhavaprakasha Nighantu*, *Dhanvantari Nighantu*, *Kaiyadeva Nighantu*, *Charaka Samhita* and *Sushruta Samhita*—describe *Kataka* seeds as possessing a pungent (*katu*), astringent (*tuvara*), bitter (*tikta*) and clear (*viśada*) taste; cooling (*śītala*) and light (*laghu*) qualities; and a sweet post-digestive effect (*madhura vipāka*). *Katak* (Strychnos potatorum) is known as *Pathyaprashi, Chakshushya, Nirmali, Tatatkotī*, and *Vilvasetaka*; it is especially useful for purifying water. These texts attribute to the seeds actions including anti-diarrheal (*ātisāra hara*), detoxifying

(*viṣa hara*), anti-inflammatory (*śopha hara*), ocular cleansing (*netra śodhana*), diuretic (*mutra kṛcchra hara*), vermifuge (*krimi hara*) and wound-healing (*tvacchikitsā*).[8,12]

MATERIALS AND METHODS

The study was conducted on *Nirmali Beeja* (seeds), a plant-based sample submitted by KLE Ayurved Pharmacy to the Central Research Facility at Shri B. M. Kankanawadi Ayurveda Mahavidyalaya, Belgaum. A 50-gram sample of the seeds (Batch No. I) was used for analysis. Macroscopic examination was performed to assess the part, color, and taste of the seeds. Physico-chemical parameters such as foreign matter, total ash value, acid-insoluble ash, water-soluble extractive, and alcohol-soluble extractive were evaluated according to the standards outlined in the Ayurvedic Pharmacopoeia of India.[13] For the detection of bioactive compounds, preliminary phytochemical screening was carried out using both water and alcohol extracts. This screening included tests for carbohydrates, reducing sugars, proteins, amino acids, steroids, flavonoids, alkaloids, tannins, and various glycosides.[14,15] Additionally, Thin Layer Chromatography (TLC) was performed on the alcohol extract using a mobile phase consisting of toluene and ethyl acetate in a 7:3 ratio. The Rf values were recorded under both short and long wave UV light to identify the presence of different phytoconstituents.[16] Nirmali Beeja (Strychnos potatorum) is recognized in the Ayurvedic Pharmacopoeia of India for its therapeutic uses in cleansing and detoxification.[17] Its seeds are traditionally used to purify water, a property validated by Reddy et al., who reported significant microbial reduction using seed extracts.[18] Sharma et al. further confirmed its antidiabetic, antimicrobial, and ocular benefits, supporting its classical applications.[19]

RESULTS

The macroscopic evaluation of *Nirmali Beeja* revealed that the seeds were cream-white in color and had no bitterness in taste. The physicochemical analysis showed that the foreign matter content was 0.449%, total ash value was 1.933%, and acid-insoluble ash was 0.338%, all within acceptable limits.[20] The water-soluble extractive value was found to be 7.274% and the alcohol-soluble extractive value was 2.1627%, indicating good solubility of phytoconstituents.[21] Preliminary phytochemical screening of the water extract tested positive for carbohydrates, reducing sugars, and saponin glycosides, while the alcohol extract tested positive for carbohydrates, reducing sugars, alkaloids, tannins, and glycosides.[22,23] TLC analysis of the alcohol extract displayed multiple Rf values: 0.39, 0.48, and 0.57 under short

wave UV, and 0.32, 0.42, 0.46, 0.60, 0.68, 0.76, and 0.84 under long wave UV, confirming the presence of a diverse range of phytochemical constituents.[24]

Phytochemical Profile: Preliminary phytochemical analysis reveals that both aqueous and alcoholic extracts of Strychnos potatorum seeds contain a variety of secondary metabolites. Aqueous extracts tested positive for carbohydrates, reducing sugars, and saponin glycosides, while alcoholic extracts were positive for alkaloids, tannins, glycosides, and flavonoids.[25,26] TLC profiling further confirmed the presence of diverse compounds based on multiple Rf values.[27] These bioactive molecules are responsible for the seed's therapeutic versatility. Alkaloids present in the seeds are known for their antimicrobial, analgesic, and anti-inflammatory actions.[28,29] Tannins exhibit potent antioxidant and astringent properties, useful in managing diarrhea and oxidative stress.[30,31] Saponins and flavonoids play roles in immunomodulation, hepatoprotection, and lipid regulation.[32,33] In Ayurvedic medicine, Strychnos potatorum is extensively used for various therapeutic purposes. It is traditionally employed in *Jalashodhana* (water purification), where seeds are rubbed with water and added to turbid sources to clarify and reduce impurities.[34] For gastrointestinal disorders such as *Atisara* (diarrhea), powdered seeds are administered for their absorbent and astringent properties.[35] In the treatment of *Netra roga* (eye disorders), decoctions and eye washes prepared from the seeds are commonly used.[36] The plant is also beneficial in Mutrakricchra (urinary disorders) due to its diuretic action and its ability to reduce inflammation in the urinary tract.[37] Furthermore, in cases of *Kustha* and *Visarpa* (various skin diseases), topical application of seed paste has been traditionally practiced for its healing and soothing effects.[38]

Pharmacological Activities: Experimental studies validate many of these traditional claims. The antidiarrheal activity of Strychnos potatorum has been demonstrated through the significant reduction of castor oil-induced diarrhea in rat models using both alcohol and aqueous seed extracts.[39,40] Its antimicrobial properties are evidenced by ethanolic and aqueous extracts showing inhibitory effects against Escherichia coli, Staphylococcus aureus, and Pseudomonas aeruginosa.[41,42] In liver protection, the plant exhibits hepatoprotective effects in models of paracetamol- and carbon tetrachloride-induced toxicity.[43] The antioxidant and anti-inflammatory activities are attributed to its flavonoid- and tannin-rich fractions, which help reduce inflammation and oxidative stress markers in experimental models.[44,45] The diuretic activity of the seed extracts has also been pharmacologically

validated, as they enhance urine output and promote the excretion of waste products like urea and creatinine.[46] Additionally, the plant shows promising anthelmintic and antifungal effects, with extracts demonstrating efficacy against parasitic helminths and fungal strains such as Candida albicans.[47,48]

Table no 1: Pharmacological Attributes and Medicinal Applications of Kataka (Strychnos potatorum).

No	Verse (Sanskrit)	Classical Reference	Translation/Meaning	Therapeutic Properties (Classical)	Modern Correlation/Reference
1.	*हरिद्रा मञ्जिष्ठा सुवहा सूक्ष्मैला पालिन्दी चन्दन कतक शिरीष सिन्धुवार श्लेष्मातका*	*Charaka samhita su 4/16*	*Kataka* (Strychnos potatorum), or *Nirmali Beeja*, is traditionally recognized in Ayurveda for its *viṣaghna* (antitoxic) properties.	*Viṣaghna*	Strychnos potatorum seeds exhibit antioxidant, cytoprotective, and antimicrobial properties, supporting their traditional use in detoxification and infection treatment
2.	*तत्र सप्त कलुषस्य प्रसादनानि भवन्ति | तद्यथा- कतकगोमेदकबिसग्रन्थिशैवालमूलवस्त्राणि मुक्तामणिश्चेति*	*Sushruta samhita su. 45/17*	There are seven purifying substances, which are as follows: ***Kataka*** (Strychnos potatorum), is among them	कलुषस्य प्रसादनानि	Water Purification and Antitoxic Uses
3.	कृष्णसर्पवसा शङ्खः कतकात् फलमञ्जनम्| रसक्रियेयमचिराद न्धानं दर्शनप्रदा|	*Ashtang hridayam uttartantra 13/41*	fruit of *Kataka* (Strychnos potatorum) that is believed to restore sight or cure blindness quickly	दर्शनप्रदा	
4.	*कतंकं तुवरं तिक्तं विशदं शीतलं लघु। विकाशि मधुरं छेदि चक्षुष्यं कफवातनुत्॥*	*Kaiyadeva Nighantu – Aushadhi Varga 1, Verses 1139–1145*	*Kataka* is astringent, bitter, clear, cold, and light. It promotes clarity, is mildly sweet, cuts through	*Chakshushya* (good for eyes), Kapha-*Vatahara*, *Vishad* (clarifies), *Vikāshi* (enhances	Seeds used in traditional medicine to purify water; studied for anti-inflammatory and anti-diabetic effects.

			obstructions, is good for the eyes, and alleviates *Kapha* and *Vata*.	clarity)	
5.	*तृष्णां दाहं विषं गुल्मं हन्ति तोयमलापहम्॥*	Kaiyadeva Nighantu – Aushadhi Varga 1, Verses 1139–1145	It alleviates thirst, burning sensation, poisons, and abdominal tumors; purifies water.	*Trishna-Dahahara, Vishaghna, Gulmahara, Toyamalāpaha*	Strychnos potatorum seeds used in traditional water filtration, have antimicrobial properties.
6.	*शीतलं तत्फलं बालं रक्तपित्तहरं परम्। तृष्णामोहविषनुदात्करं चक्षुष्यमुत्तमम्॥*	*Kaiyadeva Nighantu – Aushadhi Varga 1, Verses 1139–1145*	Its fruit is cold, especially effective in children, alleviates bleeding disorders, thirst, delusion, and poisons; best for eye health.	*Raktapitta hara, Trishna, Moha, Vishaghna, Chakshushya*	Research shows antioxidative and hepatoprotective properties of the fruit.
7.	*मधुरं क्षैणपित्तस्तनं रुचिकृत् दुर्जरं परम्। तस्येव च फलं पक्कं वातकृन्मेहनाशनम्॥*	*Kaiyadeva Nighantu – Aushadhi Varga 1, Verses 1139–1145*	The fruit is sweet, increases *Pitta* when immature, improves taste but is hard to digest; ripe fruit increases *Vata* and alleviates urinary disorders.	*Ruchikrut, Mehanashana, Vatakrut*	Studied for anti-diabetic and diuretic effects.
8.	*सपिच्छलच्छर्दिकरं क्षैणपित्तप्रसेचकृत्॥ शोफपाण्डुप्रमेहघ्नं आमलागरसापनम्।*	*Kaiyadeva Nighantu – Aushadhi Varga 1, Verses 1139–1145*	Causes nausea and vomiting when combined with mucus, stimulates diminished *Pitta*, reduces swelling, anemia, diabetes, and balances sour digestive disorders.	*Shophahara, Pandughna, Pramehaghna, Amlapachana*	Used in anemia and diabetes anti-inflammatory in Ayurvedic medicine.
9.	कतकस्य च मूलं तु सर्वकुष्ठव्रणप्रणुत्	Kaiyadeva Nighantu – Aushadhi	The root of *Kataka* cures all types of skin	*Kushtaghna, Vranahara*	Roots studied for antimicrobial and wound healing

		Varga 1, Verses 1139–1145	diseases and wounds.		potential.
10.	*कतंकं शीतलं पाथुस्नुष्णविषविनाशनम्॥*	*Dhanvantari Nighaṇṭu - 3/180-182. Chandanādi Varga*	*Kataka* is cooling, purifies water, and neutralizes hot poisons.	*Shitalam, Vishaghna, Toyashodhana*	Used traditionally in purifying drinking water and in detoxification.
11.	*नेत्रोष्णरोगविध्वंसी विधिना उजनयोगतः॥*	*Dhanvantari Nighaṇṭu - 3/180-182. Chandanādi Varga*	Used in eye wash treatments, it destroys eye disorders involving heat.	*Netra Roga hara (Ushna), Ujanayoga*	Eye drops from Kataka are used for eye infections.
12.	*कतकस्य फलं तिक्तं चक्षुष्यं पित्तलं मृदु। वारिप्रसादनं कृष्टश्लेष्मकर्मशमं जयेते॥*	*Dhanvantari Nighaṇṭu - 3/180-182. Chandanādi Varga*	*Kataka* fruit is bitter, promotes eye health, mildly increases *Pitta*, purifies water, and balances excessive *Kapha* activity.	*Chakshushya, Pittala, Kaphahara, Toyaprasadana*	Anti-inflammatory and water purifying properties confirmed in modern studies.
13.	*कतकस्य फलं नेत्र्यं जलनिर्मलताकरम्। वातक्षयरहमं शीतं मधुरं तुवरं गुरु॥*	*Bhāvaprakāśa - Pūrvakhaṇḍa - Miśraprakaraṇa - 7/90: Āmrādi Phalavarga*	*Kataka* fruit is good for the eyes, clears water, alleviates *Vata* and tissue depletion, is cooling, sweet, astringent, and heavy.	*Netrya, Vatakshayaghna, Shita, Guru*	Water purification and ocular health benefits documented.

DISCUSSION

The growing interest in ethno-medicinal plants has renewed attention toward Strychnos potatorum, a plant with both cultural and clinical relevance. Its broad phytochemical diversity provides a sound basis for its multifaceted pharmacological actions. Traditional Ayurvedic texts mention its use for treating diarrhea, urinary issues, and for purifying water—uses now validated through in vivo and in vitro studies.[49,50] Modern research confirms antidiarrheal effects through inhibition of hypersecretion and improved gut motility.[51,52] The antimicrobial profile supports its utility in contaminated water and infections.[53,54] S. potatorum seed extracts exhibit broad-spectrum antimicrobial activity, particularly against E.

coli, S. aureus, and P. aeruginosa, which aligns with classical claims of *Vishaghna* (antitoxic) and *Shodhana* (cleansing) actions.[55,56] Hepatoprotective actions are mediated by antioxidant enzymes and membrane-stabilizing effects.[57] These Hepatoprotective properties have been compared with silymarin, indicating promising protective effects against oxidative stress-induced liver damage.[58,59] Antioxidant and anti-inflammatory effects, attributed to tannins and flavonoids, further support its traditional indications in *Raktapitta* (bleeding disorders) and *Shotha* (inflammation).[60,61] The diuretic potential of the seed extracts is significant in managing urinary tract disorders (*Mutrakrichra*), confirmed by increased urine output and clearance of nitrogenous wastes in experimental models.[62,63] Moreover, anthelmintic and antifungal effects provide an additional rationale for its inclusion in treating *Krimi and Kustha* conditions.[64,65] Beyond its pharmacological actions, S. potatorum holds promise in environmental and public health settings. Its use in *Jalashodhana* (water purification) is validated by microbial and physicochemical studies.[66,67] and further exploration into its bio-adsorptive properties may aid in sustainable, low-cost water treatment solutions.[68,69] Recent advances suggest potential anticancer, immunomodulatory, and lipid-lowering effects of various extracts, although more clinical trials are needed to validate these emerging applications.[70,71,72] However, the presence of toxic strychnine-type alkaloids in related Strychnous species raises safety concerns. Although S. potatorum is generally safer than S. nux-vomica, it is imperative to differentiate species accurately and ensure proper dosage and preparation.[73,74] Further toxicological profiling, standardization of extracts, and well-designed clinical trials are essential for its safe and effective integration into mainstream and integrative medical systems.[75,76,77]

CONCLUSION

Nirmali Beeja (Strychnos potatorum) holds significant promise as a therapeutic agent with wide-ranging applications, from water purification to gastrointestinal, ocular, and dermatological disorders. The combination of its rich phytochemical content and diverse pharmacological activities supports its continued use in both traditional Ayurvedic practices and modern integrative medicine. Further pharmacological investigations and clinical trials will be pivotal in validating and expanding its therapeutic potential.

Additionally, the ecological benefits of S. potatorum, especially in water purification, highlight its relevance in addressing contemporary environmental health challenges. Standardizing preparations and ensuring proper species identification will be crucial for its

safe and effective use. As research progresses, S. potatorum has the potential to become a key player in the development of natural remedies for a variety of diseases, both in clinical and environmental health contexts.

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