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BIOACTIVE POTENTIAL OF SOYMIDA FEBRIFUGA BARK: A NATURAL ANTIDIARRHOEAL AGENT

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ABSTRACT

Diarrhoea remains one of the leading global health concerns, especially in developing countries where infectious agents and poor sanitation contribute significantly to morbidity and mortality. The limitations of conventional therapies, coupled with growing antimicrobial resistance, have stimulated interest in traditional medicinal plants as alternative remedies. Soymida febrifuga (Roxb.) A. Juss., belonging to the family Meliaceae, is an ethnomedicinally significant plant widely used in Indian traditional medicine. Its bark is reputed for treating fever, wounds, ulcers, and gastrointestinal disorders, including diarrhoea. Phytochemical investigations have revealed the presence of bioactive compounds such as alkaloids, flavonoids, tannins, terpenoids, saponins, and glycosides that may contribute to its antidiarrhoeal efficacy. Pharmacological studies suggest that bark extracts exhibit significant antidiarrhoeal activity by reducing gastrointestinal motility, decreasing intestinal secretions, and exerting antimicrobial effects against diarrhoea-causing pathogens. This review consolidates the ethnomedicinal relevance, phytochemical profile, pharmacological evidence, and potential mechanisms underlying the antidiarrhoeal activity of S. febrifuga bark, highlighting its promise as a natural therapeutic agent and future candidate for phytopharmaceutical development.

1. INTRODUCTION

Diarrhoea continues to be a global health crisis, especially in low- and middle-income countries, where inadequate sanitation, contaminated water supply, and poor healthcare infrastructure contribute to its persistence. Although oral rehydration therapy has drastically reduced mortality rates, it does not address the underlying infection or inflammation. Synthetic antidiarrhoeal agents such as loperamide and diphenoxylate, while effective, have limitations including constipation, abdominal discomfort, and risk of dependence. Additionally, rising antimicrobial resistance necessitates alternative solutions. In this context, medicinal plants with ethnomedicinal usage provide a promising avenue for novel drug discovery. Soymida febrifuga, an indigenous species, has been recognized in Ayurveda and traditional systems for treating fever, wounds, and gastrointestinal disorders, making it a subject of growing pharmacological interest.

Diarrhoeal disease remains a major global public-health challenge. In 2021, it caused an estimated 1.17 million deaths across all ages worldwide, despite long-term declines since 1990. Among children, diarrhoea was responsible for about 9% of deaths in those under five years old, amounting to approximately 444,000 child deaths. This highlights persistent inequities in access to safe water, sanitation, and hygiene.

Conventional management strategies—including oral rehydration salts (ORS), zinc supplementation, targeted antimicrobials, and antimotility agents—have significantly reduced mortality. However, these approaches do not fully address pathogen burden, intestinal hypersecretion, or inflammatory processes, and antimicrobial resistance continues to undermine antibiotic effectiveness.

In this context, traditional medicines are gaining attention as potential sources of novel antidiarrhoeal therapies. Soymida febrifuga (Roxb.) A. Juss. (Meliaceae), a deciduous tree native to the Indian subcontinent, has long been used in Ayurveda and folk medicine to treat diarrhoea, dysentery, fever, and other gastrointestinal disorders. Bark decoctions, in particular, have been traditionally prescribed for bowel complaints.

The bark of this plant is rich in bioactive compounds, including limonoid and tetranortriterpenoid scaffolds, tannins, flavonoids such as luteolin glycosides, triterpenes like lupeol, and phytosterols such as β-sitosterol. These phytochemicals are associated with astringent, anti-secretory, antispasmodic, antioxidant, and antimicrobial properties, all of

which are relevant to diarrhoeal pathophysiology. Studies have shown that extracts from different plant tissues, including bark, contain compounds with antibacterial and antioxidant activity, supporting the plausibility of their protective effects against enteric infections and oxidative damage in the gut.

Pharmacologically, effective botanical antidiarrhoeal agents usually act by reducing intestinal motility, limiting fluid accumulation and secretory flux, and exerting direct antimicrobial activity. These mechanisms align with the known chemistry of Soymida febrifuga, particularly its tannins, limonoids, and flavonoids. While controlled in-vivo antidiarrhoeal studies on the bark remain limited, the convergence of traditional use, antimicrobial and antioxidant activity, and the presence of bioactive chemotypes known to influence gut function strongly supports further evaluation. Rigorous testing in preclinical diarrhoeal models—such as castor-oil induced diarrhoea, enteropooling, and charcoal-meal transit assays—followed by well-designed clinical studies, would help determine its true therapeutic potential.

2. Ethnomedicinal Relevance of Soymida febrifuga

Soymida febrifuga, belonging to the Meliaceae family, grows predominantly in the dry deciduous forests of central and southern India. The bark of this plant is well documented in Ayurveda as ‘Rohini’ for its fever-reducing (antipyretic) properties. Traditional healers administer a decoction of the bark to treat dysentery, chronic diarrhoea, and stomach ulcers. Tribal communities mix powdered bark with honey as a remedy for gastrointestinal infections, while its use in treating intestinal worms, inflammatory bowel disorders, and liver dysfunction has also been recorded. This ethnomedicinal foundation underlines the significance of scientific validation through modern pharmacology.

3. Phytochemical Profile of Bark Extract

The bark is rich in diverse classes of bioactive metabolites, providing a chemical basis for its therapeutic potential. Tannins, known for their protein-precipitating ability, create a protective layer on the intestinal mucosa, thereby reducing secretions. Flavonoids are multifunctional agents, exerting antioxidant, spasmolytic, and anti-inflammatory effects that reduce oxidative stress and intestinal contractions. Alkaloids may interact with cholinergic receptors to reduce gut motility and also possess antimicrobial properties. Saponins influence fluid dynamics in the intestines, while terpenoids and glycosides extend broad

pharmacological benefits including antimicrobial and anti-inflammatory effects. The synergy of these compounds highlights a multi-targeted action profile.

4. Pharmacological Evidence of Antidiarrhoeal Activity

Several experimental studies have validated the traditional claims of antidiarrhoeal efficacy. In rodent models, ethanolic and methanolic extracts of the bark significantly reduced the frequency of defecation and delayed the onset of diarrhoea induced by castor oil. The charcoal meal test demonstrated reduced intestinal transit, confirming antimotility effects. Enteropooling assays revealed a pronounced antisecretory effect, comparable to loperamide. In antimicrobial studies, extracts exhibited broad-spectrum activity against Escherichia coli, Shigella flexneri, and Salmonella typhi, all of which are major diarrhoea-causing pathogens. These findings strongly support the traditional use and provide a mechanistic foundation for its efficacy.

5. Mechanisms of Antidiarrhoeal Action

The mechanisms underlying the antidiarrhoeal activity of S. febrifuga bark are multifaceted. Flavonoids and alkaloids act on smooth muscle relaxation, reducing hypermotility. Tannins precipitate proteins, leading to reduced intestinal permeability and secretion, and forming a protective mucosal barrier. The antimicrobial action targets pathogens responsible for infectious diarrhoea, while the antioxidant and anti-inflammatory properties protect against secondary intestinal damage. Together, these mechanisms offer both symptomatic relief and curative potential.

6. Toxicological and Safety Profile

Safety evaluation is critical for herbal therapeutics. Acute oral toxicity studies in rodents have demonstrated that S. febrifuga bark extracts are safe even at high doses, with no observed behavioral or biochemical abnormalities. Subacute studies reveal no significant impact on vital organ function or hematological parameters. However, comprehensive chronic toxicity and human clinical studies are still lacking. Standardization of dose and formulation is essential before clinical translation.

7. Comparative Analysis with Other Antidiarrhoeal Plants

Several medicinal plants are known for their antidiarrhoeal effects, such as Aegle marmelos (bael), which is rich in tannins and effective against secretory diarrhoea, and Holarrhena antidysenterica (kurchi), traditionally used against amoebic dysentery. Soymida febrifuga

shows comparable or potentially superior efficacy in preliminary pharmacological studies. Its broader spectrum of phytochemicals offers combined antimotility, antisecretory, and antimicrobial benefits, suggesting an advantage over other single-mechanism plants. However, head-to-head comparative clinical studies are required.

8. Future Prospects and Research Gaps

Despite promising preclinical data, several gaps must be addressed. Isolation and structural characterization of individual bioactive compounds remain incomplete. Standardization of extracts and identification of optimal doses are urgently needed. Well-designed clinical trials in human subjects are essential to establish efficacy and safety. Additionally, advanced formulations such as phytopharmaceutical capsules, syrups, or nanoparticles may enhance bioavailability. Exploring synergistic effects with probiotics and other herbal agents could further enhance therapeutic outcomes. Finally, integrating traditional knowledge with modern drug discovery pipelines may fast-track development.

9. CONCLUSION

Soymida febrifuga bark holds immense promise as a natural antidiarrhoeal agent. Traditional wisdom, supported by phytochemical richness and pharmacological evidence, demonstrates its potential to act through multiple pathways: reducing motility, controlling secretion, combating pathogens, and protecting intestinal mucosa. The presence of tannins, flavonoids, and alkaloids provides a strong mechanistic basis for its efficacy. While preclinical studies have laid a solid foundation, further advancements demand isolation of active constituents, detailed safety evaluations, and robust clinical validations. If these gaps are addressed, S. febrifuga could emerge not only as an accessible remedy in traditional medicine but also as a lead candidate in phytopharmaceutical development. Its multifaceted activity also positions it as a potential model for plant-derived drugs targeting complex gastrointestinal disorders. Thus, S. febrifuga bark extract represents both a heritage of traditional medicine and a beacon for future therapeutic innovation. Moreover, its exploration underscores the critical importance of bridging ethnomedicine and modern science, thereby providing a framework for developing evidence-based plant-derived therapeutics that are both safe and effective.

Table 1: Phytochemical Classification of Soymida febrifuga Bark.

Phytochemical Class	Pharmacological Role
Tannins	Astringent action, reduces intestinal secretion, forms mucosal protective layer
Flavonoids	Antioxidant, anti-inflammatory, spasmolytic
Alkaloids	Anticholinergic and antimicrobial activity
Saponins	Influence intestinal fluid balance
Terpenoids	Broad pharmacological activities including antimicrobial effects
Glycosides	Contribute to antimicrobial and anti-inflammatory potential

Table 2: Experimental Models and Antidiarrhoeal Outcomes.

Experimental Model	Observation	Outcome
Castor Oil–Induced Diarrhoea	Reduced stool frequency and delayed onset	Significant antidiarrhoeal activity
Charcoal Meal Transit Test	Reduced charcoal intestinal transit	Inhibition of hypermotility
Enteropooling Assay	Reduced intestinal fluid accumulation	Antisecretory effect comparable to loperamide
Antimicrobial Assay	Activity against E. coli, Shigella flexneri, Salmonella typhi	Broad-spectrum antimicrobial effect

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