Chapter 9

Climbing towards cure: phytochemical and antibacterial exploration of *Gouania leptostachya* DC. (Rhamnaceae)

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ABSTRACT

Lianas being famous for their entwining vines but less studied in light of their pharmacological potential. *Gouania leptostachya* (Rhamnaceae) is one such liana known for its traditional medicinal uses across tropical regions of Asia. Present study explores the phytochemical composition and antibacterial potential of its leaf extracts. The phytochemical screening showed that the hydroethanolic extract was richer in secondary metabolites, including tannins, saponins, phenolic compounds, and reducing sugars, while the non-polar extract contained only reducing sugars. When tested against *Escherichia coli* to validate its folk medicinal practices, the hydroethanolic extract exhibited notable antibacterial activity, with a minimum inhibitory concentration (MIC) of 12.5 mg/mL. Observations suggested that the polar extract of *G. leptostachya* leaves holds promising antibacterial properties, possibly linked to the presence of phenolic and tannin compounds. This study provides a scientific basis for the plant's traditional use and supports its potential as a natural source of bioactive compounds.

Keywords: Bioactivity, folk medicine, liana

INTRODUCTION

In tropical forests, lianas (long-stemmed woody vines) form an important part of the forest structure. These plants grow from the ground and climb trees or other supports using tendrils, hooked spines, or climbing roots to

reach sunlight in the upper canopy (Rowe, 2018). Unlike epiphytes that live on other plants, lianas stay rooted in the soil while extending high into the forest layers (Ceballos *et al.,* 2025). Their presence often reflects the health and maturity of a forest ecosystem. Although they compete with trees for light, water, and nutrients, and sometimes slow their growth by adding weight, lianas also play vital ecological roles (De Deurwaerder *et al.,* 2024). They connect tree canopies, creating natural bridges that allow animals to move easily through the forest, and influence forest regeneration and diversity (Schnitzer and Bongers, 2002). In addition to their ecological functions, many lianas have cultural and medicinal importance (Devarakonda *et al.,* 2022). Communities living in tropical regions have long used them in traditional healing, food, and daily practices (Dung *et al.,* 2015). Thus, lianas are not only a structural element of forests but also a source of knowledge and health for people who live close to them. *Gouania leptostachya* (Figure 1) in that context was studied for correlating its ethnomedicinal practices with today's modern medicine.



Figure 1: Leaves and inflorescence of *Gouania leptostachya*

Being a native species in the Indian subcontinent and Western Malaysia, this Slender Spiked Gouania belongs to family Rhamnaceae. It typically grows in wet tropical biomes and has ethnobotanical relevance which makes it an integral but lesser-known part of the folk medicinal practices (Gumisiriza *et al.,* 2024). Its leaves, stems, and roots are prepared as poultices, extracts, decoctions, herbal baths, and smoke inhalations for the management of ailments including sores, wounds, gastrointestinal disorders, postpartum complications, inflammatory diseases, and fever (Table 1). Thus, its potential

pharmacological relevance has been assessed in this study to support its traditional therapeutic reputation.

Table 1: Traditional ethnomedicinal uses of *G. leptostachya*

Plant parts used	Mode of use	Ethno-medicinal applications	Associated communities/ regions	Source(s)
Leaves	Poultice applied externally/ topically	Treatment of eczema (local name: *Raktapitchali*)	India (Odisha, Jharkhand, Uttarakhand, West Bengal)	Devarakonda *et al.,* (2022); Pradhan and Badola, (2008); Uprety *et al.,* (2016)
Leaf	Extract applied externally	Treatment of wounds	India (Himachal Pradesh)	Sharma *et al.,* (2024)
Leaves and stems	Decoction or cold infusion taken orally	Relief from stomachache and diarrhea	Indonesia	Gumisiriza *et al.,* (2024)
Whole plant (mainly leaves)	Herbal bath formula and food supplement	Postpartum care, treatment of convulsions in newborns, numbness, fainting, antispasmodic conditions and general inflammation	Mien tribe, Northern Thailand, Vietnam, Bhutan, Nepal	Panyaphu *et al.,* (2011); Dung *et al.,* (2015); Gumisiriza *et al.,* (2024)
Roots	Roots burned; smoke inhaled	Treatment of fever	Rural communities of North Andaman, India	Prasad *et al.,* (2008)

METHODOLOGY

Leaves of *Gouania leptostachya* (Figure 2) were collected from Chandaka Khordha, Odisha, India, and taxonomically identified by the authors. The collected samples were properly tagged and placed in cotton bags to prevent contamination during transport.



Figure 2: Leaves of *G. leptostachya*

In the laboratory, the leaves were washed thoroughly under running tap water followed by distilled water to remove adhering dust, debris, and surface contaminants. Cleaned leaves were shade dried at ambient temperature (25 ± 2 °C) for 7-10 days to preserve thermolabile phytoconstituents and then finely powdered using a mechanical grinder. The powdered material was subjected to solvent extraction by the maceration method (Devi *et al.,* 2025) using two solvents of different polarity, n-hexane and hydro-ethanol (1:1), to ensure a broad spectrum of phytochemical recovery. The mixtures were agitated intermittently for 48 hours and filtered through Whatman No. 1 filter paper, after which the filtrates were concentrated at room temperature to evaporate residual solvent. The obtained crude extracts were stored in sterile glass vials under refrigeration (4°C) until further analysis. Preliminary qualitative phytochemical screening was performed on both extracts following standard procedures to detect the presence of major classes of

secondary metabolites such as tannins, flavonoids, terpenoids, reducing sugars, saponins, alkaloids, carbonyl compounds, and phenolic compounds. The antibacterial potential of the extracts was subsequently evaluated against *Escherichia coli* (MTCC 45). The minimum inhibitory concentration (MIC) was determined by the broth microdilution method following standard protocols with minor modifications (Jena *et al.,* 2025) to assess the concentration-dependent antibacterial efficacy of the extracts.

RESULTS AND DISCUSSION

The qualitative phytochemical screening of *Gouania leptostachya* leaf extracts revealed the presence of key secondary metabolites that varied according to solvent polarity (Table 2). The non-polar n-hexane extract detected reducing sugars (Figure 3), indicating a limited phytochemical yield. Meanwhile, the polar hydroethanolic extract exhibited a richer phytochemical profile, containing tannins, saponins, phenolic compounds, and reducing sugars (Figure 4). This suggests that polar solvents are more efficient in extracting diverse bioactive compounds from *G. leptostachya* leaves, reflecting their higher phytochemical richness. The antibacterial activity of its hydroethanolic leaf extract was tested against *E. coli* (MTCC 45). The extract effectively inhibited bacterial growth at all tested concentrations, with the minimum inhibitory concentration (MIC) recorded at 12.5 mg/mL (Table 3). The results were consistent across all replicates. Quality control checks verified sterility in the nutrient broth, viability of the microbial culture, and complete inhibition in the antibiotic control.

Table 2: Detection of secondary metabolites of *G. leptostachya* leaf extract

Polarity	Solvent extract	Detected secondary metabolites	Phytochemical richness
Non-polar	n-Hexane	Reducing sugars	◆
Polar	Hydroethanolic	Tannins, Saponins, Phenolic compounds and Reducing sugars	◆

(◆= low, ◆= high)

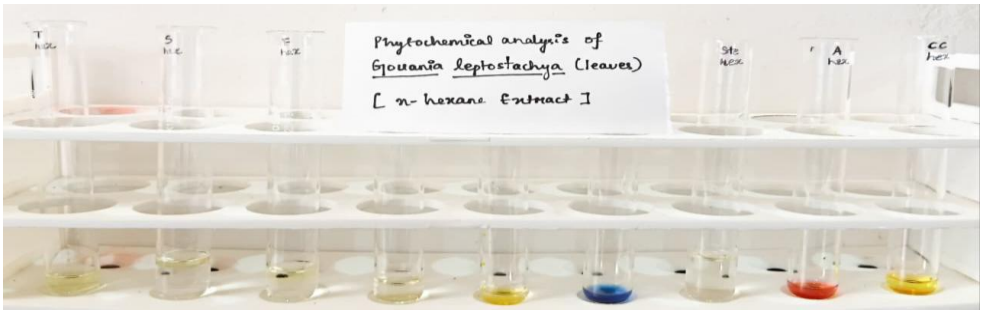


Figure 3: Detection of secondary metabolites in n-hexane extract

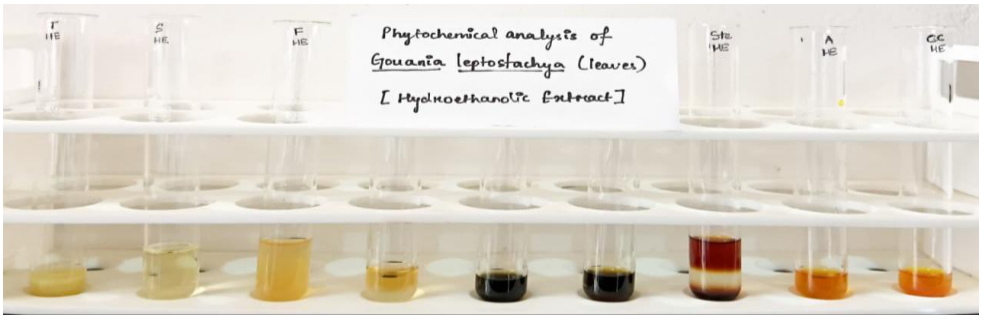


Figure 4: Detection of secondary metabolites in hydroethanolic extract

Table 3: Estimation of Minimum Inhibitory Concentration (MIC)

Sample	Extract	Concentration (mg/mL)	Result	Replicates (n)	QC note
G. leptostachya (Leaves)	Hydroethanolic	100	NG	3	consistent
		50	NG	3	consistent
		25	NG	3	consistent
		12.5 (MIC)	NG	3	consistent
Nutrient broth	-	-	NG	3	sterility
Microbial broth	-	-	G	3	culture viable
Antibiotic	-	-	NG	3	positive control

(G = Growth, NG = No growth QC = Quality control)

CONCLUSION

Gouania leptostachya is a plant with valuable bioactive potential, particularly evident in its hydroethanolic leaf extract, as observed in the experimental study above. The presented results align with its long-standing traditional uses. While the current findings are preliminary, they open the scope for further research on isolating specific compounds and understanding their mechanisms of action. As a forest liana with deep ethnobotanical roots, *G. leptostachya* continues to prove how traditional knowledge and modern science can complement each other in exploring nature's pharmacy.

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