EJPMR, 2026, 13(9), 90-95 **Review Article** **Impact Factor: 8.158**

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

ISSN (O): 2394-3211
ISSN (P): 3051-2573
Coden USA: EJPMAG

AN INTEGRATIVE REVIEW OF ETHNOBOTANY, PHYTOCHEMISTRY, PHARMACOLOGICAL POTENTIAL, SAFETY, AND THERAPEUTIC PERSPECTIVES OF *IPOMOEA STAPHYLINA* ROEM. & SCHULT

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How to cite this Article: Sivakumar Thangam Sharmila[1], Lakshmi S Vijapur[1], Krishnagowdu Saravanan[1], Sundarasamy Dhanapal[1]*. (2026). An Integrative Review of Ethnobotany, Phytochemistry, Pharmacological Potential, Safety, and Therapeutic Perspectives Of Ipomoea Staphylina Roem. & Schult. European Journal of Pharmaceutical and Medical Research, 13(9), 90–95.

Article Received on 30/07/2026 **Article Revised on 21/08/2026** **Article Published on 01/09/2026**

ABSTRACT

Ipomoea staphylina Roem. & Schult. (Convolvulaceae) is a medicinal climber with documented traditional applications and an emerging experimental evidence base. This review synthesizes published information on taxonomy, ethnobotanical relevance, phytochemistry, pharmacological activity, safety, conservation and future research priorities. Species-specific investigations have reported antioxidant, anti-inflammatory, antibacterial, anti-ulcer, antidiabetic, hepatoprotective, nephroprotective, analgesic, antimutagenic and cytotoxic potential, although the evidence is predominantly preclinical. Phytochemical studies have reported phenolics, flavonoids, alkaloids, terpenoids, sterols, saponins and other metabolites, with compounds including sitosteryl-3-O-β-D-glucoside, d-chiro-inositol, quercetin-associated polyphenols and β-sitosterol reported in different investigations. Recent work has extended investigation to *Helicobacter pylori* and flower-derived β-sitosterol. The review emphasizes the distinction between traditional claims, in vitro findings, animal evidence and clinical evidence. Major gaps include standardized botanical material, validated quantitative phytochemistry, bioassay-guided isolation, pharmacokinetics, comprehensive toxicology and human trials. An integrated ethnobotany, pharmacognosy, phytochemistry and pharmacology framework is proposed for future research.

KEYWORDS: *Ipomoea staphylina*; ethnobotany; Convolvulaceae; phytochemistry; antioxidant; antibacterial; hepatoprotective; pharmacology; traditional medicine; β-sitosterol.

1. INTRODUCTION

Natural products remain an important source of chemical diversity for drug discovery. Historical and contemporary analyses emphasize that plant-derived metabolites can provide lead structures, pharmacophores and complex mixtures with biological activity (Atanasov et al., 2021; Dias et al., 2012; Harvey, 2008). Ethnobotany adds a valuable selection strategy by documenting how communities identify and use plants in particular cultural and ecological contexts. However, traditional use is best regarded as a hypothesis-generating source of evidence rather than proof of efficacy or safety (Calixto, 2000; Capasso et al., 2000). Ipomoea is a large and diverse genus of Convolvulaceae. *I. staphylina* has received increasing attention because of traditional applications and a growing number of experimental studies. Taxonomic identity is particularly important in ethnopharmacology; Staples (1996) specifically addressed the identity of *I. staphylina* in Asia, underscoring the importance of reliable nomenclature and specimen authentication. This review aims to critically synthesize published evidence on *I. staphylina*. The objectives are to: (i) summarize taxonomy and distribution; (ii) examine ethnobotanical evidence; (iii) collate phytochemical findings; (iv) critically evaluate pharmacological studies; (v) assess toxicological and

translational gaps; and (vi) propose priorities for conservation and future research.

2. Taxonomy, Botany, Distribution and Habitat

Kingdom: Plantae; Order: Solanales; Family: Convolvulaceae; Genus: *Ipomoea* L.; Species: *Ipomoea staphylina* Roem. & Schult. The taxonomic identity of *I. staphylina* in Asia has been specifically discussed by Staples (1996). Ethnopharmacological research should document a voucher specimen, collection locality, date, collector and herbarium accession. This is particularly important when vernacular names overlap among related climbers. Species authentication is a prerequisite for reproducible extraction, phytochemical profiling and pharmacological testing. Published work places *I. staphylina* within Asian tropical/subtropical medicinal-plant contexts, with Indian records including Tamil Nadu. Ethnobotanical studies from Tamil Nadu, including work around Gingee Hills and the Irula communities of the southern Western Ghats, illustrate the importance of documenting local plant-use knowledge in the species' broader cultural landscape (Muralidharan & Narasimhan, 2013; Sarvalingam et al., 2014).

3. Ethnobotanical Approaches and Traditional Uses

The published literature describes *I. staphylina* as a traditionally used medicinal climber, with reports involving stomach disorders, pain, inflammation, rheumatism and other ailments (Jeyadevi et al., 2019; Narayanan & Suseem, 2024). Ethnobotanical investigations in Tamil Nadu provide useful regional context, but species-specific claims should always be traced to the original field record rather than generalized across the genus. The literature associates the plant with gastrointestinal and stomach-related conditions, inflammatory complaints, pain and rheumatic conditions. These reports are supported by subsequent experimental investigations into anti-ulcer, anti-inflammatory, analgesic and antioxidant properties (Banerjee & Firdous, 2015; Firdous & Koneri, 2012; Ghosh & Firdous, 2014; Jeyadevi et al., 2019) (Table 1).

Table 1: Ethnobotanical Applications of *Ipomoea staphylina* Roem. & Schult.: Experimental Validation and Levels of Pharmacological Evidence.

Traditional/ ethnobotanical domain	Plant material	Scientific follow-up	Evidence level	References
Stomach / ulcer-related use	Whole plant / hydroalcoholic preparations	Anti-ulcer rat study; *H. pylori* investigation	Traditional + preclinical	Banerjee et al. (2015); Narayanan et al. (2024)
Inflammation	Leaves / ethanol extract	Carrageenan, granuloma and cell-based assays	Preclinical	Firdous et al. (2012)
Pain	Hydroalcoholic extract	Analgesic experimental study	Preclinical	Ghosh et al. (2014)
Liver-related use	Leaves / aqueous or hydroalcoholic extract	CCl4-induced liver injury models	Preclinical	Bag et al. (2013); Jeyadevi et al. (2019)
Metabolic disorders	Leaves	STZ/STZ-nicotinamide models and enzyme assays	Preclinical	Firdous et al. (2016)

4. Phytochemistry

Species-specific screening has reported several phytochemical classes, including alkaloids, saponins, flavonoids, steroids, glycosides, phenols and sterols in ethanol extracts (Padmashree et al., 2018). Reddy et al. (2013) investigated multiple plant parts and isolated sitosteryl-3-O-β-D-glucoside and d-chiro-inositol from leaf material. Jeyadevi et al. (2019) quantified total phenolics and flavonoids in an aqueous leaf extract and used HPLC to identify polyphenolic constituents including protocatechuic acid, chlorogenic acid, caffeic acid, vanillin, p-coumaric acid, naringenin, quercetin and rutin. The same study connected the extract's antioxidant profile with hepatoprotective effects in a CCl4-induced rat model. GC–MS-based work has expanded the chemical profile of the species, while chromatographic isolation has identified sterol and inositol-related constituents (Padmashree et al., 2018; Reddy et al., 2013). More recent flower research isolated β-sitosterol and characterized it by HPTLC, NMR, GC–MS and FTIR (Narayanan et al., 2025) (Table 2).

Table 2: Phytochemical Investigations of *Ipomoea staphylina* Roem. & Schult.: Plant Materials, Analytical Approaches, and Principal Findings.

Material / analytical approach	Principal findings	References
Leaves and other plant parts; chromatography/spectroscopy	Sitosteryl-3-O-β-D-glucoside and d-chiro-inositol isolated	Reddy et al. (2013)
Plant extracts; preliminary screening + GC–MS	Multiple secondary-metabolite classes and GC–MS profile	Padmashree et al. (2018)
Aqueous leaves; HPLC	Polyphenols including quercetin, rutin and phenolic acids	Jeyadevi et al. (2019)
Flowers; HPTLC/column chromatography/NMR/GC–MS/FTIR	β-sitosterol isolated and characterized	Narayanan et al. (2025)

5. Pharmacological Activities

5.1 Antioxidant activity

Antioxidant activity has been demonstrated in multiple experimental settings. Reddy et al. (2013), reported DPPH and superoxide radical-scavenging activity in several extracts. Jeyadevi et al. (2019), reported ABTS and DPPH activity for aqueous leaf extract, with IC50 values of 32.08 ± 0.12 and 45.24 ± 0.65 µg/mL, respectively. These findings provide chemical-assay evidence, but assay activity should not be interpreted as clinical antioxidant efficacy.

5.2 Anti-inflammatory activity

Firdous and Koneri (2012) reported anti-inflammatory activity of ethanolic leaf extract and fractions in carrageenan-induced paw edema and cotton-pellet granuloma models, with additional investigation in LPS-activated RAW 264.7 cells. Kokila and Jeevan (2021), also reported dose-dependent anti-inflammatory activity in vitro. The convergence of findings supports further mechanistic investigation.

5.3 Antibacterial activity

Padmashree et al. (2018) examined antibacterial activity alongside phytochemical and GC–MS analyses. Kokila and Jeevan (2021) reported antibacterial activity of an ethanol extract against selected bacterial isolates. More recently, Narayanan et al. (2024) specifically investigated *I. staphylina* extracts against *H. pylori* and isolated quercetin-associated phytochemical material, linking a traditional stomach-related use with a defined pathogen-focused research question.

5.4 Anti-ulcer activity

Banerjee and Firdous (2015) evaluated a hydroalcoholic extract in rats and reported anti-ulcer activity. This study is important because it represents an attempt to move from ethnomedicinal claims toward an animal model. However, clinical efficacy, optimal dose and comparative effectiveness against standard therapy remain unresolved.

5.5 Antidiabetic activity

Firdous and Koneri (2014) examined ethanolic leaf extract and fractions in glucose-loaded and streptozotocin-induced diabetic mice. Firdous and Singh (2016) subsequently evaluated the leaves in a streptozotocin–nicotinamide type-II diabetes model. These studies provide preclinical evidence but do not establish human antidiabetic efficacy.

5.6 Hepatoprotective and nephroprotective activity

Bag and Mumtaz (2013) investigated hydroalcoholic leaf extract for hepatoprotective and nephroprotective activity. Jeyadevi et al. (2019) later examined an aqueous leaf extract in CCl4-induced liver injury in Wistar rats. In the latter study, extract treatment at 250 and 500 mg/kg for 8 weeks was associated with restoration of biochemical parameters and antioxidant defenses, alongside histopathological evidence of protection.

5.7 Analgesic and anthelmintic activity

Ghosh and Firdous (2014) reported analgesic activity of hydroalcoholic extract. Ghosh and Firdous (2014) also reported investigation of aqueous extract against Indian earthworm. These findings are preliminary and require standardized models, controls and independent replication.

5.8 Antimutagenic and cytotoxic studies

Banerjee and Firdous (2020) reported in vitro antimutagenic activity using bacterial tester strains. This is distinct from demonstrating anticancer efficacy. A 2025 flower study investigated cytotoxicity against HCT-116 colon cancer cells and reported β-sitosterol isolation; the authors reported IC50 values in the low-50 µM range for tested flower extracts (Narayanan et al., 2025). Such cell-line findings are exploratory and cannot be translated directly into cancer treatment claims. Fig.1 and Table 3, summarizes the pharmacological activities *I. staphylina* plant.

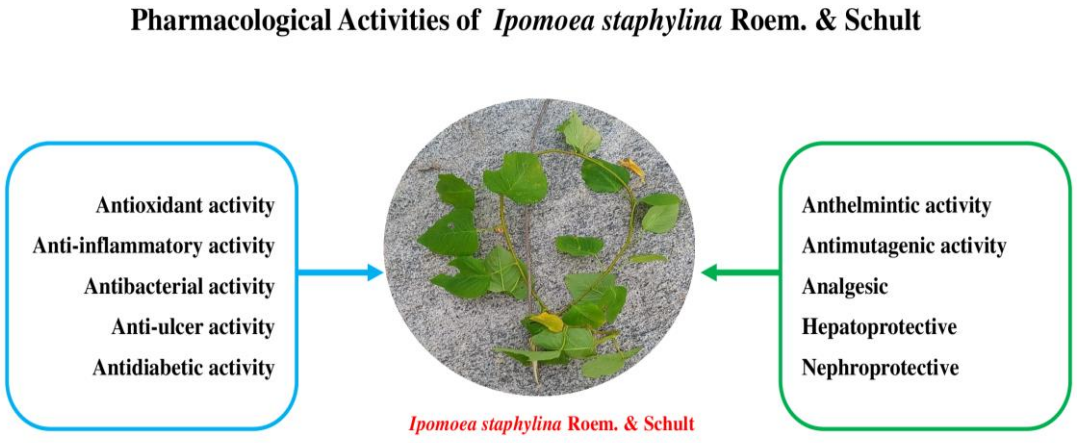

Fig. 1: Pharmacological Activities of *Ipomoea staphylina* Roem. and Schult.

Table 3: Pharmacological Activities of *Ipomoea staphylina* Roem. and Schult.: Experimental Models, Key Findings, and Levels of Evidence.

Activity	Plant material	Model/assay	Key finding	Evidence category	References
Antioxidant	Stem/leaves/whole plant; aqueous leaves	DPPH, superoxide, ABTS	Radical-scavenging activity reported	In vitro	Reddy et al. (2013); Jeyadevi et al. (2019)
Anti-inflammatory	Leaves/ethanol fractions	Carrageenan, granuloma, RAW 264.7	Reduced inflammatory responses reported	In vitro + animal	Firdous et al. (2012)
Antibacterial	Ethanol/flower extracts	Agar diffusion; bacterial strains; H. pylori	Inhibition reported	In vitro	Kokila et al. (2021); Narayanan et al. (2025)
Anti-ulcer	Hydroalcoholic whole plant	Rat ulcer model	Protective activity reported	Animal	Banerjee et al. (2015)
Antidiabetic	Leaves/ethanolic extract	STZ and STZ-nicotinamide models	Metabolic improvements reported	Animal	Firdous et al. (2016)
Hepatoprotective	Leaves/aqueous or hydroalcoholic	CCl4-induced injury	Biochemical and histological protection	Animal	Jeyadevi et al. (2019)
Analgesic	Hydroalcoholic extract	Animal analgesic model	Activity reported	Animal	Ghosh et al. (2014)
Antimutagenic	Leaf extract	Ames-type bacterial tester strains	Mutagen-induced colony response reduced in selected conditions	In vitro	Banerjee et al. (2020)
Cytotoxic	Flowers	HCT-116 MTT assay	Reduced cell viability reported	Cell culture	Narayanan et al. (2025)

6. Toxicological Evaluation and Safety

Safety evidence for *I. staphylina* is substantially less developed than its pharmacological literature. The existence of biological activity does not establish safety, and the absence of a reported adverse effect in a short experiment cannot be interpreted as proof of long-term safety (Calixto, 2000; Capasso et al., 2000). Future work should include acute and repeated-dose toxicity, hematology, serum biochemistry, organ weights, histopathology, reproductive and developmental toxicity, genotoxicity, and herb–drug interaction studies. The antimutagenic report by Banerjee and Firdous (2020) is encouraging but should not be treated as a complete genotoxicity assessment. Standardized extracts should be chemically fingerprinted before toxicology. Dose selection should be related to quantified marker compounds and exposure data. Human studies should not be initiated without adequate preclinical safety characterization.

7. Conservation, Sustainable Utilization and Cultivation

Conservation of medicinal plants involves maintaining both biological resources and associated cultural knowledge. For *I. staphylina*, a species-specific population assessment is needed before assigning a formal conservation-risk category. Ethnobotanical work in Tamil Nadu demonstrates the broader importance of documenting local plant-use systems (Kottaimuthu, 2008; Muralidharan & Narasimhan, 2013; Sarvalingam et al., 2014). Collection practices should avoid destructive harvesting where possible, particularly removal of entire plants or roots. Community-based cultivation, propagation studies, authenticated planting material and post-harvest quality control could reduce pressure on wild populations. Future cultivation research should address propagation, soil, water, nutrient management, harvesting season, drying, storage and phytochemical consistency. A standardized monograph should ideally define botanical identity, moisture, foreign matter, extractive values, chromatographic markers and contaminant limits.

8. Research Gaps and Future Perspectives

The evidence base is limited by small numbers of species-specific studies, heterogeneous extraction procedures, incomplete chemical standardization, limited pharmacokinetics, incomplete toxicology and absence of controlled human trials. A recent review similarly emphasizes the need for further isolation and characterization of active constituents (Narayanan & Suseem, 2024). The most useful next steps are: (1) authenticated multi-site ethnobotanical surveys; (2) quantitative ethnobotanical indices; (3) standardized extracts; (4) LC–MS/MS, NMR and metabolomic profiling; (5) bioassay-guided fractionation; (6) mechanism-of-action studies; (7) pharmacokinetics and bioavailability; (8) GLP-oriented toxicology; and (9) appropriately designed clinical studies where preclinical evidence justifies translation.

9. CONCLUSION

Ipomoea staphylina Roem. & Schult. is a medicinal climber with a developing evidence base spanning ethnobotany, phytochemistry and experimental pharmacology. Published species-specific studies provide support for antioxidant, anti-inflammatory, antibacterial, anti-ulcer, antidiabetic, hepatoprotective, nephroprotective, analgesic, antimutagenic and cytotoxic research directions. The phytochemical literature indicates a chemically diverse plant matrix, including polyphenols, sterol-related constituents and other secondary metabolites. However, chemical identification alone does not establish therapeutic causality. The most important scientific requirement is to connect authenticated botanical material, quantitative chemical markers, standardized extracts or purified compounds, validated biological models, pharmacokinetics and safety data. The review therefore supports continued investigation but recommends a cautious translational interpretation. At present, *I. staphylina* should be considered a promising research candidate rather than a clinically established treatment. Future research integrating ethnobotany, pharmacognosy, phytochemistry, pharmacology, toxicology, molecular biology and conservation science may determine whether the species can contribute to evidence-based botanical medicines or novel bioactive compounds.

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