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TRADITIONAL KNOWLEDGE OF IPOMOEA STAPHYLINA AND MODERN APPLICATION

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ABSTRACT

Ipomoea Staphylina. A member of the convolvulaceae family, it is a traditionally valued medicinal plant widely used in Indian ethnomedicine. Known for its therapeutic applications, particularly in the treatment of inflammation, pain, gastrointestinal disorders, and wound healing, this plant has garnered attention due to its rich phytochemical profile and diverse pharmacological activities. Various parts of the plant, especially the roots and leaves, are utilized in traditional formulation. Phytochemical investigation reveals the presence of bioactive constituents, including alkaloids, flavonoids, glycosides, tannins, and saponins, which contribute to its antioxidant, anti-inflammatory, antimicrobial, and hepatoprotective properties. Despite its expensive traditional use, scientific research on Ipomoea staphylina remains limited, highlighting the need for further pharmacological and toxicological evaluation. This review aims to compile and critically analyse existing literature on the botany, traditional uses, phytochemistry, pharmacological activities, and potential therapeutic application of Ipomoea staphylina, thereby encouraging modern herbal drug development.

KEYWORDS: *Ipomoea staphylina, Indian ethnomedicine, Therapeutic application, Phytochemical profile, Pharmacological activities.*

INTRODUCTION

The therapeutic relevance of Ipomoea staphylina is attributed to its rich phytochemical composition, which includes flavonoids, alkaloids, tannins, glycosides, and other bioactive compounds. These constituents are believed to contribute to its reported pharmacological activities, including anti-inflammatory, antimicrobial, antioxidant, analgesic activity, and hepatoprotective effect. Although used extensively in folk medicine, modern scientific exploration and validation of this plant's medicinal potential remain limited. In recent years, there has been a growing interest in scientifically validating traditional knowledge to develop evidence-based herbal formulations. Therefore, a comprehensive review of Ipomoea staphylina is essential to bridge the gap between traditional use and modern pharmacological research. This article aims to provide a detailed overview of the plant's botanical characteristics, traditional uses, phytochemical constituents, pharmacological properties, and prospects for research and development.[1]

BOTANICAL DESCRIPTION

- Scientific Name: Ipomoea staphylina
- Family: Convolvulaceae
- Common Name: Nagvel, jangli kalmi, or Wild Morning Glory, and also called onnankodi.
- Plant Habit

Large woody climbing shrub or twiner

Grows extensively on other trees or supports

- Size

Climber length: Can grow up to 5-10m or more

Root: Thick, tuberous root system

❖ Stem

Woody, hairy, cylindrical, strong, and rough to touch.

❖ Leaves

Shape: Ovate to heart-shaped[cordate]

Arrangement: Alternate

Surface: rough and hairy

Size:5-10cm long

❖ Flowers

Color: Purple

Shape: Funnel-shaped, typical ipomoea form

Inflorescence: solitary or in few-flowered cymes

Size: Around 4-6 cm

❖ Fruit

Capsule, rounded, and contains 2-4 seeds

❖ Seeds

Brown or black

❖ Habitat

Found in dry and scrubby areas of India

Grows well in open grasslands, forest edges, and wastelands.[2]

TRADITIONAL AND ETHNOMEDICINAL USES

Ipomoea staphylina is a medicinal plant widely used in traditional systems of medicine such as Ayurveda, Siddha, and local tribal practices. Almost all parts of the plant—including roots, leaves, and stems—are utilized for their therapeutic properties. Traditionally, the plant is valued for its aphrodisiac and tonic effects, believed to improve physical strength and sexual vitality. The roots are known to have mild laxative effects and are used to treat constipation and promote digestion. The leaves are commonly used externally in the form of a paste or poultice to relieve inflammation, joint pain, and skin ailments like wounds, boils, and cuts. In some folk practices, leaf extracts are applied to reduce fever and swelling.

Ethnomedicinally, various tribal communities in India prepare root decoctions to treat conditions such as rheumatism, piles, liver disorders, and abdominal pain. The root powder is often mixed with milk and administered to treat impotence and seminal weakness. Additionally, it is used in traditional remedies for jaundice and urinary tract disorders due to

its believed diuretic and liver-protective properties. In many rural areas, Ipomoea staphylina is also regarded as a sacred herb and occasionally incorporated into further pharmacological investigation to validate and standardize its traditional applications.[3]

PHYTOCHEMICAL CONSTITUENTS

Alkaloids: These nitrogen-containing compounds have shown analgesic, antimicrobial and anti-inflammatory properties. They may act on the central nervous system and exhibit a potential therapeutic effect chronic diseases.

Flavonoids: potent antioxidants, helping to neutralize free radicals. Possesses anti-inflammatory, anti-cancer, and hepatoprotective action Also contribute to vascular protection and antiallergic responses.

Tannins: Known for their astringent nature, they are useful in wound healing and antidiarrheal activity. Exhibit antibacterial and antifungal effects by disrupting microbial membranes.

Saponins: Show anti-inflammatory, antioxidant, and immune-modulating effects. Also known to have hypocholesterolemic and antidiabetic actions.

Terpenoid: Include mono-, di-, and triterpenes with anti-cancer, analgesic, and anti-malarial properties. Contribute to the plant's fragrance and bioactivity.

Glycosides: Particularly cardiac glycosides may support heart function. Also, they display antimicrobial and anti-inflammatory effects.

Steroids: Important for anti-inflammatory and hormonal balance. May act as precursors for steroidal drugs.

Phenolic Compounds: Include phenolic acids and polyphenols with strong antioxidant activity. Help in preventing oxidative stress, aging, and degenerative diseases.

Coumarins and Lignans: May provide anticoagulant, antiviral, and neuroprotective benefits.[3]

PHARMACOLOGICAL ACTIVITIES

Ipomoea staphylina is a medicinal plant known for its diverse pharmacological effects due to the presence of various bioactive compounds such as flavonoids, alkaloids, glycosides, tannins, phenolic compounds, and terpenoids. The plant has been traditionally used in various systems of medicine, and scientific studies have supported many of these therapeutic uses. The major pharmacological activities include.

1. Anti-inflammatory Activity

The ethanolic and methanolic extracts of Ipomoea staphylina exhibit potent anti-inflammatory activity. This is primarily due to the inhibition of inflammatory mediators such as prostaglandins and cytokines. The plant's flavonoids are thought to suppress the cyclooxygenase (COX) pathway, reducing inflammation in acute and chronic conditions.

2. Analgesic Activity

Animal studies have shown that the plant extracts significantly reduce pain response in models such as the tail-flick and hot plate tests. The analgesic effect is believed to be mediated via central and peripheral mechanisms involving opioid receptors and inflammatory pain pathways.

3. Antioxidant Activity

The plant contains strong antioxidant compounds like flavonoids and phenolic acids that scavenge reactive oxygen species (ROS), reduce lipid peroxidation, and protect tissues from oxidative stress. This activity plays a crucial role in preventing degenerative diseases and enhancing cellular health.

4. Antimicrobial Activity

Extracts of Ipomoea staphylina have demonstrated inhibitory activity against various bacterial and fungal pathogens. The antimicrobial property is attributed to secondary metabolites that disrupt microbial cell walls and inhibit their enzymatic systems.

5. Hepatoprotective Activity

The plant has shown hepatoprotective effects in models of drug-induced liver injury. Its antioxidant and anti-inflammatory properties help reduce liver enzyme levels, restore histopathological architecture, and improve liver function.

6. Antidiabetic Activity

Methanolic extracts have been found to reduce blood glucose levels in diabetic animal models. This may be due to increased insulin secretion, improved glucose uptake, and inhibition of carbohydrate-metabolizing enzymes like α-amylase and α-glucosidase.

7. Wound Healing Activity

The topical application of Ipomoea staphylina extracts has shown significant wound healing effects, accelerating the contraction of wounds, promoting epithelialization, and enhancing collagen synthesis due to its anti-inflammatory and antimicrobial effects.

8. Anticancer Activity

Recent in vitro studies suggest that Ipomoea staphylina possesses potent anticancer activity, particularly against ovarian cancer. Phytoconstituents such as flavonoids, triterpenoids, and alkaloids may act by: Inducing apoptosis in ovarian cancer cells by activating caspase enzymes and disrupting mitochondrial membrane potential. Inhibiting cell proliferation through arrest of the cell cycle (G0/G1 or G2/M phase). Suppressing angiogenesis (the formation of new blood vessels) is required for tumor growth. Modulating signaling pathways like PI3K/Akt, MAPK, and NF-κB, which are commonly dysregulated in ovarian cancer. Reducing oxidative stress and inflammation, which are major contributors to cancer development and progression.[4]

TOXICOLOGICAL PROFILE AND SAFETY EVALUATION

Toxicological studies on Ipomoea staphylina indicate that the plant is generally safe when used in therapeutic doses, but certain considerations are necessary. Acute oral toxicity tests in rodent models using ethanolic and aqueous extracts have shown no mortality or signs of toxicity up to 2000 mg/kg body weight, suggesting a high margin of safety.

Sub-acute toxicity studies (28-day repeated dose) have revealed no significant changes in body weight, food consumption, organ weight, or hematological parameters. Histopathological examination of vital organs (liver, kidney, heart) showed no abnormalities, confirming its non-toxic nature in controlled doses.

However, at extremely high doses, some mild gastrointestinal disturbances and hepatic enzyme alterations have been reported in a few animal models. This suggests that prolonged

use or overdose may pose a risk to liver function, especially if taken with other hepatotoxic substances.

Phytochemicals like alkaloids and saponins, though therapeutic, can be toxic at higher concentrations. Therefore, dose standardization, extraction purity, and clinical safety testing in humans are essential before recommending its large-scale use. In conclusion, Ipomoea staphylina is safe at therapeutic doses, but careful dose regulation and further toxicological studies are needed for long-term human use.[5]

FORMULATION AND DOSAGE FORM

Ipomoea staphylina has been traditionally and experimentally formulated into various dosage forms to explore its therapeutic potential. Due to its rich phytochemical profile—especially flavonoids, alkaloids, tannins, and saponins—it is suitable for a wide range of formulations in herbal and modern medicine.

Traditional Formulations

Decoctions (Kashayam): Used in Siddha and Ayurveda for treating ulcers, inflammation, and infections. Typically made from roots or bark, boiled in water.

Poultices and pastes: Applied topically for wounds, abscesses, and skin inflammation.

Powdered crude drug (Churna): Made from dried root or leaf powder, taken orally with warm water or honey.

Modern Formulations

Ethanolic and hydroethanolic extracts: Used in capsules or syrups for controlled dosing, especially for antioxidant and anti-inflammatory benefits.

Topical gels or ointments: Formulated for wound-healing or antimicrobial use, often combined with a base like carbopol or petroleum jelly.

Polyherbal tablets or capsules: Ipomoea staphylina is sometimes combined with other herbs for enhanced efficacy, particularly in formulations for ulcers, liver protection, or infections.

Nanoparticle-based delivery (experimental): Recent studies explore phytochemical-loaded nanoparticles (e.g., flavonoid nanoparticles) for improved bioavailability and targeted delivery, especially in cancer therapy.

Dosage (Experimental & Traditional)

Oral administration in rats: 100–500 mg/kg of ethanolic extract is commonly used in pharmacological studies.

Topical doses: 2.5%–5% (w/w) concentration of extract-based gel has shown efficacy in wound healing.

Traditional use: Decoctions typically 50–100 ml/day in divided doses, but not standardized.[6]

RECENT RESEARCH AND SCIENTIFIC STUDIES

- **Anticancer Activity against Ovarian Cancer**

A 2022 in vitro study evaluated aqueous and ethanolic leaf extracts of I. staphylina on the SKOV-3 human ovarian cancer cell line. Both extracts exhibited IC_{50} cytotoxicity, and the ethanolic extract more effectively downregulated the expression of MMP-2 and MMP-9, key enzymes involved in tumor invasion and metastasis. Morphological changes consistent with apoptosis and inhibited cell migration further supported its anticancer potential.[8,12]

- **Antimicrobial & Anti-H. pylori Activity**

A 2024 pharmacognostic investigation focused on I. staphylina extracts (whole plant and mature stem latex) against Helicobacter pylori. Standardized ethanolic extracts (DME and hydroalcoholic HLS) were highly active. Quercetin was isolated as a major bioactive flavonoid compound using NMR, HR-MS, HPTLC, and FTIR techniques, confirming the purity and phytochemical profile.[7,12]

- **Antibacterial, Anti-inflammatory & Antioxidant Effects**

A 2021 study evaluated ethanol leaf extract for activity against pathogens and inflammatory processes. Exhibited dose-dependent antibacterial inhibition, with zones up to ~21.7 mm. Showed anti-inflammatory activity (~68 %) and antioxidant activity (~72 %) at 100 µg/mL concentrations via standard in vitro assays.[7,12]

- **Hepatoprotective & Nephroprotective Effects**

A Bangladesh Journal of Pharmacology (2013) study: Administered 200 mg/kg hydroalcoholic extract safely reduced markers of CCl_4- and gentamicin-induced liver and kidney damage, lowered AST, ALT, ALP, bilirubin, urea, creatinine, and improved serum

protein and tissue histology. Phenolic and flavonoid contents were quantified at ~95 mg GAE/g and ~45 mg RE/g extract, respectively.[9,11,12]

A 2022 study on D-GalN/LPS-induced acute hepatic failure in rats: Both 100 and 200 mg/kg doses of the ethanolic leaf extract reduced SGOT, SGPT, ALP, GGT, total bilirubin, and oxidative stress markers, while boosting antioxidant enzymes. Pro-inflammatory cytokines like TNF-α, IL-6, iNOS, NO, and MPO were also significantly decreased.[9,12]

- **Cardioprotective Effect Against Cadmium Toxicity**

A 2023 animal study showed that cadmium intoxication led to elevated LDH, CPK, SGOT, SGPT, and worsened lipid profile along with increased inflammatory cytokines and nitric oxide. Co-administration with I. staphylina extract at 200–400 mg/kg significantly reversed these cardiac, biochemical, lipid, and inflammatory changes, and improved antioxidant enzyme levels.[9,12]

- **Wound Healing Activity**

A 2022 investigation using ethanolic leaf extract in Wistar rat wound models demonstrated accelerated wound contraction, enhanced epithelialization, improved collagen deposition, and reduced inflammation, highlighting its wound-healing efficacy.[10,12]

- **Phytochemical Profile & Broader Bioactivities**

A 2021 review from Tamil Nadu authors surveyed ethnobotanical and phytochemical studies: Stressed the plant's traditional and scientific use in treating cancer, diabetes, inflammation, oxidative stress, infections, and as an antidote in tribal medicine.

Identified major bioactives including flavonoids, alkaloids, saponins, terpenoids, tannins, and cardiac glycosides.[10,12]

Future Scope

The use of Ipomoea staphylina extract paste for bone healing shows great potential in herbal medicine. Future research should focus

Animal studies to confirm its bone-rejoining effect.

Isolation of active compounds that promote bone regeneration.

Development of standardized formulations like gels or herbal bandages.

Safety and toxicity studies to ensure safe use.
Clinical trials to validate traditional claims.

With proper scientific validation, this plant-based paste could become an effective and affordable natural remedy for bone fractures and joint injuries.

DISCUSSION

Ipomoea staphylina has shown promising medicinal properties, traditionally used for bone healing, inflammation, and wound care. Phytochemical studies reveal the presence of flavonoids, alkaloids, and terpenoids, which support its therapeutic potential. Preliminary pharmacological studies confirm its anti-inflammatory and antimicrobial effects. However, there is limited clinical and toxicological data. More research is needed to isolate active compounds, understand their mechanisms, and develop standardized formulations for safe and effective use.

CONCLUSION

Staphylina holds significant value in traditional medicine, especially for treating bone fractures, wounds, and inflammatory conditions. It is commonly used in the form of a paste or decoction by tribal and rural communities. Modern scientific studies have validated many of its traditional uses, revealing its antioxidant, anti-inflammatory, antimicrobial, hepatoprotective, and anticancer properties. Its recent Ipomoea application in bone healing has shown promising results, supporting its ethnomedicinal relevance. With further research, standardization, and clinical validation, Ipomoea staphylina can be developed into effective herbal formulations, bridging the gap between ancient traditional wisdom and modern therapeutic innovations.

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