Research Article

Phytochemical and Pharmaceutical Importance of *Ipomoea staphylina* Roem. and Schult: A Medicinal Review

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ABSTRACT

Plant based remedies are best alternative to allopathic medicine. They have been contributed significantly to rural livelihoods. Apart from the traditional healers used herbal medicine, many people are involved in the collection and trading of medicinal plants. This has been resulted an increasing demand for herbal remedies worldwide leading to enhance new drugs. The bioactivity of natural compounds is associated with the effects of various phytochemicals such as alkaloids, tannins, cardiac glycosides, terpenoids, saponins, flavonoids etc. In this study the medicinal plant *Ipomoea staphylina* was reviewed. This plant was widely used for the treatment of various diseases like cancer, diabetes, inflammation, oxidative stress, pathogenic infection etc. reported by various authors. Moreover, this plant was used by many tribal people for the treatment of many diseases included antidote. Thus the plant might be useful for discovery of new natural drugs for many diseases after detailed study.

Key words: Ethnobotanical, Phytochemistry, Bioactive compounds, *Ipomoea staphylina*, Diabetes and Cancer.

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INTRODUCTION

Plants have been a valuable source of natural products for maintaining human health, especially, in the last decade with more intensive studies for natural therapies.[1] Medicinal herbs are widely used with a greater number of people seeking remedies and health approaches free from side effects caused by synthetic chemicals. Recently, considerable attention has been paid to utilize eco-friendly and bio-friendly plant-based products for the prevention and cure of different human diseases. It has been recorded that 80% of the world's population has fidelity in traditional medicine, particularly plant-based drugs for their primary health care.[2] India is also one of the mega biodiversity countries in the world.

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The total number of plant species of groups recorded from India is 45000. Of these seed-bearing account for nearly 15,000-18,000. In India, more than 1000 species were used in several countries in the traditional system of medicine viz. Ayurveda, Siddha, and Unani which has survived through 3000 years mainly using plant-based drugs. The ancient texts like Rigveda (4500 – 1600 B.C) and Athrvana Veda mention the use of several plants as medicine. The books on Ayurvedic medicine such as Charaka Samhita and Sushruta Samhita referred to the use of more than 700 herbs.[3]

Classification and Taxonomy

Kingdom:	Plantae
Division:	Tracheophyta
Class:	Magnoliopsida
Order:	Solanales
Superorder:	Asteranae
Family:	Convolvulaceae
Genus:	*Ipomoea*
Species:	*staphylina* Roem. and Schult

Vernacular Name

Tamil: Onaankodi, Onan Kodi.
English: Clustered Morning Glory
Kannada: Ugina kodi, Unang kodi, Sunang kodi,

Distribution and description

Ipomoea staphylina Roem. and Schult is a climber plant grows near water resources and distributed throughout India, China, and Sri Lanka Deciduous forests. Leaves were stout stragglers. 15 x 10 cm dimension, broadly ovate, base cordate, apex acute, membranous, nerves oblique; petiole 6.5 cm. Flower is Panicle of cymes axillary, to 15 cm; pedicels 0.5-1 cm; bracts minute; outer sepals 5 x 4 mm, oblong, obtuse, inner obovate with hyaline margins, 6 x 5 mm; corolla 2 cm long, shallowly 5-lobed, funnel-shaped, pink; stamens 5, included, base dilated, hairy, filaments 7-8 mm; anthers 3 mm; ovary 2 mm; style 1.5 cm, stigma 2, globose. In axillary or subterminal panicles; white with a purple throat. Flowering from December-March. Fruit is subglobose capsule; seeds oblong, subtrigonous, hairy at top. Fruiting is from January-April (Figure 1).

Phytochemical constitutions

Niranjan and Prabhurajeshwar[4] reported that leaf and bark extracts of *Ipomoea staphylina* showed alkaloids, flavonoids, glycosides, tannins, saponins, phenols, carbohydrates and protein. Padmashree *et al.*[5] reported that the petroleum ether extract had soponins, steroids, glycosides and sterols. The chloroform extracts possessed saponins, steroids, sterols and ethanolic extract had alkaloids, saponins, flavonoids, steroids, glycosides, phenols and sterols.

Figure 1: Images of Medicinal plant *Ipomoea staphylina*.

GC-MS analysis of ethanol extract of *Ipomoea staphylina* confirmed that presence of 79 compounds, out of this 55 compounds were known for its medicinal properties, most of them were antimicrobial agents, food additive and flavoring agents, antioxidant, anticancer properties, Anti-hypercholesterolemic, anti-inflammatory agents, cytotoxic, cosmetics and perfumeries, hepatoprotective properties, antiviral properties, analgesic, insect pheromones, rest of them were allergenic, anesthetic, antimutagenic, antispasmodic, choleretic, dermatitigenic, fungicide, herbicide, laxative, pesticide, lipoxygenase-inhibitor, pesticide, tyrosinase inhibitor, vermifuge etc. Major compound is Dodecanoic acid, 3-hydroxy-, 9-Hexadecen-1-ol, 9-Octadecen-1-ol, Hydroperoxide, 1-ethylbutyl and 3,3,7,11-Tetramethyltricyclo [5.4.0.0(4,11)] undecan-1-ol were identified.[5] Reddy *et al.*[6] reported that Sitosteryl-3-O-β-D-glucoside and chiro deoxy inositol were isolated from leaves of *I. staphylina*.

Ethnobotanical Study

Many of the *Ipomea sp.* has reported effective antimicrobial properties. Ipomea genus is thus extensively used in Traditional and Chinese medicine.[7] These species are used in diverse parts of the world for the healing of several diseases, such as, dysentery, diabetes, hypertension, arthritis, constipation, fatigue, rheumatism, inflammations, hydrocephaly, meningitis, kidney ailments and some of these species exposed potent hypoglycaemic, antimicrobial, analgesic, spasmolitic, hypotensive, anticoagulant, anti-inflammatory, psychotomimetic, spasmogenic, and anticancer activities. Literature suggests the presence of Polyphenols and Flavones were reported. Polyphenols are natural source of antioxidants that human can consume as dietary supplements.[8] They are widely used biologically to compensate and boost up the antioxidant requirements. It is extensively used as traditional remedies to heal human illness. Similarly flavones are also secondary metabolite that is of vast pharmacological importance both *in vitro* and *in vivo*. Presence of Flavonoids has shown potent antibacterial properties against many bacteria and as well as it is known to be cardio protective.[9]

Pharmacological activity

Antidiabetic activity

Durga *et al.*[10] studied *in-vitro* antidiabetic activity of *Ipomoea staphylina*. In this study they reported that the extracts of *Ipomoea staphylina* showed good antidiabetic activity by inhibiting α-glucosidase, α-amylase and 5-lox enzyme. The 50 % inhibitory concentration of various

extracts of *ipomoea staphylina* was found to be very less potent compared to standard. So extracts of *Ipomoea staphylina* are devoid of *in-vitro* antidiabetic activity.

Firdous and Raju[11] reported that ethanol and ethyl acetate extracts of *I. staphylina* leaves and its fractions had beneficial effects on blood glucose level. The extracts and its fractions restored the altered total cholesterol, triglycerides level to normal. Liver enzymes sucha as SGOT, SGPT and ALP level was elevated in STZ induced rats and it was normalized by the treatment of ethanol and ethyl acetate leaf extracts of *I. staphylina*. Unfavourable alteration in the level of total protein and liver glycogen were restored to near normal after the treatement with *I. staphylina* leaf ethanol and ethyl acetate extracts. The leaves ethanol and ethyl acetate extracts of *I. staphylina* and its fraction have shown more significant effect on STZ induced diabetic in mice than the n-butanol fraction.

Firdous *et al.*[12] reported that the ethanol extract of *Ipomoea staphylina* leaves and its fractions had potential antidiabetic effect on alloxan induced diabetes rats. Plant extracts and its fractions improved blood glucose level and restored altered total cholesterol, triglycerides. Plant possessed also good hepatoprotective activity by reducing elevated level of liver enzymes such as SGOT, SGPT, ACP and ALP. It also reduced the elevated levels of serum creatinine, urea and BUN and prevented kidney. Thus the ethanol leaves extract of *Ipomoea staphylina* and its fraction have shown more significant effect on diabetic rats.

Anticancer activity

Padmashree *et al.*[5] revealed that *Ipomoea staphylina* Roem. and Schult. leaf ethanol extract showed moderate cytotoxicity against DLA and EAC in all tested concentrations which is moderate compared with standard curcumin. 14 known anticancer compounds were present in the ethanol extract of *Ipomoea staphylina* Roem. and Schult. However it shows moderate anticancer activity. *Ipomoea staphylina* Roem. and Schult. leaf ethanol extract, neither acts as effective anticancer agent in suppression of cancer cells nor toxic.

Antimicrobial activity

Prasanthi and Priyadarshini[13] also study antibacterial activity of *Ipomea staphylina* against *Staphylococcus aureus* and *E. coli.* Present results showed the plant extract at 1 ml concentration inhibited two bacterial strains effectively compared to standard antibiotic penicillin. The plant extract showed much potent results when compared to the antibiotics present. Thus development of potent natural antibiotic components from this plant might turn in building up potential pharmaceuticals.

Ethanol extract of *I. staphylina* leaf showed appreciable antibacterial activity in all tested concentrations (12.50, 25, 50, 100 mg ml-1). In 100 mg concentration maximum zone of inhibition showed by *Pseudomonas aeruginosa* (23.33±0.66) followed by *Staphylococcus aureus* (22±1.15), *Xanthomonas campestris* (21.33±0.88), *Salmonella typhi* (21±1.54), *Klebsiella pneumoniae* (20.33±1.2), *Pseudomonas syringae* (17±0.57) and least was *Escherichia coli* (16±0.57). The standard drug ciprofloxacin showed maximum zone of inhibition for all the pathogenic bacteria compared to palnt extracts Padmashree *et al.*[14] They reported that leaf ethanol extract of *Ipomoea staphylina* can act as good antibacterial agents. Because the leaf and bark of the plant tested on different organisms and some of the organisms have controlled in high concentration of plants extract. This bioactivity is due to the presence of secondary metabolites in the plant.[14]

Niranjan and Prabhurajeshwar[4] evaluated antibacterial and antifungal study of *Ipomoea staphylina* by disk diffusion method, against three bacterial strains viz., *B. subtilis*, *S. aureus* and *E. coli*. The inhibition zone of different extract of *I. staphylina* was observed at a various concentration (10, 20, 30, 40, 50 μg/ml) after 24 hr of incubation. Streptomycin was used as positive control. In this study they reported that leaf and stem extracts of *Ipomoea staphylina* showed potent antimicrobial activity against bacterial strains *E. coli*, *Staphylococcus aureus*, *Bacillus subtilis* and fungal strain *Aspergillus niger*. Thus the plant *I. staphylina* might be used as drugs in the form ointment for the antimicrobial activity.

Antioxidant activity

Methanolic extract of *Ipomoea staphylina* leaves was found to be potent for *in-vitro* antioxidant activity in DPPH and superoxide radical scavenging activity. Thus the methanol extract leaf of *Ipomoea staphylina* might be useful for the treatment of inflammation further detailed study.[10] Firdous and Raju[11] reported that the extracts of *Ipomoea staphylina* Roem. and Schult. enhanced the activities of endogenous antioxidant enzymes SOD, CAT and GPx in STZ induced diabetic albino rat model. The ethanol and ethyl acetate extracts of *Ipomoea staphylina* leaves fraction have shown more significant effect of endogenous antioxidant enzymes on STZ induced diabetic in mice than the n-butanol fraction.

Padmashree *et al.*[5] reported that leaf ethanolic extract of *Ipomoea staphylina* Roem. and Schult. showed appreciable antioxidant activity. It is proved that as the concentration of secondary metabolites increases, the bioactivity

will also increase. *Ipomoea staphylina* Roem. and Schult. leaf ethanolic extract showed dose dependant radical scavenging activity in all tested concentrations. In ABTS radical scavenging activity, *Ipomoea staphylina* leaf ethanolic extract showed dose dependant antioxidant activity in all tested concentrations. IC value of the ethanolic crude extract (84.37±2.68) is comparable with the value of standard Butylated Hydroxyl Anisole (66.92±0.36). In superoxide NBT radical scavenging activity *Ipomoea staphylina* Roem. and Schult. leaf ethanolic extract showed dose dependant antioxidant activity in all tested concentrations. IC_{50} value of the ethanolic crude extract (134.19±1.45) is comparable with the value of standard Gallic acid (102.17±0.49). In Hydroxy radical scavenging activity, *Ipomoea staphylina* leaf ethanolic extract showed IC_{50} (243.133±1.45) compared with standard EDTA (200.51±2.45).

Anti-inflammatory activity

Prasanthi and Priyadarshini[13] revealed that the plant extracts showed potent COX inhibition that clearly suggests the extracts contains potent anti-inflammatory components that could be of great therapeutic use. The three different line show the activity inhibition by three different samples namely water, ethanol and n-butanol extracts respectively out of which ethanol extract posed the most significant inhibition activity.

Other activities

The plant *Ipomoea staphylina* has been used in different systems of traditional medication for the treatment of diseases and ailments of human beings. It has been reported for its analgesic,[15,16] anti-inflammatory,[17,18] anti-diarrheal and gastroprotective properties.[19] *Ipomoea staphylina* is used as purgative, dyspepsia, anthelmintic, bronchitis treatment[20] and also used for respiratory disorders.[6] *Ipomoea staphylina* has been used for the treatment of ulcer.[21] Hepatoprotective and nephroprotective activity of *Ipomoea staphylina* was reported by Bag *et al.*[22] Kanikkars tribal people of Tirunelveli District, used *Ipomoea staphylina* leaf latex to cure foot crack,[23] Tamil Nadu Irulas and Palliyars tribes were eaten the plant leaves in raw and roots were used as a anti dote for snake-bite.[24-26] Valaiyans tribes of Karandamalai, Dindigul District were used *Ipomea plant* leaves for the treatment of stomach disorders.[27]

CONCLUSION

From this study it is concluded that the medicinal plant *Ipomoea staphylina* was widely used for the treatment of various diseases like cancer, diabetes, inflammation, oxidative stress, pathogenic infection etc. reported by various authors. Moreover, this plant was used by many tribel people for the treatment of many diseases included antidote. Thus the plant might be useful for discovery of new natural drugs for many diseases after detailed study.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest

ABBREVIATIONS

GC-MS: Gas Chromatography Mass Spectrum; **SGOT:** Serum glutamic oxaloacetic transaminase; **SGPT:** Serum glutamic pyruvic transaminase; **ALP:** Alkaline Phosphatase; **STZ:** Streptozotocin; **ACP:** Acid Phosphatase; **BUN:** blood urea nitrogen; **DLA:** Dalton Lymphoma ascites; **EAC:** Ehrlich ascites carcinoma; **SOD:** Superoxide dismutase; **CAT:** catalase GPx - glutathione peroxidase; **EDTA:** Ethylene diamine tetra acetic acid; **COX:** Cyclooxygenase.

SUMMARY

In the present study we reviewed phytochemistry and pharmaceutical activity of medicinal plant *Ipomoea staphylina*. Bioactivity of natural compounds is associated with the effects of various phytochemicals such as alkaloids, tannins, cardiac glycosides, terpenoids, saponins, flavonoids etc. Medicinal plant *Ipomoea staphylina* was showed phytochemical such as alkaloids, flavonoids, tannins, phytophenols etc. Pharmaceutical studies of this plant showed various pharmaceutical activity against cancer, diabetes, inflammation, oxidative stress, pathogenic infection etc. Moreover, this plant was used by many tribal people for the treatment of many diseases included antidote. Thus the plant might be useful for discovery of new natural drugs for many diseases after detailed study.

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