



Review Article

www.ijrap.net (ISSN:2229-3566)



A REVIEW OF PHYTOMORPHOLOGICAL, PHYTOCHEMICAL AND PHARMACOLOGICAL ACTIVITY ON *IPOMOEA CARNEA*

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Received on: 17/03/21 Accepted on: 10/07/21

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DOI: 10.7897/2277-4343.1204128

ABSTRACT

Ipomoea carnea Jacq. grows as wild plant in India. It is identified as a useful material for several applications including medicinal purposes. Different extracts of *Ipomoea carnea* plant possess anti-bacterial, anti-fungal, antioxidant, antimicrobial, anti-cancer, anti-convulsant, immune modulatory, anti-diabetic, hepatoprotective, anti-inflammatory, anxiolytic, sedative, cardiovascular, inhibition and wound healing activities. However, some toxicological effects have been also reported. In this review the potential of phytochemical, pharmacological and other activities of *Ipomoea carnea* are discussed.

Keywords: *Ipomoea carnea*, Chemical constituents, Phytochemical, Antimicrobial, Anti-cancer

INTRODUCTION

Ipomoea carnea is generally known as Bush Morning Glory. This plant is spread all over the world including American tropics, Argentina, Brazil and Bolivia, Pakistan, Sri Lanka, etc. It is well distributed in India and found particularly in Chhattisgarh and Madhya Pradesh. In India, it has become a naturalized species invading the wetlands, canals, drain banks, waste lands, field edges and roadsides. The plant can propagate both vegetatively by stems which show rooting within a few days and sexually by seeds and has rapid growth rate¹.

This evergreen, flowering shrub grows to a height of 5 m. The stem is thick and develops into a solid trunk over several years with many branches from base. The stem is erect, woody, hairy, and cylindrical in shape and greenish in color. It has alternate leaves. Normally it attains 1.25 - 2.75 m long and 0.5 - 0.8 cm diameter. The leaves are light green, heart shaped or somewhat lanceolate and 10-25 cm long. The upper surface of leaf is dull green, and the lower surface is paler. The leaves which receive lesser sunlight² may grow larger than the leaves which receive full sunlight. The plants bloom in clusters of 4 inches pink flowers all spring and summer long. Flowers of *Ipomoea carnea* are axial. The pedicel is green, erect, and cylindrical. Its length ranges between 1.5-2.2 cm and diameter ranges between 0.15-0.20 cm. The mouth of the corolla has an entire margin, with slight conspicuous depressions at the points of the cohesion of the petals, measure 5.2-6.0 cm long and 1.6-1.8 cm width at its mouth. The flowers are pale rose, pink or light violet in lax, terminal, pedunculate cymes; fruits have a glabrous capsule; seed is silky. As the name suggests, the blooms³ fade as the sun warms them, just like morning glories - but they are impressive while they last, blooming in large clusters at the ends of the tall branches which is very attractive to butterflies and hummingbirds. The species is used as folk medicine in traditional medicinal systems including Ayurveda, Siddha, and Unani. Leaves are used as purgative. Leaves paste is applied on Haja (a kind of sore between

toes and fingers due to fungal infection). In Brazil, *Ipomoea carnea* is known as *canudo-de-pita*, literally "pipe-cane", as its hollow stems were used to make tubes for tobacco pipes. It acts as toxic to cattle. It is reported to have stimulatory allelopathic effects. Roots are boiled to use as laxative and to provoke menstruation. Traditional healers⁴ for treatment of skin diseases have used it. The milky juice of plant has been used for the treatment of leucoderma and other related skin diseases. Only external applications have been recommended due to poisonous nature of the plant. It has depressant effect on central nervous system. Also shows muscle relaxant property. The aim of this review is to highlight the traditional uses, phyto-constituents, and pharmacological profile of *Ipomoea carnea*.

Taxonomic classification

Kingdom: Plantae

Sub Kingdom: Tracheobionta

Division: Spermatophyta

Subdivision: Magnoliophyta

Class: Magnoliopsida – Dicotyledons

Subclass: Asteridae

Order: Solanales

Family: Convolvulaceae

Genus: *Ipomoea*

Species: *Ipomoea carnea* Jacq.

Traditional uses

The species is used as folk medicine in traditional medicinal systems comprising Ayurveda, Siddha, and Unani. The most efficient use of the species is in skin diseases; particularly the milky juice (latex) of plant is advantageous in treatment of leucoderma. The latex is used as an antiseptic for treating lesions in traditional medicines because of its anti-inflammatory effects. The whole plant extract prepared in hot water is extensively used as an anti-rheumatic medicine, and the plant is also believed to

reduce the teratogenic effect of cyclo-phosphamide. In many folk medicines, it is used as aphrodisiac, purgative as well as cathartic. Antimicrobial and antifungal activities of extracts of the plant have been reported by various workers. Aqueous extract of the plant demonstrates neuromuscular blocking activity while plant has been proven to have antioxidant, anti-diabetic, wound healing, cardiovascular and hepato-protective activities.

Aqueous extract⁵ of leaves has shown embryo-toxic effects in rats resulting in skeletal and visceral abnormalities, malformations and reduced maternal reproductive performance. Furthermore, in African culture, the leaves of *Ipomoea carnea* are claimed to be effective in the treatment of pile, rheumatic pain, toothache, and other inflammatory conditions. The plant extract releases precursor which plays a significant role in the nociceptive mechanism, causing inhibitory effect on pain development process, thus, ameliorating the symptoms associated with various inflammation⁶.

Phytochemistry - Various phytochemical constituents in different parts of *Ipomoea carnea* are given below.^{7,8}

Root

The roots are reported to contain 2-Ethyl-1,3-dimethylbenzene, 2-(12-Pentadecynyloxy) tetrahydro- 2H-pyran, 3-Furanyl[2-hydroxy-4-methyl-2-(2-methylpropyl) cyclopentyl]-methanone, 2,2-Dideuterooctadecanal, Hexadecanoic acid, Linoleic acid.

Stem

The stem of the plant contains 2-(12-Pentadecynyloxy) tetrahydro- 2H-pyran, 1-Octadecanol, Hexadecanoic acid, Epiglobulol, Squalene, 1-Octadecanol.

Leaves

The leaves of the plant showed the presence of thirteen compounds which include Hexadecanoic acid, stearic acid, 1, 2 diethyl phthalate, n-octadecanol, octacosane, hexatriacontane, tetracontane, 3-diethylamino-1-propanol. Also, the presence of swainsonine and calystegines B1, B2, B3, and C1 were detected in the aqueous ethanolic extract of leaf.

Flowers

The flowers of the plant are reported to contain flavonoids, tannins, glycosides, alkaloids, carbohydrates, and phenolic compound. The presence of swainsonine and calystegines B1, B2, B3, and C1 confirmed in the aqueous ethanolic extract of flowers.

Seeds

Presence of swainsonine and calystegines B1, B2, B3, and C1 are found in seeds of the plant *Ipomoea carnea*.

Pharmacological potential

Antioxidant activity

It was studied that the methanolic extract of *Ipomoea carnea* was dissolved in distilled water and partitioned with *n*-hexane, chloroform, ethyl acetate and *n*-butanol consecutively. The antioxidant potential of all these fractions and remaining aqueous fraction was assessed by four methods: DPPH free radical scavenging activity, total antioxidant activity, FRAP assay and ferric thiocyanate assay and total phenolics were also determined. It was found that the percentage inhibition of DPPH radical was highest for *n*-Butanol fraction (91.11% ± 0.68), total antioxidant activity was highest for chloroform (0.9096 ± 0.1). FRAP value was highest for ethyl acetate fraction (511.99 ± 1.8 µg of trolox equivalents). Total phenolic contents were maximum for chloroform fraction (113.05 ± 1.2 mg of gallic acid equivalents).

Wound healing activity

When fresh flowers of *Ipomoea carnea* was extracted with 95% ethanol and the extract was concentrated in vacuum and the aqueous concentrate was treated with successive fraction of various solvents viz., diethyl ether, chloroform, and ethyl acetate. The fresh flowers of *Ipomoea carnea* contain Kaempferol and its 3-O-β-D glucoside. These were known to retain considerable wound healing activity. Wound healing normally involves an initial inflammatory phase followed by fibroblast proliferation, formation of collagen fibres and shrinking and drying of the scar.

Antidiabetic activity

The study revealed that when antidiabetic property of *Ipomoea carnea* leaves were carried out in normal rats and in streptozotocin induced diabetic rats; the aqueous extract of *Ipomoea carnea* considerably reduces the blood glucose level of rats. It increases the glucose tolerance in normal rats.

Antifungal activity

Antifungal activity of *Ipomoea carnea* has been demonstrated against *Alternaria alternata* and *Curvularia lunata*. Chloroform and Methanol extract of *Ipomoea carnea* revealed antifungal activity against eleven pathogenic and non-pathogenic fungi. Antifungal fractions of the leaves of *Ipomoea carnea* were attained using *Colletotrichum loeosporioide* and *Cladosporium cucumerinum* as test organisms. The activity of the purified fraction was further established by the dose dependent inhibition of the spore germination of *Alternaria alternata* and *A. porri*. The active fraction was recognized as a mixture of (E)-octadecyl p-coumarate and (Z)-octadecyl p-coumarate.

Anti-inflammatory activity

Aqueous extracts of mature green leaves of *Ipomoea carnea* were tested for anti-inflammatory activity. The extracts were used at a dose of 250 mg/kg and 500 mg/kg body weight. The study concluded that *Ipomoea carnea* leaves possess a strong anti-inflammatory activity at dose of 500 mg/kg and possesses better result as compared to Etoricoxib 6 mg/kg.

Hepatoprotective activity

Ipomoea carnea can be a favorable bioactive substance for prevention and treatment of liver injury. *Ipomoea carnea* holds good hepatoprotective activity using CCl₄ induced hepatotoxicity in rat. This hepatotoxicity is due to free radical CCl₃ which is metabolite. It lessens alkalization of cellular proteins and other macromolecules with simultaneous attack on polyunsaturated fatty acids to produce lipid peroxide.

Glycosidase inhibitory activities

Analysis of *Ipomoea carnea* plant material was carried out by gas chromatography-mass spectrometry recognized the presence of the mannosidase inhibitor swainsonine and 2 glycosidase inhibitors, calystegine B₂ and calystegine C₁, consistent with a plant-induced α-mannosidosis in the goats. The described storage disorder is analogous to the lysosomal storage diseases induced by ingestion of locoweeds (*Astragalus* and *Oxytropis*) and poison peas (*Swainsona*). *Ipomoea carnea* makes guinea pigs a valuable animal model for the reproduction of induced α-mannosidosis.

Anti-cancer activity

In *in-vitro* and *in-vivo* studies it was found that hydroalcoholic extract of *Ipomoea carnea* leaves possess substantial anticancer property with the dose dependent effect. This may probably, due to the presence of phytochemicals such as alkaloids, phenols, and flavonoids.

Immunomodulatory activity

Toxic component in it is- the nortropane alkaloid calystegines B₁, B₂, B₃ and C₁ and the indolizidine alkaloid swainsonine. Effects of swainsonine in female rats were found that reduction in body, increase in spleen/body weight ratio, decrease in the thymus/body weight ratio and histological changes. When pregnant rats were treated with 7 gm/kg of *Ipomoea carnea* AF, all the litters died immediately after birth. Rats consume considerably less food due to effect of *Ipomoea carnea*. Swainsonine has immune effect due to glycoprotein metabolism. Due to this Rheumatoid arthritis (RA) was developed to both adult (70 days old) and juvenile rats (21 days old). Hence swainsonine modulates the immune function.

Anxiolytic activity

Ipomoea carnea seems to fall under the sedative-hypnotic category of central depressants activity. The anxiolytic effects of the aqueous and methanolic extract of *Ipomoea carnea* leaves (32.50 and 16.25 mg/kg I.P.) was assessed in mice using elevated plus maze, open field test and hole board test models, diazepam was used as positive standard. The intra-peritoneal (I.P.) LD₅₀ of the *Ipomoea carnea* leaf aqueous extract (ICLAE) and *Ipomoea carnea* methanolic extract (ICLME) in mice was found to be 325 mg/kg I.P. body weight. ICLME exhibited greater anxiolytic effect as compared to ICLAE (doses of 32.5 mg/kg and 16.2 mg/kg) and diazepam. The effect of the ICLAE and ICLME revealed a dose dependent significantly increased the number of head dipping behaviour in whole board test at doses 32.5 and 16.2 mg/kg when compared with control and diazepam 1 mg/kg, 2 mg/kg as a standard.

Antimicrobial activity

In one study n- hexane, ethyl acetate, acetone, ethanol, and acetone fraction extract were prepared from *Ipomoea carnea* leaves. Crude acetone extracts revealed activity against *Proteus vulgaris* and *Salmonella typhimurium*, while the crude ethanol extract explicates antimicrobial activity against *Pseudomonas aeruginosa*. This was the first report showing inhibition of *Proteus vulgaris* and *Salmonella typhimurium* by the acetone extract while ethanol extract exhibits promising inhibition against *Pseudomonas aeruginosa* of *Ipomoea carnea* leaves. A secondary metabolite dibutyl phthalate isolated from stem of *Ipomoea carnea* has also been recorded for antibacterial activity.

Cardiovascular activity

When aqueous extract of *Ipomoea carnea* was hosted to isolated frog heart then initial blockade for 5-10 seconds was observed. When dose increased then the timing increased up to 2 minutes. It might be due to *Ipomoea carnea* produces a positive inotropic effect on isolated frog heart by sodium extrusion or release of the intracellular calcium. When atropine 1 µg/ml was introduced in extract then the initial different phase was blocked used stimulant effect become stronger.

Mosquitocidal activity

Synergistic effect of insecticides with plant extracts of *Ipomoea carnea* is reported against malarial vector, *Anopheles stephensi* has been reported.⁹⁻²⁴

CONCLUSION

Ipomoea carnea Jacq. is one of the most promising shrubs which possess a lot of therapeutic values. The plant *Ipomoea carnea* is a foundation of pharmacologically and medicinally vital phyto-constituents hence this plant has shown tremendous applications in both traditional as well as modern medical practices. Several mechanisms are likely to account for the observed pharmacological effects, the most important being the

antimicrobial, antidiabetic, anti-inflammatory, antioxidant, antifungal, wound healing, cardiovascular, glycosidase inhibitory, anticancer, anxiolytic, Mosquitocidal, immunomodulatory, hepatoprotective activity.

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Cite this article as:

Mahaveer Sing et al. A Review of Phytomorphological, Phytochemical and Pharmacological activity on *Ipomoea carnea*. Int. J. Res. Ayurveda Pharm. 2021;12(4):166-169
<http://dx.doi.org/10.7897/2277-4343.1204128>

Source of support: Nil, Conflict of interest: None Declared

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