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Pharmaceutical efficacy of *Ipomoea carnea*

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ABSTRACT: *Ipomoea carnea* Jacq. which grow as wild plant in India has been identified as a useful material for several applications including medicinal purposes. However, there are few scientific studies on this medicinal plant, and most of the information are scattered. In this review, we have summarized the existing knowledge and recent progress on the medicinal importance of *I. carnea*. Different extracts of *I. carnea* plant possess anti-bacterial, anti-fungal, anti-oxidant, antimicrobial, anti-cancer, anti-convulsant, immunomodulatory, anti-diabetic, hepatoprotective, anti-inflammatory, anxiolytic, sedative, cardiovascular, Inhibition and wound healing activities. However, some toxicological effects have been also reported. The objective of this study is to review the potential of *Ipomoea carnea* with reference to its phytochemical, pharmacological and other activities.

Keywords: *Ipomoea carnea*, Chemical constituents, Phytochemical, Pharmaceuticals and Pharmacological activity.

INTRODUCTION

Ipomoea carnea Jacq. the pink morning glory belongs to family Convolvulaceae (Frey, *et al.*, 1995; Indian Herbal Pharmacopoeia, 2002). This plant is spread all over the world including American tropics, Argentina, Brazil and Bolivia (Shinners, 1970), Pakistan, Srilanka etc. (Bhattacharyya, 1976; Mahapata, 1978; Sharma, 1978; Austin and Ghazanfar, 1979; Dassanayake and Fosberg, 1980). It is well distributed in India and found particularly in Chhattisgarh and Madhya Pradesh. (Ekka and Dixit, 2007; Dwivedi, 1999; Dwivedi, 2003). It can be easily grown from seeds which are toxic and it can be hazardous to cattle, the toxicity is related to the bioaccumulation of selenium species in leaves but mostly in seeds (Nusrat, *et al.,* 2014). The stem of *I. carnea* can be used for making paper (Dutt, *et al.,* 2005). The plant is also of medicinal value. It is used in different traditional medical systems including Ayurveda, Siddha, and Unani. The plant part is used for Safed Dag (Leucoderma) (Adsul, *et al*., 2012), Cyclophosphamide (Phillips, *et al.,* 1994) as aphrodisiac, purgative and cathartic. It contains a component identical to marsilin, a sedative and anticonvulsant (Meira, *et al.,* 2012). A glycosidic saponin has also been purified from *I. carnea* with anticarcinogenic and oxytoxic properties (Sharma & Bachheti, 2013). The aim of this review is to highlight the traditional uses, pharmaceutical, phytochemical, and pharmacological investigation carried out on the plant so that more pharmacological studies could be conducted to investigate the unexploited potential.

Botanical classification of *Ipomoea carnea*
Kingdom: Plantae
Sub kingdom: Tracheobionta
Division: Spermatophyta
Subdivision: Magnoliophyta
Class: Magnoliopsida – Dicotyledons
Subclass: Asteridae
Order: solanales
Family: convolvulaceae
Genus: *Ipomoea*.
Species: *Ipomoea carnea* Jacq.

Synonym
Hindi: Beshram, Behaya; English: Bush Morning glory; Oriya: Behayo; Marathi: Beshram; Bengali: Beshram;

A. External Morphology of Plant
Ipomoea carnea (Fig.1) grows to a height of 6 m on terrestrial land, but acquires a shorter height in the aquatic habitats. 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 more or less cylindrical in shape and greenish in colour. It has alternate leaves. Normally it attains 1.25 - 2.75 m long and 0.5 - 0.8 cm diameter. The internodes measure 3.5 - 6.0 cm in length. The leaf is simple and petiolate, petiole is cylindrical, attains 4.0 - 7.5 cm length and 2.5 – 3.0 mm diameter. The upper surface of leaf is dull green and the lower surface is paler. The leaves which receive lesser sunlight may grow larger than the leaves which receive full sunlight.

Fig. 1. Photograph of *Ipomoea carnea.*

The difference is more in aquatic conditions (Afifi, *et al*., 1988; Chaudhuri, *et al.*, 1994). 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 (Cook, 1987). One report shows that identification and phylogenetic analysis of *Ipomoea* species collected from eastern India using inter simple sequence repeat markers (Rout, *et al.*, 2010).

Both molecular and morphological markers will be useful for preservation of the *Ipomoea* germplasm collected from Eastern part of India.

B. Proximate chemical analysis

Proximate Chemical analysis includes cold water solubility, hot water solubility, ether solubility, alcohol benzene solubility, 1% NaOH solubility, pentosan content, lignin content, holocellulose, hemicellulose, alpha cellulose, acetyl content, methoxyl content, uronic anhydride, Ash Content (Nandkumar, 2009). The values for proximate chemical analysis tabulated in Table 1.

Table 1: Proximate Chemical Analysis of *Ipomoea carnea.*

S. No.	Parameters	Results
1.	Cold water solubility	8.43
2.	Hot water solubility	12.60
3.	Ether Solubility	3.04
4.	Alcohol benzene solubility	8.46
5.	1% NaOH solubility	28.6
6.	Pentosan Content	17.60
7.	Lignin content	18.08
8.	Holocellulose	67.49
9.	Hemicellulose	22.40
10.	Alpha cellulose	46.45
11.	Acetyl content	4.32
12.	Methoxyl content	4.76
13.	Uronic anhydride	3.45
14.	Ash Content	6.14

Note: The values are expressed in % on OD woody material basis

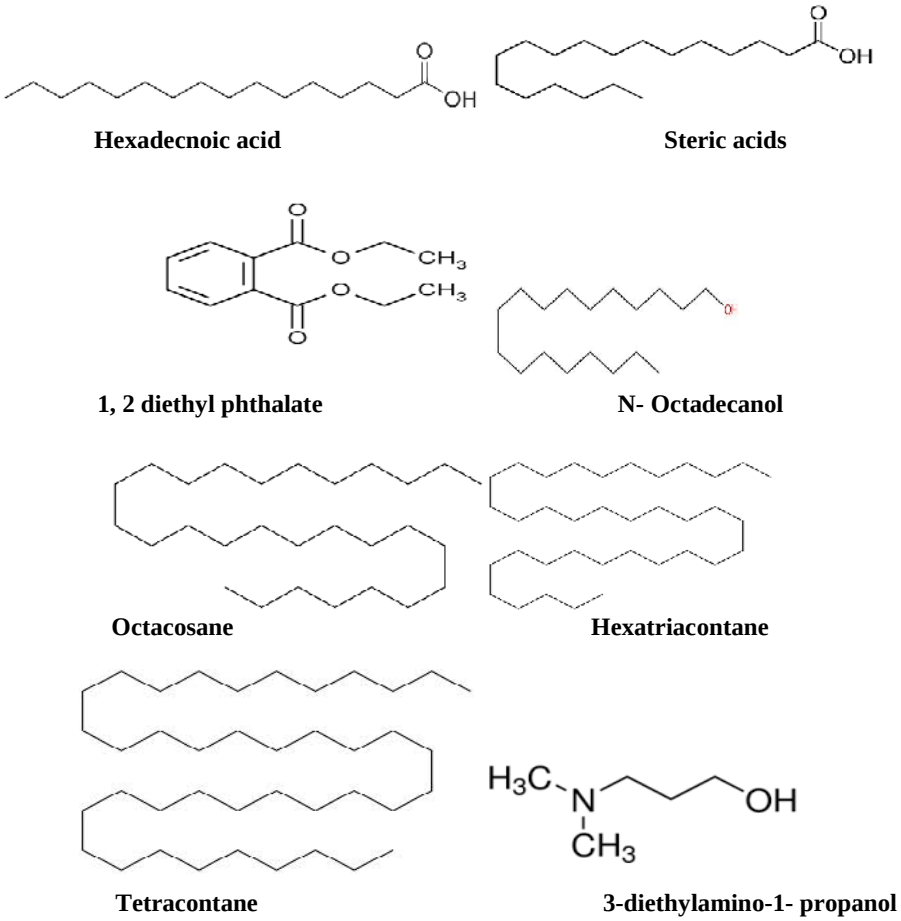
REVIEW OF LITERATURE

The literature survey reveals that the plant possess various bioactive compounds such as glycosides, alkaloids, reducing sugars, flavonoids, fatty acid, esters, alcohol (Nandkumar, 2009 Kyoko, *et al*., 2003) and tannins (Afifi, *et al*.,1988). The leaves of this 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 (Tirkey, *et al*.,1988; Vaishali, *et al*., 2009) (Fig. 2).

One study shows that Ethanol – Water (80: 20) extract of *Ipomoea carnea* contains appreciable amount of flavonoids and phenol. Flowers contain maximum amount of phenolic compounds while stem contain their minimum amount. Phenolic values lies between 45 to 73 mg catechol equivalent / gm (Khatiwora, *et al.*, 2010; Sahayaraj and Ravi, 2008). *Ipomoea carnea* is a rich source of chemical compounds, pigments, steroid etc (Barenbaum, 1986). Chloroform extract of *Ipomoea carnea* showed the presence of steroids, carbohydrates, alkaloids, phenolic compounds, saponins, xanthoproteins and flavonoids (Khatiwora, *et al*., 2010). Gupta, *et al* (2010) studied that when *Ipomoea carnea* flowers were analyzed with Petroleum ether and Hydro alcoholic treatment then Flavonoids, Tannins, Glycosides, Alkaloids, Carbohydrates, and Phenolic compound were observed.

In another study, leaves, flowers and seeds of *Ipomoea carnea* were treated with aqueous ethanol. The extracts obtained were purified with Amberlite IR-120B (H+ form). After this they were treated with *N*-methyl-*N* (trimethylsilyl) trifluoroacetamide.

These derivatives were analysed by capillary GCMS (Gas Chromatography mass spectrum) presence of swainsonine and calystegines B1, B2, B3, and C1 are found in all parts of the plant *Ipomoea carnea*. Swainsonine are found in all parts of *Ipomoea carnea*. It is lysosomotropic compound which produces neurological disorders. The nortropane alkaloids calystegines B2 (2) and C1 (3), together with swainsonine (1) (Fig. 3), have been detected in the leaves collected in Mozambique where goats were intoxicated (Balogh, *et al.*, 1999).



Hexadecnoic acid **Steric acids**

1, 2 diethyl phthalate **N- Octadecanol**

Octacosane **Hexatriacontane**

Tetracontane **3-diethylamino-1- propanol**

Fig. 2. Structure of compounds present in *Ipomoea carnea.*

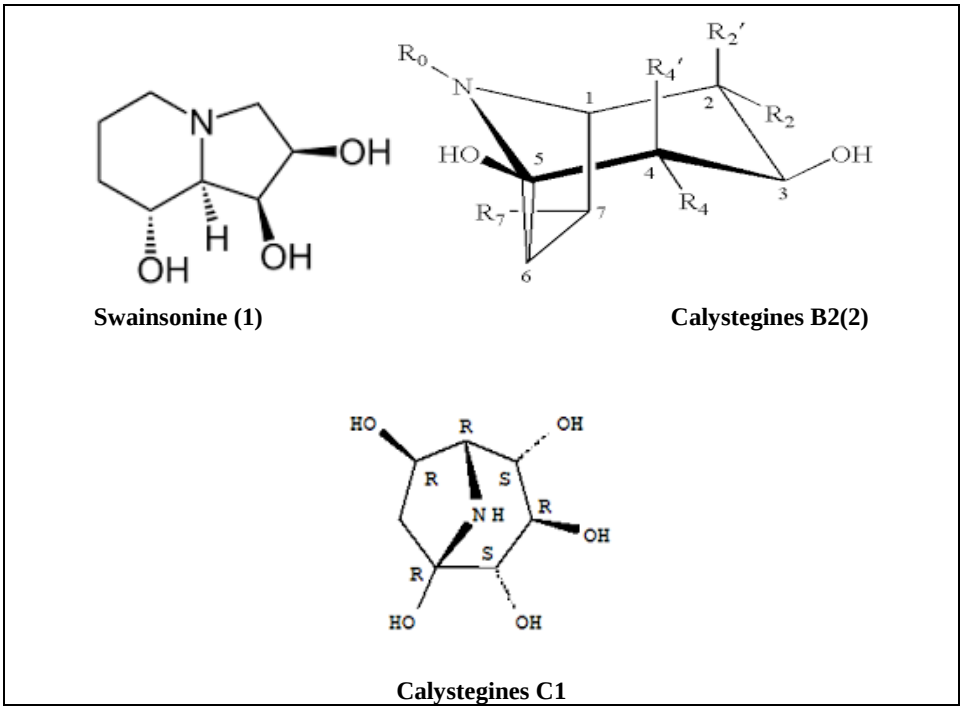


Fig. 3. Structures of alkaloids isolated from *Ipomoea carnea.*

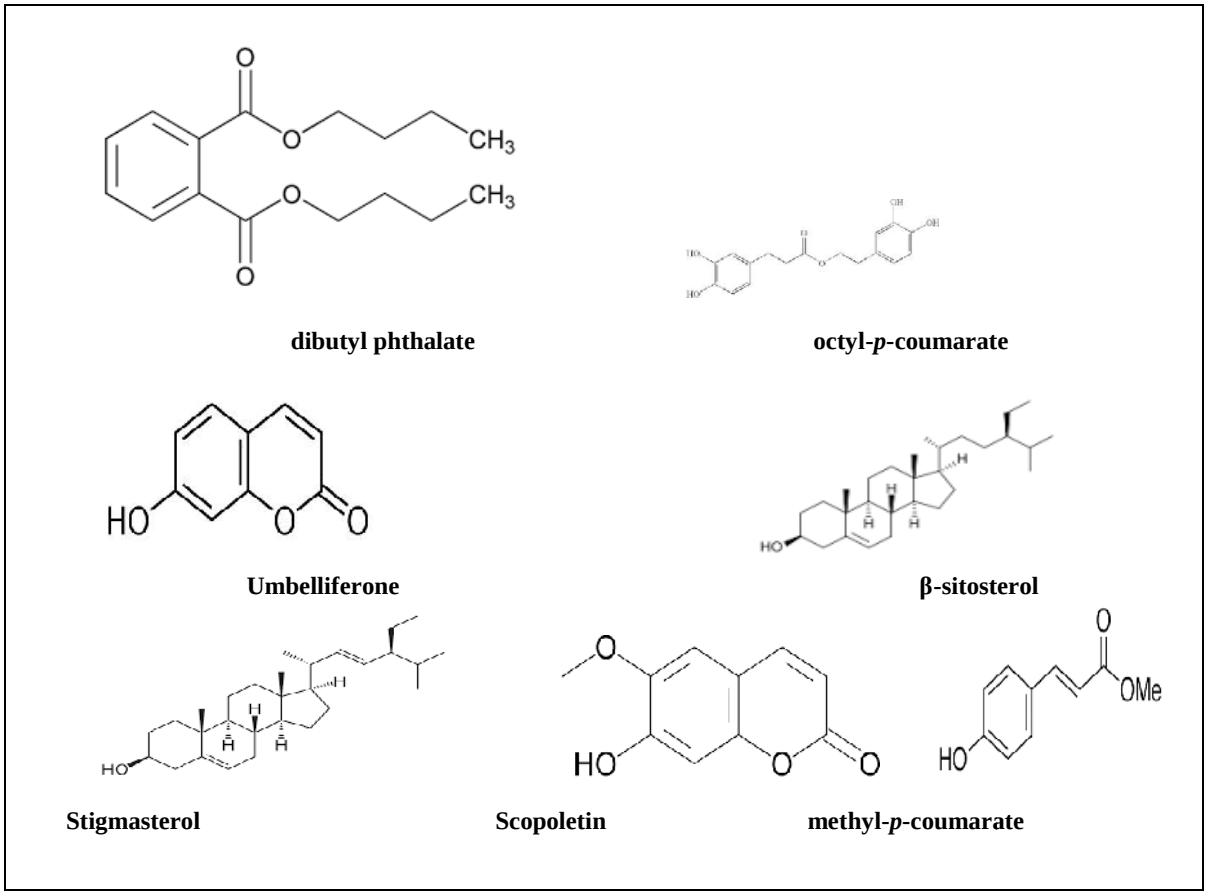


Fig. 4. Structures of secondary metabolites isolated from *Ipomoea carnea*.

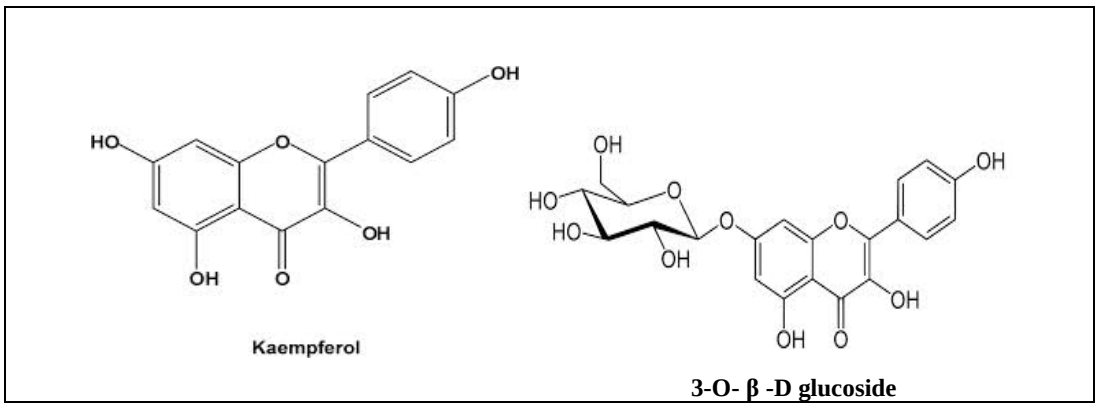


Fig. 5. Structure of Kaempferol and its 3-O- β -D glucoside present in flowers of *Ipomoea carnea.*

Khatiwora, *et al*., (2010) and Adsul, *et al*., (2011) separated bioactive secondary metabolite dibutyl phthalate from *Ipomoea carnea*. Its structure was studied by HPTLC, IR, MS, 1H-NMR, 13C-NMR. A new compound identified as Butyl- (E) - 3' hydroxyl- 7',7'- dimethyl - oct- 5'- enyl –phthalate was elucidated by IR, MS, 1H-NMR, 13C- NMR, DEPT, HMBC and HSQC. from ethyl acetate extract of *I. carnea* stem (Khatiwora, *et. al*., 2013)

Saleem, *et al*.,(2011) and Sahayaraj and Ravi (2008) studied bioactive secondary metabolites isolated from the *n*-hexane soluble part of the ethanolic extract of *Ipomoea carnea*, which were identified as octyl-*p*-coumarate, umbelliferone, β-sitosterol, stigmasterol, **P** - dodecyl-*p*-coumarate, methyl-*p*-coumarate, scopoletin and 3-oleanone (Fig. 4).

Latex of *Ipomoea carnea* contains a compound Carnein. It is 80kDa subtilisin-like serine protease. It shows exceptionally high resistance to chemical and thermal denaturation. Carnein were isolated from *Ipomoea carnea* latex, purified and crystallized by the hanging-drop vapour – diffusion method (Patel, *et al*, 2009a).

PHARMACOLOGICAL PROFILE

Glycosidase Inhibitory Activities: Analysis of *Ipomoea carnea* plant material by gas chromatography–mass spectrometry established the presence of the mannosidase inhibitor swainsonine and 2 glycosidase inhibitors, calystegine B2 and calystegine C1, consistent with a plant-induced a-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*) (Balogh, *et al.*, 1999). *Ipomoea carnea* makes guinea pigs a valuable animal model for the reproduction of induced alpha-mannosidosis (Cholich *et. al*., 2009).

Anti-Inflammatory Activity: Aqueous extracts of mature green leaves of *Ipomoea carnea* were used 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 posses a strong anti-inflammatory activity at dose of 500 mg/kg and possesses better result as compare to Etoricoxib 6 mg/kg (Khalid, *et al.*, 2011).

Antioxidant Activity: In one research study the methanolic extract of *Ipomoea carnea* was dissolved in distilled water and partitioned with *n*-hexane, chloroform, ethyl acetate and *n*-butanol successively. The antioxidant potential of all these fractions and remaining aqueous fraction was evaluated by four methods: DPPH free radical scavenging activity, total antioxidant activity, FRAP assay and ferric thiocyanate assay and total phenolics were also determined. Different fraction show variable activities with respect to different values. 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) (Abbasi, *et al*., 2010; Gaur, *et. al.*, 2009; Adsul, *et. al.*, 2012).

Antidiabetic Activity: In one study antidiabetic property of *Ipomoea carnea* leaves were carried out in normal rats and in streptozotocin induced diabetic rats. The aqueous extract of *Ipomoea carnea* significantly reduces the blood glucose level of rats. It increases the glucose tolerance in normal rats (Kadiyawala, *et al.*, 2012).

Anti-cancer activity of *Ipomoea carne:* On the basis, the in-vitro and in-vivo studies it was found that hydroalcoholic extract of *Ipomoea carnea* leaves possess significant anticancer property with the dose dependent effect. This may probably due to the presence of phytochemicals such as alkaloids, phenols and flavonoids (Anand, *et. al*., 2013)

Antimicrobial Activity: In one study n- hexane, ethyl acetate, acetone, ethanol and acetone fraction extract were prepared from *Ipomoea carnea* leaves. Crude acetone extracts shows activity against *Proteus vulgaris* and *Salmonella typhimurium*, while the crude ethanol extract elucidates 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 (Adsul, *et al*., 2012). A secondary metabolite dibutyl phthalate isolated from stem of *Ipomoea carnea* has also been recorded for antibacterial activity (Khatiwora, *et al.*,2012).

Antibacterial Activity of nanoparticles synthesized from *Ipomoea carnea* extract: Recently biosynthetic method has been developed using plant resources, *Ipomoea carnea* has also been used for this purpose. It contains polyphenols and alkaloids which can be used as reducing agents in the synthesis of nanoparticles. Thus *Ipomoea carnea* has additional antimicrobial use. The weed is extracted and silver nitrate is added to it. Silver nanoparticles are obtained by this method. The weed extract-based synthesis of silver nanoparticles is very efficient against selected human pathogens and can be used in the fabrication of hospital clothes, gloves and masks to avoid the spread of infection among healthcare workers (Daniel, *et al*., 2014).

Wound Healing Activity: Ambiga, *et al.,* (2007) studied fresh flowers of *Ipomoea carnea* extracted with 95% ethanol. 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 (Figure No.5). These were found to possess appreciable 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. These phases are concurrent but independent of each other. These activities are comparable to Sulphathiazole and significantly improved than untreated wounds.

Immunomodulatory Activity: *Ipomoea carnea* is a poisonous plant. Toxic component in it are- the nortropane alkaloid calystegines B1, B2, B3 and C1 and the indolizidine alkaloid swainsonine (SW) (Cook, 1987; Sahayaraj and Ravi, 2008). Effects of swainsonine (SW) in female rats were (a) Reduction in body weight (b) Increase in spleen/body weight ratio, (c) Decrease in the thymus/body weight ratio, and (d) Histological changes. When pregnant rats were treated with 7 gm/kg of *Ipomoea carnea* AF, all of the litters died immediately after birth. Rats consume significantly 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). So swainsonine modulates immune function (Rosenberg, 1999; Lunardi, *et al*., 2000).

Cardiovascular Activity: When aqueous extract of *Ipomoea carnea* was introduced 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 may be suggested that *Ipomoea carnea* produces a positive inotropic effect on isolated frog heart by sodium extrusion or release of the intracellular calcium (Bachhav, *et al*., 1999). When atropine 1 µ gm/ml was introduced in extract then the initial different phase was blocked used stimulant effect become stronger.

Anti- Malarial activity: Synergistic effect of insecticides with plant extracts of *Ipomoea carnea* is reported against malerial vector, *Anopheles stephens* (Kuppusamy, *et al*., 1992).

Embryotoxic effect: Dried leaves of *Ipomoea carnea* were used to prepare an aqueous extract of prenatal daily exposure to 0.0, 0.7, 3.0 or 15.0 mg/kg. When these extract were introduced to rats following result were observed. a) Maternal reproductive performance showed adverse effect. b) Skeletal and visceral abnormalities. c) Malformations were observed. Prenatal ingestion of the *Ipomoea carnea* AQE in rats induces embryotoxicity. These effects are associated to an active principle from *Ipomoea carnea* acting on maternal homeostasis, or directly in the conception (Hosomi, *et al*., 2008).

Antifungal Activity: Antifungal activity of *Ipomoea carnea* has been identified against *Alternaria alternate* and *curvularia lunata* (Agarwal and Uppadhay, 1997). Chloroform and Methanol extract of *Ipomoea carnea* show antifungal activity against eleven pathogenic and nonpathogenic fungi (Ikeda, *et al*., 2003). Antifungal fractions of the leaves of *Ipomoea carnea* were achieved using *Colletotrichum gloeosporioides* and *Cladosporium cucumerinum* as test organisms. The activity of the purified fraction was further confirmed by the dose dependent inhibition of the spore germination of *Alternaria alternate* and *A. porri*. The active fraction was identified as a mixture of (E)-octadecyl p-coumarate and (Z)-octadecyl p-coumarate (Nidiry, *et al*., 2011).

Hepatoprotective Activity: Liver diseases are serious health problem whose treatment is limited. *Ipomoea carnea* can be a promising bioactive substance for prevention and treatment of liver injury (Gupta, *et al*., 2012). *Ipomoea carnea* possesses hepatoprotective activity using CCl4 induced hepatotoxicity in rat. This hepatotoxicity is due to free radical CCl_3 which is metabolite. It reduces alkalization of cellular proteins and other macromolecules with simultaneous attack on polyunsaturated fatty acids to produce lipid peroxide. It results in liver damage (Bishayee, *et al*., 1995).

Effect of *Ipomoea carnea* on Nervous System: *Ipomoea carnea* is a poisonous plant; it affects central nervous system adversely. When goats were fed with fresh leaves flowers and stems of *Ipomoea carnea* for 45 to 60 days then Hirsute coat, depression, difficulty to stand up, ataxia, hypermetria, wide–based stance, in-coordination of muscular movements, intense tremors, spastic paresis, abnormal postural reactions, nystagmus, hyperreflexia, hypersensitivity to sound, head tilting and loss of equilibrium were observed in all treated animals. The cerebellum is one of the main affected organs in the *Ipomoea carnea* intoxication. This organ processes information from other nervous areas, mainly spinal cord and sensory receptors, with the purpose to coordinate skeletal muscle movements (Rios, *et al*., 2008). The functional units of the cerebellum cortex are the Purkinje cells; these cells send inhibitory projections to the deep cerebellar nuclei**.** These neurons were severely affected in this intoxication, including necrosis in some of them (Barbosa, *et al*., 2006).

Anxiolytic Activity: *Ipomoea carnea* appears 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 16.25mg/kg i.p.) was evaluated 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 showed greater anxiolytic effect as compared to ICLAE (doses of 32.5mg/kg and 16.2mg/kg) and diazepam. The effect of the ICLAE and ICLME showed a dose dependent significant increased the number of head dipping behaviour in hole board test at doses 32.5 and 16.2 mg/kg when compared with control and diazepam 1mg/kg, 2mg/kg as a standard. These observations indicate that ICLAE and ICLME showed an anxiolytic activity (Bidkar, *et al*., 2012). In experimental studies in which the plant was given to adult goats, all animals showed disorders of behaviours and consciousness as well as abnormalities of goat (ability to stand and posture) and one goat died (Tokarnia, *et. al*., 2002; Raut, *et. al.*, 2013).

***Ipomoea Carnea* as a Biocompost**: Composting is one of the most promising ways to recycle the wastes generated from power plants, as the process reduces the volume and stabilizes the waste. The high organic matter content in the compost product also preserves soil fertility. A large variety of thermophilic micro-organisms have been reported in composting and other self-heating organic materials. *Ipomoea carnea* is useful to increase the microbial activity of bio-compost. The organic content of bio-compost also increases after treatment of *Ipomoea carnea*. The thermophilic bacteria are in highest number in *Ipomoea carnea* compost their number is (43×10^6) at 50^oC in bio-compost of 30^{th} day. *Ipomoea carnea* is also useful in germination of different seeds. Such as in groundnut *Ipomoea carnea* compost mixture showed highest (83%) percentage of germination when compare to OS (49%) in 5th day (Moindi, *et al*., 2012).

Effect of *Ipomoea carnea* on aquatic creatures: When ethanolic extract of *Ipomoea carnea* leaves was tested for its toxicity against fish Guppy (*Poecilia reticulata*) then toxicity was proved. The extract was used in 0.025, 0.050, 0.07 and 0.1 mg/ml concentrations. Ethanolic extract of *Ipomoea carnea* leaves showed toxic effect, causes mortality in guppy fishes. All concentrations of ethanolic extracts of *Ipomoea carnea* leaves were found toxic. The experiment has shown that ethanolic extract of *Ipomoea carnea* leaves showed three times higher mortality than control in guppy fishes. On exposure of guppy fishes to various concentrations of solid ethanolic extract of *Ipomoea carnea* leaves it shows change in behaviour like surfacing, gulping, mucous secretion from skin, omitting, increase in rate of gill opercular movement, loss of body balance and change in body colour to white (Wanule and Balkhande, 2012).

OTHER USES OF *IPOMOEA*

A. Ipomoea carnea as a raw material for paper making

Ipomoea carnea is a good raw material which is replacement of wood. Soda lignin and Soda Anthraquinone lignin obtained from wood and *Ipomoea carnea* is almost same. Their functional groups are highly similar. In both the lignin samples the presence of vanillin and syringaldehyde was found. Addition of anthraquinone to the pulping process does not affect the quality of lignin precipitated from soda black liquor; even though it nearly doubles the amount of lignin precipitated from black liquor. Rate of delignification was higher with 0.1% addition of anthraquinone (Nand Kumar, 2011a). *Ipomoea carnea* had been found that very useful for paper making (Nandkumar, 2011b).

B. Activated Carbon from Ipomoea carnea

It has been observed that *Ipomoea carnea* is a suitable raw material for the production of activated carbon. It is effective in the removal of copper from aqueous solution. It was concluded that the activated carbon produced from morning glory by zinc chloride activation has better adsorbing capacity of copper than the raw adsorbent. After activation with zinc chloride lot of micro pores were produced**.** With the increase in micro pores the adsorption percentage of copper was increased. The adsorption of copper was found to be maximum at its natural pH. The adsorption of copper by raw adsorbent and activated carbon both follows pseudo second order rate kinetics (Miranda, *et al.*, 2012).

C. Ipomoea carnea as a potential source of textile

Cellulose content of *Ipomoea carnea* is over 55% and lignin content is about 17% which indicates it is a fibrous material and can be used as filler for making light weight polymer composite which provides an effective means of utilization of a large quantity of this diffuse shrub. It can judiciously be used for producing light weight composite materials. Reinforcement of *Ipomoea carnea* particulate into the epoxy matrix shows improvement in both the tensile and flexural properties compared to pure epoxy (Basumatary and Acharya, 2013; Chand and Rohatgi, 2005).

D. Ipomoea carnea as a potential source of Energy

World is suffering from energy crisis. *Ipomoea carnea* is a potential biogas source of Energy**.** *Ipomoea carnea* biomass and distillery waste admixture proved to be the best substrate. The biomethanation parameters optimized at 4L digester level were used at 25L, 50L and 100L scale-up digesters, and it was found that these parameters were satisfactorily transformed to scale-up levels, as shown by good daily volumes of biogas produced and % methane contents. The chemical analysis of digester effluent for NPK and micronutrients showed that the sludge and remaining effluent possesses good manorial value to be used as a supplement to fertilizers in agriculture. *Ipomoea carnea* has a suitable methane content which makes *Ipomoea carnea* suitable for energy production (Deshmukh, 2012).

E. Pest Management activity of Ipomoea carnea

The effect of *I. carnea* extracts were studied for their antifeedant efficiency against rice pest namely the Leaf folder (*Cnaphalocrosis medinalis*). The mortality percentage on exposure (hr) in 100% EtOH extract of *I. carnea* was 100% mortality observed in 12 hr in all the three test concentrations. In 50% EtOH extract of *I. Carnea* was 100% (1000ppm), 5% (500ppm) and 18% (100ppm) on 12 hr. 95% (500ppm) on 24 hr. In water extract of *I. Carnea* the mortality was observed on 24. Mortality observed after pupa formation (48 hr) in control (Agnello, *et.al.,* 2013).

F. Inhibition Activity

Ipomoea carnea is an effective agent against the weight loss for mild steel due to rusting (Srivastava & Srivastava 2012). It has been found that when 0.01 % *Ipomoea carnea* was added to paste containing 4N HCl (40 Parts) + H_2SO_4 (60 Parts) then weight loss reduced from 20.4 mg/dm2/hr to 10.2 mg/dm2/hr, as the concentration of *Ipomoea carnea* was further increased weight loss was further decreased. At 5% concentration, the weight loss obtained was 6.9 mg/dm2/hr. Inhibitor efficiency was 50% which continuously increased with increase in concentration of inhibitor upto 66%. The inhibition is due to the formation of the film on the metal/acid solution interface through adsorption of *Ipomoea carnea* leaves extract molecules. The absorption of *Ipomoea carnea* leaves takes place uniformly over the surface act as a anodic type inhibitor. The result is isolation of swainsonine, 2-epilentiginosine, calystegine A3, B1, B2, B3 and C1 and N-methyl-trans-4-hydroxy-1-proline (Balogh, 1999; Haraguchi, *et al*., 2003). Swainsonine and calystegine A3, B1 and B2 are potent inhibitors (Ikeda, *et al*., 2003). A new type of enzyme (ICChI) has been purified and characterized from the latex of *Ipomoea carnea*. It is highly stable enzyme and can be very useful in Industrial and Biotechnological applications. In addition, it may be employed in agriculture, environmental protection, recycling chitinous waste, and chito-oligosaccharide production (Patel, *et al.,* 2009b).

G. Some negative effect of Ipomoea carnea

Consumption of the seeds may cause negative side effects, including vomiting, nausea and indisposition; probably as a result of non-water-soluble alkaloids. Visions of "small people" are very common, as well as LSD-like sensations, although the effects are not exactly like LSD. The seeds also seem to stimulate the uterus, probably due to the alkaloid ergonovine (Gaur, *et. al.,* 2014).

CONCLUSION

The present study is aimed at identifying pharmaceutical potentials of locally available non-economical weed plants namely *Ipomea carnea* commonly found in waste lands. The plant shows the presence of many chemical constituents which are responsible for various pharmacological medicinal properties. The different parts of *Ipomoea carnea* have been screened for various pharmacological activities such as Glycosidase Inhibitory Activities, Anti-Inflammatory Activity, Antioxidant Activity, Antidiabetic Activity, Antimicrobial Activity, Wound Healing Activity, Immunomodulatory Activity, Cardiovascular Activity, Embryotoxic effect, Antifungal Activity, Anti-cancer, Hepatoprotective Activity, Inhibition Activity and Anxiolytic Properties. Hence *Ipomoea carnea* has a leading capacity for the development of new good efficacy drugs in future. *Ipomoea carnea* as seen from the present investigation can also be used as Biopesticide, an effective reinforcement in polymeric composite creating a variety of technological applications beyond its traditional uses.

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