Wound Healing Potential of *Ipomoea carnea* Jacq.: An Un-Explored Herb Used in Indian Traditional System of Medicine

Vellingiri Vadivel* and Pemaiah Brindha

Department of CARISM, School of Chemical and Biotechnology, Chemical Biology Lab (ASK II-409), SASTRA University, India

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*Corresponding author:* Vellingiri Vadivel, Department of CARISM, School of Chemical and Biotechnology, SASTRA University, India; Email: vadivel@carism.sastra.edu

**Abstract**

Historically, plants have provided a source of novel drug compounds as plant derived medicines have made large contributions to human health and well being. Wounds are essentially the disruption of functional continuity of cells and tissues at the site of injury, and can be caused by insults to the tissue sites by physical, chemical, microbiological or immunological process [2]. Humans and all animals have in situ capabilities of healing wounds in their body parts through continuous tissue repair and tissue regeneration [3]. However, such capabilities are impaired by age, stress situation, obesity, sex, life style, conditions of health and immunity status, severity and types of wounds, patient’s medication status, disastrous nature of the assault-environment around the site of the wounds and potentials of serious microbial infection [4].

Curing of acute and chronic wounds proceed through common basic phases of hemostatis, inflammation, proliferation, fibroplasias, collagen deposition, epithelialization, contraction, re-modelling and maturation (Figure 1) [5]. During the wound healing process, a series of events encompass the repair especially through the presence and actions of activated platelets, neutrophils and macrophages [6]. Increased vascular permeability and angiogenesis are the consequences of the healing, where multiple cellular and cytokine-mediated events are recruited [7]. The endothelial cells are up-regulated by the actions of secreted soluble factors from the activated cells which include the fibroblast growth factors, transforming growth factors, epidermal growth factors and vascular endothelial growth factors among others [8]. The platelets also get activated by the contents from the vascular wall; the main activators such as fibronectin, fibrillar collagen and other matrix proteins cause the kickoff [9,10].
Figure 1: Different stages of wound healing process.

The basic understanding that platelets and the fibrins produced from fibrinogen at the wound site set off several biochemical processes which include collagen synthesis, cell migration, fibroplasias and angiogenesis have been significantly investigated [11]. During the last two decades, there has been increased interest to assess the utility of plant extracts in wound healing and to gain more insight into the active constituents that promote or modulate the healing process [12,13]. Among the various wound healing plants, *I. carnea* Jacq. (Family: Convolvulaceae) is well known herb extensively used in folk medicine in India.

**Ipomoea carnea**

*I. carnea* is popularly known as morning glory, a native plant of South America and is cultivated in India as hedge plant. This plant is spread all over the world including American tropics, Argentina, Brazil and Bolivia, Pakistan, Sri Lanka etc. In India it is distributed particularly in central and Southern states [14,15]. In India, it has become a naturalized species invading the wetlands, canals, drain banks, waste lands, field edges and road sides. The plant can propagate both asexually by stems which show rooting within a few days and sexually by seeds, and has rapid growth rate.

It is a large diffuse, straggling shrub with milky juice, grows to a height of 2 m on terrestrial land, but acquires a shorter height in the aquatic habitats [16]. 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 (Figure 2). The leaf is simple, alternate and petiolate and the petiole is cylindrical. The upper surface of leaf is dull green and the lower surface is paler. It has dichotomously branched axillary and terminal pedunculate cymes. Flowers are axial and pale rose/light violet in colour and the pedicel is green, erect and cylindrical. The mouth of the corolla has an entire margin, with slight conspicuous depressions at the points of the cohesion of the petals. Fruits have a glabrous capsule and seeds are silky [17].

**Phytochemistry**

The leaves have been recorded to contain a polysaccharide called Ipomose and saponins. Chemical analysis of showed the water solubility (8.43-12.60%), lignin content (18.08%), holocellulose content (67.49%), cellulose content (22.40%) and ash content (6.14%) [18]. Presence of phenols, flavonoids, alkaloids, tannins, glycosides and Dibutyl Phthalate [19-24]. Presence of swainsonine and calystegines (Figure 2) were detected in the aqueous ethanolic extract of leaf [25,26]. Leaves showed the presence of thirteen compounds which include hexadecanoic acid, stearic acid, 1,2-diethyl phthalate, n-octadecanol, octacosane, hexatriacontane, tetracosane, 3-diethylamino-1-propanol and stigmasterol [27-29]. Latex of *I. carnea* was reported to contain a serine protease called carnein [30].

**Figure 2:** Morphology of Ipomea carnea Jacq (A) and its major phytochemical constituents, swainsonine (B) and calystegine-B2 (C).

**Medicinal value**

*Carnea* has been used traditionally for the treatment of a large number of diseases. Leaves are used as purgative and leaves paste is applied on sore between toes and fingers due to fungal infection [31].The milky juice of plant has been used for the treatment of leucoderma and other related skin diseases [27]. 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 [32]. In Africa, leaves of related species *I. involucrata* are claimed to be effective in the treatment of pile, rheumatic pain, toothache and other inflammatory conditions [33]. This plant was reported to possesses many medicinal properties like anti-inflammatory activity [34], antioxidant activity [35,36], anti-diabetic activity [37], muscle strain relieving activity [38], anti-bacterial activity [39], anti-fungal activity [40], cardio-vascular activity [41], immuno-modulatory activity [42], anxiolytic activity [43], and hepatoprotective activity [44].

Flower extract of *I. carnea* was found to have protective effect on hematological changes occurring toluene di-isocyanate-induced inflammation in Wistar rats. Leaves of *I. carnea* are used...
in the treatment of wounds along with sesame/coconut oil by the traditional healers in India. According to indigenous system of medicine in Tamilnadu, the wounds are treated by applying oil and then dressed with the leaves of I. carnea. Would healing activity of I. carnea flower extract containing kaempferol was proven in animal model by Ambiga et al. [45]. Methanolic extract of I. carnea was found to possess significant would healing property [46]. Tubers of related species (I. batatas) was also reported to exhibit wound healing activity [47].

### Toxicity issues
Toxic and poisonous effects of I. carnea leaf was reported by Sharma and Bachetti [48] and also experimentally proven by Amna et al. [49]. I. carnea [50] and its related plants I. sericophylla and I. riedelii [51] were reported to be toxic to cattle and affected the central nervous system. Aqueous extract of this plant exhibited embryo toxicity in rat model [52,53]. The role of alkaloids in the toxicity of I. carnea was experimentally proven by Husea et al. [54]. Toxicity of I. carnea was proven in rat [55], guinea pig [56,57] and goat models [58].

### Conclusion
Nature has given herbs as a gift to the human beings for living a healthy life. But, some of the herbal plants are under-utilized or un-explored to the extent that they actually deserve to treat human ailments. It is the responsibility of the researchers to reveal the therapeutic efficacy of medicinal plants, which are used by ethnic populations as well as by indigenous medical practitioners. I. carnea is a wonderful wound healing herb used in Indian indigenous system of medicine along with sesame/coconut oil, but the detailed scientific research on its therapeutic potential is not yet carried out and also the mechanism of wound healing action was not investigated scientifically. Hence, necessary steps could be taken to evaluate the medicinal value of this plant and also to clarify the toxicity issues associated with this herb. Since, the plant parts of I. carnea are reported as toxic in various in-vivo models, it has been used only for external applications in wound healing. But, dermal/skin toxicity of this plant extract/active constituents should also be analyzed in suitable experimental models. Research initiatives on this plant could provide a novel, safe and efficient wound healing drug to human community.

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### References