

## PHARMACOLOGICAL REVIEW OF INULA RACEMOSA HOOK. F

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**ABSTRACT**

Root of *Inula racemosa* Hook. F (Asteraceae) is used in treatment of cardiac disease and asthma. In this global era of traditional medicine scientist are looking toward Ayurveda and other traditional medicine with their scientific validation of therapeutic principles. The plant *I. racemosa* was evaluated for a number of activities such as anti-histamine, antiallergic effect and mast cell stabilizing activity, adaptogenic, cardioprotective, antibacterial, antidiabetic, anti-inflammatory, hepatoprotective, antimutagenic, antiapoptotic, activity. The cardio protective action was clinically proven by several scholars. In the present review we have tried to collect knowledge on

phytochemistry and pharmacological properties of *Inula racemosa* which is extensively used in Indian system of medicine i.e. Ayurveda.

**KEYWORDS:** *Inula racemosa*, antibacterial, cardio protective activity, anti-histamine.

**INTRODUCTION**

*Inula racemosa* Hook. F (Asteraceae) is a well-known medicinal plant in Ayurveda as Pushkarmula, which is widely used for *vatakapha jwara* (fever caused by vata pitta imbalance), *sotha* (swelling), *arachi* (anorexia), *swasa* (breathlessness) and *Parshwashoola* (chest pain on either side). It works as 'Rasayana' (rejuvenator, immunomodulator) agent. The root powder is commonly used to cure *swasa roga* (asthma/ dyspnea), lipid disorder, angina and dyspnea, diabetes and to provide strength to heart.<sup>[1,2]</sup> by Ayurvedic practitioners in India. It possesses *Katu*, *Tikta rasa*, *Laghu guna*, *Katu Vipaka*, *Usna Virya*. It was mentioned under *Hikka nigrahana* and *Swasahara mahakashayas* by Acharya Charaka. Acharya Charaka also mentions it best for *Hikka* (Hicough), *Swasa* (Breathlessness) *Kasa* (cough) and *Parshwashoola* (Pain in the flanks). Compendia of medieval period clearly

mentioned the application of *Pushkaramoola* in the management of *Hridshoola* (cardiac pain).<sup>[3]</sup>

It is a critically endangered species due to the fragile nature of its habitat, and its ruthless over exploitation due to commercial medicinal properties is at the verge of extinction.<sup>[4,5]</sup> Much of the investigations support the therapeutic efficacy of the plant as Cardioprotective, Anti-histamine, Antiallergic effect and Mast cell stabilizing, Antibacterial, Anti-diabetic, Adaptogenic, Antimutagenic, Antiapoptotic, Anti-inflammatory and Analgesic, Hepatoprotective activity and roots used as anthelmintic, antiseptic, anti-inflammatory and diuretic agents.<sup>[6]</sup>

The present article is an attempt to summarize pharmacological investigation carried out on *I. racemosa* which helps in understanding scientific basis of clinical application mentioned in Ayurveda classics.

### **Botanical description**

*I. racemosa* found in temperate and western alpine regions of Himalayas, Kashmir and Himachal Pradesh upto 4,200. The plant is a stout shrub. It has two types of large leaves arranged in a racemose manner. Upper leaves are lanceolate and embracing the stem with its base. Lower leaves are toothed and densely hairy. The stem is grooved and all vegetative parts are covered with densely matted woolly hairs. The abaxial laminal face is densely tomentose. Radical leaves are 40 x 20 cm broad and are oval-shaped, with narrowed ends to lanceolate with long petioles. The cauline leaves are smaller than radical leaves, oblong and embracing the stem half round (i.e. semi aplexicaule). The flowers are large, shady yellow daisies arranged on apical spike like cluster. The fruits are flattened, achene, slender and glabrous. Root stock branched; fresh roots are irregularly fusiform with pungent odour similar to camphor and bitter taste.

### **Pharmacological activity**

#### **1. Antibacterial activity**

Isoalantolactone, a major constituent of *I. racemosa* exhibit significant fungistatic nature of toxicity against *Gaeumannomyces graminis var. tritici*, *Rhizoctonia cerealis* and *Phytophthora capsici*. It also shows weak antibacterial activities against *Staphylococcus aureus*, *Escherichia coli*, *Sarcina lentus*, *Pseudomonas fluorescense*, and *Bacillus subtilis*.<sup>[7]</sup>

A sesquiterpene lactone Alantolactone isolated from the root of *I. racemosa* found effective against *Shigella dysenteriae*.<sup>[8]</sup> Sesquiterpene lactones, dehydrocostus lactone and costunolide from hexane fraction of methanol extract shows Antimicrobial against *Malassizia furfur*, *S. aureus*, *Streptococcus mutans*, *Propyionibacterium acne* and *Cornybacterium xerosis*.<sup>[9]</sup> Essential oil from *I. racemosa* also possesses antimicrobial potential.<sup>[10]</sup>

## 2. Anti-histamine, Antiallergic Effect and Mast cell stabilizing activity

*Inula racemosa* was investigated against different type of stimulus for asthma such as immunological, physiological and biochemical conditions. Petroleum ether extract exhibit superior activity then other ethanol and water extract. Petroleum ether extract found to be effective against histamine induced contraction, milk induced leucocytosis, milk-induced eosinophilia and clonidine- induced mast cell.<sup>[11]</sup> The ethanolic extract from roots of *I. racemosa* significantly prevent immunologically induced degranulation of mast cells.<sup>[12]</sup> The polyherbal formulation containing *I. racemosa* exhibit antihistaminic property, mast cell stabilizing as well as spasmolytic activity in histamine induced bronchoconstriction experiment on guinea pig ileum.<sup>[13]</sup> Srivastava has reported that alcoholic extract of root of *I. racemosa*, shows significant antiallergic effect in egg albumin induced passive cutaneous anaphylaxis (PCA) and mast cell degranulation in albino rats.<sup>[14]</sup>

## 3. Cardioprotective activity

*racemosa* alcohol extract significantly reverse the lipid derangement and reduced the atherogenic index. It also shows antioxidant potential in heart. It prevents Coronary artery changes, Aortic lesion area and % bodyweight increase.<sup>[15]</sup> In a study it was reported that *I. racemosa* root adrenergic beta-blocking activity as it prevent ST-segment depression, T-wave inversion in the post-exercise electrocardiogram and exhibit negative inotropic as well as negative chronotropic effects on frog heart.<sup>[16]</sup> In a clinical study, 50 patients of ischaemic heart disease treated with Pushkara guggulu (a combination of *I. Racemosa* and *Commiphora mukul*) 6 gms per day. Improvement has been observed in Precordial pain, discomfort and dyspnoea on effort, Mean Serum cholesterol. Significant improved in the E. C. G. pattern has been also observed.<sup>[17]</sup> In another clinical study with 200 patients of ischemic heart disease providing gum guggul in combination with *I. racemosa*, restoration of electrocardiogram (ECG) total cholesterol, triglyceride and total blood lipids to normal has been reported.<sup>[18]</sup> Similar effects were also reported by other clinical studies.<sup>[19-20]</sup> At 450 mg/kg it enhanced PGE2 like activity in isoproterenol induced myocardial ischemia in rabbits.<sup>[21]</sup> Petroleum

ether extract of the root and its isolated compound Alantolactone exhibit cardio protective activity in ischemic rats. Significant antioxidant activity also exhibit in term of reduces the lipid peroxide levels and restoration of glutathione content.<sup>[22]</sup>

Lipistat (a polyherbal capsule containing 500 mg of *Terminalia arjuna*, *I. racemosa* and *Commiphora mukul* manufactured by Dabur India) was evaluated for its Cardio protective potential. It significantly normalizes the total cholesterol, triglycerides, low-density lipoprotein (LDL) and high-density lipoprotein (HDL), and promotes antioxidant enzymes such as glutathione (GSH), superoxide dismutase (SOD) and catalase (CAT). The results shows cardioprotective potential in doxorubicin treated animals.<sup>[23,24]</sup>

Isoprenaline induced myocardial infarction model was used to evaluate cardio protective role of Pushkarmula. Different biochemical markers such as serum cAMP-PDE, cardiac cAMP-PDE cardiac cAMP adenylyl cyclase, Circulating GOT, LDH, CPK, cAMP, Cortisol, pyruvate, lactate glucose were evaluated. Results show that plant exhibit cardio protective activity.<sup>[25]</sup>

The root of *I. racemosa* has been considered to exhibit cardio-protective effect and relieve ischemic pain.<sup>[26]</sup>

Alcohol and hexane extracts of Roots of *I. racemosa* (100 & 250 mg/kg bw) were evaluated for estrogenic activity by the Immature rat uterotrophic assay. Report shows that classical uterine and ovarian morphological changes induced by estrogen stimulation has been observed. The result was further confirmed with isolated compounds Alantolactone (ALT), Isoalantolactone (IALT) and Stigmasterolglucoside (SG).<sup>[27]</sup>

It was also reported that it prevent myocardium from isoproterenol-induced infarction and leakage of myocytes specific marker enzymes creatine phosphokinase-MB and lactate dehydrogenase from the heart. Moreover it improved cardiac function by increasing the heart rate, mean arterial pressure, contractility and relaxation along with decreasing left ventricular end diastolic pressure.<sup>[28]</sup>

#### 4. Anti-diabetic activity

The petroleum ether extract of roots lowered plasma insulin and glucose levels within 75 min of oral administration to albino rats and it significantly counteracted adrenaline-induced hyperglycaemia in rats.<sup>[29]</sup> Alcoholic extract of the roots of *I. racemosa* exhibit hypoglycemic

effect along with increase in liver glycogen content.<sup>[30]</sup> However it does not induce insulin secretion from pancreas.<sup>[31]</sup>

In a clinical study with 15 patients of diabetes mellitus were treated with 3 g of *I. racemosa* roots powder thrice in a day for three months duration. The result was significantly positive in terms of blood glucose level.<sup>[32]</sup> In experimental model of corticosteroid induced hyperglycaemia in mice, Roots of *I. racemosa* decreased the serum concentrations of the thyroid hormones tetraiodothyronine (T4) and triiodothyronine (T3) which refer that the hypoglycemic effect was mediated through its cortisol inhibiting potency.<sup>[33, 34]</sup> Aqueous and methanol extract of the root of *I. racemosa* produced significant reduction in blood sugar level in glucose included hyperglycemia<sup>[35]</sup> and alloxan-induced hyperglycemia respectively.<sup>[36]</sup>

### 5. Adaptogenic activity

The animals treated with root extract *I. racemosa* (100mg/kg) and (200mg/kg) showed positive adaptogenic activity. It significant reduction in the immobility period in forced swimming test as well as elevates anti-oxidant markers in addition to adrenaline and serotonin levels.<sup>[37]</sup>

### 6. Antimutagenic and Antiapoptotic Effects

Aqueous root extract (ARE) of *I. racemosa* was experimentally investigated for its chemopreventive potential. It was found effective against 4-nitroquinoline-1-oxide (4-NQO) induced DNA damage and apoptosis in mice bone marrow cells.<sup>[38]</sup>

### 7. Anti-inflammatory and Analgesic activity

Anti-inflammatory (carrageenan induced paw edema) and analgesic (hot plate) activity was performed with Ethanolic extracts of *I. racemosa*. The results were impressive as compared to standard drug Aspirin<sup>[39]</sup> as well as indomethacin.<sup>[40]</sup>

### 8. Hepatoprotective activity

The aqueous, methanolic and total aqueous extract showed better hepatoprotective activity than the petroleum ether extract at 100 mg/kg in rats and they were non toxic upto 10 g/kg. The LD50 of pet ether extract is reportedly 1.5g/kg bw.<sup>[41,42]</sup> Hydro-alcohol extract of root of *I. racemosa* shows free radical scavenging activity in DPPH activity, reducing power and hydrogen peroxide scavenging activity.<sup>[43]</sup> In vitro hepatoprotective activity of *I. racemosa*

roots against CCL4 induced toxicity on Chang cell Line. Higher percentage viability was observed with ethanolic extract treatment.<sup>[44]</sup> It was also reported that the drug shows liver-protective activity against Hepatic ischemia–reperfusion (I/R). It has ability to restore normal hepatic architecture.<sup>[45, 46]</sup>

## CONCLUSION

In the present review we have tried to collect knowledge on phytochemistry and pharmacological properties of *Inula racemosa* which is extensively used in Indian system of medicine i.e. Ayurveda. Root of *I. racemosa* is used in treatment of cardiac disease and asthma. In this global era of traditional medicine scientists are looking toward Ayurveda and other traditional medicine with their scientific validation of therapeutic principles. The plant *I. racemosa* was evaluated for a number of activities such as anti-histamine, anti-allergic effect and mast cell stabilizing activity, adaptogenic, cardioprotective, antibacterial, antidiabetic, anti-inflammatory, hepatoprotective, antimutagenic, antiapoptotic, activity. The cardio protective action was clinically proven by several scholars.

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