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Medicinal properties of Himalayan Marsh Orchid: *Dactylorhiza hatagirea*(D.Don) Soó (Garud Panja)

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Abstract

Dactylorhiza hatagirea (D.Don) Soó (Syn. *Orchis hatagirea* D.Don) is a famous and endangered remedial plant, found in high altitude Zones (at 2800-4440 m a.s.l.) of the higher Himalayas. The common names for *D. hatagirea* are *Hatpanja* or *Hatajari* in Uttarakhand, in Kashmir *Salam panja*, *Panchaunle* in Nepal and in Ladakh *Wanglak* or *Angulagpa*. Due to its extreme therapeutic properties and excess utilization in environment, the species leads to vulnerable with loss. In the present study,pharmacological properties and traditional uses of *D. hatagirea* was discussed. For the conservation of *D. hatagirea* from destruction, it is categoeized as 'Critically Endangered' in the KWLS. Because of high therapeutic value of this plant, its valuable protection becomes much important. Thus, an incorporated conservation accesssion is desired to protect this Himalayan orchid (*D. hatagirea*). *Dactylorhiza hatagirea* is a therapeutic plant species of orchid, also known as marsh orchid restricted to North-Western Himalayan range distributes across India, Pakistan, China, Bhutan, and Afghanistan. Dactylorhin, a bioactive component found in the tuber of

D. hatagirea, contributes for immense medicinal importance to cure numerous ailments. Generally dactylorhin possess neurostimulant, antibacterial, immunomodulator activity along with diverse nutritional properties. Due to much medicinal importance, overexploitation of *D. hatagirea* take place and it becomes a threatened plant species. So there is essential need to conserve this plant species, for this various conservation approaches such asmajor biotechnological involvements such as plant tissue culture, advancement of molecular markers, next-generation sequencing have been followed. As these are the few significant approaches for the conservation of extraordinary Himalayan orchid. It is expected that in future, medicinal plants like *D. hatagirea* will be used to develop potent therapeutics.

Keywords: Threatened, endangered, conservation, molecular markers, therapeutic

1.1 Pharmacological Importance of *D. hatagirea*

Himalayan orchid, *D. hatagirea* has significantly important species due to its extensive variety of phytochemicals that possess a broad array of therapeutic outcomes. Various properties related to vitaltherapeuticadvantages of *D. hatagirea* are shown in **figure 1 and table 1.**

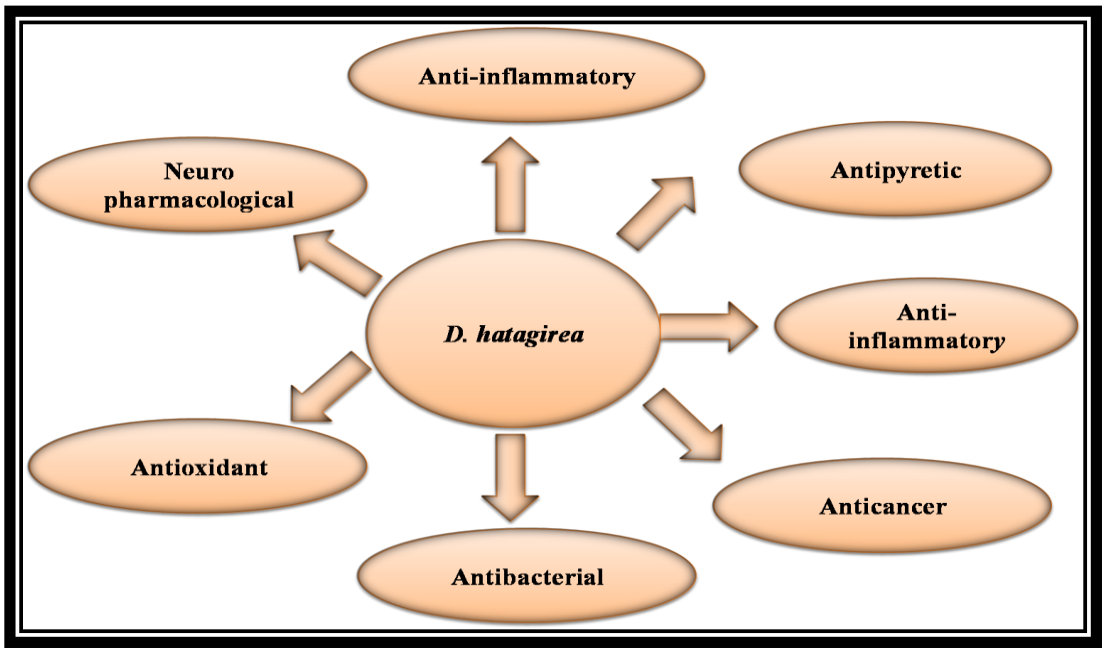

Figure 1: Pharmacological properties of *D. hatagirea*

1.1.1 Antimicrobial Activity

The extracts (shoot and root)of *D. hatagirea* are efficient in the treatment of extensive array of ailments caused by Gram-negative and Gram-positive bacteria (Ranapal, 2009). *D. hatagirea* was reported greatlyeffectual against *Shigella flexinerai* and *Escherichia coli*, that showed refusal against synthetic therapeutics (Vij *et al*., 1995). Various extracts with different solvents of this plant species were prepared with water, chloroform, petrol, methanol and ether. Further plant extracts were tested against different bacterial strains for the assessment of zone of inhibition (ZOI) along with analysis of minimum inhibitory concentration (MIC) (Charpinella*et al*., 1999). The study showed that the rhizome part of *D. hatagirea* is extra efficient as cpmpared to the aerial divisions against the entire bacterial strains. The antimicrobial property of ethanol and methanolicplant extracts ofroot and shoots of *D. hatagirea* against *S. aureus, E. Coli*, *B. subtilis*, and *P. aeruginosa* confirmed MIC at lesser range (Ranapal, 2009; Kumar *et al*., 2010). The potential of *D. hatagirea* to exhibit antibacterial effect against various bacterial strains imitate its capability for use as efficient antibacterial candidate drug.

1.1.2 Neuropharmacological Activity

Psychoactive drugs or Sleep-inducingmedicinesare generallyfamous by name of sleeping pills and sometimes, hypnotic drugs; principalrole of these drugs is to cure insomnia (sleeplessness) by inducing sleep, as well used in surgical anesthesia. The hydroalcoholic extract of *D. hatagirea* showed that oral administration of this plant extract was non-toxic in acute toxicity study at different doses, in mice, with no lethality. Moreover, the study proves that *D. hatagirea*extended the time of sleeping in dose dependentmanner in the treated animals as contrast to untreated ones(Sirohi and Sagar, 2019).

1.1.3 Anti-Inflammatory Activity

D. hatagirea possess numerous bioactive components in the tuber part such as flavonoids, alkaloids, steroids, diterpenes,saponins, tannins and glycosidesand these showedeffective anti-inflammatory action. By using different rat models, it was concluded that *D. hatagirea* possess anti-inflammatory activity as shown in paw edema rat model stimulated by carrageenan along with

a cotton pellet granuloma rat model for acute or chronic inflammation. The Wistar rats of either sex showed improved response towards*D. Hatagirea* hydroalcoholic extracts in contrast to control group (Indomethacin 10mg/kg and aspirin 100 mg/kg).Both acute and chronic inflammatory study showed that hydroalcoholic extracts of *D. hatagirea* possess anti-inflammatory activity (Sirohi*et al*., 2019).

1.1.4 Anti-Cancerous Activity

D. hatagirea extract showed a significant outcome on cancerous cell lines. It was reported that of breast cancer (MDA-MB-231) along with Michigan Cancer Foundation-7 (MCF-7) cell lines developed in an artificial media i.e.Dulbecco's modified Eagle medium (DMEM) and antibiotics (1%) with fetal bovine serum (FBS), attenuated their population [13]. On the other hand,normal cell line (human embryonic kidney (HEK-293)) cell lines weredeveloped in Leibovitz (L-15) medium showedinsignificantoutcome. *D. hatagirea*root extractshowedelevated anti-cancerous activity as compared to shoot extracts (Popli and Sood, 2016).

Table 1: Ethnomedicinal uses and method of utilization of *D. hatagirea*

S. No.	**Plant Part used**	**Disorder/diseases**	**Method of utilization**	**Author/S**
1.	Tubers	wound healing, headache, skin problems	Fine powder of tubers with mustard oil used for healing wounds.	Hamilton and Radford, 2007
2.	Tubers	chronic diarrhea, stomachache, intestinal disorder	Powdered tuber mixed with another medicinal herb, and consumed with water/milk.	Arora *et al*., 2017

3.	Tubers	kidney disorders, burning sensation, and urine discharge	Unspecified	Ballabh *et al*., 2008
4.	Leaves and Tubers	Neurological (brain tonic, nerve tonic)	Leaves and Tubers extract	Khajuriya *et al*., 2017
5.	Leaves and Tubers	(asthma, bronchitis, lungs, and other pulmonary problems	Decoction made with leaves and tubers	Rawat and Jalal, 2011

1.2 Conservation Approaches

The therapeutic importance of *D. hatagirea*, leads this plant to overexploitation and it becomes a threatened plant species. Therefore, there is requirement to protect this plant species, for this various conservation approaches such as plant tissue culture (*in vitro* propagation), more advancement of molecular markers, and next-generation sequencing have been followed.

1.3 Conclusion and future Prospectives

D. hatagirea has various ethnomedicinal properties to cure numerous diseases like diarrhea, stomachache,cracked bones, chronic gout, Parkinson's disease, tuberculosis. Along with this, *D. hatagirea* also contributes for pharmacological properties that include anti-cancerous, antibacterial, anti-inflammatory and neuropharmacological activity. The current study aims at recognizing the active constituents of the plant that could be beneficial in future formulation of the plant in better therapeutic approach. Further, there is a need to explore anti-inflammatory activity in the design of effective anti-inflammatory drugs.Though, future study requirements include animal models study, beneath stress conditions as well to know its consequences on various signaling pathways. Factors responsible for occurrence of the ailments should be discovered to combat the underlying cascades for devising efficienthealingsystem.As it is an endangered plant species some effective measures are to be applied like mass multiplication through plant tissue culture, to preserve the germplasm of this vitally endangered Himalayan orchid. Furthermore, the

areas where there is a natural population of *D. hatagirea* should be affirmed as medicinal plant conservation areas (MPCA).

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