ISSN: 0976-7126
Alchi *et al.,* 16(4):32-38, 2025

International Journal of Pharmacy & Life Sciences
Open Access to Researcher

A review on *Dactylorhiza hatagirea* (D. Don) and its therapeutic application

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Article info

Received: 30/11/2024

Revised: 12/12/2024

Accepted: 23/01/2025

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Abstract

Dactylorhiza hatagirea, commonly known as "Salam Panja" or "Marsh Orchid," is a critically endangered medicinal plant native to the Himalayan region. Renowned for its diverse therapeutic properties, the plant has been a cornerstone of traditional medicine systems, including Ayurveda and Tibetan medicine. The rhizomes of *Dactylorhiza hatagirea* are rich in bioactive compounds such as flavonoids, glycosides, and alkaloids, which contribute to its pharmacological potential. This review explores its applications in wound healing, anti-inflammatory activity, immune modulation, and as an aphrodisiac. Studies indicate that its mucilaginous content supports tissue repair and provides a protective barrier against infections, making it highly effective in wound management. Additionally, its antioxidant properties aid in reducing oxidative stress, a critical factor in chronic diseases. However, due to overexploitation and habitat destruction, the plant faces a severe threat of extinction, emphasizing the need for conservation efforts and sustainable harvesting practices. Further research is necessary to fully understand the molecular mechanisms of its therapeutic effects and to develop standardized formulations for clinical use.

Keywords: *Dactylorhiza hatagirea*, Applications, Therapeutics

Introduction

About 8% of flowering species in the monocot family Orchidaceae include the potentially therapeutic orchid *Dactylorhiza hatagirea (D. Don).* There are numerous biotic and abiotic hazards to the plant. *D. hatagirea* is popularly referred to as Marsh Orchid,HimalayanOrchid,orMunjatakainSanskrit6 .Itis alsorecognized byseveral colloquialisms in a variety of languages and geographical areas throughout the world. There are roughly 75 species in the genus, which are found over the majority of the northern temperate zone.This is a terrestrial, perennial herbaceous plant that grows to a height of 40–60 cm. Its stem is erect and slender, and its roots are tuberous and divided into finger-like projections. Its leaves are lanceolate or elliptic, and it bears dense, cylindrical racemes of flowers that range in color from purple to spotted rose- purple. Because of how lovely the flower arrangement is, collecting and overuse of it are made simple. The plant is indigenous to nations bordered by the Himalayas, including China, Tibet Autonomous Region (TAR), India, Pakistan, Afghanistan, Bhutan, Nepal, and Mongolia.[1-2]

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Role of Phytochemical in Psychiatric Disorders

The word "psychosis" refers to a broad range of mental illnesses, including delusions, different kinds of hallucinations (often auditory or visual, but occasionally tactile or olfactory), and incredibly disordered thought processes in a clear sensory environment.Plants provide the essential nutrients and remedy needed by humans, they are healthier compared to animal diets. Over time much benefits have been derived from medicinal plants due to their rich natural phytochemicals that interact favorably with the human body and neurotransmitters to produce effects that are beneficial to man. The incapacity of both conventional and atypical antipsychotics to effectively treat psychosis makes it burdensome and challenging to treat, and theyalso have a number of unsettling side effects.Many people who suffer from long-term mental health issues are understandably dissatisfied with the seeming inefficiency of traditional treatment, and they naturally look for alternative medications with fewer or no side effects as well as a more holistic approach to treatment. Secondary metabolites found in high concentration in plants have the potential to interact with the central nervous system (CNS) to produce actions.

Although psychosis is a huge social and economic issue, it is still not adequately managed. Thetreatment ofschizophrenia mostly involves the useofconventional and atypical antipsychotics; typical antipsychotics, such as haloperidol and chlorpromazine, are only useful in treating positive symptoms and have unsettlingside effects such extrapyramidal side-effects.Although they are insufficient and moderate, the atypical antipsychotic medications olanzapine and risperidone have some positive effects on negative symptoms and cognitive deficits . Long-term use also raises the oxidative load, which increases the risk of diabetes, cardiovascular disease, and agranulocytosis, which is present with clozapine. It also causes moderate to severe weight gain.Because of their distinctively high chemical diversity, biochemical specificity, and a number of other qualities that make them promising lead structures for the treatment of various disorders, including psychosis, the use of medicinal plants as supplemental remedies for the treatment of psychosis has become necessary.Medicinal plants are used in addition to or as a substitute for conventional medicine. Patients seek a more all-encompassing approach to treatment, others anticipate minimal or nonexistent side effects from alternative medications, and many with long-term mental health issues are understandably dissatisfied with the seeming inefficiency of traditional therapy.

Many factors, including genetic predisposition, lifestyle choices like substance abuse, and, more recently, diet, are thought to play a role in neuropsychiatric disorders. This is because certain observations have linked the incidence of psychotic episodes in neuropsychiatric diseases to poor dietary patterns, such as a lower intake of fruits, vegetables, fibers, omega-3 fatty acids, vitamins, and minerals. All of thesesubstances can be obtained naturally, which supports the use of natural products in psychosis, especially given their high antioxidant content, since oxidative stress is linked to psychosis.

Secondary Metabolites of medicinal plants in Psychosis

The inability to adequately standardize reproducible extracts and the necessity to definitively identify important active ingredients and comprehend synergy withinthem limit the discovery of useful plant-based medicinal plants for the treatment of psychosis.Many naturally occurring phytochemicals are said to have positive benefits on the brain's ability to operate properly. In essence, metabolites have an impact on how the human brain functions, most likely as a result of the relationship between molecular functioning, plant, and mammalian biochemistry.Second, the consequences could derive from the parallels between human neural systems and the commonnatural herbivores of plants. Consequently, the same processes that allow phytochemicals to interact with the central nervous system of herbivorous orsymbiotic insects will likewise allow them to interact with the central nervous system of humans. This interaction is the result of their synthesis having been maintained by natural selection. Secondary metabolites have important roles in general protection (antioxidant, UV light-absorbing, free radical-scavenging, and antiproliferative agents, for example), as well as in protecting the plant

against pathogens like bacteria, fungus, and viruses.Based on the chemical makeup of their purported active ingredients, phytochemicals are described below. Phenolic compound, Alkaloids abd Terpenes

Phenolic compounds:

Phenolic compounds are ubiquitous in the kingdom of plants, with about 10,000 structures known to exist as of yet. Except for a few special chemicals, precursors generated via the phenylpropanoid route are used to manufacture phenolics. They are structurally similar in that they have one or more hydroxyl groups connected to atleast one aromatic hydrocarbon ring.Phenolic compounds range in complexity from simple low-molecular-weight substances like tannins, flavanoids, and stilbenes to more complicated structures like coumarins, simple phenylpropanoids, andderivativesofbenzoicacid.Viadirectinteractions withneurotransmittersystems, thesesubstancesarecrucialfortheproperoperationoft hecentralnervoussystem.[3]

Terpenes:

Terpenesareabroad,diversifiedclassofchemicalmol eculesproducedbyavarietyof plants, including certain insects and conifers. Hydrocarbons make up terpenes. They frequently have a strong smell, and by drawing predators and herbivore parasites, as well as by discouraging herbivores, they may protect the plants that generate them. Even though they are sometimes used interchangeably, terpenoids, also known as isoprenoids, are modified terpenes because they have extra functional groups, frequentlyoxygen-containingones.Themaincomponentofrosinmadefr omresinand turpentine are terpenes. Terpenes are also essential components of biosynthesis.

Alkaloids:

Alkaloids are a class of naturally occurring organic compounds that mostly consist of basic nitrogen atoms. Additionally, a number of similar chemicals with weakly acidic and neutral characteristics are included in this group.

Alkaloids are another name for certain artificial substances with a comparable structure. Alkaloids can also include sulfur, oxygen, and, very infrequently, other elements like phosphorus, chlorine, and bromine in addition to carbon, hydrogen, and nitrogen. The first individual alkaloid, morphine, was extracted in 1804 from the opiumpoppy(Papaversomniferum).Alkaloidsarepr oducedbyawiderangeof organismsincludingfungi,bacteria,plants,andanima ls.[4]

Use o fherb's as medicine:

Plant parts used for medical purposes include seeds, berries, roots, leaves, bark, and flowers. This practice is known as herbal medicine, botanical medicine, or phytomedicine. There is a long history of using herbalism outside of traditional medicine. The increasing acceptance of herbal medicine can be attributed to advancementsinclinicalresearch,analysis,andqualit ycontrol,aswellastheirability to effectively treat and prevent disease.Long before written history began, people employed plants for therapeutic purposes. As early as 3,000 BC, Chinese and Egyptian papyrus literature mention the medical applications of many plants. Herbal remedies have been employed in traditional medical systems such as Ayurveda and TraditionalChineseMedicine,whileindigenoussoci etieslikeNativeAmericanand African cultures used plants in their healing rituals. Researchers discovered that individuals used similar or identical plants for similar purposes across the globe.With the advent of chemical analysis in the early 1800s, scientists started removing and modifying the active components from plants. As chemists started synthesizing plant substances later on, the usage of herbal treatments gradually decreased in favor of pharmaceuticals. Herbs are the source of nearly one-fourth of pharmaceutical medications.According to recent estimates from the World Health Organization, 80% of people globally receive some portion of their basic healthcare from herbal medicines. Approximately 600–700 plant-based medications are available in Germany, and 70% of doctors there write prescriptions for them. Herbal medicine use has increased in the United States over the past 20 years as a result of a return to natural or organic cures coupled with public unhappiness with the high expense of prescription drugs.

Dactylorhiza hatagirea

Synonyms: Salampanja, Salap, Panchaungle, Narmad, Hathajari

Biological Source

D. hatagirea belongs to the family Orchidaceae, genus *Dactylorhiza*, order Asparagales, clade Monocot, and primitive angiosperms. The plant thrives best in temperate to alpine environments (2500–5000 m) in the Pakistani Himalayan area.

Geographical Source

Extending to Nepal. North-west Nepal, North-central Nepal, Hulma, Dolpa, Doti, Kaski, Rasuwa, Sindhupalchok, Dolakha, and Lingtshi, Phajodhng, Chele-la, LingshiDungkhang, respectively, are the areas in Nepal and Bhutan that have been reported.It is found in the Hindu-Kush Himalayan region and is native to China, Pakistan, and other places. The Himalayan states of Himachal Pradesh, Uttarakhand, Sikkim, and Arunachal Pradesh, as well as the union territories of Jammu & Kashmir and Ladakh, are known to host the plant. The plant is widely employed in traditional medical systems such as Tibetan herbalmedicine, Siddha and Unanimedicine in India,.[5]

Bioactive Compounds

Albumin, butanedioic acid, hydroquinone, lesoglossin, militarrin, pyranoside, pyrocatechol, and volatile oil are all obtained from tuber extract. Many human ailments are treated with chemicals derived from the plant that have antioxidant properties. The active ingredients of *D. hatagirea* include indole alkaloids, phenolics (stilbene, such as resveratrol), and saponins in addition to ascorbic acid, phyllo- and naphthloquinones, glucomannan, and carotenoids. *D. hatagirea*is used for the treatment of amala pitta (gastritis), madhyabhangaasthi (bone fracture), jvara (fever), vajikarana (erectile dysfunction), haima (cold), bhishajyati (wound healing), and ayurdamah (nerve tonic). With the growing research in the biopharmaceutical and drugindustry,extractionofthesecondarymetabolites andantioxidantsfromthisplant has increased its demand.

Application:

- Thesilkindustrymakesextensiveuseof*D.hatagirea*tubersassizingmaterial. Gardens are used to grow the plants for aesthetic reasons.
- The flowers can be used as ornaments (in flower vases, twisted inside hair ponies, or made into bracelets and necklaces) because of their visually pleasing appearance.
- Leavesandagrounded stemareused towardoff insects.
- Livestock consume the plant's leaves and stem as feed. *D. hatagirea* contributes to the enhancement of frozen milk products' body and texture, color and appearance, flavor and taste, and melting quality.
- Youngshootsandleaves arealsoutilizedasvegetables.
- Theperfumeindustryusestheflowerextracttoboostaroma. Plant tubers are utilized in witchcraft[6]

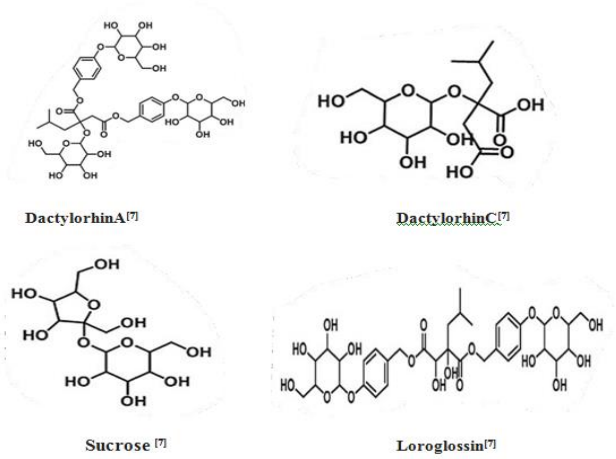

Fig. 1: Major Phytochemicals

Fig. 2: *Dactylorhiza hatagirea*

Pharmacological Significance

High-value orchid *D. hatagirea* contains a variety of phytochemicals that have a wide range of positive benefits. There are following list of the vital health advantages of using *D. hatagirea* :

Neuro-Pharmacological Activity

Dactylorhiza hatagirea (D.Don) Soo is a member of the orchidaceae family. The plant is native to the Indian Himalayan region and is almost endemic there.It is distributed throughout Tibet, Bhutan, Nepal, Pakistan, and Afghanistan. There have been reports of it from Himachal Pradesh, Uttarakhand, Arunachal Pradesh, Jammu & Kashmir, and Sikkim in India. The juice taken from the tuber is used as a tonic and to cure pyorrhea, which is an inflammation of the gums and teeth. Root extract is administeredfordigestiveailments,whilerootpasteis externallyappliedasapoultice for cuts and wounds. The flowering plant species Lavandula stoechas, often known as Spanish lavender, topped lavender, or French lavender, is a member of the Lamiaceae family and is foundnaturally in anumberofMediterranean nations, including France, Spain, Portugal, Italy, and Greece.Commercial applications for it include pesticides and air fresheners. Flower spikes have been applied externally for wounds, rheumatic pain, antiseptic, digestive, antispasmodic, healing, insect repellent, and antibacterial properties.[10]

Anti-Bacterial Activity

While *D. hatagirea's* antibacterial activity was determined through laboratory study,the species' status was calculated using data from the inventory of medicinal herbs.It was discovered that *D. hatagirea* was present at frequencies of 71% and 17%, respectively.While the density was determined to be 0.17 individuals per square meter, the number of *D. hatagirea* was discovered to be 1671 per hectare. *D. hatagirea* was found to have a relative density of 9% in relation to other species. In order to determinetheZoneofInhibition(ZOI)andMinimumInhibitoryConcentration(MIC), the study also focuses on the investigation of the antibacterial properties of extracts of

D. hatagirea rhizome and aerial part that were prepared separately with petrol ether, chloroform, methanol, and water against five bacteria.The ZOI of the water extract of the rhizome against Shigella flexinerai was found to be 13 mm, while the ZOI of the chloroform extract of the aerial section of D. hatagirea against Escherichia coli was found to be 14 mm.[11]

Anti-Cancerous Activity

Critically endangered *Dactylorhiza hatagirea* is a medicinal orchid that is used to treat a variety of illnesses, such as diarrhea, dysentery, persistent fever, coughing, stomach aches, wounds, fractures, cuts, burns, and general weakness. It is native to the Himalayas and can only be found in Jammu and Kashmir, India's Ladakh area, which is located at an elevation of 3,000 meters. For the floriculture industry, they are very valuableas cut flowersand potted plants. Theplants that weregrown in thefield were taken and cultivated on two different liquid MS media: one that contained kinetin (KIN) (2 mg/l) and indole-3-butyric acid (IBA) (3 mg/l); the other that contained 6- benzylaminopurine (BAP) (3 mg/l) and indole-3-butyric acid (IBA) (4 mg/l). These were compared to the static media that contained agar (8.5g/L) as the control.within25 to 32 days of incubation, plantlets with the maximum number of shoots (43.50 ± 0.04), shoot length (31.06 ± 0.63), number of roots (15.00 ± 0.52), maximum root length (14.20 ± 0.24), and maximum biomass (6.29 ± 0.20) grew and developed on MS medium supplemented with indole-3-butyric acid (IBA) (4 mg/L) + 6- benzylaminopurine (BAP) (3 mg/L). For additional mass multiplication, the in vitro produced plantlets were once more subcultured on new media.[12]

Anti-Inflamatory Activity

The current study demonstrated the sub-acute toxicity, anti-inflammatory properties, andphytochemical screeningof ahydro-ethanolic extract oftherhizomes androots of *Curcuma angustifolia (C. angustifolia)* and *Dactylorhiza hatagirea (D. hatagirea).* The Carrageenan-Induced Rat Paw Edema technique was utilized to assess the anti-inflammatoryactivity.Foraperiodof14days,theextract'sacutetoxicity(2000mg/kg) was investigated in Swiss albino mice. The established test procedure described in the literature was used to determine the quantitative analysis of total phenolics and flavonoids as well as the qualitative analysis of different phytochemical constituents. TheFolinsCiocalteaureagentmethodandthealuminu

mchloridemethodwereusedfor thequantitativemeasurementofflavonoidsandpheno liccompounds,respectively.The presence of phenols, flavonoids, tannins, saponins, and alkaloids was determined by phytochemical analysis. *Dactylorhiza hatagirea* roots and Curcuma angustifolia rhizomesextractshavetotalphenoliccontentsof(0.67 5,0.456mg/100mg),flavonoids (0.832,1.091mg/100mg),andotherconstituents.Upt o2000mg/kgofhydro-ethanolic extract did not have any harmful effects.Strong anti-inflammatory properties can be found in the hydro-ethanolic extract of Curcuma angustifolia and *Dactylorhiza hatagirea*, which couldbeapromisingsourceofanti-inflammatorydrugs.[12]

Conclusion

The herbal plants include seeds, berries, roots, leaves, bark, and flowers.Asearlyas3,000BC,ChineseandEgyptianpa pyrusliteraturementionthe medical applications of many plants. Herbal remedies have been employed in traditional medical systems such as Ayurveda. *D. hatagirea* belongs to the family Orchidaceae, genus Dactylorhiza, order Asparagales, clade Monocot, and primitive angiosperms. The plant thrives best in temperatetoalpineenvironments(2500–5000m)inthePakistaniHimalayanarea.The silk industry makes extensive use of *D. hatagirea* tubers as sizing material. Gardens are used to grow the plants for aesthetic reasons.Young shoots and leaves are also utilized as vegetables. The perfume industry uses the flower extract to boost aroma. The plant possess Neuro-Pharmacological Activity, Anti-Bacterial Activity, Anti-Cancerous Activity, Anti-Inflamatory Activity.

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Cite this article as:
Alchi Mo. M., Jain V. K. and Khabiya R. (2025). A review on *Dactylorhiza hatagirea* (D. Don) and its therapeutic application. *Int. J. of Pharm. & Life Sci.*, 16(4): 32-38.

Source of Support: Nil
Conflict of Interest: Not declared
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