



**A COMPREHENSIVE REVIEW ON ETHNOBOTANICAL APPLICATIONS AND
PHARMACOLOGICAL ACTIVITIES OF SATYRIUM NEPALENSE D.DON.
(ORCHIDACEAE)**

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ABSTRACT

Orchidaceae is one among the two largest families of angiosperms. Orchids are popular all over the world due to their wide spread ethnobotanical importance and the beautiful flowers they produce. In this review, ethnobotanical uses and pharmacological activities of a highly valuable Himalayan Orchid *Satyrium nepalense* D.Don is discussed by referring flora, journals, and search engines such as Google scholar, ScienceDirect and Pubmed. Ethnobotanical investigations have revealed the potential therapeutic role of tubers and roots of *S.nepalense* D.Don. The orchid is used in traditional medicine by local people for treating ailments like diarrhoea, malaria and dysentery. Its tubers are considered as tonic and are eaten by local inhabitants. Juice of tubers is taken for fever and also applied on cuts and wounds by various tribes. *S.nepalense* is investigated for various pharmacological activities too. Studies have revealed the potential of *S.nepalense* to exhibit a range of bioactivities such as antibacterial, antifungal and antioxidant activities. In conclusion, *S.nepalense* is an extensively used rare terrestrial orchid for medicinal purposes in several parts of the India and other countries. Major emphasis has to be given for the in-situ or ex-situ conservation of this medicinally important orchid species. *S.nepalense* can be a promising herb because of its pharmacological potential in various disorders.

KEYWORDS: Himalayan Orchids, Orchidaceae, *Satyrium nepalense*, Salam mishri, Salang-mishri Ethnomedicine, Antioxidant, Antimicrobial.

INTRODUCTION

The family Orchidaceae is the second largest family of flowering plants next to Asteraceae.(The Plant List, 2014) It represents the most diverse and highly evolved group of angiosperms with about 29000 species (coming under roughly 880 genera) which are widely distributed in various parts of the world. Approximately, it consists of 8% of all vascular plants. Their distribution vary from in terms of region and climatic conditions. Depending upon the habit in which they grow, orchids can be classified as epiphytes, lithophytes, terrestrials or saprophytes. Many orchids have common occurrence while some are rare and critically endangered. Orchids are very diverse with respect to size, color and shape of the flowers. They produce minute seeds and their germination occurs with the help of fungal symbiosis. Orchids produces extremely beautiful flowers (with distinct pollination mechanisms) and hence, they are grown for ornamental purposes for generating income

out of that. Moreover, orchid species are widely used traditionally all over the world as food and for treating various human and veterinary ailments. Different parts of the orchids such as roots, leaves and pseudo bulbs have found medicinal values. Studies have shown the potential of orchid extracts and purified compounds from orchids to exhibit a myriad of pharmacological activities including antimicrobial, anti-inflammatory, antioxidant, and anticancer activities. Orchids are widespread in distribution and are known to occur in tropical and temperate regions. India represents one of the biodiversity hotspots for orchids. Western Ghats, Eastern Ghats, Himalayas and North-east states of India harbor a variety of plant species including several orchid species, many of which are endemic to particular area. Indigenous medicinal systems such as Ayurveda, Unani and Siddha make use of several orchid species for remedy against certain kinds of ailments or disorders.

Uttarakhand (India) which is a storehouse for a rich variety of medicinal and aromatic plant species. One among them belongs to the orchid which occupies different habitats and exhibit greatly specialized morphological and physiological features. The state has 12 medicinally important species of orchid out of 237 species found in different surveys. Tubers or the pseudo bulb of most of the orchids are for medicinal purpose. Many of these valuable orchids like *Orchis mascula*, *O. latifolia* etc. face the extreme danger of extinction due to over-exploitation and habitat destruction.

Satyrium nepalense [Orchidaceae] (Kharkwal 2009) locally known as *Salang-mishri* is a terrestrial orchid of about 25-60cm height found on open grassy slopes and as forest undergrowth in montane to alpine Himalayas at an altitude of 2400-3000m. It is widely distributed in India from Kashmir to Arunachal Pradesh and S.India. It is also known to occur in other countries like Sri Lanka, Myanmar, Pakistan and China. *S.nepalense* is one of the medicinally important orchids and is reported to be ethno-medicinally useful for treating various illnesses including malaria, dysentery etc.

In this review, an extensive literature survey was conducted to compile data available on ethnomedicinal uses and pharmacological activities of *S.nepalense* by referring standard flora, journals, books and search engines viz. PubMed, Google Scholar and Science Direct.

PLANT DESCRIPTION^[1]

S.nepalense is an erect and glabrous herb which is about 30-60cm high; rootstock with 2-3 oblong tubers. Leaves usually 2-3, sub radical, ovate-lanceolate, acute, fleshy, base stem sheathing. Flowers fragrant, pinkish and to 1.5cm across, in dense, 10-30 cm long, terminal spikes; lower bracts leaf like, upper ovate-lanceolate, equaling the ovary. Odd sepal oblanceolate, obtuse; lateral ones oblong, spreading, pellucid dotted. Petals smaller than sepals, recurved. Lip erect, projecting upwards hook shaped, curved and with 2-parallel, down projecting spurs. Pollinia 2; glands large, pale white. Capsule ovoid, ribbed.

Flowering & fruiting: July to October

Vernacular name- *Salang-mishri*

ETHNOBOTANICAL USES OF *S.nepalense* D.Don

Himalayan plants have been a significant part of traditional medicine. All over the world, orchids have been used for medicinal purposes. *S.nepalense* is one among the several orchid species that find ethnomedicinal significance.

Locally known as *Salang mishri*, native people of Uttarakhand (India) used it as folk remedy in many ailments. Decoction of tubers, roots and stems of the plant has been used in multiple infectious diseases and also as a nutritional supplement since ancient times.^[2] Its

tubers are edible which are used as tonic and also in diarrhoea, malaria and dysentery.^[3] The dried and powdered tubers of *S.nepalense* is consumed as an energizing tonic by the Todas of Nilgiris (a tribe in Himachal Pradesh). They are also used medicinally.^[4] Juice of leaves are used by locals of Nepal to cure fever and also applied on cuts and wounds.^[5,6] Fresh tubers are consumed after cooking and dried ones are sold as '*salammisri*' and regarded as tonic and also reported to be useful in malaria and dysentery.^[7] The tubers of *Satyrium nepalense* are used as tonic.^[8] Tribal people in Karnataka combine the tubers of *Satyrium nepalense* with tubers of other orchids to treat malaria and dysentery (Rao 2007). Tubers are used as a tonic and to treat malaria and dysentery by local people in Nepal (Baral & Kurmi 2006). In Chinese traditional medicine, people of Yunnan use this herb to treat low backache, chronic nephritis and weak kidneys.^[9]

Its tubers are eaten by Monpa tribe (in Arunachal Pradesh and Tibet) as the remedy for malaria, dysentery and as an aphrodisiac (Lawler 1984; Vij 1995; Rao and Sridhar 2007).

PHYTOCHEMICALS IDENTIFIED IN *S.nepalense* D.Don

Orchids are known to produce a myriad of phytochemicals including alkaloids, triterpenoids and phenolic compounds. Incredible advancement in spectral and chromatographic techniques resulted in the recovery and elucidation of structures of many phytochemicals from natural products including orchids. Studies have been carried out to detect phytochemicals/phytochemical groups in *S.nepalense*. *Satyrium nepalense* extracts showed the presence of carbohydrates/ glycosides, alkaloids, saponins, flavonoids and unsaturated sterols/triterpenes.^[10] Phytochemical screening of different extracts of tubers of *S. nepalense* was carried out by standard qualitative chemical tests. The results showed the presence of carbohydrates, glycosides and flavonoids in methanol and water extract; phenolic compounds were present in ethyl acetate and methanol extract, whereas alkaloids were absent in all tested samples. Saponins, proteins and amino acids were detected in aqueous extract, whereas tannins and resins were found in chloroform, ethyl acetate and methanol extract. Unsaturated sterols/triterpenes were present in petroleum ether, chloroform and methanol extract. (Abhay P. Mishra et al. 2018)

PHARMACOLOGICAL ACTIVITIES OF *S.nepalense* D.Don

To investigate the biological activities of *S.nepalense*, several studies have been carried out so far. The plant is reported to exhibit various bioactivities like antibacterial, antifungal and antioxidant activity. A brief description on pharmacological potential of *S.nepalense* is discussed below.

Anti-oxidant Activity

Abhay P. Mishra *et al.* screened the antioxidant activity of different extracts (petroleum ether, chloroform, ethyl acetate, methanol and water) of *S. nepalense* tubers by 2,2-diphenyl-1-picrylhydrazyl-hydrate (DPPH) radical scavenging method. Among all tested fractions, methanol extract showed the highest antioxidant activity (34.18 µg/mL IC₅₀), comparable to that of ascorbic acid used as standard (25.83 µg/mL IC₅₀).

The antioxidant activity of concentrated *ethanol* extract of tubers of *S. nepalense* was determined through DPPH method by SINGH, D. K. (2019).

Anti-microbial Activity

Abhay P. Mishra *et al.* determined the antimicrobial activities of various extracts of *S. nepalense* by the disc diffusion assay and the minimum inhibitory concentration (MIC). Antibacterial activity of the extracts were tested in-vitro against ten micro-organisms (including Gram-positive and Gram-negative species). All of them showed antimicrobial activity. Methanol extract possess the highest antimicrobial activity against both strains.

Bhatnagar *et al.* demonstrated *S. nepalense* as the most promising plant in their study involving antimycobacterial, leishmanicidal and antibacterial activity followed by *R. retusa* and *T. curculioides*.

Antibacterial potential of ethanol extract was assessed by SINGH, D. K. (2019) against three gram-positive and three gram negative bacteria, where the tested sample expressed broad spectrum activity against both strains, higher being against gram-positive followed by gram-negative bacteria.

Tuber extract shows potent antibacterial activity against four bacterial strains i.e., *Streptococcus mutans*, *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Klebsiella pneumoniae*.^[11]

Anti-fungal Activity

The ethanol extracts of tubers of *S. nepalense* was found effective against *Aspergillus flavus* and *Fusarium oxysporum*.^[12]

CONCLUSIONS

Orchids differ from other groups of plants with respect to distinct floral morphology, association with mycorrhizae, pollination pattern and production of tiny seeds. Since time immemorial, orchids have aesthetic and medicinal values as well as economic importance. Habitat loss and overexploitation seems to be the important threat for existence and dwelling of orchids in natural habitats. An extensive literature survey carried out in this study revealed the potential medicinal uses of tubers, roots, leaf and flowers of *S. nepalense*. The plant is widely used for treating several ailments including diarrhoea, malaria and dysentery. The plant is reported to exhibit some

valuable biological activities like antimicrobial, anti-fungal and antioxidant activity. *S. nepalense* seems to be a boon for the development of novel therapeutic agents and nutraceuticals. For conservation of this medicinal orchid species, more emphasis has to be given to its in-situ and ex-situ protocols.

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CONFLICTS OF INTEREST

None declared

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