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A review on *Nardostachys jatamansi* DC a flowering plant with therapeutic and pharmacognostic profiles

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Abstract

Nardostachys jatamansi DC is an endangered, primitive and therapeutic agent in the family Valerianaceae. It is a reputed Ayurvedic herb and used in various multiple formulations. *jatamansi* has been used in the treatment of many disease and has several activities including anticonvulsant activity, anti parkinson's activity, tranquillizing activity, hepatoprotective, neuroprotective, hypotensive, anti-diabetic activity. The rhizome of *jatamansi* is used as an aromatic adjunct in the preparation of medicinal oils, to promote hair growth and blackness, The roots of the herb is used in the preparation of an essential oil found to have fungi toxic activity. But this reputed plant species have become critically endangered and requires various conservation strategies. The review summarizes the conservation methodologies being investigated on the plant as well as its phytochemical and pharmacological investigations.

Keywords: *N. jatamansi*, hepatoprotective, neuroprotective, anti-parkinsons, anti-diabetics

Introduction

Nardostachys jatamansi DC. is important plant of the family Valerianaceae. It is commonly known as Indian spikenard and found in Himalayas. Flowers are dark pink in colour. *N. jatamansi* is a perennial herb. Rhizomes occurs in short pieces, has dark grey color and typical smell. Leaves are sessile and ovate. A species has very long history of use as medicine in Ayurveda, Homeopathy, ethno medicine and Indian System of Medicine (ISM) to modern medicine industry which is distributed in the Himalayas from Pakistan, India (Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim) to Nepal, Tibet and China [1]. Various methods should be used for its conservation, in situ as well as ex situ being a few. The rhizome of the herb is considered as the official plant part, found to have excellent therapeutic potential. As mentioned in Ayurveda, the roots and the rhizomes of *Nardostachys jatamansi* DC. are used to treat epilepsy, hysteria, syncope and mental weakness [2]. In India, the rhizomes and roots are being marketed as an anticonvulsant Ayurvedic drug known as Ayush 56 and also used as an antistress agent [3]. The rhizome of *jatamansi* is used as an aromatic adjunct in the preparation of medicinal oils, to promote hair growth and blackness [4]. The roots of the herb is used in the preparation of an essential oil found to have fungi toxic activity [5], antimicrobial [6], antifungal [7], hypotensive [8], antiarrhythmic [8] and anticonvulsant activity [8, 9]. *Nardostachys jatamansi* possess many activities like anti depressant activity, anticonvulsant activity, antiarrhythmic activity, CNS activity, neurotropic activity, Antiparkinson activity, antioxidant activity, Antidiabetic activity, cardioprotective activity and possess hepatoprotective activity ,useful in Alzheimer & cerebral ischemia, have antifungal property, anxiolytic & hypolipidimic activity [10]. *Jatamansi* has been traditionally used in treatment of wide range of disorders, which include digestive system, circulatory system, nervous system, respiratory system, urinary system, reproductive system and skin diseases. It also shows marked tranquillizing activity, hypotensive, hypolipidemic, hepatoprotective, neuroprotective, anti-ischemic, antiarrhythmic and anticonvulsant activities [11].

Botanical Classification

Kingdom :	Plantae.
Division :	Mangoliophyta.
Class :	Mangnoliopsida.
Order :	Dipsacales.
Family :	Valerianaceae.
Genus :	Nardostachys.
Species :	Jatamansi.
Botanical name :	<i>Nardostachys jatamansi</i> DC
Part used :	Rhizomes, Rhizome oil.

Chemical Composition

Alpha-patchoulene, angelicin, beta-eudesmol, beta-patchoulene, beta-sitosterol, calarene, calarenol, elemol, jatamansin, jatamansi oil, jatamansone, n-hexacosane, n-hexacosanol, n-hexacosanyl arachidate, n-hexacosanyl isoverate, nardol, nardostechone, norsechelanone, oroselol, patchouli alcohol, seychelane, seychellene, valeranal, valeranone. Volatile essential oil, resins, sugar, starch, bitter extractive matter, gum, ketone, sesquiterpin ketone, spirojatamol etc [12, 13]. Other sesquiterpenes include nardin, nardal, jatamnsic acid, b- maline and patchouli alcohol [14]. Various other sesquiterpenes known are nardostachone, dihydrojatamansin, jatamansic acid [15], jatamansinone, oroseolol, oroselone, seselin, nardostachyin, nardosinone, spirojatamol [16], jatamol A and B [17], calarenol [18], seychellene, seychelane, coumarin: xanthogalin [19]. An alkaloid named actinidine has also been reported. Nardal has been found as an active component [20].

Pharmacological Activities**1) Cardio protective activity-**

Doxorubicin at the dose of 15 mg/kg, i.p. administered rats showed myocardial damage that was demonstrated by the elevation of serum marker enzymes [lactate dehydrogenase, creatine phosphokinase, aspartate amino transaminase and alanine amino transaminase]. The animals showed significant changes in the antioxidant enzymes [superoxide dismutase, glutathione peroxidase catalase and glutathione-S-transferase] and lipid peroxidation levels. Pre-treatment with *N. jatamansi* extract significantly prevented and restored the antioxidant enzyme activity and lipid peroxides to near normal levels [21].

2) Antifungal and Antibacterial activity

Nardostachys jatamansi was tested for antimicrobial activity along with other 61 medicinal plants belonging to 33 different families against some microorganisms. In the study screening of antimicrobial action was done by dilution of agar by 500 µg/ml and 1000 µg/ml and all the extracts were tested along with *Nardostachys jatamansi* against *Saccharomyces cerevisiae*, *Aspergillus niger*, *Candida albicans*, *Streptococcus faecalis*, *Klebsiella pneumonia*, *Klebsiella pneumonia*, *Staphylococcus epidermidis* [22]. Methanolic extract of *Nardostachys jatamansi* is effective against most of the microorganisms there by justifying its role as antimicrobial and antifungal agent [23, 24].

3) Hepatoprotective Activity

Pre-treatment of rats with 800 mg/kg, p.o. of the 50% ethanolic extract of the rhizomes of *N. jatamansi* significantly lowered the elevated levels of serum transaminases [aminotransferases] and alkaline phosphatase in thioacetamide treated group of animals. The hepatoprotective activity was shown by the normalization of various serum

enzymes elevated in response to thioacetamide-induced liver damage [25].

4) Anticonvulsant activity

Rao VS *et al.* studied ethanol extract of the roots of *N. jatamansi* DC was studied for its anticonvulsant activity and neurotoxicity, alone and in combination with phenytoin in rats. The result shows a decrease in the extension/flexion ratio which indicates a significant increase in the seizure threshold by *N. jatamansi* root extract against maximal electroshock seizure model and exhibited minimal neurotoxicity against rota rod test. When given in combination with 50mg/kg of *N. jatamansi* root extract, an increase in the protective index of phenytoin was recorded. Thus the effect of phenytoin alone and in combination with *N. jatamansi* extract is clearly demonstrated [26].

5) Antidepressant activity

The antidepressant activity of methanolic extract of *N. jatamansi* by forced swim test (FST), tail suspension test (TST) and locomotor activity in inbred male Swiss was determined. The efficacy of the extract at the dose of 200 and 400 mg/kg, p. o. was compared with the standard drug imipramine [10 mg/kg, p. o.] in normal and sleep deprived mice. *N. jatamansi* at the dose of 200 and 400 mg/kg,p.o produced significant [$P<0.001$] antidepressant like effect in normal and sleep deprived mice in both TST and FST and their efficacies were found to be comparable to imipramine at the dose of 10 mg/kg, p.o. It did not show any significant change in locomotor functions of mice as compared to normal control. However it significantly [$P<0.01$] improves the locomotor activity in case of sleep deprivation which is comparable to normal control. This finding suggests that *N. jatamansi* has dose dependent antidepressant activity and can also be used in patients suffering from depression due to sleep disturbances [27].

6) Antioxidant activity

The antiperoxidative property of jatamansi was investigated as an iron-induced lipid peroxidation model in rat liver, quantified by thiobarbituric acid reactive substance (TBARS) content. They have observed in their study that the extract provide protection against lipid peroxidation [28]. In other study an aqueous root extract of jatamansi was investigated for its antioxidant and anti cataleptic effects on haloperidol-induced catalepsy rat model of the disease by measuring various behavioural and biochemical parameters [29]. jatamansi is an important medicinal plant mentioned in Ayurveda and Unani system used for treatment of various diseases. The different studies done on animals provide a significant effect of the different activities mentioned in traditional treatise. *N. jatamansi* has many properties with minimum animal studies which provide the researchers a platform to do research on those activities to scientifically validate the finding and serve the humanity. The rhizomes are traditionally used as immunomodulators, and give various other activities like antiparkinsons, antidiabetic, nootropic activity etc. [30].

7) Antidiabetic activity

The extract of jatamansi has been shown to a significant hypoglycemic activity. It decreases glucose level significantly in diabetic and non-diabetic rats as compared to respective controls [30]. The present study was carried out to evaluate the antidiabetic activity of *Nardostachys jatamansi* ethanolic

rhizome extract in alloxan induced diabetic rats for 7 days. The ethanolic extract at high dose (1400 mg/kg) exhibited significant antihyperglycemic activity than at low dose (500 mg/kg) in diabetic rats. The results showed that it has significant antihyperglycemic effect in experimental model of diabetes mellitus^[31].

8) Antiparkinson activity

Ahmad *et al.* administered rats with 200, 400, and 600 mg/kg body weight of *N. jatamansi* roots for 3 weeks. The right striatum was infused with 2 µl of 6-OHDA (12 µg in 0.01% in ascorbic acid-saline) on day 21, while 2 µl of vehicle was infused in the sham-operated group. The neurobehavioural activity in the rats were tested after three weeks of 6-OHDA injection which were then sacrificed after 6 weeks in order to evaluate lipidperoxidation, reduced glutathione content, the activities of glutathione-S-transferase, glutathione reductase, glutathione peroxidase, superoxide dismutase and catalase, quantification of catecholamines, dopaminergic D2 receptor binding and tyrosine hydroxylase expression. The alterations caused by 6-OHDA injections such as increase in drug-induced rotations and deficits in locomotor activity and muscular coordination were extensively and dose-dependently restored by *N. jatamansi*. Thus attenuation of Parkinsonism might be enhanced using the extract of *N. jatamansi* as indicated by this study^[32].

9) Anxiolytic activity

Nardostachys jatamansi has profound applications against pharmacological interventions and is categorized as a hypno-sedative drug according to Ayurveda. In the present study probable mechanism of anxiolytic action of *Nardostachys jatamansi* extract (NJE) was studied using behavioral anxiolytic tests (Elevated plus maze, Open field test, Light dark box test, and Vogel's conflict test) in mice. Mice were treated orally with NJE (250 mg/kg) for 3, 7 and 14 days or diazepam (1 mg/kg) followed by behavioral assessment and estimation of monoamine neurotransmitters, GABA, and antioxidant enzymes. Treatment of mice for 7 days caused an increase in time spent in open arms in elevated plus maze, number of line crossings in open field test, increased time spent in lit compartment of light-dark box test, an increase in number of licks made and shocks accepted in Vogel's conflict test, with results comparable to diazepam and this treatment also caused a significant increase in monoamine neurotransmitters and GABA in brain and tissue antioxidant parameter^[33].

10) Cardioprotective activity

Doxorubicin at the dose of 15 mg/kg, i.p. administered rats showed myocardial damage that was demonstrated by the elevation of serum marker enzymes [lactate dehydrogenase, creatine phosphokinase, aspartate amino transaminase and alanine amino transaminase]. The animals showed significant changes in the antioxidant enzymes [superoxide dismutase, glutathione peroxidase catalase and glutathione-S-transferase] and lipid peroxidation levels. Pre-treatment with *N. jatamansi* extract significantly prevented and restored the antioxidant enzyme activity and lipid peroxides to near normal levels^[34].

Conclusion

N. jatamansi is an important medicinal plant mentioned in Ayurveda and Unani system used for treatment of various diseases. The different studies done on animals provide a significant effect of the different activities mentioned in

traditional treatise. *N. jatamansi* has many properties with minimum animal studies which provide the researchers a platform to do research on those activities to scientifically validate the finding and serve the humanity. The rhizomes are traditionally used as immunomodulators, and give various other activities like antiparkinsons, antidiabetic, nootropic activity etc.

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