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A review article on phytochemistry and pharmacological profiles of *Nardostachys jatamansi* DC-medicinal herb

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Abstract

Nardostachys jatamansi [Family *Valerianaceae*] is a perennial herb found in Alpine Himalayas. *N. jatamansi* used for long period in various chronic diseases therapeutically.

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, antiparkinson's activity, tranquillizing activity, hepatoprotective, neuroprotective, hypotensive, anti-diabetic activity. The objective of current review is to search literature for the pharmacological properties, safety/toxicity studies, phytochemical investigation and pharmacognostic studies of *N. jatamansi*. Complete information about the plant has been collected from various books, journals etc.

Keywords: Pharmacological, Phytochemical, *N. jatamansi*, sesquiterpenes, uses.

1. Introduction

Nardostachys jatamansi DC. is a small, perennial, dwarf, hairy, rhizomatous, herbaceous, endangered and most primitive species within family *Valerianaceae*. The 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]. It is obtained from wild and cultivated plants in Britain, The Netherlands, Belgium, France, Germany, eastern Europe and Japan. Polyploidy occurs in *V. officinalis* and there are diploid, tetraploid and octaploid types^[2].

2. History

The word '*Valeriana*' is the first met with in writings of the ninth and tenth century^[2]. The plant has been valued for centuries in Ayurvedic in Indian, Unani in ancient Greek and Arab, and in ancient Egypt and Rome for its medicinal values. The powdered root of *N. jatamansi* is also mentioned in some Islamic traditions as the fruit which Adam ate in Paradise, which God had forbidden him to eat. *N. jatamansi* is also used to season foods in Medieval European cuisine, especially as a part of the spice blend used to flavour. Hippocrates used in sweetened and spiced wine drink^[10]. The rhizomes of the plant are used in Ayurvedic system of medicine as a bitter tonic, stimulant, antispasmodic, epilepsy and to treat hysteria^[11].

3. Pharmacognostic profile

3.1 Botanical classification^[3, 4]

Nardostachys grandiflora DC or *Nardostachys jatamansi* DC belongs to the family Valerianaceae. Botanical classification of the plants is given below.

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

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Fig: Aerial Parts of *Nardostachys jatamansi* dc

3.2 Common Names [5, 6, 7]

Languages	Vernacular Names
Sanskrit	Jatamansi, Bhytajata, Tapaswani
English	Musk-root, Indian spikenard, Indian nard
Hindi	Balchara, Jatamansi
French	Nard Indian
Kashmir	Bhutijata
Punjab	Billilotan
Marathi	Jatamavshi
Tamil	Jatamanji
Assamese	Jatamamsi
Bengali	Jatamamsi

3.3 Geographical source

These plants are found in the Alpine Himalayas at altitude of 3000-5000 meters, extending East wards and Kumaon to Sikkim and Bhutan. [8, 9]

3.4 Macroscopic Characters [8, 12]

The leaves are rosy, slightly pink or blue in dense cymes.
 Colour: Dark grey rhizomes are crowned with reddish brown tufted fibres.
 Odour: Highly agreeable, aromatic.
 Size: Rhizomes are 2.5 to 7.5 cm in length.
 Shape: Elongated and cylindrical.

3.5 Microscopical Character [2]

A transverse section of the rhizome shows a thin periderm, a large parenchymatous cortex which is rich in starch and an endodermis containing globules of volatile oil. Within a ring of collateral vascular bundles lies a large pith containing scattered groups of sclerenchymatous cells.

3.6 Chemical Constituents

Nardostachys jatamansi consist of following constituents but the main active constituents in the plant material are sesquiterpenes and coumarins [13]. Jatamansone or valeranone is the principal sesquiterpene [14]. The other sesquiterpenes includes Alpha-patchouli-ol, angelicin, β -eudesmone, β -atchoulense, β -sitosterol, calarene, elemol, jatamansin, jatamansinol [15], jatamansone, n-hexacosanyl, n-hexacosane, Orosolol, patchouli alcohol, valeranal, valeranone, nardostachnol, seychellene, seychelane, nardostachone [16, 17]. (+) volatile oil essential oil, resin, sugar, starch, bitter

extractive matter, gum, ketone, jatamansic acid [17], jatamansone semicarbazone, lupelol, Malliene, Calarenol [18], terpenic, coumarin-jatamansin, propionate, cyclohexanal ester, heptacosanyl pentanoate are isolated from rhizomes [9], diethaniod bicyclic-ketone-nardostachone, An alkaloid named actidine has also been reported, Nardal has been reported to be an active component [19].

3.7 Phyto-Chemistry

The rhizomes and roots of the plant have medicinal value and, therefore, have been the focus of chemical studies [18]. Chatterjee *et al.* undertook the chemical examination of the rhizomes in detail leading to the isolation of a new terpenoid ester, nardo-stachysin [20]. *N. jatamansi* has been discovered with both volatile and non-volatile constituents. Sesquiterpenes contribute to the major portion of the volatile compounds while sesquiterpene, coumarins, lignans, neolignans, alkaloids form the major components of the non-volatile extracts [21, 22]. Sesquiterpenes and coumarins are present in considerable amount in the roots of *jatamansi* plant mainly responsible for its essential oil [13].

3.8 Adulterant [9]

It is adulterated with rhizomes of *Selinum vaginatum* (Apiaceae) which contains a volatile oil.

3.9 Action and Uses in Ayurveda and Siddha [23]

Medhya (Brain tonic), Rasayana (Rejuvenative to the mind), Nidhrajnana (Promotes sleep), Manasrogaghna (Alleviates mental diseases), Pachana (Digestive), Kasawasahara (Alleviates- coughs and breathing difficulties), Kushtaghna (Stops skin diseases and itching), Dahaprasha- mana (Stops burning sensations), Varnya (Benefits complexion) and Roma sanjanana (Promotes- hair growth).

3.10 Action and Uses in Unani [24]

In the Unani system of Medicine, *N. jatamansi* DC is used as hepatoprotective, cardio-tonic, diuretic and analgesic.

3.11 Uses

- N. jatamansi* is primarily used in modern medicine for cognitive and neurological function benefits.
- Jatamansi relieves symptoms like vertigo, seizures etc. in fever.
- Jatamansi oil possess antiarrhythmic activity and also used as a flavouring agent in the preparation of medicinal oil [8].
- The medicated jatamansi oil is extremely beneficial for smooth, silky and healthy hair.
- It has protective effect in epilepsy, cerebral ischemia, liver damage [24, 25].
- It is used in mental disorder, insomnia, hypertension and heart diseases [26].
- It is very effective in producing typical non- specific stress manifestation [27, 28].
- It is used as a carminative, as an antispasmodic in hysteria [2], palpitations and convulsion [29, 30], seminal debility [31].
- It also recommended in scorpion sting [32].
- The herb increases appetite, relieves the phlegm in cough and asthma, proves useful in hepatitis and treats enlargement of the liver.

3.12 Preliminary Phytochemical Screening

Preliminary phytochemical investigation for the presence of various phytoconstituents like glycosides, flavanoids, steroids, saponins, phenolic compounds [33, 34], alkaloids, proteins, tannins, terpenes, lignin's, volatile oils and fats etc [35, 36].

4. Pharmacological Activity

4.1 Antifungal-Activity

N. jatamansi essential oil demonstrated fungi static activity against *Aspergillus flavus*, *Aspergillus niger* and *Fusarium oxysporum* [37] *Mucor fragilis*, *Rhizopus stolonifer* and this oil was found to be fungi static of fungicidal to one or the molds, depending upon the concentration [38].

4.2 Hepatoprotective Activity

The roots extract of *jatamansi* also possess the hepatoprotective activities and it has been proved by several studies. Pre-treatments of rats with 800 mg/kg body wt of the 50% ethanolic extract of *N. jatamansi* DC demonstrated significant hepatoprotective activity against thioacetamide induced hepatotoxicity. Marked reduction in raised levels of serum transaminase and alkaline phosphatase was observed. Pre treatment of the animals with the extract further resulted in an increase in survival in rats intoxicated with LD₉₀ dose of the hepatotoxic drug [24].

4.3 CNS Activity

Valeranone prolonged barbiturate anesthesia, impaired rotarod performance, inhibited electroshock convulsions, and Potentiated the hypothermic effects [14]. Limited results from behaviour- ral tests revealed that an extract from *N. jatamansi* exhibited significant antidepressant activity [39].

Studied the effect of acute and sub chronic administration of alcoholic extract of the roots of *N. jatamansi* DC on nor epinephrine (NE), dopamine (DA), serotonin (5-HT), 5-hydroxyindoleacetic acid (5-HIAA), gamma-amino butyric acid (GABA), and taurine on male albino Wistar rats. The acute oral administration of the extract did not change the level of NE and DA but resulted in a significant increase in the level of 5-HT and 5-HIAA. A significant increase in the level of GABA and taurine was observed in the drug-treated groups when compared to the controls. A 15-day treatment resulted in a significant increase in the levels of NE, DA, 5-HT, 5-HIAA, and GABA [40].

4.4 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 results demonstrated a significant increase in the seizure threshold by *N. jatamansi* DC root extract against maximal electroshock seizure (MES) model as indicated by a decrease in the extension/flexion ratio.

However, the extract was ineffective against pentylene-tetrazole-induced seizures. Further, pre-treatment of rats with phenytoin at a dose of 12.5, 25, 50 and 75 mg/kg in combination with 50 mg/kg of *N. jatamansi* DC root extract resulted in a significant increase in the protective index (PI) of phenytoin from 3.63 to 13.18 [41].

4.5 Neuroprotective Activity

Salim S *et al* pre treatment with an alcoholic extract of *N. jatamansi* DC dosed at 250 mg/kg of for 15 days protected rats against focal ischemia caused by middle cerebral artery

occlusion. The protective effect may be associated with improving glutathione content, inhibiting lipid peroxidation, and activity on the Na⁺/K⁺ ATP ase and catalase enzyme systems [42].

4.6 Antiparkinson's Activity

Parkinson's disease is a most common neurodegenerative diseases, and oxidative stress has been evidenced to play a vital role in its causation. It was evaluated that the ethanolic extract can slow the neuronal injury in caused by parkinson's rats.

Ahmad M *et al.* treated with 200, 400, and 600 mg/kg of *N. jatamansi* DC roots for 3 weeks in rats. Antiparkinsonism activity was studied on 6-OHDA (12 µg in 0.01% in ascorbic acid-saline) induced Parkinsonism. Three weeks after the 6-OHDA injection, the rats were tested for neuro behavioural activity and quantification of catechol amines, antioxidants, dopaminergic D2 receptor binding and tyrosine hydroxylase expression were also estimated. The increase in drug-induced rotations and deficits in locomotor activity and muscular coordination due to 6-OHDA injections were significantly and dose-dependently restored by *N. jatamansi* DC [43].

4.7 Tranquilizing Activities

German R *et al* investigated sesquiterpene valeranone (*Yatamanson*) isolated from *Nardostachys jatamansi* DC rhizomes for tranquilizers activity in rodents and significantly the prolongation of barbiturate hypnosis, the impairment of rotarod performance, as regards the hypotensive property was demonstrated [44].

4.8 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 [45]. In other study an aqueous root extract of *jatamansi* was investigated for its antioxidant and anticataleptic effects on haloperoidal-induced catalepsy rat model of the disease by measuring various behavioural and biochemical parameters [46].

4.9 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 [47]. The present study was carried out to evaluate the antidiabetic activity of *N. jatamansi* ethanolic extract in alloxan induced diabetic rats for 7 days. The ethanolic extract at high dose (1200 mg/kg) exhibited significant antihyperglycemic activity in diabetic rats. The results showed that it has significant antihyperglycemic effect in experimental model of diabetes mellitus [48].

4.10 Others activity

Animal studies done on *jatamansone* have reported anti estrogenic activity [49], moreover, *jatamansone* have reported antiarrhythmic and antihypertensive activity [50], Anti asthmatic activity [51], nematicidal activity [52] and antibacterial activity [53].

5. Discussion

N. jatamansi is an essential herb with multiple remedies. It is important plant of Ayurvedic material medica. Present review

states that the *N. jatamansi* has so many pharmacological activity, thereby increasing the use of it. Conservation and sustainable use of biodiversity is the basic requirement to save the valuable plant *N. jatamansi* is one of them. It is very useful plant due to several medicinal properties but overexploitation makes plant status crucial and demand proper Conservation.

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