

An insight of *Nardostachys jatamansi* (Valerianaceae): A Review

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Abstract

Jatamansi is a renowned Ayurvedic medicinal herb used since ancient times to treat various disorders. It's a perennial herb with scientific name *Nardostachys jatamansi*, belongs to family Valerianaceae and is found in alpine regions in Himalyas. It is also known by various names such as *Mansi*, *Jatamansi*, *Baalchad*, *Kalichad*, *Balchara*, *Bootajata*, *Jatamanchi*, Nardus root and Spikenard having various active constituents such as: light yellow essential oil with pleasant smell, jatamansone, jatamansin, nardostachone and actinidine. The drug has varied effects on various systems of body for example on nervous system it is *sangyasthapan* (which restores consciousness), *medya* (brain tonic), *nindrajanan* (which induces sleep) etc. The plant pacifies all the three doshas (*vata*, *pitta* and *kapha*) therefore it possesses tridoshahar action. Beside these actions, many studies have been describing multidimensional pharmacological activities of Jatamansi. It is used in various formulations commercially. This review deals with ancient to modern approach of *Nardostachys jatamansi* based on phytoconstituents and pharmacological studies.

INTRODUCTION

Nardostachys jatamansi DC belongs to the Valerianaceae family and is a famous Ayurvedic herb. The roots and rhizomes of Jatamansi are used in India from ancient time. Acharya Charaka described it as anti-pruritis whereas Sushruta has described it as rakshoghan dravya (it is corelated to the disinfectant and aseptic procedures of modern science).^{1,2} In Sarangadhar Samhita, it is mentioned as one of the ingredients of lavangadi churna.³ In various Nighantus like Raj Nighantu, Priya Nighantu, Shankar Nighantu, Dhanvantri Nighantu, Nighantu Adarsh and Bhavpraksh Nighantu its synonyms and properties are mentioned.^{4,5,6,7,8} It is collected from alpine Himalayas at the altitude of 3000-5000m in India, Nepal and Pakistan. It has three varieties: *Nardostachys grandiflora*, *Nardostachys chinesis* and *Nardostachys gracilis*.^{9,10} The rhizome of plant has various properties such as anti-consultant, anti-microbial, anti-fungal, anti-arrhythmic activities. The oil of the plant is used as a poison antidote for treating insomnia and as a sedative.^{11,12}

Conceptual study:

Jatamansi is extensively described in various literatures, such as: Charaka Samhita, Sushruta Samhita, Nighantu Adarsh, Bhavaprakash Nighantu, Priya Nighantu, Shankar Nighantu, and Raj Nighantu. Its equivalent words reported in different literature are recorded in table 1. The ayurvedic properties of the plant are reported in table 2.

Table 1: Vernacular names of Jatamansi^{10,11,12,13,14,15}

Language or place	Name
Sanskrit	mamsi, jaa, jaila, bhytajata, jatamansi, mansi, jatila, pishita, mishi, kravyadi, peshi, jata, hinstra, mata, nalda, maishi, jatavati, tamshi, sugandhmansi, sulomsa, akash mansi, bhootjata, keshini, jata, mansini, jatala, chakarvartani, phaldanksha, tapasvani, krishnajata, vilomasa, mura, bhutabjata, janini, mrigbaksha
Hindi	balchara, bal-chir, jatamansi
English	nardus root, musk root, Indian spikenard, Indian nard, spike nard
Bengali	jatamamsi, balchara
Guajarati	baalchad, kalichad, jatamansi
Kannada	bhootajata, ganagila maste, jatamansi
Kashmiri	Bhutijata
Malayalam	manchi, jatamanchi, jatamansi, balchara
Marathi	jatamansi, jatamavshi
Oriya	Jatamansi
Punjabi	billilotan, balchhar, chharguddi, jatamansi
Assamese	jatamamsi, jatamangshi, jatamansi
Telugu	jatamansi, jatamams, balchara, jatamanshi, jatamansi
Urdu	sambul-ut-teeb
Tamil	jatamanji, jatamansi

Table 2: Ayurvedic properties^{10,11,12}

Rasa (taste)	Madhur (sweet), Tikta (pungent), Katu (bitter), Kashaya (astringent),
Guna (properties)	Laghu (lightness), Snigdha (unctuousness)
Virya (potency)	Sheeta (cold)
Vipak (metabolism)	Katu (bitter)
Doshkarma	Tridosahar

Habitat

It is perennial herb propagated by its underground parts. It is distributed throughout the alpine and a sub alpine region of India at the height of 3300-5000 m in Himalayan region from Punjab to Sikkim and in Bhutan. The plant grows on the open stony and the grassy slope. It is also distributed in South West China, Sikkim, Afghanistan, Nepal, and Pakistan.^{12,13,16}

Morphological characters

Leaves are long pink or blue, rosy in dense cymes, ovate and sessile.

Flowers are usually oblong, bracts having white creamy sometimes rosy or slightly pink in color present in clusters. Corolla is 4 in number and having 5 lobes capitate stigma, acuminate apex. Calyx is present a top of the ovary.

Rhizomes of the plant are dark grey in color, covered with brown hairs. Internally it is reddish brown in color.

Fruit of the plant is shaggy small up 4 mm in length.^{11,12,17,18}

Microscopical characters

The transverse section of the rhizome shows the several layers of flattened polyhedral cells. It also contains the prismatic crystals with it. Oil cells with the brown color are prominent, it also contains vascular bundles, in periphery number of spiral vessels, endosperm, parenchymatous cells and idoblasts and starch grains are present.^{10,13,19}

Different actions of *Nardostachys jatamansi*

Some of the actions of plant are: *dahaprasmanan* (which subsides the burning sensation), *vednasthapan* (analgesics), *vranya* (which improves the complexion), *sangyasthapan* (which restoring the consciousness), *medya* (brain tonic), *nidrajanan* (which induce sedation), *balya* (which improves the muscular strength), *deepan* (promoting the appetite), *pachan* (digestives, help in digestion), *anuloman* (carminative, which prevent the formation of gas in GIT), *yakritutejak* (which stimulate the liver), *hridaya* (cardio-protective), *vajikaran* (aphrodisiac), *juwarghan* (anti-pyretic), *artavajanan* (which encourages menstrual bleeding), *swedjanan* (which promoting sweat), *kusthaghan* (which prevent the skin diseases), *keshvardhak* (which promote hair growth).^{10,11,12}

Part used

Root, rhizome^{10,11,17,19}

Dose

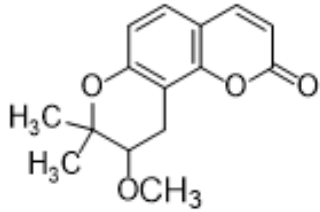
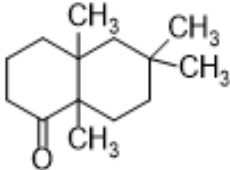
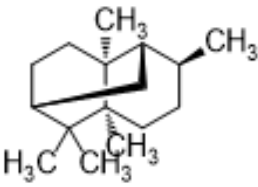
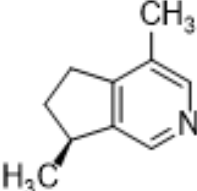
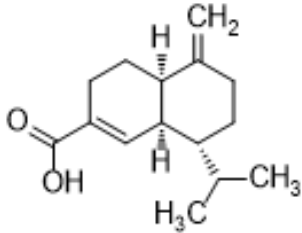
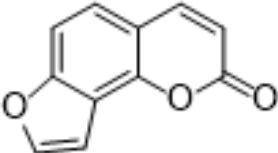
1-3 gm or 2-4 gm^{10,11,16,17}

Chemical constituents

Rhizomes and roots of the plant contains number of chemical constituents such as essential oil which is pale yellow in color and has pleasant odour. It is rich in coumarins and sesquiterpines (jatamansone, valerone, jatamansol, jatamansic acid, dihydrojatamansin, nardosatchone). Some other constituents are jatamol A, jatamol, nardosinone, spirojatamol, patchouli alcohol, jatamansinone, oreoseoloi, oroseolol, oreselone,

valeranal, seselinardostachyins, seychelane, sugar, resins, starch etc. The structure of important constituents is reported in table 3.^{10,17,19,20}

Table 3: Chemical structure of chemical constituents

 <p style="text-align: center;">Valeranol</p>	 <p style="text-align: center;">Jatamansone</p>
 <p style="text-align: center;">Patcholi alcohol</p>	 <p style="text-align: center;">Nardostachone</p>
 <p style="text-align: center;">Jatamansic acid</p>	 <p style="text-align: center;">Angelicin</p>

Adulterant

This plant is adulterated with rhizomes of *Selinum vaginatum* (Apiaceae) which contains a volatile oil.¹⁶

Few formulations

Rakshoghan ghril, sarvoshadhisanan, mansyadi kwath, madhuparnyadi taila, changeri ghrila, kulathadi ghrila, hriberadi ghrila, khadiradi gutika, padma taila, amritadi taila, madhuparnyadi taila, tapaswini vati, jestalabangadi, rachhognaghril, jatamansi ark and mansi churan.^{6,11,12,21}

Recent studies

Pharmacognostical study

Various investigations have been carried out on *Nardostachys jatamansi*, such as morphological character, microscopic, physicochemical evaluation, phytochemical screening and TLC profile of powdered crude drug, and significant qualitative and quantitative parameters have been reported.²¹

Analytical studies

Twenty-nine compounds were identified in the essence of *Nardostachys jatamansi*. The essence was prepared in cleverger apparatus by hydro-distillation. Gas chromatography-mass spectroscopy method was used to identify the essence compounds. Essential oil from the two species of *Nardostachys jatamansi* was determined by GC-MS technique for the analysis of essential oils. Both the oils contain high amount of sesquiterpenes in which jatamansone were the major sesquiterpine and α -gurjunene. Physical and chemical parameters were also done on both species such as refractive index, specification rotation, iodine number, specific gravity, saponification value, acid number etc.²² New sesquiterpene acid, pyranocoumarin and nardin were isolated from the spectral studies characterized rhizomes of *Nardostachys jatamansi*. X-ray crystallographic studies were used for the stereochemistry of nardin²³. RP-HPLC GMS used to analyze *Nardostachys jatamansi*'s metabolite profile, 70 per cent ethanol extract showed polyphenols and flavoinds, and hexane extract showed fatty acids, sesquiterpines etc. Ethanolic extract had more potent anti-oxidant activity then hexane extract.²⁴

Pharmacological studies

Neuroprotective activity

Alcoholic *N. jatamansi* extract at a dosage of 250mg / kg (for 15 days) protected rats from focal ischemia. The result can be attributed to inhibiting lipid peroxidation, enhancing the quality and function of glutathione in Na+/K+ATPase and catalase enzyme systems.^{11,25}

Antidepressant activity

Jatamansi root extract showed antidepressant activity, indicated by increased concentrations of central monoamines, inhibitory amino acids and changes in gamma-amino butaric acid, serotonin, taurine and 5-hydroxyindoleacetic acid levels.²⁶

Two dose levels of drugs (200 and 400 mg / kg) were administered in male Swiss mice to determine antidepressant activity by using tail suspension test, forced swim test and locomotive activity. The finding suggested that dose-dependent antidepressant activity is present in *Nardostachys jatamansi*²⁵.

Anti-Parkinson activity

Jatamansi hydro-alcoholic root extract was examined for the activity in haloperidol induced Parkinsonism which was compared with combination of L-dopa and carvidopa. The altered levels were restored²⁵.

Rats were treated for three weeks with jatamansi plant in dose of 600, 400 and 200 mg / kg. In the right striatum, 2 ml of 6-OHDA [12 mg in 0.01 per cent ascorbic acid-saline] was administered on day 21 while 2 μ l of vehicle was received by sham-operated group. Three weeks the rats were tested for neurobehavioral activity after 6-OHDA injection and after 6 weeks they were sacrificed for lipid peroxidation estimation, activities of glutathione-S-transferase, reduced glutathione content, catecholamine quantification, expression of tyrosine hydroxylase, glutathione reductase and catalase and binding of D2 receptor dopaminergic. Jatamansi restored the increase in drug-induced rotations significantly and dose-dependently and decreased muscle coordination and locomotive activity due to 6-OHDA injections.^{25,26}

Anticonvulsant activity

As shown by a decrease in the extension / flexion ratio, the results obtained by ethanolic extract of jatamansi root showed a significant increase in the threshold of seizure against the maximum model of electro shock seizure. But the seizures induced by pentylenetetrazole, the extract was found to be ineffective. Additionally, pretreatment of phenytoin to rats in dose of 12.5, 25, 50 and 75 mg / kg combined with root extract of jatamansi in dose of 50 mg / kg resulted in a significant increase from 3.62 to 13.17 in the protective index for phenytoin. The results of phenytoin with and without combination with the extract of jatamansi clearly demonstrated the synergistic activity of both the drugs.^{25,26}

Nootropic activity

When the ethanolic extracts of the plant were given to the young and aged mice, it improves the learning as well as the memory in young mice and also reversed age related amnesia in older mice. So, the plant has proved its memory restorative activity.²⁶

Cardio protective activity

Once doxorubicin was given to rats, they exhibited myocardial injury which was verified by elevation of the serum enzyme. Then plant extract treatment was given which restored the action of the antioxidant enzyme in addition lowered the lipid peroxide level near normal.^{25,26}

Hypolipidemic activity

At an intra-peritoneal dose of 15 mg / kg, single dose of doxorubicin administered to rats showed rise in cardiac and serum lipids as well as significantly increase in serum low density lipoproteins, very low-density lipoproteins, and a decrease in high density lipoprotein levels, resulting in changes in cardiac and serum lipid processing enzymes. Pretreatment to doxorubicin-induced rats with a 500 mg / kg oral jatamansi extract for seven days exhibited significant lipid status prevention with lipid metabolizing enzyme activity.²⁵

Hepatoprotective activity

Nardostachys jatamansi ethanolic root extract has the hepato-protective function by reducing the alkaline phosphatase and transaminase serum levels.²⁵ For the hepatoprotective activity, ethanolic extract of Nardostachys jatamansi was evaluated using D-galactosamine induced hepatoprotective model. The activity was evaluated by using different biochemical parameters like alanine aminotransferase (ALT), albumin (ALB), total protein (TP), lactate dehydrogenase (LDH), aspartate aminotransferase (AST) and serum cholesterol (CHL).²⁷

Antifungal activity

The essential oil present in the plant was found to be fungistatic against *Aspergillus niger*, *Aspergillus flavus*, and *Fusariumoxysporum* etc.²⁶ In the antimicrobial screening study, agar dilution was performed by 1000 ìg / ml and 500 ìg / ml and all sixty-one extracts were evaluated against *Candida albicans*, *Klebsiella pneumonia*, *Aspergillus niger*, *Streptococcus faecalis*, *Saccharomyces cerevisiae*, *Staphylococcus epidermidis*, *Klebsiella pneumonia* together with *Nardostachys jatamansi*. *Nardostachys jatamansi* methanol extract was effective

against most of the microorganism's present, thus justifying its function as an antimicrobial and antifungal agent.²⁵

Anti-inflammatory activity

Plant methanol extract exhibited anti-inflammatory activity by inhibiting the endotoxin shock and reducing the production of IL-1, IL-6, TNF, and IFN. Extract of *Nardostachys jatamansi* shows anti-inflammatory activity against LPS induced inflammatory responses²⁸.

Anti-inflammatory action of extracts of rhizomes and reference drugs phenylbutazone and acetylsalicylic acid were evaluated using models for inflammation. The extract of *Nardostachys jatamansi* showed protective effect against acute, sub-acute and chronic models of inflammation²⁹.

Antioxidant activity

Antioxidant activity was shown by the aqueous root extract of the plant in haloperidol-induced catalepsy rat model. Ethanolic extract of jatamansi were given to the Wistar rats in two doses. Study revealed radical scavenging activity by low IC₅₀ value. Pre-treatment with the extract decrease the nitrite level and lipid peroxidation level. Aqueous root extract of jatamansi possessed the anti-oxidant activity by measuring biochemical parameters and behavioral parameters and provide protection against the lipid peroxidation³⁰.

Antihyperglycemic effect

The effective dose for antihyperglycemic activity of jatamansi in diabetic rats was found to be 500 mg / kg. The hydro-alcoholic extract was used for loading glucose and alloxane-induced diabetes on wistar albino rats. Antidiabetic analysis using ethanolic extract to aid the traditional use of jatamansi in hyperglycemia was further reported. Over a 10-day period, the study was conducted using a dosage of 1200 mg / kg, 800 mg / kg and 200 mg / kg. Results confirmed that compared to rats, the dose of 1200 mg / kg in the disease model had significant antihyperglycemic effects. This research did not show any effect on toxicity, even at the 3000 mg / kg level. The use of STZ injection has also verified the research of diabetics.³⁰

The study conducted seven days to assess antidiabetic action of the ethanolic rhizome extract of *Nardostachys jatamansi* in diabetic rats induced by alloxan. The high-dose ethanolic extract (1400 mg / kg) in diabetic rats exhibited considerable antihyperglycemic action compared with low-dose (500 mg / kg). The results revealed that the experimental diabetes mellitus model has noticeable antihyperglycemic action.²⁵

Anticancer activity

Jatamansi's roots were explored against two lines of human cancer neuroblastoma, i.e., SK-N-SH and IMR-32, using SRB assay for the anti-proliferative potential in vitro. It tested three extracts, including 95% alcoholic, 50% hydroalcoholic and aqueous extracts, and four fractions, such as butanol, chloroform, aqueous and hexane. The 95 per cent alcoholic extract exhibited considerable and dose-dependent inhibitory effect for both neuroblastoma cell lines to proliferate. The growth inhibition percentage was noticed to be 71 percent vs. IMR-32 and 85 percent vs. SK-N-SH at 100 µg / ml. It demonstrated growth inhibition of the cancer cell lines of neuroblastoma at 30 mg / ml and 100 µg / ml at 45% and 82% against SKN-SH and 54% and 91% against IMR-32.²⁵

Radioprotective activity

The effect of jatamansi ethanol extract has been studied in whole-body electron beam radiation (EBR) on Swiss albino mice exposed to 6Gy. Survival assay was done to demonstrate the EBR's lethal dose. The jatamansi extract (DRF) dose reduction factor was calculated by taking the EBR LD50 ratio with and without the jatamansi extract therapy.²⁵

Effect on Estrogen and hair growth

In the treatment of cancer that causes hair loss *Nardostachys jatamansi* has been examined. The results verified this plant's role in promoting hair growth. The study of hair growth was designed not only to assess the impact of extract on hair growth, but also separated fractions called nardin, nardal and jatamansic acid.^{25,30,31}

Conclusion

This review gives a comprehensive information about Jatamansi and its uses. The *Nardostachys jatamansi* has various traditional and modern uses identified through modern testing procedures. Various studies on the plant revealed and supported number of pharmacological activities such as neuroprotective, anti-depressant, anti-parkinson, cardio protective, hepatoprotective, anti-fungal, anti-oxidant etc. The plant is used in the treatment of various nerve diseases in various Ayurvedic formulations. Therefore, steps should be taken to popularize the use of Ayurvedic medicine and should be included in more clinical trials.

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