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A review on pharmacognostic and phytochemical study of a plant *Nardostachys Jatamansi*

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Abstract
Nardostachys jatamansi is a small, dwarf, hairy, perennial, rhizomatous, herbaceous, rare and most ancient species within family Valerianacae. Distributed in the Himalayas from Pakistan, in India including Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim to Nepal, Tibet and China which show a historical medicinal uses in Ayurveda, ethnomedicine, Homeopathy and Indian System of Medicine (ISM) to current medicine industry. The herbs and rhizomes of this hairy, perennial, dwarf and herbaceous plant are used for medicinal purpose. Mostly Herbs and rhizome are used for this hairy, perennial, dwarf and herbaceous plant. The plant has demonstrated several pharmacological activities including hepatoprotective, cardio protective and hypolipidemic and antifungal. Clinical research in Animal with jatamansone, has justified hypnosedative claim of Ayurveda. The review summarizes, phytochemical and pharmacological investigations carried out on the plant. By the virtue of above property this is Tridoshahara. *Nardostachys jatamansi* contains a number of bioactive chemicals, including crystalline acid, Jatamansic acid, hydrocarbons, a polyoxygenated crystalline solid together with A-endesmol, B-eudesmol, ethanol, angelicin, 4-hydroxythymol dimithyl ether. The present review detailed focus on its pharmacognostical, pharmacodynamics, pharmacological studies and its therapeutic importance.

Keywords: *Nardostachys jatamansi*, pharmacodynamics, pharmacognostics, pharmacological and therapeutic activity

1. Introduction
Role of herbal medicine
Medicinal plants and natural compounds show enormous pharmaceutical, cosmetic, pharmacological responses now days. Plant derived medicine shows better results with less side effects as compare to chemical drugs Synthetic compounds are mainly chemical drugs, shows adverse side effects in consumers and patients treated with these drugs. So from many years herbal medicines are used instead of chemical drug [1].
Herbal medicines are also referred to as herbal remedies, herbal products, phytotherapeutic agents, phytomedicines, herbal medicinal products and phytopharmaceuticals. The use of herbal medicines in science based approach for the treatment and prevention of disease known as phytotherapy. The use of herbal medicines contrasts with traditional medical called herbalism which uses herbal medicines in a holistic manner and mainly on the basis of their empirical and traditional uses [2].

2. Plant introduction
Nardostachys jatamansi is a small, dwarf, hairy, perennial, rhizomatous, herbaceous, rare and most ancient species within family *Valerianacae.* Distributed in the Himalayas from Pakistan, in India including Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim to Nepal, Tibet and China which show a historical medicinal uses in Ayurveda [1], ethnomedicine, Homeopathy and Indian System of Medicine (ISM) to current medicine industry. Polyploidy occurs in *V. officinalis* and there are diploid, tetraploid and octaploid types [2]. *Nardostachys jatamansi* Dc. Herb is woody rootstock, long, stout, covered with fibers from the petioles of withered leaves commonly known as Spikenard, occurs naturally in the alpine regions of Himalayas at the height of 11-17 thousand feet, ascending eastwards Punjab, Kumaon to Sikkim and Bhutan regions [3].

Fig 1: Natural habitats (A & B), naturally growing mature plants (C & D) and germplasm, rhizome and seeds (E & F) of *Nardostachys jatamansi*[3].

History

Ayurvedic classics found that *Jatamansi* is described in, *Sushruta Samhita, Nighantus Chikitsagranthas* and *Charaka Samhita*. In *Charaka Samhita*, it is described in *Sangyasthapana Mahakashaya* used as *dhumvarti* for *hikkashwasa*, used in *Kushtha. Hriveradighrita* used in *arsha* used in *kasa. Mahapaishachikaghrita* used in *unmade.* In *Sushruta Samhita,* it is described as *Kumararasayana* [4]. In ninth and tenth century the word *'Valeriana'* is the first used for the plant. For its medicinal values the plant is valued from ancient times as in Ayurveda in India, Unani in ancient Greek and Arab, and in ancient Egypt and Rome. In some Islamic traditions the powdered root of *N. jatamansi* is also mentioned as the fruit which Adam ate in heaven, 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 the plant in sweetened and spiced wine drink. The rhizomes of the plant are used in Ayurvedic system of medicine as a bitter tonic, stimulant, and epilepsy, antispasmodic and to treat hysteria [5].

3. Pharmacognostics Profile

3.1 Taxonomy [6]

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

Table 1: Taxonomical classification

Kingdom	Planate
Division	Mangnoliophyta
Order	Dipsacales
Class	Mangnoliopsida
Family	Valerianaceae
Genus	Nardostachys
Species	Jatamansi

3.2 Local Names [6]

Table 2: Common names of plant

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

3.3 Botanical study

Macroscopic Characters [8]

The leaves are rosy, slightly pink or blue in dense cymes.

Colour: reddish brown tufted fibres crowned in dark greyish rhizomes.

Odour: Highly agreeable, aromatic.

Size: Rhizomes are 2.5 to 7.5 cm in length.

Shape: Elongated and cylindrical.

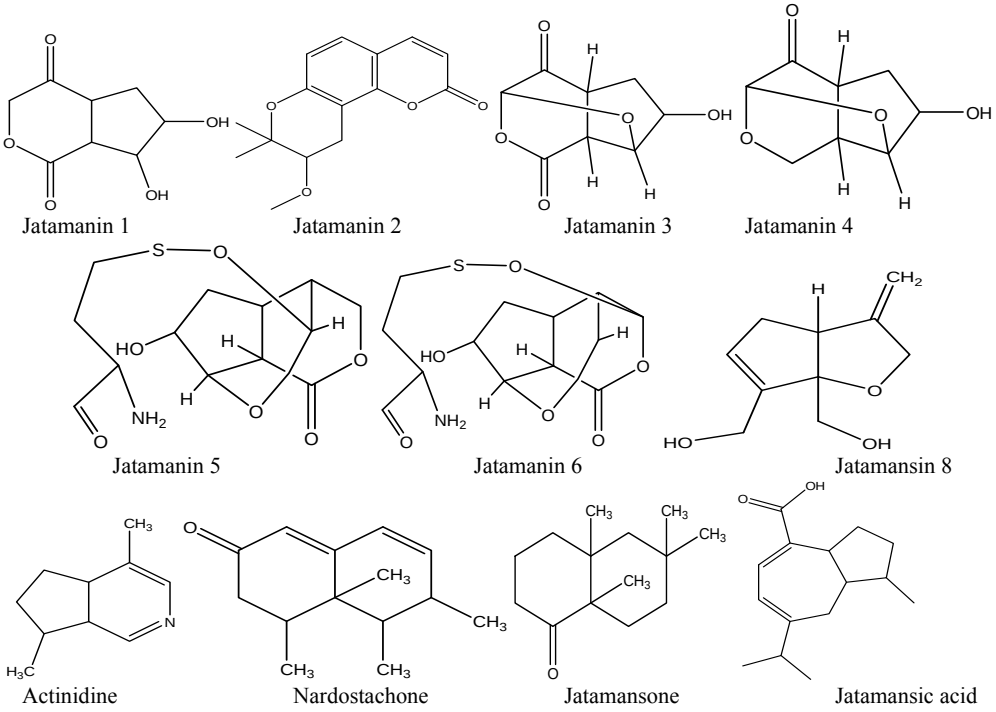
Rhizome- A transverse section of the rhizome shows a thin periderm, it can be more or less circular in outline. A large parenchymatous cortex contains starch and an endodermis containing globules of volatile oil. Within a ring of collateral vascular bundles lies large pith containing scattered groups of sclerenchymatous cells.
Cork: 2-5 layers of cells filled with oil granules.
Cortex: Cortex is broad, 7-11 layers
Cambium ring: Distinct and continuous [9]

Leaves- Leaves develops from both rootstock and stem. Basal leaves in rosettes are 15-18 cm long and 2.5 cm wide, longitudinally veined; leaves on stem is opposite pairs are about 7.5 cm long and 2.5 cm wide, sessile, base attenuate into petiole nearly equal to leaf blade in length, margin entire apex obtuse. Leaves are cauline, lower ones elliptic to obviate; upper ones sessile, onlanceolate to lanceolate, sometimes serrate.

Flowers- The inflorescence may have one or in rare cases 2-3 terminal capitates clusters. flowers are pale pink or blue. Capitula of cymes, terminal, 1.5-2 cm broad; main inflorescence rachises and lateral rachises sometimes elongated; involucral bracts 4-6. Its calyx are 5-lobed; fruit, usually ciliate. Corolla purple-red, campanulate, 4-9mm, 5-lobbed; lobes broadly ovate to oblong. Stamens are nearly equal to corolla in length and are generally 4 in numbers, filaments villous. Style nearly equal to stamens in length, stigma capitates. The flowers are arranged in clusters and have many small flowers. They are bilaterally symmetrical and usually bisexual [9].

4. Chemical Constituents

Nardostachys jatamansi consist of following constituents but the main active constituents are sesquiterpenes and coumarins. valeranone or Jatamansone is the principal sesquiterpene. The other sesquiterpenes includes Alpha-patcho-ulense, β-eudesemo, β-sitosterol, elemol, angelicin, jatamansin, jatamansinol, calarene, jatamansone β-atchoulense, n-hexaco- sanyl, n-hexacosane, Oroselol, valeranal, valeranone, seychelane, nardostachnol, nardostachone [10]. (+) volatile oil essential oil, resin, sugar, starch, bitter extractive matter, gum, ketone, jatamansic acid, jatamansone, lupelol, Malliene, Calarenol, coumarin-jatamansin, propionate, cyclohexanal ester, heptacosanyl pentanoate are isolated from rhizomes, diethaniod bicyclic-ketone-nardostachone [11]. The phytochemical investigation of hydro alcoholic extract of *Nardostachys jatamansi* have shown the presence of steroids, alkaloids, sterols, tannins, mucilage, flavonoids, carbohydrates, gums, terpenes and glycosides [12].



Structure 1: Chemical structure of some important medicinal compounds [12]

5. Physico-chemical Properties

Specific gravity: 0.9300 to 0.9587 at 25 ºC
Refractive index: 1.5055 to 1.5458 at 25 ºC
Acid number: 1.5 to 8
Ester number: 6 to 45
Ester number after acetylation: 40 to 65
Solubility: Soluble in 0.4 to 1.5 vol. of 90% alcohol.[13, 14]

6. Uses

1. Jatamansi oil possesses antiarrhythmic activity and also used as a flavouring agent in the preparation of medicinal oil.
2. *N. jatamansi* is primarily used in modern medicine for cognitive and neurological function benefits [14]
3. Jatamansi relieves symptoms like vertigo, seizures etc. in fever.
4. The medicated jatamansi oil is beneficial for smooth, silky and healthy hair.
5. It has protective effect in epilepsy, cerebral ischemia and liver damage.
6. It is very effective in producing typical non- specific stress manifestation [15].
7. It is used in mental disorder, insomnia, hypertension and heart diseases.
8. It is used as a carminative, as an antispasmodic in hysteria, palpitations and convulsion and seminal debility [16].
9. It also recommended in scorpion string.
10. The herb increases appetite, relieves the phlegm in cough and asthma, proves useful in hepatitis and treats enlargement of the liver [17].

7. Medicinal properties

It possesses stimulant and antispasmodic properties. Used to treat epilepsy, hysteria, convulsive ailments, itch, boils, palpitations, diseases of heart, and diseases of the head. Other use includes ailments of the hair. The roots are also used for improving the complexion, increasing the luster of the eye and promoting the growth and increasing the blackness of the hair. Jatamansi consists of dried rhizome of *Nardostachys*

jatamansi DC [10]. It has been used in herbal combinations with other herbs to evaluate depressant activity. Ayurveda says the roots and rhizome of *Nardostachy jatamansi* DC have various effects on "doshas". Ultimately it is trido shashamak but especially kapha-pitta nashak been clinically employed for their anti-ischemic, antioxidant, neuroprotective and anticonvulsant activities. *Nardostachy jatamansi* DC also works as a memory enhancer. It is also intented for aging-induced amnesia due to natural aging of mice. Rhizome of *Nardostachy jatamansi* DC is proved to be a useful memory restorative agent in the treatment of dementia and as anti-stress [6].

8. Pharmacological activities

S. No.	Pharmacological Activity	Plant part used	Effect	Author name/ Year
1	Antimicrobial	Root	Antimicrobial susceptibility test of same fractions showed the *n*-butanol fraction potent against all pathogens and most affected one was *Escherichia coli* [11].	Narayan S. *et al.* (2016)
2	Anti-ulcer	Rhizome	Gastric secretion, pH of gastric juice, Free acidity the extract of *Nardostachys jatamansi* significantly inhibited ulcer formation in Pyloric ligation models [12].	Syed Atiq U.R *et al.* (2016)
3	Antihypertensive	Rhizome	The ACE inhibitor activities of hydroalcoholic extracts were as follows; *M. vulgare* > *N. Jatamansi* > *P. ferulacea* [13].	Foroogh N *et al.* (2015)
4	Anticancer	Seeds	The anticancer property of *Monochoria Vaginalis, Ipomea Carnia, Nardostachys Jatamansi*on HeLa cells obtained moderate results with the treatment of these extracts morphological changes in the cells were observed [14].	Sivajothi V. *et al.* (2015)
5	Insomnia	Powder extract	Both possess significant anti-anxiety activity without significant sedative-hypnotic activity. This increases their utility for the treatment of anxiety neurosis [15].	Toolika E. *et al.* (2015)
6	Anti diabetic	Rhizome	The analysis of results of this study reveals that *Nordostachys jatamansi* hydroalcoholic extracts posses good anti diabetic activity in alloxan- induced diabetic rats [16].	Aleem M.A *et al.* (2014)
7	Anti diuretic	Root	Ethanolic and petroleum ether extracts of *Nardostachys jatamansi* DC roots have showed dose dependent increase in urine and electrolyte excretion. Relatively ethanolic extract showed more activity when compared to petroleum ether extract [17].	Digvijay G. K *et al.* (2014)
8	Anti-inflammatory	Rhizome	Protective effect of N. jatamansi rhizome extract against acute, subacute and chronic models of inflammation, which may be attributed to its anti-inflamatory potential [18].	Rajnish K.S *et al.* (2014)
9	Insecticidal	Root	Water-distilled essential oil from *Nardostachys jatamansi* (Caprifoliaceae) roots was analyzed by gas chromatography-mass spectrometry (GC-MS)..*N. jatamansi* has potential for development into natural insecticides or fumigants for control of insects in stored grains [19].	Xin Chao L. and Zhi Long L. *et al.* (2014)
10	Heamatopoetic activity	Rhizome	Nardostachys jatamansi can be attributed to stimulating or protecting hematopoiesis in bone marrow and the subsequent increase of haematological constituents in the peripheral blood [20].	Damodar Godwa K.M *et al.* (2013)
11	Antidepressant	Root	The antidepressant activity of Nardostachys jatamansi ethanolic root extract on whole body electron beam radiation induced depression in swiss albino mice, using established models for depression [21].	Deepa B. *et al.* (2013)
12	Anti cancer	Root	*Nardostachys jatamansi* show significant antitumor activity in Sarcoma 180 solid tumor bearing mice and is comparable to the reference standard, 5-fluorouracil [22].	Madhulika B. *et al.* (2013)
13	Radioprotective	Rhizome Powder	The radioprotective activity of Nardostachys jatamansi extract may be due to free radical scavenging and increased antioxidant level in mice [23].	Madhu L.N [22] *et al.* (2012)
14	Anticataleptic	Root	Hydro alcoholic root extract from *Nardostachys jatamansi* was investigated for anti cataleptic effects in the haloperidol-induced catalepsy rat model of the disease by measuring behavioral, biochemical parameters and neurotransmitter levels [24].	Raseed A. *et al.* (2012)
15	Hypertension	Rhizome	*Nardostachys jatamansi* is a very effective, potential and safe drug for the management of patients with essential hypertension along with dietary restrictions and modified lifestyle [25].	Velpandian V *et al.* (2012)
16	Antibacterial and Antioxidant	Root	Gram negtative bacteria only *K. pneumoniae* and *E. aerogenes* were found to be sensitive to *N. jatamansi* essential oil while S. *typhimurium* and *P. aeruginosa* were resistance to *N. jatamansi* essential oil. Antioxidant activity of essential oil of *N. jatamansi* showed that it was able to reduce the stable radical 2,2-diphenyl-1-picrylhydrazyl (DPPH) [26].	Zahida P. *et al.* (2011)
17	Antioxidant	Rhizome	The anti-stress effect of hydroethanolic extract of (70%) of *N. jatamansi* was evaluated for its antioxidant property [27].	Nazmun L. *et al.* (2009)
18	Cardioprotective	Rhizome	Rhizome shows efficacy against mitochondrial and lysosomal damage induced by doxorubicin in rats. The cardioprotective efficacy of N. jatamansi could be mediated possibly through its antioxidant effect as well as by the attenuation of the oxidative stress [28].	Rajakannu S. *et al.* (2007)
19	Antianxiolytic	Whole plant	The principal constituents of *Nardostachys Jatamansi* are volatile essential oil contain Jatamansone, Sesquiterpenoid [0.0 2-0.1%], Spirojatamol, patchouli alcohol, Jatamol A and B, Jatamansic acid, nardostachone and other constituents are resin, sugar, starch, bitter extractive matter and gum [6].	V.M. Jhadav *et al.* (2009)

9. Marketed preparation [30]

S. no.	Trade name of the prepration containing Jatamansi	Product name	Uses for	Pharmaceautical company
1	Jatamansi	Payodhii	Anticholestrolic	XO Herbs
2	Jatamansi	Kesh kanti oil	Hair care	Patanjali
3	Jatamansi	Ovarin	Utrine tonic	Ban labs ltd

Conclusion

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 activities, 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. *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.

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