



***Nardostachys jatamansi* (D. Don) DC.: A Comprehensive Review on its Phytochemistry, Pharmacology, Conservation Status and Recent Therapeutic Advances**

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ABSTRACT

Nardostachys jatamansi (D. Don) DC. (caprifoliaceae, valerianoideae), commonly known as Indian spikenard or jatamansi, is a minute rhizomatous perennial herbaceous plant of the alpine and sub-alpine Himalaya (3000-5200 m). It has been used for millennia in Ayurveda, Unani, Siddha, Tibetan and traditional Chinese medicine as a nervine tonic, sedative, antispasmodic and cardiogenic agent. The rhizomes of this plant contain a variety of sesquiterpenoids (jatamansone/valeranone, nardosinone, nardostachone, spirojatamol, calareneol), pyranocoumarins (jatamansin, jatamansinol, seselin), iridoids, lignans and flavonoids, which are responsible for the pharmacological activities of this plant. This review focuses on the neuroprotective, anxiolytic and antidepressant, anti-parkinsonian, hepatoprotective, cardioprotective, anticancer, antioxidant, anti-inflammatory, antidermatitis, antimicrobial and antidiabetic properties of *N. jatamansi*, published mostly between 2018 and 2025. Particular emphasis is placed on mechanistic studies, network-pharmacology and molecular-docking analyses, while the limited body of randomized controlled trials for generalized anxiety disorders and post-stroke depression is also highlighted. Essential-oil chemistry and geographical variations are discussed, together with nanotechnology-based approaches to extraction and delivery, conservation status (IUCN Red List), and micropropagation and conservation strategies to ensure a sustainable supply of raw material. The review also highlights the research gaps, particularly in human clinical studies, pharmacokinetics and toxicology, and provides an outlook on future research.

Keywords: *Nardostachys jatamansi*; jatamansi; spikenard; *Valerianaceae*; neuroprotection; anxiolytic; sesquiterpenoids; conservation; ethnopharmacology

Introduction

India holds a rich history in the fields of wellness, medicine and surgery. Ayurveda is one such branch of traditional Indian medicines which has stood the test of time and is still flourishing. 'Ayurveda' literally translates to 'Knowledge of life'. Ayurveda is based on the use of materials derived from nature or nature itself. Humongous number of plants and trees are a part of Ayurveda, different parts like leaves, shoots, roots, flowers, fruits hold medicinal importance. Use of naturally derived medicine shows lower or no side effects compared to synthetic medicines. The branch involved in preparation of herbal medicines is called 'herbalism'.

Among the Himalayan flora with a long history of therapeutic use, *Nardostachys jatamansi* (D. Don) DC—commonly known as jatamansi, muskroot, or Indian spikenard—is a unique species. It is mentioned in the Old Testament, Homer's Iliad, and the classical Ayurvedic literature, and its aromatic rhizome has been traded in South and Central Asia for over two millennia (Dhiman & Bhattacharya, 2020). References of Jatamansi have been found in India from Mesopotamian period which was one of the earliest civilisations in the world. In the Cuneiform scripts it has been mentioned that the plant was exported to the Arab countries, Egypt and Greece. The Bible, the holy text of Christians also mentions the plant as Spikenard. Germany called it *Nardus Indica* in ancient times (Shah, N.C., 2023). The plant is today known in pharmacognosy as a nervine tonic and "medhya rasayana" (a kind of cognition-enhancing restorative) used to treat insomnia, anxiety, hysteria, epilepsy, and cardiac palpitations (Pathak & Godela, 2024).

In the last decade, the mechanistic and clinical research on *N. jatamansi* was significantly advanced. The focus of investigation shifted from ethnopharmacological descriptions to specific molecular targets: docking of secondary metabolites to Alzheimer's disease targets and transcriptomic analysis of secondary-metabolite biosynthesis, as well as randomized controlled trials in anxiety and post-stroke depression. Nevertheless, the species is now classified as Critically Endangered on the IUCN Red List because of unsustainable wild harvesting, slow growth, and poor natural regeneration (Royal Botanic Gardens, Kew, n.d.). Thus, a review is needed that would integrate the recent pharmacological findings with the conservation biology of

the species. This article aims to provide a comprehensive update on *N. jatamansi* for phytochemists, pharmacologists, and clinicians who study this species.

Botanical Description, Taxonomy, and Distribution

The current taxonomy of *N. jatamansi* recognizes a different placement from the older grouping of *Valerianaceae*. Based on molecular phylogenetic studies of a large number of species, the genus was placed under one of the subfamilies of *Caprifoliaceae* (subfamily *Valerianoideae*). *N. jatamansi* is the only accepted species of the one and only (monotypic) genus *Nardostachys* (Royal Botanic Gardens, Kew, n.d.). It is a small, hairy perennial herb with a maximum height of around 60 cm, a very thick oblique densely fibrous underground stem (rhizome) on top of which still stand the brown leaf remnants from previous years - these features give the species its 'haired' appearance (*jatamansi* = 'hair' in Sanskrit) and at the same time account for its rich, musky scent of essential oils.

The plant grows up to 4-20 inches in height. It shows polyploidy i.e diploid, tetraploid and octaploid types. The leaves are long, sessile and oval in shape about 15 to 20 cm in length. Flowers are pinkish white in color with a bell shape. The roots are thick with reddish brown fibers surrounding it. The growth season of this species is from May to late October. June to August is the flowering season and the fruiting season is from August to September. The reproduction takes place by vegetative reproduction with the means of rhizome and also by seeds. Once planted the plant takes 3 to 5 years to reach reproductive maturity. Roots and rhizomes of *Jatamansi* are primarily utilized for medicinal importance.

English	Indian Nard, Indian Spikenard, Muskroot, Nardin, Nardus Root, Spikenard
Chinese	Gansong, Kan-sung-hsiang, Ku-mi-ch
Gujarati	Kalichad
Hindi	Balchar, Jata Jatila, Mamsi
Japanese	Kanshoku
Kannada	Bhootajata, Ganagilamaste
Kashmiri	Bhutijata
Malayalam	Jatamanchi, Manchi
Marathi	Jatamansi
Punjabi	Billilotan, Chharguddi
Sanskrit	Bhyatajata, Tapaswini, Vilomasa
Telugu	Jatamams

Table 1: Common names of *N. jatamansi* in various foreign as well as regional languages

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Dipsacales
Family	Valerianaceae
Genus	Nardostachys
Species	Jatamansi
Botanical name	Nardostachys jatamansi DC
Part used	Roots and rhizomes

Table 2: The botanical classification of *N. jatamansi*

GEOGRAPHICAL DISTRIBUTION

Jatamansi has been largely distributed in the northern region of India followed by Nepal, Bhutan, Tibet, China and Myanmar. It is reported to occur at high altitudes. First occurrence in the Indian Subcontinent was reported by Royle in 1939 at Kedarkantha in Uttarkashi, Shalma in Bhutan and Gosainthan in Nepal all of these regions are situated above 3300 m altitude. He also reported the plant to be very common in the higher altitudes beyond 3600 m especially in the Tehri Garhwal region. Its distribution in India spans from Western Himalayas to Kumaon Himalayas and some parts of Eastern Himalayas. In the Garhwal region it is found in districts of Tehri, Rudraprayag and Chamoli. Bageshwar and Pithoragarh districts in Kumaon. In the Eastern Himalayas, Sikkim and Arunachal Pradesh house the Jatamansi population. This plant is found only in the Himalaya region (endemic) and can be found growing wild in the higher altitudes (from 3,000 to 5,200 meters above sea level) in rocky, moist alpine meadows of this area including the states of Uttarakhand and Himachal Pradesh (India) Nepal Bhutan Tibet western and central China, and northern Myanmar (Royal Botanic Gardens, Kew, n.d, Krishnan et al., 2024).

Traditional and Ethnomedicinal Uses

In Ayurveda, jatamansi rhizome is categorized as Medhya (cognition promoting), Nidrajanana (sleep-inducing), Akshepashamana (seizure-calming), and Hrid-balya (cardio-tonic); it is also Deepana and Pachana (digestive stimulant), Yakriduttejaka (hepatostimulant), Dahaprashamana (antipyretic/soothing), Vajikara (aphrodisiac/vitality-promoting), and Kushthaghna (beneficial in skin disorders) (Pathak & Godela, 2024). In the Unani system, jatamansi is referred to as Sunbul-ut-Teeb and is used for cardiac and neurological disorders, while in traditional Chinese medicine, the rhizome (“Gansong”) is used to regulate qi flow, relieve pain, and improve digestion (Duan et al., 2025). It is also used in folk medicine: a paste is made from the ground rhizomes to treat arthritis, cough, cold, and urinary tract disorders; the essential oil of jatamansi has been used traditionally in hair oils, perfumery, and incense making (Krishnan et al., 2024, Pathak & Godela, 2024).

Phytochemistry

N. jatamansi accumulates a chemically diverse array of secondary metabolites in the rhizomes and roots, extensively characterized from the sesquiterpenoids, pyranocoumarins, iridoids, lignans, and flavonoid/phenolic components.

Sesquiterpenoids

Sesquiterpenoids dominate as the main active fraction, including jatamansone (also called valeranone), nardostachone, nardosinone, nardin, nardal, calarene, calarenol, seychellene, spirojatamol, patchouli alcohol, elemol, and jatamansic acid (Goyal & Rath, 2021). Ongoing phytochemical mining also revealed new skeleta: twenty terpenoids have been isolated from the roots and rhizomes, including the previously undescribed isonardosinane-type sesquiterpene incorporating a γ -lactone, and a new sesquiterpenoid dimer, incorporating the nardosinane- and aristolane-type unit, some of which showed cytotoxic activity toward human pancreatic cancer cell lines. Nardosinone, in particular, has emerged as a key marker compound with a demonstrated neuroprotective, anti-inflammatory, antidepressant, cardioprotective, and anti-arrhythmic activity, and its stability profile under physiological and thermal stress has been recently characterized, revealing degradation products including 2-deoxokanshone M and L (Xue et al, 2023).

Pyranocoumarins and Iridoids

A distinctive feature of *N. jatamansi* chemistry is the pyranocoumarin fraction—seselin, jatamansin, jatamansinol, jatamansine, jatamansinone, and dihydrojatamansin—as several of which show favorable drug-likeness profiles and blood–brain-barrier permeability in computational screens for Alzheimer's disease targets (Anupama et al., 2023; Shah et al., 2025). Novel iridoid-type constituents, narjatamanins A and B, incorporating an unusual 2,3-seco-iridoid skeleton with a 1,10-oxygen bridge, have also been isolated and shown to delay paralysis phenotypes in a *Caenorhabditis elegans* Alzheimer's disease model.

Flavonoids, Phenolics, and Other Components

HPLC and GC–MS profiling of ethanolic and hexane extracts have identified polyphenols and flavonoids—in particular, gallic acid, catechin, chlorogenic acid, epicatechin, rutin hydrate, and quercetin-3-rhamnoside—as well as fatty acids, alkane hydrocarbons, esters, and additional sesquiterpenes. A single alkaloid, actinidine, and a lignan/neolignan fraction have also been reported. This chemical richness explains the plant's polypharmacological profile, but also complicates standardization, since relative proportions of marker compounds vary with plant part, geographic origin, extraction solvent, and growth conditions (Pathak & Godela, 2024).

Sr. No.	Compound	Formula	Parts
1	Aristolene	C ₁₅ H ₂₄	Roots grayish brown variety
2	Calarene	C ₁₅ H ₂₄	Roots grayish brown variety
3	Calarenol	C ₁₅ H ₂₂ O ₃	Roots
4	1,8,9,10-tetrahydroaristolane-2-one	C ₁₅ H ₂₀ O	Roots and Rhizome
5	Nardostachone	C ₁₅ H ₂₂ O	Roots
6	Kanshone H	C ₁₅ H ₂₀ O	Roots and Rhizome
7	Nardosinone	C ₁₅ H ₂₂ O ₃	Roots and Rhizome
8	iso nardosinone	C ₁₅ H ₂₂ O ₃	Roots and Rhizome
9	Narchinol A	C ₁₂ H ₁₄ O ₃	Roots and Rhizome
10	Narchinol B	C ₁₂ H ₁₄ O ₃	Roots and Rhizome
11	Nardoaristolone B	C ₁₄ H ₁₈ O ₂	Roots and Rhizome
12	Nardosinone	C ₁₄ H ₂₂ O ₃	Roots and Rhizome
13	iso nardosinone	C ₁₅ H ₂₂ O ₃	Roots and Rhizome
14	Narchinol A	C ₁₂ H ₁₄ O ₃	Roots and Rhizome
15	Narchinol B	C ₁₂ H ₁₆ O ₃	Roots and Rhizome
16	Alpha-methoxydesoxonarchinol	C ₁₃ H ₂₀ O ₃	Roots
17	Kanshone B	C ₁₅ H ₂₂ O ₄	Roots and Rhizome
18	Kanshone D	C ₁₅ H ₂₂ O ₄	Roots and Rhizome
19	Kanshone E	C ₁₅ H ₂₀ O ₄	Roots and Rhizome
20	Kanshone G	C ₁₅ H ₂₂ O ₃	Roots and Rhizome
21	Kanshone K	C ₁₅ H ₂₂ O ₃	Roots
22	Kanshone L	C ₁₅ H ₂₀ O ₄	Roots and Rhizome
23	Kanshone M	C ₁₂ H ₁₄ O ₃	Roots and Rhizome
24	Kanshone N	C ₁₅ H ₂₂ O ₄	Roots and Rhizome
25	Nardosinanone G	C ₁₅ H ₁₈ O ₃	Roots and Rhizome
27	Valerenic acid	C ₁₅ H ₂₂ O ₂	Rhizome
28	Nardal	C ₁₅ H ₂₂ O	Rhizome
29	Nardin	C ₁₅ H ₂₂ O ₂	Roots and Rhizome
30	Nardin methyl ester	C ₁₆ H ₂₄ O ₂	Rhizome
31	Nardin A	C ₁₅ H ₂₀ O ₃	Rhizome
32	Nardin B	C ₁₅ H ₂₂ O ₃	Rhizome
33	Nardochinin D	C ₁₅ H ₂₄ O ₃	Roots and Rhizome
34	Alpha-Gurjuene	C ₁₅ H ₂₄	Rootstock
35	Jatamansic acid	C ₁₅ H ₂₂ O ₂	Roots and Rhizome
36	(-)-Globulol	C ₁₅ H ₂₆ O ₂	Rootstock
37	Viridiflorol	C ₁₅ H ₂₆ O	Rootstock

Sr. No.	Compound	Formula	Parts
38	Ledol	C ₁₅ H ₂₆ O	Rootstock
39	Nardol	C ₁₅ H ₂₆ O	Greyish brown variety
40	Teuclatriol	C ₁₅ H ₂₈ O ₃	Roots and Rhizome
41	Narjatamolide	C ₁₉ H ₂₄ O ₄	Roots and Rhizome
42	Jutamol A	C ₁₅ H ₂₄ O	Roots
43	Jutamol B	C ₂₀ H ₃₂ O ₃	Roots
44	Beta- Eudesmol	C ₁₅ H ₂₆ O	Roots
45	Nardoeudesmol D	C ₁₅ H ₂₆ O ₃	Roots and Rhizome
46	Valencene	C ₁₅ H ₂₄	Rootstock
47	Eremophilene	C ₁₅ H ₂₄	Rootstock
48	Alpha-curcumene	C ₁₅ H ₂₆	Rootstock
49	Seychellane	C ₁₅ H ₂₆	Roots and Rhizome
50	Beta-Maaliene	C ₁₅ H ₂₄	Rootstock
51	Alpha-Vatirenene	C ₁₅ H ₂₂	Rootstock
52	Alpha-Patchoulene	C ₁₅ H ₂₄	Roots
53	Beta- Patchulene	C ₁₅ H ₂₄	Roots
54	Jatamansone	C ₁₅ H ₂₆	Rootstock

Table 3: Phytochemical constituents

Pharmacological Activities

Neuroprotective Activity and Alzheimer's Disease

A voluminous literature supports neuroprotection in Alzheimer's disease (AD) through *N. jatamansi*, including network-pharmacology and molecular-docking identification of plausible multi-target AD therapeutics among pyranocoumarins like seselin, jatamansinol, jatamansine, jatamansinone and dihydrojatamansin (Anupama et al., 2023), dihydrojatamansin predicted to inhibit acetylcholinesterase while jatamansinol showed docking similarity for butyrylcholinesterase, glycogen synthase kinase-3beta and Keap1, with molecular dynamics and MM-GBSA analyses confirming the ligand-target complexes' stability, and, complementary in vivo work, in *Drosophila* AD model, of jatamansinol protection against amyloid-beta42 neurotoxicity (Kizhakke et al., 2022), while a 2025 integrative study using phytochemical profiling concatenated to ADMET prediction, network-pharmacology and 100 nanosecond molecular-dynamics simulations confirmed spirojatamol's affinity for PRESenilin-1 (PS1), a core AD drug target, and favorable blood-brain-barrier permeability for several constituents (Shah et al., 2025). Previous pharmacological work has also established that *N. jatamansi* ethanol extract ameliorates amyloid-beta42 cytotoxicity in vitro and protection in models of cerebral ischemia (Liu et al., 2018) while novel iridoids, narjatamanins A and B isolated from whole plant delayed AD-like paralysis in *C. elegans* model and green microwave-assisted extraction optimized for preserving plant anti-Alzheimer's activity of recovered secondary metabolites (Arya et al., 2022).

Anti-Parkinsonian Activity

Nardosinone-type sesquiterpenes attenuate NF- kappa B and MAPK signaling in lipopolysaccharide-stimulated BV2 microglial cells (Ko et al., 2018) while narostachin exerts anti-neuroinflammatory effects through TLR4/ MyD88-dependent suppression of NF- kappa B and JNK signaling (Kim et al., 2020). In rodents, combination of *N. jatamansi* with levodose ameliorated Parkinsonian symptoms through activation of Nrf2 and inhibition of NLRP3 inflammasome signaling (Li et al., 2023) and nardosinone improved levodose efficacy, partly via modulation of the gut microbiota, in a 2024 study (Liu et al., 2024). Mechanistically, in a 2025 study using both lipopolysaccharide (LPS)-stimulated BV2 and an MPTP/probenecine mouse model of Parkinson's disease demonstrating an ethyl acetate extract of *N. jatamansi* (containing 10 approximately 10.2 % nardosinone by HPLC) suppresses glucose metabolic reprogramming in activated microglia while modulating brain-infiltrating T-cell populations, a novel immunometabolic mechanistic link for the herb's traditional neuropsychiatric usage being explored in contemporary neuroimmunology (Duan et al., 2025). Early foundational

work has shown *N. jatamansi* attenuation of 6-hydroxydopamine-induced Parkosin in rats, at behavioral, neurochemical and immunohistochemical levels (Khan et al., 2012) while the association of *N. jatamansi* with crocetin and selen increased cognitive impairment in Parkinson's model (Khan et al., 2012).

Anxiolytic and Antidepressant Activity

N. jatamansi traditionally classically as hypno sedative, tranquilizing, and nootropic agent. Mechanistically, anxiolytic effects are mediated by GABA - benzodiazepine receptor complex while pharmacological action shows inhibition of GABA transaminase and monoamine oxidase along elevation of biogenic amine as well as inhibitory neurotransmitter levels (Malik et al., 2018; Dhingra & Goyal, 2008) with system-pharmacology revealing putative multi-target mechanisms.

In a randomized, double-blind, placebo-controlled trial in post-stroke depression (n = 40), statistically significant decrease in Hamilton Depression Rating scale scores reported for *N. jatamansi*-treated but not control group (Bhat & Ahmad, 2023) attributable to combination of anxiolytic, sedative, tranquillizing and antioxidant actions and flavonoids/polyphenols mediated stress modulation (Wang et al., 2021) while separate randomized double-blind control trial comparing *jatamansi* root extract with Imipramine for generalized anxiety disorders (each of n = 38 group) reported comparable anxiolytic and antidepressant benefit corroborating preclinical evidence of efficacy and therapeutic utility. A completed phase-II randomized controlled trial of combination bacopa, *N. jatamansi* aqueous extracts v/s olanzapine in schizophrenia (Q. Mundewadi Ayurvedic Research & Charitable Trust, n.d.) further exploring potential beyond mood and anxiety disorders. Collectively the body of clinical evidence with, albeit limited, human sample sizes, represents somewhat unique human efficacy evidence vis-a-vis other pharmacological indicators reviewed here.

Hepatoprotective Activity

Njatamansi is classified as *Yakriduttejaka* (hepatostimulant) in Ayurveda and confirmed in experimental evidence in protecting against thioacetamide toxicity in rats (Ali et al., 2000). Broader reviews continue to cite hepatoprotection as one of the consistent pharmacological effects reviewed across various animal models and extract types (Pathak & Godela, 2024; Goyal & Rath, 2021)..

Cardioprotective and Hypolipidemic Activity

Jatamansone exhibits antihypertensive, anti-arrhythmic activity and the crude extract shows vasodilator, bronchodilator and platelet aggregation inhibitory effects (Pathak & Godela, 2024). In a rodent model of doxorubicin-induced cardiotoxicity, standardized methanolic extract of *N. jatamansi*, characterized by HPTLC fingerprint and GC-MS chemo-profiling, attenuated apoptosis, inflammation, and oxidative stress in cardiac tissue at both low and high doses, indicating cardioprotective effect achievable without compromising chemotherapeutic action of doxorubicin. This extends the findings characterization *N. jatamansi* as cardioprotective and hyperlipidemic herb capable of decreasing lipid peroxidation.

Anticancer and Cytotoxic Activity

Phytochemical fractionation of roots and rhizomes yield twenty-terpenoids including previously undescribed sesquiterpene skeleton screening for cytotoxicity against human pancreatic cancer cells (Ma et al., 2022). Though representing an early-stage isolate-level finding rather than therapeutic validation, this identifies *jatamansi* as a potential source of novel structurally diverse cytotoxic sesquiterpene scaffolds requiring further structure activity and in-vivo evaluation.

Antioxidant Activity

Across the extracts investigated *N. jatamansi* consistently displayed high free radical scavenging activity with a 70% ethanol extract showing IC₅₀ DPPH=222.22 +/- 7.4, ABTS=13.90 +/- 0.5, Superoxide radical 113.81 +/-4.2 ug/mL along with notable metal chelating, Fe reducing capacity (Razack et al., 2015) while essential oil (NJO) obtained by hydro-distillation at 4.28 yield, containing terpenoids (68.83%) and aromatic compounds (15.01%) as main fractions, displaying high superoxide-scavenging capacity compared to ascorbic acid; computational analysis suggests mechanism involves combination of direct hydrogen /electron donation mechanism as well as indirect cytoprotective mode through activation of Nrf2 ARE pathway, upregulation of endogenous antioxidant enzymes such as SOD and glutathione peroxidase (Zhang et al., 2026).

Anti-inflammatory and dermatological Activity

Yoon et al., investigated fourteen compounds from *N. jatamansi* including two novel ones and evaluates anti-inflammatory effects in TNF-alpha /INF-gamma-stimulated HaCaT keratinocytes as a standard in vitro model for atopic dermatitis like cutaneous inflammation. Cyclooolivil and related dioxatricyclodecane derivatives reduced production of inflammatory cytokines like IL-6 IL-8 and RANTES while cyclooolivil inhibited COX-2 expression with mechanistic studies providing evidence that its anti-inflammatory action was mediated by inhibition of JAK/STAT signaling pathway or NF kappa B (Yoon et al., 2024). Provide molecular basis for traditional topical and cosmetics usage of *jatamansi* and identifies cyclooolivil as promising candidate for inflammatory skin diseases.

Antimicrobial and Antifungal Activity

Essential oil and extract fractions show activity against Gram-positive, Gram-negative bacteria like *Staphylococcus aureus*, *Escherichia coli*; anti-fungal activity (Zhang et al.,2026; Pathak & Godela, 2024). Through GC-MS and bioassay work, on rhizomes harvested in different districts of Nepal (Taplejung, Gorkha and Jumla), identifies 66 total essential-oil compounds, of which sesquiterpenes formed the major group followed by aromatics and determines presence of calarene, seychellene, alpha.patchoulene, valencene, 7-epi-alpha-selene, patchouli alcohol common to all three districts while confirming antibiotic, and antioxidant activity; differences in chemotype, between geographical source, did not affect antibacterial activity. Micro-propagated (in vitro-grown) plant material has been validated as possessing comparative antibacterial activity to wild harvested rhizome material (Pant et al.,2024).

Antidiabetic and other Metabolic Activity

Hydroalcoholic extract has shown antihyperglycemic in alloxan induced diabetic rats. Recent reviews confirm anti-diabetic effects along with anti-hyperglycemic, antifungal, anti-oestrogen, nemacidal and anti-asthmatic effects along with establishing its long-standing anticonvulsant, and antiepileptic and tranquilizing properties (Pathak & Godela, 2024).

Essential Oil Chemistry, Chemotypic Variation and Quality Control

The characteristic musky odor of jatamansi is derived from a sesquiterpene-rich essential oil that has been historically exploited for its use in perfumery ('spikenard oil') or hair-care formulations. Modern GC-MS analyses consistently identify jatamansone/valeranone, calarene, seychellene, patchouli alcohol and related sesquiterpenoids as major constituents, although relative proportions vary significantly with geographic origin, potentially season and altitude. Since *N. jatamansi* is frequently adulterated with closely-related *V. jatamansi* and related species in commercial trade, recent multi-source data-fusion approaches incorporating chemical profiling together with geographical origin-specific biomarkers have been proposed for authentication purposes (Pathak & Godela, 2024). This is a critical issue for pre-clinical research, given heterogeneity in material quality has likely contributed to inconsistent efficacy observations in the preclinical literature.

Toxic effects:

Several cytotoxicity studies have been reported on various extracts of roots of *N. jatamansi*. Razack et al. showed that 75 µg/ ml was a toxic dose for 70% ethanolic root extracts of *N. jatamansi* on Neuroblastoma cells (Razack et al.,2018). Wang et al., 2021 reported that methanolic root extracts of *N.jatamansi* showed 200 µg/ ml on Murine macrophage RAW 264.7 cell line (Wang et al.,2021). Jatamansi is consumed traditionally for multiple ailments without any significant side effects. However, individuals with hypersensitivity should take special precautions while consuming. It may lead to breathing issues, skin irritation, drowsiness and stomach upset.

Marketed formulations:

Sr. No.	Product name	Use For	Pharmaceutical Company
1	Payodhi	Anticholestrolc	XO Herbs
2	Kesh Kanti Oil	Hair Care	Patanjali
3	Ovarin	Uterine Toinc	Ban Lab ltd
4	Jatamansi Oil	Hair Care	Tung Velly
5	Jatamansi Soap	Skin care	Santva
6	Jatamansi and Brighraj Hair butter	Hair care	Himalayan Origins
7	Jatamansi Churna	Digestion care	AGNIVESH AYURVED HEALTHCARE PVT. LTD
8	Jatamansi and Brahmi Hair therapy	Hair care	The paradise tree
9	Jatamanasi Hair Conditioner	Hair care	Roots and Herbs
10	Jatamansi Hydrating facial cleanser	Skin care	Jivisa
11	Relaxing face mask	Skin care	OJ Naturals

Table 4: Commercially available formulations containing *N. jatamansi* as active

Conservation efforts:

Due to medicinal properties of *N. jatamansi* it has been largely exploited for its roots. Its habitat i.e Himalayan Forest is very vulnerable to overexploitation and anthropogenic activities. Endemism, overutilization, improper management and limited efforts in conservation are the main culprits in pushing *N. jatamansi* into the list of IUCN critically endangered species. Habitat degradation, climate change, low seed viability and erratic seed production are some of the additional factors responsible for deterioration of *N. jatamansi* population (Chauhan, H.K., 2021).

The principal legislation controlling the harvesting of medicinal plants in India are the Indian Forest Act (1927) and some provisions of the Wildlife (Protection) Act (1927/1991/2002). It is forbidden by these acts to gather medicinal plants that are in danger of extinction from forests. In an attempt to save *N. jatamansi*, the Indian government has banned the widespread gathering of plant materials from their natural habitat for any reason (Purohit et al. 2012).

The National Parks and Wildlife Conservation Act (1973) and the Forests Act, 1927 (1976) govern the harvesting and trading of wildlife in Nepal. Divisional Forest Officers grant licenses that authorize the harvesting of therapeutic plants. The license details the species' harvest period, collection region has been attempted to be cultivated in Nepal and India (Chauhan and Nautiyal, 2005); nonetheless, the majority of the species' present commercial demand is satisfied by wild gather. It is recommended that future studies concentrate on comprehending the factors that drive demand, such as the proportionate need for various applications, developing strategies and instruments to strengthen community oversight and control over production zones, improving cultivation and propagation practices, and long-term monitoring

One aspect regarding conservation of plants is finding a substitute having similar properties to the original plant. But in most cases, it is found that adulterant instead of substitute is used in the marketed plants. The properties which root of Jatamansi possess like analgesic, sedatives which are useful in neurological disorders are also found in a plant called *Selinum vaginatum* C. B Clarke also commonly known as Bhootkeshi. Roots of *N. jatamansi* and *S. vaginatum* are often confused due to their resemblance to each other pertaining to morphology and odor. A study carried out by Pandey et al. compared phenolic profiles and antioxidant properties of *S. vaginatum* and *N. jatamansi*. Strong variation was observed between the phenol contents as well as antioxidant activities of both the plants and hence *S. vaginatum* as substitute for *N. jatamansi* is not recommended. It was also stated that more detailed studies need to be carried out for drawing out proper conclusions which take into account all the aspects of the plant (Pandey et al., 2013).

Home remedies

Jatamansi is highly regarded not only in the Indian medicinal system but also in Chinese, Tibetan, Nepalese, Bhutanese and Japanese medicines (Dhiman and Bhattacharya, 2020). Its roots and rhizomes have a bitter flavor and are aromatic, antispasmodic, diuretic, nerve sedative, nerve stimulant, tonic, carminative, and sedative to the spinal cord. They additionally help with digestion and appetite. They are also used in treatment of nervous, digestive, circulatory, respiratory, urinary, and reproductive systems (Joshi and Parle, 2006). The herb also comes handy in cure of cough, fever, headache, food poisoning, cholera, stomach disorders, intestinal worms, joint pain, rheumatism, stomach disorders, jaundice, and cardiac problems, and to purify the blood (Ghimire and Aumeeruddy-Thomas, Y., 2009). The concoction i.e the parts of the plant boiled in water also called as 'Kadha' in Marathi and Hindi is said to be very helpful in enhancing memory.

Conclusion

In conclusion, *Nardostachys jatamansi*, commonly known as jatamansi, is a remarkable herb with a long history of medicinal and aromatic uses. From its traditional role in Ayurvedic medicine to its modern applications in aromatherapy and pharmaceuticals, this plant has demonstrated versatile therapeutic properties. Its ability to alleviate stress, anxiety, and insomnia, coupled with its potential neuroprotective and antioxidant effects, make it a valuable natural remedy in today's fast-paced world. Furthermore, its antimicrobial and anti-inflammatory properties add to its medicinal significance. Beyond its medicinal uses, jatamansi's aromatic qualities make it a popular choice in perfumery and fragrance industries. Its deep, earthy scent has a calming effect and is often used in aromatherapy practices to promote relaxation and emotional well-being. While further research is warranted to fully understand the mechanisms of action and potential side effects, the existing evidence suggests that *Nardostachys jatamansi* holds promise as a holistic solution for various health concerns. Whether used as a herbal supplement, essential oil, or fragrance ingredient, jatamansi continues to captivate with its therapeutic benefits and rich cultural heritage.

Bibliography:

1. Dhiman, N., & Bhattacharya, A. (2020). *Nardostachys jatamansi* (D. Don) DC.-Challenges and opportunities of harnessing the untapped medicinal plant from the Himalayas. *Journal of ethnopharmacology*, 246, 112211.
2. Shah, N.C., 2023. Historical profile of *Nardostachys jatamansi*: an ancient incense & aromatic medicinal herb from Kumaon, Uttarakhand. *Indian Journal of History of Science*, pp.1-8.
3. Pathak, S., & Godela, R. (2024). *Nardostachys jatamansi*: Phytochemistry, ethnomedicinal uses, and pharmacological activities: A comprehensive review. *Fitoterapia*, 172, 105764.
4. Royal Botanic Gardens, Kew. (n.d.). *Nardostachys jatamansi* (D. Don) DC. *Plants of the World Online*. Retrieved September 15, 2026.

5. Royle, J. F. (1839). *Illustrations of the botany and other branches of the natural history of the Himalayan Mountains and of the flora of Cashmere*. Wm. H. Allen & Co.
6. Krishnan, N., Singh, P. K., Velmurugan, D., Mariappanadar, V., Chinni, S. V., & Pachaiappan, R. (2024). Enhanced production of actinidine and glaziovine alkaloids from *Nardostachys jatamansi* (D. Don) DC. through cell suspension culture with elicitors treatment. *Process Biochemistry*, 138, 139–149.
7. Duan, C., Lin, W., Zhang, M., Xue, B., Sun, W., Jin, Y., Zhang, X., Guo, H., Yuan, Q., Yu, M., Liu, Q., Wang, N., Wang, H., Wu, H., & Wang, S. (2025). *Nardostachys jatamansi* extract and nardosinone exert neuroprotective effects by suppressing glucose metabolic reprogramming and modulating T cell infiltration. *Cells*, 14(9), 644.
8. Goyal, S., & Rath, S. A. (2021). Comprehensive review of Jatamansi (*Nardostachys Jatamansi*). *Int J Res AYUSH Allied Syst*, 8, 3461-5.
9. Xue, B.-X., Yang, T.-T., He, R.-S., Gao, W.-K., Lai, J.-X., Liu, S.-X., Duan, C.-Y., Wang, S.-X., Yu, H.-J., Yang, W.-Z., Zhang, L.-H., Wang, Q.-L., & Wu, H.-H. (2023). Degradation profiling of nardosinone at high temperature and in simulated gastric and intestinal fluids. *Molecules*, 28(14), 5382.
10. Anupama, K. P., Shilpa, O., Antony, A., & Gurushankara, H. P. (2023). Jatamansinol from *Nardostachys jatamansi*: a multi-targeted neuroprotective agent for Alzheimer's disease. *Journal of Biomolecular Structure and Dynamics*, 41(1), 200-220.
11. Shah, A. J., Dar, M. Y., Adnan, M., Varma, T., Agarwal, D., Garg, P., Mir, R. H., Meena, R., & Masoodi, M. H. (2025). Integration of phytochemical profiling and computational approaches to evaluate the neuroprotective potential of *Nardostachys jatamansi* in Alzheimer's disease. *Biotechnology Reports*, 45, e00881.
12. Nakoti, S.S., Juyal, D. and Josh, A.K., 2017. A review on pharmacognostic and phytochemical study of a plant *Nardostachys Jatamansi*. *The Pharma Innovation*, 6(7, Part G), p.936.
13. Kizhakke Purayil, A., Olakkaran, S., Antony, A., Raghu, S. V., & Gurushankara, H. P. (2022). Jatamansinol from *Nardostachys jatamansi* (D. Don) DC. protects A β 42-induced neurotoxicity in Alzheimer's disease *Drosophila* model. *Neurotoxicology*, 90, 62–78.
14. Liu, Q. F., Jeon, Y., Sung, Y. W., Lee, J. H., Jeong, H., Kim, Y. M., Yun, H. S., Chin, Y. W., Jeon, S., Cho, K. S., & Koo, B. S. (2018). *Nardostachys jatamansi* ethanol extract ameliorates A β 42 cytotoxicity. *Biological and Pharmaceutical Bulletin*, 41(4), 470–477.
15. Arya, A., Chahal, R., Almutairi, M. H., Kaushik, D., Aleya, L., Kamel, M., ... & Mittal, V. (2022). Green approach for the recovery of secondary metabolites from the roots of *Nardostachys Jatamansi* (D. Don) DC using microwave radiations: Process optimization and anti-alzheimer evaluation. *Frontiers in Plant Science*, 13, 987986.
16. Ko, W., Park, J.-S., Kim, K.-W., Kim, J., Kim, Y.-C., & Oh, H. (2018). Nardosinone-type sesquiterpenes from the hexane fraction of *Nardostachys jatamansi* attenuate NF- κ B and MAPK signaling pathways in lipopolysaccharide-stimulated BV2 microglial cells. *Inflammation*, 41(4), 1215–1228.
17. Kim, D.-C., Park, J.-S., Yoon, C.-S., Kim, Y.-C., & Oh, H. (2021). Nardostachin from *Nardostachys jatamansi* exerts anti-neuroinflammatory effects through TLR4/MyD88-related suppression of the NF- κ B and JNK MAPK signaling pathways in lipopolysaccharide-induced BV2 and primary microglial cells. *Molecular Medicine Reports*, 23(1), 82.
18. Li, J., Yu, J., Guo, J., Liu, J., Wan, G., Wei, X., Yang, X., & Shi, J. (2023). *Nardostachys jatamansi* and levodopa combination alleviates Parkinson's disease symptoms in rats through activation of Nrf2 and inhibition of NLRP3 signaling pathways. *Pharmaceutical Biology*, 61(1), 1175–1185.
19. Liu, M., Xue, J., Cao, Y., Hao, Z., Wang, Y., Li, J., Jiang, T., & Shi, J. (2024). The effects of nardosinone on levodopa intervention in the treatment of Parkinson's disease. *Biomedicine & Pharmacotherapy*, 174, 116448.
20. Khan, M. B., Hoda, M. N., Ishrat, T., Ahmad, S., Khan, M. M., Ahmad, A., Yusuf, S., & Islam, F. (2012). Neuroprotective efficacy of *Nardostachys jatamansi* and crocetin in conjunction with selenium in cognitive impairment. *Neurological Sciences*, 33(5), 1011–1020.
21. Malik, R., Firdose, K. F., & Bhat, M. D. A. (2018). Efficacy of *Nardostachys jatamansi* DC. in the management of premenstrual syndrome: A randomized controlled study. *Journal of herbal medicine*, 14, 17-21.
22. Dhingra, D., & Goyal, P. K. (2008). Inhibition of MAO and GABA: probable mechanisms for antidepressant-like activity of *Nardostachys jatamansi* DC. in mice. *Indian journal of experimental biology*, 46(4), 212.
23. Bhat, M. D. A., & Ahmad, H. (2023). Efficacy of *Nardostachys jatamansi* (D. Don) DC in post stroke depression: A randomized, double blind, controlled trial. *Brain Behavior and Immunity Integrative*, 2, 100012.
24. Wang, M., Yang, T.-T., Rao, Y., Wang, Z.-M., Dong, X., Zhang, L.-H., Han, L., Zhang, Y., Wang, T., Zhu, Y., Gao, X.-M., Li, T.-X., Wang, H.-Y., Xu, Y.-T., & Wu, H.-H. (2021). A review on traditional uses, phytochemistry, pharmacology, toxicology and the analytical methods of the genus *Nardostachys*. *Journal of Ethnopharmacology*, 280, 114446.

25. Q. Mundewadi Ayurvedic Research & Charitable Trust. (n.d.). *A safety and efficacy study of Bacopa monnieri and Nardostachys jatamansi to treat schizophrenia* (NCT00483964). ClinicalTrials.gov.
26. Ali, S., Ansari, K. A., Jafry, M. A., Kabeer, H., & Diwakar, G. (2000). *Nardostachys jatamansi* protects against liver damage induced by thioacetamide in rats. *Journal of Ethnopharmacology*, 71(3), 359–363.
27. Ma, L.-M., Wang, K., Meng, X.-H., Zheng, Y.-D., Wang, C.-B., Chai, T., Naghavi, M. R., Sang, C.-Y., & Yang, J.-L. (2022). Terpenoids from *Nardostachys jatamansi* and their cytotoxic activity against human pancreatic cancer cell lines. *Phytochemistry*, 200, 113228.
28. Razack, S., Kumar, K. H., Nallamuthu, I., Naika, M., & Khanum, F. (2015). Antioxidant, biomolecule oxidation protective activities of *Nardostachys jatamansi* DC and its phytochemical analysis by RP-HPLC and GC-MS. *Antioxidants*, 4(1), 185–203.
29. Zhang, H., Qin, H., Zha, J., Zheng, Y., Ji, J., Chen, R., Liu, T., & Cheng, J. (2026). Chemical analysis, antioxidant and antimicrobial activities of *Nardostachys jatamansi* essential oil, and computational evaluation of mechanisms. *Frontiers in Nutrition*, 13, 1764021.
30. Yoon, C.-S., Lee, H., Liu, Z., Dong, L., Lee, G., Kim, N., Oh, H., & Lee, D.-S. (2024). Cyclooolivil isolated from *Nardostachys jatamansi* inhibits TNF- α /IFN- γ -induced chemokine production by blocking NF- κ B and JAK/STAT activation in HaCaT keratinocytes. *International Journal of Molecular Sciences*, 25(6), 3342.
31. Pant, H. C., Gaurav, N., & Pant, H. V. (2024). Mountainous therapeutic plant *Nardostachys jatamansi* (D.Don) DC grown in vitro used as a substitute for wild plants. *Journal of Drug Research in Ayurvedic Sciences*, 9(5), 335–346.
32. Wang, M., Yang, T.T., Rao, Y., Wang, Z.M., Dong, X., Zhang, L.H., Han, L., Zhang, Y., Wang, T., Zhu, Y. and Gao, X.M., 2021. A review on traditional uses, phytochemistry, pharmacology, toxicology and the analytical methods of the genus *Nardostachys*. *Journal of Ethnopharmacology*, 280, p.114446.
33. Bose, B., Kumaria, S. and Tandon, P., 2022. Physiological insights into the role of temperature and light conditions on in vitro growth, membrane thermostability and antioxidative activity of *Nardostachys jatamansi*, an IUCN Red-listed critically endangered therapeutic plant. *South African Journal of Botany*, 146, pp.365-374.
34. Rao, V.S., Rao, A. and Karanth, K.S., 2005. Anticonvulsant and neurotoxicity profile of *Nardostachys jatamansi* in rats. *Journal of ethnopharmacology*, 102(3), pp.351-356.
35. Chauhan, H.K., 2021. *Nardostachys Jatamansi*. The IUCN Red List of Threatened Species 2021.
36. Purohit, V. K., Chauhan, R. S., Andola, H. C., Prasad, P., Nautiyal, M. C., & Nautiyal, A. R. (2012). *Nardostachys jatamansi* DC. is at risk in the Himalayan region. *Current Science*, 103(3), 251–252.
37. Chauhan, R.S. and Nautiyal, M.C., 2005. Commercial viability of cultivation of an endangered medicinal herb *Nardostachys jatamansi* at three different agroclimatic zones. *Current Science*, 89(9), pp.1481-1488.
38. Pandey, M.M., Katara, A., Pandey, G., Rastogi, S. and Rawat, A.K.S., 2013. An important Indian traditional drug of ayurveda *jatamansi* and its substitute *bhootkeshi*: chemical profiling and antioxidant activity. *Evidence-Based Complementary and Alternative Medicine*, 2013.
39. Dhiman, N. and Bhattacharya, A., 2020. *Nardostachys jatamansi* (D. Don) DC.-Challenges and opportunities of harnessing the untapped medicinal plant from the Himalayas. *Journal of ethnopharmacology*, 246, p.112211.
40. Joshi, H. and Parle, M., 2006. *Nardostachys jatamansi* improves learning and memory in mice. *Journal of medicinal food*, 9(1), pp.113-118.
41. Chauhan, R.S., Kaul, M.K., Kumar, A. and Nautiyal, M.C., 2008. Pollination behaviour of *Nardostachys jatamansi* DC., an endangered medicinal and aromatic herb. *Scientia horticulturae*, 117(1), pp.78-81.
42. Ghimire, S.K. and Aumeeruddy-Thomas, Y., 2009. Ethnobotanical classification and plant nomenclature system of high altitude agro-pastoralists in Dolpo, Nepal. *Botanica Orientalis: Journal of Plant Science*, 6, pp.56-68.