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A DETAILED REVIEW ON THE RARELY FOUND HIMALAYAN HERB *SELINUM VAGINATUM*: ITS ACTIVE CONSTITUENTS, PHARMACOLOGICAL USES, TRADITIONAL AND POTENTIAL BENEFITS

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ABSTRACT

Introduction: Traditional herbs and drugs are the current choices of people in most areas where herbs are commonly being prescribed and used for the management of diseases. The current scenario of undertaking Ayurveda medications and herbs as a potent cure for many diseases is growing phenomenally. In this paper, we have presented a detailed analysis of a Himalayan Herb *Selinum vaginatum*, which is a good source and a potential treatment for curing many diseases. The potential of this herb is not much explored scientifically. It is found in the regions of Northern Himalayas alongside the states like Himachal Pradesh, Kashmir, Uttarakhand, high altitude regions China mainland (Himalayan region) – Kailash Mountain region, Pakistan, etc**. Objectives:** The main objective of the paper is to get detailed information about the taxonomical classification of species, traditional uses, pharmacological actions, and chemical composition of *Selinum vaginatum*. **Material and Methods:** The review was performed to gain detailed knowledge of *Selinum vaginatum*. The review was carried out using search engines to investigate tribal uses, pharmacological actions, and pharmacognostic characteristics. The data collected from multiple platforms were used in this research. **Result:** The roots of the plant have been used traditionally and show pharmacological activities like anti-fungal, anti-convulsion action, seed germination inhibition effects, sedative, analgesic and hypotensive actions, antioxidant activity, anti-epileptic and anti-hysteria effect, etc. The key constituents reported in the plant roots are Selenidin, Angelicin, Oroselol, alpha-pinene, camphene, elemol, limonene, 3, 5-nonadiyne, sesquiterpenoids (valerenic acids), phenol (chlorogenic acid), valerianannoids, essential oils, vaginidin, angelicin, selinidin, orosenol, and selinone. **Conclusions:** The information documented in this paper will be helpful for medicinal, commercial, and industrial uses. It will help grow information about this Himalayan herb and its unexplored therapeutic potentials can be tested pharmacologically. A lot of information about the tribal uses is also shared in this paper, which will direct the interest of researchers over this plant and test the activities of the essential oil and the components of *Selinum vaginatum in vitro* and *in vivo*. The analysis of the extracts from the plant must be well researched for pharmacologically active constituents to find the active constituents responsible for therapeutic benefits.

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Introduction

Recommencement on the use of herbal drugs and products for curing any ailment and treatment of diseases has been restored in recent decades [1]. The refurbished belief in herbal drugs is the need for usage of a healthier form of medicines especially green medicine in comparison to the synthetically prepared drugs. Henceforth the herbal drugs are being preferred over the

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allopathic medications mostly in cases of neuroprotection, as these medications are economic and possess minimum side effects [2].

The plant *Selinum vaginatum* is also known as Bhutakeshi or Bhootkeshi or Bhutberi in Ayurveda. [3]. It is indigenous to Indian and is found in the high Himalayan altitude region, Kullu district of Himachal Pradesh at an altitude of 2700-3700 m, Holi range of Chamba, Rampur and Rohru division of Shimla district, Chhota and Bara Bhangal area of Kangra. *Selinum vaginatum* was also reportedly found in the Kali Ganga HEP project site with a latitude of 300 36'40" and longitude of 7905'10" in the Banj oak forests [4].

The general features of the plant *S. vaginatum* show that the plant is a glabrous stout herb whose height is 1-1.5 m. It is mainly found in the western regions of Himalayas at the altitude of 1800 – 3800 m. Its rhizome or rootstock region is mainly 10-15 cm, usually with tapered ends. It belongs to the Umbelliferae family [5]. A total of 35 species of Selinum have been distributed worldwide. The species of this plant are perennial and branched. The plants belonging to this genus are usually found on the slopes rich in humus in the zone of South Africa, Himalaya, and Andean mountains. In India, there are approximately five species of Selinum, *S. vaginatum*, S. *wallichianum*, S. *candollii,* S. *striatum*, and S. *elatum*, which have been recorded and collected from Uttarakhand, Kumaun region, and Garwal Region [5-7].

The roots, rhizome, and fruits of the plant have high medicinal values that are used as a Nervine sedative, in the treatment of conditions like hysteria dysmenorrhea, and skin diseases [8]. The roots are fiber-like and thus given the name Bhutakeshi and the major medicinal used noted to date are hypotensive action, analgesic, and nerve sedative action [9].

Roots of N. *Jatamansi* and *S. vaginatum* are confusing as they show good resemblance in their morphological characteristics and odor; hence, at the time they are used as each other's substitute in the Indian herbal drug market [10]. It is usually used as an adulterant to the drug Nardostachys *Jatamansi* D C. (Valerianaceae) [11], which is used as an ancient medicinal plant belonging to the family Valerianacae and has antiparkinson, antifungal, anticonvulsant, antioxidant, and hepatoprotective activities [12]. The complete taxonomical classification and synonyms of the *Selinum vaginatum* are mentioned in Tables 1 and 2.

Table 1: The other names of the plant are as follows: [13, 14]

S. No.	Language/ Aspect	Name
1.	Scientific Name	*Selinum vaginatum*
2.	Ayurveda	*Rochanatagara, Mansri Vishesa, Rochana-Tagara*
3.	Hindi	*Bhutakesi, Muramaansi*
4.	Bengali	*Bhutakesi*
5.	Marathi	*Mura*
6.	Oriya	*Bhutakesi*
7.	Telugu	*Bhutakesi*
8.	Garhwal	*Taggar*
9.	Kumaun	*Moor*
10.	Kannada	*Mura*
11.	Malayalam	*Moramamsi*
12.	Kashmir	*Pushwari, Peshavari, Bhutakeshi*
13.	Trade name	*Bhutkeshi*
14.	Synonym	*Akasamamsi, Mura, Bhurigandha, Gandhamadam*

Methodology

The literature survey was performed to gain detailed knowledge of *Selinum vaginatum*. The survey was carried out using search engines. The data were collected from multiple platforms and were used in this paper. The search engines used were Google scholar (https://www.google.com/scholar), PubMed (http://www.ncbi.nlm.nih.gov/ PubMed), Research Gate (https://www.researchgate.net/), Science Direct (http://www.sciencedirect.com), Scopus (http:/www.scopus.com), Google engine and SciFinder (http://www.libnet.ulg.ac.be/en/eresources/scifinder-scholar). The papers in English were only considered and the rest were ignored. The inclusions and exclusion considered for the searched data were according to the following:

Inclusion criteria

- The studies, which have been included were either in vivo, ex vivo or in vitro with or without the use of any experimental animal, including the human subjects or were derived from cells/tissues/microorganisms/rodents.
- The studies, which have reported bioactive compounds or have preliminary reports of active compounds.

- Studies of *S. vaginatum* or its herbal mixture
- Studies with crude extracts of the drug, isolated or extracted fractions from different solvents
- Studies with reported mechanisms or activity of the herb.

Exclusion criteria

- Any replicated data or title, which is not falling in the inclusion limits was excluded
- Unpublished data from reports and dissertations were not considered.

The papers were searched using the terminologies like "Phytochemical Studies", "Pharmacological action", "Antioxidant Activity", "Anti-Convulsant", "Anti-Hysteria Effect", "Antioxidant Activity", "Hypotensive Actions", "Aphrodisiac", "Sedative action", "Analgesic action". The chemical structures were found by PubChem (http://pubchem.ncbi.nlm.nih.gov/search/#collectioncompounds) and drawn with the help of sourced articles using a freeware version of the software ChemSketch. A total of 74 papers were selected for extracting useful information on *S. vaginatum* and its species.

Table 2: The taxonomical classification of the plant is as follows: [15]

S. No.	Taxonomical Category	Classification
1.	Kingdom	*Plantae* (comprising all living or extinct plants)
2.	Phylum	*Tracheophyta*
2.	Subkingdom	*Tracheobionta,* (have lignified tissues or xylem for conducting water and minerals)
3.	Superdivision	*Spermatophyta*, (produce seeds)
4.	Division	*Magnoliophyta*, Flowering plants
5.	Class	*Magnoliopsida* (flowering plant producing an embryo with paired cotyledons)
6.	Sub Class	*Rosidae*
7.	Order	Apiales
8.	Family	*Umbelliferae*
9.	Genus	*Selinum L. – selinum*
10.	Species	*Vaginatum*
11.	Other species of Selinum	• Selinum *capitellatum var. scabrum (Jeps.) Munz* • Selinum *capitellatum* (A. Gray) Benth. and Hook. f. • Selinum *carvifolia (L.)* L. - Cambridge Milk-parsley or Little-leaf Angelica • Selinum *longicalycinum* M.L. Sheh • Selinum *pyrenaeum* (L.) Gouan • Selinum *papyraceum* C.B. Clarke • Selinum *wallichianum* (DC.) Raizada & H.O. Saxena syn. • Selinum *tenuifolium Wall*. ex C.B. Clarke • Selinum *cryptotaenium Boissieu*

General Features

Selinum vaginatum is a medium or probably a dwarf plant with 35 species of perennial plants. The plants belonging to this genus are found in humus-rich slopes of Himalayas as well as in South African and Andean mountains at the height of 6000–14000 ft. It is also referred to as *Selinum vaginatum* C.B. Clarke and is an important medicinal aromatic plant species (MAPs) as their genus. The rhizome roots of *S. vaginatum* possess a characteristic odor just like Nardostachys Jatamansi [11] but they can be easily differentiated based on their anatomies [15]. The images of the plant are shown in Figures 1 and 2.

Macroscopic and Microscopic Studies:

The rhizome roots of the plant are covered with brittle hairs on the ends. The fractures seen on the roots are short and brittle and the roots are intense black-brown in color. Organoleptic features of the plant are as follows: odor is strongly aromatic and camphor-like while the taste is bitter. The transverse section of the roots shows it has circular outlines while the cork possesses 4-8 layers of cells, which are filled with some material. Schizogenous canals are not abundantly present whereas the xylem vessels have scalariform thickenings [13].

Figure 1: Rhizomatous roots of *S. vaginatum*

Figure 2: Himalayan Plant *S. vaginatum* in its habitat in Rohtang valley

Phytochemical Studies

The rhizomes of *S. vaginatum* have a characteristic odor and also can be differentiated with adulterants by anatomical differences. They possess an aromatic odor, diuretic, and antispasmodic properties. The petroleum extracts of the roots contain Selenidin, Angelicin, and Oroselol [11, 16]

When the distillation was completed, a green-yellow colored essential oil was collected from *S. vaginatum*. 37 constituents in total composed of 96.4% of the entire volatile oil were found by using GC/MS and GC/FID. The significant component of the essential oil obtained from *S. vaginatum* is bornyl acetate (60.4%). Whereas other important components are alpha-pinene (11.0%), camphene (6.8%), elemol (3.4%), limonene (2.9%), 3, 5-nonadiyne (1.2%), etc. S. tenuifolium, a plant from the same genus, also showed the presence of 3, 5-nonadiyne, bornyl acetate, limonene, alpha- pinene, and camphene. [15]

The studies have indicated that the constituent of the essential oil is sesquiterpenes, monoterpenes, and some hydrocarbons. [17]

The roots of the plants have been used traditionally for the treatment of various diseases like sleep disorders, epilepsy, snake poisoning, obesity, nervous disorders, skin ailments, and eye troubles. The roots have shown a strong presence of sesquiterpenoids (valerenic acids), chlorogenic acid, valerianoids A-C, and essential oils [18-20].

The dried roots of the plant were packed in filter paper and refluxed for 2 cycles of 30 minutes in 50 ml RBF using 20ml methanol. The marcs were then washed with methanol and concentrated to half of its volume. The Valerenic Acids are proven to be easily soluble in methanol and are present around 360.22; 0.0360 (µg/g; %w/w) in the *Selinum vaginatum* roots [21]. The major active constituents and their chemical structures extracted using different solvent mediums are presented in Figure 3 and Table 3. Bhootkeshi plant belonging to the family Umbelliferae acts as a nerve sedative, which is useful in the treatment of hysteria. It contains coumarins mainly vaginidin, angelicin, selinidin, orosenol and selinone. [10, 11, 22, 23]

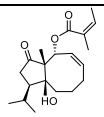
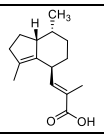
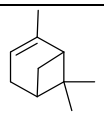
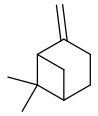
S. No.	Name	Chemical Structure	Obtained from	Occurrence in other main host plants.
1.	Vaginatin		Roots of *Selinum vaginatum*	*Ferula communis* (Family – Umbellifers)
2.	Vaginidin		Roots of *Selinum vaginatum*	N/A
3.	Selinone		Roots of *Selinum vaginatum*	N/A
4.	Selinidine (I)		Roots of *Selinum vaginatum*	N/A
5.	Oroselol		Roots of *Selinum vaginatum*	*Nardostachys jatamansi* (Family - Honeysuckle)
6.	Lomatin		Roots of *Selinum vaginatum*	*Raulinoa echinata* Cowan (Family - Rutaceae)
7.	Valerenic Acid		Roots of *Selinum vaginatum*	*Valeriana officinalis*, (Family- Caprifoliaceae)
8.	Angelicin		Roots *of Selinum vaginatum*	*Angelica archangelica* (Family - Apiaceae)
9.	4-hydroxy-4-methylpentan-2-one		Roots of *Selinum vaginatum*	*Oenothera glazioviana* (Family: Onagraceae)
10.	Alpha – Pinene		Roots of *Selinum vaginatum*	*Rosmarinus officinalis* (Family - family Lamiaceae)
11.	beta – Pinene		Roots of *Selinum vaginatum*	*Pinus kesiya* (Family -Pinaceae)
12.	Carvone		Roots of *Selinum vaginatum*	*Carum carvi* (Family – Umbellifers) Mentha spicata (Family: Lamiaceae) Dill (Family- Umbellifers)

Figure 3: Chemical Constituents in roots of *S. vaginatum*

Table 3: Major chemical compounds found in *S. vaginatum* as reported by variable extractions

S. No.	Plant Name	Plant Part	Extraction Medium	Technique used	Major Isolated Compound	Reference
1.	*S. vaginatum* Clarke	Roots	Light petroleum extract	UV & IR spectrum	Selinidin (I) C9H20O5	Sheshadri and Sood (1964) [23]
2.	*S. vaginatum*	Roots	Petroleum ether extract	TLC & UV-visible spectrum	Selinidin, Angelicin, Coumarin ester, Selinidin and Oroselol	Sheshadri et al. (1966) [22]
3.	*S. vaginatum*	Roots	Petroleum ether extract	UV, IR & NMR spectral studied	Lomatin, Vaginidin Oroselol, Selidinin, Angelin	Sheshadri and Sood (1996) [22]
4.	*S. vaginatum*	Roots	Methanol Extract	UV, IR, TLC fingerprinting	Valerenic acid (VA)	Batra et al. (2016) [21]

Phenolic Content

S. vaginatum methanolic extract shows a significant amount of phenolic content, which was found to be 22.74 mg GAE g−1. The research also proved that there was a substantial quantity of protocatechuic acid and Chlorogenic acid found in *S. vaginatum* [24].

Volatile Compounds

The plants from Selinum species are rich in essential oil content. When the essential oil constituents of *S. vaginatum* from two distant places Tungnath (Uttarakhand) and Rohtang (Himachal Pradesh) were compared, it was found that out of 28 only 12 compounds were observed to be commonly found in both. This was performed using GC-MS and GC-FID analysis. The variation in the essential oil was due to the genetic makeup as well as the environmental factors involved. Using GC/MS and GC/FID analysis it was found that the underground part of *S. vaginatum* beard 37 constituents, which constituted to 96.4% of the complete volatile portion. [25]

In a research performed for identifying the essential oil components of *S. vaginatum* using GC-MS and GC-FID many components were identified and quantified as Tricyclene (0.26), 4-Hydroxy-4-methylpentan-2-one (0.9), Carvone (0.16), Thymol (0.13) alpha-pinene (11.02), beta-pinene (0.53) Terpinen-4-ol (0.13), Camphene (6.81), Beta-Myrcene (0.89), p-Cymene (0.09), Thymolmethyl ether (0.17), Limonene (2.94), 3,5-Nonadiyne (1.19) alpha Pineneoxide (0.06), Verbenol (0.15), Borneol (1.67), trans –Verbenone (trans), trans-Carveol (0.11), p-Cymen-8-ol (0.23), 14-Hydroxy –muurolene (0.46), Eudesmol isomer (0.02), Guaiol (0.08), Pogostol (2.13), Elemol (3.41), Isobornyl isobutyrate (0.07), etc. [26]

Pharmacological Actions

Antibacterial Action

The antibacterial action of the essential oils from *S. vaginatum* has been observed. The pharmacological action was justified by determining the minimum bactericidal concentration (MBC) and minimum inhibitory concentration (MIC) with the help of the disc diffusion method. All strains of bacteria were separately cultured (prepared on nutrient agar) for 24 hours.

The bacterial strains tested were Gram-positive: *Staphylococcus aureus* (MTCC 737), *Bacillus subtilis* (MTCC 121), *Enterococcus faecalis* (MTCC 439) and Gram-negative were *Erwinia chrysanthemi* (KUMSCC 328), *Klebsiella pneumoniae* (MTCC 109), *Agrobacterium tumefaciens* (MTCC 609), *Escherichia coli* (MTCC 443), *Xanthomonas phaseoli* (KUMSCC 327), *Salmonella enterica* (MTCC 3223) and *Pasteurella multocida* (MTCC 1148).

The findings suggested that the essential oil collected from the roots and aerial parts of *S. vaginatum* wherein γ-terpinene, (2E, 6E)-farnesol, β-pinene, (2E, 6Z)-farnesol, and elemol, which had the antibacterial potential against *Bacillus subtilis, Erwinia chrysanthemi, Salmonella enterica, Enterococcus faecalis*, and *Klebsiella pneumonia* [27].

Antioxidant Activity

The methanol extract from the roots of *S. vaginatum* has reportedly shown significant antioxidant properties. The phenolic contents have been useful in the treatment of hysteria, epilepsy, syncope, etc. The total antioxidant content of *Selinum vaginatum* root extract was measured with the help of phosphomolybdenum complex recorded spectrometrically at 695nm. In the experiment, the antioxidant content was found 143 μmol ascorbic acid equivalent per gram [24].

The improvement of induced neural damage caused by methylmercury was recorded by the dosing of the essential oil of *Selinum vaginatum* (Edgew) C. B. Clarke. The research was performed using a rat brain and studying its mitochondrial fractions where the MTT assay indicated the restoration of the low GSH levels and catalase activity, which was induced by MeHg [28].

DPPH Radical Scavenging Activity

To the methanolic solution of DPPH, 2ml (100mM) of the test sample – methanolic extract of *Selinum vaginatum* (dissolved in methanol) was added at variable concentrations of 40–200 µg/mL. Here an equal amount of methanol was added as a control. Then the absorbance was recorded at a wavelength of 517 nm after 5min, 15min, and 30 min.

The scavenging action was calculated by percentage:

$$\%\ \text{Scavenging Activity} = \frac{A_{517}\ \text{of control} - A_{517}\ \text{of sample}}{A_{517}\ \text{of control}} \times 100$$

S. vaginatum extract was recorded IC_{50} 165 μg/mL of DPPH radical scavenging activity post reacting with DPPH radicals. The action was dependent on the concentration and time with a percentage value of 57.48% at 200 μg/mL concentration and 30 minutes [24].

Anti-Fungal Action

The anti-fungal action of the essential oil (obtained after steam distillation) from the roots of *S. vaginatum* was tested. Various concentrations of the oil were prepared using distilled water, 10% DMSO, and potato dextrose agar (PDA). The mycelium plugs were kept on the center of each plate while in the control group plate 10% DMSO of the same amount was applied. Different plates were tested after incubation for 3-8 days at 25±2 °C and tested until the fungus in the control plates reached the periphery. Then the inhibition of the fungal strain was calculated. MIC was then calculated by the agar dilution method where oil samples were dissolved in 10% DMSO and spore suspension of 10 µl spore of every fungal strain was then inoculated in PDB medium - Potato dextrose broth at 25±2°C for 4-8 days. MIC was calculated when there was no visible growth in the test tubes [29].

The oil of selinum was tested for R. *solani*, S. *sclerotiorum* (for an incubation time of 4 days) and C. *graminicol*a, A. *tenuis*, and F. *oxysporum* sp (for incubation of 8 days) at 25±2°C. When the results were observed, the oil inhibited the growth of mycelia strain as per the dose-dependent manner. The essential oil was effective against all the pathogenic fungi tested in the experiment but the results were variable at different concentrations.

The inhibitory action was variable from 52.50% to 100% against different concentrations of pathogenic fungi. The essential oil from the roots of *S. vaginatum* was found to completely inhibit the growth of A. *tenuis*, C. *graminicola*, and S. *sclerotiorum* at 500 µg/mL, 3000 µg/mL, and 2000 µg/ml, respectively. Though F. *oxysporum* and R. *solani* were slightly less affected by this oil [29].

Essential compounds in *Selinum vaginatum* and its reported pharmacological actions in other plants

Bornyl acetate present in *S. vaginatum* has also been reported from Valeriana *officinalis* [30] Alpha- pinene and Beta- pinene are present in this species, therefore, it has shown anti-convulsing activities [24, 31] seed germination inhibition effects [31], and insecticidal effects [32]. These essential compounds are also found in *S. vaginatum* hence there is a strong probability that these compounds present in the herb are responsible for its medicinal uses (reported by tribals). Investigations have revealed that sesquiterpenes present in *S. vaginatum*, which has potential pharmacological uses and is also useful in ethnomedicinal systems and this chemical has opened new avenues for research in the medical sector. N. *jatamansi* and *S. vaginatum* both have been used traditionally for the treatment of hysteria, epilepsy, and seizures. As oxidative stress can be a cause of seizures and thus it is assumed that the antioxidants present in the compounds found in these species might be responsible for the therapeutic uses. As the phenolic compounds are very powerful antioxidants, they have shown various biological responses like anti-carcinogenic, antibacterial, antiviral and vasodilator actions [33, 34]

Tribal uses

The leaves of the plants are considered nutritious by locals and are used as fodder for sheep and goats. The roots of the plant possess a strong musky odor and are used by locals to create incense sticks and dhoop, which is used while performing worship to God. Small pieces of roots or pinch of powdered roots are used as a spice to add flavors to the cooked dishes [35, 36].

The plant has been used traditionally in many regions of India and has been used for effective treatment of diseases. A list of the traditionally reported use of *S. vaginatum* and their parts used is mentioned in Table 4. Since the ancient time, a lot of tribals have been relyed on the herbs that grow in their vicinity or nearby areas. A survey was performed on the medicinal plants used by Migratory Shepherds in Shimla in Himachal Pradesh where it was noted that *S. vaginatum* leave juice was used for the treatment of skin allergy [37, 38].

A research was conducted about the usage of ethnomedicine (herbal remedies) in Uttarakhand where the Bhotia tribe of Mana village used *Selinum vaginatum* to increase lactation in cows. The tribal people used the roots of the plant or even the plant as a whole, this plant was set on fire and then the smoke released from this was given to cows to stimulate lactation

[39]. Bhotia tribe people from Bageshwar District of Kumaon region in the Himalayas also used the smoke of *S. vaginatum* roots for inducing lactation in cows [40].

In Nanda Devi biosphere research of Uttarakhand, a study was conducted where the shepherds, faith healers, priests, and housewives were taken to the forest reserve for identification of herbal plants they use for treatments. Out of many medicinal plants *Selinum vaginatum* was identified as a healer for mental disorders. The powder of S *vaginatum* was used in the treatment of epilepsy and hysteria [41].

Ranaa et al. also conducted a survey in 2019 where he consulted the local people and came to know about the Folk Medicine Recipe of *Selinum vaginatum.* The powder of roots was given as ½ teaspoon two times a day for six months for treating conditions like epilepsy, convulsion, and hysteria. Leaves of the plants were also used for their medicinal value. The leaves were dried in shade then washed with hot water three times. This was then consumed as a vegetable two times a day for treating conditions like blood dysentery, colic, urinary complaints, and diabetes. Leaves of *S. vaginatum* have also been used in improving lactation and treating menstrual problems [42].

Root powder of *Selinum vaginatum*, Acorus *calamus*, and Paeonia *emodi* are mixed and given as half teaspoonful two times a day for treating epilepsy and hysteria. The same powder, when given for 7 to 21 days, treats pharyngitis [42, 43].

Extensive surveys were conducted in Gurjar dominant villages to get ethnobotanical information about the Gujjar tribe in high altitude regions (Adhwari's) of Churah subdivision in the district Chamba of Western Himalaya where it was noted that all parts of the plant *S. vaginatum* were used in making incense sticks [44, 45].

A study was conducted in the Lahaul valley, which is a proposed Cold Desert Biosphere Reserve of India, where 66 villages of Chandra-Bhaga, Mayar, Bhaga, and Chandra were identified for getting information about the medicinal plants they use. The inhabitants conveyed that they used *Selinum vaginatum* for the treatment of skin diseases, hysteria, in liquor preparation, dysmenorrhea, and as a Nervine sedative [46].

The rhizome of *S. vaginatum* is mentioned in API- VI volume in Indian Pharmacopoeia as well as mentioned in Unani medicine [47].

According to a report generated by Conservation Concern Medicinal Plants for Himachal Pradesh, the plant *Selinum vaginatum* of the Himalayan region was put under the category of Critically Endangered species [48]. This is a region in Northwestern Himalayas. *S. vaginatum* is called Matoila by the locals and it is used by the tribals of Parbati valley for treatment of hysteria and dysmenorrhea. The plant is also used as a nervine sedative, in liquor preparation and treatment of skin diseases [8].

S. vaginatum is commonly called as Matosal by the locals of Lahaul Valley. The rhizome of *S. vaginatum* us used by the locals of Lahaul Valley, which follows an Amchi System of Medicine. The valley is a cold deserted area of Himachal Pradesh in the region of North-Western Himalayas, India. It was noted that the tribals used rhizomes of *S. vaginatum* for treating asthma, cough, hysteria, as an analgesic and an antibacterial. The rhizome was also used as a sedative, nervous tonic and preparation of local liquor. Household use of the rhizomes is as spices and also in making incense sticks [36, 49].

A study was performed to collect information about prominent medicinal plants in the Parbati valley of Kullu district in HP (Himachal Pradesh) where the morphological feature was deeply studied and information was also collected about the medicinal benefits of the plants from the locals of the valley. It was noted that the plant was used by people for making ornaments, fodder, and as a potential source of medicines. Local people termed *S. vaginatum* as Bhutjata or Bhutkeshi and it was used to treat patients with mental disorders. The roots of the plant also yield essential oil, which was used as a hypotensive, sedative, analgesic, and in making incense sticks [50].

In a case study conducted in Urgam Valley of Chamoli Garhwal, Uttarakhand the information was collected about the Traditional Herbs used by Inhabitants where it was found that half tablespoon of the root powder of *S. vaginatum* was used as a coolant by locals [51].

The tribals of Kugti wildlife sanctuary (conservation on Himalayan brown bear Ursus arctos habitat) used rhizome of *S. vaginatum* for evil spirit treatments. They believe that the rhizomes of the plant can be used for warding off evil spirits [52].

The local inhabitants of four villages – Manali, Nasogi, Dhungari, and Banaun were investigated from the Manali region in Northwestern Himalayas. *S. vaginatum* – called Matoila in the local language was used by the natives of these villages. The roots of the plant were used as a nervine sedative [53].

To know more about the medicinal practices and herbs used by the Jaad Bhotiya Community of Uttarakhand in Western Himalayas, a survey was conducted where the roots of *Selinum vaginatum* were reportedly used by locals in curing skin diseases and swelling muscles [35, 54, 55].

In the cultural studies and analysis of the medicinal herbs used in the Dudu valley-Jammu and Bhaderwah Hills of Jammu Province the roots of *Selinum vaginatum* were used as a Carminative, in the treatment of fever and Worms [56-68].

The popular medicinal plants in the hariyali Devi landscape of Uttarakhand were identified where *S. vaginatum* was also a noteworthy herb popularly used by the local inhabitants of that area [59].

In research, it was quoted that *S. vaginatum* roots were used in treating painful toothache and according to the local beliefs, the whole plant is often kept in houses to rid off any evil spirit [60].

Table 4: Traditional and Tribal uses of various parts of Selinum and their reported biological roles

S. No.	Plant	Parts used	Medicinal Action reported by traditional uses	Reference
1.	*S. vaginatum*	Roots	Some chemical constituents were reportedly showing anti-inflammatory action	Srivastava et al. (2010) [61]
2.	*S. vaginatum* C.B. Clarke	Roots	It has shown hypotensive action, it has analgesic and sedative aphrodisiac effects as well	Vineet et al. (2011)
3.	*S. vaginatum*	Whole plant	The plant has diuretic activity, anti-spasmodic action and is used as fragrance	Chauhan et al. (2012) [26]
4.	*S. vaginatum* C.B. Clarke	Whole plant	In the treatment of epilepsy, mental weakness, and Convulsions	Pandey et al. (2013) [24]
5.	*S. vaginatum*	Root	In treating skin diseases	Sharma et al. (2004) [62]
6.	*S. vaginatum*	Root	The paste of root or extract of the plant root is used to relieve swelling and skin diseases.	Nand 2018 [35]
7.	*S. vaginatum*	Root	Churna of the dried roots is used in the treatment of Epilepsy, Vertigo, Phthisis, Asthma, Syncope, Raktagata Hypertension, Bleeding disorder, Thirst and Disease due to Vata dosha	The Ayurvedic Pharmacopoeia of India, 2008 [14]

Adulterant

The roots and rhizomes of the plant have great medicinal values hence the studies have been focused on identifying its chemical constituents. *Selinum vaginatum* is mostly used as an adulterant for Nardostachys sp., which has a similar composition of essential oil and the morphology resembles the roots and rhizomes of the herb.

Discussion

Many herbs have anti-stress properties like *Selinum vaginatum* and its substitutes like Valeriana Jatamansi and Nardostachys Jatamansi are some of them, which show potential CNS protective actions. In the Indian system of medicine, these plants are used alone or in combination medicines as an ayurvedic formulation to cure many diseases [63]. It has been reported that many villagers including those living in the Dharchula areas of the Kumaon region of the Himalayas in the Pithoragarh district of Uttaranchal use bhootakeshi for its medicinal values [64].

The roots of this plant are also used by tribals and locals in other Himalayan regions hence it would be recommended to carry out further research on this plant and use the isolated Phyto-constituents to cure diseases efficiently. Herbal plants are a strong dependence by the local inhabitants since ancient times and they rely on these sources for treatment in South India, North India and all other parts of the country [65].

Phytochemicals, which are present in the roots of *S. vaginatum* are alkaloids, flavonoids, tannins, Coumarins, phenolic compounds, Triterpenoids, saponins, etc. which in many plant analysis and studies have shown pharmacological activates [66]. In recent years we have seen the interests of people drifting towards herbal medication for various treatments. Even our ancestors depended on natural sources of medication and observed good results hence most locals prefer indigenous forms of medications as a cure for many ailments or for dealing with chronic disease conditions [67].

With high rates of reported ADR's, people have been looking for ayurvedic solutions for their efficient pharmacological actions and easy availability from the neighborhood. A lot of plants have been reported to have medicinal uses, used by the locals and tribal [68-77].

Conclusion

A lot of plants from the species of Selinum are present in the Himalayan region. The phytochemicals present in the species are being tested for their biological actions, which will be very beneficial in the treatment of many diseases and conditions.

Locally, *Selinum vaginatum* has been used in treating mental disorders, sleep disturbances, and many other cases. The root and rhizome of the plant have high medicinal values as the locals mainly consume them as medicine. So, it would be suggestive to conduct in vitro and in vivo studies to confirm the therapeutic uses.

The presence of phytoconstituents reported in *Selinum vaginatum* could be a potential source for anti-inflammatory action, insecticidal, antibacterial, anti-epileptic actions, etc. This review paper summarizes the information about the pharmacognostic, botanical, pharmaceutical properties, and traditional actions of the natural compounds present in *Selinum*

vaginatum. It also highlights the rare information present about the current status of the rarely found medicinal herb and the findings of its traditional uses. Tribal and locals have been using *Selinum vaginatum* for the treatment of hysteria, epilepsy and many other neurological issues hence the active constituents of the plant must be isolated and studied for their pharmacological activities.

The data collected from various sources about *Selinum vaginatum* produce enough information to pronounce the drug as a potential source of alternative medicine. No studies have been reported about the toxicity studies hence clinical trials should be carried out to explore its therapeutic benefits.

Current status and future trends

The traditional and natural forms of medicines have been of great importance. Medicine systems like Chinese medicine, Kampo, Ayurveda, Korean traditional medicine and Unani system of medicine have been popularly used in major parts of the world. Hence in order to develop modern medicinal research on the herbs proper information must be available. As most of the information is not properly drafted or recorded there needs to be critical reviews of plants to contribute to standard data, information and pave a way for future research to authenticate the traditional uses.

This review will help in developing the monograph of the plant as not much has been documented, reviewed and analyzed about this Himalayan plant.

List of Abbreviations

MeHg = Methylmercury

DPPH = 2, 2-Diphenyl-1-Picryl Hydrazyl

GC/FID = Gas Chromatography-Flame Ionization Detector

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Conflict of Interest

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