



Traditional uses, phytochemistry, and pharmacology of the medicinal plant *Saussurea obvallata* (DC.) Sch.Bip (Brahma Kamal): A Review

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Abstract

Saussurea obvallata is a prominent medicinal plant that is extensively utilized in various indigenous medical systems for the treatment of diverse diseases. Numerous studies on the phytochemical constituents and their traditional uses have been published, demonstrating their therapeutic benefits. Sesquiterpene lactones have been reported as the major phytoconstituents of this species. Currently, the green synthesis of silver nanoparticles using plant extract rich in phytochemicals has gained significant attention. This plant species has shown potential in nanoparticle synthesis, with subsequent studies on particle applications. This review seeks to clarify the various facets of *S. obvallata*, exploring a comprehensive analysis of botany, phytochemistry, pharmacology, traditional and folkloric uses, and religious significance in Hindu mythology.

Keywords: *Saussurea obvallata*, Ethnobotany, Phytochemistry, Silver Nanoparticles.

Introduction:

India, recognized as one of the world's mega-biodiverse nations, supports a significant proportion of global floral and faunal species, despite covering only 2.4% of Earth's land area. This vast diversity arises due to India's wide-ranging ecological zones, from the Himalayas to coastal wetlands. India comprises 10 biogeographic zones, four hotspots of biodiversity (the Himalayas, Indo-Burma, Western Ghats, and Sundaland), and a variety of wetland ecosystems (MoEF, 2024). India has a vast ecosystem and species diversity, with over 103,200 species of fauna and 55,000 species

of flora, of which 12,000 are endemic. The latest estimate of plant diversity in India is represented as 22100 angiosperms, 1319 pteridophytes, 83 gymnosperms, and 2819 bryophytes among others (Plant Discoveries, BSI, 2023). Among flowering plants, major families with more than 500 species include Poaceae (1,291), Orchidaceae (1,229), Leguminosae (1,225), Asteraceae (892), Rubiaceae (616), Cyperaceae (545), Euphorbiaceae (527), and Acanthaceae (510) (Plant Discoveries, BSI, 2023). In India, the Asteraceae family is estimated to contain about 177 genera and 892 species (Pandey *et al.*, 2007). This family consists mostly of herbaceous plants with some trees and shrubs (Butola and Samant, 2010). The highest number of *Saussurea* genus is present in the northern region of the Himalayas, particularly Sikkim, where it is the dominant genus. The genus *Saussurea* is named after Horace Benedict de Saussure (1740-1799), a Swiss philosopher. *Saussurea obvallata*, commonly known as the Brahma Kamal, means “flower of the Lord Brahma” and is the state flower of Uttarakhand, India (Butola and Samant, 2010; Atpadkar and Mote, 2024). The plant is known worldwide as the "sacred lotus" due to its significance and auspicious nature (Semwal *et al.*, 2020). Generally, these plants are native to cool temperate regions (Butola and Samant, 2010). It is utilized in traditional medicine and is venerated in local cultures for its beauty and symbolic meaning. It is frequently connected to the gods. This species is distinguished by its large, eye-catching white flowers, which are rare and bloom at night (Semwal *et al.*, 2020).



Material and methods

All the data is sourced from existing literature. The relevant information about the genus *Saussurea obvallata* was collected via major scientific databases such as the Web of Science, Scopus, Google Scholar, Science Direct, and Springer Link.



(Source: Plants of the Word Online)

Review of Literature

Taxonomy, Diversity, Distribution, and Habitat Preference

Belonging to the diverse Asteraceae family, the genus *Saussurea* thrives predominantly in alpine regions across the Himalayas, with species richness particularly noted in Uttarakhand. Several species are endemic and culturally significant, including *S. obvallata*, widely known as Brahma Kamal. It may be found in the Himalayan zone at high elevations of 3000- 4800 meters (R). Brahma Kamal is primarily found in Uttarakhand's Kedarnath district, which includes Tungnath, the Valley of Flowers, and Hemkund Sahib. In addition, this plant can be found in Myanmar, Northern Burma, Bhutan, Southwest China, Nepal, and India's higher Himalayan area from Jammu Kashmir to Garhwal (Phondani *et al.*, 2010). The plants of this genus are commonly known as Snow Lotus. It has approximately 400 species, out of which 62 are distributed in India and 289 species are found in China (Kumar and Pundir, 2022). *Saussurea* (Asteraceae) is one of the important genera that comprises around 490 species of flowering plants, which are indigenous to temperate, cool, and arctic parts of Europe, Asia, and North America (Semwal *et al.*,2020). This



genus comprises approximately 27 ethnologically important species, such as *Saussurea laniceps*, *S. costus*, *S. medusa*, *S. obvallata*, *S. involucreta*, etc. These plants are used historically to cure a variety of illnesses and also have aesthetic and religious significance. (Kumar and Pundir, 2022). Brahma Kamal (*Saussurea obvallata* (DC.) Edgew.) is endangered and one of the most important species of this genus, and is being used for traditional, ornamental, and religious purposes (Semwal *et al.*, 2020).

Vernacular names: The plant is well-known by the names "Brahma Kamal," "flower of the Lord Brahma," and "sacred lotus". In addition, the herb is also referred to as Snow Lotus in English, Sacred Saussurea, King of Himalayan flowers, and Brahma Kamal in Hindi.

Kingdom	Plantae
Division	Tracheophyta
Class	Magnoliopsida
Order	Asterales
Family	Asteraceae
Genus	<i>Saussurea</i>
Species	<i>Obvallata</i>

Saussurea thrives in various habitats, including shady and moist areas, open grassy slopes, alpine meadows, and rocky terrains. It shows the highest species diversity in alpine meadows and slopes, with 55 species recorded, while 32 species are found mainly in shady, moist locations (Butola and Samant, 2010)

Phytochemical analysis and inflammatory activity

Inflammation is part of the natural response of body tissue against harmful stimuli like damaged cells, pathogens, or irritants (Atpadkar and Mote, 2024). Past research shows the presence of active compounds in Brahma Kamal in different solvents like ethanol, methanol, chloroform, and distilled water (Semwal *et al.*, 2014).

Brahma Kamal is a medicinal plant that contains many active secondary metabolites that are used in the treatment of various diseases with minimum side effects. Phytochemical screening of the extract showed the presence of Alkaloids, Tannins, Flavonoids, saponins, and steroids (Semwal *et al.*, 2014). Sesquiterpene lactones have been reported as the major phyto-constituents of this species (Pandey *et al.*, 2007). Multiple solvents are used for the extraction of phytochemical constituents, such as methanol, ethanol, distilled water, chloroform, etc. In methanol solvents, most of the secondary metabolites are present except tannins. In ethanol, phenol, tannins, proteins, and steroids are absent, but saponins, terpenoids, flavonoids, glycosides, and alkaloids are present. In chloroform



solvents, phenol and glycosides are absent, and in distilled water, only tannins show their presence (Semwal *et al.*, 2014).

By protein denaturation method, the methanolic extract of leaves of *S. obvallata* shows direct anti-inflammatory activity as compared to standard Diclofenac sodium; the same result is also shown by the membrane stabilizing method. The extract used in the protein denaturation method showed 46.10% inhibition of protein denaturation at a concentration of 100 µg/ml (Atpadkar and Mote, 2024).

Religious aspects

Brahma Kamal is widely venerated and has great cultural significance because it appears in various mythologies concerning Hindu deities, particularly Lord Shiva. Pastoralists collect it, transport it to communities at lower elevations, and then give it to worshippers as a gift from the gods. It is also used to make celebratory decorations for temples. On festive occasions such as Savan-Janmasthanmi. In Hindu religious traditions, *S. obvallata* holds sacred status, being offered during rituals at prominent shrines like Kedarnath and Badrinath and distributed as „prasada (Semwal *et al.*, 2014). It is offered to the Goddesses Nanda Devi and other deities on auspicious days (Singh *et al.*, 2023). Nanda Devi is the highest peak in the Western Himalayas; it is a famous place for the celebration of "Nanda Astami" in honor of the goddess Nanda Devi. This event is connected to the harvesting of the holy flower Brahma Kamal (*Saussurea obvallata*) at the end of August. Celebration of Nanda Astami highlights the inherent message of conservation in a traditional society for the collection of Brahma Kamal. Only two people (Out of many Joharis) are appointed for the collection of flowers from Salang Gwar, the river alpine meadow where the species is abundant (Semwal and Painuli, 2019). After performing ceremonial baths, dressed in white, the people enter the meadow barefoot and hold a cucumber to honor the goddess. Along with all rituals, the appropriate prayers to the local deity are done, and the collection of Brahma Kamal begins. At the time of collection, they ensure that only fully open flower is collected (Singh *et al.*, 2023)

Ethnobotanical Information

Species	Parts used	Ethnobotanical Applications	Disease treated	References
<i>S.obvallata</i> (DC.) Edgew.	Seed	The powder of seeds is soaked in water overnight and then filtered (1 cupful) (19)	In mental conditions,	Rahman <i>et al.</i> , 2014, 19 Phondani <i>et al.</i> 2010
		The juice of fresh roots and paste is applied to wounds and cuts.	Used as an antiseptic and for healing wounds. Cure leucoderma	Semwal <i>et al.</i> , 2020, Rahman <i>et al.</i> ,2014, Butola and Samant, 2010.



	Root	Take 200 ml decoction of roots, add 2-3 spoons of <i>Cedrus deodar oil</i> , and apply 100 ml superficially to treat the heart.	In cardiac disorders, bruises and fractures	Semwal <i>et al.</i> , 2020, Phondani <i>et al.</i> 2010
	Leaf	Fresh leaf extract is taken orally as a tonic.	For cough and internal injury.	Rahman <i>et al.</i> ,2014, Semwal <i>et al.</i> , 2014
		100ml of dried leaves and their decoction, combined with a half spoon of salt and a few drops of this paste, were applied to the affected area (20 ml × 3 days).	Used for the treatment of wounds, cuts, and boils.	Maikhuri <i>et al.</i> 2000, Phondani <i>et al.</i> 2010
	Entire plant	The paste or dried powder of the plant is used.	Haematuria is treated.	Rahman <i>et al.</i> ,2014,
		The paste prepared from the whole plant is applied.	In bruises, cuts, Headaches, and body pain,	Semwal <i>et al.</i> , 2020, Bisht <i>et al.</i> , 2013 Sharma and Samant, 2014
		Whole inflorescence	It protects woolen clothes from insect damage.	Chauhan, 1999, Phondani <i>et al.</i> , 2010
	Flower buds	The flower heads are roasted in ghee, and a dosage of one teaspoon is administered to patients in the morning for a period of 3 to 6 days.	Hydrocele,	Gupta <i>et al.</i> ,m2013
		Raw form	In the treatment of urinary infections in Cattle	Saklani and Rao, 1996
	Seed oil		Used for headaches	
	Bract		In cough and respiratory disorders	Gupta <i>et al.</i> , 2013

Antimicrobial activity of *Saussurea obvallata*

Antibacterial activity-



the leaf extract of *S. obvallata* is used against different strains of bacteria. One gram-positive strain, *Staphylococcus aureus* (MTCC 6908), and three Gram-negative strains, *Klebsiella pneumonia* (MTCC 9544), *Pseudomonas aeruginosa* (MTCC 4306), and *Escherichia coli* (MTCC 1698), namely (Gupta *et al.*, 2013). The well diffusion method is used for this estimation. DMSO was used as a negative control, whereas Ampicillin was used as a Positive control. The result is observed in the form of inhibition, and it is measured in terms of zone of inhibition (ZOI) in mm formed on the L.B (Luria Bertani agar) agar plates (Gupta *et al.*, 2013).

In the aqueous extract of leaves, the maximum zone of inhibition was 20.43 ± 0.30 mm for *Staphylococcus aureus*, and the minimum ZOI was 11.57 ± 0.23 mm for *Escherichia coli*. In a methanolic extract of leaves, the maximum ZOI was 19.90 ± 0.56 mm for *Klebsiella pneumoniae*, and the minimum ZOI was 10.83 ± 0.43 mm for *Escherichia coli*, while intermediate values for ZOI (13.60 ± 0.21 mm and 13.90 ± 0.21 mm) were recorded for SA and PA, respectively (20). Ampicillin (positive control) had the highest ZOI against PA (34.33 ± 0.33 mm). 5% DMSO (negative control) did not demonstrate any ZOI for particular bacterial strains. (Gupta *et al.*, 2013).

Antifungal activity of *Saussurea obvallata*

Antifungal activity of extracts of leaves of *S. obvallata* was measured against three fungal species, *Candida glabrata* (CG), *Candida tropicalis* (CT), and *Candida albicans* (CA), in terms of zone of inhibition (ZOI). In the aqueous extract of leaves, ZOI was 15.43 ± 0.30 mm for CA, 13.90 ± 0.17 mm for CG, and 8.30 ± 0.15 mm for CT. In the methanolic extract of leaves, ZOI was 15.90 ± 0.56 mm for CA, 14.57 ± 0.23 mm for CG, and 13.17 ± 0.09 mm for CT. Fluconazole (positive medication) had the highest ZOI against CT (25.97 ± 0.49 mm), followed by CG (22.40 ± 0.31 mm) and CA (25.93 ± 0.54 mm). DMSO does not exhibit ZOI against any of the strains (CT, CA, or CG). (Gupta *et al.*, 2013).

Role of Braham Kamal in the Production of Indole Acetic Acid (IAA) from Endophytic Bacteria

Endophytes have the ability to produce bioactive substances that shield plants against infections. By producing hydrolytic enzymes, limiting nutrients, and using antibiotics to combat pests and diseases, endophytic bacteria can enhance plant health. For the isolation of endophytic bacteria, leaves of *Saussurea obvallata* were selected. A total of three endophytic bacteria were isolated, and they were named IS-1, IS-2, and IS-3. The isolates were identified as *Micrococcus roseus*, *Micrococcus luteus*, and *Bacillus subtilis*, respectively. To identify the isolates, Bergey's Manual of Determinative Bacteriology was reviewed (MacFaddin, 2000). All three isolates were tested against Salkowski's reagent to check their ability to produce IAA. Among all three isolates, IS-2 *Micrococcus luteus* showed the maximum production of IAA, but IS-3 also showed comparable production of IAA. The isolates IS2 showed $380 \mu\text{g/ml}$ of IAA, and IS3 showed $280 \mu\text{g/ml}$ of IAA production. So they can conclude that Braham Kamal is suitable for the isolation of endophytic bacteria, and these are accountable for beneficial effects on the growth of plants (Nanaware *et al.*, 2023).



Nanoparticles formed from *S. obvallata* and their different activities

The phytochemicals present in the aqueous extract of *S. obvallata* act as capping and reducing agents, which help in the formation of silver nanoparticles (AgNPs). Due to the presence of phenols, flavonoids, and triterpenes in the plant extract, they contain active oxygen that has the potential to donate electrons for the reduction of silver precursors into AgNPs.

Antimicrobial activity of AgNPs

AgNPs' antibacterial efficacy was discovered to be dose-dependent. The antibacterial activity of AgNPs increased with concentration because of more extensive interaction between AgNPs and bacterial proteins that contain sulfur, which causes cell death. Hence, 1 microgram/ml of AgNPs was found to have antimicrobial activity against gram-negative bacteria *Escherichia coli* (12mm) and gram-positive bacteria *Enterococcus faecalis* (13mm) (Ibrahim, 2015; Sagar *et al.*, 2024)

Antioxidant activity by AgNPs

Antioxidant activity was also shown by the synthesized AgNPs. The DPPH method was used to quantify the antioxidant activity of the AgNPs. DPPH was used as a radical source, and AgNPs were used as a radical scavenger. The change in color of the DPPH solution from deep violet to pale yellow confirms the presence of AgNPs. The absorbance of DPPH at 517 nm is slowly decreased with an increase in the amount of AgNPs, which also confirms the free radical scavenging activity of AgNPs. The percentage of inhibition increased with the concentration of AgNPs, so we can say that it is also dose-dependent, and the free radical scavenging activity of AgNPs exhibited up to 61.21% ± 0.02% at a 500 µg/mL concentration of AgNPs (Abdel-Aziz *et al.*, 2014; Sagar *et al.*, 2024).

Discussion and Conclusion

From both cultural and spiritual viewpoints, *S. obvallata* holds a prominent place in Hindu mythology, frequently linked to Lord Brahma and utilized in sacred rituals. Its status as an endemic species, confined to the high-altitude Himalayan regions, highlights the urgent need for its conservation.

In summary, *S. obvallata* is a plant of considerable pharmacological and cultural importance. Its diverse significance encompasses traditional healing practices, contemporary phytochemical research, advancements in nanotechnology, and religious customs. Although it shows great promise as a therapeutic agent, additional studies are necessary to isolate its active compounds, confirm their medicinal effects through clinical trials, and establish sustainable methods for harvesting and preservation. A synergistic approach that combines ancestral wisdom with modern scientific techniques will be essential to unlock the full medicinal and technological benefits of this valuable Himalayan species.



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