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Review Paper

Comprehensive Review of *Saussurea Obvallata* (Brahmakamal) An Endangered Medicinal Herb: Its Ethnobotany, Phytochemistry and Pharmacological Potentials

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ABSTRACT

The genus Saussurea comprising more than 450 species is an important genus of family Asteraceae. Among all species, around 62 important species are found in India. Some most common species are Saussurea obvallata, Saussurea costus, Saussurea auriculata, Saussurea gossypiphora, etc. In this study, Saussurea obvallata commonly known as Bramhakamal is the primary plant of focus renowned for its spiritual and medicinal value. It holds significant spiritual and cultural importance in Hinduism and Buddhism. Saussurea obvallata is widely famous for its flower blooming at night. The plant has been long utilized in herbal medicine indicating potential therapeutic benefits. It is used to treat a variety of medical conditions involving wounds, heart problems and psychological disorders. The plant's phytochemical analysis showed that it contains a number of chemical components that are important for the treatment, such as proteins, alkaloids, flavonoids, phenol, saponins, tannins, and terpenoids. This review is a comprehensive study of Saussurea obvallata from its distribution to phytoconstituents and pharmacological activity.

INTRODUCTION

Saussurea obvallata, popularly known as the Brahma Kamal, is a rare and revered flowering plant. Brahma Kamal holds a special place in Hindu and Buddhist traditions.[1] In Hinduism, it is related with Lord Shiva and Lord Brahma, the flower is considered so sacred that it is often used in religious ceremonies and prayers. In Buddhist

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traditions, it is also regarded as a symbol of spiritual awakening and used in meditation and offerings to invoke blessings.[2] Despite its medicinal and spiritual importance, overharvesting, habitat loss, and climate change all pose threats to the plant.[3] *Saussurea obvallata* belongs to Asteraceae family. It typically appears at the uppermost point of the 3000–4800 meter mountain pinnacle ranges in the snow-capped Himalayan region.[4] It is a herb that is hermaphrodite and typically grows between 5 to 10 cm in height. Flowers bloom among the hillside's boulders and grasses during the monsoon season (July to August).[5]

Saussurea obvallata also has significant medicinal value in traditional healing practices. Locals harvest the plant to make traditional Ayurvedic medications. Because of its medicinal qualities, several plant parts, including leaves, stems, flowers, and roots, are used in Ayurvedic medicine. The leaves, rhizomes, and flowers are used to cure digestive disorders, urinary tract issues, colds, and coughs.[6] Particularly useful as an antiseptic to treat cuts and bruises are rhizomes. Additionally, it is used to cure heart disorders (with roots and leaves), mental disorders (using seeds), and wounds, cuts (using dried leaves). It is used to treat cerebral ischemia and limb paralysis in the Tibetan medical system.[5]

Distribution :

Saussurea is indigenous to the Himalayan region's alpine meadows, which range at elevation from 3,700 to 4,600 meters in India, Bhutan, Nepal, Pakistan, and Southwest China. The states of Uttarakhand, Himachal Pradesh, Jammu & Kashmir and Sikkim are where it is most common in India.[7,8]

2. PHARMACOGNOSY

2.1. Morphology of *Saussurea Obvallata* :

Saussurea obvallata is titled as “King of Himalayan Flowers” and commonly known by several names such as Brahma kamal, Shiv kamal, Snow lotus, etc. *Saussurea obvallata* is a perennial herb native to the Himalayan region. It is particularly found at high altitudes in India, Nepal, Tibet and China. The genus *Saussurea* is a large and diverse group of plant within the family Asteraceae, consisiting variety of species.[9] The plant is famous for its beautiful white flowers blooming only once in a year, with the outer ray florets in white or lavender color and central disc florets in yellow color. The flower head is round and large with high fragrance.[1] *Saussurea obvallata* has single unbranched stem. The stem is thick and succulent growing upto height of 15 to 60 cm long and 2 to 8.33 mm diameter. It is green in color with smooth surface. The stem provides structural support to plant and helps store water and nutrients.[10] The leaves are individual, lanceolate shape, long and attached directly to the stem. The leaves measure 18 to 42.75 mm in width and 9 to 20.83 cm in length. The surface of leaves is smooth and dark green in color.[11] *Saussurea obvallata* has a well developed root system, which is fibrous and rhizomatous. The roots are dark brown in color and hairy with numerous root hairs that increase the absorption of water and nutrients.[11] The seeds of *saussurea obvallata* have oval shape and dark brown color. The seed has hard outer layer with smooth surface. The seeds possess a pappus, a structure consisting of white, feathery hairs attached at one end, which facilitates seed dispersal and imparts a floret-like appearance to the seeds.[1]



Figure 1 : *Saussurea obvallata* flower

Table 1 : Scientific classification[12]

Kingdom	Plantae
Clade	Tracheophytes
Clade	Angiosperms
Clade	Eudicots
Clade	Asterids
Order	Asterales
Family	Asteraceae
Genus	*Saussurea*
Species	S. obvallata
Synonyms	Aplotaxis obvallata DC. Theodorea obvallata (DC.)Kuntze

3. AYURVEDIC SIGNIFICANCE

Saussurea obvallata has been traditionally used in the treatment of wounds showing the antioxidant, anti-inflammatory, antibacterial properties.[13] Also used to treat other medical conditions including respiratory disorders, urinary infections, digestive issues, fever, cough and mental disorders. Roots, leaves, flowers, and seeds are among the plant parts that have potential medicinal effects.[4,10]

Table 2 : Uses of different parts of *saussurea obvallata*

Sr.No.	Plant part	Use
1	Leaves	The leaves are used to treat minor wounds, cuts and fungal infections.[14]
2	Flower	The roots are used to cure peptic ulcers, diarrhea, and respiratory conditions.[15]
3	Buds	Used to treat urinary tract infections, joint pain and arthritis.[15]
4	Seeds	The seeds are used for skin health and to treat inflammation.[14]
5	Roots	The roots are used to treat respiratory tract infections, joint pain, colds, and coughs.[16]

Table 3: Important species of genus *Saussurea*

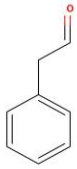
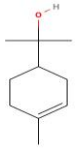
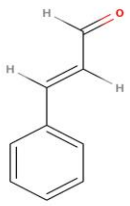
Sr. No.	Species	Common name	Distribution	Medicinal property	Reference
1	*Saussurea costus*	Costus or Kuth	China, India, Nepal	anti-inflammatory, anti-ulcer	17, 18, 19, 20
2	*Saussurea lappa*	Indian Costus	India, Nepal, Pakistan	anti-hepatotoxic, gastro protective	6, 17, 21, 22

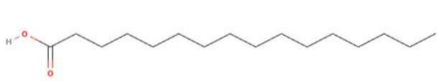
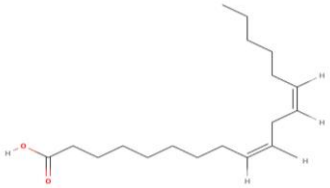
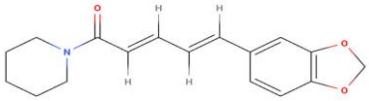
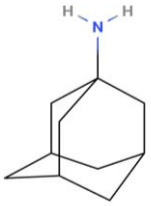
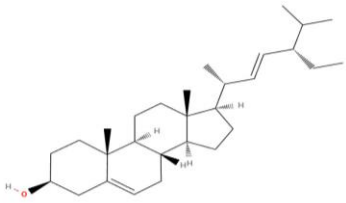
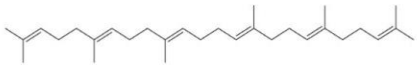
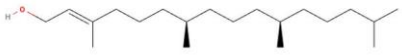
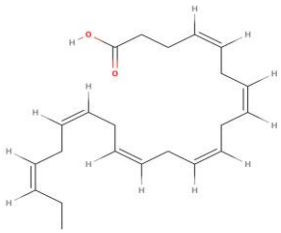
3	*Saussurea medusa*	Snow lotus	Tibet, India, China	respiratory support, immune system modulation	17, 23
4	*Saussurea gossypiphora*	Kasturi Kamal	India, Nepal, Bhutan	antioxidant, anti-inflammatory	17, 24, 25
5	*Saussurea auriculata*	Thimra	India, Nepal	antioxidant, anti-inflammatory	17, 16, 22
6	*Saussurea simpsoniana*	Fen Kamal	Tibet, China, India	analgesic, immune system support	17, 16, 26
7	*Saussurea heteromalla*	Batula	India, Bhutan, Nepal	treat leucoderma and wounds	17, 16, 27

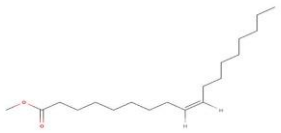
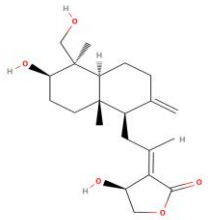
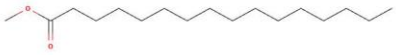
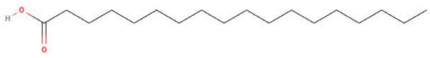
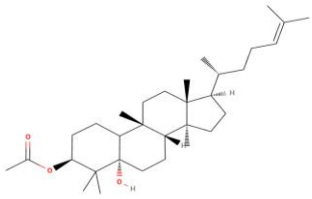
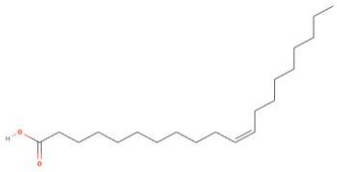
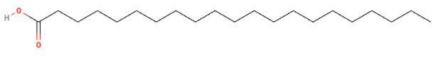
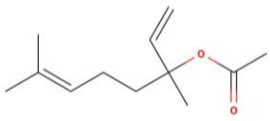
4. PHYTOCHEMISTRY

The genus *Saussurea* is rich in various phytoconstituents that are responsible for its diverse pharmacological activities and plays an important role in ethnomedicine, as evidenced by Ayurvedic, Chinese, Siddha, Tibetan, Unani, and modern medicine systems for treating a variety of illness.[28] It includes alkaloids, flavonoids, tannins, terpenoids, saponins, phenol, zinc phenolics along with minerals including calcium, proteins, chromium, iron, magnesium, lead, copper, nickel that are beneficial and contribute to the plant's therapeutic value.[29,30,31,4]

Table 4 : Major constituents in *saussurea obvallata* extract

Components	Molecular formula	Structure
1-Docosanol	$C_{22}H_{46}O$	
Benzeneacetaldehyde	C_8H_8O	
α -Terpineol	$C_{10}H_{18}O$	
Cinnamaldehyde	C_9H_8O	

Palmitic acid	$C_{16}H_{32}O_2$	
Linoleic acid	$C_{18}H_{32}O_2$	
Piperine	$C_{17}H_{19}NO_3$	
Amantadine	$C_{10}H_{17}N$	
Stigmasterol	$C_{29}H_{48}O$	
Squalene	$C_{30}H_{50}$	
Phytol	$C_{20}H_{40}O$	
Doconexent	$C_{22}H_{32}O_2$	

Methyl oleate	$C_{19}H_{36}O_2$	
Andrographolide	$C_{20}H_{30}O_5$	
Methyl palmitate	$C_{17}H_{34}O_2$	
Stearic acid	$C_{18}H_{36}O_2$	
Litsomentol	$C_{30}H_{52}O_2$	
Gondoic acid	$C_{20}H_{38}O_2$	
Henicosanoic acid	$C_{21}H_{42}O_2$	
Linalyl acetate	$C_{12}H_{20}O_2$	
Tetratetracontane	$C_{44}H_{90}$	

5. POTENTIAL THERAPEUTIC APPLICATIONS

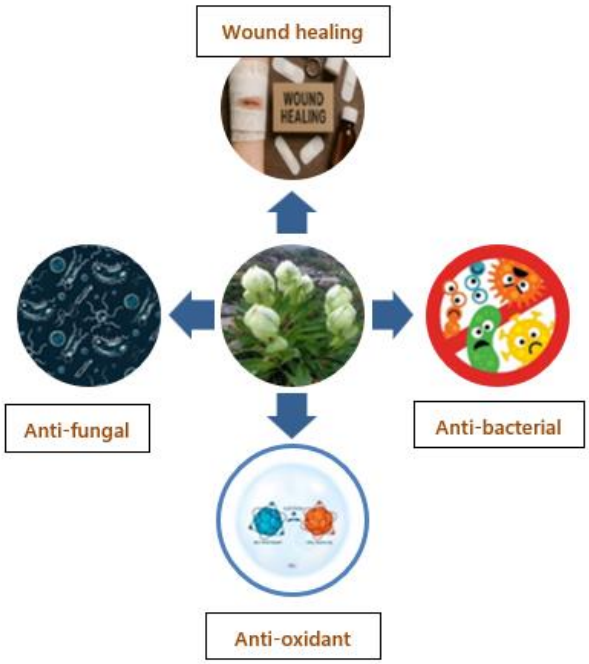


Figure 2 : Different pharmacological activities of *saussurea obvallata*

5.1. ANTIFUNGAL ACTIVITY

Three strains of Candida - C. albicans, C. glabrata, and C. tropicalis were tested for antifungal activity using the well diffusion method in a methanolic extract of *saussurea obvallata* leaves and flowers. The culture media used is potato dextrose agar (PDA). After sterilising the petri plates, the appropriate volume of media (20 ml) was added, and the plates were left to harden. Each plate was inoculated in the centre, and a sterile cork borer was used to prepare the wells. The positive control was fluconazole (1 mg mL-1), whereas the negative control was 5% DMSO. The inoculation plates were incubated at 280C for 15 hours after 20 µL of extract from separate stocks (5 mg mL-1) was put into every well. The fungus colony diameter (mm) was calculated by averaging three different measurements, which were carried out in triplicate. A clear zone in the fluconazole well indicates that it has antifungal properties. A clear zone surrounding the well where the fungus has been stopped from developing is an indication of the plant extract's antifungal properties.[32,33,34,4]

5.2. ANTI-BACTERIAL ACTIVITY

As a negative control, 3% dimethylsulfoxide (DMSO) was used to examine the antibacterial properties of synthesized silver nanoparticles of *saussurea obvallata* leaf extract. No bactericidal activity was shown by the 5% leaf extract or the negative control. It was discovered that the silver nanoparticles antibacterial activity depended on their dosage. Their antibacterial effectiveness increased with concentration because of a greater contact between the silver nanoparticle and the proteins of sulfur-containing bacteria, which led to cell death. It was found that the antibacterial action was effective against both Gram-positive (E. faecalis) (13 mm) and Gram-negative (E. coli) bacteria (12 mm) at a dosage of 1 mg/mL. The contact between microorganisms can be explained in three ways. The first possibility is that the negatively charged silver nanoparticle (stabilized carboxylate) and the positively charged membrane proteins on the bacterial surfaces will be attracted to each other electrostatically. Second, the bacterial cell wall may undergo physical changes that cause intracellular components to be ejected and cell death to occur. Third, because silver nanoparticles can pass through bacterial membranes, they may interfere with DNA replication and cellular respiration, endangering the bacteria and causing cell death.[13,35,36,37]

5.3. ANTI-OXIDANT ACTIVITY

Saussurea obvallata extract's antioxidant properties was assessed by employing the hydrogen peroxide (H2O2) method. This process involves incubating the scavenger with hydrogen peroxide, and then using a UV spectrophotometer to measure the breakdown or loss of H2O2. PBS

(phosphate buffer saline) was combined with 1 mL of a 20 mM hydrogen peroxide solution. A comparison with phosphate buffer was made when measuring the absorbance at 230 nm. PBS was used as the blank, while the controls were hydrogen peroxide (2 mL) and solvent (1 mL). Using ascorbic acid as a standard, values of 0.2, 0.4, 0.6, 0.8 and 1.0 mg mL-1 were used to generate the calibration curve. Because of the extract's scavenging ability, a higher decrease in H2O2 concentration indicates more antioxidant activity.[32,38,39]

5.4. WOUND HEALING ACTIVITY

The wound healing study of *saussurea obvallata* extract was carried out by excision wound model method. The animals were distributed into different groups,

Group 1 - Only ointment base, or 1 g/kg topically, was given for 16 days.

Group 2 - An excision wound model was topically treated twice daily for 16 days with a 10% betadine iodine ointment.

Group 3 - For 16 days, an excision wound model underwent topical application of 10% w/w of the extract in a basic ointment basis twice a day. After being gathered and split up into groups, the initial rats were injected with ketamine hydrochloride to render them unconscious. The excision incisions were made 5 cm and 1 to 1.5 cm from the spinal column and dorsal thoracic area, respectively. The wounded region was cleaned with 70% alcohol, and a sharp surgical blade, a 5-8 mm biopsy punch, a sterile round seal with a diameter of 2.5 cm was used. To make a wound that was 200–500 mm2 in diameter and 2 mm deep, the whole thickness of the circular skin from the specified spot on the animal's back was cut off. To restore homeostasis, the wound was wiped with a cotton swab dipped in normal saline. Until the epithelium had completely grown, the drug was applied topically twice a day. The characteristics of the wound studies were monitored at regular intervals to determine the percentage of the wound and the epithelization time, or the formation of new epithelial tissue to cover the wound. At regular intervals, the wound evaluation parameters were measured.

The wound contraction was calculated as a percentage of the decrease in wounded areas on days 4, 8, 12, and 16 until complete re-epithelization was achieved. The scar peeled off without revealing any signs of the drug incision, marking the day entire epithelization was achieved.[1,40]

6. TOXICOLOGICAL STUDIES

Saussurea obvallata is generally regarded as non-toxic in moderate amounts. However, in high doses, it can show some toxicity. Consuming it as it may cause gastrointestinal issues if ingested in large quantities and minor skin irritation may occur. Sesquiterpene lactones a class of compound found in *saussurea* species may cause allergic reactions.[41]

7. FUTURE ASPECTS

Saussurea obvallata is a valuable plant serving multiple roles in the environment, culture and human health. Its medicinal properties, ecological significance, cultural reverence and rarity make it a plant worth conserving and studying. The objective of the current study is to assess its primary ecological and biological properties as well as its applications in both traditional and modern fields. The plant contains bioactive compounds that have potential uses in modern medicine. Research has shown that it have wound healing, anti-cancer, anti-diabetic, and immune-boosting effects. The plant’s medicinal value is largely due to its phytochemical constituents. *Saussurea obvallata* has high conservation significance due to its rarity and threatened status.

Protecting it can be useful to assess the health of high-altitude ecosystems. Conservation measures for this plant may also help to protect other unique and threatened species that share its habitat.

CONCLUSION

This study highlights the significant potential of *Saussurea obvallata* as a traditional medicinal herb with itsvarious therapeutic applications. The pharmacological properties of this plant such as anti-fungal, antioxidant, and antimicrobial effects by both traditional knowledge and preliminary scientific studies, indicate its promising role in treating a variety of ailments. Its phytochemicals and pharmacological activites were evaluated using methanolic, ethanolic and aqueous extract. Further research is necessary to confirm these claims, by developing standardized dosages, and fully investigating the range of its bioactive components.

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