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A Multifaceted review of the Botanical, Ecological, and Pharmacological Aspects of Sassurea obvallata DC Edgew, EmphasiZing its TRADITIONAL USES.,

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ABSTRACT :

Brahma Kamal is the most hopeful flowering plant of the Himalayas. It is highly famous for both its beautiful flowers and its incredible application in conventional medicine. During the rainy season, the flowers of Brahma Kamal bloom. The Brahma Kamal possesses phenols, alkaloids, glycosides, steroids, and flavonoids as its primary secondary metabolites. The whole plant has been used conventionally to treat arthritis, spasms, and ulcers. The aim of the present review is to present an overview of all the work done on the botanical, ecological, pharmacological activity, and folk uses of the plant by various researchers. Normal ecological methods have been suggested for assessing the populations of rare, endangered, indigenous, endemic, and commercially useful species to determine the amount of stock present today of these species in the natural habitat. Further phytochemical studies are recommended to determine the active constituents. Most of the Saussurea species do not have propagation and culture techniques, except for S. costus, S. obvallata, and S. medusa (white lotus). In addition, local communities need to be educated on the value of conservation and sustainable use of species within this genus. The Pahari language, which is native to Himalayan populations, is employed for local names in parentheses.

INTRODUCTION :

India's plant life is among the richest in the world owing to its varied climatic and geographical conditions. IUCN (International Union for Conservation of Nature and Natural Resources) is an organization that works for nature conservation. [1] Sassurea obvallata DC Edgew have been utilized to relieve bone aches, wounds, mental health issues, stomach ailments, colds, and coughs. Its most important and threatened variety is "Brahma Kamal," which serves traditional, religious, and ornamental purposes. The purpose of this review is to contrast and evaluate previously published studies. Prior studies on Saussurea obvallata DC Edgew have targeted its prominent defensive attributes, phytochemistry, pharmacology, ethnomedicinal practices, pharmacogenetics, and low proliferation. [2] One of the richest and most ancient cultural traditions in using medicinal plants belongs to India. The ranges of the Western Himalayas from 500 m to snow-topped mountains house a varied selection of critical and endemic medicinal flora, which renders it a hotspot of biodiversity. [3, 4] It is used in Tibetan medicine to treat heart disease (roots and leaves), mental disease (seeds), and cuts, wounds, and boils (dried leaves). It also treats cerebral ischemia and paralysis of the limbs. [5] Very little is known about S. obvallata, however. This rare plant grows in the Himalayas from 3000 to 4800 meters altitude. Brahma Kamal is the official state flower of Uttarakhand (India). The plant is very popularly used in Uttarakhand for traditional, medicinal, ornamental, and religious purposes. [6] The plant flowers between July and August, during the peak of the monsoon, and remains visible till mid-October, but the plant thereafter withers, and the flowers again bloom in April only. The flowers break out among the pebbles and grasses of the slope. The taxonomy of the widely distributed genus is continuously changing with new finds of species in China. Still, information about this plant continues to be limited. [7]

BOTANICAL DESCRIPTION :

Saussurea obvallata DC Edgew is an ephemeral, hermaphrodite perennial herb with a thick, unbranched caudex that grows 15-80 cm tall. The stems are hollow, erect, and ribbed. Lower stem leaves and leaf blade bases are petiolate. The leaf blade is 7-32 × 1-6.5 cm and elliptical, elliptic-oblong, or obovate in shape. The middle and upper leaves of the stem are sessile with a semi-amplexicaul base and an elliptic to ovate shape, 5-16 × 1.5-8 cm. The boat-shaped, pale yellow uppermost stem leaves are elliptic or ovate, 5-15 × 1.5-9 cm. Purple flower heads are shielded from cold alpine conditions by papery yellowish-green scales. The leaves are basal-shaped and cauline. "Brahma kamal" leaves are petiolate, lanceolate to elliptical in shape, base-sheathed, and wider in size with scarious and serrated edges. The leaf apexes are acute to obtuse to cuspidate. The cauline leaves are lanceolate or elliptic-spathulate, and the flowers are bisexual with violet-colored tubular corollas. A huge flower cluster covers the flower head. [9] The plant has religious importance in the upper Himalayan region of Garhwal. The blossoms of the plant are employed to worship Goddess Nanda Devi, Lord Shiva in Kedarnath, and Lord Vishnu in Badrinath. [10]

Parts	Color	Odor	Taste
Rhizome	Dark Brown	Odorless	Bitter, Astringent
Stem	Brown	Odorless	Astringent
Leaf	Green	Aromatic	Bitter, Astringent
Flower	Purple Bract: Yellow	Aromatic	Sweet Astringent

Taxonomical Classification :

S*aussurea*, sometimes known as Snow Lotus, is a genus of the Asteraceae family that grows in the Himalayan area. There are around 400 species in the genus, with 62 discovered in India. [11]

- **Kingdom** - Plantae
- **Subkingdom** - Viridaeplantae
- **Infrakingdom** - Streptophyta
- **Division** - Tracheophyta
- **Subdivision** - Spermatophytina
- **Infradivision** - Angiospermae
- **Class** - Magnoliopsida
- **Superorder** - Asteranae
- **Order** - Asterales
- **Family** - Asteraceae
- **Genus** - Saussurea DC
- **Subgenus** - Amphilaena

Figure 01 SAUSSUREA OBVALLATA

Vernacular names

The plant is also known as "Brahma Kamal," meaning "flower of the Lord Brahma" or "sacred lotus". The plant is also known as Snow Lotus in English, Sacred S*aussurea*, King of Himalayan Flowers, and Brahma Kamal in Hindi.

Microscopy :

Microscopic examination of the leaves showed one layer of epidermis comprising parenchymatous cells. The vascular bundles are found centrally, while stomata, palisade, and spongy parenchyma tissue are present on the underside of the epidermis. Powder microscopy of the leaves showed cork cells, pitted vessels, endocarp fragments, and xylem pieces. The T.S. of the stem showed numerous ridges on the outer side. Epidermis consists of parenchymal cells, while hypodermis possesses a couple of layers of collenchyma cells. Vascular bundles are ring-shaped with the shape of a wedge. [12] A T.S. of a root revealed the presence of epidermis, cortex, endodermis, vascular bundles, and a one-layered pericycle. A fluorescence study proved the presence of many fluorescent chemicals in leaves, which emit light when they are exposed to UV light of varying lengths. [13]

ECOLOGICAL DESCRIPTION:

Habitat and Distribution

S*aussurea obvallata, DC Edgew*, also referred to as Brahma Kamal, is a flowering plant that grows at high altitudes in the Himalayan region. It occurs at altitudes of 3,000 to 5,000 meters (9,800 to 16,400 feet) above sea level. This species occurs mainly in alpine meadows, rocky slopes, and subnival zones of the Himalayas, especially in India (Uttarakhand, Himachal Pradesh, Sikkim, and Arunachal Pradesh), Nepal, Bhutan, and Tibet (China).

Climatic Conditions

This species is also adapted to harsh alpine conditions that involve low oxygen, severe winds, elevated ultraviolet (UV) radiation, and extremely low temperatures. It tolerates extended, freezing winters and has a short growing season that runs from June through September.

Conservation Status

Because of overharvesting, habitat loss, and global warming, Saussurea obvallata DC Edgew is threatened with population decline and is considered vulnerable or near-threatened in most areas. It is conserved under Indian conservation programs, especially in biosphere reserves like the Nanda Devi and Valley of Flowers National Parks, both UNESCO World Heritage Sites.

Pharmacological Activity:

Antioxidant activity

ROS molecules have a very short half-life and are highly reactive because they possess imperfect valences. Too much generation of free radicals leads to oxidative stress. Oxidative stress is thought to cause a number of age-related diseases, such as Alzheimer's and Parkinson's, arthritis, and cancer. Antioxidants target free radicals and prevent oxidative damage. [14, 15] Leaves and flowers methanol and aqueous extracts of Saussurea obvallata DC Edgew were tested against ascorbic acid employing a standard diphenylpicrylhydrazyl and hydrogen peroxide assay. The researchers concluded that flowers methanol and aqueous extracts had DPPH free radical scavenging activity of 82.88 ± 0.48% and 29.25 ± 0.86%, respectively. [16] Meanwhile, aqueous and methanol extracts of leaves showed intermediate free radical scavenging activity. Flowers possessed moderate activities of H_2O_2 free radical scavenging activity, while methanol and aqueous leaf extract possessed the highest and lowest percentages, respectively.

Wound healing activity

Wound healing of the body includes replacing dead and damaged cells with new cells. It proceeds through inflammation, tissue repair, and remodeling. Brahma kamal leaf ethanol extract was more superior to the conventional 10% w/w povidone-iodine ointment in experimental animals for wound healing. [17]

Antibacterial and antifungal activity

Mishra et al. examined the antibacterial activity of S. *obvallata DC Edgew* leaves against both gram-positive and gram-negative bacteria. The petroleum ether extract exhibited remarkable antibacterial activity with 87.2 ± 1.6, 98.4 ± 1.1, and 90.2 ± 1.8 µg/ml, respectively. The study found that gram-negative bacteria required a slightly greater minimum inhibitory concentration of petroleum ether extract compared to gram-positive bacteria. Semwal and Painuli studied the antibacterial and antifungal properties of S*aussurea obvallata DC Edgew* leaves and flowers against four bacterial strains (Pseudomonas aeruginosa, Escherichia coli, Staphylococcus aureus, and Klebsiella pneumonia) and three fungal strains (Candida albicans, Candida glabrata, and Candida tropicalis). The extract from S*aussurea obvallata DC Edgew* leaves and flowers showed strong antibacterial activity against all three types of bacteria. Both extracts were shown to be resistant to E. coli due to a smaller zone of inhibition. [18,19]

Anti-hypoxic activity

Employing a normobaric hypoxia model, Ma et al. evaluated the anti-hypoxic activity of the 20 herbs and suggested that Brahma Kamal possessed the longest life period among them. As increased lactic acid concentration indicates reduced anti-hypoxic activity, Schurr asserts that the content of lactic acid in the blood is a marker of anaerobic respiration. Active phytoconstituents present in the petroleum ether extract of Brahma Kamal could be beneficial for the treatment of acute mountain sickness. [20, 21]

Anti-cancer Activity

When tested against MCF-7 breast cancer cell lines, the anticancer activity of S. obvallata leaf and flower extracts demonstrated significant activity compared to a positive control.[22]

Anticancer and radioprotective activity

Liang-wen and his colleagues looked into S. *obvallata's* radioprotective activity and hypothesized that it would have a dose-dependent radioprotective effect on radiation-exposed mice. However, the aqueous extract of S. *obvallata* exhibits moderate radioprotective action, according to Ying et al. (2015).

When S. *obvallata* leaves and flower extracts were tested for their anticancer activity against MCF-7 breast cancer cell lines, a review paper also revealed that the results indicated that the extracts had a significant anticancer activity when compared to the positive control.[23]

Traditional use:

One of the chief components of traditional medicine is Brahma Kamal. While such methods could be explored for therapeutic procedures, the therapeutic action of Brahma Kamal has not yet been optimally assessed. Coughs, colds, pain in bones, and infections of the urinary tract are all managed with the leaves, flowers, and rhizomes of Brahma kamal. [24, 25] Dry leaves are applied in the treatment of boils and healing of wounds, leaves and roots are applied in the treatment of heart ailments, and seeds are applied in the treatment of neurological disorders. [26] It is an excellent appetizer and liver tonic; plant soup increases blood volume and decreases liver infections and UTIs. The plant is also used in the medical machine system for the treatment of paralysis and cerebral ischemia. [27,28]

Conclusion:

Brahma Kamal, or Saussurea Obvallata, DC Edgew, is a Himalayan medicinal plant that is rare but renowned for its therapeutic and phytochemical properties. Its traditional application is supported by scientific evidence, which also proves its antibacterial, anticancer, and antioxidant activity. Its overexploitation and habitat destruction may threaten its existence. Its long-term protection needs sustainable conservation strategies. Future work should center on the establishment of biotechnology-based propagation technology and isolation of bioactive molecules to evaluate their clinical value. In order for this species to address the challenges of drug development and herbal therapy, which integrate scientific medical techniques with traditional herbal medicine, it has to be conserved**.**

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