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Research Article

A Compressive Review on Therapeutic Potential, Phytochemical and Traditional Usage Of Brahma Kamal

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Abstract
Brahma Kamal is the most promising flowering species in the Himalayas. It is renowned for its beautiful flowers and remarkable use in customary medicine. Brahma Kamal flowers appear in the middle of the monsoon season. Steroids, flavonoids, glycosides, alkaloids and phenols are the major secondary metabolites present in the Brahma Kamal. Traditionally, the whole plant is used for the management of arthritis, spasms, and sores. The present review aims to summarize all the investigations performed by various researchers on its pharmacological activity, phytochemistry, and traditional uses of the plant.

Keywords: Brahma kamal, *Saussurea obvallata*, sacred lotus**,** Snow of Lotus**,** Flowers of Brahma

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Introduction:
Medicinal plants are one of the largest sources of medicine in all the countries and play a significant role in both the modern and traditional systems of medicine [1]. From the ancient period, herbs have been used as the first line of drug therapy by the local community worldwide to treat various types of disease [2]. Traditional medical knowledge is the most accessible and cost-effective approach for managing multiple medical conditions. Indigenous therapists are knowledgeable about various medicinal plants that are useful in helping treat numerous diseases such as arthritis, fever, gastrointestinal disease, piles, and skin disorders [3-4]. Several studies have documented that due to low cost, better effectiveness, and minimal side effects, several communities of developed and underdeveloped countries used these medical practices to treat several diseases and passed down this information from one generation to another generation [5]. About sixty-five percent of Indians use indigenous remedies [6]. According to investigation of World Health Organization eighty percent of people globally prefer traditional therapies [7]. The use of medicinal plants as natural alternatives is growing every day and becoming more and more popular around the world. Globally, day by day, the market demands for medicinal plants and herbal drugs are increasing worldwide; for example, in India, the market demand for herbal plants is growing at an average rate of 20% annually [8]. Similarly, 76.7% of the population of

Thailand and 90% of the German population use natural herbal remedies to treat specific health issues [9-10]. It is assumed that by the year 2050, the global market of herbal medicine may increase by more than 5 trillion U.S. Dollars [11-12], and the Himalayan region of Uttrakhand is one of the richest locations for a wide range of therapeutic, aromatic, and spices plants [13-14]. According to the report, 600 species of pteridophytes, 44 species of gymnosperms, and roughly 8000 species of angiosperms are in the Indian Himalayas [15]. Moreover, in the past 1-2 decades, the demand for herbal products and plant-based medicines has suddenly increased, leading to extensive exploitation of medicinal plants worldwide [16].

Methods:

Search Strategy with Data Collection

Experimental investigations carried out by different researchers on this plant from 1986-2023 covering areas like morphology, traditional uses, phytochemistry, pharmacological profile, biochemical constituents, and geographical distribution were searched in different peer-reviewed journals using other scientific databases, including Scopus, Pub Med, Google Scholar, Web of Science, Science Direct. Only articles that are available in English have been reviewed.

Extraction of Information and Software Used

The article studies were selected based on the following inclusion criteria: the research and review article published in the English language and demonstrated the morphological, microscopical characteristics of the plant, pharmacological activity, and ethnobotanical uses. Those published in non-English languages and did not meet the inclusion criteria were excluded from the study. The valuable and beneficial data collected from the various research and review papers has been thoroughly elaborated in the current manuscript and summarized in tabulated form. The Chem Spider and PubMed databases were searched for chemical structures found in the plants. Chem Draw (version 12.0.2) and Biorender were used to draw the chemical structure and figures of various biological activities of the plants.

Occurrence and Distribution:

Braham kamal, the state flower of Uttrakhand named after Brahma, scientifically known as *Saussurea obvallata*, belongs to the *Saussurea* genus *and* family Asteraceae [17]. There are about 400 species of plants in the Saussurea genus, of which sixty two are found in India and 289 species found in China [4] This particular species is typically found on mountains; therefore, sometimes these plants are also known as snow lotus [18]. It is an indigenous herb found in the Himalayan geographic area and has a long cultural and medicinal history; it is found in the Himalayan alpine meadows that stretch from Jammu and Kashmir to Arunachal Pradesh, at elevations between 3700 to 4600 meters. Brahma Kamal is particularly found in the Kedarnath district of Uttarakhand, including Tungnath, Valley of Flowers, and Hemkund Sahib. In addition, this plant is also found in Myanmar, Northern Burma, Bhutan, Southwest China, Nepal, and the upper Himalayan region of India from Jammu Kashmir to Garhwal[19].

The flowering session of the plant is between July and August, in the heart of the monsoon, and visible up to mid-October, but after that, the plant dies, and the blossoms again only bloom in April. The flowers bloom amongst the grasses and pebbles of the hillside [20]. The taxonomic knowledge of this widely distributed genus is continuously growing, and several new species from China have been identified recently. However, the availability of data on this plant is still limited.

Taxonomic Classification

Kingdom: Plantae
Class: Magnoliopsida
Order: Asterales
Family: Asteraceae
Genus: *Saussera*
Species: *Saussurea obvallata*

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

BOTANICAL DESCRIPTION

Saussurea obvallata is a short-lived perennial aromatic herb that is hermaphrodite and grows up to a height of 15–80, strong caudex that is often unbranched. The stems are hollow, erect, and ribbed. Lower stem leaves and the base of the leaf blade are petiolate. The leaf blade is ovate, elliptic-oblong, or obovate, measuring 7-32 × 1-6.5 cm. The middle and upper stem leaves are sessile, with a semiamplexicaul base and an elliptic to ovate shape, measuring 5-16 × 1.5-8 cm. The uppermost stem leaves are elliptic or ovate, boat-shaped, 5-15 × 1.5-9 cm, with pale yellow surfaces from both sides [21]. The purple flower head are sheltered from the chilly alpine environment by the layers of papery, yellowish-green bracts. Leaves are both cauline and basal-shaped.

The basal types are petiolate, elliptical to lanceolate in shape, sheathing at the base, and broader in size with scarious and serrated margins. The apexes of leaves are in acute to obtuse to cuspidate forms. Cauline leaves can be lanceolate or elliptic-spathulate and flowers are bisexual in type with tubular corolla and violet color. A massive bunch of flowers shields the head of a flower. The entire plant of Braham kamal is odorless, except the flower and leaf, which are highly aromatic. The bract at the base of the flower is sweet and acrid, whereas the rhizome leaf and stem are better in taste. The organoleptic properties of the whole plant are depicted in Table 1. The plant has significant religious importance in the upper Himalayan region of Garhwal. Therefore, the flowers of the plant are used for the worship of goddess Nanda Devi as well as lord Shiva in Kedarnath and Lord Vishnu in Badrinath [22]

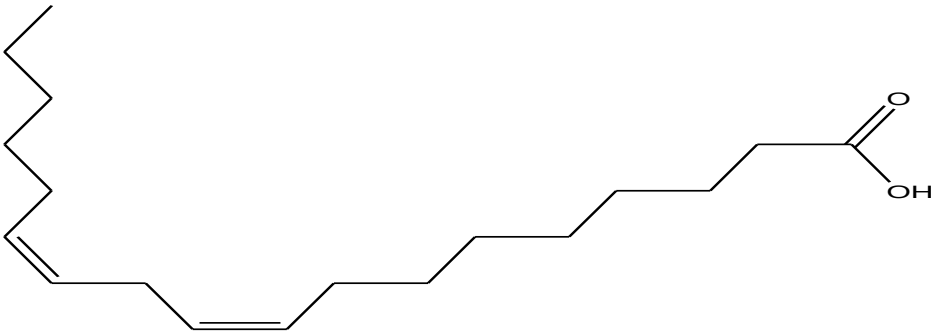
Table 1: Organoleptic properties of *Saussurea obvallata*

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

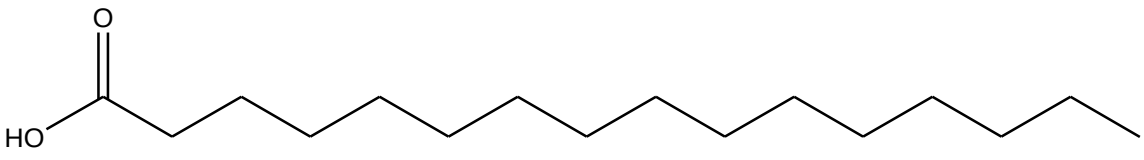
Microscopy: Microscopic analysis of leaves demonstrated the presence of a single layer of the epidermis composed of parenchymatous cells. The vascular bundles are centrally located, and Stomata, Palisade, and spongy parenchyma tissue are also present at the lower side of the epidermis. However, the powder microscopy of the leaf demonstrated the presence of cork cells, pitted vessels, endocarp pieces, and xylem fragments within the leaves. The T.S. of the stem demonstrated the presence of numerous ridges on the outermost side. The Parenchymal cells comprise the epidermis, whereas a few layers of collenchyma cells comprise the hypodermis. Vascular bundles are organized in rings with a wedge shape [23]. Furthermore, a T.S. of root revealed the presence of epidermis, cortex, endodermis, vascular bundles, and single-layered pericycle. Fluorescence analysis showed that the leaves contain several fluorescent compounds and give fluorescence when exposed to longer or shorter UV light [24].

Phytochemical Profile

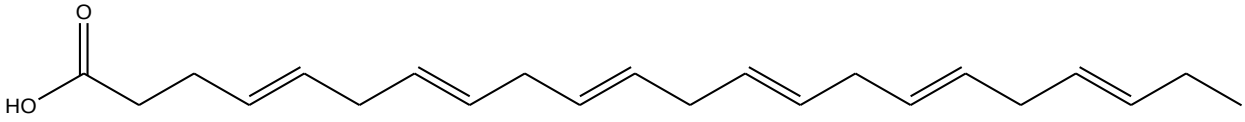
Alonso-Amelot et al. & Zlatić & Stanković state that the brahma kamal typically synthesize a extensive number of secondary metabolites, but several Alpine species produce additional compounds as a result of stress caused by extreme cold weather, and these plants are becoming more and more critical because of their distinctive medicinal properties [25-27]. Earlier findings of Semwal et al. 2014 have revealed that the flowers and leaves of the plant contain various phytochemical constituents such as alkaloids, glycosides, flavonoids, phenol, saponins, steroids, tannins, terpenoids, lignans, sesquiterpenes, and lactones[28]. Furthermore, the presence of squalene and α-linolenic acid methyl ester was revealed by GCMS studies of various fractions of pet. ether extract of leaves. [29]. Recently, Mahmad Afzan et al. extracted the oil from the leaves of Brahma kamal at different temperatures and pressures and demonstrated that the highest percentage of oil yield (3.2 ± 0.20 %) was achieved at 40 °C and 30 MPa of pressure. Furthermore, the another GCMS study of leaves oil extracted by using green extraction method revealed the presence of six fatty acid compounds including myristic acid, oleic acid, linoelaidic acid, dodecanoic acid, n-hexadecanoic acid, and phytol[30]. Additionally, Semwal et al. showed that flowers contain methyl palmitate, linalyl acetate, palmitic acid, and methyl stearate, while leaves contain linoleic acid, palmitic acid, eltanolone, and doconexent [31]. Some of the phytochemicals structure is depicted below.



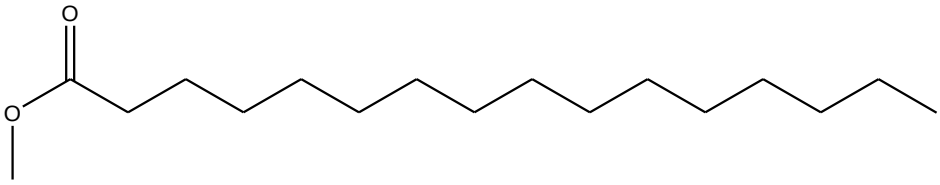
Linoleic acid



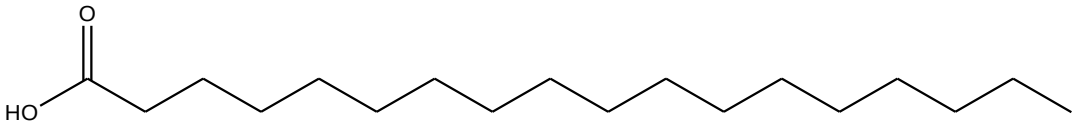
Palmitic acid



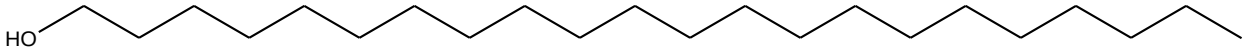
Doconexent



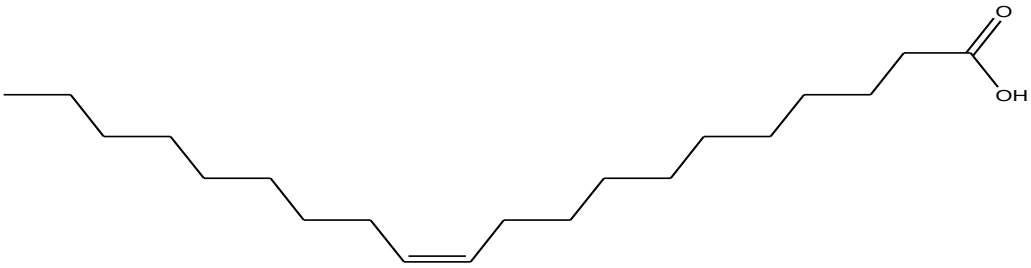
Methyl palmitate



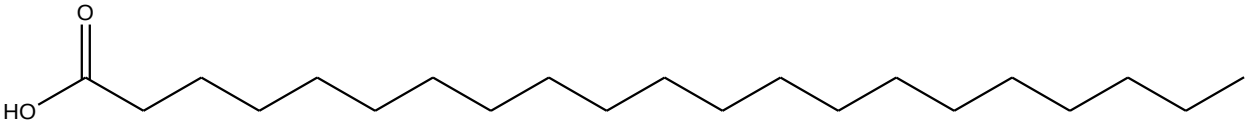
Stearic acid



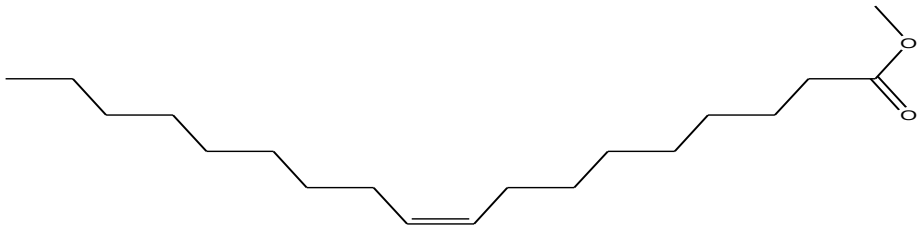
1-Docosanol



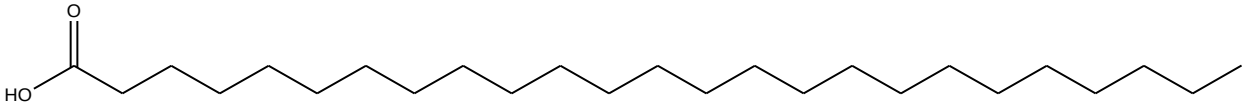
Gondoic acid (cis-11-Eicosenoic acid)



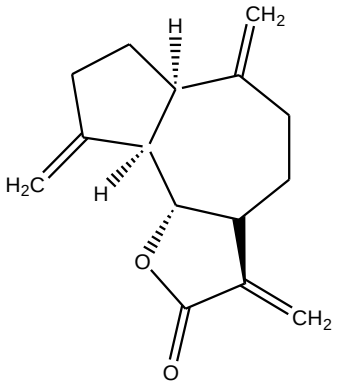
Henicosanoic acid



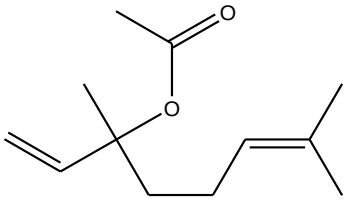
Methyl oleate



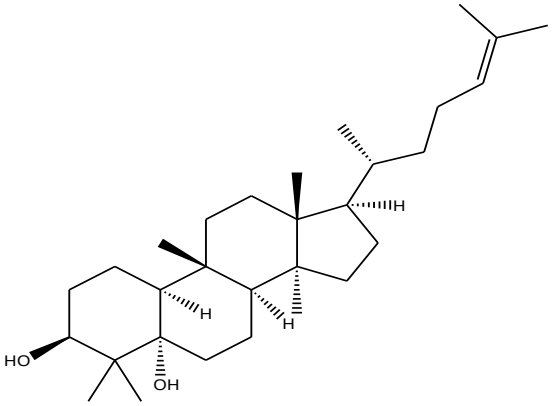
Pentacosanoic acid



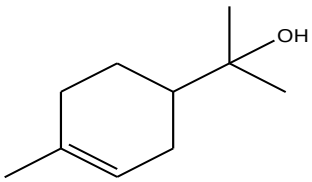
Dehydrocostus lactone



Linalyl acetate



Litsomentol



alpha-Terpineol

Traditional use: Brahma Kamal has a significant role in conventional medicine. However, the therapeutic effects of Brahma Kamal have not been scientifically evaluated, but such practices may be assessed for therapeutic motives. The whole Brahma Kamal plant can be used to treat various diseases depicted in Table 2. People indigenous to Tibet and other places, such as the upper Himalayas of Garhwal, utilize Brahma Kamal to prepare traditional medicines. The leaves, flowers, and rhizomes of Brahma kamal are utilized in the management of urinary tract infection, colds, coughs, and bone discomfort [32-33]. The leaves and roots used in the management of cardiac disease, seeds for neurological disorders, and dry leaves are utilized to treat boils and healing of wounds [34]. It is outstanding liver tonic and appetizer; plant soup increase the blood volume and mitigates UTI and liver infections. In the machine system of medicine, the plant is also used for the treatment of cerebral ischemia as well as paralysis [35-36].

Mineral Content: Braham Kamal is a rich source of mineral elements. Tiwari et al. have examined the Brahma kamal for the presence of various inorganic compensates such as phosphate, calcium, magnesium, potassium, iron, silica, protein, crude fiber, ash, reducing sugars, and amino acid content[37] and suggest that the inflorescence, leaves, and stem possess highest concentrations of protein (26.25%), iron (0.042%), and crude fiber (20.0%), respectively[38]. Table 3 illustrates the important minerals in Brahma Kamal. In addition, aspartic acid, alpha-alanine, beta-alanine, glycine, histidine, leucine, isoleucine, lysine, methionine, phenylalanine, serine, threonine, and tryptophan amino acids were also found. The amount of amino acids was observed larger than the leaves.

Parts used	**Traditional Uses**	**Reference**
Whole aerial herbal plants	Bone ache, digestive and liver problems, appetizer, asthma, and bronchitis, as well as paralysis, Cerebral ischemia, Headache, Body pain ,Bruises,Cuts	[39]
Roots	Plague, painful periods, snake bite, Antiseptic Boils, Leucoderma, Fever, Cough, Cardiac disorders, Bruises, Cuts.	[40]
Leaves	Cough and cold, cardiac disorder, Boils, Wounds, Bruises, Cuts, Fractures	[41-42]
Seeds	Mental Disorder	[43]
Seed oil	Seed oil is applied on the head twice a day for headache	[44]
Flowers	Antipyretic, Antiseptic, sexually transmitted disease, irregular menstruation cycle: The flower is cooked with taga misri and taken against urine tract infection.	[40]

Table: 3 Mineral content in *Brahma Kamal*

Name	Value	Name	Value
Ca	17602	Sr	87
Mg	2486	Cu	35
Fe	1221	Ni	12
Mn	148	Cr	04
Zn	115	Pb	90

Pharmacological Activity:

Antioxidant activity: The reactive oxygen species (ROS) are molecules with a short $t_{1/2}$ and are highly reactive due to their incomplete valances. Excessive production of free radicals leads to oxidative stress. It is believed that oxidative stress participates in numerous age-related disorders such as Alzheimer's, Parkinson's, arthritis, and cancer [45]. Antioxidants are substances that fight against free radicals and prevent oxidative stress [46]. The aqueous and methanol extract of *Saussurea obvallata* leaves, and flowers were investigated using a standard diphenylpicrylhydrazyl and hydrogen peroxide assay against ascorbic acid. The investigators revealed that the methanol and aqueous extract of flowers showed 82.88 ± 0.48% and 29.25 ± 0.86%, of DPPH free radical scavenging activity, [31]. At the same time, leaves aqueous and methanol extract demonstrated intermediate free radical scavenging activity. Furthermore, methanol and aqueous leaf extract showed the highest and lowest percentages of H2O2 free radical scavenging activity, and flowers had intermediate levels of H2O2 free radical scavenging activity.

Antibacterial and antifungal activity- Mishra et al. examined the antibacterial activity of *S. obvallata* leaves against both gram-positive and gram-negative bacteria**.**. The petroleum ether extract showed remarkable antibacterial activity with 87.2 ± 1.6, 98.4 ± 1.1, and 90.2 ± 1.8 µg/ml, respectively [29]. The outcomes of the investigations demonstrated that the minimum inhibitory concentration of petroleum ether extract was slightly higher for gram-negative than gram-
positive bacteria. Further, Semwal and Painuli investigated the antibacterial and antifungal activity of *Saussurea obvallata* leaves and flowers against the four bacterial strains (*Pseudomonas aeruginosa*, *Escherichia coli*, *Staphylococcus aureus*, and *Klebsiella pneumonia* bacteria) and three strains (*Candida albicans*, *Candida glabrata*, and *Candida tropicalis*) of fungus. Both the extract of *Saussurea obvallata* leaves and flowers showed potent antibacterial activity against all three strains of bacteria. Still, both extracts were found to be resistant to *E. coli* due to less zone of inhibition [31].

Anti-hypoxic activity: Ma et al. evaluated the 20 herbs for their anti-hypoxic activity using a Normobaric hypoxia model and suggested that Brahma Kamal had the longest survival time compared to other herbs [47]. According to Schurr, the concentration of lactic acid in the blood is a sign of anaerobic respiration since a higher lactic acid concentration indicates less anti-hypoxic activity. The active phytoconstutents present in the petroleum ether extract of Brahma Kamal might be helpful in the management of acute mountain sickness [48].

Wound healing activity: Wound healing is a complex and dynamic biological process of the body in which the damaged and dead cells are replaced by newly produced cells or tissue. Inflammation, tissue repair, and remodeling are the initial steps in the wound-healing process.The ethanol extract of Brahma kamal leaf demonstrated the excellent wound healing efficacy in experimental animals when compared to standard 10% w/w Povidone-iodine ointment [49]

Anticancer and radioprotective activity: Liang-wen and his co-workers investigated the radioprotective activity of *S. obvallata* and suggested that *S. obvallata* might produce a dose-dependent radioprotective effect on animals exposed to radiation, However, Ying et al. 2015 indicated that the aqueous extract of *S. obvallata* has moderated radioprotective activity. Furthermore, a review paper reported that the when *S. obvallata* leaves and flower extracts were evaluated for their anticancer activity against MCF-7 breast cancer cell lines, the finding of the study suggested that the extracts had a significant anticancer activity in comparison to positive control [50].

Consent for Publication

The authors have provided their consent for the publication of this manuscript. All authors contributed equally to this work. Dr. Bhupesh Chander Semwal developed the concept and prepared the manuscript.

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Declaration of Competing Interest

All the authors of this manuscript declare that they have no conflict of interest.

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References:

1. Salmerón-Manzano E, Garrido-Cardenas JA, Manzano-Agugliaro F. Worldwide research trends on medicinal plants. *International journal of environmental research and public health*. (10):3376(2020)
2. Atanasov AG, Zotchev SB, Dirsch VM, Supuran CT. Natural products in drug discovery: Advances and opportunities. Nature reviews Drug discovery. 20(3):200-16 (2021)
3. Vidyarthi S, Samant SS, Sharma P. Traditional and indigenous uses of medicinal plants by local

residents in Himachal Pradesh, North Western Himalaya, India. International Journal of Biodiversity Science, Ecosystem Services & Management, 9(3), 185-200(2013).
4. Kumar J, Pundir M. Phytochemistry and pharmacology of Saussurea genus (Saussurea lappa, Saussurea costus, Saussurea obvallata, Saussurea involucrata). Materials Today: Proceedings. 56:1173-81(2022)
5. Singh A, Nautiyal MC, Kunwar RM, Bussmann RW. Ethnomedicinal plants used by local inhabitants of Jakholi block, Rudraprayag district, western Himalaya, India. Journal of ethnobiology and ethnomedicine, 13(1), 1-29 (2017).
6. Timmermans K. Intellectual property right and traditional medicine: policy dilemmas at the interface. Social Science & Medicine , 57(4):745–56(2003)
7. Balakrishnan R, Vijayraja D, Jo SH., Ganesan, P, Su-Kim I, Choi DK. Medicinal profile, phytochemistry, and pharmacological activities of Murraya koenigii and its primary bioactive compounds. Antioxidants, 9(2), 101(2020). doi: 10.3390/antiox9020101.
8. Kang W, Wang Y. China Digital Governance Development Review Over the Past Two Decades. International Journal of Public Administration in the Digital Age, 5:92–106 (2018). doi: 10.4018/IJPADA.2018070107.
9. Zhang J, Du S, Duan X, Zhang S. Effects of ultrahigh pressure processing on the physicochemical characteristics of Taibai Kudzu starch. Nongye Gongcheng Xuebao/Transactions of the Chinese Society of Agricultural Engineering, 23(4):269-71(2007)
10. Phumthum M, Balslev H. Thai Ethnomedicinal Plants Used for Diabetes Treatment. OBM Integrative and Complementary Medicine3:1–25 (2018;). doi: 10.21926/obm.icm.1803020.
11. Ujowundu CO, Okafor OE, Agha NC, Nwaogu LA, Igwe KO, Igwe CU. Phytochemical and chemical composition of Combretum zenkeri leaves. Journal of Medicinal Plants Research. 4(10):965-8 (2010)
12. Painuli S, Quispe C, Herrera-Bravo J, Semwal P, Martorell M, Almarhoon ZM, Seilkhan A, Ydyrys A, Rad JS, Alshehri MM, Daştan SD. Nutraceutical profiling, bioactive composition, and biological applications of Lepidium sativum L. Oxidative Medicine and Cellular Longevity. 2022:2910411 (2022). doi: 10.1155/2022/2910411.
13. Painuli S, Semwal P, Cruz-Martins N, Bachheti RK. Medicinal Plants of Himalayan Forests. In Non-Timber Forest Products (pp. 175-212), Springer, Cham (2021).
14. Rawat VS, Chandhok A. Medicinal plants used by tribes of Uttarakashi District of Uttarakhand Indian Journal of Botanical Research 5(3&4), 169-173 (2009).
15. Bhat JA, Kumar M, Bussmann RW. Ecological status and traditional knowledge of medicinal plants in Kedarnath Wildlife Sanctuary of Garhwal Himalaya, India. Journal of Ethnobiology and Ethnomedicine.9:1-8(2013).
16. Singh G, Rawat GS. Ethnomedicinal survey of Kedarnath wildlife sanctuary in western Himalaya, India. Indian Journal of Fundamental and Applied Life Sciences., 1: 35-36(2011)
17. Ghosh, D. Brahma Kamal. Resonance, 22(4), 377-387 (2017).
18. Butola JS, Samant SS. Saussurea species in Indian Himalayan Region: diversity, distribution and indigenous uses. International journal of plant Biology, 1(1), e9(2010).
19. Kamal B. Brahma Kamal–the spiritually revered, scientifically ignored medicinal plant. Current Science, 104(6), 685 (2013).
20. Von Raab-Straube E. The genus Saussurea (Compositae, Cardueae) in China: taxonomic and nomenclatural notes. Willdenowia. 41(1):83-95(2011).
21. Lian BYX. Flora of China vol 20-21: Asteraceae: Cardueae, Saussurea obvallata, Science Press/Missouri Botanical Garden Press, vol. 20. Beijing/St. Louis; 1994-2008. http://www.efloras.org/florataxon.aspx?flora_id=2&taxon_id=242346852 [assessed on 23 October 2023]
22. Saklani A Rao RR. In high altitudes of Himalaya, Biodiversity, Ecology and Environment, Gyanoday Prakashan, Nainital 2: 323-334(2000).
23. Yadav C, Chaubey S, Singh DC. Pharmacognosy of different parts of Brahmkamal: the state flower of Uttrakhand, India International Journal of Research in Ayurved and Pharmacy 9(4):170-175(2018)
24. Devi KS, Narayana SL, Menghani P, Georgekutty J. Microscopic, pharmacognostic and phytochemical screening of Epiphyllum oxypetalum (dc) haw leaves. Journal of Pharmacognosy and Phytochemistry. 2018;7(6):972-80.
25. Alonso-Amelot ME, Oliveros A, Calcagno-Pisarelli MP. Phenolics and condensed tannins in relation to altitude in neotropical Pteridium spp: A field study in the Venezuelan Andes. Biochemical systematics and ecology. 32(11):969-81(2004)
26. Zlatić NM, Stanković MS. Variability of secondary metabolites of the species Cichorium intybus L. from different habitats. Plants. 6(3):38(2017).
27. Mangal AK, Tewari D, Shantha TR, Bansal S, Mangal M. Pharmacognostical standardization and HPTLC fingerprinting analysis of Crocus sativus L. Indian Journal of Traditional Knowledge 17 (3):592-597(2018)
28. Semwal P, Anthwal P, Kapoor T, Thapliyal A. Preliminary investigation of phytochemicals of Saussurea obvallata (Brahm Kamal) and Pittosporum eriocarpum (Agni): two endangered medicinal plant species of Uttarakhand. International Journal of Pharmacognosy, 1(4), 266-269 (2014).
29. Mishra AP, Saklani S, Sharifi-Rad M, Iriti M, Salehi B, Maurya VK, Sharifi-Rad J et al.,.

Antibacterial potential of Saussurea obvallata petroleum ether extract: A spiritually revered medicinal plant. Cellular and Molecular Biology, 64(8), 65-70(2018).
30. Mahmad A, Noh TU, Salim F, Shaharun MS. Supercritical Carbon Dioxide Extraction of Fatty Acids Compositions from Epiphyllum oxypetalum (DC.) Haw. Leaves Oil. Malaysian Journal of Chemistry, . 25(2), 63-70(2023)
31. Semwal P, Painuli S. Antioxidant, antimicrobial, and GC-MS profiling of Saussurea obvallata (Brahma Kamal) from Uttarakhand Himalaya. Clinical Phytoscience, 5(1), 1-11(2019).
32. Kirtikar KR and Basu BD: Indian Medicinal Plants. Dehradun, 2: (1984).
33. Negi KS, Gaur RD and Tiwari JK: Ethnobotany 2: 15 (1999)
34. Tsarong TJ. Handbook of Traditional Tibetan Drugs: Their Nomenclature, Composition, use and Dosage, Tibetan Medical Publications, Kalimpong 1986.
35. Phondani PC, Maikhuri RK, Rawat LS, Farooquee NA, Kala CP, Vishvakarma SCR, Rao KS and Saxena KG. Ethnobotanical Uses of Plants among the Bhotiya Tribal Communities of Niti Valley in Central Himalaya, India. Ethnobotany Research & Applications 8: 233-244 (2010).
36. Maikhuri RK, Nautiyal S, Rao KS, Semwal RL. Indigenous knowledge of medicinal plants and wild edibles among three tribal sub communities of the central Himalayas, India. Indigenous Knowledge and Development Monitor, 8(2), 7-13(2000).
37. Tiwari VK, Rajwar GS, Rawat GS. Chemical composition of Saussurea obvallata Wall. ex Clarke, I. Indian journal of forestry 9(4): 312-314(1986).
38. Jyothi R, Murthy KS. An overview on Saussurea obvallata: A spirituo-scientific plant of India. Journal of Drug Delivery and Therapeutics. 13(10):145-6(2023).
39. Joshi, Pooja, and Nilanjana Rao. Role of indigenous people in conservation of biodiversity of medicinal plants: An Indian case study. Survival and Sustainability: Environmental concerns in the 21st Century 91-101 (2011).
40. Singh V, Singh Y, Koirala R, Keshwa K, Tamta P, Singh TR. Therapeutic and cultural evaluation of Brahma Kamal (Saussurea obvallata (Dc.) Edgew: An endangered potential herb. Journal of Ayurveda and Integrated Medical Sciences. 8(6):109-18(2023).
41. Sharma K, Jeet K, Baldi A. Management of acute mountain sickness: An exploratory review on herbal Drugs. Indian Journal of Natural Products (1):5(2015).
42. Monika, DM, Bisht PS, Chaturvedi P. Medicinal uses of traditionally used plants in Bhatwari block, district Uttarkashi, Uttarakhand, India. Journal of Scientific Research, 64(1), 119-126 (2020).
43. Mitra D, Rani A, Palni LM, Sharma K, Uniyal N, Chauhan A, Semwal P, Arya P. Isolation and characterization of dominant fungi from Rhizospheric soil of Saussurea obvallata (DC.) Edgew.(Brahma Kamal) of the Indian Himalayan Region. Journal of Pure and Applied Microbiology 13(3):1509-15(2019)
44. Samal PK, Dhyani PP, Dollo M. Indigenous medicinal practices of Bhotia tribal community in Indian Central Himalaya. Indian Journal of Traditional Knowledge 9 (2):256-260 (2010)
45. Caponio GR, Lippolis T, Tutino V, Gigante I, De Nunzio V, Milella RA, Gasparro M, Notarnicola M. Nutraceuticals: Focus on anti-inflammatory, anti-cancer, antioxidant properties in gastrointestinal tract. Antioxidants11(7):1274(2022).
46. Singh S, Ahuja A, Agrawal N, Sharma S, Varshney DS. Antioxidant Properties of Nutraceuticals. InImmune-Boosting Nutraceuticals for Better Human. Health Apple Academic Press. pp. 205-244(2024)
47. Ma HP, Fan PC, Jing LL, Yao J, He XR, Yang Y, Chen KM, Jia ZP. Anti-hypoxic activity at simulated high altitude was isolated in petroleum ether extract of Saussurea involucrata. Journal of ethnopharmacology 137(3):1510-5(2011)
48. Schurr A. Lactate: the ultimate cerebral oxidative energy substrate? Journal of Cerebral Blood Flow & Metabolism. 26(1):142-52(2006)
49. Khadanga M. Brham Kamal(Epiphyllum oxypetalum): Wound healing activity study. Journal of Emerging Technologies and Innovation Research 6(6):306-312 (2019)
50. Liang-Wen BI, Wen-Hui LI, Wei Duan, Ying GU, Protective effects of Saussurea obvallata extracts on ionic radiation in mice. Journal of Modern Oncology, 7:1218-1221(2009)