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Review Article

Saussurea obvallata Has Its Significance Role In The Treatment Of Wound Healing : A Review

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ABSTRACT

Brahma Kamal (Saussurea obvallata) is a jeopardized restorative herb of the high-altitude Himalayan region with enormous traditional importance. Brahma Kamal and their related family member are situated in Himalaya. Flower of this family sprout during mid-monsoon months among the stones and grasses of elevated glades and crevasses. These amazingly uncommon plants are well known for their lovely flower, yet additionally for their huge significance in customary medication. Traditional Indian literature shows that these medicinal plants have been in use for managing illness since Vedic period. The emergence of herbal revival in modern era has led to massive exploitation of this medicinal herbal flora from the wild. Continuous desertification and unrestrained grazing pressure in high-altitude Himalayan pastures threatens the endurance of some significant therapeutic plants, one of them is Brahma Kamal. This review article is an endeavor attempt to document diverseness, dispersion, spatiality, traditional and pharmacological uses of these important plants.

INTRODUCTION

The Himalayan Mountains are rich in a wide diversity of flora, including many fabled and archaic plants. The species Saussurea obvallata, is renowned as Brahma Kamal. Its name alludes to Brahma, the Hindu concept of the ultimate deity in existence. The head of this flower crowns all other Himalayan flowers. S. obvallata typically appears at the uppermost point of the 4600–5600 meter mountain pinnacle ranges in the snow-capped Himalayan region. There are also some S. obvallata varieties in Myanmar and a few areas in southwest China [1]. Known as the king of Himalayan flowers, Brahma Kamal (Saussurea obvallata) is the state flower of Uttarakhand, India. It is an endemic herb of the Indian Himalayan region. The plant can be found at elevations ranging from 3,800 to 4,800 meters...This herb is hermaphrodite and grows to a height of 5 to 10 cm on average. Mid-monsoon (mid-July) to mid-

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October is when flowers begin to blossom; after that, the plant dies and reemerges in April. Brahma Kamal is typically found in the areas around Kedarnath, Tungnath, the Valley of Flowers, Hemkund Sahib, and Gangotri 3 in Uttarakhand. In the area, the plant has great religious significance. It is distributed as "prasada" and offered to Lord Shiva at Kedarnath and Lord Vishnu at Badrinath. According to the widely accepted mythology found in the Vedas and Puranas, Lord Shiva, the Hindu deity of destruction, slashed off Ganesha's head out of rage. Lord Bhrama, the Hindu god of creation, then produced Brahma Kamal as a result of Parvati, Lord Ganesha's mother, showing him favor. Brahma Kamal was accustomed to attaching an elephant's head to Lord Ganesha's body .The Ramayana and Mahabharata, two sacred Indian texts, reference Brahma Kamal. The native people of Tibet and other regions, such as the Garhwal Himalayas, employ Brahma Kamal to prepare traditional medicines. The leaves, rhizomes, and flowers are used to cure digestive disorders, urinary tract issues, colds, and coughs. 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, and boils (using dried leaves). It is used to treat cerebral ischemia and limb paralysis in the Tibetan medical system[9]. Since the rhizospheric microflora is crucial for the germination, development, and survival of plants in their specific niches, This work was carried out to isolate the fungal community of the Saussurea obvallata rhizospheric zone in order to determine the role of rhizospheric microflora in Saussurea obvallata growth. We found in this study that Saussurea obvallata's rhizospheric soil has a potential fungus colony .The whole plant of Saussurea obvallata is used by the local people of the Himalaya, for traditional, cultural, and religious purposes. The Conservation Assessment and Management Plan (CAMP) had categorized Saussurea obvallata as an endangered species. Several investigations have been carried out to study reproductive biology, genetic diversity, cultivation and propagation of S. obvallata in view of conservation and management of the endangered medicinal herb. To the best of our knowledge, no study has been done to study rhizospheric microbes of Saussurea obvallata till now.

Fig no.1 Collection Sites Of Saussurea Obvallata

As rhizospheric microflora plays an important role in germination, growth and survival of plant in respective niche. In order to know the role of rhizospheric microflora in growth of Saussurea obvallata, this study was conducted to isolate the fungal community of Saussurea obvallata rhizospheric region. In the present study, we revealed that the potential fungal community present in the rhizospheric soil of Saussurea obvallata [5]

Table no 1. Growth conditions and collection site details of selected isolates

Isolate name	Grow condition temperature	Medium	Soil sample
MaHaD1	25±3.0°C	Fungal Broth and PDA	MG
MaHaD2	25±3.0°C	Fungal Broth and PDA	MP
MaHaD3	25±3.0°C	Fungal Broth and PDA	HP

BACKGROUND

They are inexpensive, efficient, and have few to no negative effects, herbal medicines have long been employed in traditional Indian medicine as well as other medical systems around the world. A rising number of individuals worldwide are becoming interested in these qualities of the so- called "natural" medications. According to a World Health Organization (WHO) survey, almost 70% of prescribed human medications are made from plants, and 80% of the population in developing nations still relies on traditional and folk medical systems. Additionally, 85% of traditional medicines are made with plant extracts .The global market for herbal medications is currently valued at US$62 billion, but it is expected to reach US$5 trillion in both the Asian and global markets by 2050. The plant is widely recognized throughout Uttarakhand for its traditional, medicinal, decorative, and religious uses. It is used to treat a variety of illnesses and conditions, including paralysis, cerebral ischemia, wounds, cardiac problems, and mental illnesses. Some people also use it as an antibacterial and to help heal cuts.[4] The assessment of its total phenolic and flavonoid contents, as well as the antioxidant and antibacterial properties linked to its extracts, are the subjects of the current investigation. The active ingredients in crude methanolic extracts of S. obvallata leaves and flowers have been identified by Gas Chromatography-Mass Spectrometry (GC-MS) based investigation.[4]

TAXONOMY

Under the common generic name Saussurea, Brahma Kamal and other related species are members of the dicotyledonous family Asteraceae's Cynareae tribe. The genus Saussurea was named for the Swiss philosopher Horace Benedict de Saussure (1740–1799) by A P de Candolle in 1810. Among the larger genera in the Asteraceae family is Saussurea. There are an estimated 410 species in it that are indigenous to Asia, Europe, and North America's cold, temperate, and Arctic climates. Central Asia and the alpine Himalayan environments are home to the highest diversity of Saussurea. The terms "Saw-wort" and "Snow Lotus" are common English names for plants in the genus Saussurea; however, the latter name is used for several species found in Central Asia that are found at high elevations. A few species of Saussurea are considered in this article: Snow Lotus (S. tridactyla Sch. Bip. ex Hook. f.), Kasturi Kamal (S. gossypiphora D. Don), Phen Kamal (S. simpsoniana [Field & Gard.] Lipsch.), Brahma Kamal (Saussurea obvallata [DC.] Edgew.), and Grass-leaved Saw- wort (S. graminifolia Wallich ex DC.). These species, which are all located in the chilly alpine regions of the Indian Himalayan Region, are almost entirely indigenous. [11]

Table 2. - Taxonomical Classification

Kingdom	Plantae
Phylum	Tracheophytan
Class	Magnoliopsida
Order	Asterales
Family	Asteraceae

Tribe	Cynareae
Genus	Saussurea
Species	Saussurea obvallata
Binomial name	Saussurea obvallata(DC.) Edgew
Synonyms	Aplotaxis obvallata DC. Theodorea obvallata (DC.)Kuntze

DISTRIBUTION

The aforementioned species are all confined to high mountain ranges (3000–5700 m) and have adapted to persistent snowfall, severe cold, and powerful winds [4]. Alpine meadows, glacier slopes, lake and stream banks, alpine screes, rocky slopes, and some other high mountain habitats are the primary growth sites for Brahma Kamal (Figures 2a and 2b). It can be found in the Himalayan mountains of India, namely in the valley of flowers at a height of roughly 3600– 4500 meters, in the regions of Kashmir, Sikkim, Garhwal, Chamoli, and Hemkund..Brahma Kamal is grown outside of India in East Tibet, Pakistan, Bhutan, Nepal, and Myanmar. Most Kasturi Kamal occurs at elevations between 4300 and 5600 meters on shady, damp rocky slopes and alpine screes in India's Ladakh, Himachal Pradesh, Lahaul and Spiti Valley, Garhwal, and Sikkim, as well as in a few other nearby nations including Nepal, Bhutan, Southern Tibet, and South-West China. Phen At an elevation of 4400–5600 meters, kamal grows best in dry regions, alpine meadows, screes, and stony slopes. This plant's range is restricted to the high mountain regions of China, Tibet, Nepal, Bhutan, Pakistan, and India's Kashmir, Himachal Pradesh, Garhwal, Chamoli, Hemkund, and Sikkim. Only high alpine regions (up to 5100 m) are home to snow lotus, ideally dry rocky slopes, screes, and alpine meadows. Nearly indigenous to the Himalayan region of Sikkim. It is extremely poorly distributed throughout Tibet, Bhutan, and Nepal in addition to India. Finally, the Grass-leaved Saw-wort is found only in Kashmir, Pindari, Phurkia, and Kumaon in India, as well as in Nepal, Bhutan, and Southern Tibet. It grows in alpine meadows, agricultural fields, and rocky slopes at an elevation of 3500–5600 m.[6]

Etymology

Planter Horace Benedict de Saussure The introduction of the generic names "Saussurea" and "obvallata," which are derived from "obvallatus," which indicates that anything is enclosed by a wall and alludes to involucriform bracts, is best explained by taxonomists.

Geographical Distribution

The high mountain environments of Himachal Pradesh, Himkund, Kashmir, and Sikkim are home to Saussurea obvallata. Additionally, it is available in a number of nations, including China, Tibet, Bhutan, and Pakistan.

Organoleptic Description

An organoleptic examination of the plant showed that Saussurea obvallata is odorless throughout. The exceptionally fragrant blossom is the standout feature. The stem tastes astringent, the rhizome and leaves are bitter and astringent, and the bracts tend to be sweet and astringent. The entire plant is coarse by nature.

Botanical Description

Saussurea obvallata is a little perennial herb that reaches a length of 60 cm. a hollow, tall stem that ranges in color from purplish to reddish brown, as well as basal and cauline leaves that can be either petiolate or rosulate. The wide base leaves include prickly edges.

Fig 2- Distribution Of Saussurea Obvallata

Distinguishing Features

(Saussera obllavata) The plant bears dense clusters of dark purple flower heads encircled by huge, glossy, translucent, pale yellow, papery, and boat-shaped bracts.

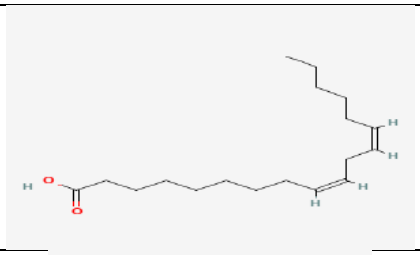
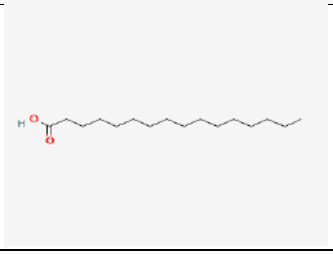
Propagation

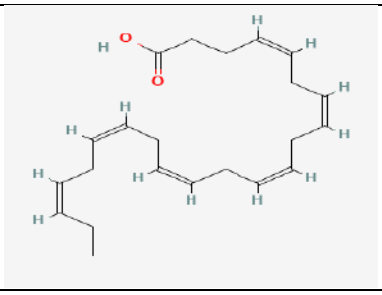
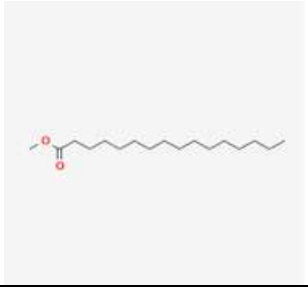
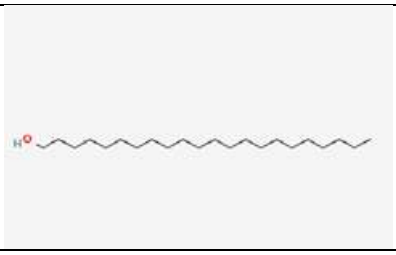
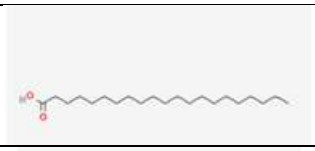
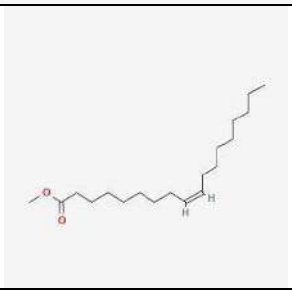
The species naturally spreads via vegetative perennial rootstock and seeds. The methods used for the species' propagation are not adequately supported by evidence. Enough growth regulators can be added to the plant to enrich it.

CHEMICAL COMPONENTS

Alkaloids, calcium, chromium, copper, ferrous ions, iron, lead, magnesium, manganese, minerals, nickel, phenol, proteins, saponins, steroids, strontium, tannins, terpenoids, zinc phenolics, flavonoids, sesquiterpenes, and lactones. [11] [2]

TABLE 3 - Some Of The Major Constituents In S. Obvallata Extracts

Compounds	Molecular Formula	PubChem CID	Chemical Structure
Linoleic acid	C18H32O2	5280450	
Palmitic acid	C16H32O2	985	

Doconexent	C22H32O2	445580	
Methyl palmitate	C17H34O2	8181	
Stearic acid	C18H36O2	5281	
1-Docosanol	C22H46O	12620	
Gondoic acid	C20H38O2	5282768	
Henicosanoicacid	C21H4202	16898	
Methyl oleate	C19H3602	5364509	

Saussurea obvallata PLANT CARE

LOCATION AND SUNLIGHT

The Brahma kamal plant requires indirect and continuous sunlight exposure. The plant leaves, which can also store water, will be sun burnt due to direct sunlight. They will turn pale. Avoid changing the plant's location frequently. Once the sign of budding is visible, do not change the placement of the plant till the plant stops flowering. Otherwise, the bud will not bloom.

WATERING

Brahma kamal is a succulent plant that can retain water in its leaves in arid conditions. This characteristic makes the plant leaves soft and fluffy. Hence, watering must be done when the top layer of the soil dries up. You can find out if the soil has dried by touching its top surface. Avoid

overwatering. The leaves will become yellowish and brownish, a sign of root rot. Also, ensure watering directly over the soil instead of watering over the plant's leaves to avoid fungal growth.

TEMPERATURE

Warm and normal humid climatic conditions are ideal for the Brahma Kamal plant to thrive. However, they must be protected from direct exposure to sunlight and strong heat or cold winds. The suitable temperature for the Brahma Kamal plant ranges from 25 to 35 degrees Celsius.

POTTING SOIL AND REPOTTING

The saussurea obvallata requires a fast-draining medium for growth. Hence, it is necessary to select the right potting soil for the plant. The succulent cannot grow in standing water. Thus, the potting soil required should mainly have sand and perlite. Remember to choose a container with a minimum of three to four drainage holes to allow the excess water to escape Repotting is required if the plant has outgrown the flowerpot, especially every two years. Remove the plant from the existing pot without damaging its root balls for repotting. Select a big-sized container and place the plant in a fresh potting mix. Avoid watering for a minimum of two days to allow the plant to recover from this change.

FERTILISING

The plant requires good quality of fertilisers high in phosphorus. This helps the plant in producing flowers. The fertiliser should be added before and during the plant's blooming season, in a gap of 25 to 30 days. Stop using the fertiliser once the flowering stops.[15]

Fig 3 – Plant Care Of Saussurea Obvallata

ECOLOGY AND ENVIRONMENT

The nation's most fragile and vulnerable ecology is found in the Great Himalayan region. The region's two main seasons are winter and summer. Summers are short and frigid, and winters are lengthy and bitterly cold. Alpine climate is impacted by this meteorological phenomenon. At high elevations, it grew chilly and dry, whereas at low elevations, it got humid. This region has regular fluctuations in atmospheric weather conditions. The majority of the year is spent with snow in this area. Everyday events include windstorms, snowfall, and sudden rain. Here, the state of the atmosphere is incredibly variable .Height increases cause the air to become faster, drier, and finer. There are two zones in the Great Himalayan region: Eastern and Western. Both regions have abundant floral resources..This region gave rise to over ten thousand plant species and is currently home to fifty different plant biomes. Despite the harsh atmospheric conditions, the majority of this alpine environment is a snowy desert with stony boulders. This makes it difficult for relatively few to develop here. They must withstand periods of little growth season, snowstorms, and bitterly cold temperatures. Species belonging to the Saussurea genus that have survived here are midgets, measuring five to eleven centimeters in height, and they start short of the base. Saussurea leaves wind up the flowering stem after developing a thick rosette structure at the base. The flowers are arranged in a dense head

of tiny capitula, often completely encased in papery bracts or dense wooly hair ranging in color from white to purple. Thick wooly hairs aid in the thermoregulation of the flowers, preventing ice damage at night and UV damage from the exceptionally high altitude daytime. [11]. The Indian Himalayan Region, which includes the Himalayas and neighboring mountain ranges in the northern part of Indian Territory, is home to the nation's extremely delicate and sensitive mountain ecology. Winters and summers are the two main seasons. The summers are chilly and brief, whereas the winters are lengthy and bitterly cold. Depending on elevation, the alpine climate varies. As elevation increases, the weather becomes drier and colder; as elevation decreases, the weather becomes wetter. As a result, the weather and temperature in the Indian Himalayan regions fluctuate rapidly. Snowfall typically occurs in the upper alpine regions throughout the year. The monsoon season, floods, strong winds, snowstorms, and other precipitation events can erupt out of the blue, making the environment unpredictably unstable. In addition, the air is extremely thin, dry, and has very little precipitation at high altitudes.. Due to its distinct bio geographic position at the meeting point of the Indo-Malayan regions, a broad range of elevations, a variety of topography, and a multitude of ecological niches, the Indian Himalayan Region is home to a diverse range of floristic elements. The Eastern and Western Himalayas are the two subgroups of the acknowledged separate phyto geographic zone that encompasses the entire region. More than half of all plant species in India are vascular plants, of which there are about 10,000 species in the Indian Himalayan Region. But in reality, the majority of the Indian Himalayan Region's high alpine habitats are rocky deserts with constant snowfall and hostile weather. As a result, very few species of vascular plants can thrive here..They must adjust to a brief growing season, strong winds, and below-freezing temperatures. The high altitude species of the genus Saussurea that are discussed here are all dwarf, low-lying plants that range in height from 5 to 10 cm. The leaves spiral up the flowering stalk after developing in a thick base rosette. The blooms emerge as a compact cluster of tiny capitula, frequently encircled entirely by papery bracts covered in dense woolly hairs ranging from white to purple. The dense woolly hairs aid in the flowers' ability to regulate their body temperature, reducing the risk of frost damage at night and shielding them from UV rays from strong, high-altitude sunshine [6].

PHARMACOLOGICAL STUDY

ANTIBACTERIAL STUDY -

S. obvallata extracts (20 µl of 5 mg/mL) were evaluated against four bacterial strains (Pseudomonas aeruginosa, Escherichia coli, Staphylococcus aureus, and Klebsiella pneumoniae) and three fungal strains (Candida albicans, Candida glabrata, and Candida tropicalis). We employed the well diffusion method to carry out the antimicrobial assay. Zone of inhibition measurements performed during the investigation revealed that methanolic and aqueous extracts had modest antibacterial and antifungal activity against all pathogens. 8.30 to 15.90 mm and 8.87 to 20.50 mm, respectively, were these ranges. Two in-vitro tests, the DPPH and H2O2 procedures, were used to assess the antioxidant activity of S. obvallata extracts (20 l of 1 mg/mL). Both extracts showed significant antioxidant activity, with reported values ranging from 29.25 to 82.88%.

ANTIOXIDANT ACTIVITY -

Two methods (DPPH test and H2O2 assay) were used to assess antioxidant activity in vitro; considerable variance ($p < 0.05$) and insignificant variation were noted, respectively. The methanolic and aqueous extracts of flowers showed the highest and lowest percentages of DPPH free

radical scavenging activity, whereas the aqueous and methanolic extracts of leaves show intermediate values. Along with it, the methanolic leaf extract and aqueous leaf extract had the highest and lowest percent H2O2 free radical scavenging activity, respectively, while the aqueous extract and methanolic extract of flowers had the intermediate values of H2O2 free radical scavenging activity.[14]

ANTICANCER ACTIVITY -

When S. obvallata leaf and flower extracts were tested against MCF-7 breast cancer cell lines, they demonstrated a substantial amount of activity in comparison to a positive control. Mishra et al. (2018) state that the bacterial strains Salmonella typhi, Pseudomonas aeruginosa, Escherichia coli, Bacillus cereus, Bacillus subtilis, and Staphylococcus aureus were used to test the antibacterial activity of S. obvallata petroleum ether extract (1-3 mg/disk). The disc diffusion approach was employed to look for germs. The less susceptible bacterial strain in this investigation was P. aeruginosa, and the leaf extract demonstrated the highest zone of inhibition against S. aureus (15.2 mm) at 3.0 mg/disk. To find the MIC value of S. obvallata extract, it was tested against a variety of bacteria.

PLANT TISSUE CULTURE -

Plant tissue culture has become more important in plant biotechnology. Numerous studies reported on the large-scale production of plant material and the manufacture of biologically active substances using plant tissue culture techniques. There are just two published investigations on the micro propagation of S. obvallata from the Indian Himalayan Region. Joshi & Dhar published the first protocol for S. obvallata micropropagation in 2003. Because mature explants aren't easily accessible, the epicotyle segments of young aseptic seedlings were used for the goal of multiplication. The many shoots (five shoots per explant) on Murashige and Skoog (MS) media were produced using epicotyle explants. The results indicated that before to field transplantation, the plantlets needed to be ex-vitro acclimated for 12 days and invitro rooted for 15 days.

ANTI-HYPOXIC EFFICACY-

The anti-hypoxic effectiveness of S. obvallata was examined in hypoxia mouse models. These models were used to investigate the levels of adenosine triphosphate (ATP) and ATPase, blood sugar, glycogen content in the skeletal muscles and liver, lactic acid (LAC) and lactate dehydrogenates (LDH), and adenosine triphosphate (ATP) and ATPase activity (Ma H-P et al. 2011, 2011). At a dosage of 1000 mg/kg, Saussurea involcucrata (Kar et Kir.) Sch.-Bip demonstrated the highest anti-hypoxic activity in this investigation (survival time = 40.78 min, prolongation rate = 33.13%), while Saussurea obvallata produced the most noteworthy outcomes in terms of survival time (36.34 min) and prolongation rate (20.52%). Furthermore, at the time of testing, the plasma concentration of LAC in mice was found to be 1.93 mmol/L for S. involucrata and 2.84 mmol/L for S. obvallata .A dosage of 1000 mg/kg may be effective in treating acute mountain sickness.

PREVENTIVE TO IONIC RADIATION EXPOSURES -

The in vivo investigation concerning the radio protective properties of the aqueous S. obvallata extract was assessed in mouse models (via radiation exposure to 60Coγ-rays at a dose of 6Gy) by administering the extract (6Gy). Following treatment, observations demonstrated that, in comparison to the control group, the plant extract of S. obvallata considerably aided in the recovery of haematological functions and the quantity of karyota in the femur. In the same study, the aqueous plant extract of S. obvallata (bracts) has radioprotective properties that help radiation-damaged mice's hematological system recover more quickly than that of the control group.

Radioprotective effects were dosage dependent in both experiments. The radioprotective effects of S. obvallata aqueous extract on mice models were investigated in a different in vivo investigation. A 4Gy radiation dose of X-rays was used to prepare the experimental models. Following radiation therapy, the mice models received extract (4 Gy) for a maximum of 14 days. The study's findings showed that S. obvallata had a somewhat protective effect against radioactivity in mice.[13] [14]

PHARMACOGNOSTICAL STUDY

MACROSCOPIC STUDY –

Macroscopic characters of different parts of Brahmkamal (Saussurea obvallata) -

(a) Root & Rhizome:

Dark brown colour long tap root; root stock woody, thick, stout; rhizome is dark brown and tapering, densely covered with remnants of petioles of withered leave

(b) Stem:

Brown colour, erect, stout, hollow, 12 – 15 ridges present on its outer surface.

(c) Leaf:

Leaves green, simple, pinnate venation, lower petioled, upper sessile, oblong or ovate, elliptic, lanceolate, stipule absent, toothed margins

(d) Flower:

Flower head purple present in cluster enclosed by yellow papery bracts in cone shape, bracts with dark purple margins and tips

(e) Seed:

Brown colour seeds are present with white feathery hairs attached at one on its end helps in dispersion of seeds known as pappus which gives a small floret like appearance to seeds.

Macroscopic characters of different parts of Brahmkamal (Saussurea obvallata) tabulated in TABLE 4 -

Features	Saussurea obvallata
Habitat	Alpine or sub alpine range of Himalayas
Size of Plant	30-50 m
Leaf	Elliptic or oblong; lanceolate, lower petioled upper sessile
Flower	Cone shape inflorescence; Yellowish green papery bracts purple at its top; flower present in umbel like cluster.
Stem	Stout, hollow, straight lines or ridges present at outer surface
Rhizome	Dark brown Colour; densely covered with remains of leaf bases.
Seed	Brown Colour with hairy pappus gives a small floret like appearance.

ORGANOLEPTIC STUDY-

The flower of Saussurea obvallata was highly fragrant; leaf also had specific fragrance otherwiseall the other parts were odourless. Taste of bracts was sweet, astringent; rhizome & leaf taste wasbitter astringent; stem taste was astringent. All parts were coarse in touch.

Organoleptic characters of different parts of Brahmkamal (Saussurea obvallata) tabulated in TABLE 5 –

Parts	Colour	Oduor	Touch	Taste	Shape	Size
Rhizome of Saussurea obvallata	Dark Brown	Odorless	Coarse	Bitter, Astringent	Tapering, covered with leaf remnants	Measurement with leaf remnants: L.10-15cm, D.15-17
Stem of Saussurea obvallata	Brown	Odorless	Coarse	Astringent	Stout,erect	L.15-30 cm D.1.5-2.5 cm
Leaf of Saussurea obvallata	Green	Fragrant	Coarse	Bitter, Astringent	Obovate, oblong	L.7.5-20cm,W.2-3cm

Flower of Saussurea obvallata	Purple Bract: Yellow	Fragrant	Coarse	Sweet(bract) Astringen	Dense umbel like cluster	Single flower: L1.5-2.5cm, D.3-4 cm. Inflorescence.10-25cm, W.10-13cm, D.20-23cm.

MICROSCOPIC STUDY -

Microscopic characters of different parts of Brahmkamal (Saussurea obvallata) in transverse section (T.S) -

Stem:

TS of stem showed many prominent ridges on the outer most side. Epidermis made up of parenchyma cells; Hypodermis made up of few layers of collenchyma cells. Ground tissue differentiated into cortex, endodermis, pericycle. Vascular bundle are wedge shaped, arranged in ring. Vascular bundle is collateral open type with procambium clearly shows that it is dicot stem.

Leaf: Upper and lower epidermis present in leaf lamina. Epidermis present in single layer, made up of parenchymatous cells. Stomata present in lower epidermis. Palisade and spongy parenchyma present. Vascular bundle present in centre.

Root: Epidermis is uncilliate, after that cortex present which is multicellular. Intercellular spaces present in cotex. After that endodermis present made up of barel shaped cells. Pericycle is single layered. Vascular bundles are radially arranged. Pith region is very small.

POWDER MICROSCOPY STUDY -

- Tracheid, pitted vessels, parenchymatous cells, prismatic crystals, fibre, oil globules present in flower
- Cork cells, pitted vessels, fragments of endocarp, leaf fragment, fragment of xylem present in leaf.
- Cork cells, pitted vessels, annular vessels, calcium oxalate crystals, iodine, group of lignified fibres present in stem.
- Cork cells, tracheids, starch, tracheids reticulate vessels, fibre present in rhizome.[16]

Comparison of the features seen in the Powder microscopy of different parts of Brahmkamal (Saussurea obvallata) i.e. Rhizome, Stem, Leaf & Flower tabulated in TABLE 6 -

Features	Rhizome of S.obvallata	Leaf of S.obvallata	Stem of S.obvallata	Flower of S.obvallata
Starch	+	-	-	-
Tracheids	+	-	-	+
Tracheids reticulate vessels	+	-	-	-
Cork cells	+	+	+	-
Fiber	+	-	-	+
Annular vessels	-	-	+	-
Calcium Oxalates crystal	-	-	+	-
Iodine	-	-	+	-
Group of lignified fibers	-	-	+	-
Pitted vessels	-	+	+	+
Fragments of endocarp	-	+	-	-
Leaf Fragment	-	+	-	-

Fragment ofxylem	-	+	-	-
Parenchymatouscells	-	-	-	+
Prismaticcrystals	-	-	-	+
Oil globules	-	-	-	+
Starch	+	-	-	-
Tracheids	+	-	-	+

Saussurea obvallata MYTHOLOGICAL SIGNIFICANCE

As per the Hindu culture, the Brahma kamal plant is considered sacred. The flower is widely used for worshipping Lord Shiva, especially in the holy temples of Kedarnath, Badrinath and Tunganath. Brahma kamalam is named after Lord Brahma and is the same flower the deity holds in his hand. The flower signifies the divine birth of Lord Brahma, who is the creator of the universe, and who appeared from the lotus emerging from Lord Vishnu's navel.

- Some people believe that offering this flower to Lord Shiva fulfils all wishes. Some also believe that wishing when the flower is blooming fulfils wishes.
- Moreover, the flower has a pleasant fragrance, which has a soothing effect on the mind and helps one achieve inner peace and tranquillity.
- According to popular belief, Lord Brahma created the Brahma Kamal plant. As mentioned in one story, Lord Brahma meditated on a lotus flower and he fell asleep. When he woke up, he saw that he had been transformed into a lotus. This flower was named the Brahma Kamal.
- It is also believed that Lord Brahma used the Kamal flower to create the universe. However, some believe that Brahma created the flower to help Lord Shiva in placing an elephant's head on Lord Ganesha's body. The flower dropped the elixir of life from its petals, thus bringing Ganesha back to life.
- According to another popular belief, Lord Vishnu used the Brahma Kamal flower to save his wife Lakshmi after a demon killed her.[15].

CONSERVATION STATUS

Every plant species mentioned above is only found in a specific section of the globe. Since these plant species are entirely indigenous, they urgently need to be protected. S. obvallata and S. simpsoniana are in danger due to anthropogenic actions from society. However, some study indicates that S. gossypiphora is critically threatened. Both S. graminifolia and S. tridactyla are incredibly rare species. Travelers and locals alike ruthlessly gather S. obvallata and S. gossypiphora because of their medicinal qualities, mythological significance, and sacred acknowledgment. The ominous actions put S. obvallata and S. gossypiphora's existence in jeopardy. These plans are a representation of our culture and genuine humanism. To protect them, immediate regulations are needed. A few people from the Himalayan region are importing these holy plants into China.. This is these plants' largest market. The government has taken some required actions, but they are wholly inadequate to end smuggling. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) lists these plant species in "Appendix I." It was also placed on the government of India's negative import list by the Ministry of Commerce. According to Schedule VI of the Wildlife Protection Act of India, smuggling is a criminal offense [10].

MATERIAL AND METHODS FOR PHYTOCHEMICAL ANALYSIS

collection of plant material -

In September 2012, the plant material (leaves and blossoms) was harvested from Uttarakhand, India's Kedarnath valley (4335 meters above sea level, 30°40′73" N latitude, and 79°06′20″ E

longitude). Dr. Anup Chandra (Scientist–E), Systemic Botany, Forest Research Institute, Dehradun, Uttarakhand, India, later verified the identity. Fresh material was carried straight to the lab and stored in perforated poly bags.

Preparation of extracts -

With a few minor adjustments, the excerpts were made in accordance with Sati and Joshi. Samples of S. obvallata leaves and flowers were cleaned, dehydrated, and ground into a powder using an electric blender (Willey Grinder Mill, Micro Scientific, India). The phyto-constituents were extracted from the dried powder using one of two solvents: methanol or water.[4]

Extraction Methods-

The extract was made using, with minor modifications, the procedures to be described in 12, 13. After being cleaned with tap water, dried, and put in a blender to be ground into powder, the flower and leaf samples were combined. Several ratios of four solvents—water, ethanol, methanol, and chloroform—were employed in the Soxhlet extraction process. Following the collection of the extract, filter it using a muslin cloth, transfer it to 50 ml tubes, and centrifuge it for 15 minutes at 4,000 rpm and 25 oC. After being collected, the supernatant was stored for drying. It was combined with 10% DMSO after drying and utilized in the studies.

Phytochemical Analysis-

Chemical studies following established techniques are used to screen for and identify the active ingredients in the floral extract 12, 13. Each solvent extract was analyzed in 100 µl for every test.

Test for Saponins:

A test tube containing the extract was filled and shook briskly. It was believed that the production of stable foam indicated the presence of saponins.

Test for Phenols:

Extract combined with 2 milliliters of a 2% FeCl3 solution. Phenols were denoted by a blue-green color.

Test for Tannins:

Extract combined with 2 milliliters of a 2% FeCl3 solution. Tannins were signified by the color black.

Test for Terpenoids:

Chloroform (2 ml) was combined with the extract. After that, 2 milliliters of concentrated sulfuric acid were added and gently shaken. The interphase's reddish-brown hues signify the presence of terpenoids.

Test for Flavonoids :

A few drops of sodium hydroxide solution were added to the extract, causing a bright yellow color to appear. It turns colorless when diluted acid is added, indicating the presence of flavonoids.

Test for Glycosides:

Two milliliters of glacial acetic acid with a few drops of 2% FeCl3 were combined with the extract and then transferred into a second tube that held two milliliters of concentrated sulfuric acid. Glycoside is present at the interphase when a brown ring is present.

Test for Protein:

When a small amount of strong nitric acid is added to the extract, proteins are present because a yellow hue forms.

Test for Alkaloids:

After each extract was separately dissolved in diluted HCl and filtered through saturated picric acids, the presence of alkaloids was shown by the production of a brown precipitate.

Test for Steroids:

When extract is combined with two milliliters of chloroform and cautiously added H2SO4, a reddish-brown hue forms, signifying the presence of steroids [9]

RESULTS AND DISCUSSION –

The global importance of studying the chemical components of therapeutic plants has increased. A

plant sample that was obtained and certified from the Kedarnath and Dun valleys was used in this study. They were then pulverized, dried, and put through a phytochemical screening process. Powders were extracted using distilled water, methanol, ethanol, and chloroform. Four distinct solvents underwent qualitative testing. Through the use of several solvents, including methanol, ethanol, chloroform, and distilled water, the analysis revealed that positive (+) and negative (-) indicate the presence or lack of active components in leaf extract and flower extract, respectively. Both of these species of medicinal plants are rich in active ingredients, secondary metabolites that are used to treat and MODULATE a variety of illnesses with little to no negative side effects.
The results were given in Table-

TABLE 7: Phytochemical Constituents Of Saussurea Obvallata Extract

Extracts	Saponin	Phenol	Tannins	Terpenoids	Flavonoids	Glycosides	Proteins	Alkaloids	Steroids
Cloroform	+	-	+	+	+	-	+	+	+
Methanol	+	+	-	+	+	+	+	+	+
Ethanol	+	-	-	+	+	+	-	+	-
Distilledd water	+	+	-	+	+	+	+	+	+

NOTE - Positive (+) show the presence of constituents; whenever negative (-) show the absence of constituents in the flower extract

TRADITIONAL USES OF Saussurea obvallata [2]

PLANT PARTS	ETHNO PHARMACOLOGIOCAL USES	DOSAGE FORM	COUNTRY
Wholeplant	It is used in the treatment of paralysis of limbs and cerebralischemia	-	Tibet
	It is used for the treatment ofheadache and body pain	The paste prepared from whole plant is applied	India
	It is used to protect woolen clothes from the damages caused byinsects	Whole inflorescence	India
	It is used for the treatment ofbruises and cuts	The paste prepared from whole plant is applied	India
Roots	It is used as antiseptic and also used for healing cuts and bruises	The paste prepared fromroot is applied	India
	It is used to cure boils	The paste prepared fromroot is applied	Pakistan
	It is used to cure leucoderma	The paste prepared fromroot is applied	India
	It is used to cure fever and cough	-	India
	It is used to cure cardiac disorders	Decoction of roots (200ml) mixed with 2-3spoons full of the oil ofcedrus deoder and appliedexternally to treat the heart (100ml)	India
	It is used to cure bruises andfractures	Decoction of roots(200ml) mixed with 2-3 spoons full	India

		of the oil of cedrus deoder (100ml)	
Leaves	It is used to cure boils ,cuts andwounds	Decoction of dried leaves(100ml)mixed with halfspoonful of salt and fewdrops of this ,applied in the infected area (20ml*3days)	India
	It is used to cure bruises andfractures	Decoction of roots (200ml) mixed with 2-3 spoons full of the oil ofcedrus deoder (100ml)	India
	It is used to cure wounds and cuts	Dried leaves (100gm)mixed with salt (10gm)and used in infected area	India
Flower	Used to treat boils ,hydrocele and	-	India
Buds	reproductive disorders		
	It is used to cure boils ,cut and bruises	The paste prepared from flower is applied	Pakistan
	It is used to treat bone –ache , intestinal ailments, urinary tractproblems and coughs	-	India
	It is used to treat urinary infections in cattle	Raw form	India
	Flower heads are used to curehydrocele	Flower heads are roastedwith ghee and one to two tea spoons (full) are givento patients in the morning for 3-6 days	India
Bracts	It is used to treat cough andrespiratory problems	--	India
Seeds	It is used to treat mental disorders	The powder of seeds steeped in water overnightthen filtered (1 cupful)	India

WOUND HEALING ACTIVITY OF Saussurea obvallata

LEAVES -

A. WOUND

Breaks in the skin or other body tissues are referred to as wounds. These consist of skin punctures, scrapes, cuts, and scratches. Wounds are frequently the result of accidents, although they can also result from surgery, sutures, or stitches. Although minor wounds are typically not dangerous, it is nonetheless vital to clean them. Breaks in the skin or other body tissues are referred to as wounds. These consist of skin punctures, scrapes, cuts, and scratches. Wounds are

frequently the result of accidents, although they can also result from surgery, sutures, or stitches. Although minor wounds are typically not dangerous, it is nonetheless vital to clean them. You may need to consult your doctor after receiving first aid for severe and infected wounds. If the wound is deep, you are unable to stop the bleeding or remove the filth, or it is not healing, you should also seek medical assistance[33]

B. TYPES OF WOUNDS-

A wound is an injury that breaks the skin or other body tissue. Wounds can be open, with broken skin and exposed body tissue, or closed when there is damage to tissue under intact skin.

Nearly everyone will experience an open wound at some point in their lives, but the level of severity will range significantly depending on the type:

- Penetrating wounds
- Puncture wounds
- Surgical wounds and incisions
- Thermal, chemical or electric burns
- Bites and stings
- Gunshot wounds, or other high velocity projectiles that can penetrate the body
- Blunt force trauma
- Abrasions
- Lacerations
- Skin tears

Closed wounds are often caused by blunt trauma, and though the injured tissue is not exposed, there can be bleeding and damage to underlying muscle, internal organs and bones.

Major types of closed wounds include:

- Contusions – blunt trauma causing pressure damage to the skin and/or underlying tissues
- Blisters
- Seroma – a fluid-filled area that develops under the skin or tissue
- Hematoma – a blood-filled area that develops under the skin or tissue (occurring when there is internal blood vessel damage to an artery or vein)
- Crush injuries

C . SYMPTOMS OF WOUNDS-

The most typical signs of a wound are soreness, edema, and bleeding. Certain wounds hurt, bleed, and swell more than others depending on the type and location of injury. Cuts, scrapes, bruises, and scratches are examples of minor wounds that are frequently healed without the need for medical intervention. However, some wounds—like infected wounds—need to be treated in order to maintain function and avoid complications. Pus, seeping, redness, and discomfort in the site are indications of an infection.[34]

D . CAUSES OF WOUND –

The most common causes of cuts and puncture wounds are external injuries that break or tear the skin. These causes include:

- falls
- car accidents
- broken glass
- stabbings
- razor cuts

The most common causes for puncture wounds include:

- stepping on a sharp object, such as a nail
- getting bitten
- falling onto something sharp

E . WOUND HEALING –

The complex process of wound healing necessitates the cooperation of numerous cell types as well as the right extracellular milieu. High protease activity, ongoing infection, excessive inflammation, and hypoxia are common problems with chronic wounds. Despite extensive research into novel approaches to enhance cutaneous wound care, burns, chronic wounds, and skin wound infections continue to be difficult clinical issues. Modern wound dressings should ideally promote faster healing and fill in the gaps in the

healing mechanisms that keep chronic wounds from healing. Although there are many obstacles in the way of addressing the clinical complexity and heterogeneity of chronic or severe wounds, these technologies have a great deal of potential to improve outcomes for individuals with poorly healing wounds. Active dressings for wounds try to promote the body's natural healing process while addressing a number of issues that contribute to slow healing, such as excessive inflammation, ischemia, scarring, and wound infection.[25] A complicated series of cellular and metabolic processes are involved in the extremely dynamic process of wound healing. Adult animals undergo fast re-epithelization following an early inflammatory stage marked by neutrophil and macrophage infiltration. This is followed by the creation of a fibro proliferative tissue rich in immature collagen bundles and newly created blood vessels. As a final result of tissue repair, dermal collagen remodeling and scar budding occur throughout the maturation period. Leukocytes that are inflammatory in wounds have the ability to impede almost every stage of tissue healing. Neutrophils and classically activated inflammatory macrophages have the potential to hinder the healing of wounds. However, in order to reduce inflammation and encourage healing, macrophages can have a variety of phenotypes, including pro inflammatory, anti-inflammatory, angiogenic, and healing [26]

G . THE HEALING PROCESS -

Skin integrity needs to be quickly recovered following an injury in order for it to continue functioning. Peripheral blood mononuclear cells, native skin cells, extracellular matrix, growth factors, cytokines, chemokines, and regulatory molecules all play a part in this wound-healing mechanism. The inflamatory phase, the proliferative phase, and the remodelling phase are the three consecutive and overlapping processes that make up the skin repair process. Hemostasis and cutaneous neurogenic inflammation are early phenomena that occur in the initial moments following injury and last for around an hour. The rapid neutrophil recruitment to the damaged tissue in the first 24 hours and its subsequent posterior fall throughout the course of the following week. The second day after injury marks the beginning of the progressive infiltration of inflammatory monocytes-macrophages to the wound. Over the next two weeks, this infiltration peaks during the proliferative phase and begins to decline, eventually becoming the predominant mononuclear cell in the tissue repair process. After an injury, circulating lymphocytes go to the skin quickly, reaching a plateau by day four. They stay there for an additional two weeks before starting to decline. The final stage, which begins the second week following the damage, entails organizing a scar and redesigning the tissue that was previously created during the proliferation phase in order to restore the integrity of the skin. The final phase can go on for several months. Current knowledge about the crucial role played by resident and peripheral immune cells, the microenvironment, and their interactions during the wound healing process is included in this review [23]

H. FUNDAMENTAL ASPECTS OF WOUND HEALING -

There are four relatively distinct phases in wound healing process that include homeostasis, inflammation, proliferation, and remodeling -

1. **Homeostasis Phase-**

There is a chance of bleeding after the first trauma, necessitating homeostasis. Blood loss or hemorrhage from acute injury is the main cause of death on the battlefield. Tourniquets are still used in the field to momentarily block blood flow in big wounds, although they can cause tissue ischemia and reperfusion damage. Therefore, in patients with large wounds, homeostasis'- enhancing medicines are crucial for preventing

exsanguinations and hemorrhagic shock. Applying homeostatic products and applying direct pressure to the wound are the two most popular ways to help with homeostasis. Three categories of homeostatic are available: clotting facilitators (like kaolin) and mucoadhesive agents (like chitosan).

2. Inflammation Phase-

The immune system's normal reaction to any physical harm is to keep an eye on the situation and trigger an inflammatory response to combat the foreign particles.Since the first century AD, the typical indications of inflammation—known as dolor, which means pain, color, or heat, rubor, or redness, and tumor, or swelling—have been identified and recorded in Rome. Neutrophils and monocytes, which can differentiate into macrophages, mediate the inflammatory response. While macrophages eliminate cellular debris and provide soluble signals, neutrophils are involved in infection control. Fibroblasts and myofibroblasts are activated during the proliferation phase of wound healing by releasing a variety of cytokines, proteases, and growth factors in the wound.

3. Proliferation Phase –

This stage of the healing process is called rebuilding. Various cytokines and chemokines released by neutrophils and macrophages during the inflammatory phase draw additional lymphocytes, endothelial cells, fibroblasts, myofibroblasts, and keratinocytes into the wound microenvironment. The keratinocytes cover the wound bed, move from the wound edge, and help the skin's barrier function to recover. The extracellular matrix (ECM) proteins fibrin, fibronectin, collagen, and other ECM proteins are secreted by the proliferating fibroblasts and serve as a temporary matrix for angiogenesis and tissue remodeling. This creates the wound's granulation tissue, which is essential for healthy wound healing.

4. Remodeling Phase -

The remodeling of the wound and surrounding tissue by the fibroblasts, which begins approximately three weeks after injury and may last for up to two years, is the last stage of the wound healing process. The fibroblasts and myofibroblasts use proteases to break down the existing disorganized tissue while laying down an ordered network of collagen fibers and other ECM proteins. The immature type III collagen that makes up the granulation tissue that forms during the proliferation phase is rather weak. Fibroblasts replace mature type I collagen with type III collagen progressively throughout remodeling. Restoring the tissue to its pre-injury state, when the wound gradually loses vascularization, is the ultimate objective. (25)

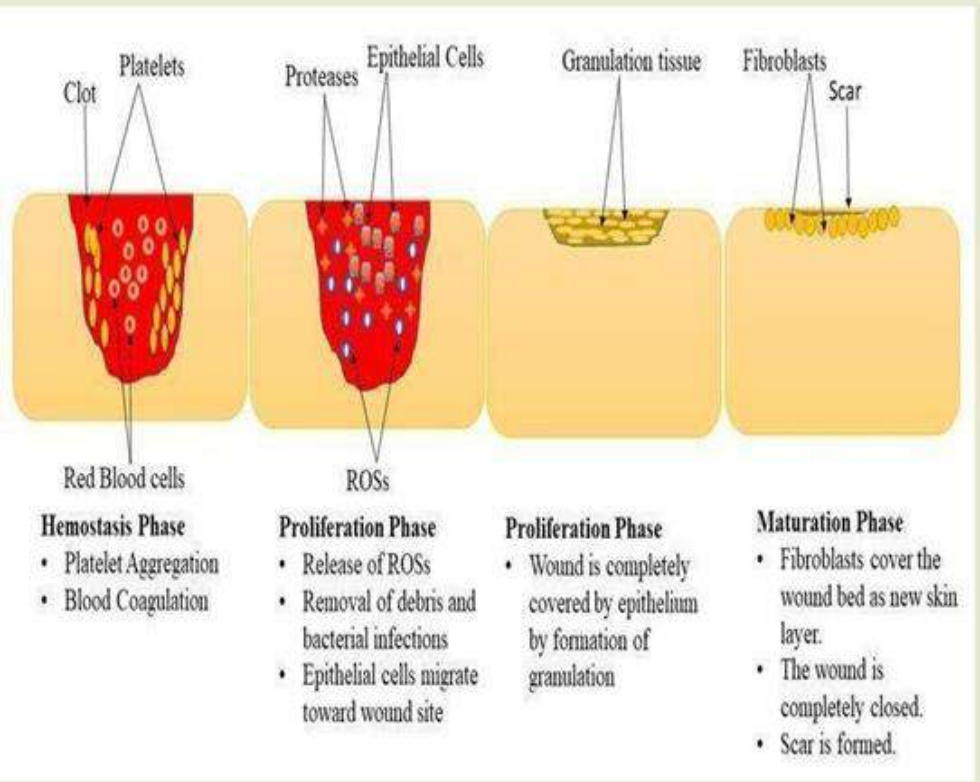


FIG 4 – Phases of wound healing

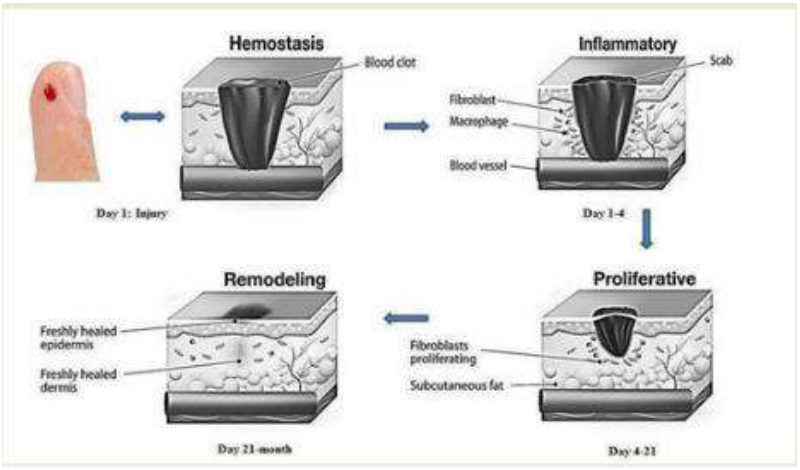


FIG 5– fundamental aspects of wound healing

I RAT MODELS OF SKIN WOUND HEALING-

Rats have been used widely in the study of skin wound healing and the efficacy of different treatment modalities. This particular animal species is often selected for its availability, low cost, and small size. Incisional and excisional models commonly use the rat's dorsum as the wound location and have been implemented in numerous wound-healing studies. Dorsal sites tend to be more effective in keeping the animal from reaching and manipulating the wound. Rats and humans share the following skin characteristics: the presence of an epidermis, basement membrane, hair follicles, and dermis. Obviously, there are numerous anatomical and physiological differences between human and rat, Among the differences is the fact that rats do not form colloids or hypertrophic scars but people of certain ethnic

backgrounds, such as African-Americans and Asians, are predisposed to excessive scarring (31)

TABLE 8 - Features of different animal species used in modeling of wound healing (32)

AnimalSpecies	Skin Type	Primary Healing Mechanism	Advantages	Limitations
1. Mouse	Loose skinned	Contraction	Smalls	Loose skin and very high hair density do not reflect the architecture ofhuman skin
			Cost efficient	In the absence of outside intervention (i.e., splinting),wounds heal primarily via contraction, obviating the need for arobust proliferative phase of wound healing
			Easy to handleand maintain	Use of splinting to avoid contraction introduces foreign material to the wound site
			Numerous transgenic, knockout, and geneinducible lines readily available	Partial thickness wounds can be difficult to make because of thinness of skin
			Broad knowledge base on mouse wound healing from years of extensive research	Consistently poor translational efficacy of therapeutics in huma
2. Rat	Loose skinned	Contraction	Small	Loose skin and high hair density do notreflect the architecture ofhuman skin
			Common	Heal primarily via contraction, thus minimizing therelevance of re- epithelization and granulation unless splinting technique is used
			Cost efficient	Use of splinting to avoid contraction introduces foreign materialto the wound site
			Easy to handle and maintain	
			Bigger than mice, whichallows for largeror more numerous wounds peranima	
3. Rabbit	Loose skinned	Contraction	Relatively inexpensive	Limited genetic tractability
			Rabbit ear model overcomeswound contraction	Paucity of species-specific reagents

			Can create several wounds in the same air	
4. Guinea pig	Loose skinned	Contraction	Relatively small and cheap	Not commonly used today
			Unable to produce endogenous vitamin C, so dietary deficiency allows study of the role of collagen in wound healing	Variable Pregnancy rates, small and variable litter size and relatively long gestational time (60e 70 days)

J. WOUND HEALING ACTIVITY OF Saussurea obvallata (TREATMENTOF WOUND HEALING)–

Brahma Kamal is a helpful medicine to treat fevers. The flowers, rhizomes, and leaves are used for the treatment of bone ache, intestinal ailments, cough, and cold. The rhizomes in particular are used as antiseptic and for healing cuts and bruises.

METHOD OF EVALUATION OF WOUND HEALING ACTIVITY OF

Saussurea obvallata

EXCISION WOUND MODEL -

The animals in this excision wound model were arranged in the following groups:

GROUP I:

For 16 days, only ointment base, or 1 g/kg topically, was administered.

GROUP II:

For 16 days, a 10% betadine iodine ointment was applied topically twice a day to an excision wound model.

GROUP-III:

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.

The first rats were collected, divided into groups, and given injections of ketamine hydrochloride to induce unconsciousness. Excision incisions were inflected 1 to 1.5 cm and 5 cm from the dorsal thoracic region and the spinal column, respectively. 70% alcohol was used to prepare the injured area, and a sterile round seal with a diameter of 2.5 cm, a surgical blade, or a 5-8 mm biopsy punch were used. The entire thickness of the circular skin from the designated location on the animal's back was removed to create a wound that measured 200–500 mm2 in diameter and 2 mm in depth. Using a cotton swab soaked in regular saline, the wound was blotted to achieve homeostasis. The medication was given topically twice daily until the epithelium was fully developed. In order to calculate the percentage of the wound and the epithelization time—which is the development of new epithelial tissue to cover the wound—the parameters of the wound studies were measured at regular intervals of time. Following an evaluation of the injured areas, the percentage of the reduction in injured areas on days 4, 8, 12, and 16 was used to compute the wound contraction, until full re-epithelization was attained. The day total epithelization was reached was defined as the scar peeled off without leaving any trace of the drug incision.

THE FOLLOWING PARAMETERS WERE THEN STUDIED AS FOLLOWS:

EPITHELIZATION PERIOD :-

The number of days needed for Escher to disappear and leave no trace of a raw wound served as a monitor.

WOUND CONTRACTION :-

14 Planimetric monitoring of the progressive changes in the wound area was used to keep an eye

on this. On several days after the wounding day, wounds were traced on a translucent paper. Throughout the tracking process, the animal was properly confined. Next, the tracings were put on a graph paper measuring 1 mm by 2. Using the beginning size of the wound (100 mm2) as 100%, the wound areas were read and the percentage of wound contraction was computed.

EVALUATION OF WOUND HEALING:-

The degree of wound healing is determined by analyzing wound contraction, which aids in wound closure and is expressed as a decrease in percentage of the initial wound size. This process is monitored from the day of the operation until the day of full epithelilization. The amount of hydroxyproline in wound tissues is measured because collagen, which is primarily made up of the amino acid hydroxyproline, makes up extracellular tissue and provides strength and support. Collagen breaks down to release free hydroxyproline and its peptides. Thus, measuring hydroxyproline can serve as an indication for collagen turnover as well as a biochemical marker for tissue collagen. In order to track the healing phase of excision wounds, the biochemical marker hexosamine—a component of the ground substance for the production of the extracellular matrix—is assessed in the granulation tissues of the wounds. Granulation tissue is extracted from the wound on the eleventh post-wounding day because the amount of hexosamine rises between the seventh and the twelfth post-wounding day and then gradually falls.15 The continual development of the tissue's biomechanical strength is one of the most important stages of dermal wound healing; the skin's mechanical characteristics are mostly related to the dermis's function in connection to the networks of collagen and elastic fibers. The least amount of force needed to split the incision apart is the healed wound's breaking strength. Skin breaking strength is a measure of the degree of wound healing and the tensile strength of the tissues around the wound. Tensile strength is frequently linked to the structure, composition, and physical characteristics of the collagen fibril network. Tensile strength is a measure of how much healed tissue can withstand strain before breaking; it can also reveal something about the quality of the repair. On days 7–9 after the wound, the sutures were taken out, and on days 8–10, the tensile strength was assessed. The tensile strength of the wound for a specific animal is determined by taking the mean tensile strength of the two par vertebral incisions on both sides of the animal. [8]

RESULT AND DISCUSSION -

In this work, Saussurea obvallata leaves were used to make an ethanolic extract, and rats were used as established models to examine the extract's ability to heal wounds. The excision wound model is chosen to investigate the wound healing activity of ethanolic extract because it is an easy technique to employ for routine screening of wound healing activity. Similar to the commercial 10% w/w Povidone-iodine ointment, the ethanolic extract of Saussurea obvallata ointment demonstrated considerable wound healing activity in an excision wound model. Therefore, it can be said that Saussurea obvallata possesses remarkable wound-healing characteristics and is good for wound healing.

CONCLUSION -

The literature analysis revealed diverse traditional uses of S. obvallata, against wounds, paralysis, cerebral-ischemia, cardiac and mental disorders. Various extracts (methanol, ethanol, petroleum ether, chloroform, n-butanol, aqueous, etc.) of S. obvallata were evaluated for their phytochemicals and pharmacological activities. Additionally, antihypoxia, anticancer, radio- protective, antioxidant and antimicrobial activities were also studied using different in-vitro and in-vivo models. S. obvallata is being used widely in traditional medicine and socioeconomic applications but scientifically, it is not fully

assessed regarding its complete therapeutic effects, toxicity and safety in human body. Further studies are essential and should focus on conservation, cultivation and sustainable utilization of the species.

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