

Saussurea lappa: An Important Medicinal Plant for Treatment Different Diseases: A review

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Abstract:

Saussurea lappa is belong to the family Astreaceae. It has been cultivated in various parts of the world a commonly known and potent plant which is well studied for its medicinal uses in diverse indigenous Indian systems of medicine. It is usually known as kuth root or costus and used in different system of medicine to treat various diseases such as asthma, ulcers and stomach problems. Indian medical systems use various preparations prepared from the roots by physicians to treat cough, cold, stomachache, toothache, typhoid and fever. It is an important drug for gout and erythroderma and stimulates spermatogenesis. Several of its activities are proved and confirmed through in viro and in vivo approaches which gave a rational scientific way to the traditional claims. As a result to the significant proven activities Saussrea lappa is having major chance for new drug discovery.

INTRODUCTION

The World Health Organization (WHO) defines traditional medicinal plants as natural plant materials which are used at least or in the absence industrial processing for the treatment of diseases at a local or regional scale (Tilburt, 2008). Traditional herbal medicine has been used in developing and developed countries for thousands of years because it is natural and causes comparatively fewer complications (Wichtl, 2004).

Early medical history is consistent with the history of herbal medicine. The first books written about medicine were the first books written about plants, including the texts of the Ebers Papyrus, written 1500 BC, in which the names of many plants have been appeared (Ackerknecht, 1973).

Different types of traditional drugs are widely used in Asia, Africa and Latin America to meet basic health needs. This use is growing rapidly in industrialized countries, which is often referred to as complementary or alternative medicine. In the United States, the National Institutes of Health (NIH) uses the complementary and alternative medicine (CAM) to cover health systems, practices, and products are not presently considered to be part of conventional medicine. Across the world (liu, 2011).

various traditional medical systems, traditional Chinese medicine (TCM) is currently the most popular, followed by Indian medicine. In Western countries, Oriental Medicine refers to Chinese, Japanese, and Korean medicines selected by immigrants from Korea,

while “Asian medicine” often includes TCM, India (Ayurveda) and Tibetan medicine. Among all treatments in traditional medicine systems, medicinal plants are most frequently used (Srivastav et al., 2011).

Knowledge of the herbs has been passed down from generation to generation for thousands of years. Herbal medicine is a major part of all systems of traditional medicine. Herbal medicine is a victory for the popular medicinal brand. It is easy to obtain and inexpensive. In the recent past, there has been a massive increase in the use of phytosanitary products in developing countries as well as developed countries resulting in exponential growth of herbal products globally. An upward trend is observed in the search for herbal. Herbal medicines have a strong conventional or conceptual basis and can be useful as medicines in terms of safety and efficacy leading to the treatment of different disease. World Health Organization has made an attempt to identify all medicinal plants used globally and listed more than 20,000 species (Srivastav et al., 2011).

According to the WHO more than 80 % of the world’s population relies on traditional herbal medicine for their primary health care. Plants continue to serve as possible sources for new drugs and chemicals derived from various parts of plants. In recent time there has been a marked shift towards herbal cures because of the pronounced cumulative and irreversible reactions of new drugs (Vijayan et al., 2007). A large number of these herbal plants and their extracts, derivatives and / or isolated components have shown beneficial biological effects: including immunomodulatory, antioxidant, anti-inflammatory, anti-

mutagenic, anti-cancer and anti-microbial effects (XD et al., 2008). One of the many plants that is used in many medicinal treatments is Saussurea Costus known as kuth is a perennial herb of western Himalayas, distributed in India and Pakistan. It grows at an altitude of 2600 4000masl (Shah, 2006).

Saussurea lappa

kuth (Saussurea lappa) is an herb belonging to the family Asteraceae. Since the ancient time, oil from the roots of plant has found uses in traditional medicine and perfumes. The genus Saussurea contains a range of about 300 species native to regions of Asia, Europe, and North America. The uncertainty in the exact number of species within genus is largely attributed to the great variability among constituent species. Variability is prevalent in morphology, growth habit, flower colour, leaves, roots, and chemical composition. It has different names in different languages. In English, it is called Costus. In Sanskrit, it is called Kushta. In Arabic/Persian, it is termed Kuy or Kur. In Hindi, it is called Kostum. In Tamil, it is known as Potchuk. In Punjabi, it is called Kot/Kust. While, its Urdu name is Minal (kadm, 2014).

Classification of saussurea

Saussurea lappa is member of family asteracea/ compositae. Asteracea is one of the largest angiosperm families, with more than 1,620 genera and about 23,600 species of plants including herbs, shrubs and trees. The genus Saussurea consists of about 300 species(kadm, 2014).

Table (1): Taxonomic classification of S. lappa C.B. Clarke (Zahara K et al., 2014).

Kingdom	Plantae
Subkingdom	Viridiplantae
Infrakingdom	Streptophyta
Division	Tracheophyta
Subdivision	Spermatophytina
Infradivision	Angiospermae
Class	Magnoliopsida

Superorder	Asteranae
Order	Asterales
Family	Asteraceae
Genus	<i>Saussurea</i>
Species	<i>S. lappa</i> C.B. Clarke

Geographical distribution

Saussurea lappa is indigenous to India, Pakistan and China, where it grows in the Himalaya region at 2500-3500 m altitude (Rao RN et al., 2013). It is found in cool temperature and arctic regions of Asia, Europe and North America. The plant is cosmopolitan in conveyance additionally among the districts of Himalayas, Kashmir, Jammu, Kishengange valley, Western Ghats and developed

in Tamil Nadu, Uttar Pradesh, wild in India at an elevation of 2500 to 3000 m and in Kashmir to take care of the business demand of the market due to over misuse of the wild (Kokate, CK et al., 2002). In India it is found in Kashmir, Jammu, and Western Ghats and is cultivated in Tamil Nadu, Uttar Pradesh and Kashmir to meet commercial demand

Plant Description

Saussurea lappa commonly known as Costus which is a tall, perennial herb that grows to a height of 1-2 m; stem is upright, stout and fibrous while root is a long stout of approximately 60 cm with a characteristic odour; leaves are lobate, stalked, membranous, irregularly toothed; upper leaves are small while basal leaves are large with long lobately

winged stalks. Flowers are stalkless, dark purple to black in colour and are arranged in terminal and axillary heads. Pappus is approximately 1.7 cm long, fluffy, feathery giving an inquisitive appearance to the fruiting flower heads. Fruit of *S. lappa* is cupped, curved, compressed and hairy (Pandey et al., 2007).

Chemistry

Saussurea lappa has explicit aromatic odour because of the existence of essential or volatile oil which is largely confined in roots. This scented volatile oil from root is chiefly comprises of hydrocarbons, oxides, alcohols, aldehydes, ketones, esters and acids (Chang and Kim, 2008). In a recent investigation, 39 constituents have been recognized from *Saussurea lappa* roots essential oil. The principal constituents were dehydrocostus lactone (44-47%), 8- cedren-13-ol (3-5%), costunolide (6-9%), and α -curcumene (3-5%), β -costol (12-14%), δ -elemene (11-13%), α -costol (2-4%), α -ionone (1-3%), α -selinene (3-5%), 4-terpinol (2-4%), and elemol (1-3%). However, trace amounts of (+)-selina-4, 11-diene, 2- β -pinene, (+)- γ -costal, (-)-(E)-trans-bergamota-2,12-dien-14-al, (-)-caryophyllene, and 12-methoxy-dihydro-dehydro

costus lactone were also reported (Dhillon et al., 1987).

Amounts of above mentioned volatile constituents vary greatly between different cultivars due to variable climatic conditions including temperature, irradiation, and humidity. Moreover, genetic background of plant also affects the chemistry of volatile constituents. Roots also contain alkaloid saussurin (0.05%), a bitter resin (4-6%) and tannins. Plant contains small amounts of various essential vitamins such as vitamin A, vitamin B1, vitamin B2, vitamin B12, and vitamin C. Mineral analysis suggest that following minerals are present (the quantities in brackets are parts per million): Ca (17602), Mg (2486), Fe (1221), Mn (148), Zn (115), Pb (90), Sr (87), Cu (35), Ni (12) and Cr (04) (Mishra et al., 2013). *Saussurea lappa*

is generally considered safe when used as directed under the supervision of an expert. When smoked, however, it causes narcotic effects. It should be consumed in pure form as impure costus contains a contaminant called aristocholic acid, which

damages the kidneys and causes cancer. Individuals who are allergic to plants and herbs of Asteraceae family should not consume Costus (Kadm, 2014).

Medicinal uses of plant kuṣṭha

Saussurea lappa is one of the most commercially viable species among all the species of genus Saussurea. It is widely utilized in various indigenous system of medicine all around the world for treating variety of disorders such as tenesmus, diarrhea, vomiting, dyspepsia, inflammation (Irshad et al., 2012). Likewise, Zahara et al. (2014) reported folk or traditional uses in Pakistan as shown in the table according to Baden Powell (Chopra et al. 1958, pp. 402-403), it was used in ulcers and as a hair lotion. In different parts of India and China it is used for toothache. In Uttarakhand, the root of a plant grown in a yard is used as a treatment for asthma and stomach upset. A paste from the roots (10g) mixed with ghee (clarified butter) (50g) that is lightly heated for 5 minutes and then applied to the joints of the body and rubbed in cases of rheumatism (Nautial et al 2001).

Dwivedi, (1963) mentions its use in asthma, cough, skin disease, gout and erysipelas (skin infection). Moreover, it is reported to be used in hemiplegia (paralysis of one side of the body); Bell's palsy; Shivering; Arthralgia. Gout. Spleen (inflammation of the spleen due to infection or infection with parasites or abscesses); Helminthiasis

(helminthic infection); And menopause (abnormal absence of menstruation). In traditional tibetan systems it is used in headache, loss of appetite, diarrhea, and abdominal pain (Olennikov et al 2011). Its use is mentioned under the name costus in Arabic and also in Pakistan. It is also reported that it was used as: children's tonsils; treatment of pleurisy, ladies used to take bath with Costus after mensuration cycle; it's used as a snuff; its incense was also used as aromatherapy for diseases. However, Waly, (2009) has given a good account of qust (Saussurea lappa) in Arab from the ancient times, and even in the time of Prophet Muhammad. It was:

1. Used in all types of phlegmatic diseases.
2. Effective in general weakness after diarrhoea and cholera.
3. Used to wash the internal organs of the females after the menses.
4. Oil prepared by qust and olive oil is effective against Alopecia and tones up the body.
5. Good remedy for freckles and chloasma (facial brown patches on the skin) when applied on the face (Shah, 2019).

Table (2): Traditional uses of Kuṣṭha in Pakistan

Conditions	Method of applications
Stomach-ache	The root in powder form is taken with water. A decoction of the root is taken. The powder is roasted in mustard oil and the paste is applied on the stomach.
Headache	Oil heated with root is applied.
Cough and cold	The root powder is taken with warm water.
Backache and chest pain	The root powder is taken with milk/decoction of root powder. Oil heated with root is massaged the affected area.

Rheumatism and painful joints	The root is roasted in ghee/butter, powdered and taken with milk. The above-mentioned ghee/ butter is rubbed on the affected part and bandaged to keep warm.
General weakness and daily fatigue	The root is boiled in milk and then it is taken twice.
Skin rashes after insect bite	The root powder is roasted in ghee/butter and applied to the affected part.
Epilepsy	The roots are taken with honey.
Typhoid fever	The decoction of the root is taken.
Persistent hiccups	The root powder is ingested.

Pharmacological uses

A- Anti-cancer activity

A phytoconstituent (Costunolide) obtained from the roots of *S. lappa* was investigated for its anticancer activity in human cancer cells (HL-60). Using apoptosis analysis, assessment of mitochondrial membrane potential, and measurement of ROS (reactive oxygen's), costunolide was proved to be a potential anticancer agent. Chemopreventive effect of *S. lappa* extract (hexane) was studied in human cancer cell lines (DU145). Dehydrocostus lactone (isolated from extract) showed strong anticancer effect and inhibited the growth of cancer cells by inducing apoptosis. Another compound Cynaropicrin (isolated from *S. lappa* roots), was investigated for its Immuno-modulatory action. Cynaropicrin showed inhibitory effects against growth of Eo1-1, Jurkat T, and U-937 cell lines, in a dose dependent behaviour. IC50 values were 10.90, 2.36 and 3.11 μ mol/l, respectively (Wahab et al., 2015). Alcoholic extract of *S. lappa* induced apoptosis in a time and dose dependent way, as it inhibited the growth of gastric cancer cell lines in 48 hours at a dose level of 80 μ g/ml (Wahab et al., 2015).

1. Prostate Cancer: In androgen-insensitive human prostate cells the apoptosis was persuaded by the hexane extracts of *S. lappa* roots It stops the migration of prostate cancer cells (Kim et al., 2012) The experiments were performed to check the relationship between apoptosis and autophagy in SLE mediated prostate cells. To study the anticancerous effects of SLE, LNCaP prostate cancer cells were cultivated with 6.3, 12.5, 25, 50, and 100mg/mL SLE for 24 hours, and the cytotoxicity was checked using the MTT assay. In a dose dependent manner the viability of LNCaP cells was reduced, SLE showed the significant effect against prostate cancer cell by suppressing AR and PSA at the transcriptional and translational level. The results of this experiment demonstrated that the anticancer effect of SLE is mediated through the regulation of apoptosis and autophagy in prostate cancer cells (Tian et al., 2017).
2. Oral Cancer: The dried roots of *S. lappa* have shown inhibition of cancerous cell propagation in human oral cancer. The experiments were carried out by performing DNA fragmentation assay and western blotting. (Moon et al., 2013).
3. Gastric Cancer: The ethanolic extract of roots of this plant, either in traditional or in combination with modern chemical therapy works on the gastric cancerous cells(Ko et al., 2004).
4. Breast Cancer: Costunolide obtained from SLE showed an inhibitory effect on the metastasis of breast cancer cells. The experiments were performed on mice and the results were checked after few days of observation, which showed the significant inhibition of growth and metastasis of breast cancer cells. Thus, it is concluded that *Saussurea lappa*-derived costunolide have inhibitory effect migration, growth and metastasis of breast cancer cells (Choi et al., 2013).

B- Bronchitis

Experiments were conducted to study the effect of different extracts of *Saussurea Costus* against chronic bronchitis and asthma. The alkaloidal fraction was found to be non-toxic and had little effect on the blood pressure and respiration of the cat and rabbit. It exhibited marked spasmolytic effect on the smooth (intestinal) and tracheal muscle of the guinea pig when stimulated by histamine and antispasmodic effect on the perfused isolated guinea

pig lungs (Lee et al., 2001). Studies were also carried out on Tincture Saussurea, petroleum ether extract, Tincture Saussurea prepared from defatted roots and extracts obtained by successive extraction of the roots of Saussurea costus. The results showed that Tincture Saussurea and petroleum ether extract produced broncho-constriction in guinea pigs while Tincture Saussurea prepared from defatted roots and other extracts produced no such effect thereby suggesting that Tincture Saussurea devoid of the petroleum ether soluble fraction would be a useful drug for chronic bronchitis and asthma (Lee et al., 2001). The preliminary experiments, thus, seemed to justify the reputation of the drug as a useful remedy against chronic bronchitis and asthma.

C- Hypoglycaemic

Saussurea costus was found most effective for obese diabetes when a detailed survey and clinical study on potent hypoglycaemic plants of different regions from India was undertaken to find antidiabetic plants used in Indian folklore and by different tribes (Pandey et al., 2007).

D- Antimicrobial

The inhibitory effects of the ethanol extract of Saussurea lappa on the growth, acid production, adherence, and water-insoluble glucan synthesis of Streptococcus mutans were examined (Yu et al., 2006). The growth and acid production of Streptococcus mutans were significantly inhibited by the presence of ethanol extract of Saussurea lappa (0.5–4 mg/ml). The ethanol extract of Saussurea lappa (0.25–4 mg/ml) also significantly lowered the adherence of Streptococcus mutans in a dose dependent manner. In water-insoluble glucan synthesis assay, 2–4 mg/ml of the ethanol extract of Saussurea lappa significantly inhibited the formation of water-insoluble glucan. Saussurea lappa is known to have therapeutic effects on oral diseases such as halitosis, dental caries, and periodontal disease (Lee, 1986; Kim et al., 1991). These results provided some scientific rationales for its use in the treatment of dental diseases and suggested that Saussurea lappa may inhibit the caries-inducing properties of Streptococcus mutans.

E- Depressant

Some research also suggests that inhalation of costus sorrel oil by women during labor reduces symptoms related to pain during labor. The drug relieves anxiety, apprehension and related symptoms Mild anesthesia and no harmful effect on mother and fetus (Pandey et al., 2007).

Conclusion

Saussurea lappa is an important and widely recognized medicinal plant provided by the pharmaceutical systems of India, China, Korea and Pakistan. It is used to treat many diseases and disorders after the experiments conducted on it, such as headache, stomach pain, epilepsy, leprosy, typhoid, pneumonia, especially chronic bronchitis, and chemicals extracted from plant roots show many pharmacological activities such as anticancer, anti-inflammatory, antimicrobial, etc. An examination of the literature on this plant concluded that it is medicinally important and endangered due to high demand and illegal consumption and exploitation. From various evidence it has been shown that S. lappa is safe and effective when used in conventional doses. It also shows some other properties except medicinal properties, such as perfume, antiparasitic and insecticide. Due to its long-standing important pharmacological and ethnological uses and the presence of several important bioactive substances that can lead to the extraction and identification of some new chemical compounds, it was concluded that Saussurea lappa could help in future clinical and chemical research.

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