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Review Article

An Overview of Phytoconstituents, Traditional Uses and Pharmacological Activity of *Allium Stracheyi*

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ABSTRACT

Allium stracheyi, commonly known as Jamboo and Dhungar in Uttarakhand, India, is a high-altitude growing plant of significant medicinal and economic importance. It is a good source of income for the tribal communities and cultivators of Uttarakhand. The plant is rich in fiber and protein, with lower fat and carbohydrate content. Phytoconstituent studies have revealed the presence of various compounds such as hydrocarbons, terpenes, terpenoids, and sulfur-containing components as volatile constituents. Traditionally, *Allium stracheyi* has been used in various ailments. It is known for its uses as spices, pickles, and medicines for jaundice, cold, cough, wound healing, and other stomach problems. It is also used as a traditional vegetable. Pharmacological studies have indicated that *Allium stracheyi* possesses significant biological activities. A hydroethanolic extract of the plant has shown promising analgesic, anti-inflammatory, and antipyretic activities. The organosulfur compounds present in the *Allium* species have been associated with antibacterial and antioxidant activities. *Allium stracheyi* is a medicinally important herb with a wide range of phytoconstituents and significant traditional uses. Its pharmacological activities make it a potential candidate for further research and drug development.

INTRODUCTION

Allium stracheyi, often known as Faran or Himalayan Spice, is a perennial herb from the *Allium* genus of the Amaryllidaceae family. This plant species is native to the alpine regions of the Himalayas, mostly found in areas of India, Nepal, Bhutan, and China at elevations of 3,000 to 5,000

meters. (Tiwari U, *et al.*, 2014). *Allium stracheyi* is noted for its strong, distinctive scent and is commonly employed as a spice or flavoring element in traditional cooking. Faran, also known as *Allium stracheyi*, is highly valued by indigenous tribes for its medicinal properties. It is used to treat many conditions such as helping digestion, soothing respiratory difficulties, decreasing

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inflammation and pain, boosting wound healing and antibacterial activity, and functioning as a diuretic (Mohan, M. *et al.*, 2019). Although the traditional uses of *Allium stracheyi* are extensively recorded, further scientific research is required to validate and comprehend the full extent of its therapeutic effects. Research into the plant's bioactive components, methods of action, and potential synergistic effects will help establish its therapeutic potential and guide the development of novel, plant-based remedies for diverse health issues (Gusain, A. *et al.*, 2023).

The bulbs of these two taxa are boiled, then fried in ghee, and consumed to treat cholera and dysentery. The raw bulb is chewed to treat coughs and colds, as well as altitude sickness; it also has strong antibacterial properties against major infections. Their juice serves as a moth repellent. Out of these two, *A. stracheyi* has become a vulnerable species (Ved, D. K. *et al.*, 2003). Uttarakhand state is located in the Central Himalaya, an area rich in biodiversity due to the high variety of plants and animals that live there. Aside from providing necessary commodities to the enormous population living in the region, including wildlife and livestock, a large number of plants have been meeting the demands of various industries based on natural goods, such as dyes, cosmetics, tannins, resins, and medicinal herbs, etc. (Payal K *et al.*, 2020)

Many Himalayan tribal cultures, including the Bhotia, Bhojas, Tharus, Koltas, Kinnaurites, and Junnaris, employ *Allium stracheyi* for various health benefits. You can eat the leaves as well as the bulb. Dried leaves are also used to season cuisine. In their natural state, flowers are used as a garnish for salads. The aerial component is used as a spice and is typically used in pickles (Nautial, S. *et al.*, 2001).

Stracheyi Allium is a 20-30 cm tall, thin herb with 3.5-5 x 5-1-1.7 cm, fibrous, oblong-ovoid bulbs. The stem is glabrous, terete, and leafy at the

base. Leaves: 2-4, linear, 11-30 cm x 1-2 mm, reaching 2-8 cm above the bulb. Semiglobose or hemispherical umbel, with a diameter of 1.0-2.5 cm with 810 loosely flowered flowers; bifid, ovate, c. 1 x 0.5 cm, acuminate spathe. The plant produces oblong-campanulate blooms with pedicels that are 3-5 mm long. Tepals: 4-5 x 2-2.5 mm; outer slightly shorter, convex, obtuse; midvein conspicuous, cohesive, and pouched at base; rosy purple or yellow; frequently white with pink veins. Anthers are yellow, oblong, 1-1.5 x 0.5-0.7 mm; filaments are purple, linear, 7-8 x 0.5 mm, free, adhering to perianth at base up to 1 mm, exerted after anthesis. Style: purple, linear, 3.5-8 mm long, trisulcate; stigma inconspicuous; ovary oblong, 1.5-2.5 x 1.2 mm, strongly trilobed, lobed wings, covered with huge nectral pits by hood-like projections. Capsules round-oblong, about 4-3 mm; yellow, glabrous pericarp thin and papery. In every locule, two seeds. 150 elliptic, plano-convex, black, roughly 3 x 1.7 mm seeds with an irregular surface (Dasgupta, S. *et al.*, 2006).

Allium stracheyi, a high-altitude plant native to Uttarakhand, India, holds a significant place in traditional medicine and local economy. Its importance is not only confined to its medicinal properties but also extends to its economic value for the tribal communities and cultivators of Uttarakhand. *Allium stracheyi*, also known as jambu, is a perennial herb with white flowers that grow to a height of 35 to 40 cm. The natives have long utilized the plant as a flavoring and spice. It is mostly found in the 2500-3000 meter high Alpine Himalayas of Uttarakhand, India, next to steep slopes, dry rock, and damp rock. Sunny sites are preferred. The parts of plants that are edible are the flowers, leaves, roots, and bulbs. This plant's leaf and bulb sections are applied locally to reduce pain and inflammation (Wang, G. K. *et al.*, 2014). Inflorescences and leaves are frequently utilized as seasonings. Despite the lack of particular information regarding this species' medical

applications, members of this genus are generally quite beneficial additions to the diet. They have sulphur-rich molecules that have antibacterial, anti-inflammatory, and antioxidant qualities. Therefore, in order to support the use of this plant as a local analgesic and in the treatment of inflammatory diseases, efforts were undertaken to explore its anti-inflammatory and analgesic potential in the current study.

TAXONOMICAL CLASSIFICATION OF ALLIUM STRACHEYI

Botanical name	<i>Allium stracheyi</i>
Kingdom	Plantae
Phylum	Tracheophyta
Class	Liliopsida
Order	Asparagales
Family	Amaryllidaceae
Genus	Allium
Species	<i>Allium stracheyi</i>



Figure- *Allium stracheyi*

PHYTOCHEMICALS OF ALLIUM STRACHEYI

Allium stracheyi extracts contain various phytoconstituents-carbohydrates, proteins, fat, phenolics, flavonoids, alkaloids, tannins,

terpenoids, saponins, anthocyanins, coumarins, thio-sulfinates, phytosterols, fixed oils, sulfur-containing compounds: 2,4-dimethylthiophene, dimethyl-disulphide, dimethyl tri-sulphide, 1,2-bis(methylthio) ethene, 3-phenylthiolane 1,1-dioxide, diallyl disulfide, calcium, phosphorus, iron, magnesium, potassium and antinutrient: phytic acid, tannic acid and oxalate. These phytochemicals contribute to the plant's medicinal properties and uses in various ailments. Major phytoconstituents are categorized into chemical class are given below.

1. Hydrocarbons, Terpenes, and Terpenoids:

These are volatile constituents found in *Allium stracheyi*. They play a crucial role in the plant's aroma and flavor.

2. Sulfur-containing components:

These compounds contribute to the characteristic pungent smell of *Allium* species. They also have antioxidant, anti-inflammatory, and antimicrobial properties (Kumar, S. *et al.*, 2015).

3. Carbohydrates and Proteins:

Allium stracheyi has a higher amount of fiber and protein contents with lower fat and carbohydrates. These nutrients are essential for the plant's growth and development (Mohan, M. *et al.*, 2019).

4. Phenolics and Flavonoids:

These are antioxidants that protect the plant cells from damage. They also contribute to the plant's color (Mohan, M. *et al.*, 2019).

5. Alkaloids:

Alkaloids are nitrogenous organic compounds that have a wide range of pharmacological effects. They are present in *Allium stracheyi* (Mohan, M. *et al.*, 2019).

6. Tannins:

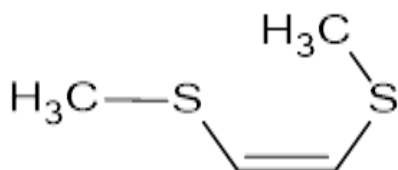
Tannins are polyphenolic compounds that have astringent properties. They are found in many plants, including *Allium stracheyi* (Gusain, A. *et al.*, 2023).

7. **Saponins:** Saponins are glycosides with foaming characteristics. They contribute to the plant's defense mechanism against microbes and pests (Gusain, A. *et al.*, 2023).

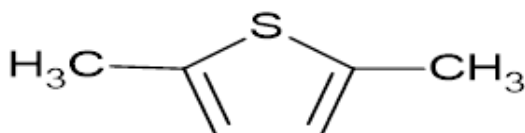
8. **Anthocyanins:** These are water-soluble pigments found in the cell sap. They are responsible for the red, purple, and blue colors of many fruits and vegetables (Gusain, A. *et al.*, 2023).

9. **Coumarins:** Coumarins are aromatic organic compounds that have been reported in *Allium stracheyi* (Gusain, A. *et al.*, 2023).

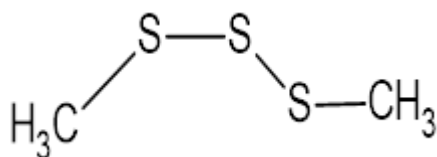
Chemical structure of some important phytoconstituents of *Allium stracheyi* are given below (Mohan, M. *et al.*, 2019).



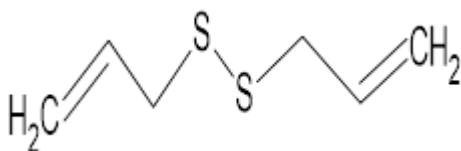
1,2-bis(methylthio)ethene



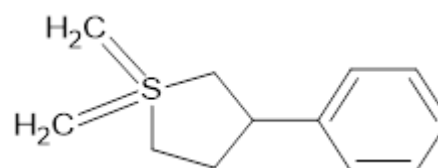
2,4-dimethylthiophene



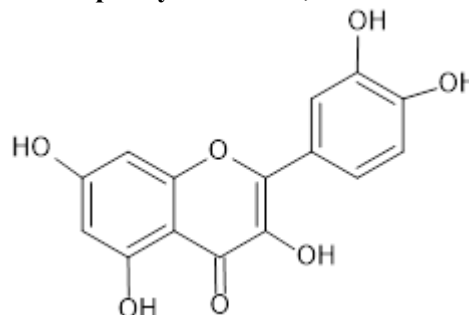
dimethyl trisulfide



diallyl disulfide



3-phenylthiolane 1,1-dioxide



Quercetin

TRADITIONAL USES OF ALLIUM STRACHEYI

Traditionally, *Allium stracheyi* has been used in a variety of ways. It has been used as a spice, in pickles, and as a traditional vegetable. Medicinally, it has been used to treat a range of ailments including jaundice, cold, cough, wounds, and stomach problems. These traditional uses highlight the plant's integral role in the local culture and healthcare practices. Here are some of its traditional uses:

1. **Medicinal Uses:** The leaves, flowers, bulbs, and the whole plant of *Allium stracheyi* are largely used as medicine. It is used in various ailments. *Allium* species are traditionally used to stimulate appetite, improve digestion, relieve stress, and alleviate cold and cough. Some of the important medicinal uses of *Allium stracheyi* plant is Jaundice, Cold, Cough, Wound healing, Cholera, Dysentery, Altitude sickness, Antimicrobial and Mouth repellent.
2. **Culinary Uses:** The plant is used as a green leafy vegetable and its hammered, dry leaves are used as a spice and condiment in the Himalayan region. It provides a distinct taste

and flavor and is also known for its preservative properties.

3. **Insect Repellent:** The pungent sulfur smell of the leaves repels insects and is used as an insect repellent in the region.
4. **Economic Importance:** It is a good source of income for the tribal communities and cultivators of Uttarakhand.

PHARMACOLOGICAL ACTIVITY OF ALLIUM STRACHEYI

Pharmacological studies on *Allium stracheyi* have revealed promising results. The plant has shown significant analgesic, anti-inflammatory, and antipyretic activities. Furthermore, the organosulfur compounds present in the *Allium* species have demonstrated antibacterial and antioxidant activities. These findings suggest that *Allium stracheyi* has the potential to be developed into effective therapeutic agents. Here are some of the key pharmacological activities of *Allium stracheyi* are given below.

Anti-inflammatory Activity: Experimental studies indicate the use of *Allium stracheyi* as an anti-inflammatory agent. This activity was evaluated using the carrageenan-induced rat paw edema method. Inflammation, while initially a defensive response to injury or infection, can become pathological if it worsens. Severe cases should be treated as soon as possible for the greatest results. Anti-inflammatory herbs effectively treat severe inflammatory reactions in the body. Yattoo. *et al.*, (2018) found that medicinal plants and their ingredients are more affordable, effective, and potent than synthetic equivalents. It was discovered that the methanolic leaf extract significantly reduced inflammation in Wistar rats in a study conducted by Ranjan *et al.*, (2010) to examine the anti-inflammatory and analgesic potential of *Allium stracheyi* leaf extract using carrageenan-induced paw oedema method.

Petroleum ether, methanol, and aqueous extract were examined for their anti-inflammatory properties in comparison to the common medication diclofenac sodium. The paw volume of the extracts was significantly reduced by the methanolic extract (61%) and the aqueous extract (46%). The anti-inflammatory effects of petroleum ether, methanol, and aqueous extract were tested against the standard medication diclofenac sodium Morris (2003). According to a recent study on a different species of *Allium*, flavonoids and organo-sulphur compounds found in this species are strong analgesics and anti-inflammatory agents because they inhibit the production of inflammatory mediators (Ranjan *et al.*, 2010).

Anti-platelet Activity: *Allium stracheyi* is a powerful natural antiplatelet aggregating agent, according to a study by Mukherjee *et al.* *Allium stracheyi* leaf extracts were used in a haemolytic assay at three different concentrations (50 µg, 250 µg, and 500 µg) and in various solvents (petroleum ether, benzene, butanol, ethyl acetate, ethanol, and water). The results showed that the butanol extract had the highest haemolytic activity, followed by the ethyl acetate extract. It has been observed that the extracts exhibit dose-dependent haemolytic activity, and that the haemolytic action increases as the extract concentration increases (Mukherjee, A. *et al.*, 2010). It can be assumed that the inclusion of substances with haemolytic qualities, such as quercetin, myricetin, chrysin, naringenin, hesperidin, and apigenin, may enhance the haemolytic activity of *Allium stracheyi* leaf extracts. (Homma, M. *et al.*, 2000; Mukherjee, A. *et al.*, 2010; Landolfi *et al.*, 1984).

Anti-oxidant Activity: Joshi *et al.* investigated the effects of different *Allium stracheyi* extracts made with different solvent concentrations (25, 50, 75, and 100% methanol and hexane) and extracted using ultrasound aided extraction technique. The



results of the DPPH (1,1-diphenyl-2-picrylhydrazyl) experiment showed that the entire plant extract of *Allium stracheyi* in 100% methanol displayed substantial free radical scavenging activity (74.654%). The extracts' percentage of radical scavenging grew in the following order, according to the results: 25% methanol content greater than 25% Over 50% hexane and over 50% methanol Over 75% of hexane More than 75% of methanol hexane. According to Joshi and Khan (2016), the methanol extract exhibits much better antioxidant activity than the hexane extract at all doses.

Anti-bacterial Activity: Joshi *et al.* also documented the antibacterial activity of *Allium stracheyi* extracts in hexane and methanol against *E. Coli* and *Bacillus subtilis*. According to the study's findings, *Allium stracheyi* extracts in solvents of hexane and methanol at concentrations of 25, 50, and 75% exhibited no antibacterial action against either of the two bacterial strains. The highest suppression of *E. coli* was observed using *Allium stracheyi* extract in 100% methanol and hexane, but *Bacillus subtilis* growth was unaffected (Joshi and Khan, 2016).

Anti-anxiety Activity: Kumar, S. *et al.* investigated the effects of *Allium stracheyi* (Baker) methanolic extract on its anxiolytic action in zebrafish behavioural models at doses of 50, 100, 200, and 400 mg/L and contrasted the outcomes with those of the reference medication, diazepam. The study's findings showed that, in comparison to diazepam, *Allium stracheyi* has a minor anxiolytic effect. It was believed that the plant extract had anxiolytic effects by adjusting brain monoamine levels, mainly serotonin (Kumar, S. *et al* 2015).

Analgesic Activity: The plant has been found to exhibit analgesic (pain-relieving) activity. This

was assessed using the hot plate method (Kumar, S. *et al.*, 2015).

Antipyretic Activity: The hydroethanolic extract of the plant showed significant antipyretic (fever-reducing) activities (Ranjan, S. *et al.*, 2010).

Acetic acid-induced writhing

The results, demonstrate that extracts of *Allium stracheyi* at doses of 100 mg/kg and aspirin at 25 mg/kg significantly ($p < 0.5$) inhibited the rate at which the control writhed when exposed to aspirin, petroleum ether, methanol, and aqueous extract, respectively, in comparison to the control. When compared to the control, the results demonstrate that all of the *Allium stracheyi* extracts at doses of 100 mg/kg and aspirin at 25 mg/kg showed significant ($p < 0.5$) inhibition of the control writhes at the rates of 686.2%, 55%, 64.62%, and 384.7% for aspirin, petroleum ether extract, methanolic extract, and aqueous extract, respectively. Furthermore, when combined with aspirin, extracts of *Allium stracheyi* at the previously indicated dosages enhanced the analgesic effect of aspirin by further reducing the writhing response. According to statistical research, methanolic extract had a greater analgesic potential (64.62%) than petroleum ether extract when compared to regular aspirin (68.62%). The model of abdominal constriction (Writhing) used in this work is believed to involve certain local peritoneal receptors (Atta, A. H. *et al.*, 1998; Bentley, G. A. *et al.*, 1983; Jais, A. M. M., *et al.*, 1997; Collier, H. O. *et al.*, 1968). The methanolic extract's capacity to significantly reduce the quantity of writhes in mice induced by acetic acid likely indicates that it has anti-nociceptive qualities. Comparing the abdominal constriction (writhing) model to other models, including the tail flick model, reveals that the former is known to be very sensitive (Bentley, G. A. *et al.*, 1983; Collier, H. O. *et al.*, 1968). This study also demonstrated that, in comparison to the methanolic extract, the anti-



nociceptive impact of the aqueous and chloroform extracts showed much less effect in the same amount of time.

OTHER PHARMACOLOGICAL USES

Compounds abundant in sulfur found in *A. stracheyi* have antibacterial, anti-inflammatory, and antioxidant qualities. Cattle are fed boiled leaves, and cold-weather decoctions of leaves are utilized as well as cough (Tiwari, U. *et al.*, 2014). In Uttarakhand, the spice known as "Pharan" is made from dried *A. stracheyi* blossoms. Additionally, it strengthens the circulatory system and functions as a tonic for the digestive system. For the treatment of dysentery and cholera, the boiled and fried bulbs in ghee are consumed. In skin disorders, *A. stracheyi* has the ability to heal wounds. Moth repellent can be made from plant juice. Due to the presence of sulphur compounds, it is sometimes employed as a flavouring agent, similar to onion flavour. Other species of *Allium* exist in the Kumaun Himalaya region (Uttara, B. *et al.*, 2009; Mohan, M. *et al.*, 2019).

Acute toxicity study (LD50) of *Allium stracheyi*

Using a technique outlined by Lorke (Lorke, D. 1983), the intraperitoneal (i.p.) acute toxicity of the methanolic extract was assessed in Swiss Albino mice. The process included determining the LD50 value in a biphasic fashion. The day before the trial, the animals were denied food but were given access to water. During the first part of the experiment, known as the investigatory step, a range of extract doses that caused harmful effects were determined. This was accomplished by giving four groups of mice (four per group) significantly different amounts of the extract intraperitoneally (50, 100, 500, 1000, and 1200 mg/kg i.p.). A phase II investigatory step was carried out by administering more precise doses (350, 400, 450, and 500 mg/kg i.p.) to four more

groups of mice in response to the results. For this reason, the mice were watched for a full day, behavioural indicators such as anxiety, excitation, ataxia, dullness, or even death. The estimated LD50 from the geometric mean of the doses that resulted in no lethality and 100% death. The data was presented as mean $\pm$ S.E. The findings were examined statistically using the student's t-test; a difference of $p < 0.5$ from the corresponding control was considered significant.

CONCLUSION

Allium stracheyi is a plant of significant medicinal and economic importance. Its diverse phytoconstituents, traditional uses, and pharmacological activities make it a valuable resource for further research and drug development. The plant's potential for providing health benefits and contributing to the local economy underscores the need for sustainable cultivation practices and conservation efforts. As we continue to explore the benefits of this remarkable plant, it is crucial to ensure that its use is sustainable and beneficial for both the local communities and the environment.

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