

ONOSMA BRACTEATUM WALL: A REVIEW OF ITS PHYTOCHEMICAL CONSTITUENTS AND THERAPEUTIC POTENTIAL

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ABSTRACT

Since the earliest days of time, numerous therapeutic plants and medications with plant origins have been utilized extensively. Due to their generally lower side effects, more than half of the population now primarily uses traditional therapies. An Ayurvedic plant belonging to the Boraginaceae family called *Onosma Bracteatum* Wall is also referred to as Segde in the Middle East and Gaozaban in the Unani medical system. This herb is known by the Arabic names "Lisan-al-Thawr" and "Saquil-ul-Hammam." "Borage" and "Vipers Bugloss" are the English names for this plant. "Gaozaban" is the name of this herb in Urdu. It is one of the important components of many Unani and Ayurvedic formulas, including Kameera gaozaban sada, Dawa ul misk motadil Jawaardar, Sahi, and the herbal formulation Joshanda, which is used to treat the common cold and influenza. It is safer as compared to self-medication with modern common cold remedies. The phytochemical investigation of the plant revealed the presence of a number of chemical components, including sugars, glycosides such as saponin and anthraquinone glycosides, flavonoids and phenolic compounds, tannins, and gums. Additionally, it contains minerals like potassium, calcium, and others that have pharmacological effects. The seeds, flowers, and leaves are traditionally used as expectorants for bronchitis, stomatitis, wounds, jaundice, constipation, weak heart muscles, rhinitis, and other conditions. This plant has reported various pharmacological actions like antidiarrhoeal, antibacterial, antifungal, antidepressant, anxiolytic, antiaging, wound healing activity, anti-asthmatic, anticancer, analgesic, antioxidant and lowers the blood pressure and as a memory and as an immunity enhancer. The present review provides a thorough overview of the research on the medicinal, phytochemical, and traditional uses of *Onosma bracteatum* Wall.

KEYWORDS: *Onosma bracteatum*, Phytoconstituents, Traditional uses, Pharmacological activities, Chemical constituents.

INTRODUCTION

Medicinal Plants have great medicinal and economic importance throughout the world due to their use in agriculture, cosmetic and food industries as well as in pharmaceutical industries. The medicinal plant-based formulations are used for basic health care in most of the undeveloped countries in all countries, around 80% of people use herbal medication for health care.^[1] According to World Health Organization (WHO) report more than half of the population in the world mainly relies on traditional remedies.^[2] *Onosma bracteatum* Wall is a hairy perennial, small herb flourishing to 0.4 m found in northwestern Himalaya. The flower, which has both male and female organs, is pollinated by insects and grows in Kashmir and Kamaun at elevations of up to 11,500 feet.^[3] It grows in dry or moist and sunny weather usually in rock crevices and is widely known as rock garden plants. The plant's dried leaves and flowers are harvested from the wild for local use as medicines and source of materials. It is a source of various ingredients in a variety of

Unani and Ayurvedic preparations to treat a number of ailments regarding human health.^[4,5] The root is used for coloring purposes and yields red dye. This is used for coloring silk and wool. On rubbing the leaf over the skin, it can cause abrasion. The leaf is covered with small hair-like structures with small nodules giving it a rough appearance like the tongue of a cow; hence the name Gojihwa. Locally it is known as Gaozaban, Gojihwa, and Sedge.^[6] It is one of the key components of the well-known herbal remedy Joshanda, which is used to treat respiratory distress, fever, catarrh cough, and other common cold symptoms.^[7] It also has antibacterial action.^[8]

PLANT PROFILE AND SYNONYMS



Figure 1: shows the profile of this plant.

Vernacular names

The vernacular names of *Onosma bracteatum* Wall is described as follows.^[9]

Hindi: Goaza, Ganjaba Goziya

English name: Cows tongue/ Lisanussoar, Sedge herb

Arabic name: Taharatulshur or Lasanulshur

Bengali name: Goazaban, Dadishaka

Gujarathi name: Bhopathsri

Kannada name: Yettina Nalage

Marathi name: Pathari

Parasi name: Kalamarumi

Telugu name: Yedunalaka

Urdu name: Goazaban

Scientific classification

The scientific classification of *Onosma bracteatum* Wall is demonstrated as follows.^[10]

Kingdom	Plantae
Phylum	Tracheophyta
Class	Magnoliopsida
Order	Boraginales
Family	Boraginaceae
Genus	Onosma
Species	Onosma bracteata Wall

BOTANICAL DESCRIPTION

Morphology

A large to medium-sized perennial herb native to the Himalayas, *Onosma bracteatum* Wall can reach heights of 4-5 metres. The dark, woody rootstock of the gojihwa plant, which has a root diameter of 2.5–5 cm, is coated in tiny hairs. The stem is simple and rarely branched arising from a persistent cluster of radical leaves approximately 50 cm long. The leaves are entire, thick, acute, lanceolate, narrowed, with conspicuous hairy pallid bases into a winged petiole, middle cauline leaves which are narrow lanceolate, sessile, rough, bristly hairy above and paler silky white beneath with evidence vein. The flowers are deep blue, later turning purplish in color, and hermaphrodite (both male and female organ) trumpet shaped, in dense, silky, and thickly covered by white stiff bristles. The root is purplish red from inside and nut lets are grey, coarsely ovoid, rough and tuberculate 4-5 mm long.^[11, 12]

Habitat

Onosma bracteatum Wall is found in the Mediterranean, regions, Europe and Asian countries including Pakistan. It is grow abundantly in North western Himalayas from Uttar Pradesh or Kashmir to Kumaon up to 3, 500 - 4, 500 meters in height.^[13] In Himachal Pradesh it is found from the districts of Kangra (chhota and Bara Bhangal) Chamba (Pangi and Bharmour area), Kinnaur and Lahual and Spiti.

Cultivation details

The plant required a well-drained soil in full sun, a deep rather rich sandy loam, brown in a crevice in a rock garden or on a wall.^[14,15] Plant tolerates hot dry condition but dislike winter wet^[16] and wet summer.^[17]

CHEMICAL CONSTITUENTS

Unsaturated pyrrolizidine alkaloids found in the leaves include lycopsamine and supindine viridiflorate. Sedge includes the minerals potassium and calcium, which give the herb its pharmacological effectiveness. Saline mucilage is present in the stems and leaves. Choline, glucose, fructose, amino acids, and tannin are all found in flowers. Protein is found in seeds, while linoleic and gamma linoleic acids are found in oils, which are also found in seeds.

PHYTOCONSTITUENTS

Onosma bracteatum has reported to contain carbohydrates fatty acids, flavonoids, tannin, sugars glycosides and phenolic compounds.^[18-21] *Onosma bracteatum* Wall contains alkannin, shikonin, ferulic and vanillic acid which gives its pharmacological properties. Phytoconstituents present in different parts of *Onosma bracteatum* are summarized in table 1.

Table 1: Phytoconstituents present in different parts of *Onosma bracteatum*.

Phytoconstituents present in different parts of <i>Onosma bracteatum</i>	
Parts	Phytoconstituents
Aerial parts	Glycoside, alkaloids, Saponin, Steroids, Coumarine
Leave	Saline Mucilage, Pyrrolizidenealkaloids,
Stem	Saline Mucilage
Seed	Protein, Oil
Flower	Choline, Glucose, Fructose, Amino Acid, Tannin
Fruits	Alkaloids, glycoside, Steroids, Terpene, Saponin, Tannin

TRADITIONAL USES

Onosma bracteatum Wall is a medicinal plant traditionally in Ayurveda to treat "*Hima*" (coolant), "*Grahi*" (absorbent, diarrhea), "*Hurudya*" (cardiac tonic, congenial for heart), "*Kasa*" (cough, cold), "*Aruchi*" (anorexia), "*Shwasa*" (asthma, chronic respiratory disorders), "*Prameha*" (urinary tract disorders, diabetics), "*Vrana*" (Ulcers, wounds). It is also used to

treat stomatitis, wound, jaundics, constipation, weakness of cardiac muscles and rhinitis. The leaves are used as tonic demulcent as well as diuretics and antioxidant.^[22] Kidney stones can be treated with sedge. As an expectorant, it is employed. The herb has tonic, refrigerant, demulcent, and alternate properties. A decoction is used in the treatment of rheumatism, syphilis and leprosy.^[23] The root is frequently used to colour things. Utilized as a stimulant and heart tonic are the blossoms of the plant. It yields a dye, which is used for coloring silk and wool.

PHARMACOLOGICAL ACTIVITIES

Antidiarrhoeal activity

An ethanolic preparation of the aerial portions of the plant *Onosma bracteatum* is used to cure the diarrhoea that castor oil and magnesium sulphate cause in mice. In the castor oil-induced diarrheal model, ethanolic extract reduced the amount of faeces the animals passed by a dose-dependent amount at 250 and 500 mg/kg body weight. Characteristic diarrheal faeces were considerably ($p < 0.05$) reduced by the ethanolic extract at higher doses (500 mg/kg). When administered to test animals to produce diarrhoea using magnesium sulphate, the extract at a dose level of 500 mg/kg considerably ($p < 0.05$) decreased the severity of the diarrhoea. Both the doses of were shown to reduce the total number of faeces when compared to the control. In the intestinal transit test, the extract at doses of 250 and 500 mg/kg prevented the mice's intestines from passing charcoal food. This delay was significantly ($p < 0.05$) greater at the 500 mg/kg dose compared to the control. At doses of 250 and 500 mg/kg, the extract reduced the intestinal transit of charcoal meal in mice when compared to the control.^[24]

Wound healing activity

In the form of an ointment with two concentrations (5% and 10% w/w ointment of bark extract in simple ointment base), an ethanolic extract of aerial portions of *Onosma bracteatum* demonstrated wound healing activity on excision and incision models in albino rats. Nitrofurazone ointment (0.2%w/w) used as standard. Both the extract and the conventional medication significantly increased the tensile strength of the incision that had been open for 10 days. The ethanolic extract of *Onosma bracteatum* (5% and 10% w/w) have significant wound healing activity in both incision as well as excision wound models when compared with the control group.^[25]

Antimicrobial and antifungal activity

By utilizing various solvents, including petroleum ether, acetone, methanol, and aqueous solvents, Shiv Shankar Gautam *et al.* have reported on the antimicrobial activity of fruit extract from *Onosma bracteatum* against five bacteria, including *H. influenza*, *R. aetuginosa*, *S. aureus*, *S. pneumonia*, and *S. pyogenes*, as well as one fungus *A. nigar*. Following the methanol extract in order of increasing activity were water, acetone, and pet ether. It displayed the highest activity (20.6 ± 0.28 mm) against

S. pneumonia and the lowest (12.6 ± 0.28 mm) against *S. pyogenes*. The most effective extracts against *S. aureus* and *S. pneumoniae* were those made from acetone and water. At 250 mg/ml, the mycelial growth of *A. nigaer* was significantly inhibited by crude extracts' antifungal activity. The methanol extract (7.6 ± 0.76 mm) with 17.82% most inhibition was noted respectively. The control mycelial growth diameter was 33.6 ± 0.57 mm. The potency of crude extracts were compared with reference drug erythromycin showed 63.45% inhibition.^[26]

Muhammad *et al.* has reported to the antibacterial activity of plant against various pathogenic strains of bacteria by agar well diffusion method. The hot water extract and cold water extract were used against four bacteria strains *Escherichia coli*, *Bacillus subtilis*, *Staphylococcus aureus* and *Proteus mirabilis*. Extract in cold water showed significant activity against *S. aureus*. The zone of inhibition measured was 15.3mm while *E.coli*, *B. subtilis* and *P. mirabilis* exhibit no activity. The plant extract in hot water showed the significant activity against the *S. aureus* and *B. subtilis*. The zone of inhibition measured were 16mm and 15.6mm and *E.coli* and *P. mirabilis* exhibit no activity. The extract of plant in hot water and cold water exhibit maximum activity against *S. aureus* while limited activity against other microorganism.^[27]

Abida *et al.* worked as antibacterial activity of n-hexen, methanol, ethyl acetate and aqueous fraction derived from *Onosma bracteatum* leaves against ATCC strains *Stapylococcus aureus*, *Escherichia coli*, *Pseudomonas aerugi nosa* and *Candida albicans* by Kirby Baur disc diffusion method at concentration of 1mg/ μ l and 2mg/12 μ l extract per disc. Azitromycin (50 μ g/6 μ l), Ciprofloxacin (30 μ g/6 μ l) and Clotrimazol (50 μ g/6 μ l) used as positive control. N-haxen and ethyl acetate fraction exhibit significant activity as compared to methanol and aqueous fraction.^[28]

Abdul *et al.* has reported antibacterial activity of joshanda for treatment of common cold. The plant extract have demonstrated maximum activity against *S. aureus* by agar well diffusion method by 25 and 50% concentration of aqueous extracts of *Onosma bracteatum*.^[29]

Anti- allergic and Anti-inflammatory activity

Patel *et al.* was reported the evaluation the potential effect of dried ethanolic extract of aerial parts of *Onosma bracteatum* on experimental allergic reaction and inflammation. Experimental models studies were vascular permeability induced by acetic acid, carrageenan induced hind paw edema, passive paw anaphylaxis, passive cutaneous anaphylaxis and allergic pleurisy. Pretreatment with ethanolic extract of plant (59.77 and 68.72% inhibition at 5 and 10mg/kg doses) significantly ($p < 0.05$) inhibited vascular leakage induced by acetic acid. Oral Pretreatment with ethanolic extract

(5mg and 10mg/kg.) as compared to control group significantly ($p < 0.05$) inhibited PCA by 21.99 and 48.49% and also significantly inhibited the eosinophil accumulation (55.75% and 77.75%, $P < 0.05$) in the pleural cavity respectively. The present results suggest the potential of *Onosma bracteatum* as an herbal based therapy as anti-allergic and anti-inflammatory agent.^[30]

Analgesic agent

Imran H *et al.* was reported the central and peripheral analgesic potential of plant extract by using aerial parts in hydro methanol solvent. Tail flick test and acetic acid induced writhing test in animal models at 50, 100, 250 and 500mg/kg i.e. 258.9 ($p < 0.0$) body weight doses is used in evaluation of analgesic effect. Tail flick test exhibit that *Onosma bracteatum* has potent analgesic effect by inducing characteristic increase in latency period in dose dependent manner at all doses at 1, 2 and 3 hours post feeding respectively using Diclofenace sodium (5mg/kg body weight) as a standard. 500mg/kg dose of plant showed maximum effect at 3hrs post feeding. Acetic acid induced writhing test also exhibit significant activity at dose of 500mg/kg and standard drug Diclofenac sodium showed 45.9% activity. On the basis of significant analgesic activity it may be used as a useful herbal remedy safely and effectively in pain disorders.^[31]

Anti-aging agent

Umer Farooq *et al.* was reported anti-ageing molecules from *Onosma bracteatum* Wall. Two known benzoquinones, allomicrophyllone and ehretiquinone and three novel benzoquinone name as ehretiquinones B-D were isolated by bioassay-guided isolation method. The anti-aging potency of the isolated benzoquinones was investigate through a K6001 yeast life span assay and it's showed most promising anti-aging activity.^[32]

Antidepressant anxiolytic effects

Hafiz Muhammad *et al.* was reported anxiolytic and antidepressant properties of *Onosma bracteatum* wall. At doses 50, 100 and 200 mg of hydroalcoholic extract of plant were fed orally 1 hour prior to test with the standard diazepam and fluoxetine by using swiss albino mice. Open field, elevated plus maze, force swimming and tail suspension test method is used to evaluate anxiolytic as well as antidepressant activities. Results of open field test showed an increase in number of line crossing as well as number of rearing in dosage – dependent design. Elevated plus maze test exhibited antianxiety effect of plant in open arms by expanded the time spent along in closed arms with diminished the time spent in dosage-dependent way. For the investigation of antidepressant effect, *Onosma bracteatum* decreasing the immobility time and increasing mobility time in forced swim model in dosage-dependent way. 200 mg/kg body weight dose of *Onosma bracteatum* exhibit significant anxiolytic and antidepressant activity.^[33]

Bronchial hyperreactivity

Onosma bracteatum is used as traditionally in Ayurveda and has been shown to have anti-asthmatic Patel *et al.* reported the impact of aerial portions of plant on bronchial hyperreactivity by using several in vivo and in vitro experimental methods. In vitro studies on tracheal strips, calculation of histamine release from lungs, overall and differentiating cell quantification in the bronchoalveolar lavage fluid, and histopathological evaluations of guinea pigs treated to egg albumin were all investigated utilizing experimental models. The differential and total leukocyte count in bronchoalveolar lavage fluid was significantly reduced after treatment with an ethanolic extract of *Onosma bracteatum* (5 mg/kg p.o. for 15 days), and histamine release from chopped lung tissues of sensitive guinea pigs was also prevented. The potentiation of histamine and acetylcholine responses was prevented by *Onosma bracteatum* ethanolic extract (5mg/kg, p.o. for 15 days), which led to a considerable reduction in the pD2 values of histamine and acetylcholine in guinea pig tracheal strip. The therapy with the ethanolic extract of plant (5 mg/kg p.o. for 15 days) significantly reduced the histopathological alterations brought on by egg albumin as well. By reducing the infiltration of inflammatory mediators like eosinophils in BALF, preventing histamine release from the guinea pigs' sensitive lungs, and reducing airway inflammation, *Onosma bracteatum* reduces bronchial hyperresponsiveness.^[34]

Psychoimmunomodulatory effects

Onosma bracteatum's psychoimmunomodulatory effects on the stress models in SD rats have been examined by Badruddeen, Sheeba Fareed *et al.* The behavioural and immune alterations in the rats, as well as the biochemical changes, were evaluated in order to measure the psychoimmunomodulatory effects of *Onosma bracteatum*. The results show that in stress control, agglutination significantly decreased with dilution, % alternation, retention transfer latency total leukocyte counts, size/weight of spleen and liver decreased, and acquisition transfer latency, total paw oedem, size of kidney, AChE activity and blood glucose level increased in comparison to normal control. Rats given *Onosma bracteatum* treatment differed from stress-treated rats in terms of percentage alternation, retention transfer delay, size of the liver and spleen TLC, and agglutination but not in terms of kidney size, total paw oedema, AChE activity, or blood glucose levels. An *Onosma bracteatum* extract shown a protective impact against the impairment of psychological functions including memory brought on by stress. Additionally, it validated *Onosma bracteatum's* historical use in the treatment of a number of immune system deficiencies and aberrant memory problems, including dementia.^[35]

free radical scavenging capacity and antioxidant activity

Onosma bracteatum's methanolic extract's antioxidant activity was assessed by Sudhanshu *et al.* using its

reducing power, hydrogen peroxide scavenging activity, and 2,2-diphenyl-1-picrylhydrazyl (DPPH) scavenging capacity. The antioxidant action of the plants may be attributed to the high amount of saponin, tannin, and alkaloids. This study demonstrates the potential of *Onosma bracteatum's* methanolic extract as a natural antioxidant.^[36]

According to Kumar *et al.* the ethanolic extract (from *Onosma bracteatum* aerial parts has hepatoprotective properties against carbon tetrachloride (CCl₄), which damages the livers of male Wistar rats. In investigations of superoxide radical scavenging and lipid peroxidation, respectively, plant extract shown efficient radical quenching ability with an EC₅₀ of 115.14 and 199.33 g/mL, as well as plasmid DNA protecting potential in plasmid nicking experiment. The plant extract decreased the carcinogenicity of 2 Aminofluorine (2AF) in the Salmonella typhimurium TA100 strain in the pre-incubation mode of research (EC₅₀ 10.48 g/0.1 mL/plate). In vivo investigations showed that pretreatment with plant extract at doses of 50, 100, and 200 mg/kg may normalize the biochemical indicators that CCl₄ (1 mL/kg b.wt.) amplified, including liver antioxidant enzymes. The repair of CCl₄-induced liver histological abnormalities was also seen after histopathological investigation. According to immunohistochemical research, treatment with plant extract decreased the level of p53 and cyclin D in hepatocytes. The Western blotting investigation showed that p-NF-κB, COX-2, and p53 were all down regulated. In plant extract, HPLC data analysis revealed that catechin, kaempferol, epicatechin, and onosmin A were the dominant components. By regulating the expression of proteins linked to the process of carcinogenesis in hepatic cells and the antioxidant defense system, the current study shows the hepatoprotective and chemo preventive potential of plant extract against CCl₄-induced hepatotoxicity.^[37]

Anticancer activity

The fundamental mechanisms of *Onosma bracteatum* cytotoxicity in prostate cancer (PC3), lung cancer (A549), and breast cancer were studied by Jawaher Albaqami *et al* (BT549). In this investigation, human breast, prostate, and lung cancer cells were treated to an extract of plant leaves in methanol. On BT549, PC3, and A549 cancer cells, *Onosma bracteatum's* cytotoxicity was evaluated using lipid peroxidation and Elisa tests. In a dose- and time-dependent manner, we discovered that *Onosma bracteatum* at various doses (0.055, 0.11, 0.22, 0.44, 0.88, 1.7 and 3.52 g/ml) decreased cell viability.

According to the lipid peroxides assay results, prostate, breast, and lung cancer cells had lower concentrations of lipid peroxides (MDA) at 1.76 g/ml in comparison to the control group. Additionally, the Elisa assay demonstrated that, in contrast to the control, prostate, breast, and lung cancer cells activated caspase-3 at a dosage of 1.76 g/ml (DMSO). For the treatment of prostate cancer, lung

cancer, and breast cancer, *Onosma bracteatum* has the potential to be a medication candidate.^[38]

Conflict of Interest statement

We declare that we have no conflict of interest.

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