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Review Article

**BORAGO OFFICINALIS LINN: A COMPREHENSIVE STUDY  
ON BIOACTIVE COMPOUNDS AND ITS VARIOUS  
PHARMACOLOGICAL USES****Divya D Shirke, Dr. R. B Kumbhar, Piyusha P. Nejdar, Vaishanavi V. Nivekar**  
New Women's College of Pharmacy, Kolhapur.**Abstract:**

*The plant Borago officinalis Linn is known as starflower, borage and gaozaban in Unani system of medicine, which is an annual herb found in Syria, Europe, America and Asia. In this study different aspects of borage such as plant characteristics, production, applications in traditional medicine, clinical considerations, its effects on patients' blood and urine biochemistry, and also the effect of the its products on liver and kidney performance tests are presented using published articles in scientific sites.*

**Key word:** *Borago officinalis Linn, Boraginaceae, Phytoconstituents, hepatoprotective effect, Anxiolytic Activity.*

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**INTRODUCTION:**

The plant *Borago officinalis* Linn is known as starflower, borage and gaozaban in Unani system of medicine, which is an annual herb found in Syria, Europe, America and Asia. It was popular for its mood elevating properties from ancient time.

It was supposed that main sources of borage are from Syria and Asia Minor while this plant is just found in very little amounts. It seems that this plant has originated from west Mediterranean areas, Spain and North Africa and then has naturalized in many other locations. Historical documents shows that people from North Africa tribes have transferred it to Spain and then to other regions. (1-4)

*Borago officinalis* from Boraginaceae family is known as borage, burrage, bourrache, and bugloss.(5) it also known as starflower. The plant is well known for its therapeutic importance to human and reputed as antispasmodic, antihypertensive, antipyretic, aphrodisiac, demulcent, diuretic and is also considered useful to treat asthma, bronchitis, cramps, diarrhea, palpitations, and kidney ailments.(6-7) the Boraginaceae family is one of the best known sources of c-linolenic acid (GLA)(8)

Botanical Name: *Borago Officinalis* Linn.

Synonym: Starflower	Other Names
Arabic: <b>Lisan-us-Saur</b>	Persian: Gaozaban
English: <b>Borage</b>	Gujarati: Gaozaban
Hindi: <b>Gojiva</b>	Urdu: Gaozaban

**TAXANOMY**

Kingdom`	:	Plantae
Subkingdom	:	Viridiplantae
Infrakingdom	:	Streptophyta
Superdivision	:	Embryophyta
Division	:	Tracheophyta
Subdivision	:	Spermatophytina
Class	:	Magnoliopsida
Superorder	:	Asteranae
Order	:	Boraginales
Family	:	Berberidaceae
Genus	:	<i>Borago</i> L.

*Borago officinalis* or borage is an annual herb which is cultivated for medicinal and culinary uses, even though it is commercially cultivated for borage seed oil.(9-11)

**MORPHOLOGY**

Borage (*Borago officinalis* L.) is an herbaceous annual plant belonging to the family Boraginaceae. Dried flower of borage is responsible for this plant pharmacological activity and can be valuable source of inflammation removal substances and promotion

of the regeneration of the skin. Plant growth regulators stimulate growth and secondary metabolites biosynthesis in various aromatic plants. Salicylic acid is one of the plant growth regulators, which is involved in various physiological processes in plants. The objective of this study was to determine the response of borage photochemical and morphological attributes in relation to application of different levels of salicylic acid. Borage planted in pots and salicylic acid was sprayed on the shoots at concentrations of 0, 0.5, 1.0 and 1.5 mM with 6 replications in a completely randomized block design. Morphological traits such as shoot height, aerial plant weight, flower dry matter, also significantly affected by different concentrations of salicylic acid. Therefore, application of suitable concentration of this growth regulator to raise the concentration of secondary metabolites in plants could be taken into consideration.(12-17)

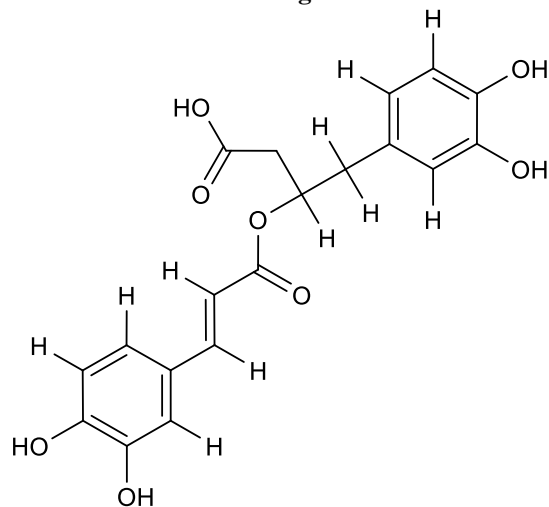
**PHYTOCONSTITUENTS**

The plant leaves extracts were obtained employing water and various organic solvents to screen polar and non polar constituents. Leaves extracts showed the presence of carbohydrate, phenols, flavonoids, phytosteroids tannins and volatile oil as presented (18) the amount of gum and mucilage available in leave and stem is 3.8% and in inflorescence is 5.4%. The amounts of potassium and calcium are reported 5.3% and 6.2% respectively. The flowers of borage and generally all parts of the plant contain 30% mucilage. Green parts of the plant contain nitrate potassium, resin, malate and a little amount of essence, manganese, phosphoric acid and allantoin.(19-20) Linolenic acid and palmetic acid are collected from flowers and a high level of ALA is in mature leaves. Boraginaceae family is one of the most known resources of GLA. In a chemotaxonomic study on 45 plant biomasses from Boraginaceae family it was determined that all biomasses contain GLA and the lowest amount (7%) was related to *Cerithe major* L. species and the highest amount

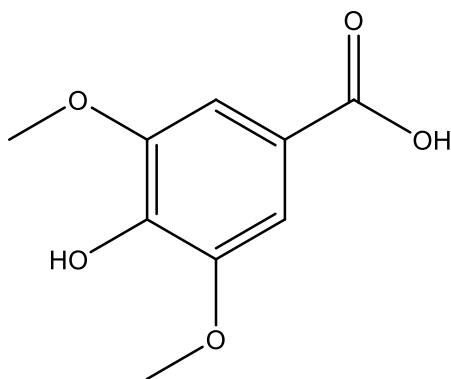
related to borage species (28%). This fatty acid is available in plant in a few amounts but is very important due to its nutritional and medicinal value. SDA is other fatty acid which is found in plants in a little amount but it is found in Boraginaceae family in amount of 2%. Several studies have been conducted on combination of fatty acid available in seed oil of planted and wild species of Boraginaceae. The amount of linoleic acid, ALA, GLA, SDA and erucic acid are of special importance in chemotaxonomic inside this family, Tocopherols are also natural effective antioxidants and borage species have high amount of  $\delta$ -tocopherols. Phenolic compounds exist in oil seeds and various studies have proved their antioxidant properties. Borage is important due to high amount of GLA available in its seed oil. In a comprehensive research, antioxidants properties of borage extracts have been reported. These excellent antioxidants properties of borage are attributed to phenolic compounds. It has been determined that rosmarinic acid, synergic acid and synaptic acid are

main phenolic compounds available in extract of borage seed. Rosmarinic acid is the main component of rosemary extract which is used extensively in food industries. On the other hand synergic acid and synaptic acid are included in phenol and main antioxidants of rapeseed and canola. There is potential for borage antioxidants to be used in food formulations and in skin health products as compounds which absorb UV. It has been suggested that linoleic acid and palmitic acid are dominant fatty acids available in mature seeds of borage. Variation in the total flavonoid content of both wild and cultivated borage plants were detected from methanolic extract (22.4 mg and 13.1 mg RU/g), respectively. Similar trend was observed with total phenols contents, it was dropped from 5.21mg GA/g to 2.37mg GA/g methanolic extracts, while the total tannins contents in the cultivated leaves methanolic extract exceeded that in wild as it was 21.33mg CA/g. (21-27)

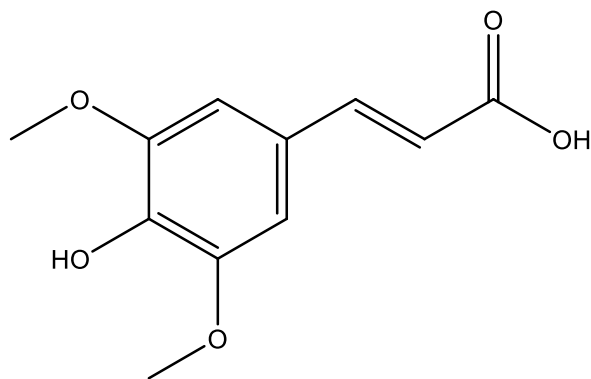
#### Structures of some of the important constituents of *Borago officinalis*



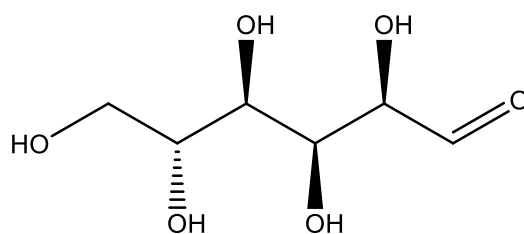
Rosmarinic acid



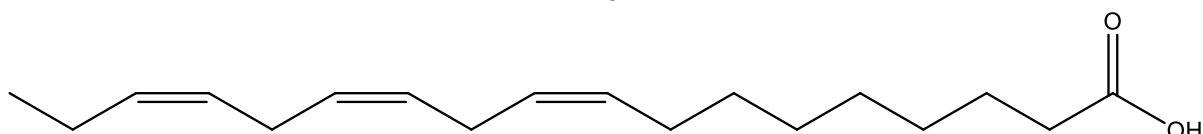
Syringic acid



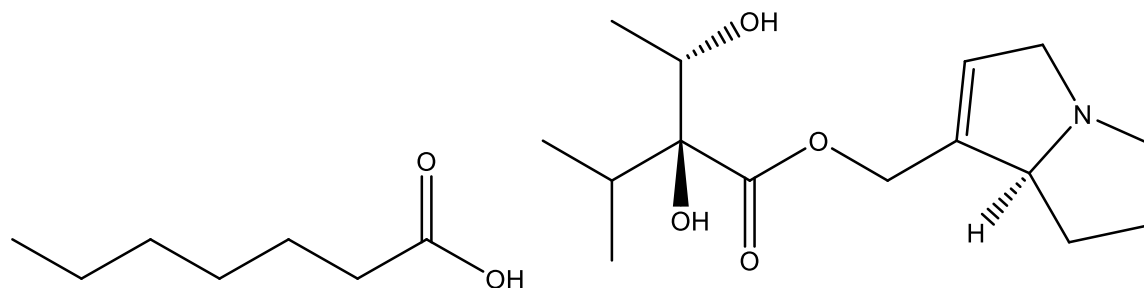
Sinapic acid



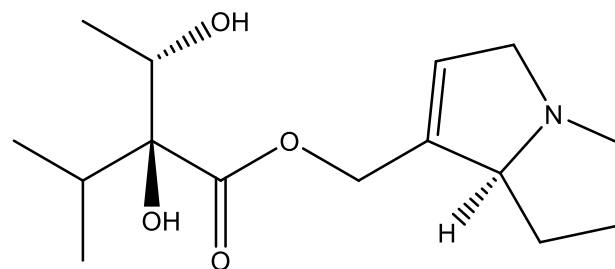
glucose



linolenic ACID



Heptanoic acid



Ambiline

### PHYTOCHEMICAL ANALYSIS

Several methods have been reported for the analysis of phytoconstituents present in *B. officinalis*. Protein & amino acids Carbohydrate and reducing Sugars Glycosides Tannin been analyzed using TLC, HPLC, MS with UV, LC (UHPLC) (28-31)

### PHARMACOLOGICAL USES

The results of recent studies show that *Borago officinalis L.* can be successfully used adjunctively in disorders of the respiratory system, urinary tract, in metabolic disorders, gout, arthritis and skin diseases

and also relieving menopause discomfort. Due to the high content of  $\gamma$ -linolenic acid, the products containing *Borago officinalis* can also be successfully used in the treatment of dermatological diseases. Atopic dermatitis (AD) is a based on the genetic changes. This disorder appears spontaneously and there is no possibility to eliminate it permanently. Many specialists recommend the use of oil from *Borago officinalis*, as it is safe and accelerates the regeneration of the skin in patients with AD due to the content of GLA.

Products rich in GLA are recommended to patients with skin problems. After prolonged use, the improvement in the appearance of skin and hair was noticed. Hence, borage oil is a common ingredient of cosmetics used in the care of dry and sensitive skin and skin with acne. It has anti-inflammatory, anti-abscess and blackhead action, it prevents acne affecting the production of sebum both qualitatively and quantitatively.(32-36)

#### Hepatoprotective Activity

The hepatoprotective effect of *Borago officinalis* L. is aerial ethanolic extract (BAEE) against CCl<sub>4</sub>-induced liver damage in comparison to silymarin, a classical antioxidant liver medicine. The hepatoprotective potential of BAEE in rats was evaluated following oral administration of CCl<sub>4</sub>, which enhanced hepatic lipid peroxidation and notably depleted reduced glutathione.

#### Gastrointestinal, Respiratory and Cardiovascular Activity

The crude leaves extract of *Borago officinalis* were investigated for its antispasmodic, bronchodilator, vasodilator and cardiodepressant activities to rationalize some of the traditional uses. *Borago officinalis* which was tested positive for flavonoids, coumarins, sterols and tannins produced a concentration-dependent relaxation of spontaneous and K<sup>+</sup> (80 mM)-induced contractions in isolated rabbit jejunum preparations, suggestive of Ca<sup>++</sup> antagonist effect, which was confirmed when pretreatment of the tissue with *Borago officinalis* produced a rightward shift in the Ca<sup>++</sup> concentration-response curves like that caused by verapamil. In rabbit tracheal preparations, *Borago officinalis* relaxed the carbachol (1 μM) and K<sup>+</sup>-induced contractions. Verapamil also produced nonspecific inhibitory effect.

Anti-oxidant Activity Borage seeds were sampled in Amdound region (North of Tunisia) during their ripening stage in order to analyse their phenolic compounds and to ascertain their antiradical scavenging activity. The harvesting time effect on some physical properties of borage seed was significant. The increase of dry weight (from 10 to 90%) during ripeness was correlated negatively with that of moisture content (from 90 to 10%). Seed phenolic contents ranged from 2.45 to 10.98 mg GAE/g DW.

#### Anxiolytic Activity

Medicinal plants with natural antioxidants have been shown to be beneficial in a variety of complications such as anxiety.

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