

Bioactivity of *Echium Amoenum*: A Mini Review

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ABSTRACT

This paper deals with *Echium amoenum*, which is one of the most important medicinal plants in Iranian traditional medicine. The flowers of this plant have been used as antioxidant with anti-inflammatory and analgesic, anxiolytic, and sedative effects in folk medicine. In recent years, the importance of oxidative stress in the pathophysiology of many human disorders has been confirmed, and it is highly recommended to use this plant as a food supplement.

Introduction

Echium amoenum is a perennial herb native to the narrow zone Iran and the Caucasus known as „Iranian borage “. It is one of the most important medicinal herbs in traditional Iranian medicine, for infectious diseases, flu and as an anti-febrile. It grows from up to 2200 meters above sea level and it is used not only in folk medicine but also in the kitchen. This plant has a variety of effects, of which the most valuable are anti-inflammatory and analgesic effects. Also, antibacterial, antioxidant, and antiviral properties of borage have been shown in different articles [1] and recent phytochemical studies of *E. amoenum* showed various substances with neuroprotective effect [2]. Clinical studies on *E. amoenum* showed effectiveness in depression and anxiety disorders [3].

Ethnobotanics

Echium amoenum Fisch. & CA Mey that is a member of Boraginaceae family [4] is a large (60 -100 cm) herb growing in Northern parts of Iran and in the Mediterranean region of Europe (Figure 1). The flowers are bright blue and star-shaped, and the fruit consists of four brownish nutlets. This hairy plant is known as Borage and its flowers and the leaves have antibacterial effects [5]. It is also used in treatment of stress and depression [6]. The genus *Echium* has 4 species. However, only two of them - *Echium vulgare* and *Echium amoenum* - have been used in traditional

medicine [7-9]. *E. amoenum* is one of the most important medicinal plants in Iranian traditional medicine, and its tea is one of the most commonly used herbal drugs. All parts of the plant, including stems, leaves and flowers have pharmaceutical uses [10]. *E. amoenum* is widely used as a sedative and mood enhancer. It is also used to treat cough, sore throat and pneumonia [2].



Figure 1: Flowering Iranian borage, *Echium amoenum* Fisch. & CA Mey.

Pharmacology

Flowers, stems, roots and leaves from the *E. amoenum* are used for medicinal purposes in traditional medicine. It represents an interesting source of various pharmacological activities [2]. Many biologically active substances were isolated from *E. amoenum*. These are mainly polyphenols with rosmarinic acid as the main ingredient [1] anthocyanidine, flavonoids, sterols, saponins, unsaturated terpenoids and unsaturated fatty acids [11,12] and trace amount of pyrrolizidine alkaloids [13]. The presence of these hepatotoxic alkaloids may be a problem, although it is not a reason to ban this popular herbal medicine. Nevertheless, further investigations including *in vivo* toxicological studies are required to confirm these points.

Antioxidant Activity

Antioxidant properties of the decoction of the flowers of *E. amoenum* was described by Ranjbar et al. Antioxidative stress potential of this plant may be due to its bioactive antioxidant components, mainly polyphenols as rosmarinic acid and flavonoids [14,11].

Antibacterial Activity

Because microorganisms become more and more resistant to antibiotic compounds, herbal antimicrobial drugs are an interesting source of new active ingredients. The study of Sabaeifard (2015) shows that the *Echium amoenum* aqueous extract has remarkable antimicrobial activity against *Staphylococcus aureus*, *Escherichia coli*, and *Pseudomonas aeruginosa*. *In vitro* aqueous extract of *E. amoenum* from dried flowers also showed concentration-dependent antibacterial activity against *Staphylococcus aureus* [5]. The traditional use of Iranian borage flowers for infectious diseases and for the control of fever seems justified.

Antiviral Activity

The aqueous extract of *E. amoenum* in concentration of 50–1000 µg/ml for 7 days is effective against herpes simplex virus type I [15]. This extract also showed concentration-dependent antiviral activity against free bacteriophage 3C, specific host of *Staphylococcus aureus* [16]. Antiviral activity of the extract is heat resistant and it can be rosmarinic acid which was found in this plant [17] and has antimicrobial, antiviral, and anti-inflammatory effects.

Anti-Inflammatory and Immunomodulatory Activities

E. amoenum has significant anti-inflammatory and immunomodulatory effects, including lymphocyte activation inhibitory effects, cellular and humoral suppression, and induces apoptosis [18]. Hexane extract of *E. amoenum* could modulate the inflammatory mode of the macrophages by inhibition in iNOS and COX2 enzymes and decreases IL-1β, IL-6, and TNF-α cytokine levels [19].

Neuroprotective Activity

The neuroprotective effects of *E. amoenum*, including analgesic [20] anti-ischemic [11] and anxiolytic effects [21] have been shown in several animal models. Its extract shows protective effect against

scopolamine-induced impairment [22]. Cyanidine-3-glucoside, which is the most important anthocyanin in the plant, has protective effects against brain damage and apoptosis caused by brain ischemia [23]. According to the articles mentioned above, it seems that *E. amoenum* may be effective against cognitive impairments caused by neurodegenerative diseases. Recent studies have suggested that the aqueous extract of *E. amoenum* is effective in treating patients with mild to moderate depression as well as obsessive-compulsive disorder [24] and generalized anxiety disorder [25].

On the rat model of Alzheimer's disease with destructed nucleus basalis Maynert (NBM) by oxidative stress was proved that that the treatment of animals with plant extract inhibited the acetylcholinesterase enzyme and improved the ability of spatial learning in the Morris water maze test. Given the pathophysiological and molecular similarities between the AD and NBM lesion models, *E. amoenum* could be used as a therapeutic adjuvant in patients suffering from Alzheimer's disease or similar cognitive disorders [26].

Can Be *E. Amoenum* a Functional Food?

Most medicinal plants exhibit specific therapeutic effects without having a nutritional role in the human diet. But this is not the case of *E. amoenum*. This plant is not only medicinal because it contains a number of beneficial substances but is also a nutrient plant [14]. However, the use of a plant as a functional food is complicated because its range is quite limited and is bound to a particular geographical area [27-31].

Conclusion

Echium amoenum is a perennial herb and it is one of the important remedies used in traditional Iranian medicine. The plant contains a number of bioactive substances. The plant has a number of pharmacological effects: antioxidant, antibacterial, antiviral, anti-inflammatory and immunomodulatory, but also neuroprotective. As it also has a nutritional value, it is possible to use borage as a functional food.

Conflict of interest

The authors declare that there is no conflict of interest with regard to the topic, creation and publication of this article, and no pharmaceutical company has supported the creation or publication of the article.

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