

## THE EFFECT *ORIGANUM VULGARE* L. ESSENTIAL OILS ON WEED SEED GERMINATION

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### Abstract

Oregano is a common name for products derived from more than 60 plant species which mostly belong to the families Lamiaceae and Verbenaceae. Within the genus *Origanum*, forty-two species and forty-nine taxa (species, subspecies and varieties) divided into 10 groups were classified. The largest number comes from the Mediterranean and it is of local character. [4]. In recent years, interest for use of natural compounds in control of weed species keeps growing. Natural compounds with allelopathic effect generally represent the products of secondary metabolism and are known as allelochemicals. Allelochemicals are safer than synthetic herbicides primarily because they are biodegradable and have a minimal detrimental impact on the environment [7].

During 2016, the allelopathic effect of oregano essential oil was studied on germination of some plant species such as: ručola (*Eruca sativa* Mill.), onion (*Allium cepa* L.), kohlrabi (*Brassica oleracea* var. *gongylodes* L.) and kale (*Brassica oleracea* var. *sabauda*, L.). Seeds of the mentioned weed species were treated with different concentrations of oregano essential oil in the amount of 200 µl/ml, 400 µl/ml, 600 µl/ml and 800 µl/ml. Distilled water was used as a control. The obtained results indicate that the increase in concentrations of the essential oil results with the reduction in germination of onion and kohlrabi plant seeds, and also with the increase in its inhibitory effects. For kale and ručola seeds a deviation in correlative inhibition of germination at a concentration of 600 µ/ml was established, while the average seed germination was higher than at a lower concentration of 400 µ/ml.

### Introduction

Essential oils have a significant role in the reduction of herbivores and parasites, so that in addition to the pharmaceutical, food and cosmetic industries, they have found the application also in the protection of ecosystems, humans, animals and foods [8]. Essential oils are complex, unstable natural compounds with a strong odour and represent secondary metabolites of aromatic plants. They are the most frequently separated by steam or hydrodistillation. In nature, they protect plants from bacteria, viruses, fungi, insects and herbivores. Essential oils have a role in attracting of certain insects to for the purpose of dispersion of pollen and seed, but for some other insects they can be repellents. They can be synthesized in all plant organs, and are kept in secretory cells, channels, cavities, epidermal cells or glandular trichomes [1][6]. In warm climate, the content of essential oil is higher. Therefore it is often said that essential oils are products of Helios synthesis. From the other hand, there really exist ‘‘chemical races’’ in many of aromatic plants [3].

Oregano (*Origanum vulgare* L.) is perennial, herbaceous plant of aromatic smell and taste. Numerous studies have confirmed antibacterial, fungicidal, antiviral and antioxidative properties of oregano. It is strongly antiseptic, and its essential oil (5%) the tincture with rosemary is used for outside rubbing in treatments of rheumatism and diseased joints [2].

There are two basic oregano species that grow in the region of Serbia. The first one is *Origanum vulgare* subsp. *vulgare* L., oregano or wild marjoram (wild marjoram – or ‘‘blue’’ oregano - for blue flowers). It is used for the production of oils for cosmetic purposes, and the

most frequently as an adjunct to massage oils. It is extraordinary antiseptic. It is used in the form of teas - as a medicinal herb. It is not used as a spice, except in special cases, as a surrogate to real oregano. It is added to alcoholic drinks that obtain specific taste and antiseptic property of this plant. The fabric industry uses it also for getting products of special lilac colour. In Serbia this plant is wild, but it is also cultivated. Mountain areas are the most suitable for its growth, although it can also be found on terrains of lower altitude. It is widely distributed, and the studies have shown that oregano of the highest quality grows in the region of Zlatibor.

Beside allelopathic effect to weed species, essential oils of aromatic plants can have a negative impact on cultivated plants. Due to their negative influence, studies on the impact of essential oils are desirable in order to get to know possibilities and restrictions of their use in agricultural production in advance. The phytotoxic potential of essential oils and their pure components have been studied earlier, and in many previous studies, it has been documented that essential oils and their compounds delay germination and inhibit the growth of weed seedlings and also seedlings of cultivated plants. These studies have to be taken into account when considering the application of essential oils in the system of food production, as well as ways of its use in order to achieve a minimum adverse effect on cultivated plants or way of use by which such negative effect would be avoided.

### Experimental

In the trial the essential oil of oregano was used (*Origanum vulgare* L.) which are the most common components were carvacrol with 85% and thymol with 5%, while all other components were represented with less than 1%.

Plant species whose seeds were used for the studies on influence of oregano (*O. vulgare* L.) essential oil to germination and growth of seedlings were the following: rucola (*Eruca sativa* Mill.), onion (*Allium cepa* L.), kohlrabi (*Brassica oleracea* var. *gongylodes* L.) and kale (*Brassica oleracea* var. *sabauda* L.).

Petri dishes were filled with fifteen seeds per dish; seeds were placed on two layers of filter paper and covered with the third one. Seeds were treated by 200 µl/ml, 400 µl/ml, 600 µl/ml and 800 µl/ml of essential oil concentrations. The laboratory test was accomplished in four replications.

After placing of seeds into Petri dishes and impregnation with distilled water and different concentrations of oregano essential oils, Petri dishes were relocated into a climatic chamber. The test was monitored on daily basis, and after four days, germinated seeds of chosen plants were numbered, and length of seedlings was measured in millimetres.

### Results and discussion

Seed germination can be defined as the emergence and development of seminal embryos of the most important structures that are, depending on plant species that are under convenient conditions for growth and development, capable of producing a normal plant. Many biotic and abiotic factors influence on seed germination, as well as on the main component of seed quality – germination [5].

In Table 1 are presented average values of rucola (*E. sativa* Mill.) seed shootings achieved by treatment with different concentrations of oregano essential oils. Given data present lack of germinated seeds after treatment with the highest oregano essential oil concentration of 800 µl/ml, and also there is a deviation in gradual successive reduction in germination with increasing concentrations, meaning that the applied concentration of 600 µl/ml resulted with higher germination than after use of the essential oil concentration of 400 µl/ml.

**Table 1** Influence of different concentrations of oregano essential oil on germination of rucola (*E. sativa* Mill.) seed.

	Control	200 µl/ml	400 µl/ml	600 µl/ml	800 µl/ml
Rucola	6.73	1.53	0.23	0.48	0

The same inhibitory effect of the essential oil in concentrations of 200 µl/ml and 400 µl/ml was established after treatment of onion (*A. cepa* L.) seed, with the average values of shootings of 0.11 mm, as well as the inhibitory effect after seed treatment with different concentrations of 600 µl/ml and 800 µl/ml, for which the identical average values of shootings length of 0.26 mm were recorded.

**Table 2** Influence of different concentrations of oregano essential oil on germination of onion (*A. cepa* Mill.) seed.

	Control	200 µ/ml	400 µ/ml	600 µ/ml	800 µ/ml
Onion	2.3	0.11	0.11	0.26	0.26

In Table 3 are presented average values of shooting length of kohlrabi (*B. oleraceavar.gongyloides* L.) seeds, obtained by their treatment with different concentrations of oregano essential oil in control with distilled water. It was found that the average length of shooting reduced with the increase of oregano essential oil concentration, i.e. shootings were the longest when sprayed by the concentration of 200 µl/ml, and the shortest after application of the highest concentration of the essential oil of 800 µl/ml.

**Table 3** Influence of different concentrations of oregano essential oil on germination of kohlrabi (*B. oleraceavar.gongyloides* L.) seeds.

	Control	200 µl/ml	400 µl/ml	600 µl/ml	800 µl/ml
Kohlrabi	12.4	1.45	1.01	0.78	0.13

In Table 4 is presented the influence of different concentrations of oregano essential oils on kale (*B. oleracea* var. *sabauda* L.) seeds. Given data show that the highest average length of seedlings was achieved after spraying with the lowest concentration of 200 µl/ml, and the lowest shootings length was obtained after use of the highest concentration of the essential oil of 800 µl/ml; and also there is a deviation in gradual successive reduction in germination with increasing concentrations, meaning that the applied concentration of 600 µl/ml resulted with higher germination than after application of the essential oil concentration of 400 µl/ml.

**Table 4** Influence of different concentrations of oregano essential oil on germination of kale (*B. oleracea* var. *sabauda* L.) seeds.

	Control	200 µ/ml	400 µ/ml	600 µ/ml	800 µ/ml
Kale	18.2	1.23	0.30	0.36	0.11

### Conclusion

Oregano is an aromatic, medicinal and spice plant. With the increase in studies of its properties, new knowledge on its usefulness arises. Because of this, it is increasingly demanded by domestic and foreign markets. Numerous studies have confirmed antibacterial, fungicidal, antiviral and antioxidative properties of oregano due to which it is widely used in traditional medicine.

The processing of the obtained results showed that oregano essential oil had a significant influence on germination of rucola, onion kohlrabi and kale seeds. All four studied plant

species did not show tolerance to treatment with the essential oil. The obtained results clearly revealed that with the increase of the essential oil concentration its inhibitory action also increased to germination of seeds of tested plants, excepting ručola and kale seeds for which there is a deviation in the gradual successive reduction in germination with increasing concentrations. For this seed, the deviation in correlative inhibition of shooting after spraying with the concentration of 600  $\mu$ /ml is obvious, while the average germination of seeds was higher than after use of lower concentration of 400  $\mu$ /ml.

Results of this study showed that in decision making on the use of oregano essential oil in the production of the studied plant species, the attention must be paid in regard to the inhibitory effect of the essential oil to germination of seeds and length of seedlings. Also, further analysis and studies should be encouraged and supported, not only on oregano essential oil, but on all essential oils on different plant species in order to find new, harmless, and sustainable strategies in plant protection as an alternative to synthetic chemical compounds, thus preventing the occurrence of environmental pollution as well as many other adverse effects of chemical plant protection.

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