ALLELOPATHIC EFFECT OF *Abuthilon theophrasti* Med. EXTRACTS ON GERMINATION OF MAIZE SEED

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Abstract
During 2014 allelopathic effects of *Abutilon theophrasti* Med. water extracts to germination and initial development of maize (*Zea mays* L.), were studied in laboratory conditions. In addition to the Water extracts out of dry mass of the tested weed species, the applied concentrations were 1 g/l, 2 g/l, 4 g/l of dry matter made out of weed species in the 3-4 leaf stage of development. Water solution of A. theophrasti showed inhibitory effect on maize seed epicotyls and hypocotyls length. The applied extracts made out of dry matter of the studied weed species *A. theophrasti* reduced maize seed germination for 9%-14% in comparison to the control in which it was 88%. After germination in a climate chamber, epicotyls' and hypocotyls' length of maize seeds was measured three, six and ten days following spraying by extracts.

Introduction
The term allelopathy has been used for the first time by Hans Molish, Vienna University in 1937. This term is constructed from two Greek words allenon which means "one on another" and pathos which has two meanings suffering or „sensitivity" , and it's used to describe mutual impact of one organism on another [1]. Allelopathy can be defined as a biochemical interaction that has either a simulative or a negative impact between plants (including microorganisms). Allelopathic effects are classified as weed on weed, weed on crop or weed on weed [2]. Soil and plant traits have a big impact on allelopathic effects. Growth inhibition that was caused by *Cyperus tuberosus* on some plants: tomato, bean, eggplant, had greater effect on light soils. Allelopathy has great role in spreading of invasive weed species. Some weed species of European origin *Centaurea maculosa* and *Centaurea diffusa*, are invasive species in North America. Allelochemicals that are produced by those two weeds, have been discovered in their native soil in Europe, but also in the soil of North America, where the concentration of their allelochemichals was far greater. So we can say that allelopathy depends on numerous factors [3]. Numerus experiments have shown that the allelopathic substances, which trigger biochemical interactions between plants are typical secondary metabolites. They have a low molecular weight, a simple structure and easily volatile [4]. Allelopathy is not only representing the effect of root exudates, but also the effect of toxicall Compounds which are the result of degradation organic matter in soil. Plants produce physiological active compounds (carbohydrates, ferments, organic and amino acids), they can have a positive or a negative effect on plants [5]. Johnson grass (*Sorghum halepense*) and wiregrass (*Cynodon dactylon*), are common weeds in corn and cotton fields that have an allelopathic effect. *Agrostema githago* has a positive effect on wheat growth. *Abuthilon theophrasti* Med. is an annual weed with a high alleopathic potential, it can have negative effects on germination and growth of other crops and weed's [3]. The leaf of *Abuthilon tehoprhasti* Med. produces moucus formations and they can severely damage the yield of soybean. The root produces various metabolic active compounds such as: organic acids, amino acids, carbohydrates, cinober. Root mucus of some plants *Thymus serpillum* prevents seed germination by getting in contact with other seeds. Remains of crops like: wheat,

sunflower, sugar beet, peas, can prevent the development monocotyledonous weeds from the *Poaceae* family, but not *Avena* spp [5]. The interaction between higher plants can be achieved through the impact of compounds, which are located in above ground plant organs. With the help of rain those compounds can get to surface of neighboring plants or in the soil. Young walnut leafs contain a high amount of juglon. Rye is a very active alleopathic plant [6]. A significant inhibitory effect is proven by aqueous extract of Jimson grass. The extract was made from different plant parts steam, root, leafs and it had the greatest effect on germination, primary root growth, and lower density of some weeds: *Ipomoea tribola*, *Echinochloa colonum*, *Rottboellia cochinchinensis*, *Rumex dentatus*, *Coronopus didymus*, *Convolvulus arvensis* and *Portulaca oleracea* [7]. Allelopathy is a phenomenon that can be used as an alternative mode to suppress weeds: allelochemicals as herbicides, in crops that are genetically modified. Lot of crops like rye or some plants from the families *Brassicaceae* and *Fabaceae* are recommended as cover crop to suppress weeds or to prevent erosion. Some crops have a positive effect in the crop rotation system, so in the next season there are less weed types in the field. In some countries secondary metabolites of microorganisms have been commercialized. These product are safe to use and have no negative impact on the environment [2].

Experimental

In 2011 and 2012, plant parts of *Abuthilon theophrasti* Med. were collected on two localities Bački Maglić and Kać. The collected plant matherial was split in two parts above-ground part of the plant (steam and leafs) and underground part (root). Above-ground and underground plant parts were together macerated. Velvetleaf water extracts of above-ground and underground were made in different concentrations: 1 g/l , 2 g/l and 4 g/l. Filter paper in Petri dishes (150 mm x 25 mm) with germinated seed of the assayed maize crop was saturated by 8 ml of the extracts. Control was moistened by distilled water. Each concetration was replicated four times. By extracts treated soybean and maize seed were germinated in climatic chamber [12] and seed surface was sterillized according to Elemaru and Filhou (2005) [8]. The assayes were set up according to the randomized block design with 4 replications. Each Petri dish contained 25 maize seeds, i.e. 100 seeds per treatment. All measurements were conducted third, sixth and tenth day after moistening of the studied crops seed. The existence of allelopathic activity of the studied weed species to the maize crops were established by measurement of the crops seed epicotyls (mm) and hypocotyls (mm) length and germination (%) [11].

Results and discussion

During the experiment that had the goal to prove alellopathic effects of *Abuthilon theophrasti* Med. water extracts on maize seed germanination. The following results have been obtained:
Treatment that contained the extract concentration of 1 g/l had an average hypocotile length value 34.98mm, value of the control 67.90mm. Treatment that contained the extract concentration of 2 g/l had an average hypocotile length value 57.91mm, value of the control 67.90mm. Treatment that contained extract concentration of 4 g/l had an average hypocotile length value 58.63mm, value of the control 67.90mm, the results are presented in figure 1.

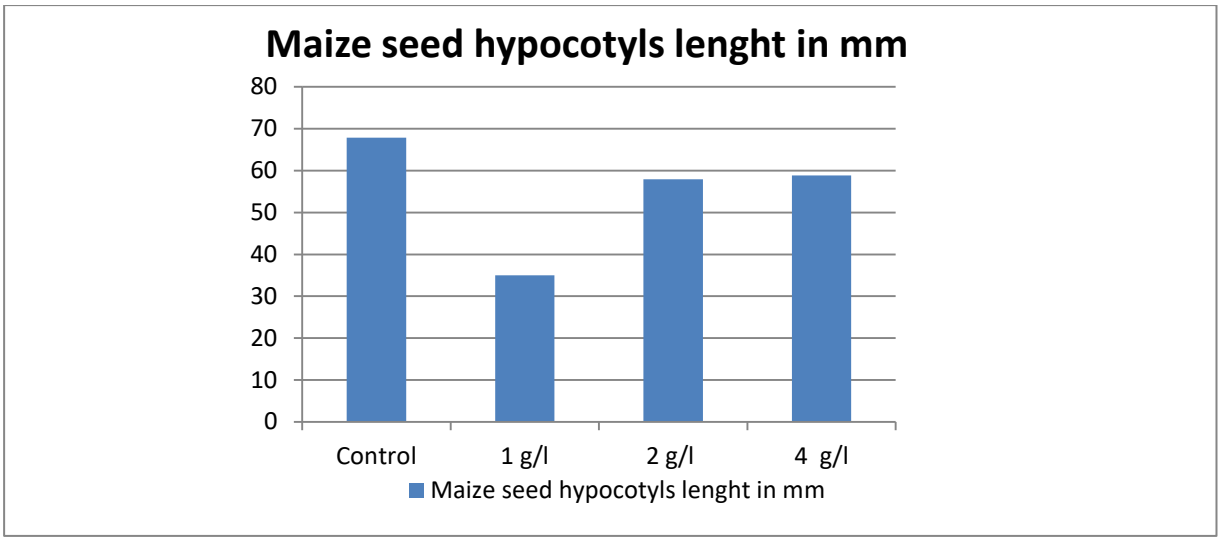

Figure 1 Measured values of maize seed hypocotyls after treatment with *Abutilon theophrasti* Med.extracts.

Average epicotyl length were for the extract concentration of 1 g/l 15.22mm compared to the control which was 54.42mm. Average epicotyl length were for the extract concentration of 2 g/l 18.95mm compared to the control which was 54.42mm. Average epicotyl length were for the extract concentration of 4 g/l 19.35mm compared to the control which was 54.42mm, the values of epicotyls length after treatment are shown in figure 2.

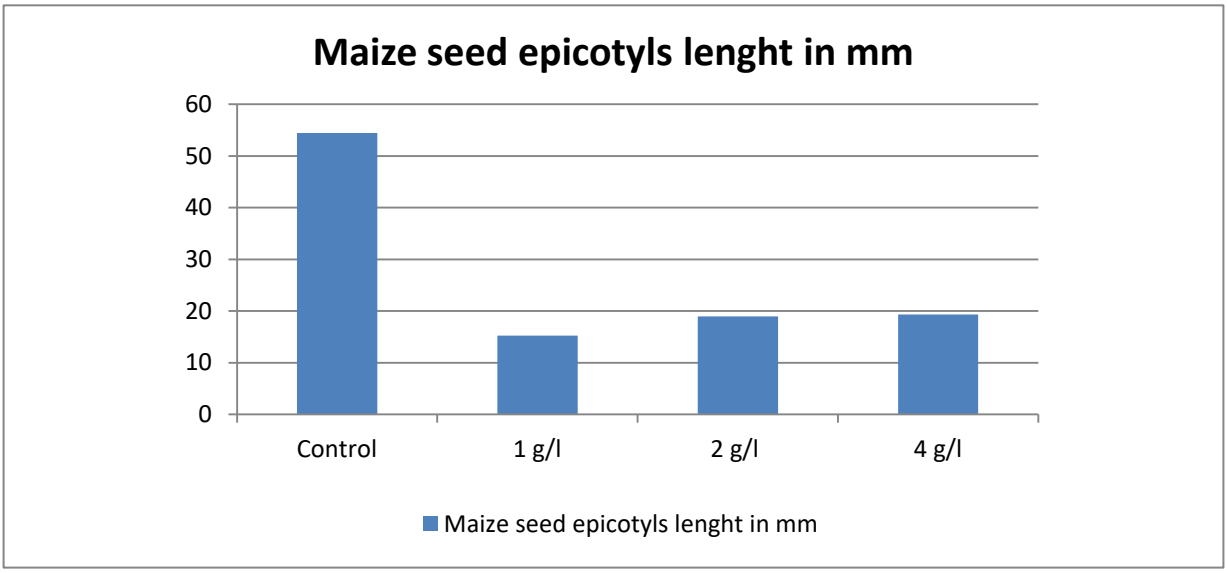

Figure 2 Measured values of maize seed epicotyls after treatment with *Abutilon theophrasti* Med. extracts.

Percentage of maize seed germination in the assay, has given different results: seeds that have been treated with the extract which had the concentration of 1 g/l 91%, compared to the control 88%. Seeds that have been treated with the extract which had the concentration of 2 g/l 91%, compared to the control 88%. Seeds that have been treated with the extract which had the concentration of 4 g/l 86%, compared to the control 88%. The results of seed germination percentage are shown in figure 3.

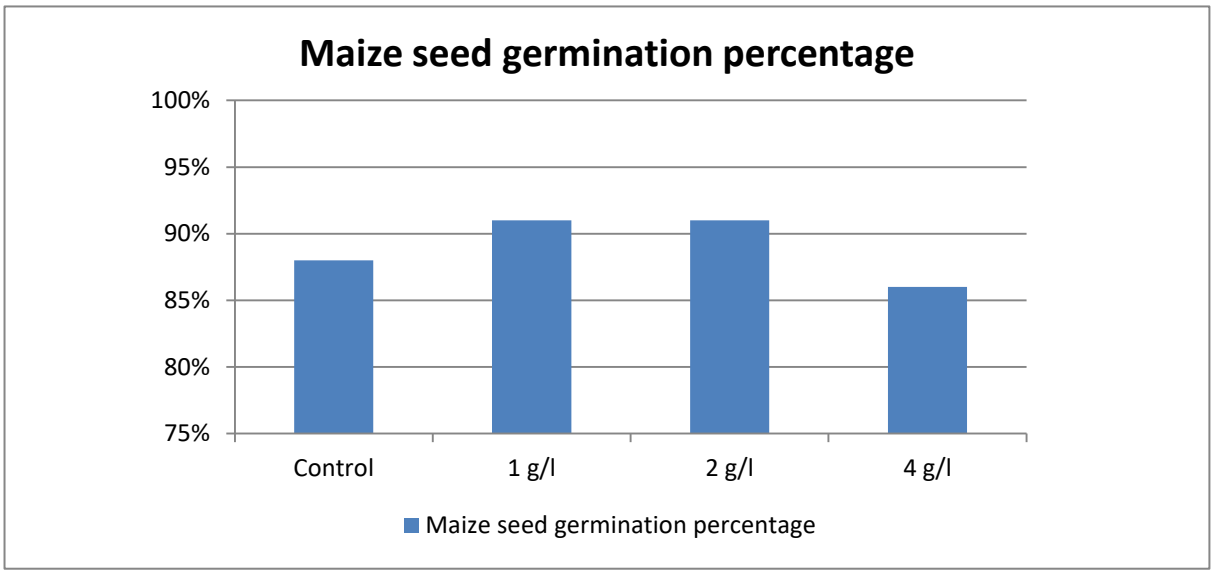

Figure 3 Seed germination of maize seeds after treatment with *Abuthilon theophrasti* Med. extracts.

Conclusion

Based on the results of the assays we can conclude, that the allelopathic effect of *Abuthilon thephrasti* Med. on maize seedlings has been detected. Water extract of *Abuthilon theophrasti* Med. had a greater impact on maize epicotyl length. Extracts of Velvetleaf had a stimulating effect on seed germination, but after the germination they shown negative effects on epicotyl and hypocotyl growth. The stimulating germination effect can be related to other factors. This research has been conducted under *in vitro* conditions, the allelopathic effects of *Abuthilon theophrasti* Med. have been proven. This indicates that further trials should be done also in the field and they should be continued *in vitro* in the next period. Allelochemicals of *Abuthilon theophrasti* Med. have shown an impact on seed germination, that trait could be used in future research to produce certain kinds of pesticides. Those allelochemicals need to be detected and their effect on crops and other weeds.

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