THE INFLUENCE *XANTHIUM STRUMARIUM* L. EXTRACTS ON MAIZE YIELD

Nataša Samardžić[1*], Bojan Konstantinović[1], Milena Popov[1], Milan Blagojević[1], Branimir Lukić[1], Branimir Pavlić[2]

[1]University of Novi Sad, Faculty of Agriculture,Department for Environmental and Plant Protection,Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia
[2]University of Novi Sad, Faculty of Technology, Bulevar Cara Lazara 1, 21000 Novi Sad, Serbia
e-mail: natasam@polj.uns.ac.rs

Abstract
In several years lasting period occur great numbers of harmful organisms that cause decrease in crops yield. The most frequently occurring weed species cause great damages in agricultural crops, with potential yield loss of 34% [5]. They compete with the crops for water, space, light and nutrients and are hosts to insects and pathogens [8].
During 2014 allelopathic influence of *Xanthium strumarium* L. on maize yield (*Zea mays* L.) was studied in field conditions. Beside water extract from plant dry weight of the studied weed species, extract of methanol was also used in different concentrations. Concentrations of 0.04, 0.02, 0.01 and 0.004 g of the plant dry weight per 1 ml of solution were used. The required material was made from weed species picked up in 3-4 leaves phenophases. The reduced maize yield was established in fields in which water extracts, as well as methanol extracts were used. In comparison to untreated control variants, the reduced yield of 10.53-30.3% was established in treatments in which water extracts were applied. In relation to control plots, methanol treatments reduced yield for 20.26-36.32%.

Introduction
Contemporary agriculture to a great extent relies on herbicide use as simple and the most efficient method for weed control. However, excessive and improper use of chemical products leads to a series of negative consequences such as the occurrence of weed resistance, the occurrence of herbicide residues in food, soil and water, i.e. environmental pollution with harmful effects to human and animal health [6] [1] [2]. In some kinds of productions, such as organic agriculture, use of chemical products is not possible and therefore different alternative and ecologically acceptable methods for weed control such as allelopathy have been studied. There are different manners for use of allelopathically active plants, for example as stubble crops that cover or suppress weeds, mulching, incorporation of plant residues, green fertilization, as united crops or in crop rotation, as well as the use of cultivars, i.e. genotypes with high allelopathic potential [7]. Weeds can be suppressed indirectly also by use of water extracts of allelopathic crops as natural herbicides or directly by use of purified allelochemicals or their derivates [10] [3].
Crop plants or crops with high allelopathic potential used for weed control include sorghum, Sudan grass, wheat, rye, rice, sunflower, buckwheat and species of the genus Brassica [9] [3].

Experimental
In the period 2012-2013, *Xanthium strumarium* L. plants were collected at localities Kać and Zmajevo near to Novi Sad.
Plants were collected in the phenophase of 2-4 leaves, and then dried at 60ºC for 5 days [11]. Extracts of *X. strumarium* L. were prepared according to Chon *et al*. (2003). Water extracts were obtained by extraction of 40g of dry material by 1l of distilled water. The samples were shaken

(GFL, Schuttelapparate Shakers, Germany, Model 3015) in the dark for 24 h at temperature of 24°C, and then filtered.

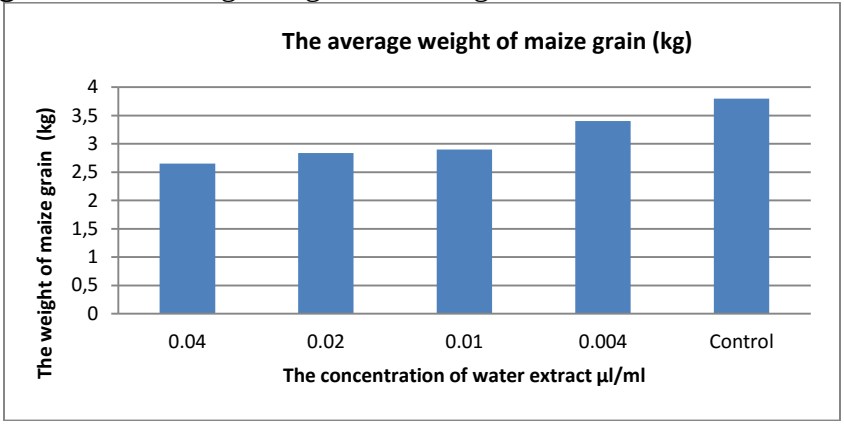
Methanol extracts were prepared by extraction of 40g of dry material by 1l of 95% methanol as extraction solvent. The samples were shaken (GFL, Schuttelapparate Shakers, Germany, Model 3015) in the dark for 24 h at temperature of 24°C, and then filtered. After filtration extraction solvent was evaporated under vacuum, and dry extracts were dissolved in distilled water, and then filtered. Water and methanol extracts of weed species *X. strumarium* L. were accurately diluted by sterile distilled water in order to obtain final concentrations of 0.02, 0.01 and 0.004 g/ml.

In 2014 the field trial was set up at locality Zmajevo, according to the randomized block design for both of the obtained extracts in maize crop phase according to BBCH scale 12-14. Measurements of 14 plants yield from each of treated plots were carried out in the phase of maize full ripening (BBCH 89). Subsequently, maize kernels were kept in paper bags (BBCH 99) for the purpose of further laboratory data processing.

Results and discussion

The influence of *Xanthium strumarium* L. water extracts on maize yield. During the studies on allelopathic influence of different concentrations of water extracts of weed species *X. strumarium* L. (0.04, 0.02, 0.01 and 0.004 g/ml), measurements and regular dating indicated a high allelopathic potential of this species to maize yield. The applied concentration of 0.04 g/ml resulted in the yield reduction of 30.3% in comparison to the control plot. The applied concentration of 0.02 g/ml resulted in the yield reduction of 25.26%, while in lower rates of 0.01 and 0.004 g/ml maize yield was lower for 23.69% and 10.53%, respectively.

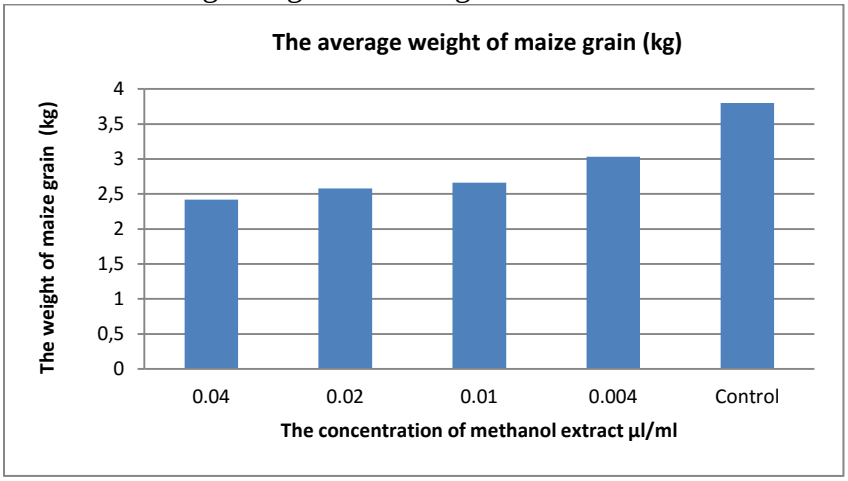
Figure 1. The average weight of maize grain treated with water extract



The influence of methanol extract of weed species *Xanthium strumarium* L. on maize yield

The studies and measurements of maize kernel after treatment by methanol extract in different concentrations showed that plants in the field treated by the highest concentration of 0.04 g/ml gave reduced yield of 36.32%. The applied concentration of 0.02 g/ml resulted in reduced yield percentage of 32.10%, while in lower concentrations 0.01 and 0.004 g/ml it was 30% and 20.26%, respectively. Significant yield reduction was established in relation to the untreated control variant.

Figure 2. The average weight of maize grain treated with methanol extract



Conclusion

Based on these studies, data on the influence of *Xanthium strumarium* L. extract on maize yieldwere obtained. The influence of water and methanol extract made from *Xanthium strumarium* L. in studied concentrations of 0.04, 0.02, 0.01 and 0.004 g/ml was highly efficient in reduction in crop yield. Use of water extract in the highest concentration of 0.04 g/ml proved that it reduces crop yield even up to 30.3% in comparison to the control variant, while the lowest concentration of use resulted in crop yield reduction of 10.53% in relation to the control. Application of methanol extract provided similar data. The used methanol extract in the highest concentration resulted in the highest yield losses of 36.32% in comparison to the control, while the lowest used concentration provided crop yield reduction of 20.26% in relation to the control.

References

A. Khaliq, A. Matloob, Z.A. Cheema, M. Farooq. Chilean Journal of Agricultural Research, 71 (3) (2011) 418-423.

B. Konstantinović, N. Samardžić, M. Blagojević, M. Popov, S.Vidović, B. Pavlić. 26th International Scientific-Expert Conference of Agriculture and Food Industry (2015) 136.

[1] D. Soltys, U. Krasuska, R. Bogatek, A. Gniazdowska. Allelochemicals as Bioherbicides (Eds.), Herbicides – Current Research and Case Studies in Use. (2013) 517-542.

[2] E. C. Large. Growth stages in cereals illustration of the feekes scale". Plant Pathology. 3 (4) (1954) 128–129.

[3] E.C. Oerke. The Journal of Agricultural Science. 144(1) (2006) 31-43.

F.A. Macias, D. Marin, A. Oliveros-Bastidas, R.M. Varela, A.M. Simonet, C. Carrera, J.M.G. Molinilo. Biological Sciences in Space, 17 (1) (2003) 18-23.

[4] H.P. Singh, D.R. Batish, R.K. Kohli. Critical review in Plant Sciences. 22 (2003) 239-311. [5] J.R.Qasem, C.L. Foy. Journal of Crop Production. 4 (2001) 43-119.

[6] L. A. Weston. Agronomy Journal. 88 (1996) 860–866.

[7] M.J. Reigosa, L. Gonzáles, A. Sánchez-Moeriras, B. Durán, D. Puime, D. Fernández, J.C. Bolano. Allelopathy Journal. 8 (2001) 211-220.

[8] S.-U. Chon, C.J. Nelson. Communications in Soil Science and Plant Analysis. 32 (2001) 1607–1619.

[9] S.-U. Chon, Y.-M. Kim, J.-C. Lee. Weed Research. 43 (2003) 444–450.