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Institute for Biological Research „Siniša Stanković", University of Belgrade

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21th Symposium of the Serbian Plant Physiology Society

COST ACTION FA1106 QUALITYFRUIT Workshop

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PETNICA SCIENCE CENTER 17-20 JUNE, 2015

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Pb, Cd and Zn stress influence seed germination and seedling growth of invasive woody plants

PP8-10

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The effect of heavy metals cadmium, lead and zinc on seed germination and early seedling growth of invasive tree species *Ailanthus altissima* (Mill.) Swingle, *Acer negundo* L. and *Ulmus pumila* L. was investigated. Seeds were germinated in 0 μM, 20 μM, 50 μM and 90 μM Pb nitrate, Cd nitrate or Zn sulfate. Seedlings were hydroponically grown in controlled conditions. Toxic metal stress imposed on these woody plants had no significant reduction in seed germination parameters. Germination capacity of seeds treated with the highest concentration of Cd and Pb nitrate was higher in *A. altissima* (88.66% and 94.67%, respectively) compared to *A. negundo*. Pb and Cd stress did not influence significantly *A. altissima* shoot and root growth. It was also found that the optimal Fe supply in Pb-stressed *A. altissima* plants increased photosynthetic efficiency and chlorophyll *b* content. These seedlings had 4-7 fold higher biomass production so that *A. altissima* plants could be recommended for phytoremediation. In Zn-stressed conditions these seedlings were tolerant to elevated concentrations in early developmental stage, but later, the strongest concentrations inhibited root growth and leaf development. It was found that Cd reduced *U. pumila* seedlings shoot length, but not significantly root length, while Pb did not influence shoot length and stimulated root length. As seed germination and seedlings early development were possible in the presence of high concentrations of Pb, Cd and Zn, investigated invasive species could be considered facultative tolerant to these toxic metals.

Keywords: toxic metals, stress, *Ailanthus altissima, Acer negundo, Ulmus pumila*

Arsenic-induced oxidative stress and antioxidant response of *Festuca rubra* L. growing on fly ash deposits

PP8-11

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Arsenic (As) is a highly toxic metalloid present in fly ash (FA) generated from coal combustion in thermal power plants and has been recognized as an environmental and human health hazard. Therefore, arsenic phytoremediation of fly ash requires suitable plant species that are tolerant to high levels of arsenic in the aboveground tissue. This study examined the metabolic adaptation of *Festuca rubra* L. under arsenic stress. Field studies were carried out in May 2009 on passive FA lagoons of thermoelectric power plant 'Nikola Tesla – A' in Obrenovac (L3 – 3-year-old lagoons; L2 – 11-year-old lagoons) and in Botanical Garden 'Jevremovac' in Belgrade (CS – control site). Concentrations of As in leaves of *F. rubra* at L3 and L2 (5.08 and 4.80 μg g^{-1}, respectively) were elevated in comparison to CS (3.43 μg g^{-1}). Arsenic accumulation caused oxidative stress in *F. rubra* leaves at both FA sites, as indicated by significant increases in MDA levels ($p<0.05$; $p<0.001$). High concentrations of As reduced the efficiency of PSII photochemistry (Fv/Fm), chlorophylls and carotenoids content ($p<0.001$). However, with increase in the concentration of As, the content of anthocyanins, phenolics and ascor-

bic acid as well as DPPH radical scavenging activity in leaves of *F. rubra* increased at both FA sites ($p<0.001$). Results of our study indicate that in spite of high oxidative stress and reduced photosynthetic efficiency, this grass species is characterized by significant activation of the antioxidant protection under arsenic stress. Therefore, *F. rubra* possesses high adaptive potential to grow and survive hostile conditions on fly ash deposits.

Keywords: arsenic, *Festuca rubra,* fly ash, oxidative stress, adaptations

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The allelopathic activity of leaf and fruit leachates of introduced invasive *Amorpha fruticosa* L.

PP8-12

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Allelopathic activity can be one of the key mechanisms that allow the spread of invasive species into new habitats and dominance in the community. *Amorpha fruticosa* is a highly invasive species in semi-aquatic ecosystems and one of the most invasive species in Serbia. The aim of this study was to determine whether this species has allelopathic activity, through research on the effect of leaches from the leaves and fruits on seedling growth of lettuce (*Lactuca sativa* L.). Because allelopathic activity varies under the influence of environmental factors, the plant material was collected from several habitat types: 1) indigo bush (*A. fruticosa*) riverine scrub community; 2) artificial broadleaved deciduous forestry plantation of *Populus canadensis;* 3) sedge and reedbeds communities, on the banks of standing water. Effects of leachates from dry leaves and fruits (with dormant seeds) of test species (*A. fruticosa*) were assayed on agar (Sandwich Method). Radicle growth inhibition of indicator species (*L. sativa*) served as a measure of the inhibitory capacity of *A. fruticosa*. Allelopathic activity varied depending on the type of plant organs tested and habitats from which the sample was taken. Leaf leachates of *A. fruticosa* showed high allelopathic activity (radicle growth inhibition: 42-82%), while leachates from fruits showed lower allelopathic inhibitory effects (radical growth inhibition: 20-57%). Highest allelopathic activity was obtained from leaf material collected from sedge and reedbeds communities, on the banks of standing water. Water stress, caused by large amounts of water in the land, may be one of the key factors that influence higher production of allelochemicals in *A. fruticosa.*

Keywords: allelopathy, *Amorpha fruticosa*, invasive, leachates