

Serbian Plant Physiology Society

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

1st International Conference
on Plant Biology
20th Symposium of the
Serbian Plant Physiology Society

Programme and Abstracts



Hotel PATRIA, Subotica, June 4-7, 2013

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and if ROS production exceeds the fruit capability to scavenge them then damage occurs. Studies have shown that in some cases there is an increase in phenolic compounds in fruit in order to cope with the cold stress or chilling. Alternatively, postharvest application of phenolic compounds or treatments that could trigger the defense response of fruit could be effective in preventing the visual symptoms. The sensitivity to cold stress varies within species, being often observed in apples, peaches, tomatoes, subtropical and tropical fruit. Phenolics are secondary plant metabolites derived mainly from the phenylpropanoid pathway although some compounds could be produced from shikimate pathway. Phenolics have effects on the nutritional value of the product, as well as on the flavour and colour, affecting its commercial value. There is a steadily increasing interest in phenolic properties relevant to medical science since they possess antioxidant and radical scavenging capacities and contribute to the prevention of many diseases, such as cardiovascular problems and cancer. Recent studies have observed that there was an increase in phenolic compounds in fruit during storage at low temperature. The increases could not be attributed only to weight loss or to postharvest ripening process in all the cases. Lately, work on fresh walnut kernels stored at 1°C showed increases in most hydrobenzoic acids and their derivatives due to cold stress, resulting in considerable antioxidant capacity of walnuts without any negative effect. It is claimed that these phenolic compounds are mainly derived through the shikimate pathway. However, experimental work with PAL inhibition indicated that phenylpropanoid pathway was responsible for the increases, whereas the induction of shikimate pathway could not be excluded. Afterall, the use of cold stress, without or in combination with other postharvest handling, would be purposeful to be adopted for enrichment of fruit or fresh nut with biophenolics.

Understanding plant-environment interactions is a key to successful yield of phytopharmaceuticals form medicinal species *in vitro*

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Plant metabolic profile is genetically pre-determined. However, its qualitative and quantitative characteristics are quite dynamic and can vary strikingly depending on the complex interrelations of the plant organism with its surrounding environment. Thus controlled modification of the exogenous parameters of the *in vitro* culture system makes it possible to target the production of plant biomass with desired properties. Experiments on modification of vitamin supplementation and plant growth regulators (PGR) treatments with different *Hypericum* species, as well as with essential oil bearing *Artemisia alba* Turra were performed *in vitro*. Previously it was established that by affecting developmental patterns of these plants it was possible to produce plant biomass with defined content of hypericin, pseudohypericin, phenolics and flavonoids, as well as essential oils. In this work we demonstrate that the physiological status of these plants is strongly affected by the complex biochemical interrelations between the factors of enzymatic and non-enzymatic antioxidant defence of the plant organism. In addition, it is shown that exogenous PGR treatments strongly affects endogenously produced phytohormones, thus affecting physiological status and secondary metabolites production in *Artemisia alba* Turra. Understanding these processes and identifying key factors of these relations are crucial for the development of protocols for the standardized delivery of secondary metabolites with antioxidant activities from medicinal and aromatic plants *in vitro*.

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The aim of this study was to determine the effect of different substrates on the chemical composition of the one strain of oyster mushroom (NS 77): ash, proteins, cellulose, fat, sodium (Na), potassium (K), phosphorus (P), magnesium (Mg), iron (Fe), manganese (Mn), copper (Cu) and zinc (Zn). Substrates were chosen based on local plant production, individually and in mixes: wheat straw, soybean straw, maize stalk, sunflower stalk, wheat straw 50% + soybean straw 50%, wheat straw 50% + maize stalk 50%, wheat straw 50% + sunflower stalk 50%. Plant material was cut in 3-5 cm lengths and sterilized in a boiling pot at 100°C for 30 minutes. Incubation was performed at 25°C, 80% humidity in complete darkness and fructification at 15-18°C, 80-90% humidity in diffuse light for 8-10 hours per day. Average oyster mushroom samples were taken from the first fruits of each repetition and used for determination of water content. Cellulose was determined by standard AOAC method, crude fat content by conventional Soxhlet method, while K, Na, Mg, Fe, Mn, Cu and Zn were determined from main solution on Varian Spectra AA-600.

During the three-year study with strain NS 77, we concluded that protein and P content in oyster mushroom depended on substrate on which it was grown, while water content, cellulose, Fe, Mn and Zn did not show significant difference depending on the substrate. Contents of ash, fat, Na, K, Mg and Cu were fairly uniform in oyster mushroom cap, while in stem the difference was significant.

Plant growth regulators treatments affect the structure and function of photosystem II and thylakoid membranes in *Artemisia alba* in vitro culture model

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It is widely accepted that *in vitro* cultured plants possess low photosynthetic capacity and ability to fix atmospheric carbon. Hence the problems of the mixotrophic and heterotrophic culture – the risk of bacterial or fungal contamination, as well as the necessity of special *ex vitro* adaptation procedures due to the high levels of the exogenously added carbon source (most often sucrose) during *in vitro* multiplication of the plants. However, a number of plants have been shown to perform photosynthesis *in vitro* as the extent of their heterotrophy, mixotrophy or even autotrophy largely depend not only on their photosynthetic ability, but also on the formulation of the culture medium and the culture vessels.

In the present work we study the structural organization of the photosynthetic apparatus of *in vitro* cultured *Artemisia alba* Tura in a model system of exogenous plant growth regulators (PGR) treatments. The samples were probed by 77 fluorescence emission spectroscopy that gives information about the light energy utilization by the photosystems and the aggregation state of the major light harvesting complex of photosystem II, circular dichroism spectroscopy that probes the macroorganization of the pigment-protein complexes and atomic force microscopy which provides topographic image of the thylakoid membrane. Our data indicate that PGR treatment results in major structural changes in the thylakoid membranes such as lowered LHCl amount and smaller PSII supercomplexes. Furthermore, the area and height of the thylakoids were strongly changed in these PGR-treatments, which might relate to their different capacity to compensate the effect of the impaired photosystem II structural organization. Further research is in progress to clarify the mechanisms of the photosynthetic apparatus adaptation to the different exogenous treatments which will be utilized as a tool for mixo- or autotrophic *in vitro* system development in this species.

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