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Meeting abstract

Plant phenolic metabolites as the free radical scavengers and mutagenesis inhibitors

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Plant secondary metabolites are involved in versatile functions on different levels in the plant organism. One of the roles is the scavenging of free radicals and the protection against excess oxidation caused by UV irradiation, chemical oxidants or pathogen attack or other kinds of stress. Involved are phenolic compounds from different classes such as numerous phenol carboxylic acids, hydroxylated flavonoids such as flavones, flavonols, leucocyanidins, anthocyanins and procyanidins as well as isoflavonoids. Many of these substances have been isolated from plant species possessing valuable and intensively studied medicinal properties.

For assessment of the free radical scavenging and antioxidant capacity of phenolic complexes in plants the chemical *in vitro* (cell free) tests can be used for their relative simplicity and sometimes reasonable cost. Here, we describe the application of several antioxidant and anti-free radical spectrophotometric assays for testing the antioxidant abilities of some rarely studied plant species containing different classes of polyphenols. In addition, the antimutagenic bacterial assays were used to examine the in vivo genoprotective activity of these compounds against chemical mutagens. Among the investigated compounds there are lipophilic flavones and their glucuronides from *Scutellaria baicalensis* and Iridaceae-type isoflavonoids from *Belamcanda chinensis*. Phenolic acids, procyanidins and flavonols containing Lamiaceae species such as *Leonurus sp*, *Lamium sp*., *Stachys officinalis*, *Marrubium vulgare*, *Galeopsis speciosa* have been also studied to comprise wider spectrum of different types of polyphenolics.

The assays used address the different aspects of antioxidant properties such as: free radical scavenging in aqueous and non-aqueous environment (ABTS and DPPH colorimetric tests), scavenging of enzymatically generated superoxide anion radical, transition metal reduction ability by phosphomolybdenum complex formation [2], protection against hydroxyl radical induced polyunsaturated lipid peroxidation in the Fenton reaction system.

It is important to employ several antioxidant assays for each object as there are usually different mechanisms of the antioxidation involved that results in varying outcome depending on the test used. For example the polyphenolic mixture from *Stachys officinalis* showed the weakest potential in the DPPH discoloration test whereas was the strongest one in molybdate reduction assay what clearly indicates the complexity of the involved mechanisms.

The antimutagenic activity of the extracted phenol complexes and isolated compounds correlates with free radical scavenging. In the Ames bacterial assays [1] the direct mutagenesis by chemical mutagens can be distinguished from the mutagenesis induced by activation of pro-mutagen with cytochrome P-450 enzymatic fractions. The aglycones were clearly more efficient than glycosides in inhibition of mutagenesis, the lipophilic flavone from *Scutellaria baicalensis* – baicalein being the most efficient. Other flavonoids were effective in inhibition of indirect mutagenesis that can be attributed to the inhibitory action against the pro-mutagen activating enzymes [3].

Free radical scavenging by the low molecular weight compounds can play an important role as the last line of defense against oxidative damage of the cells for they are

more stable than enzymatic antioxidant apparatus and can be easily accumulated in stress conditions (e.g deposited in the cell wall or the vacuole). Superoxide scavenging can protect the cells against the production of deleterious peroxynitrite upon reaction of the relatively harmless superoxide with an important signaling molecule – nitric oxide.

The activity of complex extracts is sometimes stronger than individual compounds, which can be interpreted as the necessity for preserving the native composition, more effective when acting in oxidation/reduction cascades and thereby able to reduce the formation of harmful oxidation end-products. The *in planta* function of the antioxidant and antigenotoxic compounds should be further explored in order to obtain the complete insight into their role in protecting the plant cell.

References

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