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ORIGINAL ARTICLE

Comparative analysis of bioactive phenolic compounds composition from 26 medicinal plants

Oksana Sytar [a,b,*], **Irene Hemmerich** [d], **Marek Zivcak** [c], **Cornelia Rauh** [d], **Marian Brestic** [c]

[a] *Research Center AgroBioTech, Slovak University of Agriculture, Nitra, A. Hlinku 2, 94976 Nitra, Slovak Republic*
[b] *Plant Physiology and Ecology Department, Taras Shevchenko National University of Kyiv, Institute of Biology, Volodymyrskya Str., 64, Kyiv 01033, Ukraine*
[c] *Department of Plant Physiology, Slovak University of Agriculture, Nitra, A. Hlinku 2, 94976 Nitra, Slovak Republic*
[d] *Department of Food Biotechnology and Food Process Engineering, Institute of Food Technology and Food Chemistry TU Berlin, Königin-Luise-Str. 22, 14195 Berlin, Germany*

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Abstract Bioactive phenolic compounds are powerful antioxidants in traditionally used medicinal and industrial crop plants and have attracted increased interest in the last years in their application and role in non-destructive methodology for pre-screening analysis of some stress factors. In this study the qualitative target was linked with future possible applications of received data for improving non-destructive methodology as well as for improving existing knowledge regarding antioxidant content in some plant species. Comparative analysis of total phenolics, flavonoid contents, phenolic acid composition, and antioxidant activity in known east central Europe medicinal and industrial crop plants of 26 species of families *Asteraceae*, *Rosaceae* and *Lamiaceae* was done. Among the investigated leaf extracts the highest total phenolic, total flavonoid contents and antioxidant activity have been seen for *Stachys byzantine* L. (*Lamiaceae*), *Calendula officinalis* L. (*Asteraceae*) and for *Potentilla recta* L. (*Rosaceae*). The highest syringic acid content has been found in the leaf extracts of plant family *Asteraceae* – in the range from 0.782 to 5.078 mg g^{-1} DW. The representative's family *Rosaceae* has a higher content of p-anisic acid in the range 0.334–3.442 mg g^{-1}DW compared to the leaf extracts of families *Lamiaceae* and *Asteraceae*. The comparative study showed significant differences of content of phenolic acids in the leaf extracts of different representative's families *Rosaceae*, *Asteraceae* and *Lamiaceae*. We suggest that the presence of some phenolic acids can

* Corresponding author at: Plant Physiology and Ecology Department, Taras Shevchenko National University of Kyiv, Institute of Biology, Volodymyrskya Str., 64, Kyiv 01033, Ukraine.
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be used as a possible marker for family botanical specifications of representative families *Asteraceae* and *Rosaceae*. It was supposed that some pharmacological effects can be connected with the analyzed data.

1. Introduction

Polyphenols and flavonoids are the common antioxidant natural products found in medicinal plants. Literature review shows that herbal medicines (especially from large families, *Asteraceae*, *Rosaceae* and *Lamiaceae*) have been used from ancient times as remedies for the treatment of diseases because they contain pharmacological and biological active ingredients (Saeidnia et al., 2005; Hajimehdipoor et al., 2014). Herbs have been used in many domains including medicine, nutrition, flavoring, beverages, dyeing, repellents, fragrances, cosmetics, smoking, and other industrial purposes. Furthermore, the usage of herbal extracts or active compounds (such as chlorogenic acid, ferulic acid, cinnamic, rosmarinic acids) in food, cosmetic and pharmaceutical industries have being increased in the last years, so that the biological and phytochemical study of medicinal plants is essential and an interesting area of research (Gohari et al., 2011; Bonarska-Kujawa et al., 2011; Sytar et al., 2012; Maria John et al., 2015).

Literature data show a correlation between radical scavenging capacities of plant extract families *Asteraceae* and *Lamiaceae* with total phenolic compound content (Miliauskas et al., 2004). Much research work has been done with the screening of different plant extracts for antioxidant capacity and total phenol content (Katalinic et al., 2006; Xu et al., 2014; Abbas et al., 2015). There are a few publications on phenolic content and phenolic acid composition of medicinal plants. The existing data refer usually to one or a few plant species. In addition, screened antioxidant compounds which are responsible for antioxidant activity could be isolated and then used as antioxidants for the prophylaxis and treatment of free radical-related disorders (Middleton et al., 2000; Packer et al., 1999). Therefore, research to identify antioxidative compounds is an important issue. Although it remains unclear which of the compounds of medical plants are the active ones, polyphenols recently have received increasing attention because of some interesting new findings regarding their biological activities. From pharmacological and therapeutic points of view, the antioxidant properties of polyphenols, such as free radical scavenging and inhibition of lipid peroxidation, are the most crucial. Even though a variety of herbs are known to be sources of phenolic compounds, studies on polyphenol composition and evaluating their antioxidative effects have rarely been carried out.

Lavender (*Lavandula angustifolia L.*) is an important source of a thoroughly studied essential oil, while antioxidant properties of this plant are much less documented. Data about antioxidant properties of *Salvia* plants are very scanty. The essential oils of pot marigold (*Calendula officinalis L.*) are used as medicines soothing the central nervous system and exhibiting other useful healing properties. The oil is also rich in carotenoids and used as a dye, as a lubricant and for other purposes (Marvin et al., 2000). Sweet clover (*Melissa officinalis L.*) is applied in the production of some beverages and foods (Ehlers et al., 1997). Honey of *M. officinalis* obtained during the plant flowering period was found to possess quite high antioxidant activity as it distinctly reduced polyphenol oxidase (Lei et al., 2000). Members of the *Rosaceae* family have long been used for food and medicinal purposes. The physiological functions of *Rosaceae* fruits may be partly attributed to their abundance of phenolics. Nowadays there is no available data about the phenolic composition in the leaf extracts of some representative's family *Rosacaeae*. The information on antioxidant compounds content of these plants was not presented well.

Literature data show data of antioxidant capacity and total phenolic content in selected herbs but usually no system on which part of plant was taken for analysis and in this case it is not easy to compare such results (Wojdyło et al., 2007). At the same time much research was done with antioxidant content measurement in whole plants which were usually used in the pharmaceutical industry (Nadeem et al., 2011). Nowadays with developing non-invasive techniques, which may be used in early steps of metabolomics research a special interest to have data regarding antioxidant composition in the leaves as proof or development of non-invasive approaches (Sytar et al., 2015) has increased. Such non-destructive techniques are based on simultaneous measurements of multispectrally-induced chlorophyll fluorescence (hereinafter denoted as multiplex measurements). This technique, though not yet widely used, has become more popular due to the introduction of commercially available devices in the last decade. In our previous experimental paper were published data where multiplex measurements were used for pre-screening flavonoid content in the leaves of plant species belonging to the family *Asteraceae*, *Lamiaceae* and *Rosaceae* (Sytar et al., 2015). Results of this study indicated that leaves of herbal plants belonging to families *Asteraceae*, *Lamiaceae* and *Rosaceae* can be sources of flavonoids, but more detailed biochemical analysis of their flavonoid composition is needed.

Therefore testing of bioactive components composition and antioxidant activity in the leaves of plant species belonging to family *Asteraceae*, *Lamiaceae* and *Rosaceae* is of interest, primarily in order to find new promising sources for natural antioxidants, nutraceuticals and second to use these results in future for developing a non-destructive methodology.

2. Methodology

The plants were located in the Botanical Garden Slovak agricultural university in Nitra. Leaves of medicinal herbs *Rosaceae*, *Asteraceae* and *Lamiaceae* were collected during the flowering period. Each leaf was marked as external, middle or internal considering its position within the plant, according to its length, the degree of development and level of association (Yommi et al., 2013). The longer, greener, and alternated

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