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Research Article

ANTIOXIDANT PROPERTIES OF THREE SPECIES FROM *CRASSULACEAE* FAMILY

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ABSTRACT

The aim of this paper was to evaluate the antioxidant properties of crude methanolic extracts from different parts of *Jovibarba sobolifera* (Sims.) Opiz, *Sedum acre* L. and *Sedum maximum* (L.) Hoffm and to correlate their antioxidant potential to the composition of polyphenols. The antioxidant potential of examined extracts was evaluated using three different antioxidant tests.

Keywords: *Jovibarba sobolifera*, *Sedum acre*, *Sedum maximum*, Antioxidant activity, Polyphenols.

INTRODUCTION

The plants from *Crassulaceae* family have been the scientists' point of interest for a number of years. *Sedum* is closely related to *Sempervivum*. Species from *Jovibarba* Opiz were previously included in the *Sempervivum* L. genus, and research studies on *J. sobolifera* have been stimulated by the biological activity of plants from the *Sempervivum* L. genus[2].

The phytochemical constituents of *Sedum* species have been extensively reported and some *Sedum* plants have been documented as either vegetables or folk medicines for treatment of many diseases[3]. These plants have been used for a long time in traditional medicine as an anti-inflammatory, keratolytic and analgesic agent, due to its beneficial effect on treating tooth pain or tonsillitis[4].

Sempervivum species are well known plants in folk medicine for the treatment of ear inflammation[5]. Drinking tea prepared from leaves of *S. tectorum* is recommended for ulcer treatment[6]. Fresh juice squeezed from the leaves of some species of *Sempervivum* L. has been used as folk medicine in many countries almost exclusively for external purposes. It can be spread as a pack on wounds, burns, and abscesses and on painful areas attacked by gout as a refrigerant and astringent. *S. tectorum* extract reduced lipid levels in rats and has antimicrobial and in-vitro antioxidant properties[2,6,7].

MATERIAL AND METHODS

Plant material

In this investigation three species from *Crassulaceae* family were used. The following plant material were examined: *Sedum acre* L. (roots, leaves), *Sedum maximum* (L.) Hoffm. (leaves, flowers), *Jovibarba sobolifera* (Sims.) Opiz (roots, leaves, flowers). All species were collected from natural population in Józefów near Biłgoraj in Poland. The identity of the plants was confirmed by Professor Tadeusz Krzaczek and a voucher specimens are deposited in Chair and Department of Pharmaceutical Botany. The roots and flowers were dried in normal conditions, and leaves were preliminary dried in 105°C for 30 min and then were dried at room temperature. All raw materials were pulverized and sieved according to Polish Pharmacopeia VI[1].

Studied activity

The amount of total phenolics was estimated by the colorimetric method using the Folin – Ciocalteu's reagent, adapted from Singleton & Rossi[8]. The amount of total phenolics was calculated as gallic acid equivalents (GAE) in milligrams per milliliter of sample.

Free radical scavenging activity was measured according to Brand – Williams method[9], based on the reduction of a methanolic solution of the colored free radical 1.1-diphenyl-2-picryl-hydrazyl (DPPH). The antioxidant activity was determined as the degree of inhibition on the hemoglobin-catalyzed peroxidation of linoleic acid according to Kuo, et al.[10]. The ferrous metal chelating power was determined by the method of Guo, et al.[11].

Each of the measurement described above was performed in three replicate experiments. Comparison of means was analyzed by the Student's t-test. All statistical tests were carried out at significance level of $\alpha = 0.05$. The linear correlation coefficients to determine the relationship between the concentrations of polyphenols and antioxidant activity and between different antioxidant activities were also evaluated. IC_{50} values were calculated from the concentration – effect linear regression curve.

RESULT AND DISCUSSION

All results were presented in Table 1.

The examined plants are rich in phenolic compounds, particularly in flavonoids[2,4,12,13]. Evaluation of the total phenolic content revealed that the extracts were quite rich in phenols. The highest level of GAE (gallic acid equivalents) was observed in the flowers of *Sedum maximum* (96.68 μg/g). The total phenolic content decreases in the following order:

S. maximum (flowers) > *J. sobolifera* (flowers) > *S. acre* (leaves) >*S. maximum* (leaves)>*S. acre* (roots)>*J. sobolifera* (roots)> *J. sobolifera* (leaves)

The antioxidant capacities of the plant extracts largely depend on the composition of the extracts and conditions of the test system. These capacities are influenced by many factors, which cannot be fully described with one single method. Therefore, it is necessary to perform more than one type of antioxidant capacity measurement to take into account the various mechanisms of antioxidant action[14,15,16].

The extracts from flowers of *S. maximum* (IP=94.2%) and *J. sobolifera* (IP=92%) were characterized as a strong antiradical activities. The scavenging ability of the methanolic extracts on the DPPH• radical decreases in the following order:

S. maximum (flowers) > *J. sobolifera* (flowers) > *S. acre* (leaves) > *S. acre* (fresh leaves) > *S. acre* (roots) = *S. maximum* (leaves) > *J. sobolifera* (roots) > *J. sobolifera* (leaves) > *J. sobolifera* (fresh leaves)

The chelating of ferrous ions by the methanolic extracts from examined plants was estimated using the method of Guo et al.[11]. In this assay, all examined extracts interfered with the formation of ferrous ferrozine complex, suggesting that they have chelating activity and are able to capture ferrous ion in competition with ferrozine. The metal scavenging effect of methanolic extracts decreases in the following order:

J. sobolifera (leaves)> *J. sobolifera* (fresh leaves)> *S. maximum* (leaves)> *J. sobolifera* (roots) > *S. maximum* (flowers) > *S. acre* (roots)> *S. acre* (fresh leaves) > *J. sobolifera* (flowers) > *S. acre* (leaves)

The ability to inhibit lipid peroxidation was the highest in the methanolic extract from roots of *S. acre*.

Table 1: The total phenolic content, free radical scavenging capacity, ability to lipid peroxidation inhibition and metal chelating activity of the *S. acre*, *S. maximum* and *J. sobolifera* extracts[a]

Species	Part of plant	Total phenolics (µg GAE/g of dry plant material)	IC_{50} (mg/mL) in DPPH system	Inhibition (%) in hemoglobin-linoleic acid system	Inhibition (%) Ferrozine-Fe^{2+} system
J. sobolifera	Leaves	17.58±0.14	163.28	58.28±0.7	91.76±0.69
	Fresh leaves	NT	262.05	51.97±0.69	91.11±0.72
	Radix	22.63±0.43	92.58	79.59±1.25	64.86±0.40
	Flowers	50.57±0.58	17.29	83.47±0.60	60.52±0.36
S. acre	Leaves	41.12±0.58	19.66	53.53±0.33	58.79±0.24
	Fresh leaves	NT	21.47	93.88±0.37	63.12±0.44
	Radix	25.87±0.25	33.41	100.00	63.56±0.25
S. maximum	Leaves	28.19±0.38	38.18	73.60±0.56	86.98±0.22
	flowers	96.68±1.44	0.98	67.26±0.73	64.21±0.45

[a] Values expressed are means±S.D.; NT- not tested

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