



Evaluation of antioxidant activity in some Geraniacean species

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ABSTRACT: Methanol extracts of nine species of Geraniaceae, namely *G. sylvaticum* L., *G. sanguineum* L., *G. columbinum* L., *G. caeruleum* Schur, *G. pyrenaicum* Burn.fill, *G. lucidum* L., *G. macrorrhizum* L., *G. robertianum* L. and *Erodium cicutarium* (L.) L'Hér. were studied for their antioxidant properties. DPPH (1,1-diphenyl-2-picryl hydrazyl) radical assay was used. The all examined extracts exhibited considerable free radical scavenging activity and their IC₅₀ values were below 50 µg/mL. The tested species were poor studied, with the exception of *G. sanguineum* and *G. macrorrhizum*. The antioxidant potential of newly studied species is commensurable with *G. sanguineum*, well known and widely used in herbal medicine. The obtained results indicated that Geraniacean species extracts are potential source of antioxidant activity.

Key words: antioxidant, DPPH, Geraniaceae

Received 12 September 2009

Revision accepted 18 June 2010

UDK 615.322:582.751.2 ; 582.751.2

INTRODUCTION

The family Geraniaceae is represented by 23 species of genus *Geranium* L and 4 species of genus *Erodium* L'Hér in the Bulgarian Flora. *Geranium macrorrhizum* and *G. sanguineum* are widely known in Bulgaria ethno-medicine in cases of gastrointestinal disorders against infections and inflammatory conditions, for treatment of skin disease. In the last decades the pharmacological activity and polyphenolic content of these two species has been well documented (IVANCHEVA *et al.* 1996; SERKEDJIEVA & IVANCHEVA 1996; SERKEDJIEVA 1996; SERKEDJIEVA & IVANCHEVA 1999; SERKEDJIEVA 1997; SOKMEN *et al.* 2005; SERKEDJIEVA *et al.* 2008). A polyphenol-rich extracts from aerial roots of *G. sanguineum* and *G. macrorrhizum* inhibit the reproduction of a range of viruses (influenza, herpes simplex, vaccinia, HIV-I) in cell cultures. (SERKEDJIEVA 1996; SERKEDJIEVA & IVANCHEVA 1999).

The antioxidant action has been assayed by scavenging of free radicals. This kind of antioxidative properties was

tested by the DPPH (1,1-diphenyl-2-picryl hydrazyl) radical discoloration assay (CIMPOIU 2006; KATALINIC *et al.* 2006). The addition of extracts with antioxidant activity to the DPPH solution induced a rapid decrease in the optical density at 517nm. The color of solution is changed from purple to yellow.

The present study examines six unstudied species of the genus *Geranium* and one of the genus *Erodium* (*E. cicutarium*) distributed in Bulgaria for their antioxidant properties. The received data for *G. macrorrhizum* and *G. sanguineum* were used as positive control because these two species were proved to possess high biological activities included antioxidant activity.

MATERIALS AND METHODS

Plant material. The aerial parts of plants were collected from different regions in Bulgaria. Voucher specimens were deposited at the Herbarium of the Institute of Botany, Sofia (SOM).

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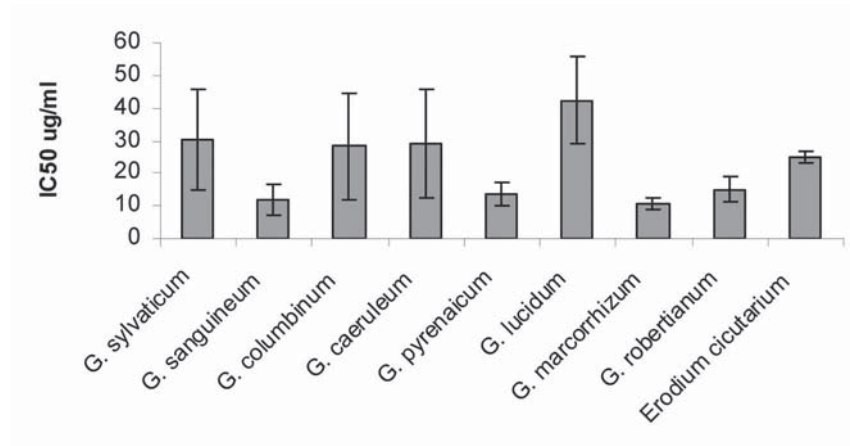


Fig. 1. Free radical scavenging activity of studied species

Preparation of extracts. 2g dry, ground plant material was extracted with 80% MeOH three times. After evaporation of the solvent the crude extract was subject to subsequent analysis.

Free radical scavenging activity determination. Different concentrations of extracts (10, 20, 50, 100, 200 and 300 µg/mL, in methanol) were added at an equal volume (2.5mL) to methanolic solution of DPPH (0.3mM, 1mL). After 30min at room temperature, the Ab values were measured at 517nm on a spectrophotometer (Jenway 6320D) and converted into the percentage antioxidant activity using the following equation: $\text{DPPH anti-radical scavenging capacity (\%)} = [1 - \frac{\text{Ab}_{\text{of sample}} - \text{Ab}_{\text{of blank}}}{\text{Ab}_{\text{of control}}}] \cdot 100$. Methanol (1.0mL) plus plant extract solution (2.5mL) was used as a blank, while DPPH solution plus methanol was used as a control (5mL). The IC₅₀ values were calculated by sigmoid non-linear regression model using plots, where the abscissa represented the concentration of tested plant extracts and the ordinate the average percent of scavenging capacity from three replicates (Software Prizm 3.00). IC₅₀ values denote the concentration of sample required to scavenge 50% of DPPH radical.

Antioxidant potential of total methanol extracts was quantitatively determined using a DPPH assay. The dosage of extract is expressed in µg of dry weight of the extract (compound) per mL of the assay mixture. IC₅₀ value represents the concentration of test extract where the inhibition of test activity reached 50%. Quercetin was employed as the reference compound. The IC₅₀ value for DPPH of quercetin was 3.1 µg/mL.

RESULTS AND DISCUSSION

Plant extracts of *Geranium macrorrhizum*, *G. sanguineum*, *G. pyrenaicum*, *G. robertianum* ranked as the top four most active plant extracts, exhibited strong activity on

scavenging DPPH radicals with the determined IC₅₀ values 10.58, 11.93, 13.61, 14.93 µg/mL, respectively. The extracts of *G. sylvaticum*, *G. columbinum*, *G. caeruleum*, *G. lucidum* shown IC₅₀ below 50µg/mL (Fig.1). This are excellent results comparing with the literature data (KUKIĆ *et al.* 2006; WOJDY *et al.* 2007) and to our previously investigations (NIKOLOVA & DZHUMANSKI 2009). The extracts of *G. pyrenaicum*, *G. robertianum* and *E. cicutarium* exhibited free radical scavenging activity comparable to that of *Geranium macrorrhizum* and *G. sanguineum*- well documented free radical scavenger plants (MILIAUSKAS *et al.* 2004; MILIAUSKAS *et al.* 2007; MURZAKHMETOVA *et al.* 2008; SOKMEN *et al.* 2005). The rest of the tested extracts had significant antioxidant activity as well. The extracts of *G. sylvaticum*, *G. columbinum*, *G. caeruleum* and *G. lucidum* L. are newly studied for antioxidant potential and had the best activity.

The results obtained in the present study showed that the extracts of Geraniacean species are promising sources of natural antioxidants. All tested extracts have strong antioxidant activity and will be subject for futher investigations.

Acknowledgements – This work was financial supported by Operational Programme “Human Resources Development” at European Social Found, project № BG051PO001/07/3.3-02/70/17.06.2008.

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REZIME

Antioksidativne aktivnosti nekih vrsta familije *Geraniaceae*

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U radu su prikazani rezultati izučavanja antioksidativnih svojstava metanolnih ekstrakata devet vrsta iz familije Geraniaceae: *G. sylvaticum* L., *G. sanguineum* L., *G. columbinum* L., *G. caeruleum* Schur, *G. pyrenaicum* Burn. fil., *G. lucidum* L., *G. macrorrhizum* L., *G. robertianum* L. i *Erodium cicutarium* (L.) L'Hér. U proceni aktivnosti korišćen je DPPH esej. Svi testirani ekstrakti pokazali su značajnu slobodno-radikalnu aktivnost, a njihove IC₅₀ vrednosti bile su ispod 50 µg/mL. Aktivnost testiranih vrsta, sa izuzetkom *G. sanguineum* i *G. macrorrhizum* je veoma slabo poznata. Rezultati pokazuju da je antioksidativni potencijal novo-izučavanih vrsta nista lošiji od aktivnosti dobro poznate vrste *G. sanguineum*. Rezultati antioksidativne aktivnosti ukazuju na visok potencijal korišćenja vrsta familije Geraniaceae u herbalnoj medicini.

Ključne reči: antioksidanti, DPPH, Geraniaceae