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Antioxidant activity of alcoholic extract of *Chelidonium Majus* L. Flowers

Research article

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Abstract
The aim of this study is to investigate the total phenolic content and antioxidant activity in extract of the plant *Chelidonium majus* L. The concentration of total phenolic content was determined using the Folin-Ciocalteu´s reagent and obtained value were 56.5 mg Gallic acid equivalents (GAE) g^{-1}. The antioxidant activity was determined in vitro using DPPH reagent and obtained value were 68.7%.

Keywords: *Chelidonium majus* L., polyphenols, antioxidant activity

1. INTRODUCTION

Chelidonium majus L. (Papaveraceae) is a perennial herbaceous plant, 50-100 cm of height, with an upright and spreading stem [1], the leaves are pinnate with lobed and wavy-edged margins, up to 30 cm long [2].

The flowers consist of four yellow petals, each about 1 cm long, with two sepals. A double-flowered variety occurs naturally. The flowers appear from late spring to summer inumbelliform cymes of about 4 flowers [3]. When injured, the plant exudes a yellow to orange latex [4].
It has many common names such as celandine, greater celandine, celandine poppy, elon-wort, felonwort, rock poppy, swallow-wort and tetter-wort [5, 6].
Recently, the extract of *Chelidonium majus* was shown to be safe for the use in veterinary and human phyto-preparations [7].

In traditional medicine, *Chelidonium majus* has been used to treat bile and liver disorders [7]. Fresh latex from plants has been used externally for the treatment of warts, corns, fungal infections, eczema, and tumours of the skin.

They are reported to have anti-inflammatory, antimicrobial, antibacterial, antiviral, immunomodulatory, choleretic, hepatoprotective, and analgesic properties [8, 9].

The extract of *Chelidonium majus* has a strong antioxidant potential and antiproliferative activity through apoptosis on leukemic cells. The extract of *Chelidonium majus* due to the presence of isoquinoline alkaloids and flavonoid components may play an important role in both cancer chemoprevention through it antioxidant activity and modern cancer chemotherapy as a cytotoxic agent and apoptosis inducer [10].

Composition of Chelidonium majus L

The therapeutic potentials of *Chelidonium majus* are related to its numerous biologically active constituents. So far, more than 70 compounds have been isolated and identified from this plant including polyphenols, alkaloids, flavonoids, saponins, vitamins (e.g. vitamin A and C), mineral elements, sterols, acids and their derivatives [6, 11].

Phenolic compounds: derivatives of kaempferol, quercetin, and isorhamnetin (kaempferol-3-O-rutinoside, quercetin-3-O-rutinoside, isorhamnetin-3-O-glucoside), 5′-methoxy-flavonol, 6′-methoxy-flavonol. Hydroxycinnamic acids (caffeic, p-coumaric, ferulic) and their derivatives (–)-2-(E)-caffeoyl-D-glyceric acid, (–)-4-(E)-caffeoyl-L-threonic acid, (–)-2-(E)-caffeoyl-L-threonic acid lactone, (+)-(E)-caffeoyl-

L-malic acid, hydroxybenzoic acids (genistic, p-hydroxybenzoic), caffeoyl threonic acid, caffeoyl glyceric acid, caffeoylmalic acid [9].

Carotenoids: violaxanthin, (all-E)-lutein-5,6-epoxide, flavoxanthin and/or chrysanthemaxanthin, (9Z)-lutein-5,6-epoxide, (13Z)- and/or (13′Z)-lutein-5,6-epoxide, (all-E)-lutein [11].

Alkaloids: benzophenanthridines (chelidonine, didehydro - chelidonine, α-homochelidonine, norchelidonine, oxychelidonine, 10-hydroxychelidonine, 10-hydroxyhomochelidonine), chelerythrine, dihydrochelerythrine, norchelerythrine, 8-hydroxydihydrochelerythrine, 8-acetonyldihydro- chelerythrine, 6-methoxydihydrochelerythrine, nitidine, dihydro-nitidine, oxynitidine, sanguinarine, dihydrosanguinarine, norsanguinarine, oxysanguinarine, N-dimethyl-9,10-dihydroxy -sanguinarine, 8-hydroxydihydro - sanguinarine, 6-acetonyl-5,6-dihydro- sanguinarine, 6-methoxydihydrosanguinarine, methyl 2′-(7,8-dihydrosanguinarine-8-yl)acetate, chelelutine, dihydrochelelutine, chelerubine, dihydrochelerubin, chelamine, chelidimerine, chelamidine, angoline and macarpine, isoquinolines (noroxyhydrastinine and turkiyenine), protopines (protopine and α-allocryptopine), protoberberines (canadine, stylopine, corysamine, berberine, dihydroberberine, coptisine, dihydrocoptisine and 8-oxycoptisine), aporphines (magnoflorine, corydine and norcorydine) and quinolizidine (sparteine) [7, 12].

In addition to these, plant also contains different aromatic and aliphatic acids such as chelidonic acid, caffeic acid, ferulic acid, *p* coumaric acid, citric acid, malic acid, succinic acid, gentisic acid, *p*-hydroxybenzoic acid and nicotinic acid [12, 13].

Recently four caffeic acid esters such as 2-(-)-caffeoyl-D-glyceric acid, 4-(-)-caffeoyl-L threonic acid, (+)-caffeoyl-L-malic acid and 2-(-)-caffeoyl-L-threonic acid lactone have been identified [14].

Besides, it contains lesser amount of phytosterols (α-spinasterol and ergosterol), polysaccharide (CM-Ala), alcohols (1-hexacosanol, chelidoniol, and nonacosanol), flavonoids (rutin, quercetin and kaempferol), choline, tyramine, histamine and saponosides [13, 15, 16].

In addition to these organic compounds, 24 essential macro- and microelements including Al, As, B, Ba, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, S, Ti, V and Zn have been identified in root

and herb. Quantitatively, most mineral elements were between 10-65%, especially for potassium (65%) and phosphorus (54%) [17].

Other Compounds: organic acids: chelidonic acid, malic acid, citric acid, succinic acid, biogenic amines, essential oil constituents, triterpenoids, saponins, resin, vitamins A, C, nicotinic acid [9].

The aim of this study is to investigate the total phenolic content and antioxidant activity in extract of the plant *Chelidonium majus* L.

2. MATERIALS AND METHODS

2.1. Plant collection and preparation of extracts

Plant leaves were freshly collected from Sadova forests, Dolj, Romania, 2021. The samples were washed with water, dried in the shade and grounded to obtain soft powder.

2.2. Preparation of the plant extracts

20 g of various powdered samples was separately soaked in 250 mL of 80% methanol and left at room temperature for 24 h and filtered. Another 250 mL 80% methanol was then added to the extracted powder, mixed and left at room temperature for 24 h and filtered. The filtrates were added together, mixed and solvent evaporated at temperature lower than 40 ˚C using rotatory evaporator. The filtrates were stored in a refrigerator at 6˚C.

2.3. Analysis methods

Measurement of total phenols

The total polyphenol content was measured using the Folin Ciocalteu reagent colorimetric method. To 800 μL of deionised water and of 50 μL of Folin-Ciocalteu reagent were added 50 μL filtrates and then accurately mixed. After 1 min, 100 μL of 20% sodium carbonate solution was added and mixed. The solution was carefully mixed and total phenol content was spectrophotometrically estimated at 765 nm

after 2 h incubation. The results were expressed as mg Gallic acid equivalents (GAE) g^{-1} of *Chelidonium majus* extracts using a standard curve generated with 10 μg, 20 μg, 40 μg 60 μg, 80 μg and 100 μg Gallic acid per mL [18].

DPPH radical scavenging activity

The DPPH radical scavenging activity (SA) was determined spectrophotometrically using the DPPH method. Briefly, 1 mL of extract solution in distilled water or 1 mL of distilled water (blank) was mixed with 2 mL of DPPH solution (2 mg of DPPH was dissolved in 50 mL of methanol). The range of the investigated extract concentrations was 0.002 - 0.5 mg mL^{-1}. The mixture was shaken vigorously and left at room temperature for 30 min, then the absorbance was read at 517 nm using a spectrophotometer Varian Cary-50. The capability to scavenge the DPPH radicals (DPPH radical scavenging activity) was calculated using the following equation:

$SA\ (\%) = 100 \times (A_{blank} - A_{sample})/A_{blank}$

where: A_{blank} is the absorbance of the blank and A_{sample} is the absorbance of the sample [18].

3. RESULTS AND DISCUSSION

Polyphenols, organic compounds found abundantly in plants, have become an emerging field of interest in recent years. A growing body of research indicates that polyphenol consumption may play a vital role in health through the regulation of metabolism, weight, chronic disease, and cell proliferation. Animal, human and epidemiologic studies show that various polyphenols have antioxidant and anti-inflammatory properties that could have preventive and/or therapeutic effects for cardiovascular disease, neurodegenerative disorders, cancer, and obesity [19-21].

The dominant explanation for these benefits is the "biochemical scavenger theory," which posits that polyphenolic compounds negate free radicals by forming stabilized chemical complexes, thus preventing further reactions [22].

There is also evidence of an additional mechanism by which polyphenols protect against oxidative stress by producing hydrogen peroxide (H_20_2), which can then help to regulate immune response actions, like cellular growth [22, 23].
The concentration of total phenolic content was determined using the Folin-Ciocalteu´s reagent and obtained value were 56.5 mg Gallic acid equivalents (GAE) g^{-1}. The antioxidant activity was determined in vitro using DPPH reagent and obtained value were 68.7%.

4. CONCLUSION

The results of present study indicate an increase antioxidant activity for *Chelidonium majus* extract as examined by DPPH method. It is suggested that the potent antioxidant activity exhibited by the plant can provide a considerable protection against oxidative stress.

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