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Biochemical peculiarities of *Glebionis coronaria* (Asteraceae) introduced in Central Polissya of Ukraine

Iryna Ivashchenko[1], Alla Bakalova
Zhytomyr National Agroecological University, 7 Stary Bulvar Str., Zhytomyr 10002, Ukraine
Dzamal Rakhmetov, Valentina Fishchenko
M. M. Gryshko National Botanical Garden, National Aacademy of Sciences of Ukraine, 1 Timiryazevska Str., Kyiv 01014, Ukraine

Abstract: *Glebionis coronaria* (= *Chrysanthemum coronarium*; Asteraceae) is a valuable vegetable, medicinal, and ornamental plant known under vernacular names garland chrysanthemum, crown daisy, etc. This species is not cultivated in the Central Polissya area of Ukraine; therefore, it is relevant to conduct the introduction studies of this valuable and rather hardy plant species, and to study its biochemical features. The aim of the present research was to carry out a comparative biochemical analysis of plant material of two varieties of garland chrysanthemum: *G. coronaria* var. *discolor* and *G. coronaria* var. *coronaria*. The objective was to determine how the conditions of introduction can influence the amount of valuable substances in the aerial mass of plants, depending on vegetation conditions; as well as the possibility of using the plants in food industry, pharmacy, and cosmetology. The introduction studies were conducted during 2014–2016 in the experimental plots of the Botanical Garden of Zhytomyr National Agroecological University, and biochemical studies were carried out at the laboratory of the Department of Cultural Flora of the M.M.Gryshko National Botanical Garden of the NAS of Ukraine. After studying the biochemical content of top biomass of *G. coronaria* introduced in Central Polissya of Ukraine, it has been found that the plant contains a number of valuable compounds, such as: ascorbic acid, carotene, sugars, fats, certain macro-, microelements and tannins. Plants of two varieties, *G. coronaria* var. *discolor* and var. *coronaria*, proved to be statistically similar as to the dry matter content, total sugars, carotenes, ascorbic acid, phosphorus, calcium, ash, tannins, fats, traces of copper, zinc, iron; the exception being manganese, the amount of which was higher in *G. coronaria* var. *coronaria*. Biochemical indices of plants changed over the years of research depending on the conditions of growing seasons. The obtained results testify to the fact that *G. coronaria* is a valuable introduced plant and a potentially rich source of biologically active substances necessary for human life-sustaining activity. *Glebionis coronaria* is a perspective vegetable plant for cultivation in the Polissya zone of Ukraine and climatically similar temperate regions for its utilization in food industry and pharmacy.

Key Words: *species, varieties, biochemical composition, biologically active substances.*

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[1]E-mail: kalateja@ukr.net

INTRODUCTION

Glebionis coronaria (L.) Cass. ex Spach. (known under common names garland chrysanthemum, crown daisy, edible chrysanthemum, etc.) is an annual herb of the family Asteraceae Bercht. & J. Presl (Compositae Giseke), tribe Anthemideae Cass. In the past the species was usually accepted as *Chrysanthemum coronarium* L. (see nomenclatural details in Turland, 2004). In terms of its origin, the literary sources indicate two regions: the Mediterranean, and probably China [Cherevchenko et al., 2012]. The species is now rather common, either in cultivation or as naturalized, in almost all continents: Africa (naturalized in Macaronesia, South Africa); Europe: Belarus, Moldova, Ukraine, Russia (European part), Austria, Croatia, the United Kingdom; North America: the USA (Arizona, California, etc.), Mexico; South America: Chile, Uruguay, etc; also occasionally in Australia, and New Zealand [Cano et al., 2017]. As an alien species, it occurs in Belgium, the Czech Republic, Germany, Hungary, Poland, Sweden, and Ireland. This type of plants is characteristic of the flora of Ukraine, growing throughout the country.

Garland chrysanthemum, known in culture for about 2000 years, is widely used as a dietary food product in Asia, particular in China, Japan, Korea, and India; it is also cultivated in France, Romania, Slovakia, Estonia, and some other countries. The plant is known as a valuable vegetable, medicinal, and ornamental crop. Its therapeutic properties are determined by a high content of various biologically active compounds in aerial parts of the plant: vitamins (in particular, C, B1, B2, PP), beta-carotene, macro-and micro elements (including potassium, calcium, iron, iodine, selenium, etc.), simple and complex carbohydrates, proteins, lactones,

essential oils, phenolic compounds, including flavonoids [Cherevchenko et al., 2012; Geest et al., 2016; Ivashchenko, 2017a, 2017b; Wan et al., 2017]. Garland chrysanthemum has antioxidant, hepatoprotective, antitumoral, insecticidal, nematocidal and antimicrobial properties [Lograda et al., 2013]. It is reported that regular intake of garland chrysanthemum leaves as food products increases the overall immunity of the organism and could be an important prophylactic measure against a number of diseases [Lograda et al., 2013; Tanaka et al., 2011].

In Ukraine, garland chrysanthemum was originally introduced in the M.M. Gryshko National Botanical Gardens of the National Academy of Sciences of Ukraine in 1986 (the Forest-Steppe zone). Garland chrysanthemum is not cultivated in Central Polissya of Ukraine; therefore, it is relevant to conduct the introduction studies of this valuable and rather hardy plant species, and to study its biochemical features. The aim of the present research was to carry out a comparative biochemical analysis of plant material of two varieties of garland chrysanthemum: *G. coronaria* var. *discolor* (d'Urv.) Turland (= *Chrysanthemum coronarium* var. *discolor* d'Urv.) and *G. coronaria* var. *coronaria*. The objective was to determine how the conditions of introduction can influence the amount of valuable substances in the aerial mass of plants, depending on the vegetation conditions; as well as the possibility of using the plants in food industry, pharmacy, and cosmetology.

MATERIAL AND METHODS

Our analysis was based on two varieties of *G. coronaria*: *G. coronaria* var. *discolor* (d'Urv.) Turland (with white-yellow heads) and *G. coronaria* var. *coronaria* (with yellow heads), which are morphologically different. According to the results of recent studies, these varieties can be alternatively classified as different species, *G. coronaria* sensu stricto and *G. discolor* (d'Urv.) Cano, Musarella, Cano-Ortiz, Piñar Fuentes, Spamp. & Pinto Gomes [Cano et al. 2017].

Preparation of plant samples for analyses. The seed material was obtained from the M.M. Gryshko National Botanical Garden (NBG) of the National Academy of Sciences of Ukraine. Introductory studies were conducted on experimental plots of the Botanical Gardens of Zhytomyr National Agroecological University. Biochemical studies were carried out in the laboratory of the Department of Cultural Flora of the M.M. Gryshko National Botanical Garden of the National Academy of Sciences of Ukraine. The raw material was collected during the flowering phase, when the plants have the maximum productivity. For the biochemical analysis, aerial parts of plants were used.

Determination of absolutely dry matter. The method is based on measuring the reduction of the mass of air-dry matter when it is dried in a drying cabinet at a temperature of 105˚C to a constant mass for 6 hours [Krishchenko, 1983]. A weight of 2.5 g air-dry ground material was tested in the given studies.

Determination of carotene. The amount of carotene was measured spectrophotometrically (spectrophotometer UNICO 2800), with the use of Kalosh gasoline solvent following to the method of Pleshkov [1985]. The method consists of the extraction of carotene with gasoline, removal of the associated pigments with aluminum oxide and calcium oxide (or calcium carbonate) and spectrophotometric determination of carotene in the gasoline extract. A weight of 5 g of fresh vegetable raw material is triturated in a mortar, transferred to a 50 ml calibrated flask to which 20 ml of gasoline is added. Carotene is extracted with constant agitation for 2 hours on a mechanical agitator. The contents of the flask was filtered and adds 0.2 g of aluminum oxide powder and 0.05g of calcium oxide to bind pigments. The mixture undergoes through stirring for 10-15 minutes in order to obtain a clear yellow-colored solution, which is due to the presence of carotene. After filtration, the gasoline carotene solution is determined at a wavelength of 440 nm.

Determination of ascorbic acid. The method is based on the ability of ascorbic acid to be restored in acidic medium to dehydroascorbic acid [Krishchenko, 1983]. Blue dye 2,6-dichlorophenolindophenol is reduced by vitamin C to a colorless compound. This reaction is the basis for the determination of vitamin C in plants. From the selected mean sample of the test material, one takes a weight of 2 g and together with 20 ml of a mixture of acids (1% HCl solution and 2% oxalic acid), puts it into a porcelain mortar and triturates quickly to form a homogeneous mass. The resulting mass is delivered through a funnel into a 50 ml capacity calibrated flask. The contents of the flask are brought to the mark and left for 20 minutes in the darkness. The contents of the flask was filtered through a two-layer paper filter into a dry conical flask (50-100 ml). From the obtained filtrate, two parallel samples, each containing 10 ml, are immediately taken with a dropper and titrated from the microburette with a 0.001 n solution of dye (2,6-dichlorophenolindophenol) until a bright pink color appears and remains pink within one minute. In parallel, a con-

trol titration of the mixture of reagents is carried out.

Determination of the total sugars content. Total content of sugars were determined according to V.P. Krishchenko [1983]. A weight of the crushed plant material (4 g) goes into a 100 ml calibrated flask with addition of a small amount of water. The flask is heated to 40° C in a water bath. After cooling, 1.5 ml of 30% acetic acid lead is added. The next day, after adding 0.5-1 ml of sodium phosphate solution, the mixture is infused for 15 minutes. The solution in the flask is brought to 100 ml with distilled water and transferred through a filter into conical flasks. Then 50 ml of the filtrate is put into a 100 ml flask, and 8 ml of a 20% solution of hydrochloric acid is added. The flask is heated in a water bath at 70° C for 5 minutes. After that, the solution is cooled and neutralized with a 12% sodium hydroxide solution. From the solution obtained, samples are taken (3 ml in each test tube) and 6 ml of a Fehling's reagent solution (1 and 2) are added. Test tubes are placed in a water bath and boiled for 6 minutes. In the presence of sugars, a red precipitate falls. The solution from the test tube is poured into a funnel with a filter and gently washed with hot water. The filter is washed until the water becomes transparent. Funnels with the residual matter are carefully transferred into clean conical flasks and the precipitate is washed with a 10 ml solution of iron-ammonia alum. The precipitate is washed with distilled hot water until the water becomes neutral. The resulting solution is titrated in 0.01 n solution of potassium permanganate.

Determination of fat. To determine the total fat content in the plant material, a method for determining the defatted residue was used [Krishchenko, 1983]. From the dehydrated plant weights (1 g), the fat was extracted with ethyl ether and the amount of crude fat was calculated from the mass of the remaining material. Extraction of fat from the samples was performed in a Soxhlet apparatus to a constant weight, the process took 12 hours.

Titrated acidity. The method is based on the titration of water-extracted acids with a solution of alkali of a known concentration [Krishchenko, 1983]. The phenolphthalein visual titration method is used.

Determination of tannins. Tannins were determined by titrimetric method using a 0.1n solution of potassium permanganate [Krishchenko, 1983].

Determination of calcium. The content of calcium was determined according to the trilonometric method [Yermakov et al., 1985]. The analysis is carried out after ashing in a muffle furnace (t = 800º C). Ash was dissolved in 10 ml of 10% HCl and filters it through a non-ash filter into a 100 ml calibrated flask. The solution is brought to the mark with distilled water. 20 ml of the obtained solution, adds to it 50 ml of distilled water and 1 ml of 1% solution of hydroxylamine, and with the help of litmus neutralizes it with a 10% NaOH solution to pH 8-9. Then a crystal of diethyl dithiocarbonate sodium and murexide on the spatula tip are added, mixed thoroughly and titrated with a 0.05 n solution of trilon B.

Determination of phosphorus content. A weight of 0.2 g of air-dry crushed plant material is transferred into a Kjeldahl flask, then 2 ml of a 30% solution of hydrogen peroxide is added. After 1.5-2 minutes one adds 3 ml of concentrated sulfuric acid, stirs it lightly and heats the flasks up to 380°C, gradually increasing the temperature. Ashing continues until the solution becomes completely colorless. After discoloration and cooling, the test solution is transferred to a 100 ml calibrated flask and brought to the mark with distilled water. The resulting solution is a starting point for the determination of phosphorus. Determination of phosphorus was carried out using a titrimetric method with molybdenum fluid [Pochinok, 1976].

Determination of copper, zinc, manganese and iron. The content of copper, zinc, manganese was determined by the atomic absorption method in accordance with GOST 30692-2000; and that of iron - by the atomic absorption method according to GOST 27998-88. The method is based on the comparison of the absorption of resonance radiation by free metal atoms when ash solutions of the analyzed products and the comparison solutions (with known mass concentrations of the metals determined) are introduced into the flame.

Dry ashing method. The content of ash in the plant material was determined by the method of combustion of organic matter with free access of air in the muffle furnace (300-700˚C) [Grytsaenko, 2003]. During the process of combustion carbon, hydrogen, and partially oxygen are emitted in the form of carbon dioxide and water vapor and only ash elements remain. For complete ashing of the sample (2 g of air-dry plant material), 5 to 6 hours suffice .

Statistical analyses. All samples were analyzed in triplicate. Data were expressed as means X ± SE using Microsoft Excel 10 and Statistica 13.3. To assess the reliability of the difference between the statistical characteristics of the two alternative sets of data, Student`s coefficient was calculated. The difference was considered to be reliable at the significance level $P < 0.05$.

RESULTS AND DISCUSSION

As a result of studying the biochemical composition of the aerial mass of *G. coronaria* plants introduced in Central Polissya of Ukraine, it has been established that the species contains a number of valuable compounds: ascorbic acid, carotene, sugars, fats, some macro- and microelements, tannins. The maximum content of ascorbic acid (235.79 mg%) and calcium (1.108%) was found in *G. coronaria* var. *discolor*, while the amount of tannins (4.68%), dry matter (18.1%), microelements: copper (8.6 mg / kg), zinc (23.7 mg / kg), manganese (18.5 mg / kg), iron (52.3 mg / kg) was higher in *G. coronaria* var. *coronaria*. The titratable acidity was higher in *G. coronaria* var. *discolor* – 4.83%. However, according to Student's criterion, at a significance level of 0.05, plants of the two varieties *G. coronaria* var. *discolor* and var. *coronaria* did not differ statistically in the content of the studied biochemical compounds, except for manganese, which is much higher in *G. coronaria* var. *coronaria* (Table 1, 2).

It is known that under conditions of the Ukrainian Forest-Steppe zone the content of carotene in plants of chrysanthemum was 0.79-1.69 mg% [Cherevchenko et al., 2012]. This amount is much lower than that obtained in our study from the plants introduced in Central Polissya: *G. coronaria* var. *discolor* – 2.94%, *G. coronaria* var. *coronaria* – 2.69 mg% (Table 1). Kidmose et al. [2006] reported the content of carotene in various vegetables growing in Asia (Taiwan), which varied from 16 to 6630 mg / 100 g (on the raw material basis), while the content of carotene in plants of garland chrysanthemum was 682 mg / 100 g (on the raw material basis), which is much higher than the results obtained in our research.

Table 1. Biochemical characteristics of *Glebionis coronaria* var. *discolor* and *G. coronaria* var. *coronaria* aerial mass in the flowering phase depending on the year of vegetation (2014–2016) (x ± SE, n = 3).

Component	*Glebionis coronaria* var. *discolor*				*Glebionis coronaria* var. *coronaria*			
	2014	2015	2016	Average value	2014	2015	2016	Average value
Dry matter, %	11.67 ±0.45	17.80 ±0.14	19.26 ±0.27	11.67 ±4.02*	15.30 ±1.23	19.11 ±0.54	19.88 ±0.16	18.10 ±2.27*
Total sugars, %	15.49 ±1.05	17.62 ±0.38	19.34 ±0.66	17.48 ±1.78*	15.63 ±0.49	18.50 ±0.58	18.21 ±0.77	17.45 ±1.46*
Carotene, mg%	1.99 ±0.015	4.69 ±0.020	2.13 ±0.142	2.94 ±1.40*	2.71 ±0.020	4.36 ±0.022	0.99 ±0.336	2.69 ±1.56*
Ascorbic acid, mg%	306.85 ±4.75	225.27 ±8.19	175.25 ±17.99	235.79 ±61.37*	205.24 ±18.96	180.99 ±9.95	132.06 ±17.43	172 ±34.44*
Phosphorus, %	0.122 ±0.007	0.071 ±0.0004	0.119 ±0.003	0.104 ±0.026*	0.132 ±0.004	0.08 ±0.001	0.127 ±0.003	0.113 ±0.027*
Calcium, %	0.437 ±0.062	1.099 ±0.023	1.787 ±0.041	1.108 ±0.624*	0.383 ±0.074	0.708 ±0.038	1.469 ±0.070	0.853 ±0.515*
Ash, %	4.09 ±0.46	6.56 ±0.12	5.84 ±0.04	5.48 ±1.19*	4.46 ±0.10	6.69 ±0.08	5.72 ±0.38	5.62 ±1.03*
Tannins, %	2.99 ±0.92	4.55 ±0.60	2.42 ±0.56	3.32 ±1.02*	6.85 ±0.70	2.39 ±0.55	4.80 ±0.57	4.68 ±2.06*
Titratable acidity, %	9.02 ±0.16	3.72 ±0.17	1.74 ±0.13	4.83 ±3.48*	4.73 ±0.16	5.25 ±0.20	1.82 ±0,06	3.93 ±1.71*
Fats, %	1.90 ±0.10	2.52 ±0.03	7.96 ±0.79	4.13 ±3.08*	1.89 ±0.59	3.91 ±0.25	6.10 ±0.62	3.97 ±1.95*

Note: * – statistically insignificant differences in the means within the series according to Student's criterion at a significance level of 0.05;
** – statistically significant differences in the means within the series according to Student's criterion at a significance level of 0.05.

Carotene is an important polyfunctional group of biologically active compounds. These compounds have proved to exhibit antioxidant and photoprotective functions in the plant organism.

From several carotene isomers, β-carotene, which is a precursor to vitamin A and has antioxidant properties, is of the greatest importance for humans. At the level of cell membranes, it neutralizes the effect of free radicals that form in the body and may lead to malignant tumors. Vitamin A provides the normal physiological state of the skin; it also stimulates the formation of mucus by the epithelial cells of the mucous membranes, plays an important role in the functioning of the organs of vision.

Table 2. Trace elements content in *Glebionis coronaria* var. *discolor* and *G. coronaria* var. *coronaria* aerial mass in the flowering phase, mg / kg (absolute dry matter basis) (x ± SE, n = 3).

Microelement	*Glebionis coronaria* var. *discolor*	*Glebionis coronaria* var. *coronaria*
Copper	7.9 ± 0.8*	8.6 ± 0.9*
Zinc	20.7 ± 2.1*	23.7 ± 2.4*
Manganese	11.1 ± 1.1**	18.5 ± 1.8**
Iron	45.1 ± 4.5*	52.3 ± 5.2*

Note: * – statistically insignificant differences in the means within the series according to Student's criterion at a significance level of 0.05;
** – statistically significant differences in the means within the series according to Student's criterion at a significance level of 0.05.

According to available data, the content of vitamin C in vegetable cultures: garland chrysanthemum (*G. coronaria*), watercress (*Nasturtium officinale* W.T. Aiton), edible amaranth (*Amaranthus tricolor* L.), white cabbage (*Brassica oleracea* L.), cabbage broccoli (*Brassica oleracea* var. *cymosa*) and celery cabbage (*Brassica chinensis* L.) varied from 150 to 30 mg% (the highest amount was found in the watercress, the lowest – in white cabbage). In garland chrysanthemum it constituted 70 mg% [Gins et al., 2014], which is significantly lower than the results obtained in our research: 172 mg% (*G. coronaria* var. *coronaria*) and 235.79 mg% (*G. coronaria* var. *discolor*). Under conditions of the Ukrainian Forest-Steppe, the amounts were somewhat higher – 186.57 and 266.54 mg%, respectively [Cherevchenko et al., 2012]. Vitamin C plays an important role in the human body as a natural antioxidant, activates the enzymes that ensure the process of carbohydrate metabolism and functioning of endoctine glands [Barata-Soares et al., 2004]. In the plant itself, ascorbic acid carries out protective functions.

Tannins (3.32–4.68) detected in *G. coronaria* (Table 1) belong to a complex group of low- and high- molecular weight natural polyphenols. In general, the cultures of the family Asteraceae are characterized by high contents of tannins. Tannins are widely used in medical practice: they show astringent, anti-inflammatory and antimicrobial activity. Preparations containing tannins are used internally in acute and chronic colitis, enteritis, gastritis, and sometimes as hemostatic agents. They are widely used for treating the inflammatory processes of the oral cavity, larynx, nose, in the form of rinses, as well as for burns, bedsores, ulcers. In our previous studies, we analyzed another group of phenolic compounds – flavonoids, which have a wide range of therapeutic effects [Ivashchenko, 2017b]. There is data proving that as to the flavonoid content in the leaves of vegetable plants, edible chrysanthemum (5.14%) and edible amaranth (4.52%) are close to such well-known medicinal plants as *Eleuthero coccus* sp., gentian (*Gentiana* sp.) and knotgrass (*Polygonum aviculare* L. aggr.) [Gins et al., 2014]. Natural phenolic compounds are potent antioxidants and pharmacologically active compounds capable of correction of various pathological conditions, including those caused by infectious damage of the body. Numerous studies show that garland chrysanthemum contains significant amounts of phenolic compounds and has antioxidant properties, irrespective of the plant growth conditions [Kim et al., 2011; Gins et al., 2014].

With regard to the content of sugars, the varieties of *G. coronaria* var. *discolor* and var. *coronaria* do not differ (17.48 and 17.47%, respectively). The difference was also insignificant in the content of fats (3.97 and 4.13%) (Table 1). P.F. Kononkov et al. [2011] reported the fat content of the plant as 2.97%. Due to its low fat content and high amounts of carbohydrate and protein, garland chrysanthemum belongs to the group of dietary food products [Cherevchenko et al., 2012]. An important property is titratable acidity, which reflects the content of free organic acids [Krishchenko, 1983]. In garland chrysanthemum, this figure was 3.93 – 4.83%.

The largest amount of calcium was distinguished in *G. coronaria* var. *discolor* – 1.108% (Table 1). Calcium plays an important biological role in the body: it takes part in the formation of the skeleton, participates in

muscle contraction, enables the cleavage of glycogen, contributes to the coagulation of blood, etc.

The content of phosphorus in the aerial part of the two varieties of garland chrysanthemum is negligible – 0.10% – 0.11% (see Table 1). The biological role of phosphorus is associated with formation and regeneration of cells, assimilation of vitamins, development of teeth and bones, exchange of energy, regulation of acid – base balance, functioning of kidneys, nerves and heart muscles.

According to the research by A. Akrout et al. [2010], in the aerial mass of garland chrysanthemum the calcium content was 1.65%, phosphorus – 0.12%, which is, in general, consistent with our results. P.F. Kononkov et al. [2011] also reported the low contents of phosphorus (0.53%) and ash (5.1%).

According to Student's criterion, at a significance level of 0.05, plants of *G. coronaria* var. *discolor* and var. *coronaria* were not statistically different in terms of dry matter, total sugars, carotene, ascorbic acid, phosphorus, calcium, ash, tannins, fats, microelements of copper, zinc, iron, except for manganese, the amount of which in *G. coronaria* var. *coronaria* was much higher.

CONCLUSIONS

Biochemical composition of the aerial biomass from *G. coronaria* introduced in Central Polissya of Ukraine shows that the plants contain a number of valuable compounds, such as ascorbic acid, carotene, sugars, fats, individual macro- and microelements, tannins. Plants introduced in Central Polissya contain a higher amount of carotene, vitamin C and fats in comparison with those growing under conditions of the Ukrainian Forest-Steppe zone and Moscow Region, respectively [Cherevchenko et al., 2012; Gins et al., 2012]. The introduced plants have a lower content of calcium and phosphorus than those from Tunisia and Moscow Region, respectively. These findings show that biochemical parameters of plants, in addition to the genotype characteristics, depend on the environmental conditions of the region of research.

The obtained results testify that *G. coronaria* is a valuable introduced plant, being a potentially rich source of biologically active compounds necessary for human life. The study proves that *G. coronaria* is a promising vegetable culture for introduction in the Central Polissya zone of Ukraine, as well as other climatically similar temperate regions of the world. This species is a good source of raw material for food industry, pharmacy and cosmetology.

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Ukraynanın Mərkəzi Polissiya ərazisinə introduksiya olunmuş *Glebionis coronaria* (Asteraceae) biokimyəvi xüsusiyyətləri

İrina İvaşenko, Alla Bakalova

Jitomir Milli Aqroekoloji Universitet, Staryy Bulvar 7 küç., Jitomir, 10002, Ukrayna

Camal Raxmetov, Valentino Fişenko

Ukrayna MEA-nın N.N.Qrişko adına Milli Botanika bağı, Timiryazevskaya 1 küç., Kiyev 01014, Ukrayna

Glebionis coronaria (= *Chrysanthemum coronarium*; Asteraceae) payızgülü, xrizantema kimi yerli adlarla tanınan qiymətli tərəvəz, dərman və bəzək bitkisidir. Bu növ Ukraynanın Mərkəzi Polissiya ərazisində becərilmir; bu səbəbdən, bu dəyərli və olduqca davamlı bitki növünün introduksiyasını tədqiq etmək və onun biyokimyəvi xüsusiyyətlərini öyrənmək vacibdir. Cari tədqiqatın məqsədi payızgülünün iki variasiyasının, *G. coronaria* var. *discolor* and *G. coronaria* var. *coronaria*. bitki nümunələrinin müqayisəli biokimyəvi analizini aparmaqdır. Tədqiqatın vəzifəsi bitkinin vegetasiya şəraitindən asılı olaraq yerüstü kütlədə qiymətli maddələrin miqdarına introduksiya şəraitinin təsirini; eləcə də bitkilərin qida, əczaçılıq və kosmetologiya sənayesində istifadə imkanlarını müəyyən etməkdən ibarətdir. İntroduksiya tədqiqatları 2014-2016-cı illərdə Jitomir Milli Agroekoloji Universitetinin Botanika Bağının eksperimental sahələrində, biokimyəvi tədqiqatlar isə Ukraynanın MEA M.M. Qrişko adına MBB-nin Kultural flora şöbəsinin laboratoriyasında aparılıb. Ukraynanın Mərkəzi Polissiya ərazisində introduksiya olunan *G. coronaria* bitkisinin yerüstü biokütləsinin biokimyəvi tərkibinin öyrənilməsi nəticəsində askorbin turşusu, karotin, şəkər, yağ, müəyyən makro-, mikroelementlər və aşı maddəsi kimi bir sıra qiymətli maddələrdən ibarət olduğu aşkar edilmişdir. Bitkinin iki variasiyasının (var. *discolor*, var. *coronaria*) quru maddə tərkibi statistik olaraq, ümumi şəkər, karotin, askorbin turşusu, fosfor, kalsium, kül, aşı maddəsi, yağ, mis, sink, dəmir, margans istisna olmaqla oxşar olması müəyyən edilmişdir; belə ki, margans *G. coronaria* var. *coronaria* taksonunda daha yüksəkdir. Tədqiqat illəri ərzində vegetasiya dövrlərindən asılı

olaraq bitkilərin biokimyəvi göstəriciləri dəyişib. Əldə edilmiş nəticələr təsdiq edir ki, *G. coronaria* qiymətli introduksiya olunmuş bitkidir və insanın həyat fəaliyyəti üçün zəruri olan potensial zəngin bioloji aktiv maddələr mənbəyidir. *Glebionis coronaria* qida və əczaçılıq sənayələrində istifadə məqsədilə Ukraynanın Polissiya zonasında və iqlim cəhətdən oxşar mülayim regionlarda becərilmə üçün perpektivli tərəvəz bitkisidir.

Açar sözlər: *növ, müxtəliflik, biokimyəvi birləşmələr, bioloji aktiv maddələr.*

Биохимические особенности *Glebionis coronaria* (Asteraceae) при интродукции в Центральном Полесье Украины

Ирина Иващенко, Алла Бакалова

Житомирский национальный агроэкологический университет, ул. Старый Бульвар 7, Житомир, 10002, Украина

Джамал Рахметов, Валентина Фищенко

Национальный ботанический сад имени Н. Н. Гришко НАН Украины, ул. Тимирязевская 1, Киев 01014, Украина

Glebionis coronaria (= *Chrysanthemum coronarium*; Asteraceae) - ценная овощная, лекарственная, декоративная культура, растение известно под народными названиями златоцвет обыкновенный, златоцвет увенчанный, т.д. Этот вид не культивируется в Центральном Полесье Украины, поэтому интродукционное изучение этого ценного и неприхотливого растения, в том числе его биохимических особенностей, актуально. Целью работы было проведение сравнительного биохимического анализа растительного сырья разновидностей хризантемы увенчанной: *G. coronaria* var. *discolor* и *G. coronaria* var. *coronaria*. для определения влияния условий интродукции на содержание ценных соединений в надземной массе растений в зависимости от условий вегетации; выяснение возможности использования растений в пищевой промышленности, фармации, косметологии. Интродукционные исследования проводили в течении 2014–2016 гг. на экспериментальных участках ботанического сада Житомирского национального агроэкологического университета; биохимические исследования – в лаборатории отдела культурной флоры НБС имени Н.Н. Гришко НАН Украины. В результате изучения биохимического состава надземной массы *G. coronaria* при интродукции в Центральном Полесье Украины установлено, что растение содержит ряд ценных соединений: аскорбиновую кислоту, каротин, сахара, жиры, отдельные макро- и микроэлементы, дубильные вещества. Растения двух разновидностей (var. *discolor*, var. *coronaria*) статистически не отличались по содержанию сухого вещества, общих сахаров, каротина, аскорбиновой кислоты, фосфора, кальция, золы, дубильных веществ, жиров, микроэлементов меди, цинка, железа, кроме марганца, которого у *G. coronaria* var. *coronaria* значительно больше. Биохимические показатели растений изменялись по годам исследований в зависимости от условий вегетационного периода. Полученные результаты свидетельствуют, что *G. coronaria* – ценный интродуцент и является богатым источником биологически активных веществ, необходимых для жизнедеятельности человека. *Glebionis coronaria* – перспективная овощная культура для культивирования в зоне Центрального Полесья с целью использования в пищевой промышленности и фармации.

Ключевые слова: *вид, разновидности, биохимические соединения, биологически активные вещества*