EXPERIMENTAL PAPER

Chemical variability of common skullcap (*Scutellaria galericulata* L.) wild growing in the area of eastern Poland

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Summary

Introduction. In the group of plants revealing adaptogenic activity, species belonging to *Scutellaria* genus are considered to be the most important ones. Common skullcap (*Scutellaria galericulata* L.) is less known species from this genus, growing wild in Poland in wet habitats. Its herb has been used in the past as a sedative and diuretic agent. **Objective.** The aim of the study was to determine the variability of common skullcap in terms of the accumulation of flavonoids in the herb. **Methods.** The objects of the study were 17 common skullcap populations growing wild in eastern Poland. At each natural site, the list of main flowering plant species was carried out, according to Braun-Blanquet scale of plant abundance. The total content of flavonoids was determined according to EP 8th. The analysis of flavonoids was carried out using HPLC, Shimadzu chromatograph. **Results.** The total content of flavonoids ranged from 0.21 to 0.50% dry matter (DM). Using HPLC, eight compounds were identified within the group, with chrysin-7-O-glucuronide (30.91–589.27 mg × 100 g⁻¹ DM), baicalin (61.90–482.93 mg × 100 g⁻¹ DM) and scutellarin (43.77–213.54 mg × 100 g⁻¹ DM) as dominants. Chrysin was the compound which in the highest degree differentiated investigated populations (CV=0.77). **Conclusion.** Obtained results indicate that investigated common skullcap populations differed in terms of the total content of flavonoids as well as the content of identified flavonoids in the herb. However, there was no clear relationship between geographical localization of populations and the content of identified flavonoids in raw material.

Key words: populations, herb, flavonoids, baicalin, scutellarin, chrysin

INTRODUCTION

In the group of plants revealing adaptogenic activity, species belonging to *Scutellaria* genus are considered to be one of the most important. Numerous ethnopharmaceutical studies indicate that they have been used in traditional medicine of Asia, North America and Europe [1, 2]. Nowadays, among the genus, the best known is Baikal skullcap (*Scutellaria baicalenis* Georgi) indigenous to Far East Asia. Its root reveals a wide range of pharmacological activities, i.e. immunostimulant, antioxidant, antimicrobial and anti-inflammatory [1, 3-6]. The monograph of *Scutellariae baicalensis radix* has been adopted in the European Pharmacopoeia [7]. Another interesting species is barbat skullcap (*Scutellaria barbata* D.Don), also native to Asia. Its herb is mentioned in Chinese, Japanese and Korean Pharmacopoeias as a raw material of anticancer properties [8-10]. In turn, blue skullcap (*Scutellaria lateriflora* L.), wild growing in North America, is a source of herb listed in the US Pharmacopoeia. It is used as a raw material with sedative and anxiolytic properties [2, 11, 12]. Many phytochemical and pharmacological studies confirmed that the biological activity of those plants is associated with the presence of flavonoids, specific for the genus, namely: baicalein, wogonin, scutellarein and their glycosides [1, 11, 13-16].

When searching for plants with an interesting medicinal activity, other, less known species from the *Scutellaria* genus, may be noticed as well. Drawing from Polish natural medicine, one of such plants is common skullcap (*Scutellaria gale-riculata* L.), growing wild on watersides, wet meadows and in different types of alder forests. It also occurs in valuable, riparian habitats, number of which has decreased recently [17-21]. Common skullcap is a perennial, up to 70 cm tall. Its leaves, with toothed margin and acute apex are located opposite one to another on the stem. Blue-purple flowers have characteristic scutellum-like upper lip. The species blooms from June to August [20]. Its herb has been used in the past as a sedative and diuretic agent. However, there is little information concerning the chemical composition of the raw material and almost any data on the range of chemical variability of the species [22-24].

The aim of present study was to determine the variability of common skullcap located in eastern Poland, in terms the content and composition of flavonoids in the herb.

MATERIAL AND METHODS

Plant material

The objects of the study were 17 growing wild common skullcap populations located on natural sites in eastern Poland. Their geographical coordinates are provided in table 1. The harvest of herb was performed in July 2013, during full blooming. In each natural site, plant material was collected from several (min. 10) plants, then

mixed to obtain a representative sample. Collected raw material was dried at 35°C, powdered and subjected to chemical analysis. Voucher specimens were deposited at herbarium of Department of Vegetable and Medicinal Plants WULS – SGGW.

Table 1.

Geographical localization of natural sites of common skullcap populations

Population No./site		Coordinates		Province/River Valley
1.	Brańszczyk	N 52° 62.157'	E 21° 54.365'	Mazowsze
2.	Urle	N 52° 34.127'	E 21° 32.750'	Bug River Valley
3.	Poręba	N 52° 64.799'	E 21° 68.380'	
4.	Węgrów	N 52° 25.800'	E 21° 59.887'	
5.	Ogrodniki	N 52° 23.830'	E 22° 46.267'	
6.	Kóзки	N 52° 21.535'	E 22° 52.162'	
7.	Sarnaki	N 52° 19.312'	E 22° 52.792'	
8.	Strzyże	N 52° 37.750'	E 21° 60.115'	
9.	Piątnica	N 53° 18.703'	E 22° 10.229'	Podlasie
10.	Niewodowo	N 53° 14.165'	E 22° 18.326'	Narew River Valley
11.	Krzewo	N 53° 14.193'	E 22° 26.319'	
12.	Burzyn	N 53° 26.946'	E 22° 45.099'	
13.	Drozdowo	N 53° 17.716'	E 22° 11.998'	
14.	Jabłonki	N 49° 42.709'	E 22° 12.618'	Podkarpacie
15.	Obarzym	N 49° 71.522'	E 22° 20.231'	San River Valley
16.	Wara	N 49° 45.792'	E 22° 13.025'	
17.	Grabownica	N 49° 37.874'	E 22° 06.053'	

Floristic observations

At each natural site the basic floristic observations, concerning the composition and abundance of main flowering plant species were carried out. Braun-Blanquet scale of plant abundance was used [17]. Floristic observations covered the whole area of each investigated common skullcap population occurring in given natural site.

Chemical analysis

Total flavonoid content

The total content of flavonoids was determined by aluminium chloride colorimetric method according to European Pharmacopoeia 8th [25]. 0.5 g of air-dry,

powdered raw material was extracted three times with portions of 20 ml acetone, 2 ml 25% HCl, 1 ml 0.5% metenamine and kept boiling for 30 min each time. Obtained mixture was completed to 100 ml with acetone. 20 ml of mixture was subsequently extracted in the separatory funnel with 20 ml of distilled water and 15 ml of ethyl acetate by shaking for 3 minutes. Separated water-acetone phase was extracted with above-mentioned method three times more, each time with only 10 ml of ethyl acetate. Cumulated ethyl acetate extract was washed two times with 40 ml of water and completed to 50 ml. 10 ml of basic solution was mixed with 2 ml of 2% AlCl_3 and subsequently completed to 25 ml with methanol: acetic acid solution (19:1). Comparison solution for each sample was prepared by completing 10 ml of basic solution to 25 ml with methanol: acetic acid solution. The absorbance was measured at 425 nm. The total flavonoid content was expressed as quercetin equivalent (% of dry mass of raw material). All measurements were performed in triplicate.

HPLC analysis of flavonoids

1g of homogenized, air-dry raw material was extracted with 100 ml of methanol in Büchi Extraction System B-811. Soxhlet hot extraction with twenty-five extraction cycles, flushing and drying was used. After evaporation of solvent, the residue was dissolved in 10 ml of methanol. The obtained extracts were filtered with Supelco Iso-Disc™ Syringe Tip Filter Unit, PTFE membrane, diameter 25 mm, pore size $0.20\ \mu\text{m}$ and subjected to HPLC. The analyses were performed using a Shimadzu chromatograph equipped with auto sampler SIL-20, photodiode array detector SPD-M10A VP DAD and Class VP 7.3 chromatography software. A modern C-18 reversed-phase column with core-shell technology (Phenomenex Kinetex® $2.6\ \mu\text{m}$, C18, 100A, $100\times 4.60\ \text{mm i.d.}$) was used as stationary phase. Binary gradient of mobile phase A (deionised water adjusted to pH 3 with phosphoric acid) and B (ACN adjusted to pH 3 with phosphoric acid) was used as follows: 0 min, 15% B; 30 min, 75% B; 30.01 min, 95% B; 35 min, 95% B; 35.01, min 15% B. The following conditions were applied: injection volume: $1\ \mu\text{l}$, flow rate $1.0\ \text{ml}\times\text{min}^{-1}$, oven temperature 30°C , total time of analysis 10 min, UV-spectra were recorded between 190 and 450 nm. Peak identification was confirmed by comparison of retention time and UV-spectra with adequate parameters of commercially available standards purchased from ChromaDex®. Standards were separately dissolved in 10 ml volumetric flask with methanol according to the ChromaDex's Tech Tip 0003: Reference Standard Recovery and Dilution (<https://chromadex.com/Literature/TechTips.html>) and used as standard stock solutions. Further calibration levels were prepared by diluting these solutions (injected volumes ranges: 10, 50, 100, 200 and $500\ \mu\text{l}$) with methanol in 10 ml volumetric flasks. $10\ \mu\text{l}$ of the working solutions were injected in six

replicates ($n=6$) using auto sampler to generate a five-point calibration curve for each standard compound separately. Method validation (precision, linearity, regression equation) was calculated with MsExcel (data not shown). Signal-to-noise ratio approach were used to determined LOD (S/N of 3:1) and LOQ (S/N of 10:1). The peak table and spectra library (190–450 nm) of individual compounds were created. Detection wavelength applied: 266 nm (chrysin 7-O-glucuronide, chrysin), 275 nm (baicalin, baicalein), 236 nm (scutellarin, scutellarein, apigenin 7-O-glucoside, apigenin). The content of the determined compounds was calculated in $\text{mg} \times 100 \text{ g}^{-1}$ dry matter (DM).

Statistical analysis

Data were subjected to statistical analysis using Statistica® software. The coefficient of variation (CV) was determined.

Ethical approval: The conducted research is not related to either human or animal use.

RESULTS AND DISCUSSION

In Poland, the genus *Scutellaria* is represented by four wild growing species, namely: spear-leaved skullcap (*Scutellaria hastifolia* L.), tall skullcap (*Scutellaria altissima* L.), small skullcap (*Scutellaria minor* Huds.) and common skullcap (*Scutellaria galericulata* L.). Among these taxa, common skullcap is the only species widespread all over the country, others are rare or very rare [19-21, 26-29]. Literature data indicate that only common skullcap has been used in the folk medicine [1, 24]. This plant grows in humid habitats such as rushes on the edges on water tanks, located closely to wet meadows as well as alder and riparian forests [17-21] (fig. 1, 2). Floristic observations indicate that examined natural sites of common skullcap differ as to the composition and abundance of associated flowering plants (tab. 2). Among the investigated sites the most abundant were Grabownica (17), Kózki (6), Strzyże (8), Urle (2) and Piątnica (9). It may suggest that the species found there the optimum of habitat. Common skullcap was accompanied in abundance by various dominant species, as following: *Urtica dioica*, *Galium palustre*, *Frangula alnus*, *Alnus glutinosa*, *Impatiens noli-tangere*, *Carex acutiformis*, *Padus avium*, *Typha latifolia*, *Geum urbanum*, *Humulus lupulus*, *Lysimachia vulgaris*. Among observed associated plants, there were also species characteristic for rushes communities, e.g: *Carex acutiformis*, *Galium palustre*, *Iris pseudoacorus*. However, plants characteristic for other habitats, such as wet meadows, nitrophilous tall herb phytocoenoses, alder and riparian forests were present on investigated sites as well [21].

Figure 1.
Flowering plant of common skullcap

Figure 2.
Natural site of common skullcap in Kózki (population No. 6)

Table 2.

The composition and abundance of main flowering plant species present on investigated natural sites

Population No./site	Plant species with the abundance scale
1. Brańszczyk	<i>Galium palustre</i> (4), <i>Bidens tripartitus</i> (2), <i>Padus avium</i> (1), <i>Scutellaria galericulata</i> (1), <i>Carex acutiformis</i> (+), <i>Vicia cracca</i> (+), <i>Ranunculus auricomus</i> (+)
2. Urle	<i>Frangula alnus</i> (4), <i>Lysimachia vulgaris</i> (4), <i>Scutellaria galericulata</i> (3), <i>Alnus glutinosa</i> (2), <i>Iris pseudacorus</i> (1), <i>Lythrum salicaria</i> (1), <i>Carex acutiformis</i> (+)
3. Poręba	<i>Impatiens noli-tangere</i> (5), <i>Alnus glutinosa</i> (3), <i>Urtica dioica</i> (2), <i>Iris pseudacorus</i> (2), <i>Ribes nigrum</i> (1), <i>Lycopus europaeus</i> (1), <i>Scutellaria galericulata</i> (1), <i>Myosotis sylvatica</i> (1)
4. Węgrów	<i>Geum urbanum</i> (3), <i>Lysimachia nummularia</i> (2), <i>Lysimachia vulgaris</i> (2), <i>Convallaria majalis</i> (2), <i>Acorus calamus</i> (1), <i>Trifolium pratense</i> (1), <i>Taraxacum officinale</i> (1), <i>Scutellaria galericulata</i> (+), <i>Alnus glutinosa</i> (+), <i>Carpinus betulus</i> (+), <i>Artemisia vulgaris</i> (+)
5. Ogrodniki	<i>Urtica dioica</i> (2), <i>Calystegia sepium</i> (2), <i>Geum urbanum</i> (2), <i>Veronica chamaedrys</i> (1), <i>Impatiens noli-tangere</i> (1), <i>Lysimachia nummularia</i> (1), <i>Scutellaria galericulata</i> (1), <i>Galium aparine</i> (1), <i>Geranium robertianum</i> (+), <i>Alnus glutinosa</i> (+), <i>Padus avium</i> (+)
6. Kózki	<i>Alnus glutinosa</i> (4), <i>Scutellaria galericulata</i> (4), <i>Urtica dioica</i> (4), <i>Humulus lupulus</i> (4), <i>Angelica sylvestris</i> (2), <i>Lycopus europaeus</i> (1), <i>Filipendula ulmaria</i> (1), <i>Ribes nigrum</i> (+)
7. Sarnaki	<i>Alnus glutinosa</i> (2), <i>Ribes spicatum</i> (2), <i>Rubus ideaus</i> (1), <i>Urtica dioica</i> (1), <i>Calystegia sepium</i> (1), <i>Geum urbanum</i> (1), <i>Geranium robertianum</i> (1), <i>Galium aparine</i> (1), <i>Scutellaria galericulata</i> (+)
8. Strzyże	<i>Typha latifolia</i> (3), <i>Scutellaria galericulata</i> (3), <i>Urtica dioica</i> (1), <i>Calystegia sepium</i> (+)
9. Piątnica	<i>Urtica dioica</i> (4), <i>Scutellaria galericulata</i> (3), <i>Angelica sylvestris</i> (2), <i>Alnus glutinosa</i> (1), <i>Impatiens noli-tangere</i> (1), <i>Lycopus europaeus</i> (1), <i>Filipendula ulmaria</i> (1), <i>Glechoma hederacea</i> (1), <i>Typha latifolia</i> (+), <i>Stachys palustris</i> (+)
10. Niewodowo	<i>Alnus glutinosa</i> (3), <i>Rubus ideaus</i> (1), <i>Calystegia sepium</i> (1), <i>Scutellaria galericulata</i> (1), <i>Stachys palustris</i> (+), <i>Galium aparine</i> (+)
11. Krzewo	<i>Urtica dioica</i> (4), <i>Impatiens noli-tangere</i> (4), <i>Trifolium pratense</i> (1), <i>Scutellaria galericulata</i> (1), <i>Alnus glutinosa</i> (+), <i>Geranium palustre</i> (+)
12. Burzyn	<i>Urtica dioica</i> (4), <i>Alnus glutinosa</i> (3), <i>Humulus lupulus</i> (3), <i>Solidago virgaurea</i> (2), <i>Galium aparine</i> (2), <i>Scutellaria galericulata</i> (+), <i>Ribes spicatum</i> (+)
13. Drozdowo	<i>Urtica dioica</i> (3), <i>Calystegia sepium</i> (2), <i>Glechoma hederacea</i> (2), <i>Impatiens noli-tangere</i> (2), <i>Humulus lupulus</i> (2), <i>Scutellaria galericulata</i> (2), <i>Rubus idaeus</i> (1), <i>Alnus glutinosa</i> (1), <i>Geranium palustre</i> (1), <i>Stachys palustris</i> (1), <i>Ribes spicatum</i> (+), <i>Typha latifolia</i> (+)
14. Jabłonki	<i>Padus avium</i> (3), <i>Impatiens noli-tangere</i> (2), <i>Bidens tripartitus</i> (2), <i>Corylus avellana</i> (1), <i>Iris pseudacorus</i> (1), <i>Acorus calamus</i> (1), <i>Alisma plantago-aquatica</i> (1), <i>Lysimachia nummularia</i> (1), <i>Scutellaria galericulata</i> (+), <i>Salvia glutinosa</i> (+)
15. Obarzym	<i>Carex acutiformis</i> (4), <i>Scutellaria galericulata</i> (2), <i>Iris pseudacorus</i> (1), <i>Acorus calamus</i> (1), <i>Eupatorium cannabinum</i> (1), <i>Galium palustre</i> (+), <i>Lythrum salicaria</i> (+), <i>Potentilla anserina</i> (+), <i>Carpinus betulus</i> (+), <i>Symphytum officinale</i> (+)
16. Wara	<i>Urtica dioica</i> (2), <i>Lythrum salicaria</i> (1), <i>Galium palustre</i> (1), <i>Calystegia sepium</i> (+), <i>Eupatorium cannabinum</i> (+), <i>Scutellaria galericulata</i> (+)
17. Grabownica	<i>Scutellaria galericulata</i> (4), <i>Urtica dioica</i> (2), <i>Iris pseudacorus</i> (2), <i>Alnus glutinosa</i> (1), <i>Padus avium</i> (1), <i>Lythrum salicaria</i> (1), <i>Alisma plantago-aquatica</i> (1)

As mentioned before, flavonoids are considered to be the most important group of secondary metabolites responsible for multidirectional pharmacological activities of the raw materials collected from *Scutellaria* species. In the present study the total content of flavonoids in the herb of common skullcap populations ranged from 0.21 (population Strzyże and Krzewo) to 0.50% DM (population Grabownica) (tab. 3). It is known that these group of plants synthesize a particular type of flavonoid compounds characterized with triple (e.g. baicalein, wogonine) or quadruple (e.g. scutellarein) hydroxylation of the ring [30]. The research carried out in this work confirmed the presence of those substances in common skullcap herb as well. Eight compounds were identified within the group, in the analyzed raw materials, namely: baicalein, baicalin, scutellarein, scutellarin, chrysin, chrysin-7-O-glucuronide, apigenin and apigenin-7-glucoside. Chrysin-7-O-glucuronide appeared to be the dominant compound (from 30.91 to 589.27 mg $\times$ 100 g⁻¹ DM, CV=0.64), followed by baicalin (from 61.90 to 482.93 mg $\times$ 100 g⁻¹ DM, CV=0.52) and scutellarin (from 43.77 to 213.54 mg $\times$ 100 g⁻¹ DM, CV=0.48) (tab. 3, fig. 3). The content of apigenin and apigenin-7-glucoside ranged between 12.34 and 30.92 mg $\times$ 100 g⁻¹ as well as 12.21 and 59.89 mg $\times$ 100 g⁻¹ DM, respectively. The content of identified flavonoid aglycones was clearly lower in comparison with their glycosides. Population No. 3 (Poręba) was distinguished by the highest content of baicalin and scutellarin, while population No. 4 (Węgrów) by chrysin-7-O-glucuronide. The highest differences among populations concerned the content of chrysin (CV=0.77) and chrysin-7-O-glucuronide (CV=0.64) (tab. 3). No relation between geographical localization of populations and the content of identified flavonoid compounds in the raw materials has been detected. The content of those compounds may be affected by other factors, e.g. genetic, edaphic or climatic (water, light and temperature conditions). Among them genotype seems to be the most important [31].

Figure 3.

Chemical structure of main flavonoids identified in the common skullcap herb: a – Baicalin, b – Scutellarin, c – Chrysin 7-O glucuronide

Table 3.

Total content of flavonoids (% DM) and content of identified flavonoid compounds (mg $\times 100$ g⁻¹ DM)

	Total content of flavonoids	Flavonoid compounds							
		Baica- lein	Baicalin	Scutella- rein	Scutella- rin	Chry- sin	Chrysin 7-O glucu- ronide	Api- genin	Apigenin 7-glucoside
1. Brańszczyk	0.44	42.40	237.48	8.02	154.70	76.62	257.82	21.48	41.73
2. Urle	0.40	37.31	196.05	10.04	109.54	134.84	452.21	13.61	36.07
3. Poręba	0.44	57.10	482.93	31.67	213.54	27.16	279.37	14.71	55.95
4. Węgrów	0.35	55.77	265.50	9.20	190.18	150.36	589.27	20.74	58.12
5. Ogrodniki	0.28	39.01	148.13	9.62	85.16	143.18	418.65	24.03	28.24
6. Kózki	0.36	70.24	240.16	11.46	52.33	19.56	30.91	27.52	19.68
7. Sarnaki	0.27	44.02	134.52	8.51	49.70	166.63	344.88	23.20	29.28
8. Strzyże	0.21	36.82	75.12	7.31	143.05	43.12	241.30	15.92	23.57
9. Piątnica	0.29	29.22	128.19	14.05	48.13	28.37	44.43	14.02	12.42
10. Niewodowo	0.24	71.82	226.26	18.78	43.77	25.96	63.11	30.92	17.18
11. Krzewo	0.21	40.22	237.97	8.52	134.42	42.11	191.45	14.45	23.63
12. Burzyn	0.41	36.32	61.90	11.12	121.53	41.89	435.50	14.69	12.21
13. Drozdowo	0.45	47.98	399.85	8.73	166.34	110.12	274.35	27.04	59.89
14. Jabłonki	0.30	43.98	205.93	10.22	82.55	26.88	93.53	25.05	26.93
15. Obarzym	0.22	35.53	216.74	11.12	133.64	42.73	256.11	24.96	50.83
16. Wara	0.24	49.10	212.18	20.85	52.61	23.97	65.58	23.55	26.67
17. Grabownica	0.50	59.42	468.18	11.27	174.91	36.87	247.14	12.34	51.64
Mean	0.33	46.84	231.59	12.38	115.06	67.08	252.09	20.48	33.77
CV	0.29	0.26	0.52	0.50	0.48	0.77	0.64	0.29	0.48

DM – dry matter; CV – coefficient of variation

The results presented in the study correspond with those obtained by other authors. Some of them state that baicalein and its sugar derivatives are the main secondary metabolites of common skullcap herb [13, 16, 22], while other consider chrysin-7-O-glucuronide as a dominant compound in the raw material [23].

According to numerous data, flavonoids detected in the raw materials collected from *Scutellaria* species reveal specific pharmacological activities. Recent studies show that chrysin (a benzodiazepine receptor ligand) indicates anxiolytic activities, while scutellarin improves microcirculation, decrease blood viscosity and demonstrate antihypertensive activity in cerebrovascular diseases. In turn, baicalin reveals spasmolytic effects [32-39]. The above mentioned flavonoids are also responsible for antioxidant, anticancer, antimicrobial, immunostimulant and anti-inflammatory effects [40-49]. Thus, those results may explain the application of common skullcap herb in folk medicine as a sedative and diuretic agent.

CONCLUSIONS

1. The populations differed in terms of the total content of flavonoids as well as the content of identified flavonoids in the herb.
2. The identified flavonoid compounds occurred predominantly in the form of glycosides. Chrysin-7-O-glucuronide and baicalin were present in the highest amount, while chrysin differentiated investigated populations at the highest degree.
3. There was no clear relationship between geographical localization of populations and the content of identified flavonoids in the herb.

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ZRÓŻNICOWANIE CHEMICZNE TARCZYCY POSPOLITEJ (*SCUTELLARIA GALERICULATA* L.) DZIKO ROSNĄCEJ NA TERENIE WSCHODNIEJ POLSKI

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Streszczenie

Wstęp. Wśród roślin wykazujących właściwości adaptogenne, gatunki należące do rodzaju *Scutellaria* uważane są za jedno z najważniejszych. Tarczycza pospolita (*Scutellaria galericulata* L.) jest mniej znanym gatunkiem z tego rodzaju, występującym w Polsce na siedliskach podmokłych. Ziele tej rośliny stosowano w medycynie ludowej jako środek uspokajający i moczopędny. **Cel.** Celem pracy było określenie zakresu zróżnicowania wewnątrzgatunkowego tarczyczy pospolitej (*Scutellaria galericulata* L.) pod kątem gromadzenia się związków flawonoidowych w ziele. **Metody.** Obiekt badań stanowiło 17 dziko rosnących populacji występujących na terenie wschodniej Polski. Na każdym stanowisku wykonano spis florystyczny głównych roślin kwiatowych, z uwzględnieniem ich ilościowości według skali Braun-Blanqueta. Ogólną zawartość flawonoidów oznaczono według Farmakopei Europejskiej 8. Analizę HPLC flawonoidów przeprowadzono przy użyciu chromatografu firmy Shimadzu. **Wyniki.** Ogólna zawartość flawonoidów wahała się od 0,21 do 0,50% suchej masy (s.m.) w przeliczeniu na kwercetynę. Wśród 8 związków czynnych zidentyfikowanych przy użyciu HPLC w największej ilości występowały: 7-O glukuronid chryzyny ($30,91\text{--}589,27 \text{ mg} \times 100 \text{ g}^{-1} \text{ s.m.}$), bajkalina ($61,90\text{--}482,93 \text{ mg} \times 100 \text{ g}^{-1} \text{ s.m.}$) i skutelaryna ($43,77\text{--}213,54 \text{ mg} \times 100 \text{ g}^{-1} \text{ s.m.}$). Związkiem różnicującym badane populacje w najwyższym stopniu była chryzyna ($CV=0,77$). **Wnioski.** Otrzymane wyniki wskazują, że badane populacje tarczyczy pospolitej różniły się zarówno pod względem ogólnej zawartości flawonoidów, jak i poziomu oznaczonych związków z tej grupy. Nie stwierdzono jednak wyraźnej zależności pomiędzy położeniem geograficznym badanych populacji a zawartością zidentyfikowanych związków w surowcu.

Słowa kluczowe: populacje, ziele, flawonoidy, bajkalina, skutelaryna, chryzyna