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Intraspecific variability of common skullcap (*Scutellaria galericulata* L.) occuring in the eastern area of Poland

INTRODUCTION

In searching new plants revealing adaptogenic activity, species belonging to *Scutellaria* genus have been specially taken into consideration. Plants indigenous to Asia, like *Scutellaria baicalensis* or *Scutellaria barbata* are well known in Western Medicine due to its various pharmacological activities. The common usage of other *Scutellaria* species in North America and Europe folk medicine suggests that these plants may contain interesting active compounds and seem to be a very promising object of future studies (Shang et al. 2010). Drawing from Polish natural medicine, some herbs are discovered again. One of such plants is common skullcap *(Scutellaria galericulata* L), growing wild in Poland on watersides, wet meadows and in boggy forests (Matuszkiewicz 2008). Its herb has been used in the past as a sedative and diuretic agent. The biological activity of this plant is compared to *Scutellaria lateliflora* – blue skullcap, an important medicinal herb described in Pharmacopoeia of United States as tonic, sedative and anxiolytic (Awad et al. 2003). According to Malikov and Yuledashev (2002), the herb of common skullcap contains specific flavonoids: baicalin, wogonin, chrysin and scutellarin – main compounds responsible for various biological activities of plants belonging to *Scutellaria* genus – but, as yet, there were only few trials concerning the evaluation of chemical composition of this species (Malikov and Yuledashev 2002, Wolfson and Hoffman 2003).

The aim of the presented study was to determine intraspecific variability of common skullcap wild growing in Eastern Poland, in respect of the content and composition of biological active compounds. Special attention was paid on the accumulation of phenolic compounds.

MATERIAL AND METHODS

Seventeen natural sites with significant prevalence of common skullcap was localized in the eastern area of Poland, in valleys of the Bug, Narew, Biebrza and San rivers. The geographical location of each site was described using GPS apparatus (Table 1). The phytosociological observations were carried out using Braun-Blanquet method (Matuszkiewicz 2008, Wysocki and Sikorski 2002). The herb was collected from each site at the full blooming stage of plants development, in July 2011. Raw material was dried at a temperature of 40 ºC, powdered and subjected to chemical analysis. The total content of flavonoids, phenolic acids and tannins was carried out according to Polish Pharmacopeia VIII (2008). The content and composition of flavonoids was determine using HPLC method, on Shimadzu chromatograph equipped with auto sampler SIL-20, photodiode array detector SPD-M10A VP DAD, Phenomenex Kinetex® 2.6 µm, C18, 100A, 100×4.60 mm column and Class VP 7.3 chromatography software.

The results were analysed with one-way ANOVA and Tukey's HSD test at α = 0.95 using Statgraphics Plus for Windows v. 4.1 software.

Table 1. Localization of common skullcap natural sites

No.	population	geographical location (coordinates)		region
1.	Brańszczyk	N 52° 62.157′	E 021° 54.365′	
2.	Urle	N 52° 34.127′	E 021° 32.750′	
3.	Poręba	N 52° 64.799′	E 021° 68.380′	
4.	Węgrów	N 52° 25.800′	E 021° 59.887′	mazowieckie
5.	Ogrodniki	N 52° 23.830′	E 022° 46.267′	
6.	Kózki	N 52° 21.535′	E 022° 52.162′	
7.	Sarnaki	N 52° 19.312′	E 022° 52.792′	
8.	Piątnica	N 53° 18.703′	E 022° 10.229′	
9.	Niewodowo	N 53° 14.165′	E 022° 18.326′	
10.	Krzewo	N 53° 14.193′	E 022° 26.319′	
11.	Strzyże	N 52° 37.750′	E 021° 60.115′	podlaskie
12.	Burzyn	N 53° 26.946′	E 022° 45.099′	
13.	Drozdowo	N 53° 17.716′	E 022° 11.998′	
14.	Jabłonki	N 49° 42.709′	E 022° 12.618′	
15.	Obarzym	N 49° 71.522′	E 022° 20.231′	
16.	Wara	N 49° 45.792′	E 022° 13.025′	podkarpackie
17.	Grabownica	N 49° 37.874′	E 022° 06.053′	

Photo 1. The natural site of common skullcap in Jabłonki

Photo 2. The natural site of common skullcap in Obarzym

Photo 3. The natural site of common skullcap in Ogrodniki

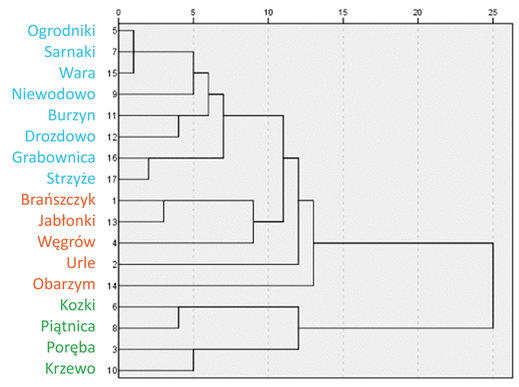
Photo 4 & 5. The common skullcap plants

RESULTS

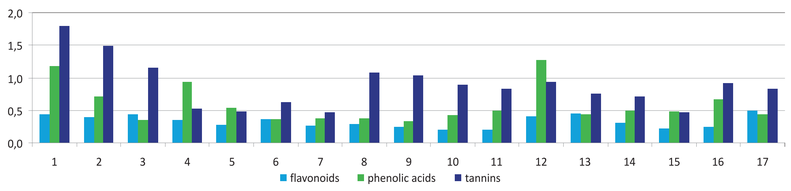
The natural sites of *Scutellaria galericulata* were classified to three phytocoenosis types. Populations occurring in Ogrodniki, Sarnaki, Wara, Niewodowo, Burzyn, Drozdowo, Grabownica and Strzyże belong to *Galio-Urticenea* group. Sites from Brańszczyk, Jabłonki, Węgrów, Urle and Obarzym were described as *Magnocaricion* phytocoenosis, while these from Kózki, Piątnica, Poręba and Krzewo were classified to *Fraxino-Alnetum*. There was no clear relationship between the geographical region and type of plant phytocoenosis. The investigated populations differed in the content and chemical composition of analysed biologically active compounds. The total flavonoid content in the herb varied from 0.21% to 0.60%; phenolic acids: from 0.33% to 1.27%, and tannins: from 0.47% to 1.80%. Using HPLC analysis eight flavonoids were detected i.e. baicalin, baicalein, scutellarin, scutellarein, chrysin, chrysin 7-glucoside, apigenin and apigenin 7-glucoside. The dominants were: baicalin (61,90 - 482,9 mg/100g), scutellarin (43,77-213,5 mg/100g) and chrysine 7-glucoside (30,91-589,2 mg/100g). Plants collected from Poręba natural site were characterised by the highest content of baicalin (482,9 mg/100g) and scutellarin (213,5 mg/100g) – flavonoids indicating an important pharmacological activity (Shang et al. 2010).

The chemical composition of common skullcap herb confirms the adequate direction of its usage in folk medicine. Taking into consideration the similarity in flavonoids composition to *S. lateriflora* herb, which is efficient in nervous diseases treatment as tonic and sedative (Awad et al. 2003), the *S. galericulata* seems to be a very interesting object of future studies.

Table 2. Dendrogram of phytosociological analysis

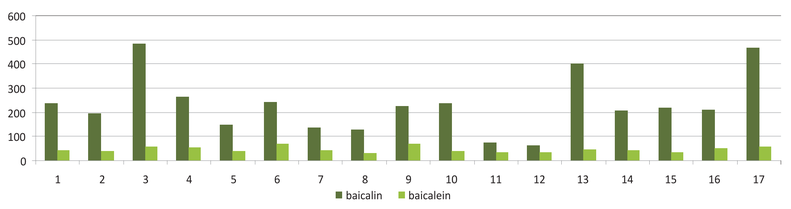


- *ARTEMISIETEA VULGARIS* LOHM., PRSG et R.TX. in R.TX. 1950
  - *GALIO-URTICENEA* (PASS. 1967)
- *PHRAGMITETEA* R.TX. ET PRSG 1942
  - *PHRAGMITETALIA* KOCH 1926
    - *MAGNOCARICION* KOCH 1926
- *QUERCO-FAGETEA* BR.-BL. ET VLIEG. 1937
  - *FAGETALIA SYLVATICAE* PAWŁ. IN PAWŁ., SOKOL. ET WALL. 1928
    - *ALNO ULMION* BR.-BL. ET R.TX. 1943
      - *FRAXINO-ALNETUM* W.MAT. 1952



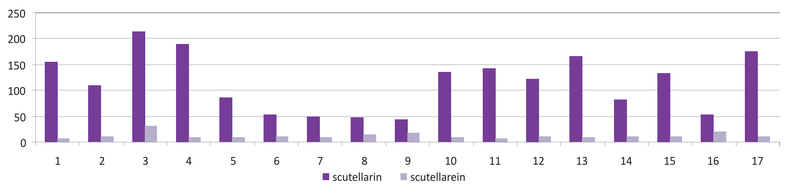
$NIR_{0.05}$ flavonids = 0.02
$NIR_{0.05}$ phenolic acids = 0.05
$NIR_{0.05}$ tannins = 0.15

Figure 1. The total content of phenolic compounds in common skullcap herb (%)



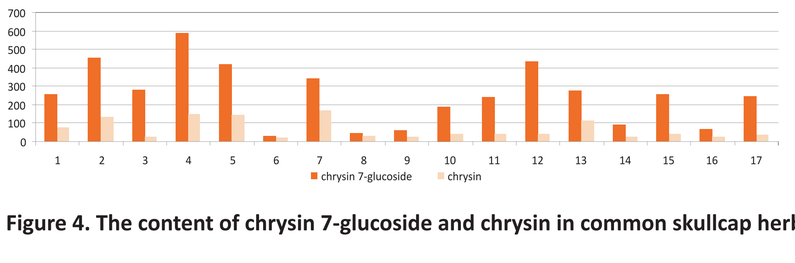
$NIR_{0.05}$ baicalin = 45.90
$NIR_{0.05}$ baicalein = 11.60

Figure 2. The content of baicalin and baicalein in common skullcap herb (mg $100g^{-1}$)



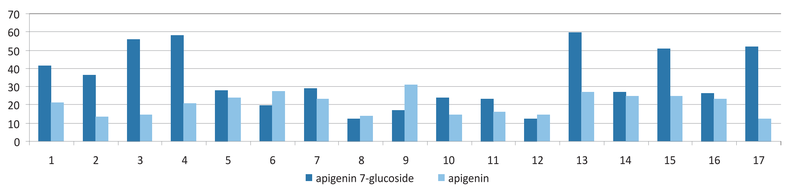
$NIR_{0.05}$ scutellarin = 32.60
$NIR_{0.05}$ scutellarein = 5.08

Figure 3. The content of scutellarin and scutellarein in common skullcap herb (mg $100g^{-1}$)



$NIR_{0.05}$ chrysin 7-glucoside = 53.00
$NIR_{0.05}$ chrysin = 23.30

Figure 4. The content of chrysin 7-glucoside and chrysin in common skullcap herb (mg $100g^{-1}$)



$NIR_{0.05}$ apigenin 7-glucoside = 9.65
$NIR_{0.05}$ apigenin= 7.13

Figure 5. The content of apigenin 7-glucoside and apigenin in common skullcap herb (mg $100g^{-1}$)

CONCLUSIONS

1. **The natural sites of *Scutellaria galericulata* were classified to three types of phytocoenosis: *Galio-Urticenea*, *Magnocaricion* and *Fraxino-Alnetum*. Most of them belongs to *Galio-Urticenea* group.**
2. **There was no clear relationship between the geographical origin of population and type of phytocoenosis.**
3. **The investigated populations differed in the content and chemical composition of analysed biologically active compounds.**
4. **The total content of flavonoids varied from 0.21% to 0.60%; phenolic acids: from 0.33% to 1.27%, and tannins: from 0.47% to 1.80%.**
5. **In the herb eight flavonoids were detected i.e. baicalin, baicalein, scutellarin, scutellarein, chrysin, chrysin 7-glucoside, apigenin and apigenin 7-glucoside, with the domination of baicalin, scutellarin and chrysine 7-glucoside.**
6. **Herb collected from Poręba natural site was characterized by the highest content of baicalin (482,9 mg/100g) and scutellarin (213,5 mg/100g) – important from the pharmacological point of view flavonoids.**

LITERATURE

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