

CHEMICAL VARIABILITY OF GREAT BURNET (*SANGUISORBA OFFICINALIS* L.) GROWING WILD IN POLAND

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Introduction

Great burnet (*Sanguisorba officinalis* L.) is a perennial belonging to the family *Rosaceae*. In Poland it usually occurs on the wet piedmont meadows. The herb and underground organs of this plants have been traditionally used as haemostatics in haemorrhage and epistaxis, and in gastrointestinal disorders (Cheng and Cao, 1992). Nowadays the extracts from great burnet are applied also as antioxidant and antibacterial agents, mainly due to high content of phenolic compounds (Zhu et al., 1999; Cai et al., 2004; Gribova et al., 2008).

The aim of the investigation was to compare ten populations of great burnet growing wild in Poland in respect of phenolic compounds accumulation.

Materials and methods

Plant material used for the experiment were herb and underground organs (rhizomes with roots) of great burnet collected from natural sites located in three regions of Poland: Malopolska, Podlasie, and Sudety (Fig. 1). The herb was harvested in July, and roots in September 2008. The plant material was cut and dried at 50°C. Total content of tannins and phenolic acids were determined according to Polish Pharmacopoeia (Farmakopea Polska VI 2002). Phenolic compounds were determined by HPLC.

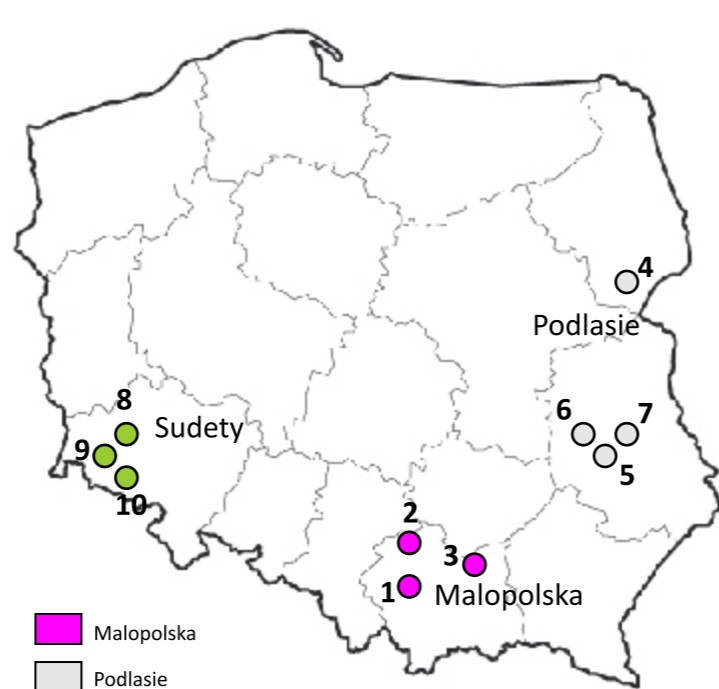


Fig. 1. Distribution map of the investigated populations in Poland

References

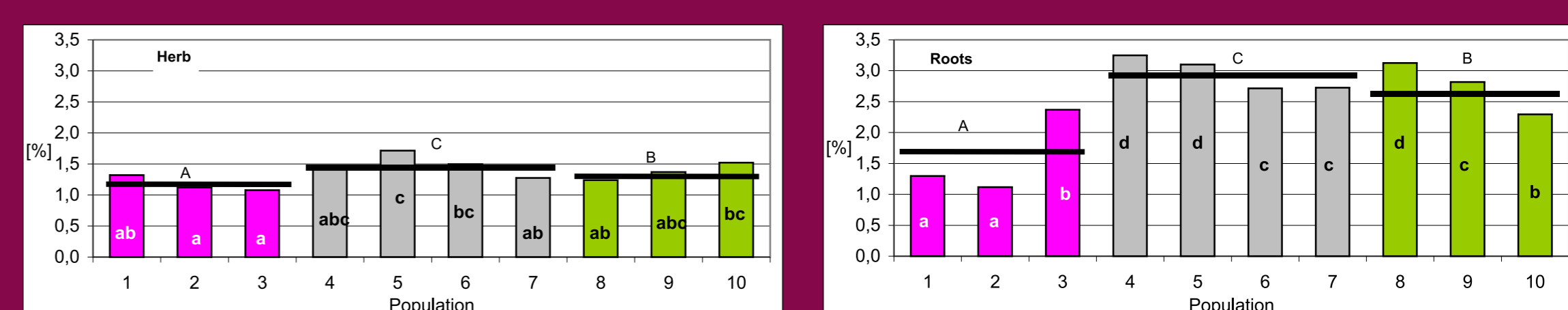
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Results

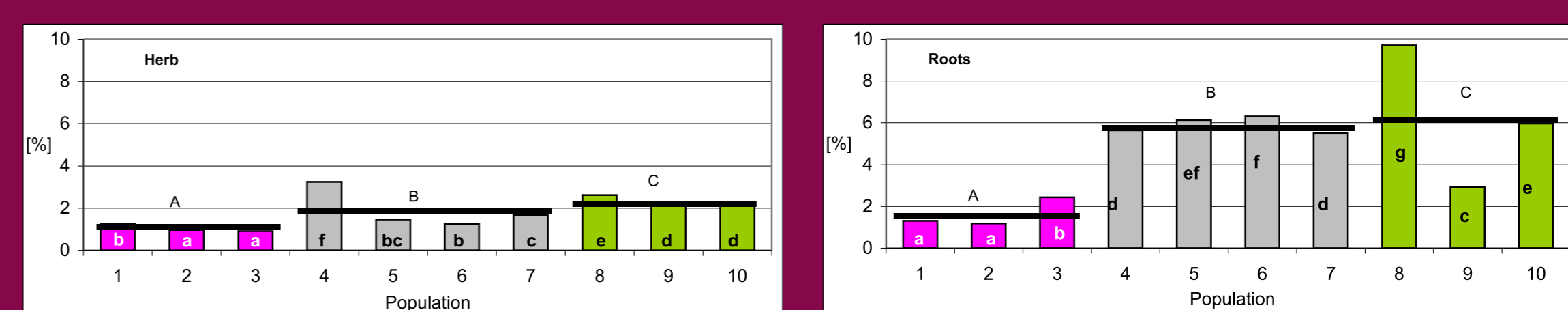
The studies revealed considerable differences in the content of determined phenolic compounds both between the populations originating from different regions of Poland and between the populations from the same region. Distinct differences in the content and composition of these compounds between herb and underground organs were also observed.

Herb was characterized by considerably lower content of tannins and phenolic acids in comparison with underground organs. The investigated populations were more differentiated in respect of the content of these compounds in underground organs than in herb. Populations from Podlasie and Sudety were richer in tannins and phenolic acids than populations from Malopolska (Fig. 2-3).

In herb five phenolic acids were identified, namely: chlorogenic, ellagic, gallic, caffeic, and rosmarinic acid, whereas in underground organs two phenolic acids (ellagic and gallic) and four catechin derivatives (*+/+*-catechin, *-/-*-epigallocatechin, *-/-*-epicatechin, and *-/-*-epigallocatechin gallate) (Tab. 1). In herb of populations from Sudety and Podlasie the main phenolic acid was gallic acid, while in herb from Malopolska – chlorogenic one. In rhizomes with roots it was gallic acid, which has been previously found by Cai et al. (2004). The highest content of this compound in herb was characteristic for the populations from Sudety, whereas in underground organs – for the populations from Podlasie. Gallic acid was reported to be pharmacologically active, e.g. in the treatment of some types of cancer and neural disorders (Ban and al., 2008). Catechins present in high amount in underground organs of great burnet investigated in this study are known as strong antioxidants (Harada et al., 1999; Nguyen et al., 2008; Yilmaz and Toledo, 2004). The populations from Podlasie and Sudety were distinctly richer in these compounds compared to the populations from Malopolska.



Differences between populations from the same region – the values indicated with the same small letter are not significantly different according to Duncan's test ($\alpha=0.01$)
Differences between the regions – the values indicated with the same big letter are not significantly different according to Duncan's test ($\alpha=0.01$)
Fig. 2. The total content of phenolic acids in herb and underground organs (%)



Differences between populations from the same region – the values indicated with the same small letter are not significantly different according to Duncan's test ($\alpha=0.01$)
Differences between the regions – the values indicated with the same big letter are not significantly different according to Duncan's test ($\alpha=0.01$)
Fig. 3. Total content of tannins in herb and underground organs (%)

Table 1. Content of identified phenolic compounds in herb and underground organs [$\text{mg}\times 100\text{g}^{-1}$]

Population	Malopolska			Mean	Podlasie			Mean	Sudety			Mean	
	1	2	3		4	5	6		7	8	9		10
Herb													
Chlorogenic acid	453.0 b*	502.2 c	142.4 a	365.9 C**	117.3 a	244.2 c	226.0 b	272.4 c	247.5 A	352.3 c	325.1 b	257.6 a	311.7 B
Ellagic acid	255.3 c	226.3 b	98.3 a	193.3 C	56.4 a	55.8 a	56.2 a	54.9 a	55.6 A	122.2 c	74.7 a	100.3 b	99.1 B
Gallic acid	272.2 b	387.6 c	153.2 a	270.9 A	169.6 a	304.7 c	307.9 c	272.2 b	294.0 B	561.8 c	344.1 a	505.2 b	470.4 C
Caffeic acid	58.9 a	35.7 b	19.0 a	37.9 A	54.1 ab	45.4 a	52.2 ab	65.8 b	54.4 B	47.4 b	35.2 ab	22.5 a	35.0 A
Rosmarinic acid	188.9 b	205.2 c	113.7 a	169.3 B	25.2 a	54.1 b	119.1 c	116.4 c	96.5 A	468.8 c	203.6 a	232.3 b	301.6 C
Roots													
Ellagic acid	185.3 a	253.9 b	170.5 a	203.3 A	15.2 a	115.8 b	297.8 d	159.3 c	190.0 A	186.8 b	273.1 c	119.5 a	193.1 A
Gallic acid	637.4 c	557.3 b	526.3 a	573.7 A	477.7 a	1128.1 d	853.2 c	629.1 b	870.1 C	826.6 c	766.5 b	276.8 a	623.3 B
Catechin	695.6 c	525.7 a	602.2 b	607.8 A	394.3 a	647.0 b	1112.6 d	796.9 c	852.1 C	1124.2 c	691.5 b	431.1 a	748.9 B
Epicatechin	114.8 b	60.7 a	122.0 b	99.2 A	670.1 a	907.6 b	981.3 d	960.9 c	949.9 C	927.2 b	966.1 c	487.6 a	793.6 B
Epigallocatechin	433.6 b	258.3 a	500.5 c	397.4 A	217.0 a	334.5 b	550.6 d	405.4 c	430.2 B	605.5 c	411.7 b	303.1 a	440.1 B
Epigallocatechin gallate	193.8 a	183.6 a	328.0 b	235.1 A	294.0 b	636.5 c	718.0 d	260.8 a	538.4 B	710.6 b	745.6 c	229.9 a	562.0 B

Conclusions

1. Significant intraspecific variability of wild growing in Poland great burnet in respect of the content of phenolic compounds was found.
2. Herb and underground organs of great burnet differed in the content and composition of identified phenolic compounds.
3. Dominated phenolic compounds in herb were gallic and chlorogenic acids, whereas in underground organs – gallic acid, *+/+*-catechin and *-/-*-epicatechin.