

# ACCUMULATION OF BIOLOGICALLY ACTIVE COMPOUNDS IN ABOVE – AND UNDERGROUND ORGANS OF COMMON AVENS (*GEUM URBANUM* L.)

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## Introduction

*Geum urbanum* L. (*Rosaceae*) is a perennial, widely distributed in Europe, Asia and North America (Wyk and Wink, 2004). Above- and underground organs of this plant are used in traditional medicine in problems with stomachache, sore throat and ulceration (Duke, 2004).

Pharmacological activity of common avens depends on the polyphenolic acids and tannins. Underground organs contain also volatile oil with eugenol as a dominant compound (Wichtl, 2004).

Taking in to consideration the high chemical diversity of wild growing plants, in this study the trials of common avens cultivation have been done. The influence of plants age and harvest time on the quality of above- and undergrounds organs of common avens was investigated.



## Materials and methods

The object of the study was one and two years old population of common avens (*Geum urbanum* L.) originating from a natural site in Podlasie region and grown at the experimental field of the Department of Vegetable and Medicinal Plants in Warsaw. Above – and underground organs at different stage of plant development were collected. Weight of raw materials was determined. Qualitative analysis of phenolic acids and catechins was performed by HPLC. The essential oils were isolated by hydrodistillation according to Polish Pharmacopoeia VI (2002) and analyzed by GC. The results were evaluated with one-way ANOVA Tukey HSD test at the 0.05 significance level in Statgraphics Plus for Windows v. 4.1.



## Results

The weight of above- and underground organs increased a during vegetation period both in one and two years old plants (Fig. 1).

HPLC analysis revealed significant differences in content of phenolic compounds as depended of the plant organs, age of plantation and date of harvest (Table 1 and 2). Four phenolic acids and two catechins were identified in aboveground organs (Table 1). The content of ellagic acid and epicatechin gallate was the highest in rosette leaves. Flowering shoots were characterized by especially high content of chlorogenic and caffeic acids. Spring root leaves were relatively poor in detected compounds.

Two phenolic acids and five catechins were found in underground organs. Underground organs of one-year old plants collected in the beginning of plant dormancy was especially rich in epigallocatechin. Underground organs collected at full plant blooming stage (second year of plant vegetation) were characterized by high content of ellagic acid, gallic acid and epicatechin gallate.

Content of essential oil in the roots was higher in the first year of plant vegetation in comparison with second year (Fig. 2). There was not distinct relationship between age of the plants and the content of eugenol and nopinone in essential oil (Fig. 3).

Table 1. Content of phenolic compounds in air-dry aboveground organs ( $\text{mg} \times 100\text{g}^{-1}$ )

		Stage of plant development		
		First year of plant vegetation	Second year of plant vegetation	
		Rosette leaves 04.09.08	Spring root leaves 17.04.09	Flowering shoots 10.06.09
Phenolic acids	Ellagic	193,55 a	54,49 c	84,56 b
	Gallic	39,98 c	47,20 b	52,62 a
	Chlorogenic	12,37 c	54,05 b	99,05 a
	Caffeic	13,05 c	22,59 b	45,74 a
Catechins	(+)-Catechin	7,09 a	5,56 b	7,05 a
	(-)-Epicatechin gallate	58,60 a	28,30 b	29,34 b

Values marked with the same letter do not differ significantly at  $\alpha=0.05$

Table 2. Content of phenolic compounds in air-dry underground organs ( $\text{mg} \times 100\text{g}^{-1}$ )

		Stage of plant development		
		First year of plant vegetation	Second year of plant vegetation	
		Beginning of plant dormancy 10.11.08	Full blooming 10.06.09	Beginning of plant dormancy 08.11.09
Phenolic acids	Ellagic acid	90,31 b	110,92 a	48,78 c
	Gallic acid	72,68 b	96,60 a	46,54 c
Catechins	(+)-Catechin	132,47 c	175,49 a	166,73 b
	(-)-Epicatechin	167,21 a	66,26 b	168,81 a
	(-)-Epigallocatechin	421,40 a	327,22 b	184,56 c
	(-)-Epicatechin gallate	180,00 b	282,66 a	90,37 c
	(-)-Epigallocatechin gallate	57,96 a	55,47 a	53,88 a

Values marked with the same letter do not differ significantly at  $\alpha=0.05$

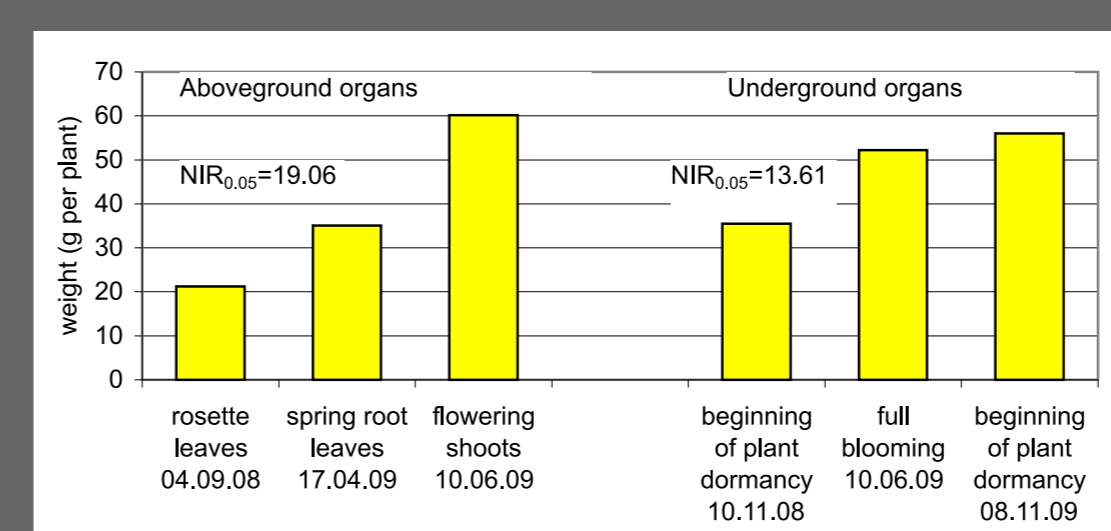


Fig. 1 Weight of air-dry above - and underground organs

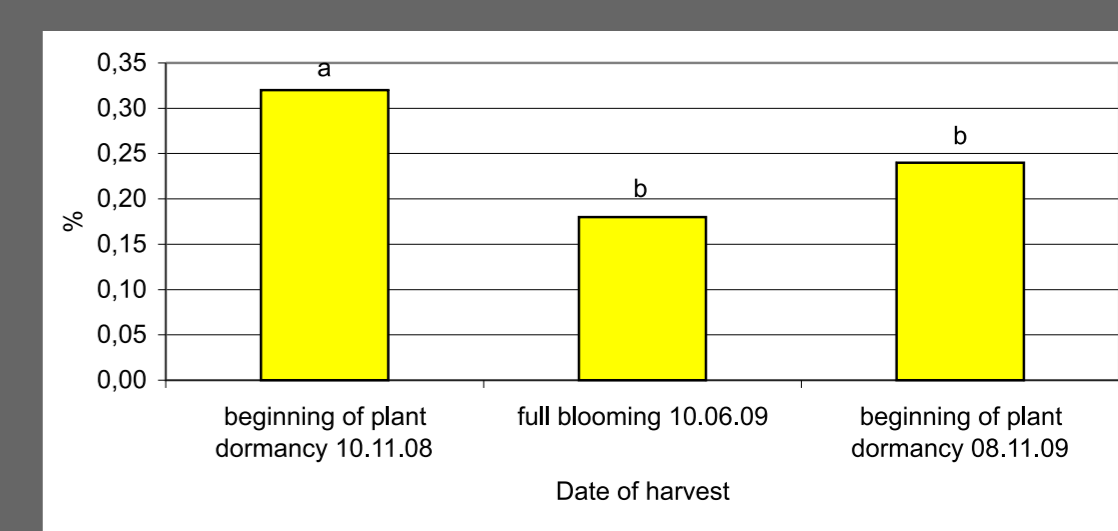


Figure 2. Content of essential oil in underground organs (%)

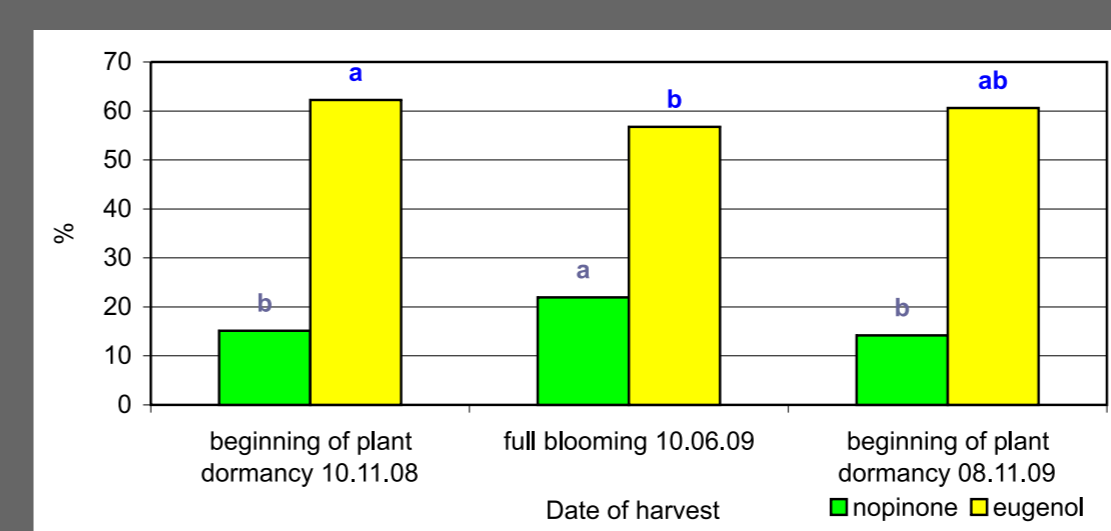


Figure 3. Content of nopinone and eugenol in essential oil (%)



Photo 1. One-year old plant of common avens



Photo 2. Underground organs from one-year old plant of common avens 10.11.08



Photo 3. Underground organs of two-years old plant of common avens 08.11.09



## References

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