

Cowslip (*Primula veris* L.) chemical composition

dependence on the soil

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Introduction

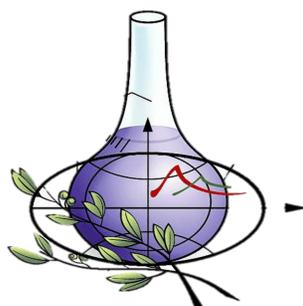


The cowslip (*Primula veris* L.) is an herbaceous perennial species of flowering plant in the family *Primulaceae*. The plant is most common in Western and Central Europe, Southern Scandinavia, the Baltic States, and even Siberia.

The bright yellow flowers start to bloom in spring. The *P. veris* is frequently found on open fields, dry meadows, sloping and rare and dry forests, forest sites. Plant is a characteristic of nutrient-poor habitats.

Cowslip is a well-known medicinal plant. The main compounds identified in plant roots, leaves and flowers are triterpene saponins as well as phenolic compounds, including flavonoids, phenolic acids, and phenolic glycosides. A significant content of tannins in cowslip defines its astringent, anti-inflammatory, antimicrobial, and antioxidant activity. High levels of ascorbic acid are found in aerial parts of cowslip plants. The yellow color of the flowers indicates carotenoids accumulation. The major carotenoids detected in the yellow flowers of *P. veris* are (9Z)-violaxanthin, (all-E)-violaxanthin, lutein, and antheraxanthin. Scientists state that the leaves' predominant carotenoids, such as lutein and β -carotene, are essential for the photosynthesis processes. Leaves, stalks, and flowers of cowslip contain chlorophyll *a* and *b*. It is known that all parts of cowslip plant accumulate up to 7% (dw) mineral content.

The aim of this study was to determine the influence of different soil on the chemical composition of cowslip (*Primula veris* L.) leaves and inflorescences.



Methodology

The cowslip (*Primula veris* L.) leaves and inflorescences were collected in April–May of 2019 in different regions of Lithuania. The areas were about 10 km away from the main roads. The main properties of the soil plough layer presented in Table 1. Each area of the experimental plot was 3 m². The plot was divided into three fields of 1 m² (three replications). 1 kg of the cowslip leaves and inflorescences was harvested separately from each field and laboratory samples were prepared.

Table 1. The main properties of the soil plough layer

	pH _{KCl}	Available phosphorus (P ₂ O ₅) mg kg ⁻¹	Available potassium (K ₂ O) mg kg ⁻¹	Available nitrogen (N) mg kg ⁻¹	Available iron (Fe) mg kg ⁻¹
Area No. 1	6.4	47	75	0.12	1206
Area No. 2	6.9	184	168	0.08	1476

The leaves and inflorescences were analysed immediately after harvesting. Dry matter, soluble solids, ascorbic acid content, titratable acidity was determined by standard methods. Total carotenoid content, chlorophyll *a* and chlorophyll *b* were analysed by using a two-ray UVS-2800 spectrophotometer. The total phenolic content was established by using the Folin–Ciocalteu reagent. The amount of crude ash was determined by the dry burning of samples at a temperature of 500° C. The number of mineral elements was determined from the dry mass of the plants. Phosphorus was measured photometrically, calcium content was established according to Commission Directive. The potassium content was determined by flame photometry, magnesium, iron, copper, manganese, zinc and boron contents were identified by atomic absorption spectrophotometry.

The results were analysed by using a two-way analysis of variance (ANOVA). Fisher's LSD test was applied to assess significant differences between mean values at the significance level of $p < 0.05$.

Results

Table 2. Chemical composition of Cowslip (*Primula veris* L.)

	Leaves		Inflorescences	
	Area No. 1	Area No. 2	Area No. 1	Area No. 2
Ascorbic acid, mg kg ⁻¹ fw	123.20 b	110.64 a	140.43 c	121.64 b
Total carotenoids, mg kg ⁻¹ fw	160.29 b	181.53 b	128.67 ab	68.76 a
Chlorophyll <i>a</i> , mg kg ⁻¹ fw	386.06 c	374.44 c	155.59 b	69.35 a
Chlorophyll <i>b</i> , mg kg ⁻¹ fw	470.60 c	334.14 b	263.74 b	145.13 a
Total phenolics, mg GRE g ⁻¹ fw	3.76 c	1.41 a	1.25 a	1.58 bc
Crude ash, % dm	10.92 b	11.08 b	5.91 a	7.52 ab
Phosphorus, % dm	0.30 b	0.55 c	0.23 a	0.29 b
Potassium, % dm	3.75 c	2.29 b	1.46 a	3.48 c
Calcium, % dm	0.90 b	0.38 a	0.40 a	0.91 b
Magnesium, % dm	0.29 c	0.21 b	0.17 a	0.36 d
Copper, % dm	5.30 a	14.70 c	9.35 b	5.70 a
Zinc, % dm	14.80 a	35.10 d	18.00 c	16.80 b
Boron, % dm	19.60 c	17.40 b	13.00 a	23.90 d
Manganese, % dm	36.70 a	670.50 b	1676.00 c	43.30 a
Iron, % dm	142.30 c	249.30 d	121.70 b	71.60 a

Main conclusions

The correlations showed the dependence of the chemical composition of cowslip (*Primula veris* L.) aerial parts on the soil composition. Higher amounts of dry matter, ascorbic acid, chlorophyll *a* and *b*, and total carotenoids were found in the leaves and inflorescences of plants collected in area No. 1. In the plant 's leaves and inflorescences from area No. 2 were established higher content of crude ash, although the amounts of individual mineral elements varied unequally.