



# Developmental and chemical diversity of *Valeriana officinalis* L.

## INTRODUCTION

Valerian (*Valeriana officinalis* L.) root is an important medicinal raw material. According to European Pharmacopeia it is standardised for valerenic acids and essential oil content. The species is highly diversified in respect of developmental and chemical traits. This variability is strictly combined with strong heterogeneity owing to allogamy of the plant. In Poland, up to 1970' valerian roots was collected mainly from natural sites. Nowadays, the raw material is harvested exclusively from cultivated plants. The local landrace called 'Lubelski' is the most popular. However, it reveals a number of traits typical for wild growing plants. This landrace was the object of our studies aiming to determine the range of developmental and chemical variability.

## MATERIALS AND METHODS

The object of the study was valerian ('Lubelski' landrace), cultivated at the experimental field of Warsaw University of Life Sciences – SGGW. In the first year of plant vegetation, at the beginning of October, the plants were evaluated in the weight of underground organs (rhizomes with roots). The content of sesquiterpenic acids, namely: valerenic and acetoxyvalerenic acids (using HPLC) and the content of essential oil (according to Ph. Eur.) in the raw material was investigated, as well.

In the second year of vegetation the following developmental traits were evaluated: the shape and colouration of rosette leaves, the number and height of inflorescences (thyrses), the period of flowering, the colour of flowers, the viability of pollen, the yield of seeds per plant, 1000-seeds weight and germinability of seeds. The observations were carried out on 100 randomly chosen plants (out of 300).

## RESULTS

The investigated plants were diversified significantly when regards the investigated traits. Fresh weight of roots ranged from 200.0 to 4460.0 g per plant (Tab. 1). The plants varied distinctly in terms of valerenic and acetoxyvalerenic acids content (CV 60.1% and 57.0%, respectively) as well as content of essential oils (CV 36.8%) in the roots (Tab. 1).

The diversity was clearly visible concerning the morphological traits of aboveground organs. The plants differed in terms of intensity of anthocyanin colouration of leaves as well as the depth of crenation on the leaf margin. Plants with green leaves and medium depth of crenation were the most common among the investigated object (Fig. 1 and 2).

The obtained results show high diversity concerning the number of inflorescences (CV 47.4%) whereas the height of plants was more uniform (CV 11.3%) (Tab. 1). The beginning of flowering period was noticed at the end of second decade of May. The full blooming stage was observed from the end of May to the first decade of June (Fig. 4).

Among the investigated landrace the majority of plants were distinguished by pink (49%) or pale pink (36%) flowers, while those with white flowers were the rarest (15%) (Fig. 3). The seed setting began two weeks after the beginning of flowering. The development of valerian inflorescences is typical for wild growing plants i.e. at the same time, the buds, flowers and seeds are produced (Fig. 4).

The obtained results show high diversity concerning the mass of seeds per plant (CV 37.1%), whereas the diversity regarding viability of pollen (CV 15.3%), 1000-seeds weight (CV 17.2%) as well as germinability (CV 10.2%) was relatively low (Tab. 1).

Table 1. Characteristics of investigated landrace

underground organs (1 <sup>st</sup> year of plant vegetation)	mean	min. - max.	CV (%)
fresh mass of roots per plant (g)	1098.9	200.0-4460.0	56.6
content of acetoxyvalerenic acid (%)	0.11	0.00-0.42	57.0
content of valerenic acid (%)	0.14	0.00-0.43	60.1
content of essential oil (%)	0.74	0.31-1.65	36.8
aboveground organs (2 <sup>nd</sup> year of plant vegetation)			
plant height (cm)	166	126-218	11.3
number of inflorescence	16	5-38	47.4
pollen viability (%)	85.96	31.88-99.04	15.3
the yield of seeds per plant (g)	23.60	8.75-54.23	37.1
1000-seeds weight (g)	0.688	0.480-0.841	17.2
germinability (%)	85.7	71.9-96.0	10.2



Photo. 1-3. Plants of different colouration of leaves

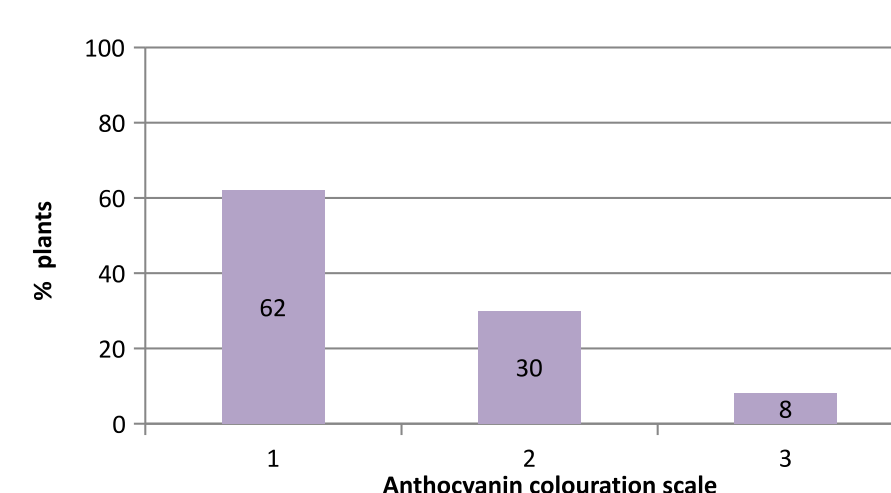


Fig. 1. The intensity of colouration of leaves: 1 - green; 2 - anthocyanin; 3 - strong anthocyanin

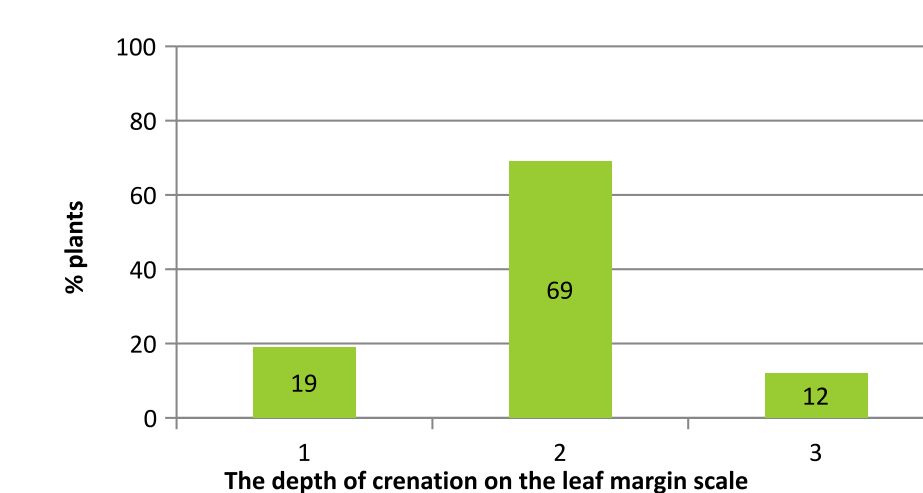


Fig. 2. The depth of crenation on the leaf margin: 1 - shallow; 2 - medium; 3 - deep



Photo. 4. Flowering plants

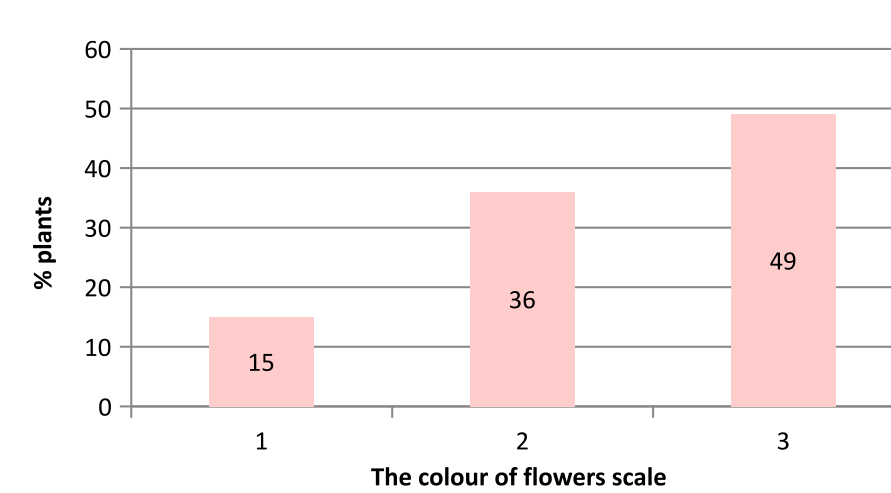


Fig. 3. The colour of flower corolla: 1 - white; 2 - pale pink; 3 - pink



Photo. 5. The flowers



Photo. 6. The stigma with germinating pollen grains



Photo. 7. The achene with pappus

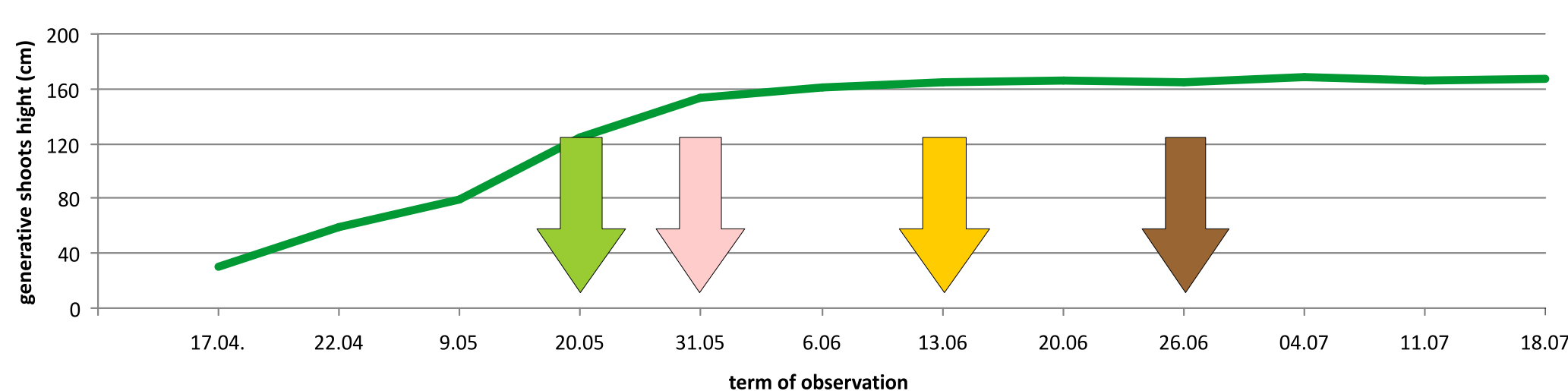


Fig. 4. Developmental stages: beginning of flowering, full flowering, fruit ripening, fruit dispersion

## SUMMARY

The most important active compounds in valerian roots are sesquiterpenic acids. High variability of the investigated landrace in respect of their accumulation gives a chance to use it in the breeding programmes.



Photo. 8. The inflorescence at the fruit ripening stage



Photo. 9-10. Seeds germination

