Variability of Morphological Characters and Active Compound Contents in *Salvia verticillata* L. in the Czech Republic

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Abstract: Whorled clary was chosen as one of the medicinal plants with prospects for the reconstruction of flowering meadows in some areas of the Czech Republic. Nevertheless, production of uniform seed mixtures for these purposes brings a risk of decreasing the natural biodiversity of such meadow phytocenoses; and therefore the variability of its morphological characteristics and the content of essential oil in individual populations of this genus in the Czech Republic were studied. Among the studied populations, statistically significant differences in morphological characters were found, but not in the contents of the essential oil.

Keywords: biodiversity; content of essential oil; lilac sage; variability; whorled clary

Medicinal plants are frequent and important components of flowering meadows; therefore such meadows can also be conceived as a kind of *in situ* or on-farm conservation of medicinal plants. *Salvia verticillata* (whorled clary) is one of the important medicinal plants used for the reconstruction of flowering meadows in the Czech Republic. The variability of morphological characteristics and the content of the pharmaceutically active substances of *Salvia verticillata* were studied in 2006 and 2007.

Plant populations from 7 natural sites in 4 protected landscape areas (PLA) in the Czech Republic (Bílé Karpaty Mts – Suchovské mlýny, Březová, Brumov-Bylnice; České středohoří Mts – Radobýl; Jizerské hory Mts – Rydvaltice; Moravský kras – Březina lom, Macošská stráň) were chosen for experiments, and collecting missions of the plant materials were accomplished in 2004. Mother plants (at least 10 plants per locality) were used to set up a field nursery in Olomouc. All plants were grown under the same field and climatic conditions in the field nursery, and were treated in the same ways (watering, weeding, harvesting, etc.). Statistical evaluation of the data obtained was done by ANOVA, one-factor analysis of variance, with a significance level $\alpha = 0.05$ resp. 0.01.

Variability of the morphological characteristics was evaluated according to the Minimal set of descriptors (designed for the Czech Gene Bank information system of plant genetic resources). Plant height and width, length and width of leaves, and length of inflorescences were measured in the field (Table 1). Field cultivation in the Olomouc nursery decreased the differences between the natural conditions of the original localities; nevertheless, highly significant statistical differences in both evaluated years were found between samples from individual localities, as well as between samples from particular protected landscape areas.

According to the literature, plant height should be up to 80 cm (Tutin *et al.* 1972); another source refers a wider range (20–) 30–90 (–100) cm (Štěpánková 2000). Our plants, in field conditions, ranged between 31 and 114 cm, which is in favour of the hypothesis that field conditions

Table 1. Evaluation of variability of morphological characteristics (in cm) in 2006 and 2007 (No. of examined plants = 22)

Characteristics	Min–max	Average ± SD
Height of plants	31–114	83.6 ± 17.2
Width of plants	40–186	122.7 ± 32.9
Leaf length	8–33.5	19.6 ± 4.3
Leaf width	4–18	9.2 ± 2.0
Length of inflorescences	16–81	41.9 ± 12.4

SD – standard deviation

support the spread of plants. Leaf length in the botanical literature is described as a (4–) 6–9 (–12) cm long leaf blade and (3–) 6–10 (–15) cm long leaf petiole (Štěpánková 2000); and this data is in accordance with our measurements where leaves were 8–33.5 cm long. However, big differences were found in the leaf width. According to Štěpánková (2000), the leaf blade is (3–) 5–7 (–9) cm wide, but our plants in the field had significantly wider leaves, up to 18 cm. Big differences in the length of inflorescences (16–81 cm), which were always measured as the length of the primary inflorescence from first branching to the top, are probably connected with the common growing potency of the studied plants. Unfortunately, it was not possible to compare this characteristic with the literature data.

The content of essential oils was analysed in a mixed sample from each group of plants, and each group was analysed separately. All the plant samples from the field nursery were prepared in the same way: the stems in full flowering stage were harvested by hand, dried at a temperature lower than 35°C (in a drying house with controlled air circulation), and ground by a laboratory homogenizer. Each sample representing the locality was a mixture of all the plants of the group. The content of essential oil was then measured gravimetrically by hydrodistillation (acc. Anonymous 1987). Two repetitions of the measurements were used in each sample.

Krstic *et al.* (2007) stated that the essential oil content of dry mass in *Salvia verticillata* in Serbia ranged from 0.40% to 0.42%. Our plants, however, only reached between 0.028 and 0.072% of dry mass (0.063% in average), which is extremely low compared to the samples from Serbia. Of course, this situation is strongly influenced by different climatic and soil conditions in each country, but the differences are too large for such an explanation on its own; and we have to also consider extremely different genotypes. The results of our measurements were so similar that no statistically significant differences were found between samples from individual localities in the Czech Republic (significance level $\alpha = 0.05$: F critical value = 2.70; F value = 0.97); also no statistically significant differences were found in our experiment between the results in 2006 and 2007 (significance level $\alpha = 0.05$: F critical value = 4.30; F value = 1.79). The content of essential oil is quite low, compared to other clary species; but its composition could be interesting, for example in the production of herbal pesticides (Pavela & Neugebauerová 2008).

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