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Conservation monitoring of a *Crocus reticulatus Stev*. population on Somlyó-hill, near Oradea (Nagyvárad)

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Abstract. Typical occurrences of *Crocus reticulatus* in Hungary are grasslands on sandy or loess soils and secondary woody vegetation, mainly black locust (*Robinia pseudo-acacia*) plantations which replace original common oak forest-steppes on sandy soils. Such kind of oak forests as *Crocus reticulatus* habitats are very rare. After our former investigations in E-Hungary and on the sandy hills of S-Nyírség (Cîmpia Nirului), we continue the work around the state boundary between Hungary and Romania. The Somlyó-hill (Dealul Şomleu) is situated SE of Oradea, at about 10 km from the city, above Betfia village. Here, the habitat of *Crocus* is very different from that around the sand hills of Nyírség, that is why the location is very interesting from a scientific pont of view. The occurrence is a karstic plateau sloping to S-SE. Here, as local people recalled, some hundreds of *Crocus* flower yearly. Management of the habitat is grazing by sheep and some (illegal) burning. The habitat has a legal status as a protected area. This occurrence is one of the easternmost in the Pannon region, which emphasizes the special character of the Betfia occurrence. The article deals with the population dynamics, variability, and viability of the local population of the species.

Introduction

The distribution of *Crocus reticulatus* is Pontic-Mediterran. The species' area is situated between E-Italy and the Caucasus. The known westernmost oc-

currences are in Kraina and in Friaul and on Monte Spaccato near Trieste (Jávorka 1964). Further east, the northern boundary of its area crosscuts the Pannon region. In Hungary, it occurs West of Danube on the Kisalföld, Bakonyalja, Mezőföld, and the Transdanubian-hills. Between the Danube and Tisa rivers, known localities are on the sand hills of Kiskunság and on Gödöllő-hills. East of Tisa river, the populations are restricted to the sand hills of Nyírség (Jávorka 1964, Farkas 1999, Molnár 2003). Habitats in Hungary are closed grasslands on sandy or loess soils, common oak forest-steppes on sandy soils and secondary woody vegetation, mainly black locust plantations which replace these oak forests.

In the Nyírség region, which includes in recent work the Romanian Érmellék (Cîmpia Ierului) too, the size of the population probably reaches hundreds of thousands of individuals. The main causes of its gradual loss are the mechanized forestry and replacement of former oak forest-steppes with black locust tree plantations. Only relic populations and sub-populations have survived until now in this region. As it was mentioned, the species occurs easternmost around Nyírség, at Valea lui Mihai (Érmihályfalva) (Máthé & Tamássy 1941). They found a larger population in a park-like oak forest-steppe (*Quercetum roboris stepposum*) on a sand-dune in the forest. Recently Carol Karácsonyi has published data from Săcuieni (Székelyhíd) (2002).

Somlyó-hill is a forerunner of Királyerdő (Padurea Craiului) mountains. The habitat of *Crocus* here is a S-SE-sloping karst limestone hillside managed by sheep-grazing and sometimes with burning as we mentioned above. Compared with the widespread sandhill habitats, the karst occurrence is uncommon, therefore we repeated our investigations on this population, too, using the same methods with those we carried out in the Nyírség region formerly (Hamecz 2010, 2011).

Crocus reticulatus is a fragile, early spring plant. Its scientific name originated from the reticulate surface of its bulbs. It has light green leaves with a white midrib, which are 1-2 mm wide. The flowers erect directly from the bulb or from a 1-2 cm long stem-internode. *Crocus* does not have aboveground parts of stem during flowering time. The flowers are usually solitary, rarely forming groups of 2-3 flowers. They have actinomorphyc simmetry. The oblongate or elliptic tepals are variable in colour from whitish to purple. Outer tepals are darker and have 3 brownish or purple stripes on their dorsal side. This is the origin of the Hungarian name and an abandoned scientific one: variegated crocus. The flowers have 1-2 membranous kataphyla. The thready stigma is long, 3-lobed and orange. Flowering period starts in February-March, even through a snow layer. The capsule is 3-sected. It erects high above the ground on the elongated stem of the flower after blossom. It is egg-shaped, acute or acuminate and its sections have membranous

walls and many seeds. The seeds are globose, yellowish-brown or ruddy (Boros 1965; Csapody 1982; Farkas 1999; Molnár 2003). The species is protected in Hungary but unprotected in Romania.

Lajos Simonkai remarked the occurrence of *Crocus reticulatus* on Somlyó-hill in 1890 but without any description of its habitat. Pop & Hodisan (1972) carried out phytocoenological investigations around Oradea and on Somlyó-hill too. In their article we can read a detailed description of open and woody vegetation types of Somlyó. They did not mention any occurrences of *Crocus* from the southern slopes, possibly because they were there in summertime and not earlier. Márton Venczel, a paleontologist at Museum Ţării Crişurilor in Oradea, called our attention on this occurrence. The Museum Ţării Crişurilor is the nature protection manager of the karst hill as a Natura 2000 Habitat Directive site. The karst holes of Somlyó hill are rich in vertebrate-remains dated in lower Pleistocene. Paleontological investigations have been carried out here since the early 20th century (Venczel 1998).

Materials and methods

We mapped the occurrences of individuals on Somlyó-hill in the 3rd week of March 2012 (Fig. 1). Where the density of specimens was higher, we counted them in a settled circle with a 5 m radius. We demonstrate these high-density patches on a Goggle Earth slide. We also drew up data about the morphological characters of 100 individuals in the field. The selected individuals represented as good as possible the whole population. We registered the following features:

- No. of vegetative (sterile) and reproductive (fertile) stems
- No. of leaves per stems
- No. of flowers on fertile stems

After the early springtime data-collection, at the end of June, we made 10 phytocoenological relevés of 5x5 m each on the known GPS-located *Crocus* occurrences. 5 of these relevés were on stony grassland and the other 5 at the ecotone between woody and grassy vegetation.

Results

The Goggle Earth map section (Fig. 2) demonstrates that the grouping of specimens on stony grasslands N and NE above the abandoned limestone-mine, at the wood limits, is larger than in the centre of the studied area. This map reflects the ecological character of this steppe and forest-steppe species which prefers

Fig. 1 - Early spring picture of the closed limestone slope steppic grassland.

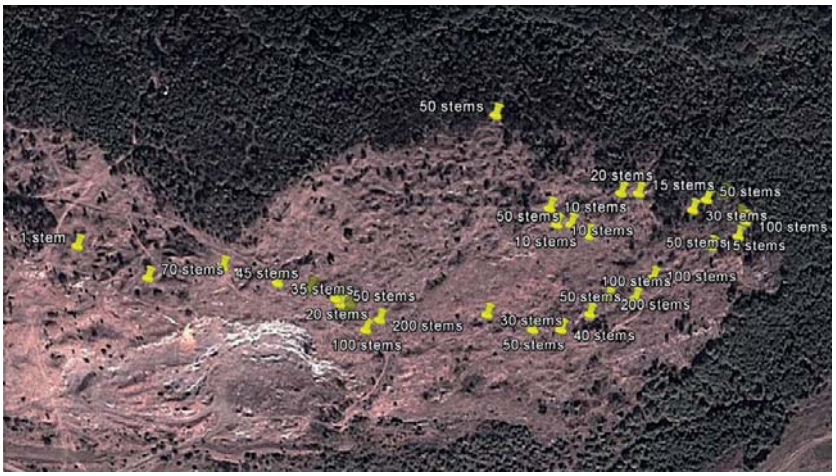

Fig. 2 - *Crocus* occurences on Google map section of the studied area carstic top of Somlyó hill.

exposed, sunny conditions. *Crocus* does not like the karst surfaces where the soil cover is too thin. However, at shelters of bigger rock-outcrops they form groups. We estimate plus 200-300 specimens outside of our 5 m radius counting circles on the hill-slope. The size of the population is near 3,000 individuals.

From investigations on morphological characters, the fact resulted that most individuals start to flower while in the stage with 3-4-leaved stems. Most sterile stems are 2-leaved (Fig. 3). Very few 4-leaved stems were without any flower (Fig. 4). These results are highly consistent with our former ones from Nyírség region, where there were no 2-leaved stems with flowers, and 3-leaved stems without flowers (Hamecz 2011).

Among reproductive stems, only 2 were carrying 2 flowers. This phenomenon is more frequent in Nyírség. There was a flower wearing 13 tepals (Fig. 5). The gynoecium and androecium were also abnormal inside this flower.

We summarize our phytocoenological relevés in Table 1. There was no significant difference of cover values between the inner part of the grassland and the ecotones at the edge of woodlands (85,6 and 84,2 % respectively) (where *Crocus* is growing). Even close to the rocky outcrops, where small bare soil-surfaces were detectable, the cover reached 84,9 %. It seems that these grasslands are more closed recently then they were found by Pop & Hodisan (1972).

Positive processes occur even on the slightly grazed S-SE gentle slopes, where we could count 60 species in our 10 relevés, a much higher number than in 1972: 37 species only. *Festuca valesiaca* cover reached 30 %, while *Bothriochloa ischaenum* reduced to 20 % during this period.

Pop & Hodisan (1972) placed this association into *Andropogonetum ischaemi* Krist 1937 and in the association-group of *Festucion sulcatae* Soó 1940. Based on our relevés we propose to include this grassland according to Borhidi's coenological system (Borhidi 2003) as follows: association class of xeric end meso-xeric grasslands (*Festucetalia valesiacae* Br.-Bl. & R. Tx. Ex Br.- Bl.1949); association group of Pannon steppic and dry grasslands (*Festucion rupicolae* Soó 1940 corr. 1964). The closest relative stands of the association occur on Cserhát-hills (N-Hungary), a limestone talus sloped steppic grassland, *Sedo acris-Festucetum valesiacae* (Penszka 1998).

The occurrence of *Crocus reticulatus* in this habitat is a curiosity. The species was not mentioned neither in this association, nor in this association's relatives until recently (Borhidi 2003).

Table 1. Phytocoenological relevés (10) of Somlyó-hill carstic steppic vegetation. 1-5 grasses without shadow, 6-10 grasses close to the woody vegetation (in edge position)

Relevés No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Cover (%)	93	87	65	98	85	78	70	98	95	80
Species list with covers-%										
Achillea nobilis	x	x	x	x	x	0,5	x	x	2	x
Acinos arvensis	0,7	0,5	x	x	x	0,3	x	x	x	0,5
Allyssum montanum	0,2	x	x	0,3	x	x	x	x	x	x
Andropogon ischaemum	8	7	15	65	25	3	6	45	5	30
Antehmis arvensis	0,2	1,5	0,3	x	x	x	1	x	x	x
Arenaria serpyllifolia	0,2	0,3	x	x	x	x	x	x	x	x
Asperula cynanchica	x	x	x	0,5	x	1,5	5	3	8	x
Bromus tectorum	38	7	1,5	15	8	2	1	x	1	4
Carex praecox	x	x	x	x	x	0,5	0,5	x	x	x
Carthamus lanatus	x	x	x	0,3	x	x	x	x	x	x
Cichonium intybus	x	x	x	x	x	x	x	0,3	x	x
Cirsium arvense	x	0,2	x	x	x	x	x	x	x	x
Condrilla juncea	x	x	x	x	x	x	x	0,3	x	x
Convolvulus arvensis	x	x	x	x	0,5	x	x	x	x	x
Crataegus monogyna	x	x	x	x	x	1	x	x	x	x
Cruciata laevipes	0,2	0,3	x	0,2	0,5	x	x	x	x	x
Crupina vulgaris	x	x	x	0,5	x	x	x	x	x	x
Daucus carota	0,3	x	x	x	x	x	x	x	x	x
Erodium cicutarium	0,3	0,5	x	0,5	0,5	x	x	x	x	x
Eryngium campestre	1	1	1	0,5	0,5	4	15	1,5	1	3
Euphorbia cyparissias	0,5	0,3	2	1,5	1,5	0,5	0,5	x	x	0,5
Festuca valesiaca	23	60	30	3	25	22	28	35	55	38
Filipendula vulgaris	0,2	x	x	x	x	1	x	x	x	x
Fragaria viridis	x	x	x	x	x	7	x	20	7	3
Galium glaucum	x	x	x	x	x	4	x	x	x	x
Geranium columbinum	x	0,3	x	2	x	x	x	x	x	x
Hieracium hoppeanum	x	x	x	x	x	x	1	x	x	x
Hypericum perforatum	x	x	x	x	x	x	x	x	1	x
Koeleria glauca	x	x	x	x	x	x	x	x	x	1
Medicago falcata	0,2	0,2	x	x	x	x	x	x	x	x
Melica transsilvanica	x	x	x	0,1	x	x	x	x	x	x
Nigella arvensis	0,2	x	x	x	x	x	0,3	3	x	0,7
Pastinaca sativa	x	x	x	x	0,3	x	x	x	x	x
Plantago lanceolata	0,7	x	x	x	x	0,3	1,5	2	1	x
Plantago media	x	x	x	x	x	0,3	x	x	x	x
Poa compressa	x	x	x	x	x	0,7	0,5	x	6	x
Polychnemum arvense	x	0,1	0,3	x	x	x	x	x	x	x

Potentilla arenaria	1,5	x	x	x	x	x	1,5	x	0,3	x
Potentilla argentea	1	0,5	x	x	1	1,5	x	x	x	x
Potentilla recta	x	x	x	x	x	x	0,5	x	x	x
Prunus spinosa	x	1	4	x	x	3	x	4	x	0,3
Rubus spp.	x	x	x	x	x	x	2	x	x	x
Sanguisorba minor	x	x	x	x	x	x	x	x	0,1	x
Scabiosa ochroleuca	x	x	x	x	x	x	x	x	0,4	x
Senecio jakobea	x	x	x	x	x	x	0,3	x	x	x
Setaria pumila	0,2	1	0,5	x	x	x	x	x	x	0,5
Sherardia arvensis	x	x	0,1	x	x	x	x	x	x	x
Teucrium chamaedrys	x	0,5	x	x	x	x	4	2	3	0,5
Thymus glabrescens	4	x	15	12	20	12	8	25	20	14
Verbascum lychnitis	0,3	0,2	x	x	x	x	x	x	x	x
Veronica prostrata	x	x	x	x	x	x	x	x	0,5	x
Veronica spicata	x	x	x	x	x	x	x	0,3	x	x
Veronica verna	0,1	0,2	x	x	x	x	x	x	x	x
Vicia grandiflora	x	x	x	0,3	x	x	x	x	x	x
Vicia lathyroides	0,2	x	x	x	x	0,3	x	x	x	x
Viola kitaibeliana	0,2	0,3	x	0,3	0,3	x	x	0,3	x	x
Xanthium spinosum	x	0,2	x	x	x	x	x	x	x	x
Xeranthemum annuum	x	x	x	0,5	x	x	x	x	x	x

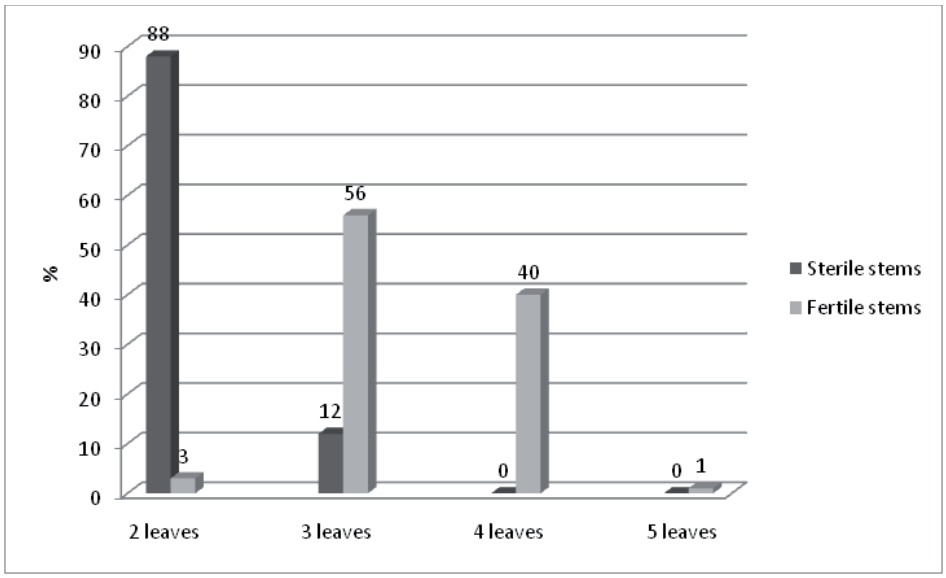

Fig.3 - Connection between leaf number and flowering capacity in the Somlyó-hill crocus population studying 100 individuals

Fig.4 - Sterile *Crocus* with four leaves.

Fig.5 - *Crocus* flower with unusual tepal number.

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