

Prilozi poznavanju flore Hrvatske

Orchids of Vejalnica and Krč (Medvednica)

Short communication

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Sažetak

Iznose se rezultati prebrojavanja orhideja na odabranom području jugoistočnog dijela planine Medvednice, 20 km udaljenom od glavnog grada Hrvatske, Zagreba. Tijekom sezone 2013. obavljeno je detaljno terensko promatranje u kojem su na 23 odabrane plohe zabilježene 24 svojite orhideja iz 11 rodova te prebrojane sve opažene jedinke. Opisuju se karakteristike odabranih livadnih i šumskih ploha te se prezentira raspodjela pojedinih vrsta orhideja, apsolutna brojnost jedinki i sličnost ploha. Prikazuju se i usputna terenska zapažanja o stanju ugroženosti staništa, ljudskim utjecajima i prisutnosti ostalih rijetkih i ugroženih biljnih vrsta. Rezultati ukazuju na bogatstvo flore koje zaslužuje posebnu zaštitu.

Cljučne riječi: prebrojavanje, NATURA 2000 ekološka mreža, Orchidaceae, Park prirode Medvednica, Zagreb, Hrvatska

Abstract

The orchid counting results are presented for the selected area of the southeastern part of the Medvednica Mt., approximately 20 km from the Croatian capital city Zagreb. During the season of 2013 a detailed field survey has been carried out in which 24 orchid taxa from 11 genera were recorded on 23 selected plots and all observed individual plants were counted. Selected characteristics of grassland and woodland plots are described and the distribution of certain orchid species, the absolute abundances and plot similarities are presented. Observations regarding the status of the habitats, human impact and the presence of other rare and threatened plant species are also given. The results show flora richness that merits special protection.

Keywords: inventarisation, NATURA 2000 Ecological Network, Orchidaceae, Nature Park Medvednica, Zagreb, Croatia

Introduction

The southeastern slopes of the Medvednica Mt. are a part of continental Croatia and biogeographically belong to the Eurosiberian-North American vegetation region, particularly the lower woodlands of the Illyrian province (Nikolić & Topić 2005). They are distinguished by hilly terrain and a combination of mixed forests and agricultural surfaces: grasslands, vineyards and orchards. A part of the area consists of habitats suitable for orchid flora, especially in a wide area around the peaks: Bedenik (384 m), Krč (399 m), Sel (450 m) and Vejalnica (503 m), which are situated northeast from the village Čučerje.

The described area was a part of the Nature Park Medvednica from the Park foundation in 1981 up to the recent border reduction in 2009 (Anonymous 2009; 2010). As from 2013 a part of the area has been included in the European NATURA 2000 Ecological Network as the Proposed Site of Community Importance and is awaiting status assessment by the European Commission. The site is named „Vejalnica and Krč“, consisting of two separate sub-sites „Vejalnica“ and „Krč“ (Anonymous 2012).

The site (Fig. 1) has been listed as an important orchid site on semi-natural dry grasslands and scrubland facies on calcareous substrates (class *Festuco-Brometea*, NATURA 2000 habitat code: 6210). According to Annex II of the Directive on the conservation of natural habitats and of wild fauna and flora, the orchid *Himantoglossum adriaticum* H. Baumann and the butterfly *Lycaena dispar* (Haworth 1802) were designated as target species. Also, other important habitat species *Anemone*

sylvestris L. and six orchid species from The Red Book of Vascular Flora of Croatia (Nikolić & Topić 2005) have been listed: *Ophrys apifera* Huds., *O. fuciflora* (F. W. Schmidt) Moench, *O. insectifera* L., *O. sphegodes* Mill., *Orchis militaris* L. and *O. purpurea* Huds.

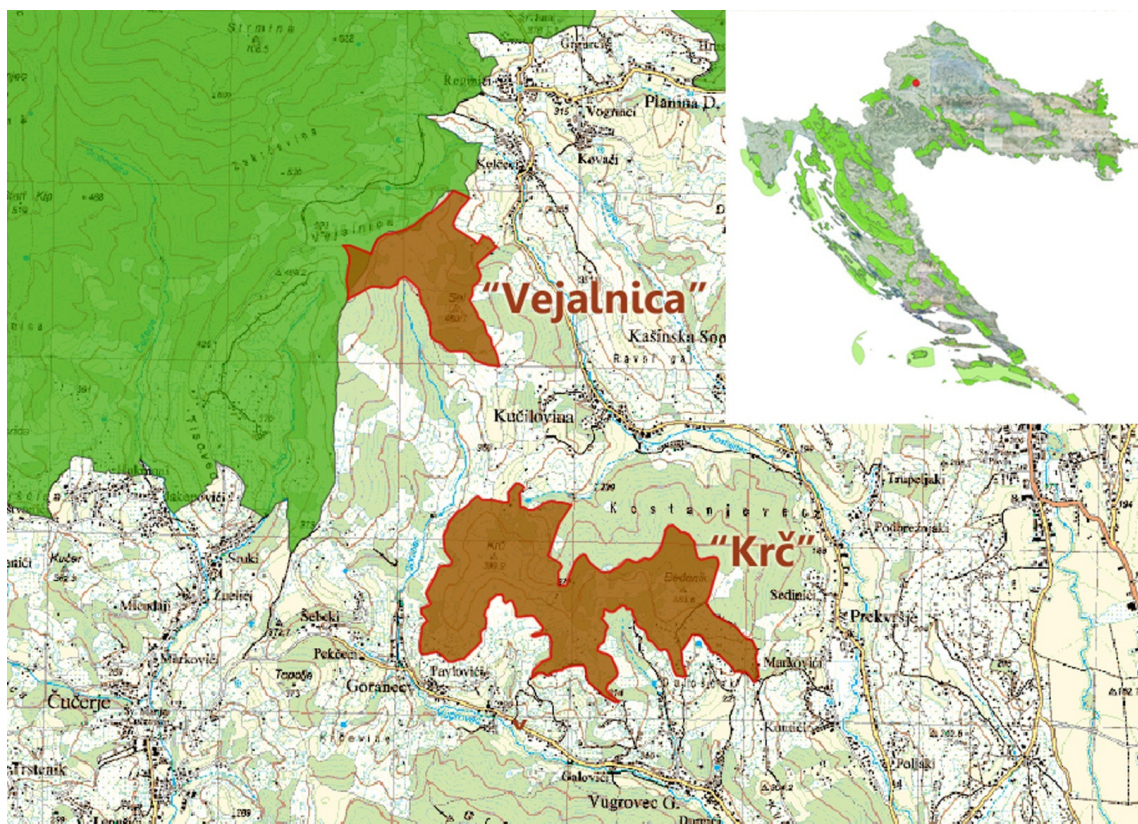


Figure 1. NATURA 2000 site „Vejalnica and Krč“ (shown as brown area; Green area is the NATURA 2000 site “Medvednica”).

Orchids are perennial plants from the family Orchidaceae which are represented with about 150 indigenous taxa in Croatia. Many of them are endangered due to loss of their favorable habitats, especially those growing on anthropogenic grasslands that are poorly managed or are completely abandoned, therefore overcome by succession to scrubland and forest.

We noticed an abundance of orchids during several years of photographing and documenting the flora and fauna diversity in the surroundings of Vugrovec. With the intention to quantify our previous observations, during 2013 we carried out a detailed field survey of the orchid flora in the „Vejalnica and Krč“ site. Our aim was to document the current state of the orchid flora and to assess the differences in abundance of individual species. Also, we wanted to supplement the existing NATURA 2000 documents with specific field data and to initiate a discussion about merging the site with the larger neighboring NATURA 2000 site “Medvednica”.

Previous studies of orchids in the Medvednica region, including the site studied in this paper, showed the following results: the last flora mapping of the Nature Park Medvednica confirmed the presence of 22 orchid taxa in the whole Park (Hršak et al. 1999); the multi-year research by Kranjčev (2005) listed 38 taxa for the whole Medvednica. In both cases dry and wet habitats were included in the studies. Our research in the „Vejalnica and Krč“ site was limited to dry habitats only.

Materials and Methods

We counted orchids on 23 plots (Fig. 2) that represent approximately 11.5% of the „Vejalnica and Krč“ site with the total area of 1.5 km². We based our plot selection on previous insights into the site, previous findings, terrain topographical features and accessibility, in order to include various microhabitats within the current borders of the NATURA 2000 site „Vejalnica and Krč“.

We chose permanent spatial features visible throughout the season as plot borders, e. g. forest paths, clearings, tall trees and steep edges. All plots are of different shapes and dimensions

and are in the elevation range between 300 and 500 m above sea level. We logged the selected borders with a Garmin eTrex 30 GPS device. Table 1 summarizes all spatial data for the plots as well as the types of vegetation coverage.

The field survey was conducted during 14 days of fieldwork from late April to late July of 2013. During this interval we visited each plot several times and counted every orchid plant found in the flowering phase. Very abundant species were counted once, in their flowering peak. Less abundant species were counted on several occasions but only the largest count was included in the results.

We divided each plot into smaller transects according to the visible borderline features and temporarily placed poles for easier orientation. Each transect was walked once. The intention was to minimize counting errors. We avoided walking over emerged stems and withered orchids and through dense grassland vegetation. The program Ecological Methodology 7.0 (Krebs 2009) was used to calculate plot similarities.

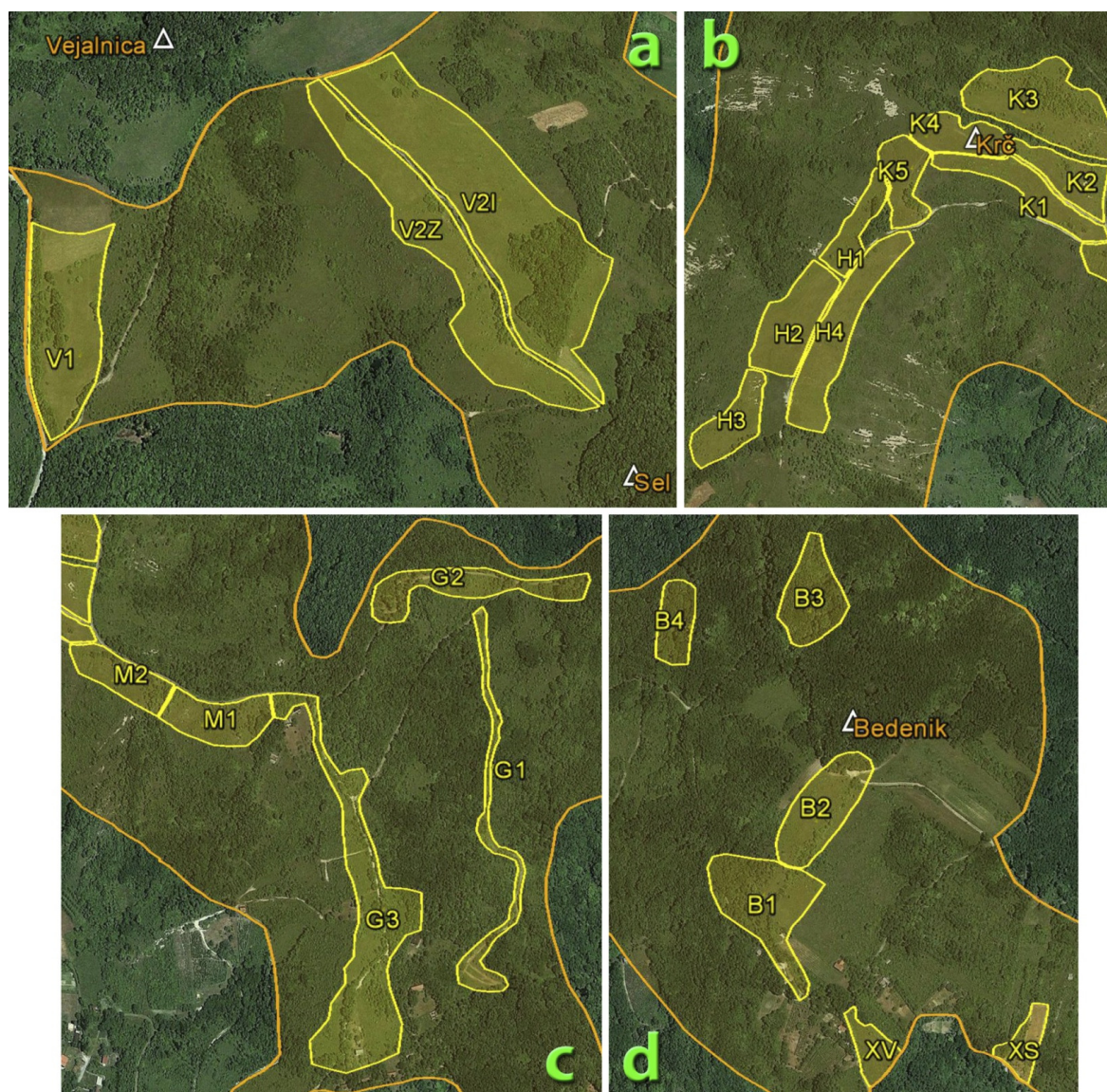


Figure 2. Locations of the studied plots. Plots are yellow areas and NATURA 2000 site “Vejalnica and Krč” is the orange area: a) plots in the sub-site “Vejalnica” b) plots in western part of the sub-site “Krč” c) plots in the middle part of the sub-site “Krč” and d) plots in eastern part of the sub-site “Krč”.

Table 1. Basic data about the studied plots.

Plot name	Sub-site	Area (m ²)	Perimeter (m)	Centroid North	Centroid East	Exposition	Slope %	Grassland	Scrubland	Orchards	Forest	Mowing
XS	Krč	2589	245	45°53'56"	16°06'03"	SW	25	yes	yes	yes	no	partly
XV	Krč	2402	232	45°53'56"	16°05'55"	SE	20	yes	yes	yes	no	partly
B1	Krč	9068	469	45°54'01"	16°05'50"	SE	20	yes	yes	yes	yes	no
B2	Krč	6414	344	45°54'04"	16°05'53"	SW	10	yes	yes	yes	yes	no
B3	Krč	5796	323	45°54'12"	16°05'53"	S	12	no	no	no	yes	no
B4	Krč	3461	249	45°54'11"	16°05'46"	S	10	no	no	no	yes	no
G1	Krč	5230	1037	45°53'59"	16°05'32"	S	10-17	no	yes	yes	yes	no
G2	Krč	6904	583	45°54'09"	16°05'31"	E	5	yes	yes	no	yes	no
G3	Krč	18211	1119	45°53'57"	16°05'25"	S,W	7-20	yes	yes	yes	yes	partly
M1	Krč	5070	321	45°54'04"	16°05'18"	SW	10-25	yes	yes	no	no	no
M2	Krč	4118	296	45°54'06"	16°05'13"	SW	10-25	yes	yes	no	no	no
K1	Krč	4729	466	45°54'09"	16°05'08"	SW	15-25	yes	yes	no	no	no
K2	Krč	3798	311	45°54'09"	16°05'10"	E	15-25	yes	yes	no	no	no
K3	Krč	10782	456	45°54'12"	16°05'09"	SE	10-20	yes	yes	no	yes	no
K4	Krč	3474	265	45°54'11"	16°05'05"	SW	5	yes	yes	no	no	no
K5	Krč	3554	282	45°54'09"	16°05'02"	S,SW	15-25	yes	yes	no	no	no
H1	Krč	3022	295	45°54'08"	16°05'00"	SW	15	yes	yes	no	no	no
H2	Krč	6192	343	45°54'05"	16°04'56"	SW	15	yes	yes	no	no	no
H3	Krč	4207	299	45°54'01"	16°04'53"	W	20-25	yes	yes	no	no	no
H4	Krč	7817	538	45°54'04"	16°04'59"	SE	5-15	yes	yes	no	no	no
V1	Vej.	11868	512	45°55'04"	16°04'27"	S	12	yes	yes	no	no	partly
V2Z	Vej.	15477	926	45°55'05"	16°04'44"	SW	10-25	yes	yes	no	no	no
V2I	Vej.	28854	978	45°55'07"	16°04'47"	SE	5-10	yes	yes	no	yes	no

Results and Discussion

In total, we found 24 taxa from 11 genera of the Orchidaceae family (Appendix 1). Most species are from the genus *Orchis* (5), following with *Ophrys* (4), *Epipactis* (4), *Cephalanthera* (3) and *Platanthera* (2). Other genera are represented by one species. On open grasslands dominate: *Anacamptis*, *Gymnadenia*, *Himantoglossum*, *Ophrys*, *Orchis* and *Platanthera*. On the overgrown edges of grassland and forests we mostly observed: *Cephalanthera*, *Limodorum*, *Listera*, and inside forests *Epipactis* and *Neottia*. All the observed orchid species are listed alphabetically in Table 2 together with their current endangerment status according to Nikolić and Topić (2005). Table 3 presents the counting results of all orchid taxa on all the selected plots.

Results show that the most widespread and abundant species are: *A. pyramidalis*, *G. conopsea*, *O. militaris* and *O. sphegodes*. The least number of individuals was found for the taxa that are also present on the fewest plots: *O. tridentata*, *O. x hybrida*, *P. chlorantha* and *E. purpurata*.

Comparing the plot habitat type with the number of the observed taxa on a plot, it became obvious that there are fewer taxa (3-4) on the forest plots (B3 and B4) and the plots near vacation cottages (XV and XS). The maximum number of taxa (12-16) was found on the combined plots of grassland and forest habitats (G3 and G2). On all grassland plots the taxa count is similar (6-11), while no plot appeared to be more special than the others. A greater variation between plots was obtained regarding the number of individual plants. Grassland plot H3 excels with the greatest number of the observed plants (1642), followed by the adjacent grassland plots H2 and K1 with approximately half of the primary value, as well as by the combined habitats plot G3 (640-870). The smallest plant count was obtained on forest plots (13-22).

It is apparent that "Krč" plots have a higher abundance than "Vejalnica" plots. For the taxa present on both sub-sites, "Krč" has a larger abundance in most cases. The only exceptions are *O. fuciflora* and *H. adriaticum*. There are species that are very abundant on one sub-site and are not present on the other. These are *O. sphegodes* that was abundant on "Krč", while not observed on the selected "Vejalnica" plots and *O. morio* that was abundant on "Vejalnica", but was not found on "Krč" plots. In both cases we have found a lot of rosettes at the start of the season 2014 on steeper slopes

adjacent to the original 2013 plots.

Table 2. List of the observed orchid taxa with IUCN status.

Taxon name	IUCN status
<i>Anacamptis pyramidalis</i> (L.) Rich.	NT
<i>Cephalanthera damasonium</i> (Mill.) Druce	NT
<i>Cephalanthera longifolia</i> (L.) Fritsch	NT
<i>Cephalanthera rubra</i> (L.) Rich.	NT
<i>Epipactis helleborine</i> (L.) Crantz	
<i>Epipactis microphylla</i> (Ehrh.) Sw.	
<i>Epipactis muelleri</i> Godfrey	
<i>Epipactis purpurata</i> Sm.	
<i>Gymnadenia conopsea</i> (L.) R.Br.	
<i>Himantoglossum adriaticum</i> H.Baumann	NT
<i>Limodorum abortivum</i> (L.) Sw.	
<i>Listera ovata</i> (L.) R.Br.	
<i>Neottia nidus-avis</i> (L.) Rich.	
<i>Ophrys apifera</i> Huds.	EN
<i>Ophrys fuciflora</i> (F.W.Schmidt) Moench	VU
<i>Ophrys insectifera</i> L.	VU
<i>Ophrys sphegodes</i> Mill.	VU
<i>Orchis militaris</i> L.	VU
<i>Orchis morio</i> L.	NT
<i>Orchis purpurea</i> Huds.	VU
<i>Orchis tridentata</i> Scop.	VU
<i>Orchis x hybrida</i> Boenn. ex Rchb.	
<i>Platanthera bifolia</i> (L.) Rich.	VU
<i>Platanthera chlorantha</i> (Custer) Rchb.	NT

Out of the 24 observed taxa in general, 23 were observed on “Krč” and 13 on “Vejalnica” plots. Such a difference is probably a result of the selection of both the grassland and forest habitats for “Krč” as opposed to the selection of only grassland habitats for “Vejalnica”. If we exclude the results for the forest plots and those around vacation cottages, thus comparing only hillside grassland “Krč” plots (M*, K* and H*) to “Vejalnica” plots, then the taxa counts are nearly equal.

It was noticed that a lower abundance of the orchid flora on “Vejalnica” plots is followed by a higher richness of other competing species and smoother terrain gradient slopes. “Krč” plots have a richer orchid flora, fewer other grassland species, and steeper terrain. The top soil is very thin on the steep grasslands, sometimes even significantly eroded and stony. We noted that orchids were present in greater numbers on such spots since there they were not threatened by other grassland species.

Table 4 contains the calculated Bray-Curtis similarity index for all plots. It clearly shows the smallest index for the dominantly forest plots compared to other grassland plots. The most similar plots, with a 79% similarity, are grassland plots H4 and K2. Also, mutually adjacent grassland plots tend to be more similar, 40-70%.

Among all findings, several orchid groups were especially interesting. The most interesting group is one of 57 individuals of *H. adriaticum* in a 20 m² segment in the middle of the plot V2Z. At the southern part of the G3 plot we found 91 individuals of *L. abortivum* in a near-circular pattern approximately 3 m in diameter. A group of 5 different orchid species: *L. abortivum*, *O. militaris*, *O. purpurea*, *O. morio* and *O. tridentata*, each represented by one individual, was found on V2Z, on a 5 m² area. We found nine individuals of *O. apifera*, among which seven were hypochromic, on the steepest part of K1. In regard to our field observations prior to this study, we were surprised by the large total number of orchids, a wide distribution of species *H. adriaticum*, *O. sphegodes* and *O. purpurea*, along with the abundance of *L. ovata* and new *O. x hybrida* individuals.

As for the other grassland flora in sub-site “Vejalnica” we have observed dense population of critically endangered (CR) *Anemone sylvestris* L., vulnerable (VU) *Dianthus giganteus* D' Urv ssp. *croaticus* D' Urv (Borbás) Tutin, *Salvia pratensis* L., *Veronica austriaca* L. ssp. *jacquinii* L. (Baumg.) Eb. Fisch., *Onobrychis viciifolia* Scop. and *Galium verum* L. Those species also grow in the sub-site “Krč”, but are less abundant. In the Krč area the dominant species are: *Globularia vulgaris* L.,

Melampyrum barbatum Waldst. et Kit., *M. arvense* L., *Linum flavum* L., *L. hirsutum* L. and *L. tenuifolium* L. Of the less abundant grassland species notable are two *Pseudolysimachion spicatum* (L.) Opiz individuals (one in the „Krč“ sub-site and the other in „Vejalnica“) and two *Muscari comosum* (L.) Mill. individuals in the sub-site „Krč“.

Table 3. Absolute abundance of the recorded orchid taxa in the studied plots. Taxon names are abbreviated with the first three letters.

Taxon name	XS	XV	B1	B2	B3	B4	G1	G2	G3	M1	M2	K1	K2	K3	K4	K5	H1	H2	H3	H4	V1	V2Z	V2I	Σ
<i>Ana.pyr.</i>	124	9	89					3	129	13	78	302	91	231	432		38	309	698	14	35	36	189	2820
<i>Cep.dam.</i>			12			1	6	5	56	12	22			4	10						151	32	50	361
<i>Cep.lon.</i>													13						2					15
<i>Cep.rub.</i>			6	6	4	1		11	13															41
<i>Epi.hel.</i>			2	1	4			1																8
<i>Epi.mic.</i>			1	27	1																			29
<i>Epi.mue.</i>			7	2	4			1																14
<i>Epi.pur.</i>						9																		9
<i>Gym.con.</i>								37	152	141	74	19	94	132	75	12	103	198	680	100	14	2	7	1840
<i>Him.adr.</i>	10						1		1	3		6	2		1	12		1	4			58	9	108
<i>Lim.abo.</i>								3	134		19		9								21	57	38	281
<i>Lis.ova.</i>									21	6	2		13	36			3		1					82
<i>Neo.nid.</i>						7		2	5															14
<i>Oph.api.</i>	1								5			9						1						5
<i>Oph.fuc.</i>		47	1						2						1							57	82	190
<i>Oph.ins.</i>				14				9	2	9		6		11	4		2	1		1		1		60
<i>Oph.sph.</i>				2						71	1	61	162	87	165	48	120	140	150	182				1189
<i>Orc.mil.</i>	2	263	13	15			4	6	109	14	45	49	27	62	130	16	31	66	77	39	12	15	52	1047
<i>Orc.mor.</i>																					1	95	156	252
<i>Orc.pur.</i>			5				4		2	17	7	19	1	13		28	4	1	30	5	11		1	148
<i>Orc.tri.</i>			1																					1
<i>Orc.x hyb</i>										2	2													4
<i>Pla.bif.</i>			3			4	1	1	13		1	15				1	263	154						456
<i>Pla.chl.</i>								5	2															7
Σ	137	319	140	67	13	22	16	84	646	288	251	486	412	576	818	117	564	871	1642	341	245	353	590	8998

Threats to the habitats

During several years of observation of the same orchid grasslands and surrounding forests in the sub-site “Krč”, we noticed continuous deterioration of habitat conditions caused by various passive and active human influences.

The land owners have abandoned the steeper grassland habitats, which are now in succession, mostly by: *Juniperus communis* L., *Viburnum lantana* L., *Quercus* spp., *Pinus* spp., *Rosa* spp., *Prunus spinosa* L. and *Cornus sanguinea* L. Although individual orchid plants tend to grow exceptionally large near scrubs, e.g.: *A. pyramidalis* - 53 cm, *O. purpurea* - 87 cm and *H. adriaticum* - 100 cm, in the long term the overgrowing scrubs will reduce the open grassland surface and thus reduce the total orchid abundance. A very small number of grasslands are mowed, typically those which are easily accessible, not so steep and closer to vacation cottages. On these grasslands succession is not an issue, but we have noticed a relation between the timing of the mowing and orchid abundance. The grasslands mowed at the end of the summer were rich with grassland flowers and orchids, but those mowed earlier, or on several occasions through the year, did not contain orchids.

Woodland habitats are also neglected and exposed to sporadic and uncontrolled legal and illegal exploitation of accessible larger trees. After such devastations the surrounding area remains covered by a large amount of leftover branches which reduce survival of previously growing species.

The forest edge habitats are also damaged during extraction and temporary storage of cut trees. Also, after cutting, a significant amount of garbage is often left in the vicinity of habitats. The areas accessible by cars are often used for waste dumping. The repairing and widening of the macadam roads by oversized machinery also has a negative impact.

The Vugrovec-Lipa segment of the M1 hiking trail passes through the middle of the "Vejalnica and Krč" site and some hikers pick the plants. In recent years we noticed motor vehicles passing through grassland plots, especially those with panoramic views.

The proximity of Zagreb, the capital city of Croatia, is an inherent threat to the biodiversity of the area because of the constant expansion of the city and urbanization of the landscape. The area has been under special threat after the exclusion from the Nature Park Medvednica since it became a zone of free construction.

Table 4. Similarity of the studied plots. (Designated as a Bray-Curtis similarity percentage index).

Plot	XS	XV	B1	B2	B3	B4	G1	G2	G3	M1	M2	K1	K2	K3	K4	K5	H1	H2	H3	H4	V1	V2Z
XS																						
XV	5																					
B1	66	10																				
B2	2	8	22																			
B3	0	0	14	20																		
B4	0	0	6	2	6																	
G1	4	2	19	10	0	11																
G2	5	4	21	30	12	9	20															
G3	33	25	32	6	1	3	4	20														
M1	8	8	20	14	0	1	10	32	41													
M2	41	19	56	10	0	1	11	33	54	46												
K1	43	14	35	8	0	2	4	12	39	34	41											
K2	35	10	37	7	0	0	3	20	45	57	58	45										
K3	35	16	31	9	0	0	4	18	58	61	51	71	63									
K4	27	25	24	5	0	0	3	12	45	34	39	67	58	66								
K5	9	7	15	18	0	1	15	19	8	46	20	34	30	26	16							
H1	11	9	16	6	0	1	3	15	32	49	37	32	58	47	38	24						
H2	25	13	21	4	0	1	2	10	48	42	36	66	55	71	70	16	62					
H3	15	9	12	2	0	0	1	5	32	27	22	43	36	47	60	12	27	57				
H4	7	15	13	9	0	0	4	22	32	65	45	34	79	54	51	35	60	49	31			
V1	19	7	33	8	0	1	11	19	31	23	44	20	22	19	13	19	16	11	8	15		
V2Z	20	21	25	8	0	1	6	9	29	14	31	14	17	12	11	12	12	9	6	9	34	
V2I	37	24	32	5	0	0	4	7	46	11	41	48	27	43	37	9	13	34	23	13	30	60

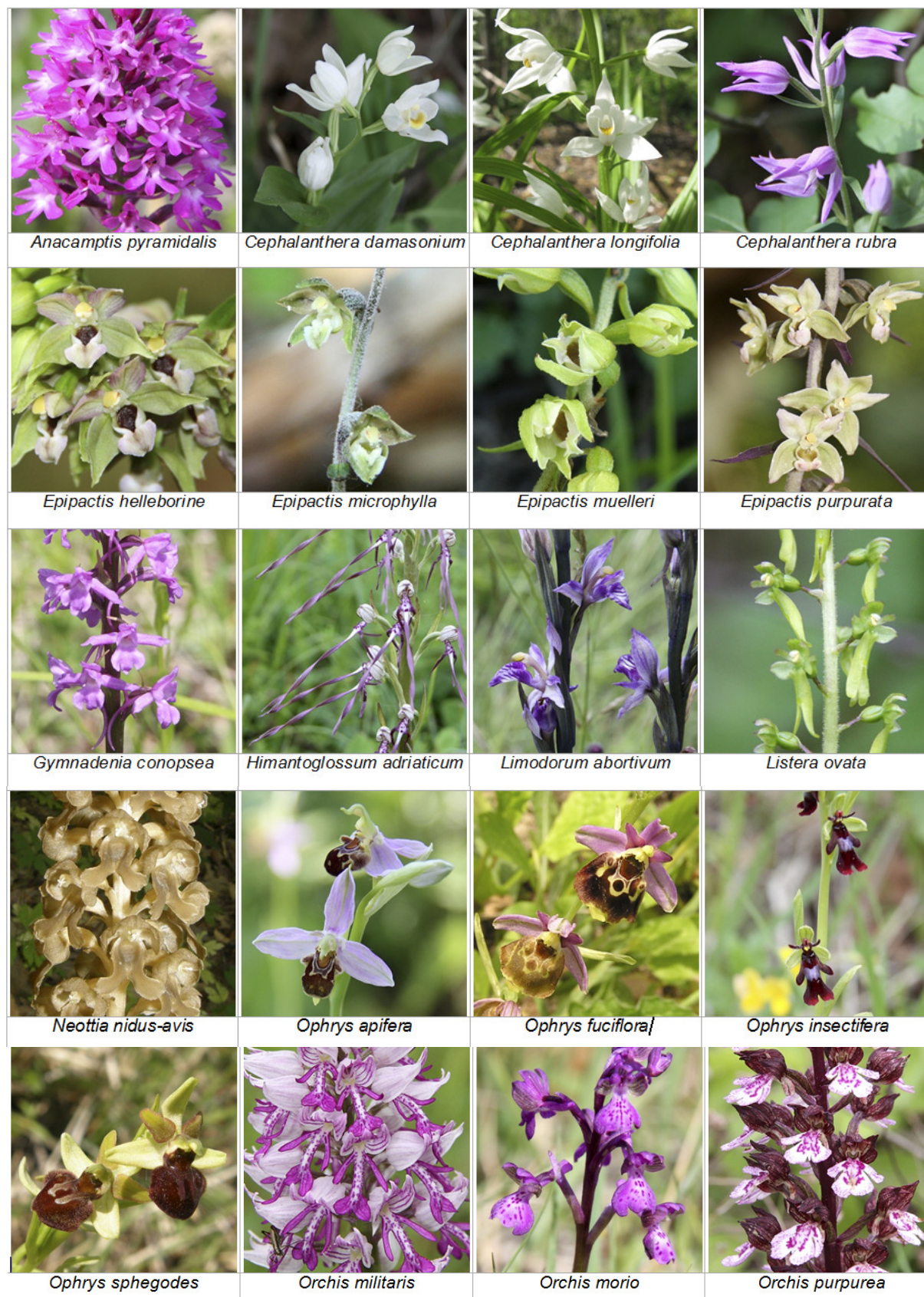
Conclusion

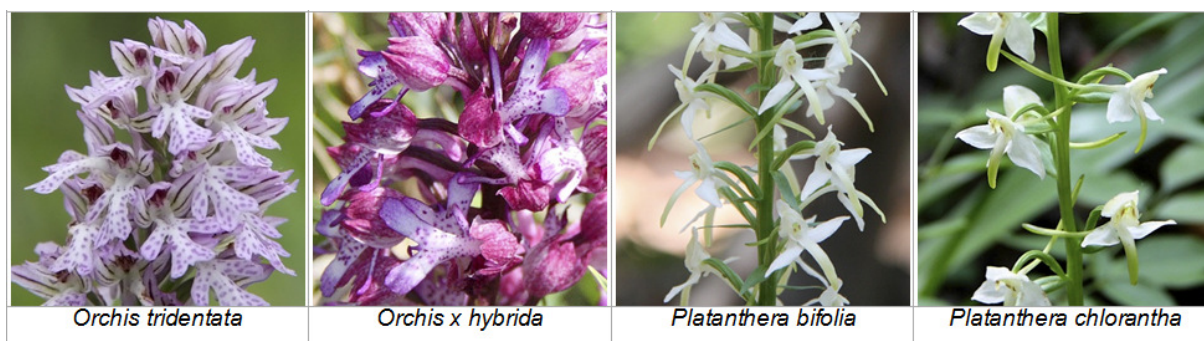
During our survey we recorded a significant abundance of orchids and a critically endangered species *Anemone sylvestris* at the site „Vejalnica and Krč“. We recommend future monitoring of the orchid flora stability and an extension of the observation scope in order to investigate the need for the protected site borders to be widened. By publishing the current status data we wish to contribute to the protection of the site status either through the existing NATURA 2000 ecological network definition or by including it back in the Nature Park Medvednica. Such actions are urgently needed since the proportions and intensity of the observed habitat threats by succession and human impact are becoming ever greater.

Acknowledgements

We would like to thank the *Himantoglossum* genus project team for including the "Krč" area into their research, recognizing its significance and suggesting it for the NATURA 2000 ecological network. Thanks to Roko Čičmir for his help in the determination of species in the *Epipactis* genus. Special thanks to our patient mentor Prof. Ljiljana Borovečki-Voska for constant botanical tutoring, motivation and encouragement. Furthermore, we thank all reviewers, lecturers and editors for their constructive contribution to the manuscript.

Appendix 1. Photographs of investigated taxa.





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