

NEW LOCALITIES OF RARE NATURA 2000
SPECIES: *PULSATILLA GRANDIS* WENDER., *GENISTA
HOLOPETALA* (KOCH) BALD. AND *CYPRIPEDIUM
CALCEOLUS* L. IN THE NW DINARIDES IN CROATIA

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New localities of three rare and floristically interesting NATURA 2000 species in the north-western Dinaric Mountains in Croatia are presented in this paper. *Pulsatilla grandis* Wender. was found on the mountains around Rijeka, above Vinodol valley (Croatian Littoral), and in the central part of Mt Velebit. *Genista holopetala* (Koch) Bald. was found on the mountains around Rijeka and above Vinodol valley (Croatian Littoral), while *Cypripedium calceolus* L. was noticed on the southern part of Mt Velebit. Information about new sites will be of great help in the future research that is essential for all three species to ensure protection and assist in setting up population monitoring. Additionally, it was ascertained that afforestation of grassland habitats by natural forest vegetation represents the greatest threat to *P. grandis* and *G. holopetala*.

Key words: rare NATURA 2000 species, NW Dinaric Mountains, Croatia

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U radu su navedeni novi, do sada neobjavljeni lokaliteti triju rijetkih i floristički zanimljivih NATURA 2000 vrsta na području sjeverozapadnih Dinarida u Hrvatskoj. Novi lokaliteti vrste *Pulsatilla grandis* Wender. zabilježeni su na planinama u zaleđu grada Rijeke, iznad Vinodola te na području srednjeg Velebita. *Genista holopetala* (Koch) Bald. pronađena je na novim lokalitetima na planinama u zaleđu Rijeke i iznad Vinodola, dok su novi mikrolokaliteti vrste *Cypripedium calceolus* zabilježeni na području južnog Velebita. Podaci o novim lokalitetima predstavljaju značajan doprinos budućim istraživanjima ovih triju vrsta koja su neophodna za njihovu adekvatnu zaštitu i moguću uspostavu monitoringa nad njihovim prirodnim populacijama. Također, utvrđeno je da zaraštanje prirodnih travnjačkih staništa drvećem i gmljem trenutno predstavlja najveću opasnost za populacije vrsta *P. grandis* i *G. holopetala*.

Ključne riječi: rijetke NATURA 2000 vrste, sjeverozapadni Dinaridi, Hrvatska

INTRODUCTION

Pulsatilla grandis Wender. (*Ranunculaceae*) is an herbaceous perennial plant with a stout rhizome. Its conspicuous blue flowers appear early in the spring. Young leaves, stems and

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the abaxial side of petals are densely covered with gentle silky trichomes, which probably serve as protection from the harsh climate conditions at a time when other vegetation is still dormant. It is a representative of steppe flora, flourishing particularly in sunny, stony dry grasslands, mostly on a limestone bedrock substratum. Rarely, it can also be found in sunny forests. The plant is distributed in the central and south-eastern part of Europe. Its range covers the countries located between Germany and the Ukraine. In the south-east, it reaches as far as the south of Macedonia. In Croatia, it can be found on Mt Papuk, in the Croatian Littoral, on Mt Senjsko Bilo, Mt Velebit and on Mt Poštak (DEGEN, 1938: 129; HORVAT, 1962; PANDŽA; TOPIĆ *et al.*, 2010; NIKOLIĆ, 2011).

Genista holopetala (Koch) Bald. (syn. *Cytisanthus holopetalus* (Fleischm. ex Koch) Bald.) (*Fabaceae*) is an ascending or erect shrub without spines, and with 2–4 yellow flowers on each branch. It is distributed in Italy, Slovenia and Croatia (POLDINI, 1964; GIBBS, 1978). In Croatia, it can be found in the Croatian Littoral, on island of Krk, in Gorski Kotar, Plitvice Lakes National Park and Mt Velebit (DEGEN, 1938: 307; POLDINI, 1964; FEOLI CHIAPPELLA & RIZZI LONGO, 1987; KRGA, 1992; RANDIĆ, 2010; NIKOLIĆ, 2011). Additionally, *Genista holopetala* is an endemic species listed in the Red Book of Vascular Plant Species of the Republic of Croatia as a data deficient (DD) species.

Cypripedium calceolus L. (*Orchidaceae*) is a perennial plant with reddish-brown or sometimes yellow-green perianth-segments and pale yellow (with reddish spots inside) labelum. It is distributed across Europe and Asia (MOORE, 1996; ERHARDT *et al.*, 2002). In Croatia, it can be found on Mt Bilogora, Mt Kalnik, Mt Žumberak, in Gorski Kotar, in Plitvice Lakes National Park, Krbava, on Mt Velebit and Mt Plješevica (DEGEN, 1938: 648; HORVAT, 1938; KRANJČEV, 2005; NIKOLIĆ, 2011).

The aim of this paper is to present new localities of *Pulsatilla grandis*, *Genista holopetala* and *Cypripedium calceolus* in the north-western Dinaric Mountains in Croatia. All three species are listed in Appendix II of the Habitats Directive (NATURA 2000 Species) (ANEX II Council Directive 92/43/EEC of 21 May 1992). Every piece of information concerning the sites of these plants is welcome and helps to broaden our knowledge of environmental conditions, range and population numbers, as well as of possible threats, and could later be useful in conducting more throughgoing research – threat assessments, developing plans for managing protected areas and ecological networks, putting in place monitoring schemes, etc. At present, several National Ecological Network (NEN) areas have been proposed for these three species: *Pulsatilla grandis* – the peak of Ivanščica, Papuk and Turjak-Mališćak-Pliš-Lapjak on Papuk; *Genista holopetala* – Obruč and Paklenica National Park; *Cypripedium calceolus* – the Žumberak-Samoborsko mountain chain, Velebit Nature Park and Plitvice Lakes National Park (NARODNE NOVINE, 2007). Some of these areas are included in the list of POTENTIAL NATURA 2000 areas covered by our research (the north-western Dinaric mountain range within Croatia's borders; for *Genista holopetala* these are the grasslands below Platak, and for *Pulsatilla grandis*, the area at the foot of Medveđak and surrounding Breza). This paper presents data on possible threats within the new localities, if such have been observed in habitats.

MATERIALS AND METHODS

The new localities were discovered during several field trips undertaken from May 2006 to September 2011. Standard identification keys were used (GIBBS, 1978; DOMAC, 1994; MOORE, 1996), while NIKOLIĆ (1994–2000) and ERHARDT (2002) were used as a standard for the nomenclature of the species. Each locality was described according to data

Tab. 1. Newly found localities of *Pulsatilla grandis*, *Genista holopetala* and *Cypripedium calceolus* in NW Dinarids in Croatia.

Loc. no.	Taxon	x coordinate	y coordinate	Altitude (m)	Habitat type according to National habitat classification (NHC)
1	<i>P. grandis</i>	5512365	4931416	927	C.3.5.2.2. <i>Seslerio-Caricetum humilis</i> Ht. 1930
2	<i>P. grandis</i>	5512033	4931047	962	C.3.5.2. <i>Saturejon subspicatae</i> H-ic 1975
3	<i>P. grandis</i>	5512012	4931434	918	C.3.5.2. <i>Saturejon subspicatae</i> H-ic 1975
4	<i>P. grandis</i>	5465656	5026371	652	C.3.5.2.1. <i>Carici-Centauretum rupestris</i> Ht. 1931
5	<i>P. grandis</i>	5466637	5022964	570	C.3.5.2.1. <i>Carici-Centauretum rupestris</i> Ht. 1931
6	<i>P. grandis</i>	5468021	5025945	710	C.3.5.2.1. <i>Carici-Centauretum rupestris</i> Ht. 1931
7	<i>P. grandis</i>	5467084	5024913	578	C.3.5.2.1. <i>Carici-Centauretum rupestris</i> Ht. 1931
8	<i>P. grandis</i>	5475194	5011871	844	C.3.5.2. <i>Saturejon subspicatae</i> H-ic 1975
9	<i>G. holopetala</i>	5448264	5034327	654	C.3.5.2.9. <i>Genisto-Caricetum mucronatae</i> Ht. 1956
10	<i>G. holopetala</i>	5455738	5032756	525	C.3.5.2.9. <i>Genisto-Caricetum mucronatae</i> Ht. 1956
11	<i>G. holopetala</i>	5458499	5034679	1074	C.3.5.2.9. <i>Genisto-Caricetum mucronatae</i> Ht. 1956
12	<i>G. holopetala</i>	5458491	5034685	1075	E.7.4.5. <i>Euphorbio triflorae-Pinetum virgae Trinjastic</i> 1999
13	<i>G. holopetala</i>	5458924	5033083	926	D.2.4. Subalpine scrub with domination of <i>G. holopetala</i>
14	<i>G. holopetala</i>	5461735	5032182	917	C.3.5.2.9. <i>Genisto-Caricetum mucronatae</i> Ht. 1956
15	<i>G. holopetala</i>	5463699	5028341	898	C.3.5.2. <i>Saturejon subspicatae</i> H-ic 1975
16	<i>G. holopetala</i>	5458008	5029011	302	C.3.5.2.11. <i>Satureio-Edraimihetum</i> Ht 1942
17	<i>G. holopetala</i>	5465057	5029892	875	C.3.5.2. <i>Saturejon subspicatae</i> H-ic 1975
18	<i>G. holopetala</i>	5465058	5030049	948	C.3.5.2.9. <i>Genisto-Caricetum mucronatae</i> Ht. 1956
19	<i>G. holopetala</i>	5464308	5029256	847	C.3.5.2.1. <i>Carici-Centauretum rupestris</i> Ht. 1931
20	<i>G. holopetala</i>	5464863	5029420	952	C.3.5.2. <i>Saturejon subspicatae</i> H-ic 1975
21	<i>G. holopetala</i>	5464800	5027707	725	C.3.5.2. <i>Saturejon subspicatae</i> H-ic 1975
22	<i>G. holopetala</i>	5466069	5028650	994	C.3.5.2. <i>Saturejon subspicatae</i> H-ic 1975
23	<i>G. holopetala</i>	5465271	5026543	725	C.3.5.2. <i>Saturejon subspicatae</i> H-ic 1975
24	<i>G. holopetala</i>	5466092	5025458	655	C.3.5.2.1. <i>Carici-Centauretum rupestris</i> Ht. 1931
25	<i>G. holopetala</i>	5467877	5028074	1141	C.3.5.2. <i>Saturejon subspicatae</i> H-ic 1975
26	<i>G. holopetala</i>	5463319	5020849	345	C.3.5.2. <i>Saturejon subspicatae</i> H-ic 1975
27	<i>G. holopetala</i>	5462529	5018895	248	C.3.5.2. <i>Saturejon subspicatae</i> H-ic 1975
28	<i>G. holopetala</i>	5475706	5011585	723	C.3.5.2. <i>Saturejon subspicatae</i> H-ic 1975
29	<i>G. holopetala</i>	5476839	5009954	573	D.2.4. Subalpine scrub with domination of <i>G. holopetala</i>
30	<i>C. calceolus</i>	4909441	5540780	751	E.6. Forest edge of subalpine beech forest
31	<i>C. calceolus</i>	4915895	5538618	1303	E.6. Forest edge of subalpine beech forest
32	<i>C. calceolus</i>	4912906	5542085	1352	E.6. Forest edge of subalpine beech forest

Note: Loc. no. – Locality number (according to the order in text)

on altitude and location obtained using a Garmin eTrex Vista HCx and the Gauss-Krüger coordinates system. Habitat type according to the National Habitat Classification (NARODNE NOVINE, 2009; FLORA CROATICA DATABASE – HABITATS, 2009) was also given.

Voucher specimens were deposited in the Fran Kušan Herbarium of the Department of Pharmaceutical Botany in the Fran Kušan Pharmaceutical Botanical Garden, Faculty of Pharmacy and Biochemistry, University of Zagreb, Zagreb, Croatia.

RESULTS AND DISCUSSION

Table 1 displays a total of 31 new localities of three rare and floristically interesting species in Croatia.

Localities of *Pulsatilla grandis*

A total of eight new localities of *P. grandis* were registered, three in the central part of Mt Velebit, near Baške Oštarije, and five in the hinterland mountains of the town of Rijeka and at the edge of Vinodol valley (Croatian Littoral).

1. Tanka Kosa at Baške Oštarije

Tanka Kosa is a mountain ridge located at Baške Oštarije in Central Velebit. The top part of Tanka Kosa is grassland dominated by narrow-leaved moor grass (*Sesleria juncifolia* Suffren s.l.). The grassland vegetation of this locality is threatened by the invasion of black pine (*Pinus nigra* J. F. Arnold) which is advancing from the eastern side of the mountain and now covers two-thirds of its surface. The *Pulsatilla grandis* population at this locality, numbering some 20 specimens, persists on the not overgrown part of the grassland exposed to the strong northerly wind (bora). Some of the specimens still survive in the shade of the black pine trees. Apart from the black pine, other woody species, such as *Amelanchier ovalis* Medik., *Juniperus communis* L., *Sorbus aria* (L.) Crantz. and *Viburnum lantana* L., also invade these grasslands. Some other plant species that grow in the same community are *Anthyllis montana* L. ssp. *jacquinii* (A. Kern.) Hayek, *Arabis hirsuta* (L.) Scop., *Arctostaphylos uva-ursi* (L.) Spreng., *Carex humilis* Leyss., *Dorycnium germanicum* (Gremli) Rikli, *Frangula rupestris* (Scop) Schur., *Genista sericea* Wulfen, *Globularia cordifolia* L., *Gentiana lutea* L. ssp. *symphyandra* (Murb.) Hayek, *Gentiana tergestina* Beck, *Orchis morio* L., *Orchis ustulata* L., *Ornithogalum umbellatum* L., *Orobanche* L. sp.

2. Debela Kosa at Baške Oštarije

A number of clusters containing several dozens of specimens of *P. grandis* grow on the gently inclined slopes of Debela Kosa at Baške Oštarije, immediately above Vrtlina (Šikić Stanovi), in grassland partially covered with *Sesleria juncifolia* s.l. Bushes of *Amelanchier ovalis* are now spreading across the grassland. Also dangerous is the invasion of black pine (*Pinus nigra*) from below (Vrtlina). The soil is brown, and bedrock consisting of carbonate rocks makes up the geological base. Plant species that grow together with *P. grandis* are *Anthericum ramosum* L., *Anthyllis montana* ssp. *jacquinii*, *Betonica officinalis* L. subsp. *serotina* (Host) Murb., *Bromus erectus* Huds., *Carex humilis*, *Centaurea triumfettii* All., *Cytisus villosus* Pourr., *Inula ensifolia* L., *Inula hirta* L., *Knautia* L. sp., *Lilium martagon* L., *Muscari botryoides* (L.) Mill., *Plantago argentea* Chaix, *Plantago holostium* Scop., *Potentilla australis* Krašan, *Primula veris* L. ssp. *columnae* (Ten.) Lüdi, *Rosa spinosissima* L., *Sanguisorba minor* Scop. ssp. *muricata* Briq., *Satureja subspicata* Bartl. ex Vis., *Seseli montanum* L. ssp. *tommasinii* (Rchb. f.) Arcng., *Stachys subcrenata* (Vis.) Briq., *Thalictrum minus* L., *Trifolium montanum* L., *Viola hirta* L.

3. Vrtlina (Šikić Stanovi) at Baške Oštarije

The Vrtlina tract, locally better known as Šikić Stanovi, is situated in the shallow valley between Debela Kosa and Tanka Kosa at Baške Oštarije. In the past, this region was poorly populated, and the pastures were used for cattle. Today, a hiking trail passes through Vrtlina. Over its entire length (about 550 metres), it alternates through open rocky ground pastures and areas overgrown with shrubs. Individual specimens of *P. grandis* grow in several locations immediately alongside the hiking trail and on the open pastures. Growing in the woody species layers of this region are *Pinus nigra*, *Fraxinus excelsior* L., *Acer pseudoplatanus* L., *Corylus avellana* L., *Cornus mas* L., *Crataegus monogyna* Jacq., *Ligustrum vulgare* L., *Viburnum lantana*, *Prunus spinosa* L., *Lonicera alpigena* L., *Lonicera caprifolium* L., *Amelanchier ovalis*, *Juniperus communis*. These plants are partially taking over the pastures. The soil is brown, and carbonate rocks make up the geological base. Other plant species that grow together with *P. grandis* are *Anemone nemorosa* L., *Anemone ranunculoides* L., *Arabis hirsuta*, *Arctostaphylos uva-ursi*, *Betonica officinalis* subsp. *serotina*, *Carex humilis*, *Carlina acaulis* L., *Cytisus villosus*, *Dorycnium germanicum*, *Filipendula vulgaris* Moench, *Galium* L. sp., *Galium verum* L., *Gentiana tergestina*, *Knautia* sp., *Rorippa lippizensis* (Wulfen) Rchb., *Rosa canina* L., *Scabiosa triandra* L., *Scilla bifolia* L.

4. Grasslands east of Kamenjak Hill

P. grandis grows abundantly on the grasslands, densely covered with *S. juncifolia* s.l., that stretch east of Vela Kamičnina (the southern peak of the Kamenjak ridge). Rich populations of *P. grandis* grow within an area some 500 metres in diameter, mostly on northern aspects and on gently inclined slopes. At present, the total number of specimens has not been estimated, although it has been observed that they grow in several separated places. Because grazing is steadily declining, the grassland is being taken over by shrubs and trees, such as *Amelanchier ovalis*, *Sorbus aria* and *Ostrya carpinifolia* Scop. The soil is shallow and brown, and bedrock is carbonate. Some other plant species that grow together with *P. grandis* are *Anthericum ramosum*, *Bromus erectus*, *Carex humilis*, *Centaurea rupestris*, *Dorycnium germanicum*, *Galium* sp., *Genista holopetala*, *G. sericea*, *G. sylvestris* Scop., *Gentiana lutea* ssp. *symphyandra*, *Gladiolus illyricus* W. D. J. Koch, *Helianthemum* Mill. sp., *Hippocrepis comosa* L., *Inula ensifolia*, *I. hirta* L., *Iris illyrica* Tomm., *Knautia illyrica* Beck, *Leucanthemum atratum* (Jacq.) DC. ssp. *platylepis* (Borbás) Heywood, *Linum narbonense* L., *Muscari botryoides*, *Peucedanum cervaria* (L.) Lapeyr., *Plantago argentea*, *Stachys subcrenata*, *Teucrium montanum* L., *Vincetoxicum hirundinaria* Medik. This habitat type is classified as a subtype of ass. *Carici-Centauretum rupestris* Ht. 1931., dominated by the grass *S. juncifolia* s.l.

5. Lukovišće Hill

The entire area in which scattered specimens of *P. grandis* can be found has a radius of some 600 metres and is located in the hilly hinterland of Bakar Bay. Several specimens of *Pulsatilla grandis* grow on the grassland in the doline between the peaks of Trebestin and Lukovišće on Mediterranean-montane pastures that are in succession. Two specimens of *P. grandis* were also found alongside the pipeline route within reach of the western edge of the doline, south-west of Velo Lukovišće. The only larger and more concentrated fragment of the *P. grandis* population, comprising several dozens of specimens, has survived on the northern side of Lukovišće Hill, also on a Mediterranean-montane pasture abandoned. The area has a northern aspect and its bedrock consists of limestones and dolomitised limestones. The soil is rendzic cambisol (rendzina). Many

shrubs have spread across the grassland, in particular *Amelanchier ovalis* and *Ostrya carpinifolia*. Plant species that grow together with *P. grandis* are *Quercus pubescens* Willd., *Sorbus aria*, *Anthyllis montana* ssp. *jacquinii*, *Carex humilis*, *Centaurea rupestris*, *C. triumfettii*, *Cyclamen purpurascens* Mill., *Echinops ritro* L., *Fraxinus ornus* L., *Genista sericea*, *G. sylvestris*, *Gentiana tergestina*, *Gymnadenia* R. Br. sp., *Leucanthemum atratum* ssp. *platylepis*, *Orchis mascula* (L.) L., *Scorzonera austriaca* Willd., *S. juncifolia* s.l., *Anthericum ramosum*, *Stachys subcrenata*, *Viola hirta*. This habitat is classified as a subtype of ass. *Carici-Centauretum rupestris* Ht. 1931., dominated by the grass *S. juncifolia* s.l.

6. Škrebutnjak at the foot of Gornje Jelenje

An isolated fragment of a *P. grandis* population is located in a forest clearing, subject to succession, in the Škrebutnjak region, not far from the ruins of a road maintenance building (along the old road Rijeka-Zagreb, immediately next to the beginning of a marked hiking trail leading to Škrljevo). The population is obviously in decline because grassland habitats are being affected by succession. Despite a thorough search, we succeeded in finding only two specimens of this species. The area has an eastern exposure, the slope is gently inclined, and the geological base is made of compact limestone. The soil is cambisol. Grassy areas are being invaded by shrubs of *Fraxinus ornus* L. Plant species that grow together with *P. grandis* are *Ostrya carpinifolia*, *Daphne alpina* L., *Genista sericea*, *Helianthemum* sp., *Anthericum ramosum*, *Bromus erectus*, *Carex humilis*, *Centaurea rupestris*, *Crocus vernus* (L.) Hill ssp. *albiflorus* (Kit.) Asch. Et Graebn., *Cyclamen purpurascens*, *Inula ensifolia*, *Leucanthemum atratum* ssp. *platylepis*, *Muscari botryoides*, *Potentilla australis*, *Satureia subspicata* ssp. *liburnica* Šilić. This habitat is classified as a ass. *Carici-Centauretum rupestris* Ht. 1931., affected by succession within a belt of hop hornbeam forest (*Ostrya carpinifolia*).

7. Hum Hill, east of Kamenjak

A small population of *P. grandis* also survives on the northern exposed slope of the western ridge of Hum Hill. A detailed search resulted in the discovery of only some dozens of individuals growing on the steep inclination of a pasture of northern aspect, affected by succession. The bedrock is composed of compact limestone. The soil is a rocky cambisol. Succession by stunted *Fraxinus ornus* shrubs is occurring in the grassland. Plant species that grow together with *P. grandis* are *Frangula rupestris*, *Satureia subspicata* ssp. *liburnica*, *Anthericum ramosum*, *Anthyllis montana* ssp. *jacquinii*, *Asperula* L., *Bromus erectus*, *Carex humilis*, *Centaurea rupestris*, *Genista sericea*, *G. sylvestris*, *Gymnadenia* sp., *Inula hirta*, *Knautia illyrica*, *Leucanthemum atratum* ssp. *platylepis*, *Trinia glauca* (L.) Dumort. This habitat is classified as ass. *Carici-Centauretum rupestris* Ht. 1931., affected by succession.

8. Zebar Hill near Drivenik (the margin area of Vinodol)

A large population of *P. grandis* is found on the southern and northern exposed slopes around the peak and on the peak of Zebar Hill (860 m.a.s.l.) overlooking Vinodol valley. Several dozens of individuals of *Pulsatilla grandis* located in a number of isolated patches can be found within a radius of some 400 metres. They are distributed over two different types of grassland communities. One grassland type is classified as a Mediterranean-montane rocky pasture affected by succession (ass. *Carici-Centauretum rupestris*), while the other consists of abandoned pastures dominated by *Sesleria juncifolia* s.l. The latter habitat was recently exposed to fire, which, it seems, did not adversely affect the survival of *Pulsatilla grandis*. We can confirm Dr Jasenka Topić's report (pers. comm.)

about a part of the population growing on the southern exposed slopes of Zebar Hill in an ass. *Carici-Centaureetum rupestris*, not far from a hang-gliding take-off spot. We also studied parts of the population, previously unknown, on the grasslands with *S. juncifolia* s.l. covering the peak and the northern exposure of Zebar Hill. The area has a northern exposure, and the slope is gently inclined. The geological base is composed of carbonate rocks. The *P. grandis* population in this habitat is threatened by shrub and tree succession and possibly by the activities of hang-glider and paragliders. Plant species that grow together with *P. grandis* are *Amelanchier ovalis*, *Anthyllis montana* ssp. *jacquinii*, *Teucrium montanum*, *Genista sericea*, *G. sylvestris*, *Globularia meridionalis* (Podp.) Schwarz, *Betonica officinalis* ssp. *serotina*, *Anthericum ramosum*, *Bromus erectus*, *Carex humilis*, *Centaurea triumfettii*, *Crocus vernus* ssp. *albiflorus*, *Galium lucidum* All., *Inula ensifolia*, *Inula hirta*, *Iris illyrica*, *Lotus corniculatus* L. ssp. *hirsutus* Rothm., *Muscari botryoides*, *Plantago argentea*, *Polygala nicaeensis* Risso ex W. D. J. Koch, *Polygonatum odoratum* (Mill.) Druce var. *odoratum*, *Potentilla australis*, *Thalictrum minus*, *Trifolium montanum* L., *Vincetoxicum hirundinaria*, *Viola hirta*.

Localities of *Genista holopetala*

Twenty one new localities of *G. holopetala* were registered in the hinterland mountains of the town of Rijeka and two, in the Mediterranean-montane area near Vinodol (Table 2).

9. Vodni Žleb above Škalnica

Vodni Žleb is a rocky area located above Škalnica near the town of Klana. Plants of *G. holopetala* grow on the southern exposed dolomite slopes inside *S. juncifolia* s.l. grasslands. Relatively numerous and vigorous *G. holopetala* population survive on the poorly covered, partially eroded steep slopes of southern aspect. The soil is very shallow rendzina, and the bedrock is composed of dolomite breccia. Plant species that grow together with *G. holopetala* are *S. juncifolia* s.l., *Globularia meridionalis*, *Carex humilis*, *Juniperus communis*, *Pinus nigra*, *Genista sericea*, *Inula ensifolia*, *Edraianthus tenuifolius* (Waldst. et Kit.) A. DC., *Fumana procumbens* (Dunal) Gren. et Godr., *Teucrium montanum*, *Carex mucronata* All., *Koeleria splendens* C. Presl, *Erica carnea* L., *Thesium divaricatum* Jan. ex Mert. et Koch, *Anthyllis montana* ssp. *jacquinii*, *Scorzonera austriaca*, *Plantago holosteum*, *Gymnadenia* sp., *Satureja subspicata* ssp. *liburnica*, *Dorycnium germanicum*. Specific to this habitat is the fairly low altitude for this type of vegetation, the isolation of fragmented associations, as well as the vigorous succession by communities of woody species. A particularly exacerbating factor is the expansion of black pine from nearby planted forest communities, which is a threat to the association and to the isolated *G. holopetala* population found here.

10. Brgudac above Rječina spring

A great number of *G. holopetala* plants were found on Brgudac plateau on the low section of Mt Obruč. Dolomite breccias are dominant in the geological structure of this area, while shallow rendzina is the dominant type of soil. *G. holopetala* grows inside *S. juncifolia* s.l. grasslands on flat or gently inclined slopes of all exposures. It is worth noting that some mountain plants (*Daphne cneorum* L., *Pinus mugo* Turra, *Gentiana clusii* Perr. et Song., *Scabiosa graminifolia* L., *Scabiosa silenifolia* Waldst. et Kit., *Carex mucronata*) are present here only at about 500 m.a.s.l. Unfortunately, a part of the site has been afforested with black pines using the rip method, leading to the destruction of a part of the vulnerable flora and vegetation. Plant species that grow together with *G. holopetala* are *Schoenus nigricans* L., *Onosma* L. sp., *Globularia meridionalis*, *Edraianthus tenuifolius*, *Erica carnea*, *Teucrium montanum*, *Gen-*

tiana clusii, *Plantago holosteum*, *Genista sericea*, *Satureja subspicata*, *Potentilla australis*, *Inula ensifolia*. The habitat type is classified as a subtype of ass. *Genisto-Caricetum mucronatae* Ht. 1956 with sporadic stretches of *Schoenus nigricans*.

11. Čunina Glava

Even though the presence of *G. holopetala* on Mt Obruč has been recorded in the past (HORVAT, 1962, POLDINI, 1964, TRINAJSTIĆ, 1998, RANDIĆ, 2010), we consider it useful to give more precise data about this species in several localized, interesting sites in the Obruč mountain system. One locality is the spacious, grassy dolomite slopes stretching below the Obruč mountain-ridge and Čunina Glava. These grasslands suffered from a large fire in 2006 attributed to lightning during a storm (RANDIĆ, 2010). Interestingly, *Genista holopetala* has recovered successfully from the disaster. We have found a similar phenomenon on the slopes affected by fire in the nearby Borovica dale that burned in a large fire in 2003. In 2007, only one year after the fire, in addition to the successful recovery of *G. holopetala* on the fire-affected slopes at the foot of Čunina Glava, we also recorded the recovery of the following species: *Coronilla vaginalis* Lam., *Allium ericetorum* Thore, *Genista sericea*, *Anthyllis montana* ssp. *jacquini*, *Campanula marchesetti* Witasek, *Linum narbonense*, *Viola* L. sp., *Chamaecytisus purpureus* (Scop.) Link and *Euphorbia triflora* Schott, Nym. et Kotschy. The habitat is classified as a fire-affected ass. *Genisto-Caricetum mucronatae* Ht. 1956.

12. Borovica (or Borova Draga) below Mt Obruč

Borovica or Borova Draga is located at the foot of Kobila cliff. *G. holopetala* grows on dolomite flats and rocks inside a native *Pinus nigra* forest. Individual plants of *G. holopetala* can be found growing up to the spring of the torrent stream Boroviščica (only about 400 m.a.s.l.). *G. holopetala* plants grow on dolomite slopes of southern exposure, together with *Pinus nigra*, *Amelanchier ovalis*, *Erica carnea*, *Polygala chamaebuxus* L., *S. juncifolia* s.l.

13. Kobila above Borovica

Kobila is a long limestone cliff located below the peak of Čunina Glava. *G. holopetala* has formed dense stands on the southern exposed slopes on a base of limestone and dolomite. Plant species that grow together with *G. holopetala* are *S. juncifolia* s.l., *Frangula rupestris*, *Satureja subspicata* ssp. *liburnica*, *Bromus erectus*, *Edraianthus tenuifolius*, *Anthyllis* L. sp., *Anthericum ramosum*, *Iris illyrica*, *Genista sylvestris*, *Teucrium montanum*, *Carex humilis*, *Centaurea rupestris* L., *Koeleria* Pers. sp., *Allium ericetorum*, *Asperula* L. sp., *Galium corrudifolium* Vill., *Euphorbia triflora*, *Orobanche* sp., *Genista sericea*, *Stachys subcrenata*, *Vincetoxicum* Wolf sp. In order to classify this type of habitat more precisely, it would be necessary to enter a new type of Mediterranean-montane shrubland habitat into the NHC, seeing how *G. holopetala* has, in places, formed dense independent communities.

14. East side of Mudna Dol

On the east side of Mudna Dol, nearby Živenski Put (below Nebesa, 1138 m.a.s.l.), there are several dolomite spots inside *S. juncifolia* s.l. grassland. *G. holopetala* grows in these spots that are exposed to the strong northerly wind. Plant species that grow together with *G. holopetala* are *Carex mucronata*, *Anthyllis montana* ssp. *jacquini*, *Scabiosa graminifolia*, *Euphrasia illyrica* Wettst., *Satureja subspicata* ssp. *liburnica*, *Genista sericea*, *Edraianthus tenuifolius*, *Genista sylvestris*, *Globularia meridionalis*, *Inula ensifolia*, *Carex humilis*, *Fumana* (Dunal) Spach sp., *Asperula* sp., *Coronilla vaginalis*, *Anthericum ramosum*, *Jurinea mollis* (L.) Rchb., *Linum catharticum* L., *Teucrium montanum*.

15. Unnamed peak between Bela (or Vela) and Mala Peša

Several dozen shrubs of *G. holopetala* were found on the south-eastern exposed rock slopes of the unnamed peak located between Bela (or Vela) and Mala Peša (921 m.a.s.l.) on the south-eastern group of Mt Obruč. The bedrock consists of limestone. Plant species that grow together with *G. holopetala* are *Sorbus aria*, *Teucrium montanum*, *Satureia subspicata* ssp. *liburnica*, *Allium ericetorum*, *Echinops ritro*, *Globularia meridionalis*, *Helianthemum* sp., *Hippocrepis comosa*, *S. juncifolia* s.l.

16. Grobničko Polje – Podkilavac

G. holopetala was found alongside the bed of the torrent stream Sušica near the small village of Podkilavac in Grobničko Polje. Several groups of *G. holopetala* grow within a grassland community dominated by *S. juncifolia* s.l. developing on shallow rendzina formed on fluvio-glacial gravel. Plant species that grow together with *G. holopetala* are *Genista sericea*, *Crepis chondrioides* Jacq., *Anthericum ramosum*, *Plantago argentea*, *Koeleria splendens*, *Allium moschatum* L., *Teucrium montanum*, *Centaurea rupestris*, *Asperula* sp., *Dianthus sylvestris* Wulfen. ssp. *tergestinus* (Rchb.) Hayek, *Bromus erectus*, *Satureia subspicata* ssp. *liburnica*, *Onosma* sp., *Edraianthus tenuifolius*, *Eryngium amethystinum* L., *Inula ensifolia*, *Fumana* sp., *Carex humilis*, *Biscutella laevigata* L., *Globularia meridionalis*, *Scorzonera austriaca*, *Leucanthemum atratum* ssp. *platylepis*, *Thesium divaricatum*, *Leontodon crispus* Vill. ssp. *crispus*, *Linum tenuifolium*.

17. Slopes below Mali Platak

G. holopetala grows on the south-western exposed slopes covered with *S. juncifolia* s.l. grassland. Individual small bushes of *G. holopetala* grow on the carbonate bedrock of abandoned pastures that have partially been planted with young black pines (*Pinus nigra*). The habitat is highly threatened by afforestation and by secondary grassland succession. Plant species that grow together with *G. holopetala* are *Sorbus aria*, *Amelanchier ovalis*, *Peucedanum* (L.) Lapeyr. sp., *P. oreoselinum* (L.) Moench, *Polygonatum odoratum* var. *odoratum*, *Campanula marchesettii*, *Anthericum ramosum*, *Genista sylvestris*, *Carex humilis*, *Daphne alpina*, *Gladiolus illyricus*, *Thalictrum minus*, *Bromus erectus*, *Trinia glauca*, *Anthyllis montana* ssp. *jacquinii*, *Satureia subspicata* ssp. *liburnica*, *Inula ensifolia*, *I. hirta* L., *Allium ericetorum*, *Stachys subcrenata*, *Coronilla vaginalis*, *Gentiana lutea* ssp. *symphyandra*, *Globularia meridionalis*, *Mercurialis ovata* Sternb. et Hoppe, *Ranunculus* L. sp., *Galium* sp. This habitat type is classified as an ass. of *Saturejon subspicatae* H-ić affected by succession.

18. Mrtvačka Glava below Mali Platak

Mrtvačka Glava is an area located below Mali Platak. *G. holopetala* grows on slopes of southern and south-western aspect. The slopes are composed of dolomite breccias and are exposed to the strong northerly wind. Plant species that grow together with *G. holopetala* are *S. juncifolia* s.l., *Gentiana clusii*, *Fumana* sp., *Daphne alpina*, *Carex mucronata*, *Globularia meridionalis*, *Inula ensifolia*, *Satureia subspicata* ssp. *liburnica*.

19. Cestarnica at the beginning of Kripanjski Put

Cestarnica is an area below Mali Platak where the continuous stretch of *S. juncifolia* s.l. grasslands ends. *G. holopetala* grows on the south-western exposed slopes, on a limestone bedrock. Plant species that grow together with *G. holopetala* are *S. juncifolia* s.l., *Genista sylvestris*, *Bromus erectus*, *Anthyllis montana* ssp. *jacquinii*, *Carex humilis*, *Teucrium montanum*, *Echinops ritro*, *Centaurea rupestris*, *Anthericum ramosum*, *Satureia subspicata* ssp. *liburnica*, *Dorycnium germanicum*, *Allium ericetorum*, *Muscari botryoides*, *Campanula mar-*

chesetti, *Knautia* sp., *Thalictrum minus*, *Inula ensifolia*, *Plantago argentea*, *Eryngium amethystinum*, *Scorzonera austriaca*, *Stachys subcrenata*, *Ruta graveolens* L.

20. Jazvina (or Jasvina)

Jazvina (or Jasvina) is a peak (952 m.a.s.l.) in the hinterland mountains of the town Rijeka. *G. holopetala* grows on the top of Jazvina. *G. holopetala* was also found on slopes (of different aspects) from the foot to the peak of Jazvina. The geological bedrock is composed of carbonate rocks, and the soil is shallow. This is the richest finding among *G. holopetala* populations below Mali Platak. Among the other shrub species *Prunus mahaleb* L. is the most common. Some other plant species that grow together with *G. holopetala* are *Amelanchier ovalis*, *Daphne alpina*, *Globularia meridionalis*, *Teucrium montanum*, *Anthyllis montana* ssp. *jacquinii*, *Athamanta turbith* (L.) Brot. ssp. *haynaldii* (Borbás et Euchtr.) Tutin, *Campanula marchesettii*, *Carex humilis*, *Gentiana clusii*, *S. juncifolia* s.l.

21. Krežala – grassy slopes between Cestarnica and Kamenjak

Krežala encompasses grassland and a scrub area of *Juniperus communis* and *Ostrya carpinifolia* located on the slopes exposed to the sun in the hinterland mountains of the town of Rijeka. Several dozen plants of *G. holopetala* grow on calcareous-dolomite slopes of western aspect. Plant species that grow together with *G. holopetala* are *Fraxinus ornus*, *Amelanchier ovalis*, *Euonymus verrucosus* Scop., *Daphne alpina*, *Dorycnium germanicum*, *Genista sylvestris*, *Satureia subspicata* ssp. *liburnica*, *Globularia meridionalis*, *Teucrium montanum*, *Bromus erectus*, *Centaurea rupestris*, *Inula ensifolia*, *I. hirta*, *S. juncifolia* s.l., *Stachys subcrenata*, *Rosa* L. sp., *Galium* sp., *Leucanthemum* Mill. sp.

22. Rebra – Bogdin

Bogdin is a peak located nearby Jasvina in the hinterland mountains of the town of Rijeka. *G. holopetala* grows on some spots exposed to the strong northerly wind and within *S. juncifolia* s.l. grasslands. On some of these grasslands *Genista holopetala* can be found in abundant numbers, while small patches of ass. *Genisto-Caricetum mucronatae* grow in places on the ridge where they are directly exposed to the bora. Plant species that grow together with *G. holopetala* are *Sorbus aria*, *Amelanchier ovalis*, *Salix appendiculata* Vill., *Daphne alpina*, *Satureia subspicata* ssp. *liburnica*, *Anthyllis montana* ssp. *jacquinii*, *Genista sylvestris*, *Carex humilis*, *Carex mucronata*, *Globularia meridionalis*, *Inula ensifolia*, *Leucanthemum atratum* ssp. *platylepis*, *Scabiosa graminifolia*.

23. Mala Kamičina (Mt Kamenjak)

Kamenjak is one of the mountains located among the hinterland mountains of the town of Rijeka. The southern rocky peak of Mt Kamenjak is known as Mala Kamičina. A larger population of *G. holopetala* plants was found in the pass located below Mala Kamičina. *G. holopetala* grows on sparsely overgrown shallow soil exposed to the strong northerly wind, and on steep slopes of western aspect below the pass. Woody species such as *Amelanchier ovalis*, *Sorbus aria* and *Ostrya carpinifolia* have overgrown the lower parts of the grassland which are not as rocky as the higher parts. Some other species that grow together with *G. holopetala* are *Fraxinus ornus*, *Daphne alpina*, *Euonymus verrucosus*, *Frangula rupestris*, *Satureia subspicata* ssp. *liburnica*, *Echinops ritro*, *Genista sericea*, *G. sylvestris*, *Teucrium montanum*, *Globularia meridionalis*, *Inula ensifolia*, *Gentiana lutea* ssp. *symphyandra*, *Knautia illyrica*, *Linum narbonense*, *Peucedanum cervaria*, *Plantago argentea*, *Allium ericetorum*, *Galium* sp., *Stachys subcrenata*, *Carex humilis*. This habitat type is a version of ass. *Carici-Centauretum rupestris* Ht. 1931 with abundantly present of *S. juncifolia* s.l.

24. Grasslands east of Mt Kamenjak (below Mala Kamičina)

G. holopetala also grows on the level or gently inclined grasslands located eastern of Mt Kamenjak (below Mala Kamičina). The geological bedrock is composed of limestone. Some groups of plants of *G. holopetala* are endangered due to succession by *Ostrya carpiniifolia*. Especially notable are the large populations of *Pulsatilla grandis*, the sites of which have never been published in botanical literature before. Plant species that grow together with *G. holopetala* are *Sorbus aria*, *Dorycnium germanicum*, *Teucrium montanum*, *Anthericum ramosum*, *Bromus erectus*, *Carex humilis*, *Centaurea rupestris*, *Genista sericea*, *G. sylvestris*, *Gentiana lutea* ssp. *symphyandra*, *Gladiolus illyricus*, *Helianthemum* sp., *Hippocrepis comosa*, *Inula ensifolia*, *I. hirta*, *Iris illyrica*, *Knautia illyrica*, *Leucanthemum atratum* ssp. *platylepis*, *Linum narbonense*, *Muscari botryoides*, *Stachys subcrenata*, *Vincetoxicum hirundinaria*. This habitat type is a subtype of ass. *Carici-Centauretum rupestris* Ht. 1931 with an abundant presence of *S. juncifolia* s.l.

25. Vela Pliš

Vela Pliš (1141 m.a.s.l.) is a peak located near Gornje Jelenje pass. Several plants of *G. holopetala* grow on the top of Vela Pliš, while a much large number of individuals are scattered on the slopes and ridge around the peak, mostly on northern, western and eastern aspects. The inclination of slopes ranges from steep to gentle. The geological bedrock is composed of carbonates, covered with shallow, black mountain soil (calcomelanosol). Plant species that grow together with *G. holopetala* are *Sorbus aria*, *Teucrium montanum*, *Daphne alpina*, *Satureja subspicata* ssp. *liburnica*, *Helianthemum* sp., *Anthericum ramosum*, *Carex humilis*, *Centaurea rupestris*, *Centaurea triumfettii*, *Hippocrepis comosa*, *Inula ensifolia*, *S. juncifolia* s.l. This habitat type is classified as an ass. of *Saturejon subspicatae* H-ić 1975 dominated by *S. juncifolia* s.l.

26. Vojsko at the edge of Kukuljanske Ponikve

Kukuljanske Ponikve is located in the hinterland of the town of Bakar. An isolated and not numerous population of *G. holopetala* grows within small *S. juncifolia* s.l. grasslands on slopes of north-eastern aspect. The bedrock is composed of carbonate rocks. The soil is shallow, skeletal and brown. Plant species that grow together with *G. holopetala* are *Teucrium montanum*, *Genista sylvestris*, *G. sericea*, *Satureja subspicata* ssp. *liburnica*, *Ruta graveolens*, *Echinops ritro*, *Potentilla australis*, *Muscari botryioides*, *Dorycnium germanicum*, *Fumana procumbens*, *Centaurea rupestris*, *Leucanthemum atratum* ssp. *platylepis*, *Lotus corniculatus*, *Linum tenuifolium*, *Thesium divaricatum*, *Carex humilis*, *Bromus erectus*, *Hippocrepis comosa*, *Stachys subcrenata*, *Eryngium amethystinum*, *Anthericum ramosum*, *Asperula* sp., which grows in this micro location at a low elevation above sea level, exposed to strong northerly winds.

27. Sopalj at the edge of Kostrena Peninsula

On the steep northern edge of Kostrena peninsula in the Sopalj region, communities of *S. juncifolia* s.l. can be found, within which is an isolated and scarce population of *G. holopetala*. Several groups of plants of *G. holopetala* grow on slopes of eastern to north-eastern aspect, on shallow rendzina and bedrock composed of dolomites. Plant species that grow together with *G. holopetala* are *Genista sylvestris*, *G. sericea*, *Teucrium montanum*, *Onosma* sp., *Centaurea rupestris*, *Thalictrum minus*, *Echinops ritro*, *Scorzonera austriaca*, *Carex humilis*, *Anthericum ramosum*, *Euphorbia fragifera* Jan, *Cephalaria leucantha* (L.) Schrad. ex Roem. et Schult., *Eryngium amethystinum*, *Asperula* sp. Succession by woody species

is a great threat to the habitat, as is fire. It is an interesting habitat because it is also the lowest known site of *Genista holopetala* in the Rijeka area.

28. Below hill Tić (edge of Vinodol)

Tić is a hill located at the edge of Vinodol valley. *G. holopetala* forms great populations which grow together with other thermophilous and Mediterranean-montane species on carbonate slopes with shallow skeletal soil, exposed to the sun. This Mediterranean-montane habitat is very interesting and valuable from the aspect of nature protection. Grassland communities are being affected by tree and shrub succession, which is a direct threat to their survival. Plant species that grow together with *G. holopetala* are *Frangula rupestris*, *Daphne alpina*, *Genista sericea*, *G. sylvestris*, *Satureja subspicata* ssp. *liburnica*, *Teucrium montanum*, *Dorycnium germanicum*, *Globularia meridionalis*, *Fumana procumbens*, *Helianthemum* sp., *Eryngium amethystinum*, *Artemisia alba* Turra, *Cephalaria leucantha*, *Dictamnus albus* L., *Centaurea rupestris*, *Linum tenuifolium*, *Aster amellus* L., *Thymus bracteosus* Vis. ex Benth., *Potentilla cinerea* Chaix ex Vill., *S. juncifolia* s.l., *Bromus erectus*, *Carex humilis*, *Koeleria splendens*, *Asperula* sp.

29. Pridva – Njivine above Antovo (edge of Vinodol)

The largest *G. holopetala* populations in this survey were found between Pridva and Njivine at the edge of Vinodol valley. Dolomite is dominant in the geological bedrock of this area. Plants of *G. holopetala* grow on slopes of south-western aspect. These are probably the richest and most thriving communities of *G. holopetala* in the broader region of Rijeka. In places, *G. holopetala* builds compact stands. To classify the habitat type in which *G. holopetala* can be found in almost pure communities more precisely, it will be necessary to introduce a new group of Mediterranean-montane shrubland in which *G. holopetala* is distributed (analogue to the group D.2.1.1.5. – communities in which *Genista radiata* prevails). Plant species that grow together with *G. holopetala* are *Dorycnium germanicum*, *Genista sericea*, *G. sylvestris*, *Satureia subspicata* ssp. *liburnica*, *Teucrium montanum*, *Globularia meridionalis*, *Edraianthus tenuifolius*, *Onosma* sp., *Jurinea mollis*, *Allium sphaerocephalum* L., *A. carinatum* L., *Jurinea mollis*, *Koeleria splendens*, *Bromus erectus*, *Melica ciliata* L., *Carex humilis*, *S. juncifolia* s.l.

Localities of *Cypripedium calceolus*

C. calceolus is one of the rarest plants in the southern section of Mt Velebit. The presence of *C. calceolus* in this area (Medačka Staza, Štirovačka Poljana, Štirovac, Bunovac, Malovan, Visočica) was previously mentioned by DEGEN (1938:648), HORVAT (1938), and NIKOLIĆ (2011). This research has confirmed the presence of *C. calceolus* in three localities and, for the first time, micro locations are described. *C. calceolus* was spotted on the northern border of Paklenica National Park. However, it should also be possible to find this species along the edge of beech forests in the entire area between Bunovac to Badanj or to Visočica. All three sites are located on soils above the carbonate bedrock, and at present are not threatened by collecting (picking), to which this species is typically exposed because of its lovely, conspicuous flowers. The reasons for this situation lie in the area's inaccessibility and, partially, in the vicinity of minefields left over from the Homeland War, because of which visitors to these parts of the Velebit mountain range are rare.

30. Štirovac

Štirovac (1569 m.a.s.l.) is one of the peaks in the vicinity of the gravel road Buljma – Vaganski Vrh. *C. calceolus* was found at the edge of a beech forest below the Štirovac

mountain lodge. Plant species that grow together with *C. calceolus* are *Fagus sylvatica* L., *Astrantia major* L., *Cardamimne enneaphyllos* (L.) Crantz, *Dryopteris filix-mas* (L.) Schott, *Maianthemum bifolium* (L.) F.W. Schmidt., *Neottia nidus-avis* Rich., *Paris quadrifolia* L., *Polypodium vulgare* L., *Pulmonaria officinalis* L., *Sanicula europaea* L., *Symphytum tuberosum* L.

31. Below Malovan

C. calceolus was found near the hiking trail to Malovan. It grows in subalpine beech forests on sites of northern aspect together with *Fagus sylvatica*, *Astrantia major*, *Cerastium dinaricum* G. Beck et Seysez, *Dryas octopetala* L., *Primula kitaibeliana* Schott, *Aethionema saxatile* (L.) R. Br.

32. Bunovac

Bunovac is a plateau located near Malovan. *C. calceolus* was found in the eastern part of Bunovac. It grows inside a beech forest between Bunovac and on a little meadow on the hiking trail to Čičina dolina. About 150–200 specimens cover an area of 15–20 m². Dominating plant species are *Fagus sylvatica*, *Abies alba* Mill., *Acer pseudoplatanus* L., *Anthriscus nitidus* (Wahlb.) Garcke, *Astrantia major*, *Geranium phaeum* L., *Picea abies* (L.) H. Karst.

In conclusion about threats

Based on field observations concerning the level of endangerment of the species *Pulsatilla grandis*, *Genista holopetala* and *Cypripedium calceolus* at 31 new sites in the north-western Dinarides, we can ascertain that succession of grasslands by natural forest vegetation represents the most important threat to *P. grandis*. A similar situation was determined concerning the habitat of *G. holopetala*. In addition, several sites of *P. grandis* and *G. holopetala* are also threatened due to black pine afforestation and, consequently, to the spontaneous expansion of black pine (*Pinus nigra*) from afforested stands onto abandoned grasslands (Mt Velebit and certain sites in the Croatian Littoral). At present, no endangerment of *C. calceolus* as a result of habitat changes has been noticed, and there is no threat of overcollection to this species because the terrain is not easily accessed and is located in an area which visitors are recommended not to enter due to landmines remaining from the Homeland War.

All eight sites of *P. grandis* are threatened, to a greater or lesser extent, by woody vegetation succession. At present, the site Škrebunjak below Gornje Jelenje, together with the site on the slopes of Lukovišće Hill, is the site most threatened by succession. The site Hum, east of Kamenjak, is moderately threatened by succession, while the grasslands south of Kamenjak and the site Zebar above Drivenik are the least threatened and have the most numerous *P. grandis* populations. Black pine succession is a threat to sites on Mt Velebit.

The greatest threat to sites in the Croatian Littoral is the succession of trees and shrubs of flowering ash (*Fraxinus ornus*), followed in numbers by hop hornbeam trees (*Ostrya carpinifolia*), while colonization by the whitebeam (*Sorbus aria*) is much less pronounced. The invasion of shrubs of the species *Amelanchier ovalis* into grasslands is a prominent feature of succession in sites on the slopes of Lukovišće Hill. Grassland communities, which have proven to be the most resistant to the invasion of woody vegetation, are communities in which the grass *S. juncifolia* s.l. grows (in particular, the grasslands east of Kamenjak and the top part of Zebar above Drivenik). An exception is the grasslands with *S. juncifolia* s.l. on the slopes of Lukovišće which are affected by shrub succession

(*Amelanchier ovalis*). An interesting feature of the sites Kobila on Mt Obruč and Pridva-Njivine at the edge of Vinodol Valley is that *G. holopetala* forms dense, monodominant stands which, according to our current observations, are not yet threatened by development of forest vegetation.

Data on new sites of *P. grandis*, *G. holopetala* and *C. calceolus*, three endangered NATURA 2000 species, in the north-western Dinarides underline the urgent need to conduct additional research and to monitor populations of endangered species to help in prescribing measures of active protection. The urgency of this matter comes from the fact that feasibility studies for the construction of wind turbines are being conducted on some of the sites (windswept areas) mentioned.

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SAŽETAK

Novi lokaliteti rijetkih NATURA 2000 vrsta: *Pulsatilla grandis* Wender., *Genista holopetala* (Koch) Bald. i *Cypripedium calceolus* L. na području sjeverozapadnih Dinarida u Hrvatskoj

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U razdoblju od svibnja 2006. do rujna 2011. godine zabilježeni su novi, do sada u literaturi nezabilježeni lokaliteti triju rijetkih i floristički zanimljivih, NATURA 2000 vrsta na području sjeverozapadnih Dinarida u Hrvatskoj. Novi lokaliteti vrste velika sasa (*Pulsatilla grandis* Wender) zabilježeni su na planinama u zaleđu grada Rijeke, iznad Vinodola te na području srednjeg Velebita. Cijelolatična žutilovka (*Genista holopetala* (Koch) Bald.) opažena je na novim lokalitetima na planinama u zaleđu Rijeke i iznad Vinodola, dok su novi lokaliteti gospine papučice (*Cypripedium calceolus* L.) zabilježeni na području južnog Velebita. Cijelolatična žutilovka je endemična vrsta uvrštena u Crvenu knjigu vaskularne flore Hrvatske kao vrsta o kojoj ne postoji dovoljno podataka. Zbog toga podaci o novim, do sada neobjavljenim lokalitetima ovih triju vrsta predstavljaju značajan doprinos i dobru polaznu osnovu za njihova buduća istraživanja. Daljnja istraživanja ovih vrsta neophodna su da bih bolje upoznali te kako bi im osigurali adekvatnu zaštitu. Također, predstavljeni podaci važni su i zbog skorašnje uspostave monitoringa na pridonim populacijama ovih triju vrsta.