

A contribution to the vascular flora of the island of Biševo (central Adriatic, Croatia)

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Floristic research on the island of Biševo was carried out during the spring of 2000 and 2001. A total of 32 taxa of vascular plants were recorded for the first time. Among them, 23 taxa are autochthonous and 9 are cultivated or formerly cultivated. The island is new locality for orchids *Ophrys tommasinii* Vis. and *Ophrys x lyrata* H. Fleischm. This paper also confirms the existence of the neglected species *Reichardia intermedia* (Sch.Bip.) Cout. and until now doubtful species *Euphorbia terracina* L. in the Croatian flora. On the basis of our research and the floristic data published so far, flora of the island of Biševo now consists of 421 plant taxa, which were recorded before the fire that occurred in August of 2003, when 80% of the island was devastated.

Key words: flora, *Euphorbia terracina*, *Reichardia intermedia*, island, Biševo, Adriatic Sea, Croatia

Introduction

The central Adriatic island of Biševo (MTB 3062/1) covers an area of 5.8 km² and belongs to the Vis archipelago (Fig. 1). The island is mostly made of limestone, but alluvial sands are found on the central and northern part of the island (MAMUŽIĆ pers. comm.).

The island has a typical Mediterranean climate (BERTOVIĆ 1975). In the village of Sarbunara there is a little climatological station that measures only rainfall data. According to these measurements the average annual precipitation for the ten-year period (1991–2001) is 545 mm. The highest amount of precipitation occurs in November and December, and the lowest in June and July, when it might not rain at all. The climate of the island is very dry and could be defined as semiarid (BOGDANOVIĆ and MITIĆ 2003), which in phytogeographical terms means that the island of Biševo entirely belongs to the eumediterranean vegetation zone of the class *Quercetea ilicis* Br.-Bl. 1947. The highest part of the

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island is Stražbenica at 240 m above sea level, thus the vertical stratification of vegetation practically does not exist (PAVLETIĆ 1973).

Vegetation of the island consists mostly of garrigues (ass. *Erico-Rosmarinetum* H-ić 1958) and degraded forms of maquis (ass. *Orno-Quercetum ilicis* H-ić (1956) 1958) (PAVLETIĆ 1973, 1975, 1985). The vegetation of rocks of *Centaureo-Campanulion* H-ić 1934 alliance with the association *Phagnalo-Centaureetum ragusinae* (Ht 1942) H-ić 1963 (PAVLETIĆ 1973), and the wall vegetation of *Parietario-Galion murale* Rivas-Martinez 1960 alliance with the association *Asplenio-Umbilicetum horizontalis* (H-ić 1963) Tri-

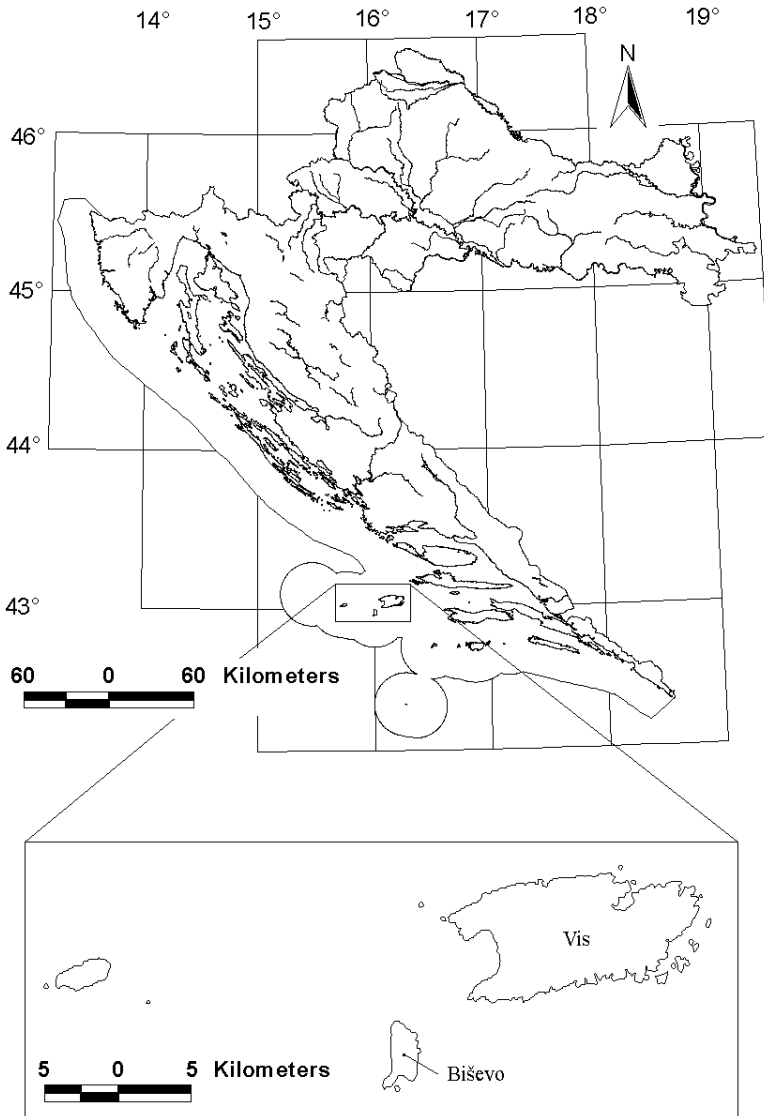


Fig. 1. The position of investigated area.

najstić 1994 are also very well developed (TRINAJSTIĆ 1994). The halophytic vegetation of the *Crithmo-Limonion* Molinier 1934 alliance on coastal rocks is represented with the association *Plantagini-Limonietum cancellati* H-ić (1934) 1939 and with its subassociation *schoenetosum* Pavletić 1992 that was described on the island of Biševo for the first time (PAVLETIĆ 1992). The coastal sand vegetation of the *Ammophilion* Br.-Bl. (1921) 1933 alliance with the association *Agropyretum mediterraneum* (Kühnh.) Br.-Bl. 1933 is only fragmentarily developed due to anthropogenic influence (PAVLETIĆ 1973). Xeric grassland vegetation of the *Cymbopogo-Brachypodium ramosa* H-ić (1956) 1958 alliance with the association *Thero-Brachypodietum adriaticum* H-ić 1970 is developed on degraded agricultural lands and grasslands around the vineyards (PAVLETIĆ 1973).

Floristic research of the island of Biševo has been carried out by several authors in the past: VISIANI (1842–1852), SPREITZENHOFER (1876), GINZBERGER (1921), PAVLETIĆ (1972, 1973, 1974, 1975, 1983, 1985, 1989, 1992), TRINAJSTIĆ (1994) and BOGDANOVIĆ et al. (2003). Our research took place before August of 2003, when a great fire devastated about 80% of the island's vegetation.

Materials and methods

Fieldwork was carried out in the spring of 2000 and 2001. Taxa were determined using the standard determination keys and iconographies (FIORI 1923–1929, 1933; TUTIN et al. 1964–1980; TRINAJSTIĆ 1975–1986; PIGNATTI 1982; DOMAC 1994; BURNIE 1995; DELFORGE 1995, 2001; BLAMEY and GREY-WILSON 1998). The nomenclature has been adjusted according to the Croatian Flora Checklist (NIKOLIĆ 1994, 1996, 1997, 2000a, 2000b), except in the cases of family *Orchidaceae* that has been adjusted according to DELFORGE (1995, 2001), then species *Reichardia intermedia* (Sch.Bip.) Cout. according to *Flora Europaea* (SELL 1976) and *Vicia lutea* L. var. *hirta* Lois. according to HAYEK (1927). Plants were collected and stored in the Herbarium of the Department of Botany, Faculty of Science, University of Zagreb (ZA). Rare and endemic species were photographed.

Life forms are interpreted according to HORVAT (1949) and PIGNATTI (1982). The abbreviations of life forms are given in the first column of Tab. 1: **Ch** – Chamaephyta, **G** – Geophyta, **H** – Hemicryptophyta, **P** – Phanerophyta and **T** – Therophyta.

Results

Prior to our research on the island of Biševo 389 plant taxa had been recorded. During our fieldwork we confirmed 269 taxa and found 32 new taxa for the island's flora. Together with our research, flora of the island of Biševo now consists of 421 plant taxa in total. Unlike prior researchers, in our list we have included species that escaped the area of cultivation and became a part of indigenous flora. Among newly found taxa, 23 are autochthonous and 9 are formerly cultivated (Tab. 1).

Discussion

Apart from listed species, we have confirmed species *Xantium spinosum* L., *Sagina maritima* G. Don and *Carex illegitima* Ces. that PAVLETIĆ (1973, 1974) did not record, but

Tab. 1. The list of new taxa recorded for the island of Biševo (formerly cultivated taxa are marked with *).

Life forms	
MAGNOLIOPSIDA	
Apiaceae	
T	<i>Scandix pecten-veneris</i> L.
Asteraceae	
T	<i>Senecio bicolor</i> (Willd.) Tod. subsp. <i>cineraria</i> (DC.) Châter *
Brassicaceae	
H	<i>Lunaria annua</i> L. *
Caryophyllaceae	
T	<i>Petrorhagia velutina</i> (Guss.) P.W. Ball et Heywood
Cichoriaceae	
T	<i>Crepis sancta</i> (L.) Babč.
T	<i>Reichardia intermedia</i> (Sch.Bip.) Cout.
Fabaceae	
T	<i>Astragalus boeticus</i> L. *
H	<i>Astragalus monspessulanus</i> L.
T	<i>Lathyrus cicera</i> L.
T	<i>Pisum sativum</i> L. *
T	<i>Vicia faba</i> L. *
T	<i>V. hybrida</i> L.
T	<i>V. lutea</i> L.
T	<i>V. lutea</i> L. var. <i>hirta</i> Lois.
T	<i>V. peregrina</i> L.
Frankeniaceae	
T	<i>Frankenia pulverulenta</i> L.
Lamiaceae	
T	<i>Ajuga chamaepitys</i> (L.) Schreb.
Oxalidaceae	
G	<i>Oxalis pes-caprae</i> L.
Rosaceae	
P	<i>Prunus avium</i> L. *
P	<i>P. persica</i> (L.) Batsch *
Rutaceae	
Ch	<i>Ruta graveolens</i> L.
Tetragoniaceae	
T	<i>Tetragonia tetragonioides</i> (Pallas) O. Kuntze *
Urticaceae	
T	<i>Urtica urens</i> L.

Tab. 1. – continued

Life forms	
LILIOPSIDA	
Cyperaceae	
H	<i>Carex divulsa</i> Stokes
Dioscoreaceae	
G	<i>Tamus communis</i> L.
Liliaceae	
G	<i>Lilium candidum</i> L. *
Orchidaceae	
G	<i>Cephalanthera longifolia</i> (L.) Fritsch
G	<i>Ophrys bombyliflora</i> Link
G	<i>O. tommasinii</i> Vis.
G	<i>O. x lyrata</i> H. Fleischm. (= <i>O. bertolonii</i> Moretti x <i>O. incubacea</i> Bianca)
Poaceae	
H	<i>Ampelodesmos mauritanica</i> (Poir.) T. Durand et Schinz
T	<i>Phalaris canariensis</i> L.

that had previously been found by GINZBERGER (1921). During our research we have also recorded species *Silene nocturna* L. that was mentioned in PAVLETIĆ (1973), but not in PAVLETIĆ (1974).

According to HRŠAK (1997) the species *Euphorbia terracina* L. (Fig. 2) is considered dubious for the Croatian flora despite the findings of GINZBERGER (1921) and PAVLETIĆ (1973). In this paper we confirm the presence of *E. terracina* L. on the island of Biševo that until now represents the only known locality in Croatia. The species was found in great number in abandoned vineyards all around the island. For that reason, we suggest that dubious status of the species should be changed.

The island is new locality for orchids *Ophrys tommasinii* Vis. (Fig. 3) and *Ophrys x lyrata* H. Fleischm (Fig. 4), that are very rare in the Croatian flora. On the island, both species can be found within small populations on the edges of garrigues or maquis. According to HAYEK (1933:380) and DE SOÓ (1980:346) *O. tommasinii* is distributed along the coasts of Croatia and northwestern Greece. The orchid *O. x lyrata* is a hybrid between *O. bertolonii* Moretti and *O. incubacea* Bianca. Although orchid *O. bertolonii* has not been found on the island of Biševo, both parental orchids were found on the nearby island of Vis (KRANJČEV 2001). In Croatia this hybrid has been noted only few times: on the island of Mali Lošinj, as its *locus classicus* (FLEISCHMANN 1904), in the southernmost part of Istria, near the town of Pula (PERKO 1998) and on Rt Kamenjak (BRANA pers. comm.) and now on the island of Biševo. Outside Croatia the species has been recorded for South Italy (DEL PRETE 1984) and Sicily (BARTOLO and PULVIRENTI 1997).

The species *Ophrys bombyliflora* Link is considered vulnerable (NIKOLIĆ and TOPIĆ 2004) while the species *Cephalanthera longifolia* (L.) Fritsch is protected by the Nature Conservation Law (PEVALEK-KOZLINA 1994).



Fig. 2. *Euphorbia terracina* L., abandoned vineyard in Sarbunara, island of Biševo, April 2001 (photo by: I. Dobrović).

Along with the typical form of species *Vicia lutea* L. on the island we found individuals with hairy stem and leaves. According to HAYEK (1927:797) this taxa is recognized as *V. lutea* L. var. *hirta* Lois. In the Croatian Flora Checklist different varieties and forms are not listed as separate taxa, but we would like to point out the presence of this variety in the Croatian flora.

The presence of *Frankenia pulverulenta* L. and *Ampelodesmos mauritanica* (Poir.) T. Durand et Schinz is significant because these species are very rare in the Croatian flora. The species *Frankenia pulverulenta* L. has a small area of distribution, limited only to few Dalmatian islands – Jabuka, Kamik (PAVLETIĆ 1983), Mljet (REGULA-BEVILACQUA and ILIJANIĆ 1984), Brusnik (BOGDANOVIĆ and MITIĆ 2003) and now Biševo. The species



Fig. 3. *Ophrys tommasinii* Vis., Kvarnar, island of Biševo, April 2001 (photo by: I. Dobrović).



Fig. 4. *Ophrys x lyrata* H. Fleischm., Donja Sarbunara, island of Biševo, April 2000 (photo by: I. Dobrović).

Ampelodesmos mauritanica (Poir.) T. Durand et Schinz is a westmediterranean species which findings on Balkan peninsula include only the island of Zakynthos in Greece, the island of Lastovo (TRINAJSTIĆ 1969) and islet Sv. Jerolim in the southern part of Istria, where its locality was devastated (FREYN 1877:464). This new locality on the island of Biševo represents an important contribution for the chorology of the species. In the recent fire in August of 2003, its habitat on the island was preserved. As the species is known to colonize the areas affected by fire, we suppose that its population on the island will increase in the near future.

The species *Reichardia intermedia* (Sch.Bip.) Cout. was omitted from the Croatian Flora Checklist (REGULA-BEVILACQUA 2000), although it was previously recorded for the islands of Vis (DOMAC 1955, 1955–1956, TRINAJSTIĆ 1999) and Molat (DOMAC 1963). The island of Biševo is the third known locality of this species in Croatia. Therefore the species should be included in the Croatian Flora Checklist.

After the fire in August of 2003 devastated about 80% of the island's vegetation, the data about the most recent island flora became particularly valuable. Since the small parts of the island remained intact, we suppose that the colonization of devastated areas will begin from these parts, as well as from the adjacent islands. Therefore, our research in the future will be focused on the colonizing species and the successional stages of the vegetation, based on these results as a »zero point« stage.

Acknowledgments

The authors would like to thank The Student Union of the University of Zagreb for funding the research. We would also like to thank M. Sc. Antun Alegro and Prof. Jasenka Topić for their help with determination of some specimens of *Poaceae* family. We are also grateful to Prof. Hannes Paulus from Zoologisches Institut der Universität Wien and Dr. Sc. Radovan Kranjčev for determination of some orchid species, and to our colleagues Ass. Prof. Božena Mitić and Ass. Prof. Toni Nikolić for their critical and useful comments on the manuscript.

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