

FLORA OF THE VELIKI LAGAN AND MALI LAGAN ISLETS (DUGI OTOK ISLAND, CROATIA)

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The flora of the two islets, Veliki Lagan (surface area of 2.16 ha) and Mali Lagan (1.04 ha), located along the north-west coast of Dugi otok island, was researched for the first time in 2014. Altogether, there were 39 species and subspecies within 37 genera and 21 families.

There were 35 and 24 taxa on Veliki Lagan and Mali Lagan, respectively. Therophytes (43.59 %) and plants of the Mediterranean floral element (43.59 %) prevailed on both islets. This highlighted the Mediterranean character of the flora.

Key words: islets, vascular flora, diversity, halophytes, eastern Adriatic, NE Mediterranean

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Tijekom 2014. po prvi put je istraživana flora Velikog (2,16 ha) i Malog Lagana (1,04 ha), otočica smještenih uz sjeverozapadni dio Dugog otoka. Zabilježeno je ukupno 39 vrsta i podvrsta svrstanih u 37 rodova i 21 porodicu. Na Velikom Laganu pronađeno je 35, a na Malom Laganu 24 svojte. U flori istraživanih otočica prevladavaju terofiti (43,59 %) i biljke mediteranskog flornog elementa (43,59 %) što ukazuje na mediteranski karakter flore.

Ključne riječi: otočići, vaskularna flora, raznolikost, halofiti, istočni Jadran, SI Mediteran

INTRODUCTION

The farthest North-Western part of the island of Dugi otok was declared to be an important landscape in 1967, along with two islets, Mali Lagan (surface area of 1.04 ha), Veliki Lagan (2.16 ha) and two reefs: Oključić (0.43 ha) and Baričevac (0.41 ha) reefs (Fig. 1).

During 2012 and 2013, floristic researches of Veli Rat and Verunić, as well as of Oključić and Baričevac reefs (PANDŽA & MILOVIĆ, 2013) were carried out. The islets of Veliki and Mali Lagan are low in altitude (about 2 m above the sea level) so they are completely exposed to the influence of salt. During 20th century, people grew beans and cereals (barley and rye) on these islets and during summer they were used to graze sheep on (Ljubo Mirković, pers. comm.). When anthropogenic influences disappeared, sea-gulls started to nest on both islets.

The goal of this research is to determine the diversity of the flora of two small islets: Mali Lagan and Veliki Lagan and to complete the list of vascular flora of the important landscape of Veli Rat within the boundaries of which the islets are located.

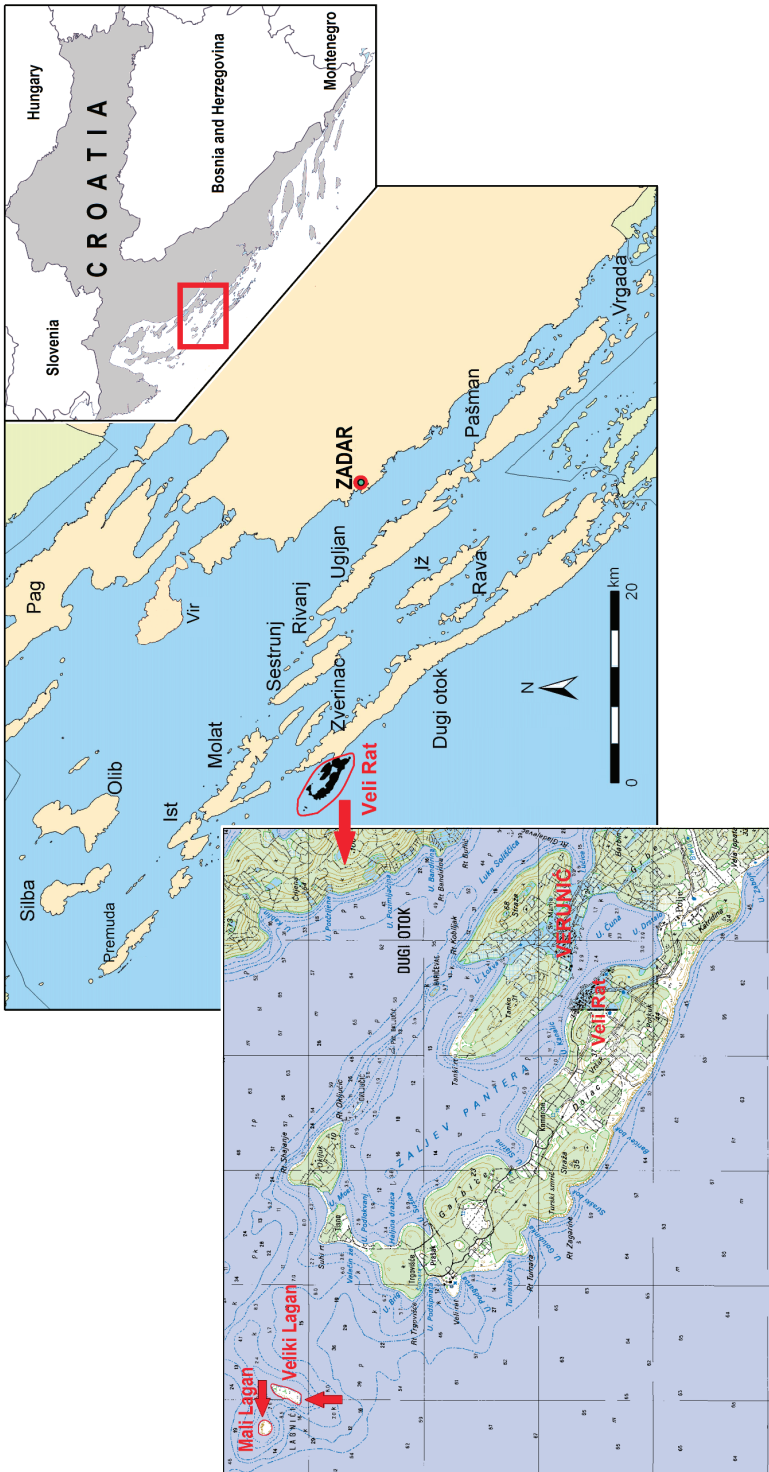


Fig. 1. Geographic location of the Important Landscape of Veli Rat and the researched islets of Mali Lagan and Veliki Lagan.

MATERIAL AND METHODS

The work was carried out during spring and summer 2014. Plant taxa determination was done using PIGNATTI (1982) and the nomenclature follows NIKOLIĆ (2014a).

In the list of flora, species and subspecies were listed in alphabetic order within higher taxonomic categories (genera, families, classes). Designations for islets, life form, chorological type (geoelement), threatened and protected status were provided for each taxon.

A numerical designation of the islet is provided as follows: 1 – Mali Lagan and 2 – Veliki Lagan.

Life forms is determined according to system of RAUNKIAER (1934) and marked with the standard abbreviations: P – *Phanerophytes*, Ch – *Chamaephytes*, H – *Hemicryptophytes*, G – *Geophytes*, T – *Therophytes*, Hy – *Hydrophytes*.

Geoelements are adjusted according to HORVATIĆ (1963) and HORVATIĆ *et al.* (1967/1968), and marked with the appropriate abbreviations in the flora list: **MED** – Mediterranean, **SEU** – South European, **EURO** – European, **EUAS** – Eurasian, **CIHO** – Circum-Holarctic and **WISP** – Widespread plants.

Species considered to be endemic according to NIKOLIĆ *et al.* (2015) are denoted with the abbreviation “**end**” in the flora list. Taxa listed in the Red Book of Vascular Flora of Croatia (NIKOLIĆ & TOPIĆ, 2005; NIKOLIĆ, 2014b) are marked with its corresponding IUCN category: **VU** – *Vulnerable* and **NT** – *Near Threatened*.

Taxa protected by the Nature Protection Act (ANONYMOUS, 2013a) and listed in the Ordinance on Designating Protected Taxa (ANONYMOUS, 2013b) are denoted as “**spr**” – strictly protected.

RESULTS

List of species

SPERMATOPHYTA – ANGIOSPERMAE

DICOTYLEDONES

Amaranthaceae

Amaranthus retroflexus L.; 1; T; **WISP**

Apiaceae

Crithmum maritimum L.; 1, 2; Ch; **MED**

Asteraceae

Carduus micropterus (Borbás) Teyber ssp. *micropterus*; 2; H, **MED**; **end**

Inula crithmoides L.; 2; Ch; **MED**

Brassicaceae

Cakile maritima Scop.; 1, 2; T; **WISP**

Raphanus raphanistrum L. ssp. *landra* (Moretti ex DC.) Bonnier et Layens; 1, 2; T; **WISP**

Caryophyllaceae

Silene vulgaris (Moench) Garcke ssp. *angustifolia* Hayek; 1, 2; H; SEU

Chenopodiaceae

Arthrocnemum macrostachyum (Morici) C.Koch; 1, 2; Ch; SEU

Atriplex littoralis L.; 1, 2; T; EUAS

A. prostrata Boucher ex DC in Lam. et DC.; 1, 2; T; WISP

Beta vulgaris L. ssp. *maritima* (L.) Arcang.; 1,2; H; MED

Chenopodium strictum Roth; 1,2; T; WISP

Ch. vulvaria L.; 2; T; SEU

Halimione portulacoides (L.) Aellen; 2; Ch; CIHO

Cichoriaceae

Cichorium intybus L.; 2; H; WISP

Scolymus hispanicus L.; 2; H; MED

Sonchus tenerrimus L.; 1, 2; T; MED

Convolvulaceae

Convolvulus arvensis L.; 2; G; WISP

Fabaceae

Lotus cytisoides L.; 1, 2; Ch; MED

Vicia angustifolia L. ssp. *angustifolia*; 1; T; EURO

Malvaceae

Lavatera arborea L.; 2; H; MED

Malva sylvestris L.; 1, 2; H; MED

Moraceae

Ficus carica L.; 2; P; MED

Polygonaceae

Polygonum aviculare L.; 1, 2; T; WISP

Portulacaceae

Portulaca oleracea L.; 1,2; T; WISP

Primulaceae

Anagallis arvensis L.; 2; T; WISP

Solanaceae

Solanum nigrum L.; 1, 2; T; WISP

Urticaceae

Parietaria judaica L.; 1; H; SEU

Tamaricaceae

Tamarix dalmatica Baumg.; 2; P; MED

MONOCOTYLEDONES

Amaryllidaceae

Allium commutatum Guss.; 1, 2; G; **MED**

Asparagaceae

Asparagus acutifolius L.; 1; G; **MED**

Poaceae

Avena barbata Pott ex Link; 2; T; **SEU**

Cynodon dactylon (L.) Pers.; 1, 2; G; **WISP**

Dactylis glomerata L. ssp. *hispanica* (Roth) Nyman; 2; H; **MED**

Digitaria sanguinalis (L.) Scop.; 2; T; **WISP**

Elymus pycnanthus (Godr.) Melderis; 1, 2; G; **MED**; NT

Hordeum murinum L. ssp. *leporinum* (Link) Arcang.; 1, 2; T; **MED**

Parapholis incurva (L.) C.E.Hubb.; 2; T; **MED**; VU; **spr**

Zosteraceae

Posidonia oceanica (L.) Delile; 1, 2; Hy; **MED**; **spr**

Analysis of the flora

There are 39 taxa within 37 genera and 21 families. Among them, 35 and 24 taxa were found on Veliki Lagan and Mali Lagan, respectively (Tab. 1).

Tab. 1. Taxonomic analysis of the flora

Taxa	Angiospermae		Total
	Dicotyledones	Monocotyledones	
Families	17	4	21
Genera	27	10	37
Species	24	8	32
Subspecies	5	2	7
Species & subspecies	29	10	39
%	74.4	25.6	100.00

Dicotyledones (74.4% of the total flora) dominated monocotyledones (25.6%). No Pteridophytes and Gymnospermae were recorded. The largest number of taxa belonged to the *Chenopodiaceae* and *Poaceae* (with seven taxa in each), followed by *Cichoriaceae* (3) and other families represented by two or only one taxon.

A relatively low number of taxa is to be expected due to the small surface area of the islets, low habitat diversity and the little human influence. The whole area of these islets is exposed to waves and strong salt spray due to the low altitudes (2 m a.s.l.). Therefore, halophytes and highly salt-tolerant taxa are the most common on both islets. In spring,

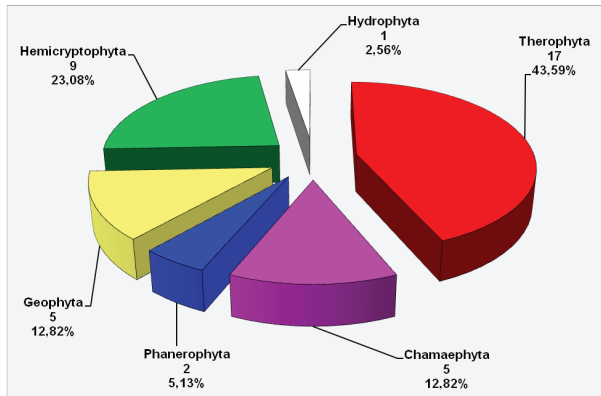


Fig. 2. Life form spectrum of the flora of Mali Lagan and Veliki Lagan.

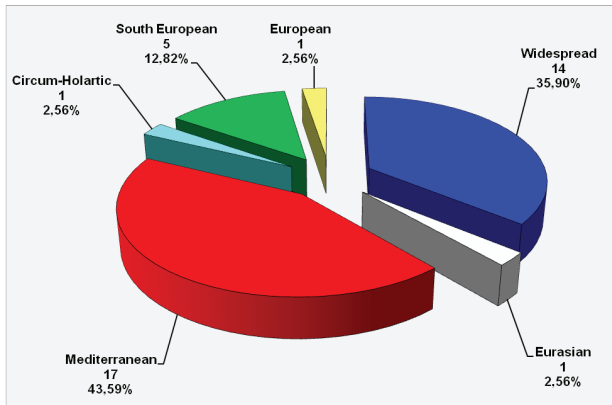


Fig. 3. The spectrum of floral elements in the study islets.

sea-gulls nest, fertilizing the soil and preserving some nitrophilic species such as *Amaranthus retroflexus*, *Chenopodium strictum*, *Ch. vulvaria*, *Lavatera arborea*, *Solanum nigrum*, etc.

Therophytes (43.59%) prevailed, followed by hemicryptophytes (23.08%), chamaephytes and geophytes (each of them with 12.82%) (Fig. 2). In this study, compared to the results of PANDŽA & MILOVIĆ (2013), the flora of the Veliki and Mali Lagan islets had a low contribution of phanerophytes (5.13% vs. 12.91%). This can be explained by the saline environment, which is not suitable for these plants.

Most of the taxa belong to the Mediterranean chorological type (43.59%) (Fig. 3). They are followed by widespread plants (35.90%) and the South-European plants (12.82%). In this case, compared to data given by us for Veli Rat (PANDŽA & MILOVIĆ, 2013), the number of widespread plants is significantly higher (35.90% vs 18.99%), while the contribution of the Southern European and Eurasian were lower. The spectrum of floral elements of the islets studied has no cultivated and adventitious plants, which is not unexpected due to the absence of anthropogenic influence and appropriate habitats.

One endemic species (*Carduus micropterus* ssp. *micropterus*) was recorded in the flora of the two islets. There were also two species from the list of strictly protected species (*Parapholis incurva* and *Posidonia oceanica*) and one endangered species (*Parapholis incurva* – VU), one near threatened (*Elymus pycnanthus* – NT). Large populations of *Posidonia oceanica* were found in the sea around both of the islets which indicates well-preserved marine habitats.

CONCLUSION

As the vascular flora of the Veliki and Mali Lagan islets has not been researched before, all of the species presented in this paper are the very first findings for these islets. The present work and similar works to follow will help in the protection of the flora and increase the importance of conservation status for these sensitive ecological gems.

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SAŽETAK

Flora otočića Velikog i Malog Lagana (Dugi otok, Hrvatska)

M. Pandža & M. Milović

Flora otočića Velikog i Malog Lagana, koji se nalaze u sastavu značajnog krajobraza “Veli rat” na Dugom otoku, istraživana je tijekom 2014. Zabilježeno je 39 svojti vaskularnih biljaka iz 37 rodova i 21 porodice. Na Malom Laganu zabilježene su 24, a na Velikom Laganu 35 svojta. Porodice s najvećim brojem svojta su *Chenopodiaceae* i *Poaceae* (u svakoj sedam svojta). Analiza životnih oblika ukazuje na dominaciju terofita (17 svojta; 43,59%), a fitogeografska analiza dominaciju biljaka mediteranske rasprostranjenosti (17 svojta; 43,59%) od kojih su 10 općemediteranske biljke. Uz mediteranske svojte veliki je udio biljaka široke rasprostranjenosti (14 svojta; 35,90%). Utvrđena je jedna endemična svojta (*Carduus micropterus* ssp. *micropterus*), jedna ugrožena (*Parapholis incurva* – VU), jedna gotovo ugrožena (*Elymus pycnanthus* – NT) te dvije strogo zaštićene svojte (*Parapholis incurva* i *Posidonia oceanica*).