

The spread of critically endangered *Anthemis tomentosa* L. (Asteraceae) in southern Istria

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Abstract

Croatian records of the critically endangered *Anthemis tomentosa* are very scarce. One population was known, from southernmost Istria, within the Significant Landscape Lower Kamenjak and Medulin Archipelago. First records from the 19th century were regarded as dubious, but the species was finally confirmed on Rt Franina (surroundings of Premantura) in the end of 90'ties. During our visits to southern Istria, we found four new localities of this species. The largest population was found in the area of Marlera (surroundings of Ližnjan), where *A. tomentosa* occurs along a four km long coastline. The species commonly occurs at the fringe between the coastal rock vegetation and calcareous grasslands, where the influence of salt spray is high. Observations have shown that *A. tomentosa* is threatened by anthropogenic influences and the population is spreading on Rt Franina since these influences have been reduced.

Keywords: critically endangered species, Lower Kamenjak, Medulin archipelago, new findings, rare species

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Sažetak

Hrvatski nalazi kritično ugrožene vrste *Anthemis tomentosa* su vrlo rijetki. Samo jedna populacija bila je poznata u južnoj Istri, unutar zakonom zaštićenog značajnog krajobraza Donji Kamenjak i Medulinski arhipelag. Prvi nalazi iz 19. stoljeća navode se kao dvojbeni, no vrsta je konačno potvrđena na rtu Franina (okolica Premanture) krajem 90-tih godina. Tijekom naših posjeta južnoj Istri zabilježili smo ukupno četiri nova nalazišta. Najveće nalazište zabilježeno je na području Marlere (okolica Ližnjana), gdje je *A. tomentosa* rasla na području koje se proteže duž četiri km obalne linije. Vrsta uobičajeno dolazi na prijelazu između vegetacije obalnih stijena i travnjačke vegetacije, gdje je visok utjecaj posolice. Opažanja pokazuju da je vrsta ugrožena ljudskim aktivnostima i da se populacija na rtu Franina počela oporavljati kada je ovaj utjecaj smanjen.

Ključne riječi: Donji Kamenjak, kritično ugrožena vrsta, Medulinski arhipelag, novi nalazi, rijetka vrsta

Introduction

A vigorous population of *Anthemis tomentosa* was found in 1995 by Topić et al. (1997) on a small, tongue-shaped piece of land named Rt Franina, at the south-eastern tip of Lower Kamenjak, the southernmost point of Istrian peninsula. This finding was published at the time as the first record of *A. tomentosa* in Croatia. A few years later, while studying the overall flora of Lower Kamenjak, Topić & Šegulja (2000) additionally provide some notes on the possible historical existence of *A. tomentosa* on Lower Kamenjak. Namely, in the 19th century, Tommasini (1873) commented on the plants collected by Otto Sendtner at Rt Kršine (“*Pa Chersina*”) at Lower Kamenjak, describing the specimens as sub-developed, but most probably belonging to *Anthemis peregrina* (= *A. tomentosa*). Later however, Freyn (1878, 1882) also cites the record from Sendtner, but finds no similar plants even after undergoing a detailed search of the locality Rt Kršine. Finally, Freyn (1882) concludes that the finding from Sendtner was dubious and *A. tomentosa* should be excluded from the list of southern Istrian plants. Therefore, the finding by Topić et al. (1997) was indeed a confirmation of dubious historical records from the 19th century, although the plants were not found in exactly the same place.

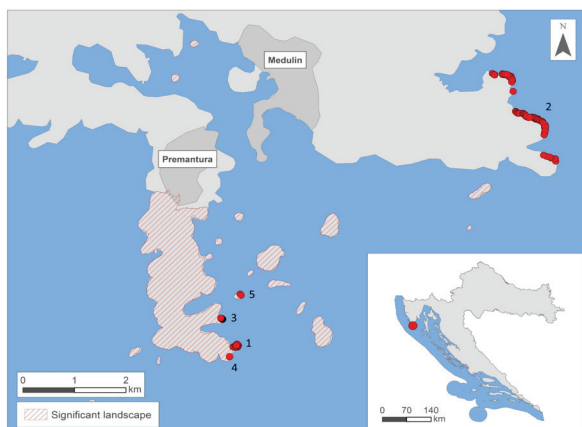


Figure 1. The distribution map of *Anthemis tomentosa* in Croatia. 1 – Rt Franina, 2 – Marlera, 3 – Rt Škara, 4 – Rt Kamenjak, 5 – islet Šekavac.

To date, these southern Istrian records are the only literature records of the species occurrence in Croatia. The European distribution of this species is also rather narrow. According to Fernandes (2010), it occurs in the central and eastern Mediterranean – in Greece, Italy, Sicily and Turkey. In Croatia, *A. tomentosa* is regarded as Critically Endangered (CR) and for this reason is under legal protection as a strictly protected taxon (Anonymous 2013, 2016).

If not precisely defined, the toponym “Kamenjak” may represent several areas in southern Istria as this toponym is used in different contexts. It can be related with Significant Landscape Upper Kamenjak, extending between the settlements Volme and Premantura. Also, it can be related with Significant Landscape Lower Kamenjak and Medulin archipelago, denoting the area of land extending southwards from Premantura as well as 12 surrounding islets. The southernmost cape of Lower Kamenjak is also named Rt Kamenjak (Fig. 1).

The area where *A. tomentosa* was firstly found is within the Significant Landscape Lower Kamenjak and Medulin archipelago, which is legally protected due to the diversity and richness of its flora and vegetation. Due to its long-recognised botanical value, the area has been the focus of floristic studies almost continuously since historical times. Apart from hosting diverse flora and habitats (Topić & Šegulja 2000, Vuković et al. 2011, Ljubičić et al. 2020), this small peninsula is a home for many rare, endemic or endangered plants, such as *Convolvulus lineatus* L., *Serapias istriaca* Perko, *Serapias × pulae* Perko, *Serapias × todaroi* Tineo, *Cicendia filiformis* (L.) Delarbre, *Ophioglossum lusitanicum* L., *Ophrys speculum* Link, *Petalophyllum ralphsii* (Wilson) Nees et Gottsche etc. (Topić 1994, Vuković et al. 2011, 2013, Brana et al. 2014, Šegota et al. 2018, 2020).

Methods

The population on Rt Franina was systematically monitored since 2001. Data on the occurrence of *A. tomentosa* on additional locations (Marlera, Rt Škara, Rt Kamenjak, islet Šekavac) was collected in different years within the 19-year period (2002-2021). The fieldwork was undertaken within the course of several different floristic studies of southern Istria. During 2015 and 2016 a floristic survey of Lower Kamenjak was undertaken for the purpose of regular monitoring of flora of the Significant Landscape.

Few years later, in May 2021 a floristic survey of six islets (Ceja, Bodulaš, Trombuja, Fenera, Fenoliga and Šekavac) around Lower Kamenjak was undertaken. Every islet was thoroughly searched and a checklist of flora was made, while the nomenclature is given according to Flora Croatica Database (Nikolić 2005-onwards). Plant specimens from islet Šekavac were collected, herbarized and stored in the ZA collection (Thiers 2021). The collecting was done in accordance with the permit from Croatian Ministry of Economy and Sustainable Development (Class: UP/I-612-07/21-48/23, Number: 517-05-1-1-21-4). The area of Marlera was firstly visited in 2002, followed by visits in 2008, 2019 and 2020 when the distribution of *A. tomentosa* was mapped in detail. In all sites, the occurrence of *A. tomentosa* was recorded using a GPS device.

Following the new discoveries, the threat level of *Anthemis tomentosa* in Croatia was re-assessed according to the newest IUCN guidelines (IUCN 2019).

Results and discussion

The population at Rt Franina has been monitored regularly since 2001. During this period, we have observed significant fluctuations in the population size; however, it is currently slowly increasing. Previously, a negative trend was observed, but the situation seems to be improving after vehicle access to Rt Franina was prohibited. Namely, Rt Franina is one of the least accessible areas in Lower Kamenjak. It is situated at the very southeast, accessible mainly through the macadam road passing through dense garrigue vegetation spreading across the land. This locality was never one of the “top visited” by summer tourists; however, the existence of the road was contributing to the anthropogenic pressure. After the road was closed for vehicles, the anthropogenic pressure was significantly reduced, allowing the population of *A. tomentosa* to slowly recover. The population is also influenced by natural factors and usually declines during extremely harsh winters. This could be the reason why the finding at Rt Kršine cited by Freyn (1878, 1882)



Figure 2. *Anthemis tomentosa* on islet Šekavac. Habitus (a) and typical habitat between coastal rocks and grassland (b).

and Tommasini (1873) was never confirmed in more recent times. Nevertheless, the population at Rt Franina has so far recovered from such events.

New populations of *A. tomentosa* were firstly recorded in 2002 at Marlera, seven km northeast from the first population at Rt Franina, outside of the Significant Landscape. Subsequent visits to the same area have finally revealed a very large area occupied by *A. tomentosa*, shown in Fig. 1. Here, the species occurs in many dense stands spreading more or less continuously along a four km long coastline. *Anthemis tomentosa* was recorded again in 2015 and 2016 at two new sites in the eastern part of Lower Kamenjak (Rt Škara and Rt Kamenjak), both only a few hundred meters from the known locality on Rt Franina. In 2021, another site with thousands of flowering plants was found on the islet of Šekavac (Fig. 2) in the Medulin archipelago, 1000 m northern from the locality on Rt Franina. The current distribution map of all known sites is shown in Fig. 1.

All stands seem to be stable and vigorous and the occurrence of *A. tomentosa* is apparently increasing. According to our observations, the first known stand at Rt Franina is slowly increasing, and other stands on Kamenjak are probably the result of its further spread. The populations vary in size, but the vast majority of plants occur at Marlera where there are scattered clusters of plants in many places along a four km coastline.

Anthemis tomentosa always grows right at the fringe between coastal rocks and grassland vegetation, as one of the first grassland plants after the rocky belt of *Limonio-Plantaginetum* (Fig. 2). This transitional zone is typically under the strong influence of salt spray. The composition of co-occurring plants is similar in all sites, with representatives of both halophytic and grassland vegetation shown in Tab. 1.

During the survey of the islet of Šekavac, this transitional zone of vegetation was studied in detail across the whole islet, but *A. tomentosa* was found

only in the north-eastern part. Noteworthy, due to their small size, other islets were also studied in great detail but *A. tomentosa* was found only on Šekavac. The islets of the Medulin archipelago including Šekavac (“Zulkovac”) were previously studied in historical times by Tommasini (1873) and Freyn (1878), but *A. tomentosa* was not recorded. During subsequent surveys of the islets of Medulin archipelago by Birač (1966) and Bogdanović & Ljubičić (2014, pers. comm.) *Anthemis tomentosa* was not found, however, the islet Šekavac was not visited during these surveys.

Despite the specific location in a highly touristic area on Lower Kamenjak, the stands are currently apparently stable and the population is seemingly spreading. Lower Kamenjak is a well-known summer tourist destination, visited by thousands of visitors daily during the summer months; therefore, populations of *A. tomentosa* are highly exposed to anthropogenic influences. According to the Red Book of Vascular Flora of Croatia (Nikolić & Topić 2005), tourism was identified as the main threat to populations and this was confirmed by our observations. However, after the anthropogenic impact on Rt Franina was significantly reduced, the population started to recover and spread.

Given that *Anthemis tomentosa* was previously designated as Critically Endangered (CR) based on a sole finding, we took new findings into consideration and provided the new assessment. The population of *A. tomentosa* in Croatia is very small, with a restricted area of occupancy (AOO = 4 km²), however the criteria A, B or C cannot be met, since they imply population decline. Therefore, according to the newest Guidelines (IUCN 2019), we assess the species following the criterion D2, which describes a very small population with a restricted area of occupancy (AOO < 20 km²) as Vulnerable (VU). Due to the threat status, legal protection and interesting population trends, we recommend regular monitoring of all sub-populations of this rare species in the following years.

Table 1. The list of plants present at finding sites of *Anthemis tomentosa* with locality numbers corresponding to the distribution map.

Locality name	Franina	Marlera	Škara	Kamenjak	Šekavac
Locality number	1	2	3	4	5
<i>Allium commutatum</i> Guss.				+	
<i>Allium sphaerocephalon</i> L.	+				
<i>Anthemis tomentosa</i> L.	+	+	+	+	+
<i>Anthyllis vulneraria</i> (L.) subsp. <i>rubiflora</i> (DC.) Arcang.		+			
<i>Arthrocnemum fruticosum</i> (L.) Moq.		+			
<i>Arthrocnemum macrostachyum</i> (Moric.) C. Koch		+			
<i>Atriplex prostrata</i> DC.					+
<i>Beta vulgaris</i> (L.) subsp. <i>maritima</i> (L.) Arcang.		+	+		
<i>Blackstonia perfoliata</i> (L.) Hudson	+	+	+		
<i>Bromus hordaceus</i> L.					+
<i>Centaurium maritimum</i> (L.) Fritsch	+	+	+		
<i>Convolvulus lineatus</i> L.	+				
<i>Crithmum maritimum</i> L.	+	+	+	+	+
<i>Dactylis glomerata</i> L.					+
<i>Daucus carota</i> L.					+
<i>Desmazeria marina</i> (L.) Druce	+	+			
<i>Desmazeria pauciflora</i> Merino	+	+			+
<i>Dorycnium hirsutum</i> (L.) Ser.		+			
<i>Elymus pycnanthus</i> (Godr.) Melderis	+	+		+	+
<i>Halimione portulacoides</i> (L.) Aellen		+			
<i>Helichrysum italicum</i> (Roth) G. Don	+	+			
<i>Herniaria glabra</i> subsp. <i>rotundifolia</i> (Vis.) Trpin	+	+			
<i>Inula crithmoides</i> L.	+	+	+	+	

Locality name	Franina	Marlera	Škara	Kamenjak	Šekavac
Locality number	1	2	3	4	5
<i>Lagurus ovatus</i> L.	+				+
<i>Limonium cancellatum</i> (Bernh.) O. Kuntze	+	+	+		+
<i>Limonium narbonense</i> Mill.		+			
<i>Lotus cytisoides</i> L.	+	+		+	+
<i>Parapholis incurva</i> (L.) C. E. Hubbard	+	+	+		+
<i>Plantago coronopus</i> L.	+	+	+		
<i>Plantago maritima</i> L.		+			
<i>Plantago subulata</i> L.	+	+	+		
<i>Reichardia picroides</i> (L.) Roth	+	+			+
<i>Romulea bulbocodium</i> (L.) Seb. & Mauri	+	+	+		
<i>Schoenus nigricans</i> L.	+	+		+	
<i>Spergularia salina</i> J.Presl & C.Presl		+			
<i>Urospermum dalechampii</i> (L.) Scop.	+	+			
<i>Trifolium scabrum</i> L.					+
<i>Valantia muralis</i> L.	+	+	+	+	

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