

CHOROLOGY OF THE SPECIES *CRAMBE TATARIA* IN NATURE RESERVE DEALUL ZACKEL, SIBIU COUNTY

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KEYWORDS: *Crambe tataria*, chorology, evaluation, Sibiu, nature reserve

ABSTRACT

The aim of this paper is to provide a better understanding of the ecological and conservation importance of the species *Crambe tataria* within the Dealul Zackel nature reserve, the Natura 2000 site ROSCI0093 Insulele Stepice de la Slimnic, Sibiu County, by studying environmental and anthropogenic factors, local distribution, and by offering new chorological data. *Crambe tataria* belongs to the Brassicaceae

(Cruciferae) family and is a steppe species, its geographical distribution in Romania is quite limited, being present only in areas where edaphic and climatic conditions are suitable, such as Dealul Zackel, which serves as a true refuge for this species, providing it with specific habitat conditions. The analyses and data provided can be used for the development of conservation measures and the updating of the management plan.

REZUMAT: Corologia speciei *Crambe tataria* în rezervația naturală Dealul Zackel, județul Sibiu.

Scopul acestei lucrări este de a oferi o mai bună înțelegere a importanței ecologice și conservative a speciei *Crambe tataria* în cadrul rezervației naturale Dealul Zackel, situl Natura 2000 ROSCI0093 Insulele Stepice de la Slimnic, județul Sibiu, prin studiul factorilor de mediu, antropici și a distribuției locale și prin oferirea de noi date corologice. *Crambe tataria* aparține familiei Brassicaceae (Cruciferae) și este o specie

stepică, răspândirea sa geografică în România este destul de limitată, fiind prezentă numai în zonele în care condițiile edafice și climatice sunt potrivite, cum ar fi Dealul Zackel care reprezintă un adevărat refugiu pentru această specie, oferindu-i condiții de habitat specifice. Analizele și datele furnizate pot fi utilizate pentru dezvoltarea unor măsuri de conservare și actualizarea planului de management.

ZUSSAMENFASSUNG: Die Chorologie der Art *Crambe tataria* im Naturschutzgebiet Dealul Zackel, Kreis Sibiu

Ziel dieser Arbeit ist es, ein besseres Verständnis für die ökologische und konservatorische Bedeutung der Art *Crambe tataria* im Naturschutzgebiet Dealul Zackel, dem Natura 2000-Gebiet ROSCI0093 Insulele Stepice de la Slimnic im Kreis Sibiu, zu vermitteln. Dies geschieht durch die Untersuchung von Umwelt- und anthropogenen Faktoren, der lokalen Verbreitung sowie durch die Bereitstellung neuer chorologischer Daten. *Crambe tataria* gehört zur Familie der Brassicaceae

(Kreuzblütler) und ist eine Steppenart, ihre geografische Verbreitung in Rumänien ist recht begrenzt und sie kommt nur in Gebieten vor, in denen die Boden- und Klimabedingungen geeignet sind, wie zum Beispiel auf dem Dealul Zackel, der einen echten Rückzugsort für diese Art darstellt und ihr spezifische Lebensraumbedingungen bietet. Die bereitgestellten Analysen und Daten können für die Entwicklung von Schutzmaßnahmen und die Aktualisierung des Managementplans.

INTRODUCTION

The chosen study area is the Șura Mică - Slimnic Steppe Islands, located in Sibiu County, in the southwest of the Transylvanian Plateau, and is part of the Natura 2000 ecological network (Ministry of Environment, 2017). Within the site there is a mixed nature reserve, Dealul Zackel (Ministry of Environment, 2017), which is an area that includes plant, animal, and geological specimens protected by law. Initially, Dealul Zackel had an area of 11 hectares, but following the major landslide in 1981, the area was reduced to 5 hectares (Drăgulescu, 2010).

Currently, only the western sector is considered a reserve, due to the planting of acacias in 1999 by a fruit farm (Drăgulescu, 2010). The rest of the reserve is also endangered due to the continuous expansion of acacias (Drăgulescu, 2010).

Crambe tataria is a plant endemic to the Pannonian Basin, distributed from the Moldavian Plateau, Central Moldavian Plateau, to the Transylvanian Plateau, Hârtibaciu Plateau, Sibiu Depression, and the Curvature Subcarpathians (Chirilă, 2022). The species preferred habitats are steppes and forest-steppes (Chirilă, 2021), but it is also often found at the edges of roads and in orchards, especially vineyards (Chirilă, 2022). Being a mesoxerophilous-mesophilous species, it is found in grassy, dry, sunny areas with soil that is poor in humus, calcareous, slightly alkaline, and rich in minerals and nutrients (Chirilă, 2021).

MATERIALS AND METHODS

We collected the field information in May when species *Crambe tataria* was in full anthesis. During this period, the entire area of the Dealul Zackel nature reserve and, implicitly, the corresponding part of ROSCI0093 Insulele Stepice de la Slimnic was surveyed for a complete inventory of *Crambe tataria* individuals. The method used to analyze the distribution of *Crambe tataria* individuals on Dealul Zackel is the

The IUCN Red List describes the plant as LC (least concern) (<https://www.iucnredlist.org/species/162122/5544350>) and the distribution as limited, being found only in Europe, in the following countries: Austria, Bulgaria, Croatia, Hungary, Italy, Liechtenstein, Moldova, Romania, Serbia, Slovakia, and Slovenia (<https://www.iucnredlist.org/species/162122/5544350#assessment-information>).

The species *Crambe tataria*, is a perennial herbaceous plant, whose size varies between 60 cm and 150 cm (Chirilă, 2022). It belongs to the order *Cruciferales* (*Capparales*), family *Brassicaceae* (*Cruciferae*) (Sârbu et al., 2013). The root reaches a great depth and is long, thick, with a brown-blackish color on the outside and white on the inside (Chirilă, 2021), while the leaves are sinuate-dentate to pinnatifid (Ciocârlan, 2009). The inflorescence is abundant, spherical in shape, consisting of racemes arranged like an umbel (Chirilă, 2021), whose petals are 5–6 mm long (Ciocârlan, 2009). The fruit is globular, measuring between 4–5 mm (Ciocârlan, 2009).

Crambe tataria is considered vulnerable in terms of its reproduction, as flowering occurs after 2–3 years or even longer, and the main method of reproduction is through seeds, although the number of fruits ranges between 2500 and 10200, the proportion of insufficiently developed seeds is high, resulting in a low germination rate (Izverscaia et al., 2002).

measurement of cover in sample plots (2 x 2 m), GPS coordinates recorded.

Data were collected regarding the density of individuals, vegetation stage, and cover.

The identification of individuals was carried out using "Flora ilustrată a României: Pteridophyta et Spermatophyta" by Vasile Ciocârlan (2009) and "Plante Vasculare din România: determinant ilustrat de teren" by Sârbu et al. (2013).

RESULTS AND DISCUSSIONS

Depending on the presence of *Crambe tataria* individuals, 111 sample squares were created so that all individuals identified in the field would be included in

such a square; therefore, the sampling was subjective, at the discretion of the specialist. The data collected from the field are presented in Table 1.

Table 1: Data collected on the fie

No.	Latitude	Longitude	Density of young, vegetative specimen	Density of mature specimens with flowers	Density of mature specimens with fruit	Coverage	Altitude
1	45°53,877'	24°10,264'	0	1	0	20%	497
2	45°53,895'	24°10,261'	0	2	0	35%	499
3	45°53,897'	24°10,262'	0	1	0	10%	499
4	45°53,898'	24°10,259'	0	1	0	20%	499
5	45°53,899'	24°10,256'	0	2	0	50%	499
6	45°53,901'	24°10,254'	0	2	0	65%	497
7	45°53,902'	24°10,252'	0	1	0	25%	498
8	45°53,904'	24°10,255'	0	1	0	35%	500
9	45°53,908'	24°10,251'	0	1	0	40%	499
10	45°53,911'	24°10,241'	0	1	0	25%	495
11	45°53,950'	24°10,306'	0	0	1	5%	535
12	45°53,950'	24°10,306'	0	1	0	20%	542
13	45°53,954'	24°10,319'	0	2	0	50%	555
14	45°53,955'	24°10,318'	0	1	0	10%	555
15	45°53,951'	24°10,326'	0	0	1	5%	561
16	45°53,949'	24°10,327'	0	3	0	30%	557
17	45°53,947'	24°10,343'	0	0	1	50%	566
18	45°53,957'	24°10,360'	0	1	0	15%	564
19	45°53,955'	24°10,359'	0	0	1	10%	563
20	45°53,955'	24°10,357'	0	0	1	7%	562
21	45°53,960'	24°10,345'	0	0	4	15%	564
22	45°53,960'	24°10,344'	0	1	0	20%	566
23	45°53,961'	24°10,347'	0	1	0	15%	566
24	45°53,965'	24°10,347'	0	2	0	15%	565
25	45°53,968'	24°10,337'	0	0	1	20%	566
26	45°53,973'	24°10,335'	0	0	1	15%	561
27	45°53,951'	24°10,349'	0	0	1	25%	567
28	45°53,946'	24°10,368'	0	0	1	15%	565
29	45°53,931'	24°10,374'	0	1	0	25%	565
30	45°53,925'	24°10,374'	0	1	0	15%	567

31	45°53,917'	24°10,371'	0	1	0	65%	566
32	45°53,917'	24°10,370'	0	0	1	15%	566
33	45°53,916'	24°10,370'	0	1	1	30%	565
34	45°53,915'	24°10,370'	0	0	1	10%	564
35	45°53,910'	24°10,376'	3	0	1	80%	566
36	45°53,911'	24°10,376'	2	0	0	5%	566
37	45°53,911'	24°10,377'	2	0	0	20%	566
38	45°53,911'	24°10,378'	2	0	0	20%	566
39	45°53,912'	24°10,382'	1	0	0	15%	566
40	45°53,911'	24°10,383'	0	1	0	15%	565
41	45°53,894'	24°10,393'	1	0	1	20%	559
42	45°53,897'	24°10,389'	0	0	1	25%	558
43	45°53,898'	24°10,387'	2	0	0	5%	556
44	45°53,901'	24°10,378'	0	0	1	20%	560
45	45°53,889'	24°10,395'	0	0	1	30%	558
46	45°53,889'	24°10,393'	0	0	1	20%	557
47	45°53,894'	24°10,391'	0	0	1	10%	560
48	45°53,895'	24°10,392'	1	2	0	35%	562
49	45°53,902'	24°10,375'	3	0	0	15%	552
50	45°53,902'	24°10,375'	0	0	1	20%	555
51	45°53,901'	24°10,375'	2	0	0	15%	555
52	45°53,899'	24°10,376'	2	0	0	15%	556
53	45°53,898'	24°10,376'	1	0	0	10%	554
54	45°53,891'	24°10,380'	1	0	1	80%	555
55	45°53,900'	24°10,369'	0	0	1	25%	555
56	45°53,907'	24°10,367'	0	1	0	25%	557
57	45°53,906'	24°10,366'	1	1	0	20%	557
58	45°53,906'	24°10,366'	1	0	0	10%	556
59	45°53,899'	24°10,360'	1	1	1	55%	550
60	45°53,905'	24°10,361'	2	0	0	20%	553
61	45°53,889'	24°10,395'	2	0	0	15%	558
62	45°53,889'	24°10,395'	0	1	1	40%	558
63	45°53,889'	24°10,395'	1	0	0	10%	558
64	45°53,889'	24°10,395'	0	0	1	20%	558
65	45°53,889'	24°10,395'	0	0	1	15%	558
66	45°53,917'	24°10,353'	0	1	0	25%	555
67	45°53,918'	24°10,355'	1	0	0	15%	556
68	45°53,919'	24°10,357'	1	0	0	15%	556
69	45°53,919'	24°10,359'	0	0	2	50%	556
70	45°53,919'	24°10,359'	0	0	1	50%	556
71	45°89,879'	24°17,268'	3	0	1	50%	523
				0			
72	45°89,880'	24°17,256'	0		2	60%	520

73	45°89,881'	24°17,256'	0	0	1	15%	520
74	45°89,873'	24°17,248'	1	0	0	15%	514
75	45°89,870'	24°17,244'	0	0	1	40%	515
76	45°89,872'	24°17,261'	2	1	0	50%	521
77	45°89,866'	24°17,254'	1	1	0	40%	517
78	45°89,876'	24°17,234'	0	1	0	20%	512
79	45°89,876'	24°17,239'	0	1	0	20%	521
80	45°89,879'	24°17,240'	0	1	0	10%	515
81	45°89,889'	24°17,243'	0	0	1	70%	521
82	45°89,889'	24°17,243'	3	1	0	60%	524
83	45°89,896'	24°17,250'	1	1	0	30%	522
84	45°89,881'	24°17,245'	2	0	0	10%	519
85	45°89,892'	24°17,223'	2	0	0	5%	512
86	45°89,901'	24°17,221'	1	0	0	5%	524
87	45°89,855'	24°17,228'	0	0	1	40%	504
88	45°89,850'	24°17,228'	2	0	0	10%	505
89	45°89,789'	24°17,451'	0	1	0	60%	507
90	45°89,843'	24°17,223'	0	1	0	10%	499
91	45°89,843'	24°17,221'	2	0	0	5%	499
92	45°89,854'	24°17,207'	1	0	0	5%	498
93	45°89,857'	24°17,134'	1	0	0	5%	501
94	45°89,863'	24°17,176'	2	0	0	5%	496
95	45°89,864'	24°17,172'	1	0	0	5%	493
96	45°89,866'	24°17,158'	1	0	0	5%	491
97	45°89,863'	24°17,158'	0	1	0	60%	487
98	45°89,860'	24°17,151'	0	1	0	15%	481
99	45°89,870'	24°17,143'	0	2	0	15%	479
100	45°89,872'	24°17,143'	0	1	0	10%	481
101	45°89,861'	24°17,143'	3	0	0	10%	477
102	45°89,876'	24°17,131'	3	0	0	10%	483
103	45°89,822'	24°17,189'	2	0	0	50%	483
104	45°89,838'	24°17,176'	1	0	0	5%	484
105	45°89,869'	24°17,128'	0	1	0	20%	479
106	45°89,866'	24°17,124'	0	0	1	20%	477
107	45°89,839'	24°17,102'	1	0	0	5%	460
108	45°89,859'	24°16,992'	2	0	0	10%	460
109	45°89,855'	24°17,063'	0	1	0	35%	453
110	45°89,853'	24°17,063'	0	1	0	50%	450
111	45°89,852'	24°17,061'	0	3	0	50%	448
			71	57	41		

In total, 169 individuals were counted, of which 71 in the juvenile stage, 57 in the mature stage with flowers and 41 in the mature stage with fruit. The density of the individuals is 169/3,2 ha, meaning 52,81 individuals/ha. Also, 5 remains of bushes from previous years were present.

The highest coverage is in young individuals, at 42%, followed by the mature individuals with flower, and lastly the mature individuals with fruit (Fig. 1). After the establishment of the sample squares, it was found that the most frequent coverage found was 15% (Fig. 2).

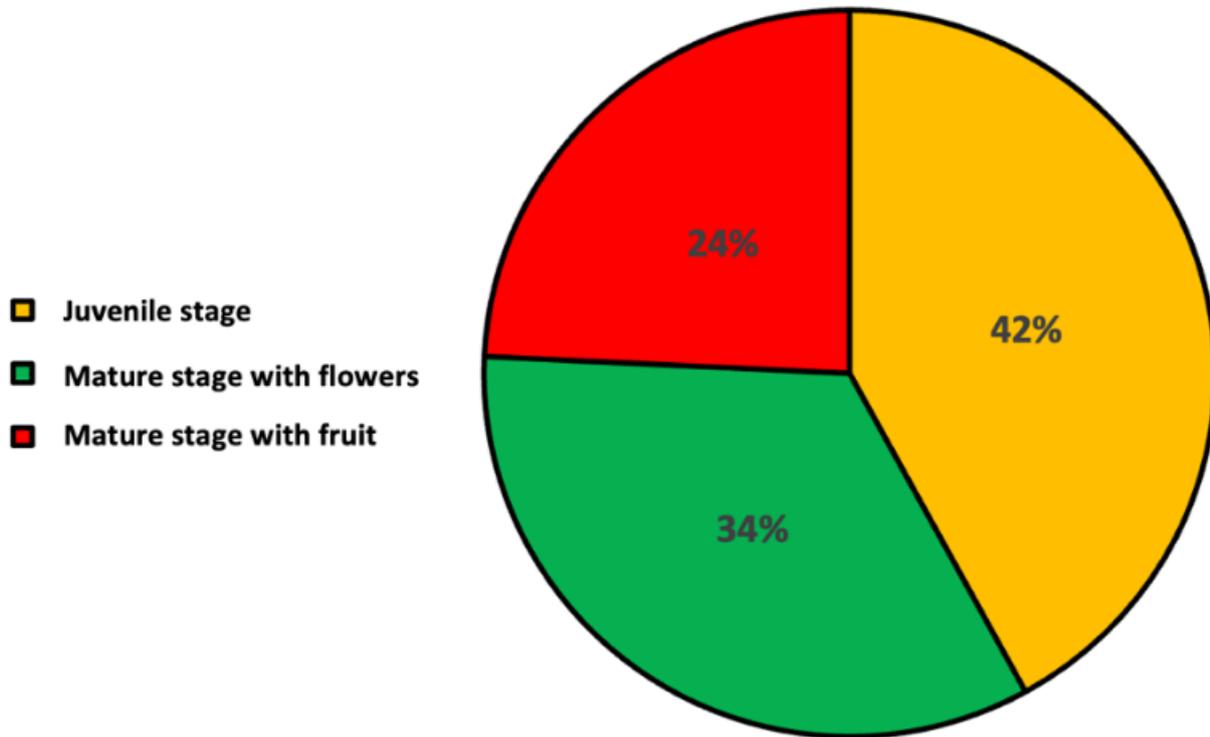


Figure 1: The density percentages of each stage of development

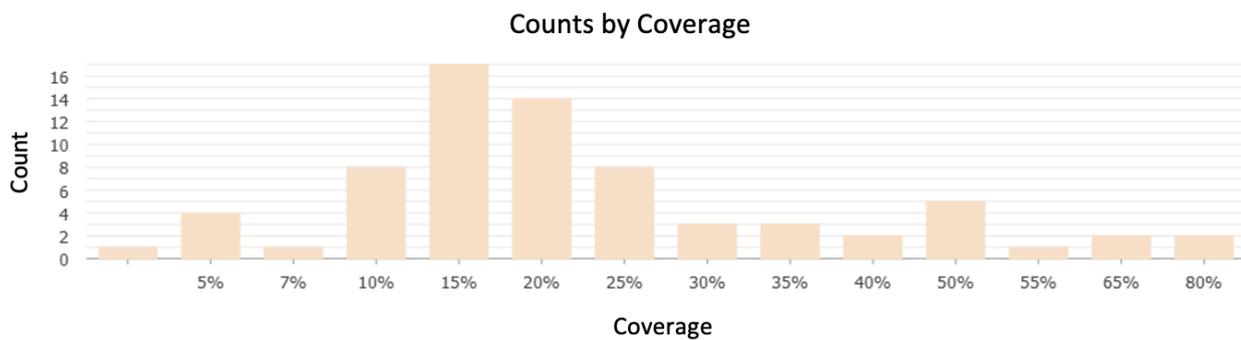


Figure 2: Counting the sample squares according to coverage

Moreover, this coverage was present in 16 sample squares, but a coverage of 10-25% was also registered in a lot of sample squares.

By measuring the coverage of each sample square, we observed that the density of the individuals of *Crambe tataria* increases with increasing altitude, no matter the stage of development of the plant (Fig. 3). Increasing the altitude has an effect on the

climatic conditions: precipitations increase, temperature and atmospheric pressure decrease, wind and solar radiation intensify (Tăușan, 2024). These changes in the climatic conditions show that the plant is more adapted to these habitat conditions. Also, we can observe that only at 471- 480 m altitude individuals appear in the mature stage with

fruit, also due to the modifications that appeared once the altitude increased (Fig. 3).

Worth mentioning is the fact that during data collection and analysis there is a

possibility of human error of approximately 5%. The charts in Figures 4.a and 4.b show the presence of each development stage of the plant in all 111 sample squares.

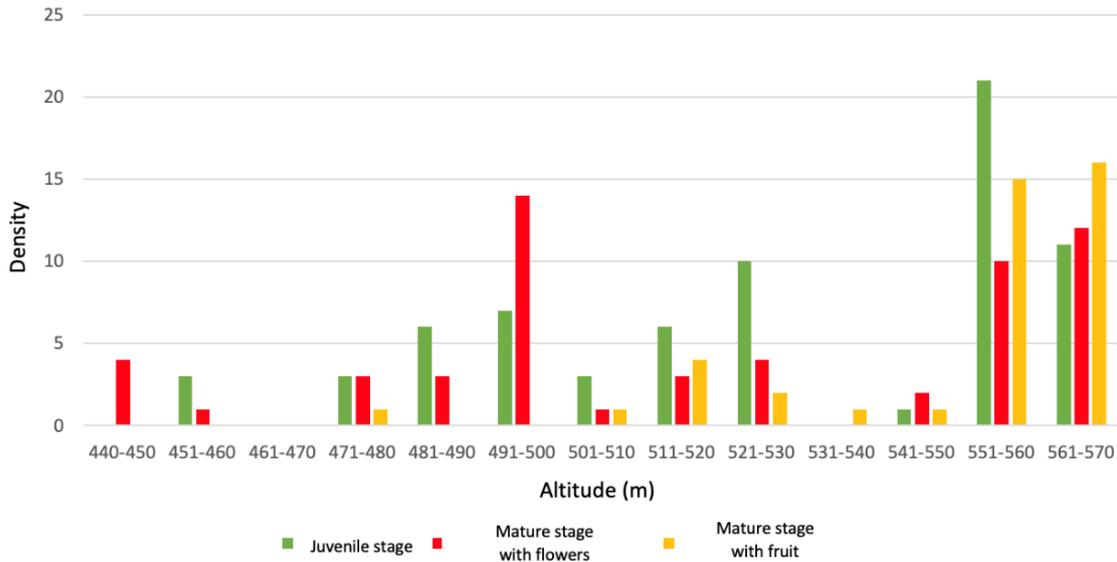


Figure 3: The density of individuals according to altitude

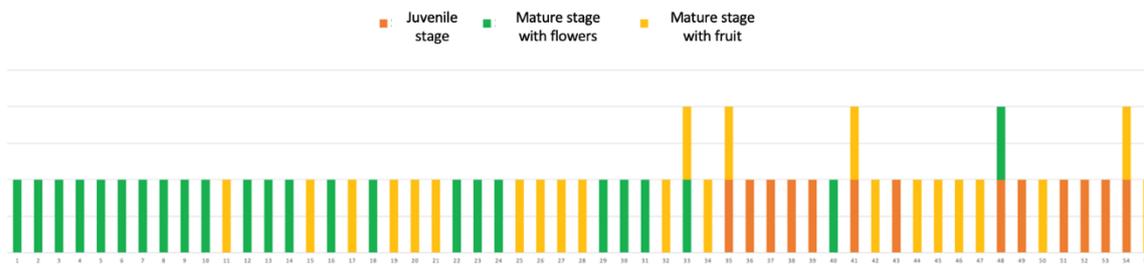


Figure 4.a: Development stages of the first 55 individuals

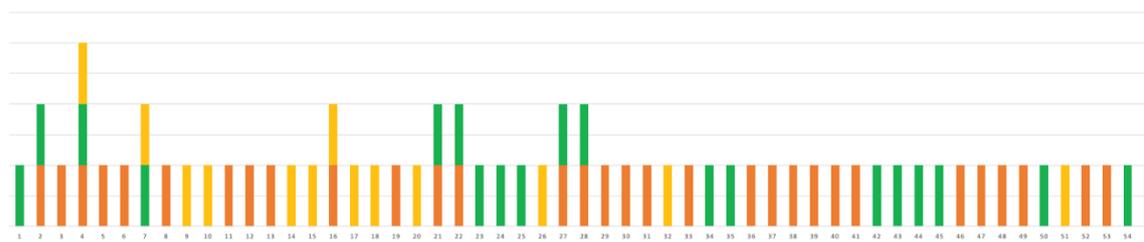


Figure 4.b: Development stages of the last 56 individuals

The conservation status of the species is favourable considering the on-site conditions, the population structure of individuals in juvenile stage and in mature stage with flowers and fruit, which assures viability given the fact that fieldwork was conducted on a regular basis and no more than 200 individuals were recorded.

We observed that the entrance of the nature reserve was marked with a gate and

outlined by a fence, these two elements having an important impact upon the conservation of the plant species found within this nature reserve. Moreover, the gate and the fence reduce the negative effects brought by anthropogenic and herbivorous activities, leading to long-term survival of the plants and reproductive success (Fenu et al., 2015).

The plant species identified in the area are: *Rosa canina*, *Prunus spinosa*, *Crataegus monogyna*, *Neotinea tridentata*, *Stipa pennata*, *Dictamnus albus*, *Pinaropappus roseus*, *Fragaria vesca*, *Vicia*

tenuifolia, *Veronica austriaca*, *Verbascum phoeniceum*, *Cynoglossum officinale*, *Salvia pratensis*, *Tragopogon dubius*, *Filipendula vulgaris*, *Astragalus monspessulans* and *Reseda lutea*

CONCLUSIONS

Following the field study conducted in May 2025, the following aspects regarding the species *Crambe tataria*, the subject of this study, were observed: 111 sample squares were created and 169 individuals were identified, with the structure by phenological development stages as follows: 57 flowering adults, 41 adults with fruits, and 71 vegetative individuals. The plant was found on flat, sunny terraces at altitudes between 448 and 567 meters. The minimum recorded cover was 5%, while the maximum cover was 80%. Currently, the conservation status of the species is vulnerable, as evidenced by the population decline.

Comparing the specialized literature with the current analyses, it was found that the number of *Crambe tataria* individuals within the Șura Mică - Slimnic Steppe Islands

Reserve, with a focus on the Dealul Zackel area, is in decline. In the 2017 Management Plan for the Natura 2000 Site ROSCI0093 Șura Mică - Slimnic Steppe Islands, 643 individuals were reported, while the data collected now suggest a number of 169 individuals—a decline of approximately 73% over 8 years. The main reason for this significant decline is overgrazing within the reserve; therefore, the current management objectives focus on prohibiting grazing, as well as controlling invasive species and banning land destruction and plant collection. This study is relevant for understanding how overgrazing affects the ecological conditions of *Crambe tataria* populations, thus providing the opportunity to develop new conservation measures.

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