

ECOLOGICAL AND CHOROLOGICAL STUDIES OF THE SPECIES *CRAMBE TATARIA* SEBEÓK FROM ROMANIA

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Crambe tataria Sebeók (Brassicaceae) is considered an endangered species due to anthropogenic impact. Populations of *C. tataria* have a fragmented distribution, in the form of more or less isolated groups, with a distribution influenced by habitat conditions. Following the analysis of old and recent data on the presence of *C. tataria* in Romania, it was found that there is no botanical work on the complete distribution in Romania. The areas involved in this study are the Northeast (Moldova), Central (Transylvania) and Southeast (Muntenia) regions. This study aimed at the chorology of *C. tataria* in Romania. Thus, the analysis of this species allowed us to elaborate on some original chorological maps, which presented an overview of the distribution of the species in Romania. Also, some considerations about the ecology of the species were mentioned, as well as the variation of the abundance of the number of individuals in the populations analyzed according to elevation. The results obtained indicated that with increasing elevation there is a decrease in the size of the *C. tataria* population. Compared to the literature, there was a decrease in the number of *C. tataria* populations.

Keywords: *Crambe tataria*, chorology, ecology, elevation, distribution maps.

INTRODUCTION

Crambe tataria is a perennial species, with heights from 60 cm to 150 cm. The root is well developed, deep, very thick, long, vigorous, fleshy and sweet, blackish-brown on the outside and white on the inside (Nyárády, 1955; Horváth, 2005; Sârbu *et al.*, 2007). The leaves have several narrow and elongated lobes, with wavy edges and large rounded teeth. The inflorescence is spherical, rich, very large, composed of numerous dense, umbel-shaped racemes. The fruit is articulated silica, with a length of 5–7 mm (Nyárády, 1955; Ball, 1964; Horváth, 2005; Popescu, 2013). Regarding the habitats occupied by *C. tataria*, its presence was found in well-drained soils and, for the most part, an alkaline pH (Horváth, 2005; Kell, 2011). It is a heliophilous species, which prefers loess soils (clay, marl), poor in humus, calcareous, dry, loose, slightly alkaline, rich in nutrients and minerals (Kell, 2011).

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C. tataria is a species of grasslands with a discontinuous distribution, from the Pannonian Plain to the grasslands north of the Black Sea (European Environment Agency, 2007–2012). The habitats of the species *C. tataria* are found in Romania in the steppe and forest-steppe areas. *C. tataria* is a mesoxerophilic-mesophilic species, being considered a specialist of open grassland areas, on sunny, dry eroded, and grassy hills (Bădărău, 2019). From a phytocoenological point of view, the analyzed species is characteristic of the *Festuco-Brometea* and *Molinio-Arrhenatheretea* classes. In the Romanian flora, *C. tataria* is mentioned in the red list of higher plants in Romania (Oltean *et al.*, 1994) as vulnerable and rare (V / R).

Crambe tataria is a postglacial relict in Romania (Béres, 1996), and thermophilic relict in Europe (Soó, 1942) being common in Transylvania, rare in Moldova, Muntenia and Dobrogea and very rare in Banat (Brândză, 1898; Nyárády, 1955; Oprea, 2005; Anastasiu, 2015). According to existing published data on *C. tataria* and field data, the distribution of the species is lower than previously studied. The main cause is overgrazing. Although in Romania, the areas where the presence of the species is reported are extensive, most populations are local, isolated, or dispersed. In Romania, according to the management plans and observations made in the field, the size of the population is between five and over 10.000 individuals. In the last three decades, the instability of the species is also confirmed by the fact that 60% of the national populations mentioned in the literature have not been identified. In this context, we start from the hypothesis that the species *C. tataria* has a much lower distribution than the one presented in the literature.

The reason for studying the species *C. tataria* is represented by its rarity at the European level, an aspect surprised by the protection status in different European countries. The study aimed to provide an overview of the presence of *C. tataria* in Romania, in areas with potentially favourable ecological conditions. In order to represent the chorological area of the species *C. tataria*, the following objectives were established: (1) the critical analysis of the literature regarding the distribution of the species *C. tataria* in Romania; (2) identification of *C. tataria* populations in Romania, and (3) elaboration a map regarding the distribution of the species in Romania.

MATERIALS AND METHODS

Various bibliographic sources have been studied for the organization and highlighting of the knowledge and implicitly of the distribution of the species *C. tataria* in Romania. In this context, the scientific material needed to complete the database, in which populations of *C. tataria* were reported, was represented by the following sources: management plans and standard forms for Natura 2000 sites;

specialized sites and databases; scientific articles; speciality books; herbarium; personal observations of researchers and personal observations. The geographical coordinates were recorded using the Android GPS Test version 1.48 Pro and then exported in .kmz format. The data collected both from the field and from the literature were organized in spatial format, by representing a distribution map, elaborated in the QGIS program version 3.14.16. This map refers to populations of *C. tataria* verified in field research. Following the analysis of the literature, herbarium, and researchers' observations compared to personal data obtained in the field, it was found that some data on the distribution of this species are uncertain. To elucidate this uncertainty, in April–August (2019–2021), field trips were made to some localities in the regions of Moldova, Muntenia, and Transylvania. The diagram regarding the variation of the abundance of the number of individuals in the populations analyzed according to elevations was made in the Past program version 4.03 (Hammer *et al.*, 2001). The identification of plant associates was determined according to the literature (Chifu *et al.*, 2014).

RESULTS AND DISCUSSIONS

C. tataria has attracted the attention of taxonomists and systematists in botany over many centuries. Thus, the first mentions of the presence of the species have been reported since the periods of the Holy Roman Empire and the Austrian Empire, with a more or less sporadic character, mainly in the early 19th century. In Romania, among the famous researchers of these periods were Johann Baumgarten (1816), Michael Fuss (1846–1866), Philipp Schur (1866), etc. Later, in the post-war period, botanists Rezső Soó (1942–1944) and Erasmus Nyárády (1955) identified about 50 localities where they reported the presence of *C. tataria*.

The chorological study highlights the presence of *C. tataria* in grasslands and bushes in steppe and forest-steppe areas (Popescu, 2013; Anastasiu, 2015; Bădărău, 2019). The analysis of data from the literature includes 168 populations of the species *C. tataria* in Romania (Fig. 1). In this context, the species is relatively common in Transylvania (64.66% of the populations mentioned in the literature), less common in Moldova (26.93% of the populations mentioned in the literature), rare in Muntenia (5.98% of the populations mentioned in the literature) and very rare in Dobrogea (1.79% of the populations mentioned in the literature) and Banat (0.59% of the populations mentioned in the literature). Over time, data on the distribution of the species in these regions (Moldova, Muntenia, Transylvania, and Dobrogea) have been supplemented by numerous works, which have focused, in particular, on the analysis of flora and vegetation (Oprea, 2005; Sârbu *et al.*, 2007; Anastasiu, 2015; Bădărău, 2019; Mânzu *et al.*, 2020).

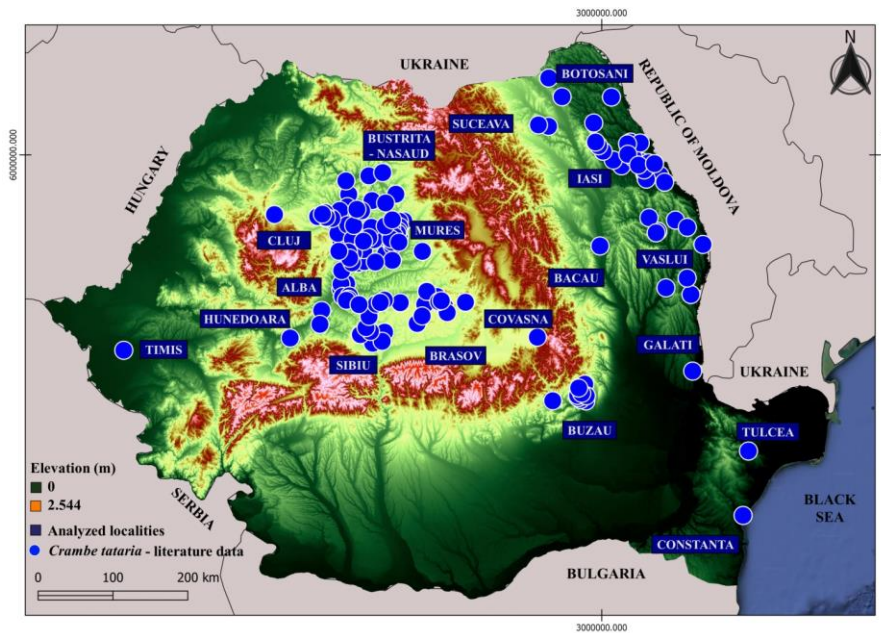


Figure 1. Distribution of *C. tataria* populations mentioned in the literature.

From a chorological point of view, in 2019, 2020, and 2021, 73 localities were checked in which the species *C. tataria* was reported. Of these localities, *C. tataria* was identified only in 21 localities (Fig. 2): a locality located in Muntenia – Pâcelele (BZ P) – Buzau County; eight localities located in Transylvania – Slimnic (SB S) – Sibiu County; Bunești (BV B) – Brasov County; Valea Glodului (MS VG), Sărmășel (MS S) – Mures County; Apahida (CJ A), Boj – Cătun (CJ BC), Vișoara (CJ V) – Cluj County; Beța (AB B) – Alba County; and 12 localities located in Moldova – Alexandru cel Bun (IS A), Bădeni (IS B), Ceplenița (IS C), Horlești (IS HR), Hălțeni (IS HL), Mirosłava (IS M), Popricani (IS P), Rediu (IS R), Tăutești (IS T), Vânători (IS VT), and Vulturi (IS VL) – Iasi County; Glodeni (VS G) – Vaslui County.

The size of *C. tataria* populations recorded varying values, ranging from one individual (IS B) to 372 individuals (IS M). Within the 21 populations analyzed, 1.863 individuals were identified. Compared to elevation, it was observed that as this variable increases, *C. tataria* becomes less abundant (Fig. 3). In this context, the species is found on large slopes, at an elevation around 160 m, in the upper half of the slopes, in open and windy places. The decrease in the number of individuals may be due to the high occupation of the niche and the dominance of competitive species, such as *Festuca stricta* subsp. *sulcata* (Hack.) Pils, *Brachypodium pinnatum* (L.) P. Beauv., *Bromopsis erecta* (Huds.) Fourr., *Euphorbia nicaeensis* All. subsp. *niccaensis*, *Inula germanica* L. and *Calamagrostis epigejos* (L.) Roth (Horváth, 1991, 2005).

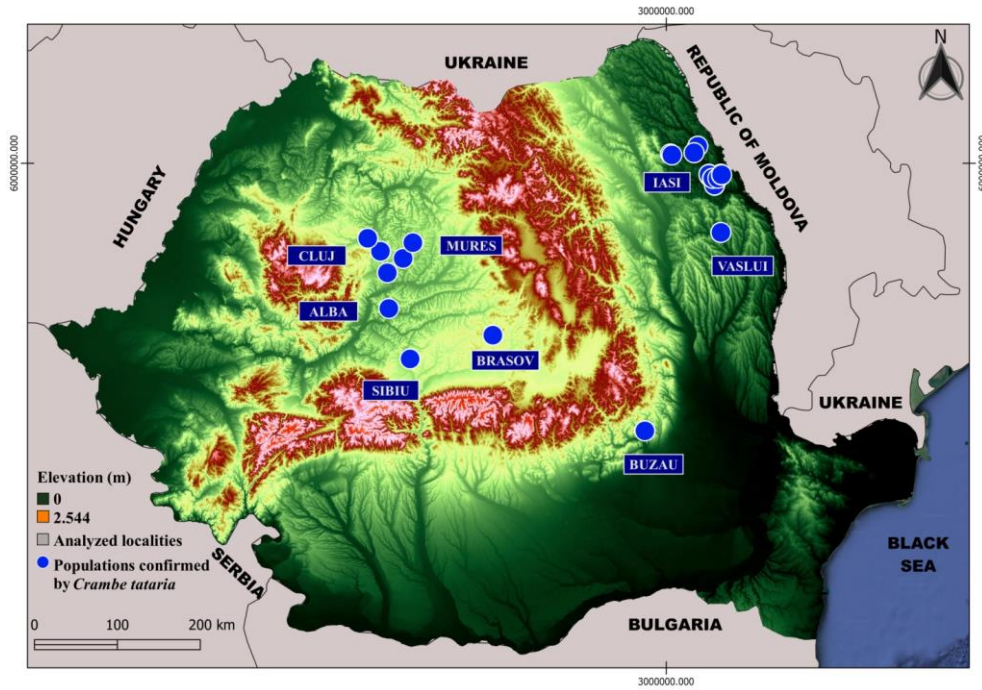


Figure 2. Distribution of verified populations of *C. tataria* in the field.

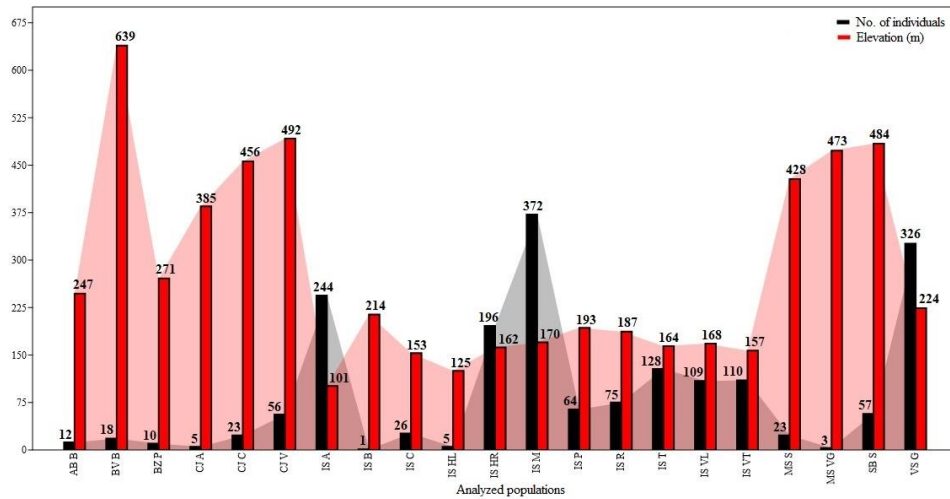


Figure 3. The variation of the abundance of the number of individuals in the analyzed populations according to elevation.

In the grasslands with *Festuca valesiaca* subsp. *parviflora* (Hack.) Tracey, *C. tataria* is relatively sporadic. At the same time, the presence of the species *Chrysopogon gryllus* (L.) Trin., *Bothriochloa ischaemum* (L.) Keng and *Stipa tirsia* Steven were observed relatively sporadically in the analyzed sample areas from Pâcelele (Buzau County). Usually, in such grasslands, *C. tataria* occurs more, but in small populations compared to degraded grasslands. Often, these types of grasslands are mixed and so surfaces without vegetation can appear where the species settles (Horváth, 2005). During field trips, it was found that most of the areas favourable to the growth of the analyzed species are currently exploited by grazing sheep. Also, the populations occupy a relatively large area outside the protected areas (70%), but also inside the protected areas (30%). Most are located in the major subdivisions of the Moldavian Plateau (mainly in the Moldavian Plain and the Central Moldavian Plateau), in the Hilly Depression of Transylvania (Someș Plateau, Transylvanian Plain, and Târnava Plateau) and the Curvature Subcarpathians (Chirilă, 2022).

Bibliographic information on the distribution indicates the presence of the species in both Central and Eastern Europe and Western Siberia. At European level, according to the European Environment Agency (<http://natura2000.eea.europa.eu/#>), 43 sites have been designated for the protection of *C. tataria*. Of these, 23 sites belong to Romania, mainly in the regions of Moldova, Transylvania and Muntenia. To these are added eight other sites not mentioned by the European Environment Agency.

The population size of *C. tataria* indicated an increase of 66.98% in 2021, compared to 2019, during the three years of study. This increase in population size is also due to the higher number of populations analyzed in 2021. In this context, in 2019, 12 populations and 1.063 individuals were analyzed, while in 2020, 15 populations and 1.320 individuals were analyzed. In 2021, 17 populations and 1.775 individuals were analyzed and 34.46% more individuals were registered with *C. tataria* compared to 2020 (Table 1).

Table 1

Population dynamics of *C. tataria* investigated

Natura 2000 site	Population	Vegetation year			
		2019	2020	2021	Total
North East Region (Moldova)					
ROSCI0222 „Sărăturile Jijia Inferioară - Prut”	Alexandru cel Bun	202	209	244	218 ± 23
ROSPA0109 „Acumulările Belcești”	Bădeni	2	2	1	2 ± 0,57
ROSPA0109 „Acumulările Belcești”	Ceplenița	22	29	26	26 ± 4
ROSCI0080 „Fânașurile de la Glodeni”	Glodeni	244	150	326	240 ± 88
ROSPA0042 „Eleșteiele Jijiei și Miletinului”	Hălceni	-	-	5	5
ROSCI0265 „Valea lui David”	Horlești	119	121	196	145 ± 44
ROSCI0265 „Valea lui David”	Miroslava	203	208	372	261 ± 96
ROSCI0265 „Valea lui David”	Tăuțești	80	85	128	98 ± 26
ROSCI0058 „Dealul lui Dumnezeu”	Rediu	33	95	75	68 ± 32

Table 1 (continued)

Natura 2000 site	Population	Vegetation year			
		2019	2020	2021	Total
North East Region (Moldova)					
ROSCI0171 „Pădurea și pajiștile de la Mârzești”	Vânători	35	35	110	60 ± 43
-	Popricani	6	75	64	48 ± 37
-	Vulturi	110	223	109	147 ± 66
Central Region (Transylvania)					
ROSCI0187 „Pajiștile lui Suci”	Beța	-	-	12	12
ROSCI0408 „Zau de Câmpie”	Valea Glodului	-	3	-	3
ROSCI0227 „Sighișoara - Târnava Mare”	Bunești	-	18	-	18
ROSCI0093 „Insulele Stepice Șura Mică - Slimnic”	Slimnic	-	57	-	57
North West Region (Transylvania)					
-	Apahida	-	-	5	5
-	Sărmășel	-	-	23	23
ROSCI0238 „Suatu - Cojocna - Crairât”	Boj - Cătun	-	-	23	23
-	Viișoara	-	-	56	56
South East Region (Muntenia)					
ROSCI0272 „Vulcanii Noroioși de la Păcelele Mari și Păcelele Mici”	Păcelele	7	10	-	9 ± 2
Total		1.063	1.320	1.775	1.386 ± 361
Mean (±standard deviations)		89 ± 87	88 ± 78	104 ± 115	94 ± 9

In Transylvania, region where elements of various European and Asian regions meet (Ghișa, 1961), the species is relatively common in the dry grasslands of Alba, Bistrita-Nasaud, Brasov, Cluj, Covasna, Hunedoara, Mures and Sibiu (Fuss, 1866; Soó, 1927, 1942; Béres, 1996; Horváth, 2005; Ferenc, 2007; Oroian *et al.*, 2017; Bădărău, 2019). The species *C. tataria* has been mentioned in 14 Natura 2000 sites. Most populations of *C. tataria* are outside protected areas (75.00%), and only 25.00% of localities are within protected areas.

In the xerophilous and meso-xerophilic steppe grasslands from the ROSCI0040 “Coasta Lunii” site, *C. tataria* was identified in Viișoara locality (Cluj County). In this case, the population is relatively grouped, being observed on slopes with northeast aspect, being threatened by grazing and fires. The presence of the species in this Natura 2000 site was confirmed in 2019 by Alexandru Bădărău, in which he identified three populations formed by compact groups. The share of individuals in a vegetative state (61%) exceeds the share of flowering individuals (39%). The presence of *Prunus tenella* Batsch is also sporadic. Another Natura 2000 site where *C. tataria* was identified is ROSCI0227 “Sighișoara-Târnava Mare”. Within the site, the population was identified between Bunești and Viscri, consisting of grouped individuals (due to shrub species that limit the spread of the species), at high elevation

(> 600 m). Factors that may threaten the survival of this species are overgrazing and the use of excess fertilizers and pesticides in agriculture. I also checked the reports from Albești, Saschiz, Mihai Viteazu, and Viscri, but I did not find any specimens during the study period. All identified individuals were in a vegetative state. In this protected area, the identified association was *Medicagini minimae-Festucetum valesiacaе* Wagner 1941.

Within the Natura 2000 site ROSCI0408 “Zau de Câmpie”, the species was observed in the grasslands from Valea Glodului locality (Mureș County), at an elevation from 470 to 477 m. The identified population consists of three individuals, preferring slopes with northeast aspects. The identified association was *Festuco rupicolaе-Brachypodietum pinnati* Mahn 1965. The presence of the species was also confirmed in the site ROSCI0093 “Insulele Stepice Șura Mică-Slimnic”. Following the expeditions made in the Slimnic and Șura Mare areas, only the population from the “Dealul Zackel” reservation was identified, not the populations from Dealul Rictoi, Gușterița, and Șura Mare. The identified association, *Elytrigietum hispidi* (Dihoru 1970). Popescu et Sanda 1988, was identified on slopes, with values from 3.6° to 20.8°, with northern and southern aspects (Fig. 4). Regarding the presence of the species in the site ROSCI0187 “Pajiștile lui Suciu”, it was identified in Beța locality (Alba County). In this locality, 12 vegetative individuals were identified, at an elevation of 247 m. The dominant species in this analyzed area was *Prunus tenella*. Szabó *et al.* (2018) identified the species in the Beța and Lopadea areas.



Figure 4. Association of *Elytrigietum hispidi* (A) and *C. tataria* (B).

Another population was identified in Sărmășel (Mures County). There was the identification of 23 individuals, of which three individuals were in a fruiting state and 20 individuals were in a vegetative state. In the site ROSCI0238 “Suatu-Cojocna-Crairât”, the presence of *C. tataria* was reported in Boj-Cătun (Cluj County). In the grasslands of this locality, 23 individuals were identified, at an elevation of 456 m. Most individuals are flowering (78%). In Apahida locality from Cluj

County, five individuals were identified, at an elevation of 385 m. The main factor threatening *C. tataria* species is overgrazing.

During the study period I did not manage to investigate the sites ROSCI0139 “Pădurea Breana Roșcani”, ROSCI0428 “Pajiștile de la Mănărade”, ROSCI0429 “Pajiștile de la Moriști și Cojocna”, ROSCI0331 “Pajiștile Balda-Frata-Miheșu de Câmpie”, and ROSCI0079 “Fânațele de pe Dealul Corhan-Săbed”. According to the management plans, the presence of the species in the ROSCI0139 and ROSCI0428 sites was not confirmed within their vicinity. However, in the sites ROSCI0429, ROSCI0331, and ROSCI0079, no recent studies have been performed to show the presence of the species on their territory. One of the reasons why the analyzed species has not been identified may be the ruderalization of the investigated areas. Another site where *C. tataria* was reported is ROSCI0210 “Râpa Lechința”, in Lechința locality from Mureș County. This population was also identified by the botanists within the management plan of the ROSCI0210 site. In the ROSCI0099 site “Lacul Știucilor-Sic-Puini-Bonțida”, *C. tataria* was identified in dry, xerophilous, and semi-dry grasslands, xeromesophilous near the area between Sic and Gherla, being formed of grouped and dispersed individuals. The presence of the species was also confirmed by the botanists within the management plan of the ROSCI0099 site, more precisely “at the exit from Sic to Gherla”. The species was also mentioned by Rezsó Soó (1942, 1944), but in the localities of Gherla and Sic. Regarding the site ROSCI0211 “Podișul Secașelor”, *C. tataria* was not identified during the study period.

Starting with the second half of the 20th century, the signalling of the presence of the species *C. tataria* in Romania, registers an increase in the number of localities with more or less compact populations, due to the conjugation of the efforts of botanists and pharmacists. From the team of researchers of this period we mention Rezsó Soó, a Hungarian botanist who researched and published data on the flora and vegetation of Transylvania. Thus, the botanist Rezsó Soó made a series of expeditions in the dry grasslands of this region. As a result, the presence of the species was reported in Alba, Cluj, Bistrita-Nasaud, Mures, and Sibiu (Soó, 1942). Even if these reports have a specific character, so far, the presence of the species in these localities has not been confirmed.

Among the pioneering studies for the study of the flora and vegetation of the Transylvanian plain are the works of Traian Săvulescu. In the “Flora Republicii Populare Romîne” (volume III), Erasmus Nyárády (1955) mentions the presence of the species in the localities of Chiochiș (Beclean), Zau de Câmpie (Valea Glodului), Gușterița, Șura Mare and Drăușeni, and in 1908 in the Grindeni - Cristur area, presence also confirmed by Iuliu Prodan (1931). Essential contributions to the research of flora and vegetation in southeastern Transylvania belong to Silvia Oroian and Mihaela Sămărghișan. Also, Nyárády (1955) mentions the presence of the species *C. tataria* in Banat, in Timișoara (Timiș County), and in Dobrogea, Brândză (1898) reports the species in Beibudzuk and Babadag in Tulcea County.

Thus, the presence of the species in Timișoara has a general character, not specifying exactly a locality. The presence of the species in Beibudzuk is uncertain because, at present, we have not found information in the literature about any locality under this name. Regarding the signalling of the species at Babadag, it is possible that it existed near the nature reserve “Babadag Forest”.

Moldova is a region characterized by grasslands with significant continental and pontic influences on flora and vegetation (Baltag and Poceră, 2009). *C. tataria* is mentioned in 14 Natura 2000 sites. In this region, *C. tataria* species has been reported in 45 localities in Bacau, Botosani, Galati, Iasi, Suceava and Vaslui counties. In some of these localities, the populations are well represented, in this way, the efforts of botanists have been concentrated towards the exhaustive knowledge of the research directions, such as the chorological and phytocoenological study. Thus, most of the reported *C. tataria* populations are outside protected areas (62.23%) and only 37.77% of the populations are protected.

Within the site ROSCI0265 “Valea lui David”, the populations of *C. tataria* form dispersed groups, being observed hundreds of specimens. From the observations made in 2019, 2020, and 2021, the population of *C. tataria* is stable in the area, with most individuals being identified inside the site, in the localities of Miroslava, Tăutești, and Horlești. In the protected area, individuals of *C. tataria* were inventoried in ponto-sarmatic steppe grasslands (62C0 *). Certain factors, such as sufficiently large habitat, habitat quality, and the abundance of the species, which show relatively small variations between the above-mentioned localities, where the majority of populations have a relatively large population (> 23 individuals), allow the long-term survival of species. In this protected area, *C. tataria* was identified in the association *Jurineo arachnoideae-Stipetum lessingiana* (Dobrescu 1974) Chifu, Mânzu et Zamfirescu 2006 (Fig. 5). It is the largest population analyzed, being identified 372 individuals, at an elevation of 170 m. The share of flowering individuals (66%) exceeded the share of individuals in a vegetative state (34%).



Figure 5. Association *Jurineo arachnoideae-Stipetum lessingiana* (A) and *C. tataria* (B).

Another Natura 2000 site of special value is ROSCI0058 “Dealul lui Dumnezeu”. In this Natura 2000 site, *C. tataria* was identified inside the protected natural area of the ponto-sarmatic steppe grasslands (62C0*), being observed approximately 70 adult and juvenile individuals, in Rediu locality, at an altitude of 187 m. The share of individuals in a vegetative state (64%) is higher than that of flowering individuals. Also, the presence of the species *C. tataria* in the Natura 2000 site ROSCI0171 “Pădurea și pajiștile de la Mârzești” is relatively sporadic, being reported about 110 individuals during the study period. Most individuals of *C. tataria* identified are flowering (74%), at an elevation of 157 m. The association identified in these protected areas is *Jurineo arachnoideae-Stipetum lessingianae* (Dobrescu 1974) Chifu, Mânzu et Zamfirescu 2006.

Regarding the Natura 2000 site ROSCI0080 “Fânașurile de la Glodeni”, most individuals of *C. tataria* were observed in the southern part of the site, and the fewest in the northern part of the site, according to the information in the plan of management. From the observations made in 2019, 2020, and 2021, the population of *C. tataria* is stable in the area, due to the sufficiently large habitat and the relatively large number of observed individuals. The grasslands of this Natura 2000 site are characteristic of the forest-steppe of central Moldova, having a continental and pontic character in terms of flora and vegetation, according to the management plan. In this sense, the grasslands are in a favourable state of conservation because anthropogenic influences are insignificant. Most of the identified individuals are in a vegetative state (80%). The dominant identified association is *Taraxaco serotinae-Festucetum valesiaca* (Burduja *et al.* 1956, Răvăruf *et al.* 1956) Sârbu, Coldea et Chifu 1999 (Fig. 6).



Figure 6. Association *Taraxaco serotinae-Festucetum valesiaca* (A) and *C. tataria* (B).

Other Natura 2000 sites where the species *C. tataria* has been reported are ROSCI0222 “Sărăturile Jijia Inferioară-Prut”, ROSPA0042 “Eleșteiele Jijiei și Miletinului” and ROSPA0109 “Acumulările Belcești”. The presence of the species

in these sites was mentioned by Mânzu *et al.* (2020) and the botanists in the ongoing project to develop management plans for these sites. During the research carried out in ROSCI0222, *C. tataria* was identified on Iacobeni hill, in Alexandru cel Bun locality. In this locality, the presence of the species is significant, and hundreds of specimens can be observed in the anthropically affected steppe grasslands. Some of the identified specimens were destroyed by sheep. Regarding the Natura 2000 site ROSPA0109, the species *C. tataria* was observed in the vicinity of Ceplenița locality and on Grădiștii hill, in Bădeni locality. The dominant association is *Taraxaco serotinae-Festucetum valesiacaе*. In the site ROSPA0042 “Eleșteiele Jijiei și Miletinului”, *C. tataria* was identified in Hălțeni (Iasi County). Five individuals were identified, at an elevation of 125 m. Also, *C. tataria* was identified in Vulturi și Popricani (Iasi County). In these localities, the population was 240 individuals, of which 79% had inflorescences. The condition of the population can be considered stable, given a large number of flowering individuals but also of the grasslands non-grazed, the habitat sufficiently extensive, etc. The stability of the population was also confirmed by genetic studies (Chirilă, 2022), in which the highest genetic diversity was observed.

During the research period, in May-August of 2019, 2020 and 2021, undertaken in the sites ROSCI0151 “Pădurea Gârboavele”, ROSCI0081 “Fânețele seculare Frumoasa”, ROSCI0082 “Fânețele seculare Ponoare”, ROSCI0286 “Colinele Elanului”, ROSCI0221 “Sărăturile din Valea Ilenei” and ROSCI0117 “Movila lui Burcel”, *C. tataria* has not been identified. In this case, repeated observations are required to determine whether the absence is temporary or permanent.

Considerable contributions to the research of Moldovan flora and vegetation were made by the botanist Constantin Petrescu (1920), with reports from Cârlig, Rediu (in the grasslands of The hill of God near Larga Jijia), Epureni, Rădeni-Păuleni and Șorogari, and by Petre Enculescu (1924), with mentions from Ceplenița (Ciritei forest). The researches continued, in 1938, when the botanists Constantin Papp and Mihai Răvăruț mention the presence of the species in the localities of Cârlig and Vânători (Mârzești), reports confirmed by Iuliu Prodan (1939). Also, the name of the locality Epureni, mentioned by the other botanists (Mihai Răvăruț, Erasmus Nyárády and Simona Mihăilescu) is wrong. Thus, the botanist Constantin Petrescu referred to the locality of Iepureni (either from Movileni commune or from Andrieșeni commune) from Iași County. This observation was also mentioned by Mânzu *et al.* (2020), the latter identifying the species between the localities of Rediu Mitropoliei and Iepureni (Movileni). Regarding the Păuleni locality, this locality was part of the Roșcani commune from Iași County, at the end of the 19th century. Currently, there is no locality under this name in Iași County, which is why we placed this report in the Rădeni-Păuleni area of Roșcani commune. It should be noted that since then the species has not been confirmed in this area.

An important contribution regarding the chorology of the species belongs to the botanist Mihai Răvăruț (1934–1941), with mentions from Belcești, Breazu,

Horlești, Rediu-Tătar, Spinoasa, Vânători and Vlădeni. Later, in 1955, Erasmus Nyárády confirmed the presence of the species in these localities but also in other localities, thus completing the chorology of the species with mentions from Cârlig, Rediu (God's Hill), Epureni, Vânători (Mârzești), Rădeni-Păuleni, Șorogari, Moara (Frumoasa), Bosanci (Ponoare) and Leorda. The species was observed in Tuluțești (Gârboavele Forest; Mititelu *et al.*, 1993b), as well as in other localities, such as Murgeni (Mititelu *et al.*, 1987), Pădureni-Dobârceni (Mititelu and Chifu, 1993), Hârlău (Mititelu *et al.*, 1992) and Bogdan Vodă (Mititelu *et al.*, 1993a). Instead, the population of Hârlău has a general character, not being confirmed so far in the area mentioned above, and in the literature is specified only the fact that the species was observed “behind the vine”. More recent studies (Mânzu *et al.*, 2020) have identified *C. tataria* in Gropnița, Potângeni, Hălceni-Iazu Vechi and Șoldana (Alexandru cel Bun).

On the territory of Muntenia, the population of *C. tataria* was reported in the site ROSCI0272 “Vulcanii Noroiși de la Pâclele Mari și Pâclele Mici”. In this context, the analyzed species was identified in Pâclele locality (Buzău County) and includes only ten vegetative individuals, at an elevation of 271 m. In the areas where the test surfaces were made, most individuals were observed around some shrubs (*Crataegus monogyna* Jacq., and *Prunus spinosa* L.), and the habitat is sufficiently extensive. *C. tataria* was identified in the association *Thymo pannonici-Chrysopogonetum grylli* Donița *et al.* 1992. Other studies (Anastasiu *et al.*, 2008) complete the chorology of the species with mentions from Măgura peak, Muchea Leoaicei, Grabicina and Pâclele Mici, and other studies (Anastasiu, 2015) confirm the presence of *C. tataria* species on Balaurul hill.

CONCLUSIONS

The investigations in the specialized literature led to the identification of the geographical position of 168 localities with *C. tataria*, of which, 60.00% are old alerts (alerts mentioned in the period 1816-2010). Most populations were identified on the administrative territory of Cluj, Iasi, Mures, and Sibiu counties, with some 110 localities (65.00%). Most populations were reported outside protected areas. The number of new Natura 2000 sites in which the presence of the species *C. tataria* presented in the paper is mentioned is higher than previously documented. In contrast, the number of populations is lower than that mentioned in the literature.

The analyzed habitats present good conditions for the majority of *C. tataria* populations. Compared to the type of management of the analyzed grasslands, some of the populations studied by *C. tataria* are degrading. Due to the extension of overgrazing, at the national level, these populations are in a continuous process of restriction.

According to the literature data, the number of populations of *C. tataria* is decreasing. On the other hand, the size of the analyzed populations and subpopulations during the three years of study registered an increase in the number of individuals. In terms of population density, there has been a decrease in the number of individuals.

We conclude that the Târnava Plateau, the Moldavian Plain, the Bârlad Plateau, and the Transylvanian Plain are the geographical units that ensure the most favourable environmental conditions for the development of *C. tataria* species. Similarly, favourable conditions for the development of the species were represented by the Curvature Subcarpathians, the Secașe Plateau, and the Hârtibaciu Plateau. Also, in this study, it was shown that with increasing elevation there is a decrease in the abundance of *C. tataria*.

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