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CONTRIBUTIONS TO THE KNOWLEDGE OF THE DISTRIBUTION OF SOME RARE TAXA IN THE FLORA OF OLTENIA (ROMANIA)

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Abstract

Oltenia is a region located in southwestern Romania and it is characterized by great climatic, pedological, geomorphological, and floristic diversity. In this part of Romania, many southern elements find their habitat, some of them being rare in the flora of the country (e.g., Cirsium creticum). Climate changes in recent years have led to obvious changes among plant taxa, both in terms of distribution in nature and especially in their phenology. For some taxa, these changes led to the widening of the area (e.g., the psammophilous elements: Erodium hoefftianum subsp. neilreichii, Mollugo cerviana, Bassia laniflora, Achillea ochroleuca, Salvia sclarea, Silene borysthenica, Limonium tomentellum, Polycarpon tetraphyllum, Hordeum bulbosum), while for others on the contrary, to its restriction (Aldrovanda vesiculosa, Pisum sativum subsp. elatius).

Key words*: flora, ecology, distribution, Oltenia, Romania.*

INTRODUCTION

Year by year, the impacts of climate change worsen and affect plants worldwide, shifting plant communities, resulting in changes in flora biodiversity and disturbing their life cycles and function (Sărățeanu et al., 2023). In this context, measures are required for restoring ecosystems as efficient tools for reducing climate related risks (Acatrinei et al., 2024; Durău et al., 2021; Sălceanu et al., 2023; Velea et al., 2021).

The study of rare taxa in the Romanian flora has drawn the attention of numerous researchers. This interest is demonstrated by the specialized works that have tackled this category of plants (Buia & Păun, 1958, 1960a, 1960b, 1964; Buia, 1959; Buia et al., 1960; Buia & Maloș, 1963; Popescu, 1971, 1974, 1979; Popescu et al., 2001, 2003; Costache, 2004b; Oprea, 2005; Dihoru & Negrean, 2009; Boruz et al., 2013; Răduțoiu & Costache, 2012; Negrean & Ciortan, 2012; Răduțoiu et al., 2013a, 2013b, 2023; Răduțoiu, 2014, 2022; Răduțoiu et al., 2014, 2016a, 2016b; Răduțoiu & Stan, 2019; Răduțoiu & Ștefănescu, 2021; Răduțoiu & Măceșeanu, 2021; Răduțoiu & Niculescu, 2023). An additional element of interest is that Oltenia comprises the range limit of plants with different sozological degrees. Thus, the two above-mentioned elements enable us to state that this part of Romania will represent an attractive territory for numerous researchers.

A simple analysis concerning the presence of spontaneous vascular plants in the Oltenia region, as compared to other regions in Romania, leads to the conclusion that Oltenia occupies a leading place (about 2/3 of Romania's spontaneous flora is located within this region). The climatic, geomorphological, and pedological conditions that characterize this part of the country also contribute to its high floristic diversity. A special peculiarity is represented by the southern elements, which are present in several areas within Oltenia, having a better representation in the southwestern part (e.g. *Hordeum bulbosum* L.).

Moreover, certain species mentioned as rare at national level are also found in Oltenia, although in this part of the country they form phytocenosis on representative surfaces (e.g., *Medicago arabica* (L.) Huds., *M. polymorpha* L.) (Buia, 1959). Furthermore, in Oltenia there are reported genera that have all the spontaneous species within Romania (e.g., *Quercus*, *Tilia*, *Acer*), or species that find their range only in this part of the country (e.g., *Trifolium michelianum* Savi, *T. squamosum* L., *Ranunculus garganicus* Ten., *Dianthus kladovanus* Degen.) (Buia, 1959).

MATERIALS AND METHODS

Area under study

Oltenia is located in southwestern Romania and, taking into account its characteristics related to relief, climate, soil, etc., as well as its borders, this region also constitutes a well-defined natural unit. Oltenia is delimited to the east by the Olt River, to the south and west by the Danube, and to the north by the Southern Carpathians. The Jiu River flows across the region on a general north-south direction and divides Oltenia into two approximately equal parts (Buia et al., 1961).

Three climatic regimes are characteristic to the territory of Oltenia: Pontic, Central European, and Sub-Mediterranean.

Materials

In order to visualize the distribution of the analyzed taxa within Oltenia, numerous field-trips were conducted over time, in different vegetation phases, with the aim of collecting all the necessary information for correct identifications and for a comprehensive distribution. In order to observe the changes that occurred under the influence of climate changes during the recent period, the collected data were compared with those existing in the specialized literature.

For each taxon under study, the collected data comprised the coordinates, the ecological conditions in which it grows in Oltenia, and the chorological toponymy. The distribution of each taxon is also represented on two maps that correlate its location with the average annual temperatures in the country and, respectively, with the average annual precipitation in Romania. The Corolog 2010 Program, developed at the Institute of Biology in Bucharest, was used to achieve these maps. The above-mentioned Program uses an Access database (RoBioAtlas, 2023), which integrates information from the specialized literature, the herbaria, and the field. The data originating in literature and herbaria are marked in red on the maps, while the new settlements where the taxa were identified are marked in green.

The abbreviations of the authors of the analyzed species were consistent with Brummit and Powell (1992) and the species names were in accordance with Euro+Med (2006-).

RESULTS AND DISCUSSIONS

Achillea ochroleuca Ehrh. – *Asteraceae*

Ecology: it grows on sandy, xeric meadows, or on sandy-gravelly substrate.

General distribution: it is a southern element of Pontic-Pannonic origin.

Distribution in Oltenia: it is known within Oltenia from the sandy surfaces located on the left side of the Jiu River, from the Obedeanu fountain – Craiova (Buia & Popescu-Mihăilă, 1952), from the settlements of Ghindeni, Apele Vii, Celaru, Ogrin, and Dăbuleni (Buia & Păun, 1964).

The species was identified between Sadova and Piscu Sadovei settlements, in Ciupercenii Noi and Desa settlements (Dolj County) (Figures 1, 2).

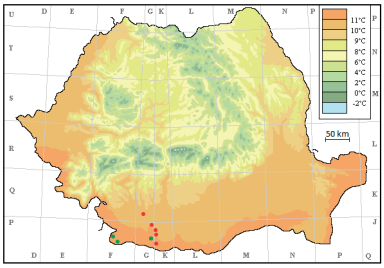

Figure 1. Distribution of the species *Achillea ochroleuca* in Oltenia, correlated with the average annual temperatures

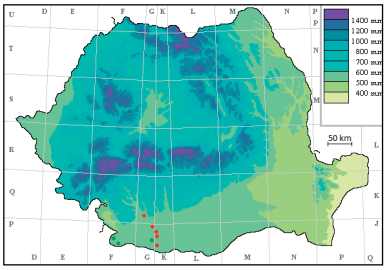

Figure 2. Distribution of the species *Achillea ochroleuca* in Oltenia, correlated with the average annual precipitation

Aldrovanda vesiculosa L. – *Droseraceae*

Ecology: it is found in ponds with stagnant, shallow water and with muddy bottom (Țopa, 1955).

General distribution: it is a cosmopolitan element, encountered in aquatic habitats. At the European level, it is protected by the Council Directive 92/43/EEC 1992, Annex II, while in Romania it is critically endangered (Dihoru &

Negrean, 2009). It is also on the IUCN Red List (Bilz et al., 2011).

Distribution in Oltenia: in the ponds located between Craiova and Breasta, as well as in those between Cernele and Atârnați settlements (Buia & Păun, 1964).

At the beginning of botanical research in Oltenia, this plant was mentioned from the Danube and the Jiu floodplains (Păun et al., 1967; Păun & Popescu, 1969, 1972), where it formed compact phytocenosis, whereas the present situation shows that this taxon has greatly reduced its distribution area because of natural causes (reduction of water level and lack of precipitation for a significant period in this part of the country), or anthropogenic ones (drainage actions in order to change the land use categories of the respective terrains).

In recent years, the species has been identified in the ponds located near the settlements of Izvoarele, Ceplea, Sărdănești, Bâlteni, and Pește ana-Jiu (Gorj County) (Figures 3, 4).

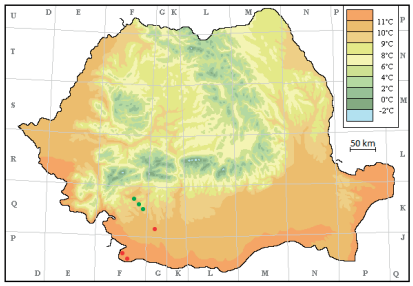

Figure 3. Distribution of the species *Aldrovanda vesiculosa* in Oltenia, correlated with the average annual temperatures

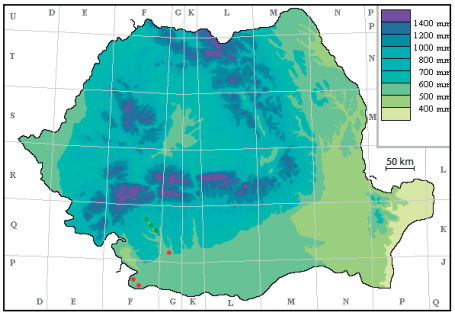

Figure 4. Distribution of the species *Aldrovanda vesiculosa* in Oltenia, correlated with the average annual precipitation

Bassia laniflora (S.C. Gmel.) A.J. Scott – *Chenopodiaceae*

Ecology: it is found on sand dunes, loess or sandy terrain located in the plain region.

General distribution: continental Eurasia.

It is known as a rare plant in almost all specialized field guides in the country (Ciocârlan, 2009, Sârbu et al., 2013).

Distribution in Oltenia: within this region, it was found in Craiova, on the Obedeanu dunes, on the outskirts of Malu Mare, Secui, Ghindeni, and Apele Vii settlements (Buia & Păun, 1964), as well as in Dăbuleni (Dihoru & Negrean, 2009).

The author of the present study found it on xerophilic areas that are characterized by the presence of sand in different degrees and are located on the outskirts of Lișteava, Sadova, and Piscu Sadovei settlements (Figures 5, 6).

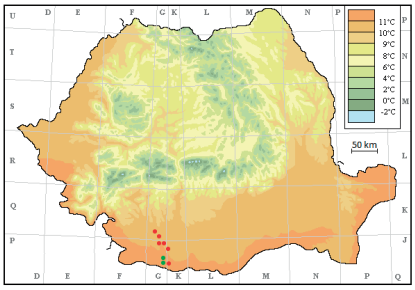

Figure 5. Distribution of the species *Bassia laniflora* in Oltenia, correlated with the average annual temperatures

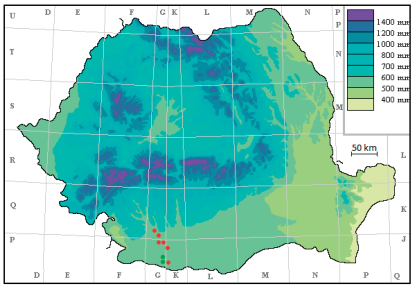

Figure 6. Distribution of the species *Bassia laniflora* in Oltenia, correlated with the average annual precipitation

Cirsium creticum (Lam.) d'Urv. – *Asteraceae*

Ecology: it is present in marshy areas or on the banks of water bodies, either in small groups of a few specimens, or on variable surfaces, ranging between 20 and 500 sq m.

General distribution: it is a Mediterranean element, the development range of which extends in the Balkan Peninsula, southern Italy, and Sicily (Dihoru & Negrean, 2009).

It is an endangered taxon, with the northern range limit on the territory of our country, being mentioned only from the southwestern part of Romania, from the plain area to the lower mountainous region, in marshy places or on the banks of water bodies (Ciocârlan, 2009; Costache 2004a, 2005, 2011; Răduțoiu & Costache 2009; Răduțoiu & Stan, 2019).

Distribution in Oltenia: The research conducted over the last 15 years has provided valuable information regarding the chorology of the species *Cirsium creticum* in Oltenia. In numerous locations, this plant has been identified under the form of scattered specimens found in the floodplains of certain rivers or hillside streams within Dolj, Gorj, and Mehedinți counties, while in other locations, it forms well-represented populations.

Following his studies in the lower catchment of the Motru River (2005), Costache I. is the first to attest to the presence of phytocenosis whose physiognomy is given by this species. Subsequent research led to the conclusion that in Oltenia, the areas dominated by this species will extend into the floodplains of the main rivers and of certain streams flowing on slopes (e.g., on the outskirts of Fratoștița village) (Răduțoiu & Ștefănescu, 2021; Răduțoiu & Măceșeanu, 2021), in the settlements of Șimian, Hinova, Vârciorova, Porțile de Fier, Strehaia, and Valea Topolniței in Mehedinți County, Motru (Gorj County), Cilieni (Olt County), and Calafat, Malu Mare, Tâmburești, Ciuperceni, Botoșești Paia (Dolj County).

It was identified in the Jiu River floodplain, near the settlements of Rojiște, Valea Stanciului, Ostroveni, Padea, Potmelțu, Tâmburești, Gângiova, Comoșteni, Horezu-Poenari, and Țuglui (Figures 7, 8).

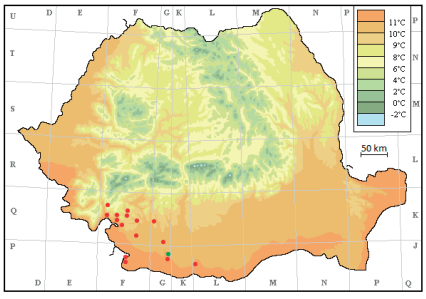

Figure 7. Distribution of the species *Cirsium creticum* in Oltenia, correlated with the average annual temperatures

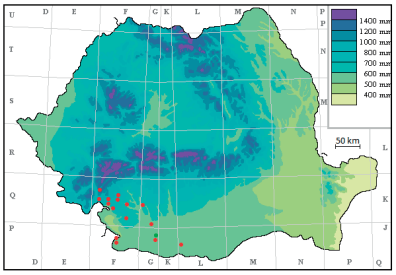

Figure 8. Distribution of the species *Cirsium creticum* in Oltenia, correlated with the average annual precipitation

Erodium hoefftianum C.A. Mey. subsp. ***neilreichii*** (Janka) P. H. Davis – *Geraniaceae*

Ecology: it is a critically endangered plant that grows on psammophilous, dry, sunny, thermophilic areas.

General distribution: East European-Anatolian-Turanian element.

Distribution in Oltenia: it is mentioned from the sandy areas located around Craiova (Buia & Păun, 1964; Răduțoiu & Costache, 2009; Cârțu & Cârțu, 1972), Tâmburești (Cârțu & Cârțu, 1972), Ciupercenii Noi (Dolj County), Ianca (Olt County), and Bistrețu (Mehedinți County) (Dihoru & Negrean, 2009). It was identified on significant areas on the outskirts of Malu Mare, Secui, and Rojiște settlements (Figures 9, 10).

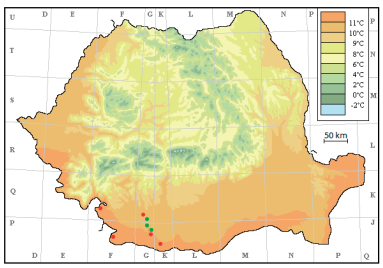

Figure 9. Distribution of the species *Erodium hoefftianum* subsp. *neilreichii* in Oltenia, correlated with the average annual temperatures

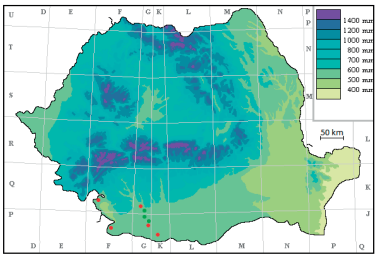

Figure 10. Distribution of the species *Erodium hoefftianum* subsp. *neilreichii* in Oltenia, correlated with the average annual precipitation

Hordeum bulbosum L. – *Poaceae*

Ecology: pastures, sunny orchards, and shrub edges.

General distribution: Mediterranean element (Euro-North African-Asian).

Distribution in Oltenia: the specialized literature mentions it from the following settlements: Coțofenii din Față, Craiova (Mofleni, Lascăr Catargiu, and Popoveni), Verbița, Verbicioara, Desa, and Nebuna (Dolj County) (Buia, 1959), Perișor, Giubega (Răduțoiu & Costache, 2009), Valea Topolniței, Schitul Topolniței (Mehedinți County) (Negrean & Ciortan, 2012), Radovan, Drăgoaia, Mărăcine, Ciutura, Răpa Roșie, and Terpezița (Dolj County) (Răduțoiu & Stan, 2019). It was identified on the side of the roads in the field, near wheat crops and orchards, between Vârtop and Caraula settlements (Figures 11, 12).

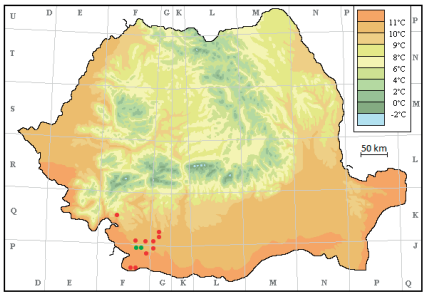

Figure 11. Distribution of the species *Hordeum bulbosum* in Oltenia, correlated with the average annual temperatures

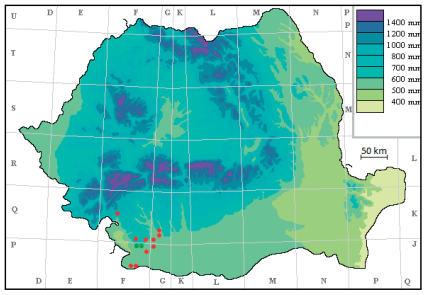

Figure 12. Distribution of the species *Hordeum bulbosum* in Oltenia, correlated with the average annual precipitation

Limonium tomentellum (Boiss.) Kuntze – *Plumbaginaceae*

Ecology: in saline, usually humid meadows located within the Oltenia Plain.

General distribution: Continental element. Southern and Eastern Ukraine, Eastern Russia, Kazakhstan.

Distribution in Oltenia: in most specialized papers, this taxon is mentioned from the classic location, i.e., Bratovoiești settlement (Ciocârlan, 2009; Sârbu et al., 2013; Răduțoiu et al., 2016b). Subsequently, it was also found under the form of scarce populations in Osica de Sus settlement (Olt County) (Răduțoiu, 2013), or as isolated specimens in Seaca de Câmp settlement (Răduțoiu & Costache, 2009), or herborized in the herbarium of the University of Craiova (CRA): the settlements of Afumați, Gura Jiului, Poiana Mare, Urzicuța, Tâmburești, Craiova – Lascăr Catargiu, between Malu Mare and Bratovoiești (Răduțoiu, 2014).

Recently, it was found under the form of isolated specimens in the Jiu floodplain, at the edge of some bushes situated on the outskirts of *Quercus robur* forests; near Rojiște settlement (Figures 13, 14) and in a subspontaneous form, in vegetative stage, near some flower shops. It must be noted that the inflorescences of this plant are frequently used in floral arrangements in some flower shops located in the municipality of Craiova.

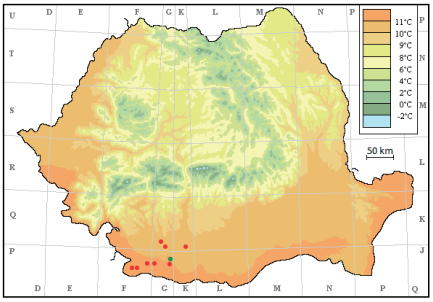

Figure 13. Distribution of the species *Limonium tomentellum* in Oltenia, correlated with the average annual temperatures

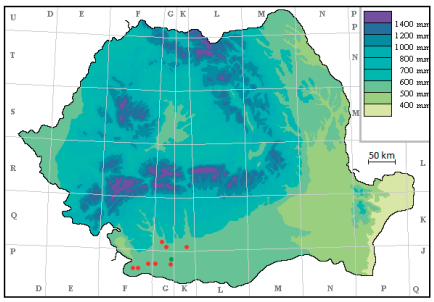

Figure 14. Distribution of the species *Limonium tomentellum* in Oltenia, correlated with the average annual precipitation

Mollugo cerviana (L.) Ser. – *Molluginaceae*
Ecology: it is a vernal plant that is encountered on sandy or sandy-clayey, dry soils, but also in more humid habitats located in various poorly maintained crops.
General distribution: Southern Europe.
Distribution in Oltenia: in this region, it is known from the settlements of Apele Vii, Craiova, Ghindeni, Secui, Cernele, Malu Mare, Teasc, Bratovoiești, Daneț, Mârșani, Tâmburești, Rojiște, Ogrin, Dăbuleni (Dolj County), and Ianca (Olt County) (Buia, 1959; Buia & Păun, 1964), Poiana Mare, Desa, and Nebuna (Buia, 1959).
The only other location where it is recorded at national level concerns the sands of southern Moldavia (Buia, 1959).
It was identified by the author of this study in the Jiu River floodplain, on sandy terrain, on the outskirts of Sadova settlement (Figures 15, 16), around Lake Victoria, located at Adunații de Georgmane.

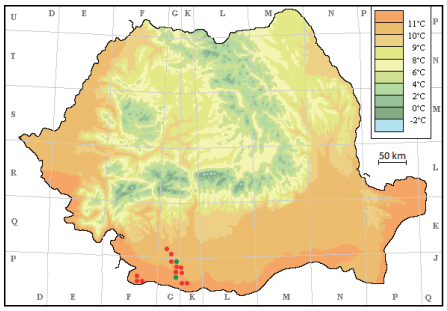

Figure 15. Distribution of the species *Mollugo cerviana* in Oltenia, correlated with the average annual temperatures

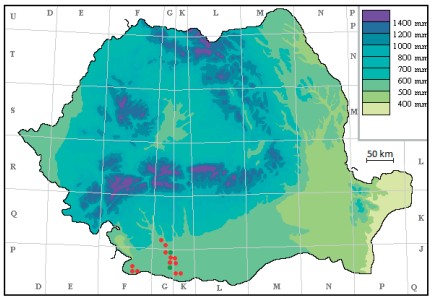

Figure 16. Distribution of the species *Mollugo cerviana* in Oltenia, correlated with the average annual precipitation

Pisum sativum L. subsp. ***elatius*** (M. Bieb.) Asch. & Graebn. – *Fabaceae*
Ecology: it is rarely found in fields, pea crops, shrub edges and ruderal places.
General distribution: it is a Mediterranean element.
Distribution in Oltenia: in Romania, it is known only from Mehedinți County, i.e. from the Danube Gorges, at Iron Gates (Ro: *Porțile de Fier*), Gura Văii, Vârciorova, and Schela Cladovei. With respect to its ecology, it is stated that this plant is found in thickets, on limestone rocks, rarely on sowed areas or in ruderal places (Țopa 1957, in Săvulescu et al. 1957; Ciocârlan, 2009).
This is the first mention of this subspecies in Dolj County, namely in Preajba settlement, on the edge of a pea crop (Figures 17, 18).

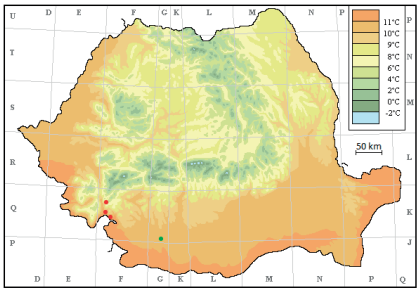

Figure 17. Distribution of the species *Pisum sativum* subsp. *elatius* in Oltenia, correlated with the average annual temperatures

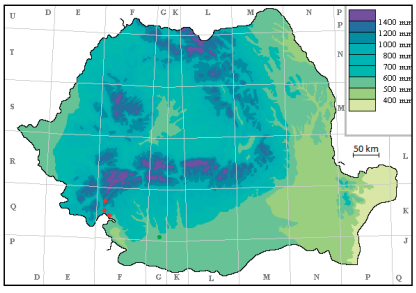

Figure 18. Distribution of the species *Pisum sativum* subsp. *elatius* in Oltenia, correlated with the average annual precipitation

Polycarpon tetraphyllum (L.) L. - *Caryophyllacaeae*
Ecology: it is a heliophilous, thermophilic taxon, which prefers ruderal places or areas with varying degrees of human-induced changes.
General distribution: Atlantic-Mediterranean-Sub-Mediterranean element.
Distribution in Oltenia: it is mentioned from Orșova (Mehedinți County) (Morariu, 1963;

Beldie & Vaczy 1976), Valea Stanciului (Costache & Răduțoiu, 2010, in Răduțoiu et al., 2023), Craiova (Cârțu & Cârțu, 1989; Răduțoiu et al., 2023).
Recent field research has led to the conclusion that the range of this species will increase in the future. This is also supported by the fact that it was identified in rich populations in other areas located in the municipalities of Bucharest (Anastasiu et al., 2024) and Craiova.

Salvia sclarea L. – *Lamiaceae*

Ecology: it is present on dry soils, in arid meadows and in grassy areas located on the sides of roads within the plain region.

General distribution: it is a Mediterranean element.

Distribution in Oltenia: the specialized literature indicates it from dry places located on Ciuperceni and Maglavit settlements (Buia, 1959), and from the outskirts of Băilești town (Răduțoiu & Stan, 2019). It is frequently cultivated in the settlements of the Danube floodplain (Răduțoiu & Ștefănescu, 2021).
It was identified as subspontaneous on the outskirts of Vârtop village, in grassy places located on the roadside, in the direction of Caraula settlement (Figures 19, 20).

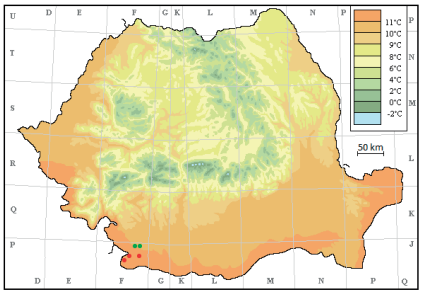

Figure 19. Distribution of the species *Salvia sclarea* in Oltenia, correlated with the average annual temperatures

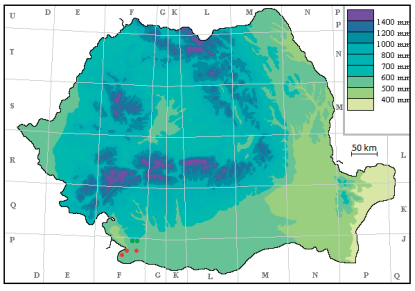

Figure 20. Distribution of the species *Salvia sclarea* in Oltenia, correlated with the average annual precipitation

Silene borysthenica (Gruner) Walters – *Caryophyllacaeae*

Ecology: it is a thermophilic, heliophilous species, which prefers sandy areas.

General distribution: it is a central and eastern European element. In the Romanian field guides, it is mentioned as a rare plant from sandy places (Ciocârlan, 2009; Sârbu et al., 2013) and the Red Book of Vascular Plants of Romania mentions it as an endangered taxon (Dihoru & Negrean, 2009).

Distribution in Oltenia: it was recorded on the sand dunes within the Obedeanu area – Craiova (Popescu et al., 2003), on the Ciuperceni-Desa area (Răduțoiu et al., 2016b), and on the outskirts of Secui settlement, Dolj County (Răduțoiu & Stan, 2019).
It is frequently found on the sands from Dăbuleni (Figures 21, 22).

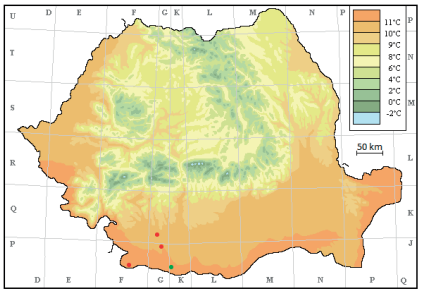

Figure 21. Distribution of the species *Silena borysthenica* in Oltenia, correlated with the average annual temperatures

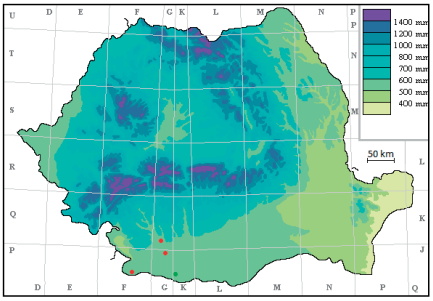

Figure 22. Distribution of the species *Silena borysthenica* in Oltenia, correlated with the average annual precipitation

CONCLUSIONS

The analysis of the plants tackled in this paper shows that those preferring dry, psammophilous places are gradually expanding their range (e.g.

Silene borysthenica, Erodium hoefftianum subsp. *neilreichii*, *Achillea ochroleuca*, *Bassia laniflora*), which is explainable if we take into account the constantly changing climatic conditions in this part of Romania (temperatures are considerably increasing and precipitation is decreasing).

At the national level, the twelve taxa under study display different sozological degrees: rare (e.g., *Achillea ochroleuca*, *Mollugo cerviana*, *Bassia laniflora*, *Pisum sativum* subsp. *elatius*), vulnerable (e.g., *Limonium tomentellum*), endangered (*Cirsium creticum*, *Salvia sclarea*, *Silene borysthenica*), or critically endangered (e.g., *Erodium hoefftianum* subsp. *neilreichii*, *Polycarpon tetraphyllum*, *Hordeum bulbosum* and *Aldrovanda vesiculosa*).

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