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RARE AND ENDANGERED SPECIES OF THE *BORAGINACEAE* JUSS. FAMILY IN THE FLORA OF THE REPUBLIC OF MOLDOVA

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Abstract: Data on the bioecological and chorological features of 21 species of rare plants of the *Boraginaceae* family, 17 of which are threatened (categories: CR, EN, VU), assessed according to IUCN criteria (2001, 2003), are presented in this article. The list of species is proposed to be included in the Law on Rare Species Protected by the State and in the 4th edition of the Red Book of R. Moldova.

Keywords: flora, rare species, conservation status, *Boraginaceae*, R. Moldova.

INTRODUCTION

The intensive crop farming and the overexploitation of natural resources, the pollution and the reckless management of forest, steppe, aquatic and riparian ecosystems have caused the loss of many populations of plant species and natural plant communities. Therefore, the number of species that become rare or threatened with extinction increases in all natural ecosystems. Currently, in the flora of the Republic of Moldova, the rare species constitute about 30% – a much higher index than the European and even the global average. The lack of population-chorological field research on rare species of vascular plants in the spontaneous flora does not allow the assessment of the degree of endangerment and the determination, according to the current situation, of the conservation status of rare species according to the criteria of the International Union for Conservation of Nature (IUCN). This fact is a drawback for the processes and activities related to plant biodiversity conservation.

MATERIALS AND METHODS

The rare species of the *Boraginaceae* family (common names: borage, forget-me-not) were identified as a result of the floristic field research and the critical processing of the materials of the Herbarium, during 2016-2017. The rare taxa were evaluated according to the IUCN requirements and criteria [4, 5], and the conservation status was determined, assigning one of the following categories: Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC) and Data Deficient (DD). The nomenclature of species was indicated according to recent publications [6, 7, 9].

Abbreviations: RBRM (Red Book of the Republic of Moldova), RBB (Red Book of Bulgaria), RLR (Red List of Romania), RBR (Red Book of Romania), HD (Habitats Directive), BC (Berne Convention).

RESULTS AND DISCUSSIONS

The research on the rare species of *Boraginaceae* family was carried out in the framework of the institutional theme of the Botanical Garden of ASM, namely “Research on the populations of vascular plants of the wild flora and the elaboration of the list of species proposed for state protection”. The sizeable family of *Boraginaceae* Juss. comprises about 115 genera with more than 2 500 species, distributed all around the world,

primarily in tropical and subtropical and partly in northern temperate areas [2]. In the wild flora of the Republic of Moldova, this family includes 22 genera with about 55 species of herbaceous plants, 21 of which are rare and 17 – threatened species (categories: CR, EN, VU). Of all the rare species, only one (*Rindera umbellata*) has been included in the 2nd and 3rd editions of the Red Book of the Republic of Moldova, 7 species have been included in the Red Book of Romania (*Anchusa gmelinii*, *A. stylosa*, *Cynoglossum creticum*, *Heliotropium suaveolens*, *Myosotis discolor*, *Rindera umbellata*, *Symphytum tauricum*) and 4 species have been included in the Red Book of Bulgaria (*Anchusa stylosa*, *Cynoglossum germanicum*, *Echium rubrum*, *Symphytum tauricum*). [1, 3, 8]. The species analyzed and evaluated according to the IUCN criteria, depending on the number of plants present in a population, the distribution within one or several areas, the range etc., were classified as follows: 2 critically endangered species, 7 endangered species, 8 vulnerable species, 2 near threatened species, 2 data deficient species. The number of threatened species (categories: CR, EN, VU) is quite large, totalling 17 species. Below, the rare species of *Boraginaceae* family are listed in alphabetical order:

1. *Anchusa gmelinii* Ledeb. – conservation status [Vulnerable (VU B2ab (ii, iv))]. Present in RLR; RBR. Pontic hemicryptophyte. Rarely found in five localities: near t. Otaci, v. Cobusca-Nouă (Bulboaca), v. Seliște (Nisporeni), v. Doi-Bani (Dubăsari), “Iagorlâc” Reserve. Threatened because of the poor propagation, the habitat degradation and the small number of locations. (Fig. 1)



Fig. 1. *Anchusa gmelinii*



Fig. 2. *A. stylosa*

2. *A. stylosa* M. Bieb. – conservation status [Endangered (EN B2ab (i, ii, iii))]. Protected according to the Biological Diversity Act, Annex 3. Present in RBB, RBR. Its range includes Southeast Europe. Annual, thermophilic, Ponto-Balkan therophyte. Rarely encountered near mun. Chișinău and Tiraspol, on slopes with steppe vegetation. Threatened because of the human settlements in close proximity, the habitat degradation and the populations, which are too small. (Fig. 2)

3. *Borago officinalis* L. – conservation status [Data Deficient (DD)]. The plant is biennial hemicryptophyte or, more often, a therophyte with a long vegetation period characterized by semi-rosette shoots. Grows in the wild at the edge of forests, only on the left bank of Dniester river; rare species. The area comprises all parts of Europe, the Mediterranean region, Iran, less often in the Caucasus, Central Asia, western Siberia. Limiting factors: the negative anthropogenic influence, the specific habitat, the



Fig. 3. *Borago officinalis*

restricted distribution. Further field research is needed. (Fig. 3)

4. *Buglossoides arvensis* subsp. *sibthorpiana* (Griseb.) R. Fern. – conservation status [Vulnerable (VU B2ab (iii, v))]. Therophyte balcanic. It is rarely found on arid slopes with clayey soil, ruderal places, in the south of Bugeac. Threatened because of the overexploitation of lands, the habitat degradation, the decline in the number of mature plants.

5. *Buglossoides czernjajevii* (Klokov) Czer. – conservation status [Vulnerable (VU B2ab (iii))]. It is found sporadically in the herbaceous layer of glades and the edge of downy oak forests, as well as on grassy slopes in the south of the republic. The places where these plants grow on the territory of the Republic of Moldova are the most southern of the species range. The species is threatened by the limited range, being found in less than 10 locations.

6. *Cynoglossum creticum* Mill. – conservation status [Endangered (EN B2ab (iii))]. It has been included in RBR. Biennial therophyte, Mediterranean element. It is rarely found at the edge of the forest of oak and European beech in com. Novaci (Călărași), and in com. Bulboaca, Băcioi (mun. Chișinău), on slopes with steppe vegetation. It is threatened because of the exploitation of forests, mowing the grasslands and the degradation of slopes with steppe vegetation.

7. *C. germanicum* Jacq. – conservation status [Endangered (EN B1 ab(iii); C2a(ii))]. Protected in accordance with the Biological Diversity Act, Appendix 3. Present in RBB. Biennial, mesophilic, Central-European species. It is rarely found at the edge of forests and in scrublands, in two localities of Călărași and Căușeni districts. Limited to the exploitation of biotopes, poor populations in individuals, presence in few locations.

8. *Echium rubrum* Forssk. – conservation status [Vulnerable (VU B2ab(ii, iii))]. It has been included in the RBB and Habitats Directive. Biennial, Ponto-Pannonian therophyte. It is sporadically distributed on the territory of the Republic of Moldova. Limiting factors: mowing, the exploitation and degradation of slopes with steppe vegetation, the anthropogenic impact. (Fig. 4)

9. *Heliotropium suaveolens* M. Bieb. – conservation status [Endangered (EN B2ab(i, ii, iv, v))]. Present in RBR. Its range includes Southeast Europe. Eastern Sub-Mediterranean element. Found in only three localities in the south of R. Moldova. Limiting factors: the anthropogenic impact, the poor propagation, the small number of locations – less than 5, the decline in the number of mature plants.

10. *H. ellipticum* Ledeb. – conservation status [Endangered (EN B2ab (i, ii, iv, v); C2a(i))]. Eurasian, thermophilic hemicryptophyte. Identified in two localities: v. Zolonceni (Dubăsari), at the edge of the forest, along Răut River, and in v. Nezavertailovca, on rocky, steep riverbank, near Cuciurgan Reservoir. Limiting factors: the restricted specific habitat, the few locations, the small populations.

11. *Heliotropium europaeum* L. – conservation status (Near Threatened (NT B2ab(iii, iv, v); C2a(i))). It is found predominantly in the southern part of the country, sporadically, on calcareous slopes with steppe vegetation, sandy terraces, pastures. The biotope loss, the presence of localities nearby and the unregulated tourism within the range threaten the species.

12. *Lappula consanguinea* (Fischer et Meyer) Guerke – conservation status (Near Threatened (NT B2ab(iii)). It is found sporadically on calcareous slopes with steppe vegetation, on toltrey (limestone), in the vicinity of Corjeuți (Edineț), Gura-Camenca (Florești), Măgura Veche (Cornești), Morovaia (Orhei), Doi-Bani



Fig. 4. *Echium rubrum*

(Dubăsari). Species with very restricted habitat, with small populations. Threatened because of the exploitation of lands, the very restricted specific habitat.

13. *Lycopsis orientalis* L. – conservation status (Data Deficient, DD). Ponto-Mediterranean element. It is found rarely in ruderal areas, in the central and southern part of the floodplain of Dniester River. There is not enough information about the status of this species.

14. *Myosotis discolor* Pers. – conservation status [Endangered (EN B2ab(i, iii, iv); D)]. Present in RBR. European-Anatolian element. It is found on rocky slopes with grassy vegetation, in the vicinity of Cahul city and Zloți station. Limiting factors: the few locations, the eastern limit of the range of the species, the anthropogenic impact. (Fig. 5)



Fig. 5. *Myosotis discolor*

15. *M. popovii* Dobrocz. – conservation status [Endangered (EN B2ab(i, iii, iv); D)]. Rare species found in Strășeni and Căpriană, on slopes with steppe vegetation and at the edge of forests. Endemic species. Limiting factors: the poor propagation, the small populations and its presence in only two locations. (Fig. 6)



Fig. 6. *M. popovii*



Fig. 7. *Onosma lipskyi*

16. *M. ramosissima* Rochel – conservation status [Vulnerable (VU B2ab(iii, iv); D1)]. European therophyte. Rare species, found in Vișoara (Glodeni), Bahmut (Călărași), Chetriș (Fălești), in glades. Limiting factors: mowing and grazing in forests, the small populations, the few locations.

17. *Onosma lipskyi* Klokov & Dobrocz. – conservation status [Vulnerable (VU B2ab(ii, iii))]. Biennial therophyte, Pontic element; identified on calcareous slopes with steppe vegetation, in three locations: Trebujeni (Orhei), Saharna (Rezina) and Molochișul Mare (Rîbnița). Limiting factors: the exploitation of steppe sectors, the small range, the specific habitat. (Fig. 7)

18. *Onosma visianii* Clementi – conservation status [Vulnerable (VU B2ab(iii))]. Biennial therophyte, Ponto-Pannono-Balkan, identified on calcareous slopes with steppe vegetation, in few locations. Threatened by the exploitation of steppe sectors, the disjunct distribution and the small populations. (Fig. 8)



Fig. 8. *O. visianii*

19. *Rindera umbellata* (Waldst. et Kit.) Bunge – conservation status [Critically Endangered (CR B1ab(i, iii, v); C2a(i))]. Present in RBRM, RBR. Ponto-Balkan hemicryptophyte, tertiary relict. Found in four localities in the south of the territory, in steppe and glades of oak forests. The last time, it was collected in 1948. Limiting factors: the anthropogenic impact, the exploitation of steppe sectors and the afforestation of glades. (Fig. 9, 10)



Fig. 9. *Rindera umbellata*



Fig. 10. *R. umbellata*

20. *Rochelia disperma* subsp. *retorta* (Pall.) Kotejova – conservation status [Vulnerable (VU B2ab(iii, iv, v)c(iv))]. Present in RBR. Ponto-Balkan therophyte. Found in Făurești, Ciorescu, Hâncești, Zloți, on sandy slopes with steppe vegetation. Limiting factors: the specific habitat, the poor propagation, the few locations, the anthropogenic impact.

21. *Symphytum popovii* Dobrocz. – conservation status [Critically Endangered (CR B1ab(ii, iii))]. European hemicryptophyte. Endemic species. Found in a single location – v. Cuhnești (d. Glodeni), in forest of oak with lime. Limiting factors: the poor propagation, the small populations and the limited range.

CONCLUSIONS

- As a result of the floristic and chorological field research and the examination of the specimens of taxa of the *Boraginaceae* family from the Herbarium, 21 rare plant species were identified and categorized according to the IUCN criteria.
- It has been proposed to include the rare and threatened species of the *Boraginaceae* Juss. family, belonging to CR, EN and VU categories, in the list of species protected by the state and in the 4th edition of the Red Book of the Republic of Moldova.

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