

TULIPA HUNGARICA BORBÁS – CONSERVATION STATUS, SPECIES DISTRIBUTION AND POTENTIAL THREATS

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Abstract

The yellow gorge tulip (Tulipa hungarica Borb.) is an endemic species of community interest, protected by the Berne Convention and the Romanian laws; it is in Annex 2 of the Directive on the conservation of natural habitats and species of wild fauna and flora and is found only on the territory of Serbia and Romania. In the Romanian literature, the species is described as critically vulnerable. From the point of view of taxonomy, it is perennial, robust, with an ovoid bulb. Among the habitat preferences, the following are mentioned: heliophilic, thermophilic and calciphilous, on moderately moist, fertile, neutral soils. The main pressure on this species refers to collection activities, but the intensity of this pressure is low, probably due to the difficult access of people to the area where the species is found. The main threats we consider climate change with all the general consequences. As limiting factors, we list the fact that there are few individuals, and as conservation measures specialists recommend monitoring populations and preserving seeds in gene banks.

Key words: conservation measures, endemic, pressure, threat, *Tulipa hungarica*.

INTRODUCTION

Threats to biodiversity are very diverse and it is very important for the conservation of biological diversity to know them and find methods of managing them (Cucu et al., 2013). Human activities put great pressure on biodiversity at European and global level. Agriculture is the main pressure affecting species and habitats, followed by the expansion of urban areas, unsustainable management actions on forests, water, soil and air pollution, fragmentation and degradation, respectively the destruction of habitats through various activities, the introduction of invasive species, illegal hunting or intensive fishing actions. Thus, in order to maintain the health of nature, the implementation of well-thought-out and applied conservation strategies is needed (EEA, 2025a). Among other aspects of assessing the conservation status of a species, it is essential to estimate its risk of extinction, thus prioritizing conservation actions. Thus, for habitat management and the development of sustainable development models, it is important to identify and quantify the main types of threats (Cucu et al., 2013). To protect nature

and slow down or halt the degradation of ecosystems and species, EU Member States have adopted an ambitious, comprehensive and long-term plan containing specific commitments and actions to restore biodiversity by 2030, called the EU Biodiversity Strategy for 2030 (EC, 2021). At EU level, vascular plants are generally assessed as having a good conservation status (27 % of species), but many are also in a poor conservation status, affected by the main pressures specified above (EEA, 2025a). The conservation status of species under the Habitats Directive refers to the sum of the influences acting on species that may affect their long-term distribution and abundance of their populations across the EU. (HD, 1992). Favourable conservation status refers to: population dynamics indicating that the species could survive in the long term in its natural habitats, the natural range of the species will not be reduced in the foreseeable future, the habitat containing the species is large enough to maintain the populations of the species in the long term. In accordance with Article 17 of the Habitats Directive, each Member State reports on the conservation status of species of

Community interest (listed in Annexes II, IV and V) at national biogeographical level. Four parameters are used to establish the conservation status of a species: distribution area, population, habitat of the species, future prospects (EIONET, 2025). When the species are facing high risk of global extinction, the IUCN Red List Categories and Criteria (IUCN, 2025) created a classification system that might be easily and widely understood: Not Evaluated (NE), Data Deficient (DD), Least Concern (LC), Near Threatened (NT), Vulnerable (VU), Endangered (EN), Critically Endangered (CR), Extinct in the Wild (EW) and Extinct (EX).

Between 2007 and 2024, Romania had 3 reporting periods on the conservation status of species: 2007-2012 (the report was carried out in 2013), 2013-2018 (the report was carried out in 2019) and 2019-2024 (the report will be carried out in 2025).

The purpose of this article is to analyse the conservation status of the species *T. hungarica* Borbás, a rare species present on Annexes II and IV of the Habitats Directive, its distribution and the identification of the pressures and threats acting on it.

MATERIALS AND METHODS

Description of the species

T. hungarica is popularly known as the Cauldron Tulip. It is a perennial plant and has a maximum height of 50 cm (PM-PNPF, 2014). It is part of the Liliaceae family and has several synonyms: Danube tulip (Segal & Alen, 2020), Đerdap tulip (after the Serbian name "Đerdap Gorge" (Palin, 2013) or Banat tulip (Bonifaciu, 1985). It is also known as Hungarian tulip (Goriup, 2008). There are uncertainties in the classification of the taxonomic status of this species: *T. orientalis* var. *urumoffii*, *T. orientalis* Levier, *T. hungarica* var. *urumoffii* (synonymous with *T. urumoffii* Hayek) (Ciocârlan, 2009), *T. hungarica* var. *undulatifolia* (synonymous with *T. urumoffii* Hayek) (Ciocârlan, 2009), *T. hungarica* Borbás subsp. *undulatifolia* (Roman) Roman et Beldie (Sârbu et al., 2013).

The studied species has a robust habitus, ovoid bulb, glabrous stem, light yellow and odourless flowers and flat, brown seeds (Dihoru &

Negrean, 2009). The flowers of this species are 4.5-8 cm in size. The perigonal leaflets are almost equal, the outer ones narrower. The stamens have 10-12 mm length filaments and 11-12 mm length yellow anthers. The ovary is elongated, 20-22 mm length, and the stigma is 5 mm wide, about 2 times wider than the ovary. The capsule is elongated elliptical, up to 70 mm length, attenuated at both ends (PM-PNPF, 2014; CNIPTMN, 2025).

Data collection

The desk work focused on publications and reports. The field work consisted of data collection in the framework of two projects coordinated by the Ministry of Environment, Water and Forests as the basis for Romania to report to the European Commission: POS project "Monitoring of the conservation status of species and habitats from Romania in the framework of article 17 of Habitats Directive" (2011-2015) and POIM project "Completing knowledge level of biodiversity through implementing the monitoring system of conservation status of species and habitats from Romania in the framework of article 17 of Habitats Directive 92/43/EEC" (2019-2023). The expertise developed within the POS and POIM projects focused (as required by the European Commission), on assessment of the conservation status of *T. hungarica*, trends, main pressures and threats. All of this was carried out based on monitoring and evaluation methods in accordance with the appropriate guidelines (Mihăilescu et al., 2015b; OM no. 3351 of December 28, 2023).

Distribution maps

The distribution map standard is: ETRS89 grid of 10 x 10 Km, ETRS LAEA 5210 projection. The methods used were mainly based on extrapolation from a limited number of data (e.g. other predictive models or extrapolations using a less complete sample of data on coverage and environmental factors). Observations and data collected during field trips formed the basis of all processing and interpretations, in order to obtain results that are as objective and of scientific value as possible. For vascular plants that are difficult to access in the field and thus difficult to inventory, the 1 x 1 km grid was established at

the European Commission level as the reporting unit for this group of species to which *T. hungarica* also belongs. The population size was calculated by reporting as a range (minimum and maximum value) and/or as a single value (measured or estimated) when only a single value obtained through expert opinion is known. The type of estimates is minimal, where insufficient data can be used for an estimate, but where the population size is known to be above a certain value, or estimates from the reporting period come from field inventories or projects that are likely to have underestimated the true population size.

Plant species monitoring plan

T. hungarica have been monitored in the field in April-May, as long as weather conditions allow, during its optimal development period, especially to observe pressures and threats, as well as other parameters useful in assessing the conservation status. This species belongs to the group of vascular plant species present in areas of siliceous or calcareous rocks and screes in mountainous/subalpine areas. This particular species vegetates in areas of calcareous and steep slopes located of the Danube River banks, benefiting from open places, in full sun during the summer, with shallow soil. *T. hungarica* is a geophyte species, perennial and clonal.

The field studies of the species assessed direct and indirect attributes. The methods for assessing direct attributes are: species identification/recording (for assessing presence and absence); functional individual counts (for estimating population size (number of individuals), mapping (estimating population size/population distribution); visual assessment (estimating regeneration success). The methods for assessing indirect attributes are: Mapping (for estimating niche availability and total coverage); visual assessment (identifying negative indicators as grazing, shading, rock dynamics, extreme climatic events, alien species) (Mihăilescu et al., 2015b; OM no. 3351 of December 28, 2023). Our monitoring studies have been developed during 2 reporting periods (6 years).

Since the habitats of this group of species are very unstable and can be damaged even by the researcher's intervention, non-destructive methods have been used, from a distance, for

example, photographing the slopes from the same point and making sketches of the vegetation distribution. Where and if possible, the point for taking shots is marked with persistent paint (if on land) or use GPS for a specific point (if on land or water) and the same lens with the same photographic magnification have been used. Binoculars have been used by a plant specialist who could identify the plant species.

The species must be in their optimal flowering period, especially when it is necessary to monitor them from a distance.

RESULTS AND DISCUSSIONS

History

The presence of the species was first reported in 1838 in the Cazanele Dunării area (Coste & Faur, 1970).

The name "*T. hungarica*" was given in 1882 by the Hungarian botanist Vincze von Borbás (1844-1905).

It was the first tulip to be described from the Balkan region (Egreta, 2017; Wilson, 2023). It was verified by the United States Department of Agriculture and the Agricultural Research Service in 1996 and is an accepted name by the Royal Horticultural Society of the United Kingdom (RHS, 2025). In 2013, phylogenetic relationships within the genus using DNA sequences were used to determine taxonomy and classifications. As a result, *T. hungarica* was placed in the subgenus *Tulipa* (along with *T. agenensis* Redouté, *T. fosteriana* W. Irving, and *T. greigii* Regel) with the characteristics of bulbous tunics densely lined on the inside with wavy or silky hairs or (nearly) glabrous (Christenhusz et al., 2013).

Ecological requirements

From a biological point of view, the species is geophytic, reproduction is amphimictic, allogamous through entomophily and barochorous and blooming in April (Dihoru & Negrean, 2009). The species is a heliophilous, thermophilic, calcicolous species, growing on moderately moist, fertile, neutral soils (Mihăilescu et al., 2015b; OM no. 3351 of December 28, 2023). The species have optimum development on sunny slopes at 100-250 m altitude tougher with other thermophilic

species: *Centaurea atropurpurea*, *Echinops bannaticus*, *Ferula heuffelii*, *Festuca pallens*, *Piptatherum holciforme*, *Ruscus aculeatus*, *Sedum hispanicum*, *Sesleria filifolia*, *Veronica crinita* (Dihoru & Negrean, 2009). The habitat preferred by the species are: open mixed deciduous forests, shrubs and steep rocky limestone slopes (Cucu et al., 2013).

International location notes

It is reported to be widespread in the Balkans (Turrill, 1929; Millaku et al., 2018), Greece, southern Bulgaria (probably native), naturalized in Romania (Booy & Raamsdonk, 1998; Christenhusz et al., 2013; Wilson, 2023; USDA, 2025), including the Western Carpathians (Hurdu et al., 2012). It is also stated to be an endemic species in Serbia (Papp, et al; 2006; Hurdu et al., 2012; Millaku et al., 2018). It is also referred to as the "Rhodope tulip", because one of its synonyms is *T. rhodopea* (Velen.). The epithet "Rhodope" refers to the Rhodope Mountains in Bulgaria, where it is mainly found (Zonneveld, 2009; Harisson, 2012; WFO, 2025).

It is mentioned as being located in the Djerdap National Park, eastern Serbia, on the right bank of the Danube canyon. The park is an internationally protected area, which continues into the Iron Gates Nature Reserve, along the left bank of the Danube (Sabovljević, 2006; Čalić et al., 2012). One of the famous endemic species of the Djerdap Gorge is *T. hungarica* (Sabovljević, 2006). In Serbia, *T. hungarica* was rare on the northern slopes (those towards the Iron Gates), but has not been recorded in the last ten years. The only evidence of its existence in Serbia is constituted by the specimens preserved in the herbarium (Wilson, 2023).

National conservation status

In Romania, it is reported at Cazanele Mari, Ciucaru Mare, Ciucaru Mic (Brânele Cazanelor), Cazanele Mici (at Bălan). The biogeographical region where it is found is continental (Mihăilescu et al., 2015b). On the red list of higher plants in Romania, the species is mentioned as rare (Oltean et al., 1994; Stevanović, 2011), endemic, isolated, permanent, native (PM-PNPF, 2014; CNIPTMN, 2025), critically vulnerable (Dihoru & Negrean,

2009; Schneider-Binder, 2014) and "critically endangered" (IUCN, 2025). The yellow tulip is a protected species under the Bern Convention of 19 September 1979 and Emergency Ordinance No. 57/2007 on the regime of national areas to be conserved.

It is also listed in the EU Habitats Directive 92/43 EEC, in Annex II and Annex IV (EEA, 2025b). The distribution and range (Figures 1 and 2) remain constant from the reporting year 2013 (first reported to the European Commission for the period: 2007-2012) (Mihăilescu et al., 2015a; EC, 2025). Monitoring of the species carried out in the period 2013-2018 and reported in 2019 led to the conclusion that the species had a favourable conservation status, with an unknown trend. In 2025, Romania's third reporting will be carried out based on the reference list and relevant documents available on the reference portal for reporting under Article 17 of the Habitats Directive. This portal contains relevant documents for the reporting format for the period 2019-2024 (EIONET, 2025). For this reporting, a favourable conservation status with a stable trend is maintained.



Figure 1. Distribution of the species *T. hungarica*

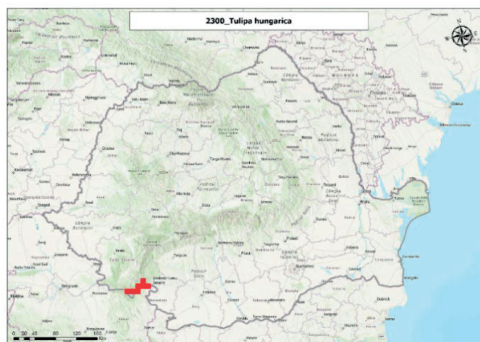


Figure 2. Range of the species *T. hungarica*

Population size

About 15 years ago, the population was quite stable, up to 250 plants (Goriup, 2008), but the plant has multiplied, from one year to the next. The number has reached over 1,000 mature individuals on the southern slopes of the Iron Gates (IUCN, 2025). In Romania, there are approximately 1000-1500 mature individuals of *T. hungarica*, on the southern slopes of the Iron Gates (IUCN, 2012). According to the parameters for assessing the conservation status of the species *T. hungarica* from a population perspective, the population size of the species in the protected natural area is estimated at approximately 8,000-10,000 individuals (PM-PNPF, 2014).

Integrative habitats

The assessment of the integrative species' habitat, shows that the habitat covers approximately 30 ha (PM-PNPF, 2014). It is mentioned as being present only in the Cazane region, in several areas: Ciucarul mic, Ciucarul Mare, the Danube Valley at Cazane near the Veteranilor Cave, Cazanele Mari (between Ciorici and Frasin), Cazanele Mici (at Bălan). *T. hungarica* is a Romanian local endemic, present only in Cazane, being of great interest to the field specialists. It is protected in the Iron Gates Natural Park, but also by its own distribution habitat (growing on almost inaccessible cliffs for humans) (Dihoru & Negrean, 2009).

The Danube River banks on which *T. hungarica* vegetate is declared as a protected area on both the Serbian and Romanian sides. The Iron Gates Natural Park (1156 km²) is located in southwestern Romania in the counties of Caraș-Severin and Mehedinți (Figure 3).

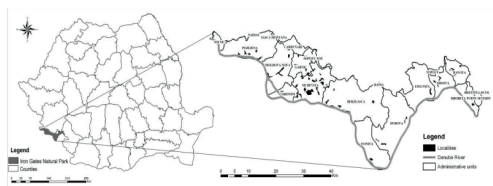


Figure 3. Location of the Iron Gates National Park (After Cucu et al., 2013)

The Iron Gates Natural Park is a transboundary Ramsar site bordering the Republic of Serbia along the course of the Danube River (Cucu et al., 2013) and it can be considered one of the regions with the highest diversity of species and habitats in Romania. *T. hungarica* is one of the many endemic species present on the territory of this natural park (Cucu et al., 2013, Clius & Patroescu, 2014; RAMSAR, 2025).

The Djerdap National Park is the largest in Serbia and covers a total area of 63,786 ha. In this border area, approximately 100 km from the entry point into Romania, the Danube forms the Iron Gates Gorge, the deepest (170 m) and most unique in Europe. This area is the habitat of 1,100 plant species (some unique in the world, such as *T. hungarica*) (Popescu et al., 2022; RAMSAR, 2025).

Pressures and threats

The beauty of the species attracted private collectors (gardeners and crops) thus the main threats is the wild specimen collection mainly because this species is rare in the wild due to its limited distribution (Dihoru & Negrean, 2009; Cucu et al., 2013). Local threats resulting from the Absolute Threats Classification System are: the presence of invasive species, inadequate forest management, some changes in agricultural practices and for some species the collection of plants either for commercial use or for gardening (Cucu et al., 2013). The limiting factors are determined by the small number of individuals, intensive collection and climate changes, which is why it is essential to protect this species and avoid its collection (Mihăilescu et al., 2015). Flowers, leaves and roots of *T. hungarica* individuals can be affected by the parasite *Vankya heufleri* (PPE, 2025).

Blooming beautifully in early April until early May, the sites where the species is present can be visited using boats on the Danube River. Fortunately, the tulips are protected by a steep wall 15 to 20 meters high, so most tourists are content to admire the tulips from a boat and also enjoy the legend that tells the story of these unique flowers (Agerpres, 2016). Because the area is very steep, the plant cannot be picked by flower lovers.

It has been found that floods have caused the extinction of the species in Serbia. Of the 15 plant species that are part of the "Red Book of the Flora of Serbia", three taxa have disappeared from the area of Đerdap National Park (*Veronica bachofenii*, *Crocus banaticus* and *T. hungarica*). These 3 species were lost due to the flooding of their habitats during the construction of a hydroelectric power plant (Iron Gate I Hydroelectric Power Plant in 1972) (Flora, 2020).

Other threats are: presence of invasive and problematic species, pollution from mixed sources, geological natural events (snow avalanches, land collapse, landslide, floodings, fire) excluding catastrophes and processes induced by human activities or climatic changes), climatic changes (extreme temperatures, long droughts, increase in precipitation flow, changes in location, range and/or habitat quality, desynchronization of biological/ecological processes, etc.).

Conservation measures

In the case of *T. hungarica*, we recommend no intervention as the main management action, monitoring populations and conserving seeds in gene banks. It can also be cultivated in Botanical Gardens (Dihoru & Negrean, 2009). Another possible method of protecting the species *T. hungarica* is the propagation and conservation of plants using *in vitro* cultures. The technique of plant propagation through the culture of anthers and microspores is called *in vitro* androgenesis. This method could be the only way to micro-propagate this rare species, as few plants remain in the wild. In order to induce androgenesis, a few investigations on pollen characters have been made (Calic et al., 2012).

The management plan states that the long-term viability of the species is ensured (PM-PNPF, 2014). The high conservation value of this habitat requires its protection and careful monitoring to minimize damage caused by the evaluator/monitor.

CONCLUSIONS

T. hungarica Borb (Liliaceae) is endemic and endangered plant of the Flora of Europe. The taxonomic status of this species is still rising

many taxonomic questions, therefore new techniques should be used for clarifying the taxonomic status, new studies are needed to deepen the morphological and molecular differences of the varieties, subspecies and species associated with *T. hungarica*.

The conservation status of *T. hungarica* species is favourable, and the active conservation measure proposed is species monitoring. The population density and distribution range are stable over two European Commission reporting periods.

The main pressure on the species refers to collection activities, but the intensity of this pressure is low, probably due to the difficult access of people to the area where the species is found.

We propose that micro-propagated plants should be used in gardening and commercial purposes and thus diminishing the collecting pressure on the wild species and their habitats.

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