

**EPIPACTIS TALLOSI A. MOLNÁR & ROBATSCH. (ORCHIDACEAE) IN  
TRANSCARPATIA (UKRAINE): NEW DATA ON DISTRIBUTION AND ECOLOGY**

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**Abstract:** In this publication, generalized information on the geographical distribution and ecological affiliation of *Epipactis tallosii* A. Molnár & Robatsch. (Orchidaceae) in Ukraine, and the state of its populations is analysed. In 2016, the species was first observed in Transcarpathia, in the vicinity of the village Nove Selo. Later, in 2020-2021 we found three new localities in the old floodplain willow-poplar forest (association *Salici-Populetum* (Tx. 1931) Meijer-Drees 1936) on the banks of the Borzhava river near villages of Bene and Kvasovo (Beregovo district). The article describes the ecology and habitat of the species in the study region.

**Keywords:** *Epipactis tallosii*, Flora of Ukraine, Orchidaceae, Transcarpathia

## 1. Introduction

Woody *Epipactis tallosii* A. Molnár & Robatsch (Orchidaceae) is an autogamous (self-pollinated) and mixotrophic species with rhizomes, which is found in a variety of habitat types. In Hungary, for example, it was common in gallery forests, lowland oak and oak-hornbeam forests and in the more hilly regions, as well as in poplar plantations. (Molnár 2009; Süveges et al., 2019). *E. tallosii* A. Molnár & Robatsch is one of the latest flowering species of its genus and recently, generative individuals have been identified even in October (Molnár 2011). The species was originally described

from Hungary (Molnár & Robatsch 1997), then it was confirmed from the Czech Republic and the South of Slovakia where the species was reported to be known from the mid 1990-s (Vlčko 1997; Mered'a 2002; Kolník & Kucera 2002; Molnár 2011). However, it was not identified until 1997. During 2012-2016, new localities of the plant were found in Ukraine, Romania, Serbia, and Croatia (Süveges et al. 2019). Thus, the species is currently known in seven countries: Hungary, the Czech Republic, Slovakia Serbia, Croatia, Romania and Ukraine.

In the most recent IUCN Red List, *E. tallosii* A. Molnár & Robatsch. is listed as one of the most threatened orchid species in Europe, and is classified as Endangered (EN) at European level (Fay 2011). *E. tallosii* A. Molnár & Robatsch. has been classified by the IUCN categories as Critically threatened (C1) in the Czech Republic (Holub & Procházka 2000; Grulich 2012), as near threatened (NT) in the Carpathian part of Slovakia (Eliáš et al., 2015) and in Hungary (Király 2007). It has been already listed as Endangered (EN) in the Red Data Book of Ukraine Therefore, we suggest that the new habitat of the species is considered in the new edition of the Red Data Book of Ukraine (find data on <https://zakon.rada.gov.ua/laws/show/z0370-21#Text>).

In the most recent years several species of *Epipactis* Zinn. were added to the Ukrainian Flora. As of 2008, only five species of the genus were known in Ukraine: *E. atrorubens* Hoffm.ex Besser, *E. helleborine* (L.) Crantz, *E. microphylla* (Ehrh.) Sw., *E. palustris* (L.) Crantz, and *E. purpurata* Sm. (Protopopova 1987; Vakhrameva et al. 2008), but in the 2009 edition of the Red Data Book of Ukraine a new species was added to the flora: *E. albensis* Nováková & Rydlo (Didukh 2009). First, *E. albensis* Nováková & Rydlo was discovered in 1997 in Transcarpathia (Drescher et al., 2003). Later, in 2012, systematic studies conducted in the Transcarpathian Lowland confirmed the presence of the species *E. albensis* Nováková & Rydlo at three new localities in Ukraine, namely close to the village of Chetfalva, Koson', Fanchykovo and Drotynsi of the Beregovo district within the floodplain of the river Tisza (Ljubka et al., 2014). Afterwards, the species was also found in the vicinity of Kyiv district (Tymchenko & Ljubka 2019).

By 2020, *Epipactis* genus is represented by the following species in Ukraine (in alphabetical order): *E. albensis* Nováková &

Rydlo, *E. atrorubens* Hoffm.ex Besser, *E. distans* Arv.-Touv., *E. helleborine* subsp. *helleborine*, *E. helleborine* subsp. *tremolsii* (Pau) E. Klein., *E. krymmontana* Kreutz, Fateryga et Efimov., *E. leptochila* (Godfery) Godfery., *E. muelleri* Godfery., *E. microphylla* (Ehrh.) Sw., *E. palustris* (L.) Crantz, *E. persica* (Soó) Hausskn. ex Nannf., *E. purpurata* Sm., and *E. tallosii* A. Molnár & Robatsch (Didukh 2009; Efimov 2008; Kreutz & Fateryga 2012; Fateryga & Kreutz 2012; Fateryga et al. 2013; Fateryga et al. 2014; Fateryga et al. 2019; Ljubka et al. 2014; Ljubka 2018; Protopopova et al. 2017; Süveges et al. 2019).

## 2. Materials and methods

Studies of the species were conducted during 2020-2021 in the Beregovo district of the Transcarpathian Lowlands. Herbarium materials of the M.G. Kholodny Institute of Botany NAS of Ukraine (KW) and the herbarium of Ferenc Rakóczi II Transcarpathian College of Higher Education (KMF) were analysed. Maps of species distribution were compiled with the help of Quantum-GIS software.

In studies of the species, data about associated plant species, habitat type and the size of the population were gathered.

For documentation, the species were collected of the two flowering specimens (without rhizome), which are stored in the herbarium of KMF. The identification was accomplished by comparing the plants to the description keys in the works of Molnár (2011).

The floral characteristics were measured on a single mounted flower per individual using a vernier calliper measurement tool.

The soil-sampling and the measurement of soil acidity was conducted by means of the ISO 10390:1994 IDT (Soil quality-Determination of pH) methods. We collected soil samples from

three new localities of the species in Ukraine in order to carry out soil reaction characterisation. Soil sampling and soil acidity measurements were undertaken using the methods described by Csoma (2009).

High resolution images of each morphological details were taken with DSLR camera equipped with a macro lens.

### 3. Results and discussions

#### 3.1. Description and diagnostic characteristics

*E. tallosii* A. Molnár & Robatsch. is (9) 10-12 cm high. The stem is yellowish green;

the leaves are 2-3 lanceolate or oval, with slightly undulated margins, inflorescence is near one-sided with (4) 5-8 small flowers, usually wide open but we saw exemplars with slightly opened flowers and pale-green sepals, the junction epichile-hypochile is „U” shaped, but with a very narrow transition: the hypochile nectariferous, coloured from the inside from light green to brown, the epichile is whitish to pinkish in colour, triangular-oval in shape, viscidium is well developed but non-functional. Peak flowering in Ukraine starts at the end of July - through the middle of August (**Fig. 1**).



**Fig. 1.** *Epipactis tallosii* Á. Molnár & Robatsch: **a.** general view; **b.** flowers (Photo: T. Ljubka, 2019, 08.09. Kvasovo)

#### 3.2. Distribution, habitat, and populations data of *E. tallosii* in Transcarpathia

New localities of *E. tallosii* in Ukraine were found between the villages of Bene and

Kvasovo K1, K2, K3 (Beregove district) in 2020-2021 years (**Fig. 2**).

*E. tallosii* A. Molnár & Robatsch. typically is grown in association *Salici-Populetum* (Tx. 1931) Meijer Drees 1936 (class *Salicetea purpureae* Moor 1958 alliance *Salicion albae*

Soó 1951). The typical habitat of *E. tallosii* A. Molnár & Robatsch. is represented by the association *Salici-Populetum* (Tx. 1931) Meijer Drees 1936 (*Salicetea purpureae* Moor 1958 class, *Salicion albae* Soó 1951 alliance). In the new locations for *E. tallosii*, non-typical species for this association prevails in the habitat. This is due the intensive agriculture activities outside the sites.

In the studied plants communities, the canopy cover is ca. 60%. Co-dominant species are *Populus alba* L. (30%) and *Salix alba* L. (30%), with an admixture of *Populus nigra* L. In the shrub-layer the following species were identified: *Cornus sanguinea* L. (40%), *Crataegus monogyna* Jacq., *Rosa canina* L., *Sambucus nigra* L., *Vitis vulpina* L., *Rubus caesius* L., and undergrowth of *Fraxinus*

*angustifolia* Vahl., *Juglans regia* L., *Acer negundo* L., *Acer campestre* L., *Malus domestica* L., *Padus avium* L. The herb layer has a coverage of 30-70% and in its composition we identified herbaceous vascular plants such as *Arctium lappa* L., *Ambrosia artemisiifolia* L., *Bellis perennis* L., *Circaea lutetiana* L., *Bidens tripartita* L., *Echinocystis lobata* (Michx.) Torr. & A. Gray., *Erigeron annuus* (L.) Pers., *Equisetum arvense* L., *Geum urbanum* L., *Hedera helix* L., *Humulus lupulus* L., *Lysimachia nummularia* L., *Plantago major* L., *Prunella vulgaris* L., *Stellaria media* (L.) Vill., *Sanicula europaea* L., *Taraxacum officinale* L., *Trifolium arvense* L., *Viola odorata* L., and *Urtica dioica* L.



Fig. 2. Map of the distribution of *Epipactis tallosii* Á. Molnár & Robatsch in Transcarpathia



**Table 1.** Localities and results of chemical analysis of soil with the presence of *E. tallosii*

Species	Locality	Altitude	Soil reaction		Number of <i>E. tallosii</i> or individuals
			pH <sub>KCl</sub> - pH <sub>H2O</sub>	GPS coordinate	
<i>E. tallosii</i>	Nove Selo (N1)	117 m	5,5 - 7,9	48.09777, 22.88282	5 - 9
<i>E. tallosii</i>	Kvasovo (K1)	113 m	5,4 - 6,6	48.16299, 22.77457	2 - 5
<i>E. tallosii</i>	Kvasovo (K2)	113 m	6,0 - 7,4	48.16283, 22.77559	3 - 7
<i>E. tallosii</i>	Kvasovo (K3)	114 m	5,7 - 6,8	48.16295, 22.77738	3 - 5

Previous studies on the populations of the species reported that in Croatia the population size varies between 35-45, in Romania – 80-100, Serbia – 18-70 of individuals observed among plantations of *Populus × canadensis* Moench (Süveges et al. 2019). The occurrence of this species in Ukraine is restricted to the old floodplain forest of the banks of river Borzhava, and extend to a maximum of 15 m away from the river at approximately 113-117 a.s.l.

At the localities in Transcarpathia we found contrast compared to populations of this species from other countries. The new populations do not have a large number of individuals and range from 2 to 7. In our opinion, the number of individual populations depends on the hydrological regime of rivers and the total amount of average monthly precipitation in the region.

The soil measurements in three localities in Ukraine, are presented in **table 1**. The soil reaction is between pH<sub>KCl</sub> – 5.4-6.0 and pH<sub>H2O</sub> – 6.6-7.9. The soil test shows that the pH level of the surveyed area matches the data from Hungary. 5.5 to 8.0 pH<sub>H2O</sub> (Molnár 2011). In addition, soils of river floodplains are formed during floods, leaving a floodplain alluvium, which is characterized by having acidic environment in humid conditions and neutral or basic environment in dry conditions. This is also confirmed by our results of chemical analysis of the soil.

## Conclusions

Currently, 4 localities of *E. tallosii* A. Molnár & Robatsch are known from Ukraine, namely in the Transcarpathian Lowland of the Transcarpathian region. It seems that the number of populations of *E. tallosii* Barbaro A, Kreutz C.A.J (2007) *Epipactis tallosii* A. Molnár & Robatsch subsp. *zaupolensis* Barbaro & Kreutz subsp. nov. (Orchidaceae) in northeastern Italy (Friuli Venezia Giulia) has been similarly documented (Barbaro et Kreutz, 2007).

The study region is small; they occupy small areas and are often represented by single individuals, sometimes by small groups. Populations of the species are more commonly found in acidic to weakly basic soils, this is confirmed by our results. The species occurs up to 120 m above sea level, mainly in the valleys of the rivers Tisza and Borzhava, on alluvial soils. In Ukraine, populations have been found in floodplain forests dominated by species of the genus *Populus*, whose trunk circumference exceeds 80 cm, belonging to the association *Salici-Populetum*, whereas outside Ukraine the species can occur in poplar plantations and, sometimes, on hills with oak and hornbeam. Such ancient floodplain forests in the region are the main habitats of the species which is likely to be the result of favourable environmental conditions for fungi without which the growth of both *E. tallosii* A. Molnár & Robatsch and other mixotrophic orchid species is impossible. In our opinion, new sites

of the species may be identified, the most likely habitats of the species are poplar plantations and willow poplar floodplain forests. However, further systematic research is needed. The species requires appropriate protection measures in all places where the species is present. Given the nature of the distribution, its status, we have prepared a description of the species in the Red Data Book of Ukraine. At the plant's sites harvesting, (collecting) deforestation, violation of hydrological conditions and drainage of plots is prohibited.

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### Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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