

Hitherto overlooked or a recent introduction? (Re)discovery of *Ornithopus perpusillus* in Hungary

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Abstract: This article presents the hitherto known records of *Ornithopus perpusillus* in Hungary. The species was first found in central Hungary as early as 1952, but was identified as *O. sativus*. It was (re-)discovered in southwestern Hungary in 2010 at several localities, in disturbed, open sandy grasslands, with co-occurrence of other Atlantic-Mediterranean species. *O. perpusillus* was likely introduced in Hungary at the beginning of 2000s, and now it is considered to be naturalized here.

Keywords: Central-Europe, sandy vegetation, Leguminosae, introduced species.

Introduction

The genus *Ornithopus* L. (Leguminosae), comprising five species (*Ornithopus sativus* Brot., *O. compressus* L., *O. micranthus* (Benth.) Ar., *O. pinnatus* (Miller) Druce., and *O. perpusillus*) occur mainly in the western Mediterranean and in North Africa. Only one species (*O. micranthus*) is native in South America (Polhill 1981). The species of the genus are annuals with small pink or yellow petals, the fruit breaks along transverse sutures between seeds during ripening. The European species of the genus can be found mainly in disturbed acidophilous sandy grasslands or in ruderal vegetation (Gladstones & Barrett-Lennard 1964). Three species (*O.*

compressus, *O. pinnatus*, *O. sativus*) have been cultivated previously as fodder plants outside their natural range (North America, Eastern Europe, Australia, New Zealand). Hungarian floras of the last half century (Soó 1964; Simon 2000; Király 2009) reported only *O. sativus* in Hungary; this species was formerly cultivated on nutrient-poor soils, mainly with cereals (Csapody & Priszter 1961).

Material and Methods

Geographical coordinates were recorded using handheld GPS device. Mapping units were defined according to the Central European Flora Mapping Programme (Niklfeld 1971). Nomenclature of plant names follows the EuroMed (2006-), while names of plant associations follow Borhidi et al. (2012). For the small geographical regions of Hungary, we relied on the work of Dövényi (2010). During our research, we reviewed all of BP's *Ornithopus* material. Specimens collected during the study are deposited in BP. The vegetation of *O. perpusillus* site at Bolhás was sampled in at six 0.25 m² micro quadrats. The abundance of plant species was estimated visually as a percentage of ground cover in each plot. Herbaria abbreviations are according to Thiers (2025).

Results and Discussion

Taxonomy and identification

Ornithopus perpusillus is often confused with the very similar *O. sativus*. The first Hungarian specimen was correctly determined by the original collector but was later erroneously revised to *O. sativus*. The main reason of misidentification is the role of quantitative characters (the size of the corolla and the length of the lower calyx-teeth), these two species cannot be distinguished well on herbarium specimens. The flowers of *O. sativus* are larger, corolla is 5–8 mm long, pink, cream-colored, less often whitish, its veins are not conspicuous. The corolla of *O. perpusillus* is smaller (3–4 mm long), whitish or pale pink, with a conspicuous vein. However, these quantitative characters are reliably visible only on fresh material. Some sources (i.e. Ball 1968; Jäger & Werner 2005) also mention the ratio of length of the bract and inflorescence as a distinguishing character, but Wallnöfer et al. (2015) suggest that this is unreliable because the length of bracts can vary widely even on the same individual. According to our observations, there are also differences in legumes between the two species. Fruits of *O. perpusillus* are always gradually curved, while the legumes of *O. sativus* are almost straight. The hairs on fruits of the former species are one and a half to two times longer and denser than those of the latter, while fruit of *O. sativus* seems to be brighter and appearing almost smooth. As the first species is certainly present the Hungarian flora, we included it in the former Hungarian *Ornithopus* key (Király 2009).

Ornithopus L.

Corolla 3–4 mm long, white or pinkish with conspicuous purple veins, calyxtube 2–3 × longer than calyx-teeth, lower calyx-teeth triangular, < 1mm long. Legume gradually curved, with dense hairs. Plant 10–30 cm high. V-VIII. Adv. Open, disturbed sand grasslands. (Belső-Somogy, Bakonyalja†) *O. perpusillus* L.

Corolla 5–8 mm long, pinkish or cream-colored with inconspicuous veins, calyxtube and calyx-teeth are equal size, lower calyx-teeth elongated, > 1mm long. Legume ± straight, with scattered hairs. Plant 30–60 cm high. VI-VIII. Adv. (DNY-Eu.) Fodder plant, formerly cultivated *O. sativus* Brot.

Distribution

O. perpusillus is an Atlantic-Mediterranean species, occurring in western and south-western parts of Europe, from NW Russia (with the easternmost occurrence near St. Petersburg, Vasiljeva 1984) to the British Isles and southern Scandinavia (Ingelög et al. 1993). The southeastern margin of the distribution is near Dnipro and Kherson in Ukraine (Prokudin 1987). It is not rare in Italy and the Iberian Peninsula but scattered in northern Algeria (Wiersema et al. 1990). The species is introduced in Estonia (island of Hiummaa, Tabaka et al. 1996). It was found on the Curonian Spit, and in two more sites in central Lithuania (Vilkonis & Svirskis 2006). Outside Europe it has also been introduced to India, Mongolia, the Caucasus, south Australia, New Zealand, Costa Rica, and east of United States (POWO 2025).

O. perpusillus is rare in Central Europe. In Germany, it is most frequent on the sandy banks of large rivers (Oder, Elbe and Rhine) and quite scattered in Northern Bavaria and Thuringia (Markgraf 1976). In Poland, it grows on the sandy banks of the large rivers Oder and the Vistula, and in sandy fields near the sea (Zajac & Zajac 2001). It was temporarily introduced on sandy pastures and in pine forests in Czech Republic. It is reported from Prague, Veltrus, Litoměřice and Nová Bystřice. In 1992, one stand was found in a sand pit near Rumburk (NW Czechia) (Chrtková 1995). Furthermore, two historical sites have recently been confirmed in eastern Bohemia near the villages Štěpánovsko and Zdelov (Doležal 2014). Its status in Czech Republic is uncertain; it occurs in secondary habitats, on the other hand, *O. perpusillus* has similar distribution area with other sub-Atlantic species (e.g. *Carex pseudobrizoides* Clavaud, *Rubus geminatus* H.E. Weber, *Luronium natans* (L.) Raf.) considered native. According to Chrtková (1995) it is non-native, but it is not listed in the Catalogue of alien plants of the Czech Republic (Pyšek et al. 2012). Grulich (2012) classified it as critically endangered. It seems that the species has recently been spreading in the Czech Republic, with 16 data points already reported in the latest synthesis (Chytrý et al. 2021)

The species is considered a casual neophyte in Slovakia, which appeared in 1989 (Medvecká et al. 2012). There is a single record from Malé Karpaty Mts, Záruby Nature Preserve, which is, however, taxonomically uncertain and probably refers to sterile *Hippocrepis comosa* (Hollá 1989).

In Austria, it was first mentioned by Neilreich (1859) from Nußdorf (today part of Vienna). Beck von Mannagetta (1890) accepted this occurrence and added two more records from the area of Vienna. Due to the lack of herbarium vouchers these records are unconfirmed. There is one collecting labelled as „Salzburg, on sandy soil” without date (LI). Given that the plant occurs in several places in nearby Bavaria, these observations from Salzburg are likely to be correct (Wallnöfer et al. 2015).

Occurrences and habitats in Hungary

First mention of *O. perpusillus* from Hungary appeared in Jávorka (1925) as an occasional alien without a precise location. The source of this record was probably the specimen collected by József Márton in Sorokújfalu (today: Sorokpolány, W Hungary) “in arenosis” at the beginning of the 19th century (BP101864). On this sheet, Jávorka’s handwriting can be found as follows: “ex Hungarie? subcultures?”. Thus, Jávorka had doubts about the origin of this collection, as J. Márton often labelled specimens as Sorokújfalu or Sorkitótfalu received from other parts of Hungary or even from abroad. In addition, sandy soils are not present in this region.

Another specimen (BP197678) from Hungary has been recently found at BP in the collection of Miklós Szalay, a parish priest from Halimba (central Hungary). The exact location of collection is not presented, only one sentence is written on the label: “escaping from a former culture”. As doublets of Szalay’s herbarium are deposited in the HNHM Bakony Museum (Zirc), during the review of the collection we found another sheet (Zirc, specimen ID: 002269), on which the details of the collection had been clarified (“in prato „Csárdarét” pr. pag Halimba, Hungaria”). The specimen had originally identified correctly as *O. perpusillus*, but in 2001, it had been erroneously revised and published as *O. sativus* by I. Galambos (Galambos 2005). The BP herbarium received only a few specimens of Szalay’s collection; these were presumably sent to S. Jávorka for identification. Probably, the specimen of *O. perpusillus* could have arrived in Budapest in this way. “Csárda-rét” is located in the west of Halimba, a village at the edge of Bakony Mts. Largest part of the site have been destroyed by bauxite mining, but some nutrient poor meadows formed on limestone and gravel, and small acidophilous sandy grasslands still exist there. According to our observation several species (*Aira caryophyllea* L., *Anthoxanthum odoratum* L., *Hypericum humifusum* L., *Moenchia mantica* (L.) Bartl.) with similar habitat preference to *O. perpusillus* occur in the area recently, therefore Szalay’s collection can be accepted as the first occurrence of this species in Hungary.

The species was rediscovered in the early 2000’s in the southern part of Somogy county (Belső-Somogy, SW Hungary). It has since been found in several places in this region and is currently known from the following locations:

- Rinyabesenyő (as *O. sativus*, without voucher, but most probably *O. perpusillus*), 2004; N. Pfeiffer (in Bartha et al. 2015); common in pioneer vegetation at the edge of dustroad S of the village (46°9'12.54"N, 17°31'10.67"E), (9871.1), 22.05.2023; M. Wolff, Fig. 1.

- Between Szulok and Barcs, fallow land, common (45°59'49"N, 17°31'05"E), (0071.1), 08.06.2020, A. Mesterházy (BP).
- Bolhás, fallow field, scattered (46°13'57.81"N, 17°15'52.18"E), (9769.4), 26.07.2010, A. Mesterházy.
- Bolhás, *Corynephorum*, scattered (46°16'40"N, 17°14'40"E), (9769.1), 30.05.2017, A. Mesterházy.
- Kaszó, disturbed grassland 0,5 km SE of Kanizsaberek (46°19'40"N, 17°11'59"E), (9669.3), 11.05.2011, G. Király.
- Kaszó, grassland with pioneer vegetation under power line 0.7 km SE of the settlement (46°18'48"N, 17°13'44"E), (9669.3), 18.05.2018, G. Király.

Based on recent records, the species is present in a relatively large area on open sandy grasslands. Its occurrence is mainly connected to typical *Filagini-Vulpinetum* habitats formed on young fallows, especially in disturbed sandy grasslands, and *Corynephorus* grasslands with pioneer and weed species (see Table 1).

Considerations on the status in Hungary

Vegetation of sandy grasslands of Belső-Somogy is well studied (Boros 1925; Lájér 1998), and the *Corynephorus* grasslands have recently been mapped (Lájér 2005). The species composition of the pioneer grasslands of Belső-Somogy region is related to the sub-Atlantic acidophilous sandy grasslands (Lájér 2005). Many of the species found here (*Anthoxanthum puelii* Lecoq & Lamotte, *Aphanes australis* Rydb., *Teesdalia nudicaulis* (L.) W.T. Aiton, *Veronica dillenii* Crantz.) have a similar distribution in Southwestern Europe. As the original habitats of *O. perpusillus* are similar to these species (Rodwell 2000; Vilkonis & Svirskis 2006), the nativeness of this species may arise in the sandy region of Belső-Somogy. This region is affected by a strong sub-Atlantic and sub-Mediterranean climate, with annual rainfall of about 780–830 mm (Borhidi 1958). The number of frosty days here is one of the lowest in Hungary (Varga 2003). Thus, *O. perpusillus* appeared in this area as in its



Fig. 1 Flower and legume of *Ornithopus perpusillus* (left) and pioneer vegetation at Rinyabesenyő (right, all photographed by M. Wolff).

Tab. 1 Vegetation of *Ornithopus perpusillus* stands recorded in % at six 0.25 m² micro quadrats at Bolhás *Corynephorum* (9769.1, 30.05. 2017, A. Mesterházy, 46°16'40.36"N, 17°14'39.61"E).

	1.	2.	3.	4.	5.	6.
E ₀ moss layer	22		16	10	35	
E ₁ herb layer	45	40	30	25	22	52
<i>Corynephorus canescens</i>	45	30	25	20	15	
<i>Teesdalia nudicaulis</i>	1	2				
<i>Ambrosia artemisiifolia</i>		4				
<i>Cynodon dactylon</i>		6				
<i>Plantago lanceolata</i>			4			
<i>Hypericum perforatum</i>			2	4		
<i>Jasione montana</i>			8			
<i>Anthoxanthum puelii</i>				2		35
<i>Ornithopus perpusillus</i>				1	2	5
<i>Conyza canadensis</i>				2		
<i>Potentilla argentea</i>				4		
<i>Euphorbia cyparissias</i>				1	6	
<i>Anthemis arvensis</i>				0,2		
<i>Hypochoeris radicata</i>					2	
<i>Rumex acetosella</i>					0,5	
<i>Filago minima</i>						20
<i>Scleranthus annuus</i>	1		2			

natural range. Seeds of Leguminosae species are viable for a long time (Rolston 1978), therefore *O. perpusillus* may have been latent in this area for decades. In the past, the distribution of open grasslands in Belső-Somogy was significantly higher than today, this habitat type was heavily grazed, so the suitable microhabitats of this species were widespread. However, the recent coverage of grasslands in Belső-Somogy has declined, many open habitats have been afforested. It is likely that – as *Anthoxanthum puelii* in similar habitats – it is in a recent introduction. *A. puelii* was discovered in 2004 in Belső-Somogy and spread quickly in extensive arable lands and fallows. The source of its introduction has been suspected in the seed tanks of combine harvesters purchased by smallholders from northern Germany in the last two decades (Pinke et al. 2006). In the case of *O. perpusillus*, the introduction by western European guest hunters is considered the most likely pathway, as the high-quality populations of deers in the region has always attracted foreign hunters, so the seed of the species may have arrived in the area with their car wheels or footwear. As the plant is an important source of protein, we have observed that games (red deer, fallow deer, wild boar) consume its shoots, so this may play a role in its regional distribution (endozoochory). The North American *Hypericum mutilum* L. was discovered in Lake Baláta in the region in 2001, and the authors attributed the occurrence of this species to hunters too (Pfeiffer & Molnár 2002).

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