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Data on the current spread of *Medicago polymorpha* L. in Hungary

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Abstract: *Medicago polymorpha* L. is a species native to the Mediterranean and Central Asia. It is not native to the Hungarian flora. Although it was recorded in some places in the 19th century, it then disappeared for a time or went unnoticed during the 20th century. However, the species has been seen again in recent years at various locations throughout the country. It is particularly characteristic of heavily disturbed anthropogenic habitats. In Zala County, for example, it has been found on roadside verges with heavy traffic. In contrast, in the areas around Lakes Balaton and Fertő, introduced populations have also been found in other urban habitats affected by holiday tourism, such as near beaches, campsites and historical sights. The plant has also been reported in agricultural areas of Kisalföld, presumably as a contaminant in imported seed mixtures. We summarize the verified Hungarian observations of *M. polymorpha* and highlight its ongoing, rapid spread. Concerning the numerous erroneous data on this species, we would also like to emphasize the need for large open data collection portals to implement more rigorous professional supervision of citizen science data, similar to the system used by the iNaturalist project community dedicated to mapping the flora of Hungary.

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Introduction

Medicago polymorpha L. is a species native to the Mediterranean region and Central Asia (POWO 2026). Its natural range extends from the Atlantic coast, across the Mediterranean, to the Caspian Sea and the Persian Gulf. However, it

has also become naturalised in areas with suitable climates on every continent. The species is absent from the cold continental regions in Eurasia with severe winters, although a few sporadic, likely introduced occurrences have been noted on overview maps (GBIF 2026).

The earliest records of this species in Hungary date back to the 19th century. In 1873, Lajos Simonkai discovered it near Nádasd (now Mecseknádasd) in Baranya County (Simkovics [Simonkai] 1878), and in June 1878 Vince Borbás collected it at the Ferencváros railway station in Budapest (BP 581852; Borbás 1879). At the beginning of the 20th century, István Szita found the species near Magyarürög (now part of Pécs), also located in Baranya County (cf. Horvát 1942, p. 94). Then, the species was not encountered for a long time. Soó (1966) referred to it as a disappeared adventive species. It was later included in overviews of the alien flora of Hungary, based on the historical data from Baranya and Budapest (Priszter 1963, 1997; Balogh et al. 2004). In 2005, the species was observed in Baranya County (Csiky et al. 2005). According to Csiky et al. (2005), the earlier record of the species in the Aggtelek Karst (Soó 1968) was incorrect, thus it has been removed.

In the last few years, our independent field surveys have identified several new occurrences of *M. polymorpha* in Transdanubia. While we were preparing our observations for publication, Pinke (2026) reported its occurrence from Persian clover (*Trifolium resupinatum* L.) fields in some sites in the Kisalföld (Lesser Hungarian Plain) region, where it was presumably introduced into the fields as a contaminant in feed grain mixtures, possibly in 2025. We also found additional records from Hungary on crowdsourced collection platforms, some of which, however, proved to be incorrect. This paper aims to review and update the known occurrences of *M. polymorpha* and to assess the significant changes in its current distribution in Hungary.

Materials and methods

Based on the results of recent publications and our sporadic floristic data collected in the last few years in Alsóörs, Balatonfüred and Pécsely, a systematic data collection was planned for the spring of 2026 in the Lake Balaton region to map the regional distribution of the species. As part of this, we surveyed lawns in heavily frequented built-up areas (parks, grassy verges) in 18 settlements, the weed vegetation at 8 railway stations, and carried out targeted sampling at 15 campsites (Appendix 1). The selection of urban lawns was carried out by using a pseudorandom method. Records of the species and other sporadic species were collected in lawns located in the busiest parts of the settlement, taken within approximately 30 minutes. At the railway stations surveyed, the weed vegetation

around outer tracks was studied for 15–30 minutes per sampling point, depending on the size of the station. At the campsites visited, surveys were conducted for 30–60 minutes, depending on the size of the campsite. We searched for *M. polymorpha*, as well as other rare or sporadic species, along the internal road network of the campsite and at empty caravan or tent sites. Sites recorded before 2026 were revisited to confirm species presence (Table 1).

During our fieldwork, geographic coordinates were recorded by using various GPS devices. We provide the grid-cell codes used in the Central European Flora Mapping System (Niklfeld 1971) wherever the locations are mentioned, and we used these CEU codes to present the locations on the national distribution map of the species.

While exploring the species' distribution in Hungary, we also checked the herbariums of public collections (BP – Hungarian Natural History Museum, Budapest; DE – University of Debrecen; JPU – University of Pécs). We also checked the species' distribution data on several online data collection portals (iNaturalist, GBIF, PlantNet, CIAT), trying to eliminate incorrect data as well as records of non-spontaneous occurrences.

The distribution map presented in this paper was created using the QGIS (Quantum GIS 3.28.3) software package. The collected specimens were deposited in the herbaria of BP, DE, and JPU as well as in private collections.

Results

Over the past three years, new occurrences of *Medicago polymorpha* were recorded at 22 sites in Hungary (Table 1). All known occurrences of the species have been found in habitats exposed to strong anthropogenic pressure. According to our observations, the plant typically appears along the verges of heavy traffic roads (3, 11, 20) and in pavement verges and lawns within settlements (1, 8, 12, 13, 14, 15, 16, 17). Most of the data is from campsites (2, 4, 5, 7, 9, 10, 18, 19, 21), but its presence has also been detected in car parks, at bus stops (17), and around touristic landmarks and hiking trails (6, 22). Occurrences along important traffic lines from the Adriatic direction (M7 highway, Route 7) and at campsite tent/caravan sites are most likely primary establishments that appeared at the sites where the propagules were introduced. We have observed populations that have been present in Nagykanizsa, Sormás, and Alsóörs for at least two years, which confirms that self-sustaining populations are present in the recently colonized sites. This year's check of the occurrences reported in Pécs also detected the species's continued presence there (János Csiky in litt.). At some of the surveyed sites, we recorded large populations of this species, numbering several hundred to several thousand individuals (5, 12, 17, 18). These large populations could be

Table 1. New occurrences of *Medicago polymorpha*. The "Collector" cell contains the initials of the authors and other data observers: Zoltán Barina (BZ), Norbert Bauer (BN), János Csiky (CsJ), Annamária Hüvös-Récsi (HRA), Gergely Király (KG), Susanne Leonhartsberger (SL), András Mészáros (MA), Uwe Raabe (UR), Dávid Schmidt (SD). **1. táblázat**. A *Medicago polymorpha* új lelőhelyei. Az adatgyűjtő rubrikában a szerzők és további megfigyelők monogramja szerepel: Barina Zoltán (BZ), Bauer Norbert (BN), Csiky János (CsJ), Hüvös-Récsi Annmária (HRA), Király Gergely (KG), Susanne Leonhartsberger (SL), Mészáros András (MA), Uwe Raabe (UR), Schmidt Dávid (SD).

No.	Collector	Date	Site revisited (year: +/–)	Settlement: locality	Remark	Collection ID	CEU No.
1	BN	15.06.2025	2026: +	Alsóörs: Vasút utca	between the beach car park and the railroad crossing	BP	9073.2
2	BN, HRA	13.06.2026		Badacsonytördemic: campsite	around the reception building and at several points in the caravan parking areas	BP	9270.2
3	BN	14.05.2026		Balatonalmádi: main road 71	mown lawn in the town, located between the railroad tracks and a supermarket	BP	8974.3
4	BN	16.06.2026		Balatonboglár: campsite	in the mown and strongly trampled lawns around the restrooms	BP	9271.2
5	BN, HRA	13.06.2026		Balatonederics: campsite	in mass in the mown lawn in front of the restrooms	BP	9270.1
6	MA	01.05.2025	2026: +	Balatonfüred: Papsoka	disturbed soil surface near the church ruins	DE	9073.1
7	BN	16.06.2026		Balatongyörök: campsite	a few specimens in an empty, shady caravan site	BP	9270.1
8	BN	11.06.2026		Csopak: Sport utca	mown roadside near the resort village	BP	9073.2
9	BN, HRA	13.06.2026		Gyenesdiás: campsite	frequent, along the paths and on the mown lawns	BP	9269.2
10	KG, UR	17.04.2026		Hegykő: campsite	on an approximately 1 m^2 patch of degraded, partially exposed soil surface at the location of a mobile food truck	herb. Király G.	8366.4

Table 1. (continued)/**1. táblázat** (folytatás)

No.	Collector	Date	Site revisited (year: +/–)	Settlement: locality	Remark	Collection ID	CEU No.
11	SD	12.06.2023	2024, 2026: +	Nagykanizsa: main road 7	along the section of the main road 7 in the town, specifically on the roadside and on a trampled lawn	BP	9567.2
12	BN, HRA	30.05.2026		Paloznak: Vörösparti sor	in large numbers in the roadside dry grass with *M. rigidula* and *M. minima*	BP	9073.2
13	CsJ	20.05.2023.	2026: +	Pécs (Patacs): Lőtér dűlő	found in a roadside lawn with *Medicago arabica*, *M. lupulina*, and *M. minima*	JPU	9975.1
14	CsJ	26.05.2025	2026: +	Pécs (Belváros): Attila út	in pavement verges with *Medicago arabica*	JPU	9975.1
15	CsJ	26.05.2025	2026: +	Pécs (Belváros): Klimó György út	in pavement verges with *Medicago arabica*	JPU	9975.1
16	MA	06.05.2025	2026: +	Pécsely: Fő utca	mown roadside along the main street of the village	DE	9072.2
17	BN, HRA	16.05.2026		Révfülöp: Káli út	a mown lawn near a bus stop	BP	9171.4
18	BN, HRA	13.06.2026		Révfülöp: campsite	on the beach lawn, and at numerous spots and in the caravan sites	BP	9171.4
19	BN	16.06.2026		Siófok: campsite	small stands in empty caravan sites	BP	9074.4
20	BZ	27.05.2024	2026: +	Sormás: rest area of M7 Motorway	dozens of specimens	–	9567.2
21	BN	16.06.2026		Szántód: campsite	a few specimens in an empty campsite	BP	9073.1
22	SL	2022	2026: –	Tihany (Sajkod)	on hiking trail E of Sajkod, on a meadow sloping towards the southwest	GJO	9073.3

a promising starting point for the species' potential expansion within the region. In the Balaton region, signs suggesting that its spread has already started within the landscape may be identifiable. For example, in the area of Alsóörs, in addition to a few stands that appear to be primary ones, we observed single individuals in various locations, such as in pavement curbs and in public flower beds. In Révfülöp, a large population was found in the mown lawns around the bus stop, stretching over 50–60 metres. In our view, this occurrence would already suggest spontaneous spread within the area.

We assume that the primary establishments found in various locations (e.g., campsites) may have resulted from separate introductions. Since the species is not very conspicuous and can be reliably identified based on its habit (Fig. 1.) for a brief period only, specifically from mid-April to mid-June during the flowering and fruit ripening stages in our region, we believe it may already be more widespread than we realize, with many unrecognized occurrences. The surface ornamentation of the fruit (pod) of this species is highly distinctive and differs from that of other *Medicago* species found in Hungary. If fruits are found, perhaps in large amounts (Fig. 2), the species can be identified later in the year on the basis of its characteristic shape and ornamentation; in some cases, individuals that flower and set fruit in early autumn may also be found.

Discussion

On the status and current spread of *Medicago polymorpha* in Hungary

Over a century after the first documented introductions of *M. polymorpha* in Hungary (Simkovics [Simonkai] 1878, Borbás 1879), Csiky et al. (2005) reported its recent occurrence and provided a critical review of the Hungarian data on the species (by using the synonym name of *M. nigra* (L.) Krock.).

The early record of Borbás from Budapest certainly indicates an occasional appearance. The population published by Csiky et al. (2005) near Rózsafa (Baranya County), specifically on the Fekete-víz plain, was found in a heavily disturbed area along a dry roadside. This occurrence was similar to our new sites mentioned above, however, it is not quite the same habitat. The species has been continuously present at this locality for more than 20 years; therefore, it has established (János Csiky in litt.). Based on this observation, Csiky et al. (2023) consider it naturalised in Hungary.

The populations that have been detected around Lake Balaton, Lake Fertő and in Zala County are almost certainly linked to tourism, where the vector is either humans or a means of transportation; thus, according to the classification by Schulze et al. (2005), the mode of propagation can be classified as anthropo-



Fig. 1. *Medicago polymorpha* stem with ripening fruits. Photo by N. Bauer, Révfülöp, 16.05. 2026.
1. ábra. *Medicago polymorpha* hajtás, érésben lévő termésekkel. Fotó: Bauer N., Révfülöp, 2026.05.16.



Fig. 2. *Medicago polymorpha* fruits in mass on the beach lawn. Photo by N. Bauer, Révfülöp, 13.06.2026.
2. ábra. *Medicago polymorpha* termései tömegesen a strand gyepjében. Fotó: Bauer N., Révfülöp, 2026.06.13.

chory and agochory. It does not seem like a coincidence that, at the Nagykanizsa habitat, it grows alongside numerous non-native Mediterranean species spread by road traffic, including *Catapodium marinum* (L.) C. E. Hubb., *Hainardia cylindrica* (Willd.) Greuter, *Parapholis incurva* (L.) C. E. Hubb., and *Plantago coronopus* L., which are also recent newcomers to Hungary (Schmidt et al. 2016, 2025). These species have already appeared at campsites and along roads surrounding Lake Balaton, together with many other introduced species. In almost all localities of *M. polymorpha*, *Torilis nodosa* (L.) Gaertn. is also found, which has been introduced in recent years and has spread extremely rapidly (Kun et al. 2023, Hábenczyus and Süveges 2024, Dudáš et al. 2024a, 2024b, Schmidt et al. 2024). Pinke (2026) reports on a different way of introduction from these cases: *M. polymorpha* was likely brought to arable fields in the Kisalföld region via contaminated seed mixtures from Italy. During data collection, we encountered another recent specimen from the Balaton region (http1), preserved in the herbarium of the Universalmuseum Joanneum (GJO) in Graz (leg. Leonhartsberger, S., 28.05.2022., Tihany, CEU: 9073.3; GJO 0112869). We have created a map showing the reliable historical and recent occurrences of *M. polymorpha* (Fig. 3). According to our present knowledge, the species has been authentically observed in 26 CEU grid cells in Hungary, but we assume that it is already much more widespread than that.

In European countries with non-Mediterranean climates, *M. polymorpha* is generally considered to be a non-native species (Dostál and Červenka 1992, Kirschner and Štěpánek 1995, Verloove 2006). In the Pannonian Basin, the species can be regarded as established in campsites in eastern Austria, where it colonized the area very rapidly (Raabe 2025). Human introduction can be considered certain for occurrences of the species in Hungary and Central Europe. According to Csiky et al. (2005), an archaeophytic origin cannot be ruled out, but neither can the continuous presence of the species in our region. It is almost certain that the current wave of the species' spread is the result of human influences that are more intense and multifaceted than ever before. Introduced populations of the species typically thrive in ruderal areas of factories, campgrounds, and settlements. In Belgium, the Netherlands, Germany and Austria, *M. polymorpha* is one of the most common introduced plants found in campsites (Verloove et al. 2020, Hohla 2025, Raabe 2025, 2026). Regarding the spread of *M. polymorpha*, it has also been proven that propagules from its established populations on other continents were carried back to Europe on the fur of grazing animals – as the most common contaminant in wool – where they became established in the vicinity of wool-processing factories (Verloove et al. 2025). It has also been found that, in addition to the structure of the fruit, the rapid

evolution of *M. polymorpha* in newly colonised areas may also play a role in the success of its proliferation and establishment (Jack and Friesen 2019).

The chronological pattern of *M. polymorpha* records in Hungary closely resembles that of several other introduced Mediterranean alien species found in the region. After being observed in the 19th century, species such as *Medicago orbicularis* (Bauer 2018) and *Torilis nodosa* (Kun et al. 2023) disappeared or went unnoticed in the 20th century but have recently been observed again as part of a new colonization. This phenomenon could be linked to the level of floristic research conducted; however, it is more likely that we are witnessing a new wave of introductions of Mediterranean species. Many species may have been introduced in the 19th and 20th centuries, but then they only survived for just a short time. Evidence for this includes the increasing number of species arriving from

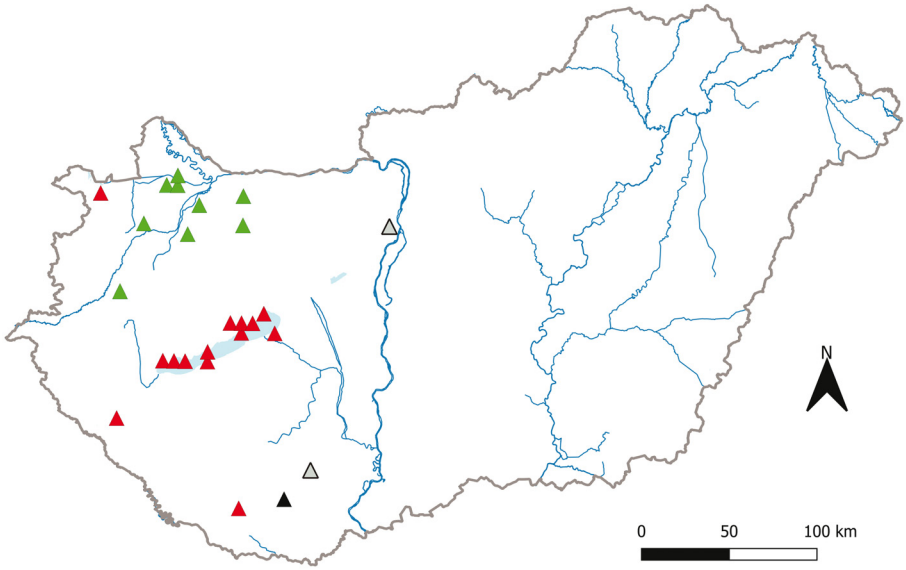


Fig. 3. Distribution of *Medicago polymorpha* in Hungary. Legend: grey triangle: early data of the species from the 19th and 20th centuries; green triangle: recent introductions of contaminated seed mixtures due to agricultural use (Pinke 2026); red triangle: new observations most probably from recent unintentional introductions, presumably via tourism and traffic; black triangle: the CEU grid cell contains both an old record (Szita in Horvát 1942, Pécs: Magyarürög) and recent observations (Csiky 2023, 2025, Pécs).

3. ábra. A *Medicago polymorpha* elterjedése Magyarországon. Szürke háromszög: alkalmi megjelenések a 19. és 20. században; zöld háromszög: közelmúltbéli behurcolás mezőgazdasági tevékenységből gyommagvakkal szennyezett vetőmaggal (Pinke 2026); piros háromszög: friss megfigyelések, feltehetően főként a gépjárműforgalom és turizmus révén; fekete háromszög: azonos cellához régi (Szita in Horvát 1942, Pécs: Magyarürög) és új (Csiky 2023, 2025, Pécs) észlelések is tartoznak.

southern regions (Mesterházy et al. 2021, Rigó et al. 2023, Bauer et al. 2025, Schmidt et al. 2025). We may be observing an expansion of Mediterranean species, facilitated by human activities, enabling certain species to survive long-term and spread spontaneously in the new territories they have colonized. Although *M. polymorpha* is listed as a naturalised species, the new records reported above are relatively recent introductions and can be related to a new wave of southern species reaching the country. We consider that, as these developments are occurring in parallel in many places, it might soon become a more common species in some parts of Hungary.

Note on the unsupervised acceptance of citizen science data

When examining the synthetic distribution maps of *Medicago polymorpha* available online, such as those in the GBIF database (GBIF 2026), it is striking that several additional records are listed for Hungary. A closer evaluation of these individual records reveals significant shortcomings in the data collection protocols of global data platforms and inadequate validation processes. For instance, the reported locations of Gödöllő, Tápiószele and Vácrátót likely represent non-spontaneous occurrences that stem from seed catalogues of botanical gardens and experimental stations, which have been uploaded by international exchange partners (also botanical gardens). Additionally, there is unverifiable seed catalogue data for a location in Jánoshalma, which lacks collector information or other pertinent details. Such data on an alien species that spreads spontaneously can significantly distort the overall understanding of its distribution and complicate scientific assessments. The GBIF database also features species data from community data collection platforms, specifically from Budapest, Budakalász and Ózd. However, based on photographic evidence, these records are all misidentifications and should be removed from the database or corrected (Appendix 2). A review of all GBIF data for *M. polymorpha* – a species not native to Hungary but which has recently begun to spread – shows that the data collection protocols of citizen science portals, which generate vast amounts of biological data, are currently insufficiently strict. To avoid misinterpretations and confusion, it is essential to strictly refine these protocols. We recommend that data import is preceded by item-by-item validation conducted by experts with a thorough knowledge of the regional flora. An example of a successful, expert-supervised initiative is the iNaturalist project "Community Flora Mapping in Hungary", where data collection adheres to the aforementioned criteria (http2). Additionally, in instances where species cannot be identified from a photograph or can only be identified with uncertainty, it is particularly important to consider only entries documented by specimens in public collections or published in scientific papers.

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Adatok a *Medicago polymorpha* L. terjedéséhez Magyarországon

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Kulcsszavak: antropochória, area expanzió, behurcolás, Fabaceae, mediterrán elem, városi flóra.

Összefoglalás: A *Medicago polymorpha* L. mediterrán–közép-ázsiai, Magyarország flórájában nem őshonos faj. A hazai idegenhonos flóralistákban 19. századi alkalmi megtelepedő, de a 20. században egy ideig eltűnt vagy szem elől tévesztett faj az elmúlt években ismét előkerült a Dunántúl számos pontján. Felbukkanása főleg erősen taposott antropogén élőhelyeken jellemző. Zalában forgalmas utak szélén, a Balaton és a Fertő tó térségében más, a nyaralóturizmus által érintett települési élőhelyeken (strandok, kempingek, történelmi nevezetességek mellett) találtuk behurcolás eredetű állományait. A Kisalföld mezőgazdasági területein is találták, feltehetően szennyezett külföldi vetőmag-keverékkel érkezett magokból származó előfordulásait. Dolgozatunkban összegezzük a *M. polymorpha* hiteles hazai megfigyeléseit, továbbá felhívjuk a figyelmet az épp most zajló, gyors térhódítására. A faj sok téves adata kapcsán arra is javaslatot teszünk, hogy a nagy

adatgyűjtő portálokon szükséges lenne a közösségi tudomány (citizen science) típusú adatgyűjtés komolyabb szakmai kontrolljának bevezetése, hasonlóan ahhoz, ahogy ez a magyarországi flóratérképezést szolgáló iNaturalist projekt esetében megvalósul.

Idézés: Bauer N., Barina Z., Király G., Hüvös-Récsi A., Mészáros A., Raabe U., Schmidt D. 2026: Data on the current spread of *Medicago polymorpha* L. in Hungary. Bot. Közlem. 113(2): 227–240. https://doi.org/10.17716/BotKozlem.2026.113.2.227

Appendix 1. Sites around Lake Balaton studied between April and June 2026 to map the occurrences of *Medicago polymorpha*.
1. Függelék. A *Medicago polymorpha* előfordulásának feltérképezése céljából a Balaton környékén 2026 áprilisa és júniusa között vizsgált helyszínek.

Lawns in built-up areas under strong human impact:
Ábrahámhegy, Alsóörs, Badacsonytomaj (Badacsonyörs), Balatonakali, Balatonalmádi, Balatonboglár, Balatonfüred, Balatongyörök, Balatonszemes, Balatonszepezd, Csopak, Fonyód, Gyenesdiás, Keszthely, Révfülöp, Siófok, Szigliget, Zánka.

Railway stations:
Alsóörs, Balatonalmádi, Balatonboglár, Balatonfüred, Fonyód, Révfülöp, Várpalota, Zamárdi.

Campsites:
Alsóörs/Paloznak, Badacsonytomaj, Badacsonytördemic (Badacsonylábdi), Balatonboglár, Balatonederics, Balatongyörök, Balatonszemes, Csopak, Fonyód (Bélatelep), Gyenesdiás, Révfülöp, Siófok, Szántód, Zamárdi, Zánka.

Appendix 2. Records of *Medicago polymorpha* L. from Hungary listed in the GBIF database based on erroneous identification (accessed on 12.03.2026).
2. Függelék. A *Medicago polymorpha* L. GBIF adatbázisban megjelenő, téves azonosításon alapuló magyarországi megfigyelései (hozzáférés: 2026.03.12.).

https://www.gbif.org/occurrence/3949325351 (Budapest, 03.10.2021, Jako K.)
https://www.gbif.org/occurrence/2974370022 (Budakalász, 20.06.2020, Károlyi B.)
https://www.gbif.org/occurrence/5110486961 (Budapest, 27.03.2025, Bódi M.)
https://www.gbif.org/occurrence/5109830471 (Budapest, 21.03.2024, Batári B.)
https://www.gbif.org/occurrence/5109580490 (Ózd, 03.05.2023, Mikola Z.)