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NEW LOCALITIES OF *ELEUSINE INDICA* (POACEAE) AND *PHYTOLACCA ESCULENTA* (PHYTOLACCACEAE) IN EASTERN HUNGARY

András Schmotzer

Wildlife Department, Bükk National Park Directorate
H–3304 Eger, Sánc u. 6, Hungary; schmotzera@bnpi.hu

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Abstract: This paper reports on the new occurrences of two alien species, *Eleusine indica* and *Phytolacca esculenta* in Eastern Hungary (in microregions of Great Hungarian Plain and North Hungarian Range units). Previously very scattered observations were documented from this part of the country. This correspondence describes the newly discovered localities of these species and presents the actualised CEU-based grid distribution map. I observed *Eleusine indica* in 5 new grids in 2018, which might refer to the present expansion of the species on trampled synanthropic habitats (mostly along roads). In the case of *Phytolacca esculenta* new occurrences increased significantly our knowledge concerning its distribution. Based on recent floristical investigations carried out between 2008 and 2019, it is registered from 10 microregions covering 37 new CEU grids (representing a 29.6% increase in data compared to previous data). The occurrence at Bükkszentkereszt (Bükk Mts) represents the population with the highest altitude record (607 m a.s.l.) so far known in Hungary. The species can colonise with 'soft invasion' variable synanthropic habitats, mostly in urban environs, thus some locations outside from the villages were also detected. The importance of the green (garden) waste deposition heaps is also considerable, which can serve as 'stepping stones' in the naturalisation process of the species.

Key words: distribution, flora mapping, green waste, invasive alien species, range expansion, urban flora

INTRODUCTION

Biological invasion is one of the key topics in recent life science. The literature has grown rapidly worldwide in the last decades, due to the complexity of this phenomena caused by the introduction and naturalisation of non-native species (Richardson *et al.* 2000, Lowry *et al.* 2013). Most of the floristical papers target the documentation of the first naturalised or even spreading populations of the alien species. Quite few examples are known where the introduction and spreading of the species are well-documented (Kowarik 1995). Thus, the importance of a lag phase in population growth of invasive species was recognised more than 30 years ago (Hengeveld 1989, Crooks 2011), the datasets

of invasive species' distribution are characterised by significant biases in most of the cases. The lag phase commonly observed for invasive species may frequently be a result of the time needed for the invader to evolve to fit the new habitat (Clements & Ditomasso 2010). The documentation of the spreading (and potentially invading) alien flora has high importance.

This paper reports on the new occurrences of two Old World alien species, *Eleusine indica* (L.) Gaertn. (Poaceae) and *Phytolacca esculenta* van Houtte (Phytolaccaceae). Both species are categorised as 'invasive species' (Balogh *et al.* 2004) and showing a rapid range expansion in the last decade in Hungary. The distribution data of these species are often neglected from the regional floras, which mostly target the floristical evaluation of an area with higher percentage of natural and semi-natural habitats. In the present distribution of these species remarkable data deficiency was detected especially of the eastern part of Hungary (Bartha *et al.* 2015). The aim of this study was to widen the knowledge on the distribution of these species.

MATERIALS AND METHODS

The studied species

Eleusine indica is an erect, tufted annual grass, branching at the base and forming clumps. It can grow 15–85 cm tall, but on trampled locations it is much lower. The roots are powerful and deep. The smooth and hairless stems are strongly compressed, 2 to 5 mm wide. The alternate leaves are rather wide and folded, arranged horizontally. They are raised along the length of stem. The leaf is smooth, except in the upper surface where long flexuous hairs are observable. The leaf sheaths are flattened and the margins present bundles of long hairs. Inflorescence is formed of 4 to 5 spikes which are light green, raised obliquely from the outermost of the culm. The sessile spikelet consists of 3 to 9 flowers; they are arranged on the lower face of the spike axis in two rows. Seeds are oblong-ovate, reddish brown to black. Length of seeds ranges from 1 to 1.5 mm. Seeds are wrinkled transversely.

Phytolacca esculenta is a perennial herb, with stout, 1–2(–2.5) m high glabrous stems. Roots are obconic, thick, fleshy. Leaves are 10–30 cm long, 5–15 cm wide, broadly ovate, with obtuse or abruptly acuminate apex. Racemes are 5–25 cm long, compact, erect even when in fruit. Flowers have 8 (7–9) stamens, filaments are widened at the base. There are 5 tepals, which are white or yellowish green, elliptic, ovate, or oblong, 3–4 × *ca* 2 mm, equal, deflexed after anthesis. Fruits (berries) are depressed-globose berries with 8 (7–9) separate free carpels, their colour is intensive purplish-black when mature. Seeds are reniform, *ca* 3 mm, 3-angulate, smooth.

Data acquisition and processing

The source of the data is based on field surveys carried out by the author in 2018 (in the case of *Eleusine indica*) and between 2008 and 2019 (in the case of *Phytolacca esculenta*). Additional *Phytolacca esculenta* records from Bálint Csontos, Roland Farkas, Gabriella Laczkó, István Lantos, and Krisztina Stoszek were also gathered and added into the enumeration. Only those records were published which are considered new occurrences compared to the online version of the *Atlas Flora Hungariae* (http://floraatlasz.uni-sopron.hu/).

Nomenclature of plants is according to Király (2009). The locations are arranged according to the units of the topographical division (landscape units) of Hungary (Dövényi 2010). Only macro- and microregions were enlisted. The administration units, local toponyms and elevation data were elaborated with the help of 1:10,000 scaled national topographic maps, while the streets and square names were derived from the Google Maps homepage (https://www.google.hu/maps). The grid numbers added in square brackets follow the codes of the Central European Flora-mapping project (Niklfeld 1971, Király 2003). Geo-coordinates of the localities were determined using a Trimble Juno 3B and Spectra MobileMapper GPS devices in Hungarian DATUM projection. The conversion of the coordinates into WGS 84 system and distribution maps (Figs 1, 3) procession was carried out in ArcGIS 10.1 software environment. If more populations were found in the same location (e.g. in a settlement) in the same CEU grid, the coordinates indicate the population with the highest individual number.

The *Eleusine indica* voucher specimens were deposited in the Herbarium Carpato-Pannonicum collection of the Hungarian Natural History Museum Budapest (BP) and partly the Herbarium of the Eszterházy Károly University, Eger (EGR). If photo documentation was carried out, this fact is also indicated in the enumeration.

RESULTS AND DISCUSSION

List of localities

A. *Eleusine indica* (L.) Gaertn. (Poaceae) – Fig. 1

1. Alföld (Great Hungarian Plain)

1.2.12. Pilis–Alpári-homokhát (Pilis-Alpár Sand Ridge) – Pilis (Pest county): 'Új-erdő', between the 49 and 50 km section of Main Road Nr. 4., along the gravel side of the road, (100 specimens); 47.26669° N 19.57515° E, 132 m [8783.1], leg.: A. Schmotzer, 16.09.2018 (photo and voucher, BP).

1.8.12 Dél-Tisza-völgy (South Tisza Flat) – Tiszakécske (Bács-Kiskun county): Holt Tisza, along a sandy dirty road beside a poplar plantation, forming massive patches (<200 specimens) (Fig. 2), 46.91095° N 20.07740° E, 82 m [9086.3], leg.: A. Schmotzer 17.09.2018 (photo and voucher, BP and EGR).

1.9.12 Tápió-vidék (Tápió Region) – Tápióság (Pest county): Ófalu part, Papp K. str, naturalised on cracked and cube sidewalk (10 specimens), 47.39925° N 19.61984° E, 130 m [8683.2], leg.: A. Schmotzer, 12.09.2018 (voucher, BP).

6. Észak-magyarországi Középhegység (North Hungarian Range)

6.5.22 Egri-Bükkalja – Noszvaj (Heves county): in the village, Bocskai str., naturalised on cracked concrete sidewalk (25 specimens); 47.93389° N 20.47976° E, 265 m [8088.4]; leg.: A. Schmotzer, 18.08.2018 (photo and voucher, BP and EGR).

6.5.23 Miskolci-Bükkalja – Miskolc (Borsod-Abaúj-Zemplén county): in the town, Vár str. at Diósgyőr Castle, one fertile individual on cube rock sidewalk (István Dancza, *pers. com.*); 48.09832° N, 20.68846° E, 180 m a.s. l. [7990.1]; leg.: A. Schmotzer; 26.09.2015.

The rapid spread of this weed originating in the Old World was detected in the last few decades in central Europe and in Hungary as well (Holm *et al.*

Fig. 1. *Eleusine indica* on a sandy dirty road at Tiszakécske (South Tisza Valley) (photo: A. Schmotzer).

1997, Jehlik 1998, Wallnöfer 2014, Balogh *et al.* 2004, Dancza 2012). Its present distribution in Hungary is rather sporadic (Bartha *et al.* 2015). After the publishing of the *Atlas Florae Hungariae*, additional records from the Great Hungarian Plain were presented by Süveges in Molnár *et al.* (2016) and Király & Király (2018). The species is regarded mostly as an element of the urban alien flora (frequent in Budapest; see Csontos *et al.* 2017) inhabiting anthropogenic habitats (sidewalks, roads, embankments). The species is reported from Hungary in 47 CEU quadrats so far, and ¾ part of its distribution is in Transdanubia and around Budapest. The species is known worldwide as a problematic weed. Holm *et al.* (1991) reported the species nearly from 60 countries as major weed infesting different crops. Up to now, significant habitat preference shift of the species into agricultural lands has not been reported from Hungary.

The reported five new occurrences are from the Eastern and Central part of Hungary (Fig. 2). Two locations are situated on the Bükk foothills (new species for the area), while the lowland locations also represent microregions where the species has not been reported before. In all locations it occurs along transport lines, mostly roadsides, but it is also naturalised on cracked concrete sidewalks in settlements. According to its high tramping and salinity tolerance, the species

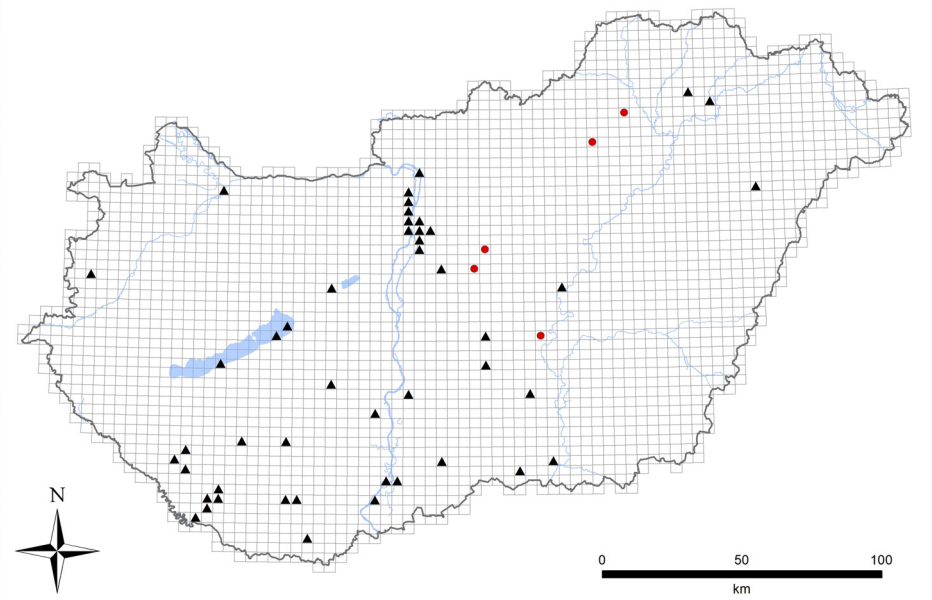

Fig. 2. Present distribution of *Eleusine indica* in Hungary (red dots are the new localities presented in this paper).

grows on open grounds and can form massive homogeneous lines and patches accompanied by annual weeds, such as *Eragrostis* spp., *Puccinellia distans*, *Cynodon dactylon*, *Portulaca oleracea*, etc. (Fig. 1).

Further expansion of the species is predicted in the warmer regions of the Carpathian Basin according to the climate change and further development of transportation.

B. *Phytolacca esculenta* Van Houtte (Phytolaccaceae) – Fig. 3

1. Alföld (Great Hungarian Plain)

1.6.13 Bodrogköz – Sárazsadány (Borsod-Abaúj-Zemplén county): in the village, Fő str., at ruderal foregarden (5 specimens); 48.26258° N, 21.49468° E, 96 m a.s.l. [7794.2); leg & det.: A. Schmotzer & Táborská J.; 02.07.2018. Sárospatak (Borsod-Abaúj-Zemplén county): in the town, Szent Erzsébet str., at damp places, along walls (10 specimens); 48.31869° N, 21.56657° E, 116 m a.s.l. [7695.3]; leg & det.: A. Schmotzer & J. Táborská; 02.07.2018 (photo).

1.7.11 Taktaköz – Kesznyéten (Borsod-Abaúj-Zemplén county): village, Béke square at a metallic fence (1 specimen); 47.96658° N, 21.04831° E, 96 m a.s.l. [8092.1]; leg & det.: A. Schmotzer; 02.09.2016.

1.7.12 Borsodi-ártér (Borsodi-Tisza region) – Tiszadorogma (Borsod-Abaúj-Zemplén county): in the village, József A. str.; at shrubby edge of a small artificial pool (2 specimens); 47.68389° N, 20.86851° E, 90 m a.s.l.; [8391.1]; leg & det.: A. Schmotzer & N. Seres; 02.09.2016.

1.7.13 Hevesi-ártér (Hevesi-Tisza region) – Poroszló (Heves county): 'Közös-legelő', Nagy Sándor str. at an abandoned house (1 specimen); 47.65498° N, 20.65014° E, 90 m a.s.l. [8389.2]; leg & det.: A. Schmotzer; 20.06.2018. Poroszló village, Bajcsy-Zsilinszky str., Feszty Á. str., Tanács str.; sporadically in the aforementioned streets, mostly in abandoned gardens and by buildings (altogether 50–100 specimens); 47.65485° N, 20.6547° E, 89–91 m a.s.l. [8389.2]; leg & det.: A. Schmotzer; 20.06.2018.

1.8.12 Dél-Tisza-völgy (South Tisza Flat) – Tiszakécske (Bács-Kiskun county): 'Holt-Tisza, Csámpa', on a garden waste deposition heap at the edge of a willow wood (3 specimens); 46.92594° N, 20.09328° E, 82 m a.s.l. [9086.4]; leg & det.: A. Schmotzer; 09.10.2016 (photo). 'Holt-Tisza'; in artificial willow-dominated forest lot (50–100 specimens); 46.91051° N, 20.07773° E, 83 m a.s.l. [9086.3]; leg & det.: A. Schmotzer; 10.10.2016 (photo).

1.9.11 Hatvani-sík (Hatvan Flat) – Zsámbok (Pest county): in the village, Szent Erzsébet square, in the church garden (10 specimens); 47.54301° N, 19.60678° E, 135 m a.s.l. [8483.4]; leg & det.: A. Schmotzer; 11.09.2018.

Fig. 3. *Phytolacca esculenta* on a garden waste deposition at Dubicsány (Sajó Valley) (photo: A. Schmotzer).

1.9.21 Gyöngyösi-sík (Lower Tarna Flat) – Kál (Heves county): in the village, Fő str., in front of a house (1 specimen); 47.72663° N, 20.25407° E, 116 m a.s.l. [8287.4]; leg & det.: A. Schmotzer; 10.07.2018. Tarnaméra (Heves county): 'Kivételesek', at a pollarded spontaneous prune shrub and garden waste heap (2 specimens); 47.64248° N, 20.16438° E, 102 m a.s.l. [8386.4]; leg & det.: A. Schmotzer; 30.06.2018 (photo).

1.9.22 Hevesi-sík (Heves Flat) – Besenyőtelek (Heves county): in the village, Fő str. and Jókai M. str. in a ruderal forecourt and at a damp wall with *Hedera helix* (<5 specimens), 47.69782° N, 20.42885° E, 104–105 m a.s.l. [8388.2]; leg & det.: A. Schmotzer; 27.07.2018. Füzesabony (Heves county): in the town, 'Csörsz-árok', Temető str. in a ruderal ditch and in a forecourt (>5 specimens); 47.72581° N, 20.41755° E, 109–112 m a.s.l. [8288.4]; leg & det.: A. Schmotzer; 06.05.2016, 05.05.2017. Heves (Heves county): in the town, Arany J. str., Erkel F. str., Kossuth L. str. and Móra F. str.; sporadically in the aforementioned streets, mostly in abandoned gardens and by the buildings (altogether 20–50 specimens); 47.59563° N, 20.28990° E, 96 m a.s.l. [8487.2]; leg & det.: A. Schmotzer; 14.07.2015, 23.06.2018, 10.04.2019. Tiszanána (Heves county): in the village, Kossuth L. str. at the front wall of a village house (1 specimen); 47.55940° N, 20.53597° E, 88 m a.s.l. [8489.1]; leg & det.: A. Schmotzer; 27.07.2018. (photo).

1.9.31 Borsodi-Mezőség – Borsodivánka (Borsod-Abaúj-Zemplén county): in the village, Béke str., at edge of a fence (3 specimens); 47.69940° N, 20.65525° E, 93 m a.s.l. [8389.2]; leg & det.: A. Schmotzer; 03.07.2017. Egerlövő (Borsod-Abaúj-Zemplén county): 'Tilajra-járó', on garden waste accumulation at the former cemetery (>5 specimens); 47.72245° N, 20.62696° E, 93 m a.s.l. [8289.4]; leg & det.: A. Schmotzer; 04.11.2017. Mezőszemere (Heves county): in the village, Arany J. str.; spontaneously in a garden (10 specimens); 47.74377° N, 20.51675° E, 105 m a.s.l. [8289.3]; leg & det.: A. Schmotzer; 19.05.2017.

1.9.32 Sajó-Hernád-sík (Sajó-Hernád Flat) – Miskolc (Borsod-Abaúj-Zemplén county): 'Rakottyás'; at the Auchan hypermarket on shrubby pavement island (1 specimen); 48.10834° N, 20.83628° E, 113 m a.s.l. [7891.3]; leg & det.: A. Schmotzer; 13.07.2018. Mályi (Borsod-Abaúj-Zemplén county): in the village, Széchenyi I. str. in the forecourt garden of a house (1 specimen); 48.02053° N, 20.83166° E, 105 m a.s.l. [7991.3]; leg & det.: A. Schmotzer; 13.07.2018. Nyékládháza (Borsod-Abaúj-Zemplén county): in the settlement, Kossuth L. str. in a forecourt, at the bottom of a fence (1 specimen); 47.99472° N, 20.83541° E, 105 m a.s.l. [8091.1]; leg & det.: A. Schmotzer; 13.07.2018.

1.13.23 Körösszög – Szarvas (Békés county): Arboretum, frequent in damp places; 46.87692° N, 20.53204° E, 84 m. a.s.l.; [9189.1]; det.: G. Laczkó, leg.: A. Schmotzer; 30.07.2018. (photo).

6. Észak-magyarországi Középhegység (North Hungarian Range)

6.5.13 Déli-Bükk (Southern Bükk) – Bükkszentkereszt (Borsod-Abaúj-Zemplén county): in the village, Árpád str., Hunyadi str., Napsugár str., Nefelejcs str. and Széchenyi I. str. in gardens, ditches and weedy forecourts in the aforementioned streets (30 specimens); 48.06650° N, 20.63335° E, 575–607 m a.s.l; [7989.2]; leg & det.: R. Farkas & B. Csontos; 04.09.2018. Felsőtárkány (Heves county): village; Fő str. and Ifjúság str.; along the narrow-gauge railway tracks and in forecourts (50 and 3 specimens); 47.98203° N, 20.43312° E, 235–237 m a.s.l. [8088.2]; leg & det.: A. Schmotzer; 28.09.2008, 14.04.2019 (photo). Szarvaskő (Heves county): in the village, Borsod str., Petőfi S. str. and II. Rákóczi F. str. ('Major-völgy') in gardens, forecourts and weedy places along the Eger Brook (30 specimens); 47.98583° N, 20.33121° E, 218–234 m a.s.l. [8087.2]; leg & det.: R. Farkas; 24.07.2018.; 'Vár-bérc', ruderal shrubby places along the railway (10 specimens); 47.98920° N, 20.33167° E, 233 m a.s.l. [8088.1]; leg & det.: A. Schmotzer; 21.06.2016.

6.5.21 Tárkányi-medence (Tárkány Basin) – Eger (Heves county): Almár district, 'Nyugodó' on a garden waste deposition at the edge of thermophilous oakwood (20 specimens); 47.96650° N, 20.36189° E, 326 m a.s.l. [8088.1]; leg & det.: A. Schmotzer; 20.06.2008.

6.5.22 Egri-Bükkalja – Andornaktálya; (Heves county) in the village, II. Rákóczi F. str., ruderal place at a parking place (1 specimen); 47.85023° N, 20.40978° E, 143 m a.s.l. [8188.3]; leg & det.: A. Schmotzer; 24.06.2018. Egerbakta; (Heves county): 'Reszél-tető', ruderal place with garden waste deposit (1 specimen); 47.94568° N, 20.27693° E, 220 m a.s.l. [8087.4]; leg & det.: A. Schmotzer; 01.09.2016. Szomolya; (Borsod-Abaúj-Zemplén county): in the village, Dózsa Gy. str. and Zrínyi M. str. on weedy edge of a road and in an abandoned garden (5 and 1 specimen); 47.89289° N, 20.50053° E, 196–200 m a.s.l. [8188.2] [8189.1]; leg & det.: A. Schmotzer; 27.05.2016, 10.06.2018.

6.5.23 Miskolci-Bükkalja – Miskolc (Borsod-Abaúj-Zemplén county): 'Gálos', in ruderal place at the Miskolc director train station (1 specimen); 48.08708° N, 20.79499° E, 118 m a.s.l. [7990.2]; leg & det.: A. Schmotzer & J. Koscsó; 26.07.2018. Vörösmarty district; Műhely str. in a spontaneous *Ailanthus altissima* plot (5 specimens); 48.08850° N, 20.79457° E, 121 m a.s.l. [7990.2]; leg & det.: A. Schmotzer & J. Koscsó; 26.07.2018.

6.7.23 Hegyalja – Tolcsva (Borsod-Abaúj-Zemplén county): in the town; Bajcsy-Zsilinszky and Kossuth L. str., at abandoned gardens, forecourts, along ditches in the aforementioned streets (50–100 specimens); 48.28795° N, 21.44609° E, 113–115 m a.s.l. [7794.2]; leg & det.: A. Schmotzer & J. Táborská; 01.07.2018. Sátoraljaújhely (Borsod-Abaúj-Zemplén county): in the town; Kazinczy F. and Petőfi S. str., in gardens, forecourts and on cracked concrete sidewalks in the

aforementioned streets (50–100 specimens) 48.39689° N, 21.65386° E, 113–117 m a.s.l. [7595.4], [7695.2], ; leg & det.: A. Schmotzer & J. Táborská J.; 03.07.2018.

6.8.12 Középső-Ipoly-völgy (Middle Ipoly Valley) – Balassagyarmat (Nógrád county): in the town, Kertész str., in a semi-shady forecourt (10 specimens); 48.07766° N, 19.2873° E, 145 m a.s.l. [7981.2]; leg & det.: A. Schmotzer & K. Harmos; 10.08.2017. Őrhalom (Nógrád county): in the village; Varbói str., ruderal place, among garden and communal waste (30 specimens); 48.07858° N; 19.40416° E, 145 m a.s.l. [7982.1]; leg & det.: A. Schmotzer & K. Harmos; 10.08.2017. 'Körpölye'; on a weedy embankment of a road (5 specimens); 48.07603° N, 19.41386° E, 152 m a.s.l. [7982.1]; leg & det.: A. Schmotzer; 26.08.2010 (photo).

6.8.21 Zagyva-völgy (Zagyva Valley) – Bátonyterenye, part Kisterenye (Nógrád county): in the town, 'Népkert' in a public city park; 48.01142° N, 19.83517° E, 190 m a.s.l. [7985.3]; leg & det.: I. Lantos; 14.06.2012.

6.8.22 Medves-vidék (Medves Region) – Salgótarján - part Salgóbánya (Nógrád county): 'Brenz-alja' at garden waste deposition close to the settlement (1 specimen); 48.14264° N, 19.8574° E, 470 m a.s.l. [7885.3]; leg & det.: K. Sztoszek; 22.08.2017.

6.8.24 Tarna-völgy (Lower Tarna Valley) – Feldebrő; (Heves county): in the village; Dózsa Gy. str., in a forecourt; 47.8076° N, 20.23986° E, 130 m a.s.l. [8187.3]; leg & det.: G. Laczkó; 25.07.2018.

6.8.41 Sajó-völgy (Sajó Valley) – Dubicsány (Borsod-Abaúj-Zemplén county): Só-rét, ruderal place on a mesophilic meadow, among garden- and communal waste (3 specimens) (Fig. 4); 48.28156° N, 20.48957° E, 144 m a.s.l. [7788.2]; leg & det.: A. Schmotzer; 13.10.2016 (photo).

A national monograph on the invasive members of the *Phytolacca* genus (*Ph. americana* L. and *Ph. esculenta*) is presented by Balogh (2005) and Balogh & Juhász (2008, 2012). These papers contain detailed information on the taxonomy, morphology, origin, life cycle, habitat preference, biotic interactions, economic importance, and nature conservation significance of the presented species.

The native range of *Ph. esculenta* is in China and possibly also in Japan. As many ornamental plants it was introduced into Europe at least 200 years ago. Late discovery of the species can be explained with the morphological similarities to the related *Ph. americana*, which was introduced from the New World in the 17th century (Skalický 1972). It has been reported from several countries in Europe as a casual species (see references in Balogh 2005). Since then, occurrences from other Central and Eastern European countries were also documented (partly as *Ph. acinosa* or *acinosa* agg.), e.g. from Bulgaria (Zieliński *et al.* 2012), Croatia (Martan & Šoštarić 2016), and Poland (Wyrzykiewicz-Raszewska 2009). Further expansion in the Slovak urban flora was also reported recently (Letz 2012).

The lag phase was quite long and partly overlooked. We assume that 'soft invasion' of the species has been taking place in the last two decades in central Europe, also in Hungary. The species was reported only as a botanical garden 'escaper' in the middle of 1980's by Terpó & E. Bálint (1985). The published distribution maps (Balogh & Juhász 2012, Bartha *et al.* 2015) report a sporadic occurrence pattern of the species. Data deficiency in its distribution is rather remarkable in the eastern part of Hungary according to these published maps. The Database of the Hungarian Flora Mapping Programme (data acquisition: April 2019) contains localities from 115 CEU grid cells. Newer robust floristical data contribution concerning this species was presented by Király & Király (2018), who report the species in additional 10 grids from the country.

The reported 37 new grid occurrences are from the eastern and central part of Hungary (Fig. 4), representing a 29.6% increase in data compared to previous data.

New occurrences are derived from 11 microregions on the Great Hungarian Plain and 10 microregions in the North Hungarian Range. Altitudinal range of the presented data varies between 82 metres (Tiszakécske in the South Tisza Valley) and 607 metres (Bükkszentkereszt in the Bükk Mts). The latter represents the population with the highest altitude record so far known in Hungary. As a

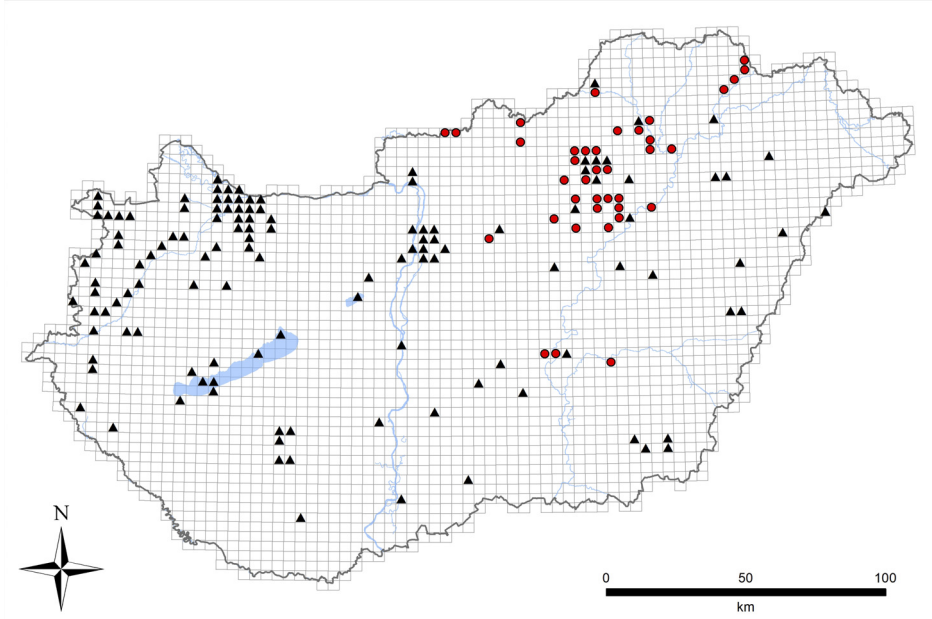

Fig. 4. Present distribution of *Phytolacca esculenta* in Hungary (dots are the new localities presented in this paper).

township (also called as urbanophile) species most of its locations are concentrated in settlements. The diverse habitats of urban ecosystem and the presenting vectors (mostly passerine birds) support the colonisation of this species. As a tall, decorative plant, deliberate plantings also strengthen the local populations.

The populations in several locations (see enumeration) are represented by one or few individuals, which might refer to the present expansion state of the species. Current spread is mostly spontaneous without direct human contribution. Balogh & Juhász (2012) emphasized that this species occurred only in settlements, with the addition, that future spreading into semi-natural habitats is expected. Among our floristical records some are represented by locations situated in the countryside, outside from the settlement border. In most of these cases *Ph. esculenta* escapes from garden waste dumping heaps and colonises the neighbouring semi-natural (e.g. at Tiszakécske, Tarnaméra, Eger and Dubicsány) or ruderal habitats (at Őrhalom and Salgóbánya). Csiky *et al.* (2018) drew attention to the importance of the floristical survey of synanthropic (urban) habitat types, which can serve as 'stepping stones' for naturalisation of potential invasive alien species. Besides their colonization in verges, gardens, and flowerbeds, garden (green) waste deposition heaps are also important to mention, also in the case of spreading *Ph. esculenta* (Fig. 3).

These observations might reflect the further expansion potential of the species, so management measures and risk analysis should be implemented in the near future.

* * *

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Összefoglaló: A dolgozat két terjedőben lévő adventív növényfaj, az aszályfű (*Eleusine indica*) és a kínai alkörmös (*Phytolacca esculenta*) terjedését mutató új florisztikai adatokat tartalmazza. Az adatközlés az ország Dunától keletre eső, a Nagy-Alföldet és az Északi-középhegységet érintő területre koncentrálódott, amely a fajok elterjedése tekintetében alulreprezentáltnak volt tekinthető. Mindkét faj hazánkban inváziós besorolást kapott, jóllehet természetes és természetközeli vegetációban nem, vagy ritkán jelenik meg. Az *Eleusine indica* esetében 5 kistájból mutattuk ki jelenlétét, melyek közül a bükki előfordulások (Miskolc, Noszvaj) a hegységre nézve újnak tekinthetők. A faj minden esetben taposott helyeken, utak mentén fordul elő, legtöbbször egyéb egyéves gyomok társaságában.

A felmérés a *Phytolacca esculenta* esetében is jelentős adatbővülést eredményezett, 10 kistáj területéről, 37 új flóratérképezési kvadrátból került kimutatásra (ez hálóegység szintjén közel 30%-os adatbővülést jelent az eddig ismert és dokumentált hazai állományokhoz képest). A felmért

bükkszentkereszti állományok egyben hazánkból jelenleg ismert legmagasabban fekvő lokalitását jelentik (607 m tszf. magasság). Számos esetben igen kis egyedszámban találtuk, mely a jelenlegi terjedés közvetett bizonyítékának is tekinthető. A faj esetében korábban jelzett 'szelíd invázió' elsősorban a településeken és azok közvetlen környezetében jelentkezik, ahol igen eltérő antropogén élőhelyeket tud benépesíteni. Szórványosan településektől távolabb is észleltük a fajt, ahol megtelepedést legtöbbször a kihordott kerti zöldhulladék segítette. Ezek jelentős másodlagos fertőzési gócpontoknak tekinthetők. A vizsgálatok a tárgyalt két faj további terjedését valószínűsítik, melynek idő- és térbeli lefolyását további florisztikai felmérésekkel szükséges dokumentálni.

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