

## Distribution of *Aegilops cylindrica* Host in Hungary

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**Abstract:** The *Aegilops cylindrica* Host (jointed goatgrass) is the only native *Aegilops* species in Hungary. Its native area runs continuously from the Mediterranean region to Western Asia, while the northern part of the western border proceeds through the Carpathian Basin. A complete census and analysis of *Aegilops cylindrica* occurrence data in Hungary has not yet carried out. The objectives of this study were to (i.) collect all accessible floristic (herbarium, published and unpublished) data of this species, (ii.) to present its current distribution, and (iii.) to evaluate its distribution in relation to recent climatic conditions. The historical and recent occurrences have been collated and interpreted in a Geographical Information System (GIS), while the large dataset was suitable for different analysis. The first grid-based distribution map of the species is presented.

Altogether 748 floristic records were gathered during the study. Of these, 296 herbarium and 218 literature data have been processed and interpreted in the geographical information system, which was further supplemented with 234 unpublished floristic data. During the evaluation 365 aggregated locations were generated for further analysis. Detailed evaluation of the distribution was presented in the context of phytogeographical regions, showing that 84.1% of localities lay in the forest-steppe belt. During the data evaluation a high degree of heterogeneity was found between the recent and the published data, and herbarium data as well. The main character of the distributional pattern was analyzed in relation to climatic maps. It was found that 81.9% of the species occurrences correlated with the 550 mm or lower annual rainfall isohyet line value, and 75.3% of its localities overlap the <10-11 °C or higher isotherm line value.

With the application of this dataset a predictive map of the full occurrence was also carried out.

Keywords: *Aegilops*, distribution, Hungary, archaeophyte, dataset, GIS.

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## Introduction

The genus *Aegilops* L. (fam. *Poaceae*, tribe *Triticeae*) occurs in the Mediterranean-western Asiatic area with a Transcaucasian centre of origin. The centre of diversity is in the Mediterranean and Irano-Turanian Regions, thus some tetraploid species (incl. *Aegilops cylindrica* Host) spread into central and southwestern Europe (VAN SLAGEREN 1994). The taxonomically problematic *Aegilops* genus consists of about 20–22 species (WATSON & DALLWITZ 1992). According to HAMMER (1980) and TUTIN & HUMPHRIES (1980) 12 taxa were distinguished in southern Europe. Geographical Information System (GIS) distribution maps of *Aegilops* species, mostly based on VAN SLAGEREN's (1994) monograph were presented by KILIAN et al. (2011). Some authors recommend including *Aegilops* species in the *Triticum* genus (BOWDEN 1959, GREUTER & RECHINGER 1967, GUPTA & BAUM 1986).

As close relatives of the common (*Triticum aestivum* L.) and durum (*T. durum* Desf.) wheats the genus members have attracted more attention from the breeding and research institutions or gene banks in recent decades (PETERSEN et al. 2006). They contain a number of useful genetic characteristics (i. e. rust and virus diseases resistance, tolerance to extreme climatic conditions and salinity), which could be incorporated in the wheat varieties genome through using rapidly developing molecular cytogenetic methods (HOLUBEC et al. 1992, SCHNIEDER et al. 2008). *Aegilops cylindrica* Host (jointed goatgrass) is only native representative of the *Aegilops* genus that occurs in Hungary. *Aegilops geniculata* is also reported from Hungary as an adventive since the second half of the 19<sup>th</sup> century. According to VAN SLAGEREN (1994), Belgian botanist, Charles BAGUET (b. 1840 – d. 1890) collected on Gellért Hill (*sine data*) and this specimen is deposited in the Herbarium of the Botanical Garden Meise (BR). This occurrence data has not been referenced in the Hungarian botanical literature (e.g. SOÓ 1973, 1980, PENKSZA 2009). Currently, SOLYMOSI (2008) reported the adventive occurrence of it from Transdanubia, very close to the Croatian border (Becsehely village). Jacob WINTERL (1788) was the first who reported *Aegilops cylindrica*, describing the species as *Aegilops nova*, and was followed in 1802 by Nicolaus THOMAS HOST describing *Ae. cylindrica* as a species in Volume 2 of the *Icones et Descriptiones Graminum Austriacorum* (HOST 1802). The typification of this species is a KITAIBEL' collection („*Buda Pesthini, in Cttu Békésiensi, Kitaibel*”), located in the Department of Botany, Herbarium Generale of the Hungarian Natural History Museum (BP) (VAN SLAGEREN 1994). Known synonyms are: *Ae. nova* Winterl, *Ae. cylindracea* Kit. ex Jáv., *Cylindropyrum cylindricum* (Host) Á. Löve and *Triticum cylindricum* (Host) Ces., Pass. & Gibelli (SOÓ 1973, VALDES et al. 2009).

The species is widespread in the Mediterranean and West Asia, with even circumboreal distribution within the area of the genus found in higher geographical latitudes. It is still questionable to classify the species as being natural or adventive in its broad distribution area. The accepted northern border of its native distribution area in the Balkans is going through the territory of Hungary and the south-western part of Slovakia (VALDES et al. 2009, HAUPTVOGEL et al. 2010, ELIÁS et al. 2013). The species was introduced to the United States and has become a serious problem there as an invasive weed in the late 19<sup>th</sup> century, classified as a "noxious weed" (HICKMANN 1993).

*Aegilops cylindrica* grows in dry, often disturbed ruderal grasslands and weedy places, often along roads, in wheel traces and on slightly degraded saline areas, where the competition of other species is weak. Sometimes the species creates dense populations, e.g. in south-east Hungary huge populations may occur together with *Taeniatherum caput-medusae* Nevski (JAKAB 2012). The species is basically connected to the synantropic vegetation, so its occurrence on the Hungarian phytosociological database (CoenoDAT Reference Database) is very sporadic (CSIKY *pers com.*).

*Aegilops cylindrica* is not a protected plant species in Hungary. According to the Hungarian Red List (KIRÁLY 2007) and list of vulnerable weeds (PINKE et al. 2001) the species was evaluated as "near threatened" (NT) IUCN category (IUCN RED LIST CATEGORIES AND CRITERIA, 2001). The species was placed on to the provisional list of typical archeophytes (TERPÓ et al. (1999).

Since the western limit of Central European distribution of *Aegilops cylindrica* falls in the Carpathian Basin (VAN SLAGEREN 1994), the classification of this species as "endangered" in northerly and westerly directions increases significantly. For example, the species is threatened in neighbouring Slovakia, so there it is classified as "vulnerable" (VU) (ELIÁS et al. 2015 in press). According to ELIÁS (2005), *Ae. cylindrica* can not tolerate shadow and heavy trampling, but can withstand mowing. The mowing in flowering time may negatively affect the number of mature grains.

A complete census and analysis of *Ae. cylindrica* occurrence in Hungary have not yet carried out. Only general information has been published (SOÓ 1973, 1980, PENKSZA 2009).

The objectives of this study were to (i.) collect all accessible floristic (herbarium, published and unpublished) data of the species, (ii.) present the current distribution and (iii.) correlate its distribution with recent climatic conditions.

## Material and methods

Several sources of data were consulted, mostly of published literature data and herbarium specimens, but also from field surveys carried out by the authors and others. A significant number of unpublished data were also gathered and added for this study.

Primary data were obtained from specimens in herbarium collections and online virtual herbarium sources (BP, DE, EGR, GAH, HPTE, GJO, NI, W, WU,

PR, PRC, OHN, SEV, UPS). Herbarium abbreviations are according to THIERS (sine dato but continuously updated). The herbarium at Gyöngyös (Mátra Museum) was indicated in the enumeratio as BP-M. Material from the private herbarium of A. SCHMOTZER were also studied (indicated as "priv. SCHA"). Herbarium labels were photographed or the information on the labels was directly stored in a database (the database including also original label and literature texts). Data from available online databases (eg. EURISCO, Dataflos, Discover Life) were also used. As for related papers we tried to detect the original data sources, but data from monographic and floristic works were processed as well. The database has been extended with unpublished data from ourselves and from other botanists, which has helped to clarify the current distribution of the species. The grid data from the National Flora-mapping Program operated by the Department of Botany, Faculty of Forestry University of West Hungary were also used in the case all the primary data (e.g. date, location and/or coordinates, collector) was available, beside the grid number.

All records were entered into GIS (using ESRI ArcGIS 9.1 software). Data without precise coordinates were indicated (e.g. old records mostly indicate name of the municipality without any lower toponyms). In this case the more suitable location for the species was chosen in the process of the GIS interpretation. Old toponyms were converted into their current official form, mainly using topographic maps. Geographical coordinates or grid numbers of the "Mapping the Flora of Central Europe" project (CEU; NIKLFELD 1971, KIRÁLY 2003) were found, using both printed and digital maps and internet sources (e.g. Hungary's military survey maps, Wikimapia 2013, Google maps 2013, Open Maps Project online digital maps, etc.).

All compiled recent and historical data are presented in Appendix 1. The locations are arranged according to units of the phytogeographical division of Hungary (BORHIDI et al. 2012). The herbarium, published and unpublished data were added separately in each phytogeographical unit. The unlocalised herbarium data (mostly from Budapest) are listed at the end of the enumeratio.

For the coherent climatic data analysis (annual mean temperature, annual precipitation and climatic vegetation zones) we have generated 500 metres buffer for all interpreted locations in order to eliminate the distortions caused by the frequently visited locations (e.g. altogether more than 30 data from Sas-hegy (Budapest) exist). These polygons were converted into one point shape file using the centroid point of the aggregated polygons. These point features (defined here as aggregated locations) were the basis of the further data processing with climatic analysis. Climatic maps from the works of BIHARI et al. (2011) were digitized in the framework of this survey.

## **Results and discussion**

Soó (1973) indicated only a restricted distribution in the synopsis: at the edge of the North-Hungarian Mountains (Tokaj, Gyöngyös and Gödöllő Hills), in Buda Hills, in Visegrád Mts. and on the Great Hungarian Plain. Additional locations

were listed in the most up to date Flora of Hungary; e.g. Zemplén Mts. (not only Tokaj), Cserhát Mts., Buda Hills, South-Transdanubia (Baranya County) and from the Little-Hungarian Plain (Moson Plain) (Soó 1980, PENKSZA 2009). The most recent work on distribution of *Ae. cylindrica* on a national scale was published by VÖRÖSVÁRY et al. (2005a,b).

Altogether 748 floristic records were gathered during the study. 296 herbarium and 218 literature data have been processed and interpreted in the geographical information system, which was further supplemented with 234 unpublished floristic data. During the evaluation 360 aggregated locations were generated. *Aegilops cylindrica* is currently known from 232 mapping grids of CEU network, which made 8.2% of the total grids on the Hungarian territory.

As a lowland–colline species originating in the Mediterranean Region, the largest populations of *Ae. cylindrica* within Hungary occur in the central and south-east part of the Great Plain, especially on the loamy soils in phytogeographical regions of Crisicum and Praematricum. While a lot of data has been published from along the Körösök rivers and in the Berettyó-Körös landscape units (see JAKAB 2012), other parts of the lowland have had only scattered surveys (except Heves Plain). It seems that the Little Hungarian Plain (Kisalföld) is less suitable for the species, with only very scattered data known (Győr and Rajka settlements). The second notable distributional centre is around Budapest and surroundings (both the Pest-plain and the Buda Hills). The Pilisense and Visegradense phytogeographical regions have a transitional position which was highlighted by ZÓLYOMI (1942). This is reflected in the variety of bedrocks, microclimatic conditions and human activities too. In the North Hungarian Mountains the species reaches its natural border, the inner chains of the Carpathians being not suitable for a northern direction of dispersal. Between the mountain ranges only adventive occurrences are known due to railway transportation in south-east Slovakia (JEHLÍK & DOSTÁLEK 2008). The most numerous populations can be found in the Matricum at the loessy foothill of Mátra Mts., while other regions are much less populated by the species (Naszály, Cserhát, Bükk foothills, Tokaj). The Transdanubian occurrences are also sporadic with the main distribution center at the foothills of Transdanubian Mountains (esp. Bakony) and the Balaton Uplands. The species is totally missing from the western part of Transdanubia and north-east Hungary (Nyírség), while occurrences in Southern-Hungary are limited to the Mecsek and Villány Mts. (Fig. 1.)

During the data evaluation a high degree of heterogeneity was found between the recent and the published data, and herbarium data as well. Comparison of the literature and herbarium data brought significant conclusions. Tab. 1. interprets the evaluation of the different data sources (herbaria, literature, unpublished recent records) with the analysis of time-scale and overlap with CEU grids.

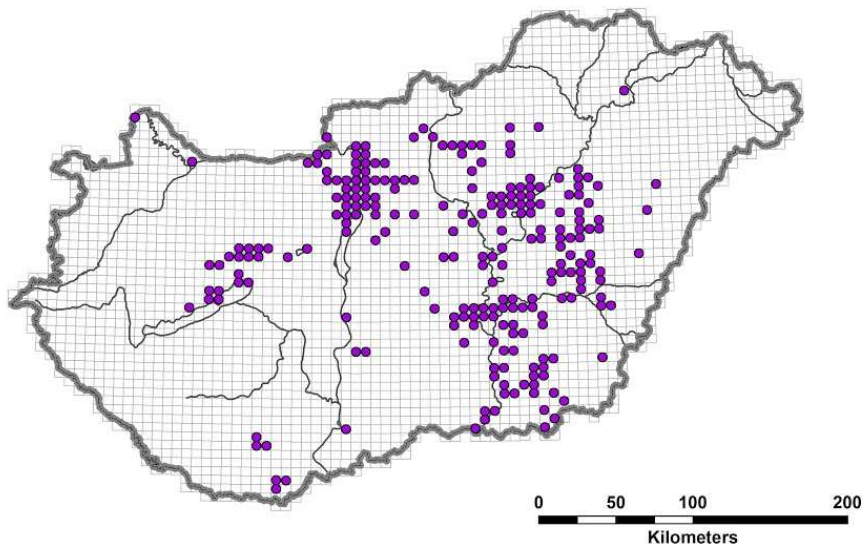


Fig. 1. Distribution of *Aegilops cylindrica* according to all evaluated floristic data.

Tab. 1. Evaluation of different data sources (herbaria, literature, unpublished) with the analysis of time-scale and CEU grids overlapping.

Data source	Herbaria	Literature	Unpublished	
Number of records	296	218	234	
Number of involved CEU grids	94	121	91	
Percentage of the total distribution of <i>Ae. cylindrica</i> in CEU grids (%)	40.5	51.9	39.6	
Time-scale (number of records)	before 1899	72	25	(-)
	1900–1949	100	18	(-)
	1950–1989	30	25	2
	after 1990	92	150	232
	not evaluated	2	(-)	(-)

### Herbarium data

If the species (as in the case of *Ae. cylindrica*) is relatively easy to recognize, taxonomically unproblematic and easily made into a pressed specimen a relatively large number of herbarium data are available. The spatial distribution of the herbarium data reflects collecting activities of the botanists. A sufficient

intensity of floristic research and documentation within the study area is necessary for successful retrospective analysis of species distribution (see PYŠEK 1991). The species was collected regularly around Budapest, both in the hilly areas (Buda Mts., Visegrádi Mts.) and the lowland parts. The Gellért Hill (indicated as Blocksberg and Mt. St. Gerardi also) was a very favoured collection location. Without duplicates, 45 herbarium specimens originated from that location (e.g. 17 specimens dated between the 1870 and 1890, from the collection of V. BORBÁS, J. DORNER, P. HORA, M. STAUB, W. STEINITZ, J. SZÉPLIGETI, R. SZÉP, GY. TAUSCHER). Many duplicate specimens can be found in different herbaria (W, PRC, GJO) in Central Europe besides BP. It is interesting to note is that the last collection from the Gellért Hill was from József PAPP (BP) and dates from 1948, it has not been found at that location since. After the World War II the number of collected *Ae. cylindrica* specimens decreased (only 30 specimens dated from the period 1950–1989). This tendency was not only noticeable in the case of *Ae. cylindrica* as the overall collecting activities declined in Hungary during this period. The recent collections after 1990 are much more dispersed, thanks to the growth of the floristic surveys' activity nationwide. The distribution of the herbarium specimens in different time-scales are shown in Fig. 2a-d.

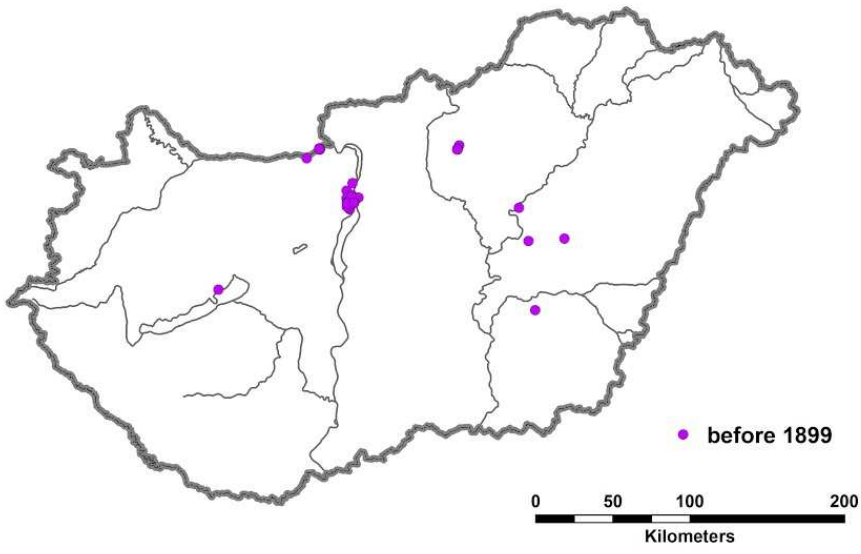
#### Literature data

Before 1900 the species' occurrence was rarely published in contrast to herbarium specimen data (Fig. 3a-c). The reason might be that (i) species were moderately distributed at national/regional level; (ii) the weedy character of the species and (iii) the lower taxonomic interest of the species (low variability). The interest increased only after 1990, when the “rarity” and the nature conservation aspects emerged. Beside *Ae. cylindrica* some weedy species were listed in different categories, involved in Red List and protection list evaluations (e.g. PINKE et al. 2011). Several data were published recently in floristic works, with nearly all micro-regions represented where the species occurs nowadays (Fig. 3d). In general, the floristic studies presented after 1990 have significantly increased our knowledge of the occurrence of the species.

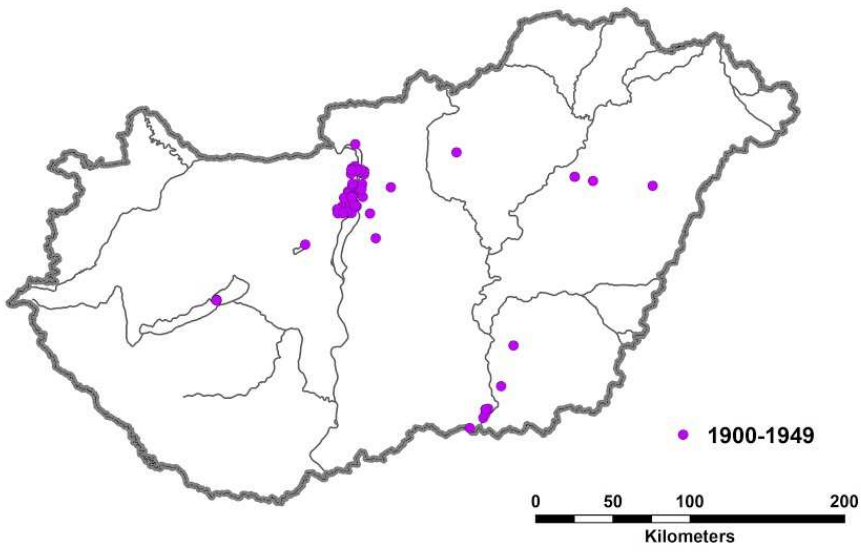
#### Climatic factors

The resolution of the available climatic maps were, although rough, suitable for evaluating the main climatic background of the distributional pattern at national level.

By using the digitized climate data (according to BIHARI et al. 2011) it was found that 81.9% of the species occurrences correlated with the 550 mm or lower annual rainfall isohyet line (Fig. 4). As a species with a southern distribution range, 75.3% of its localities overlap the <10-11 °C or higher isotherm line (Fig. 5.).

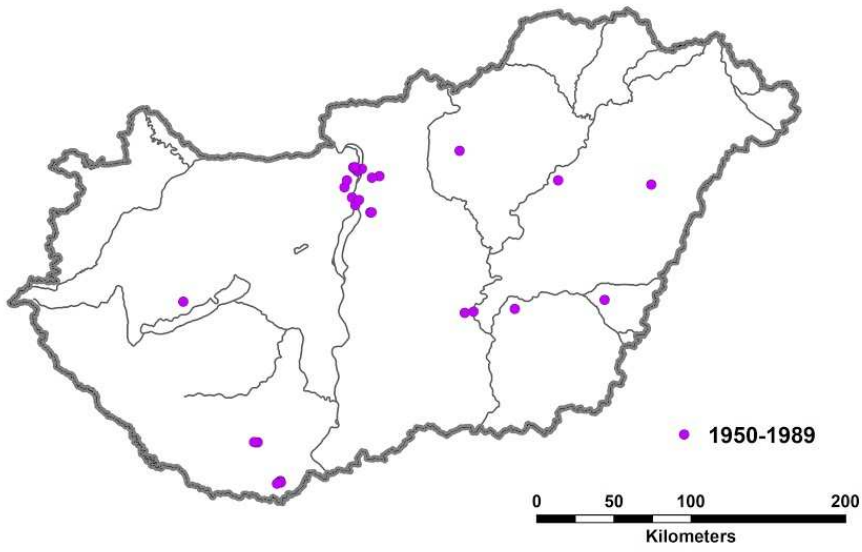


2a

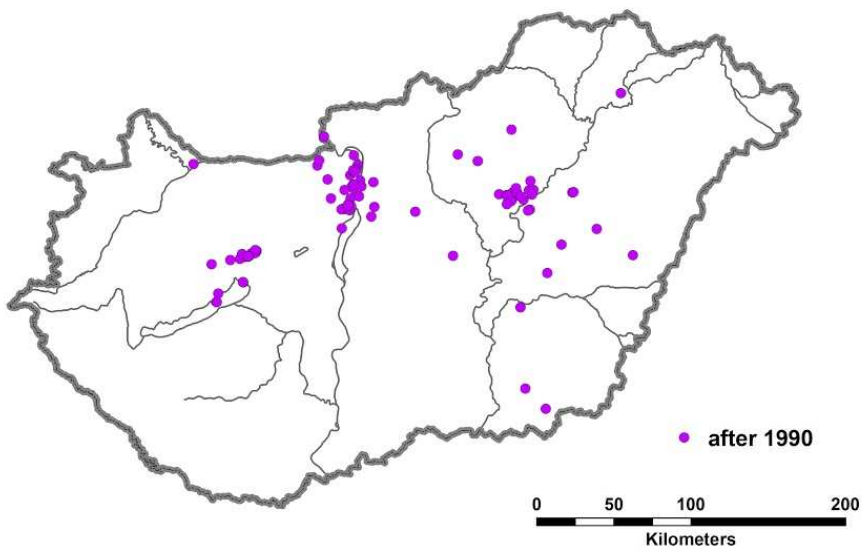


2b



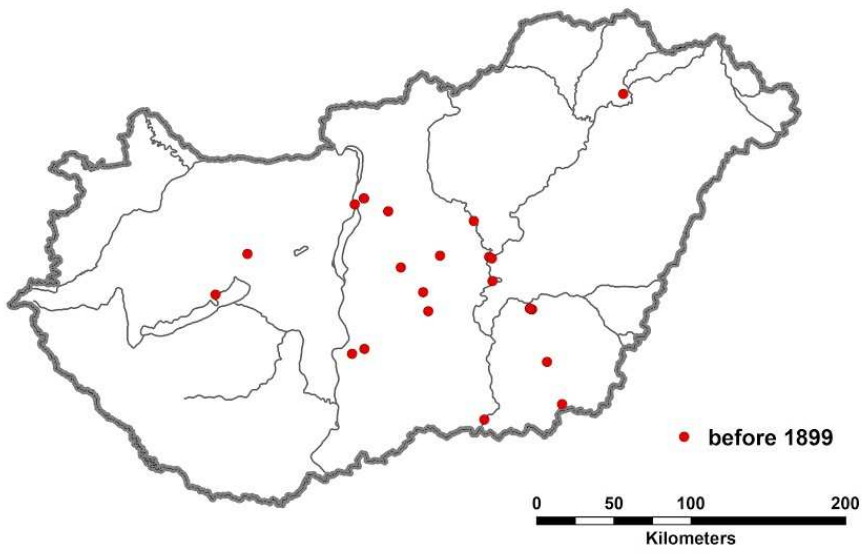


2c

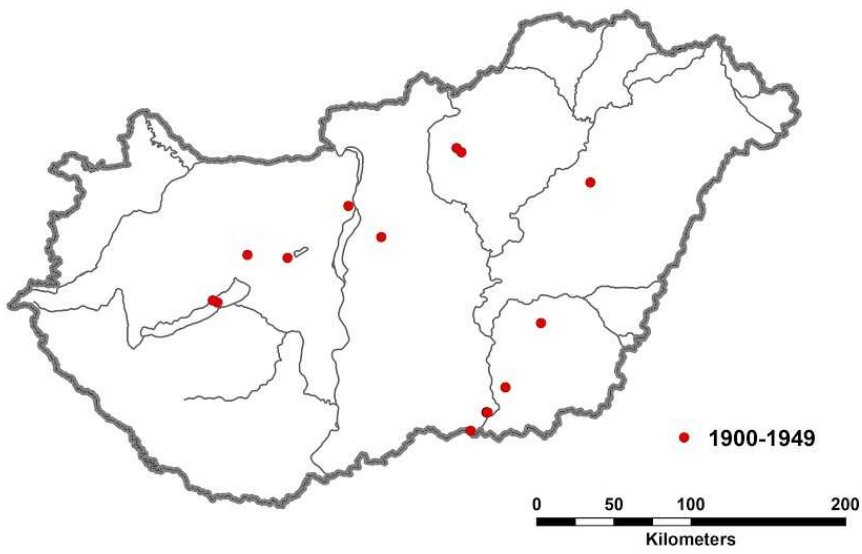


2d

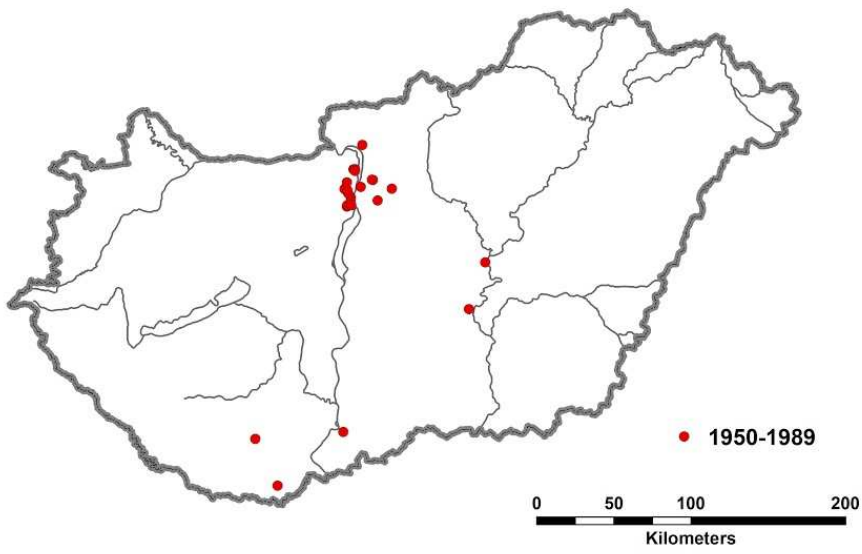
Fig. 2a-d. Distribution of *Aegilops cylindrica* according to herbarium data: a) before 1899; b) 1900–1949; c) 1950–1989; d) after 1990.



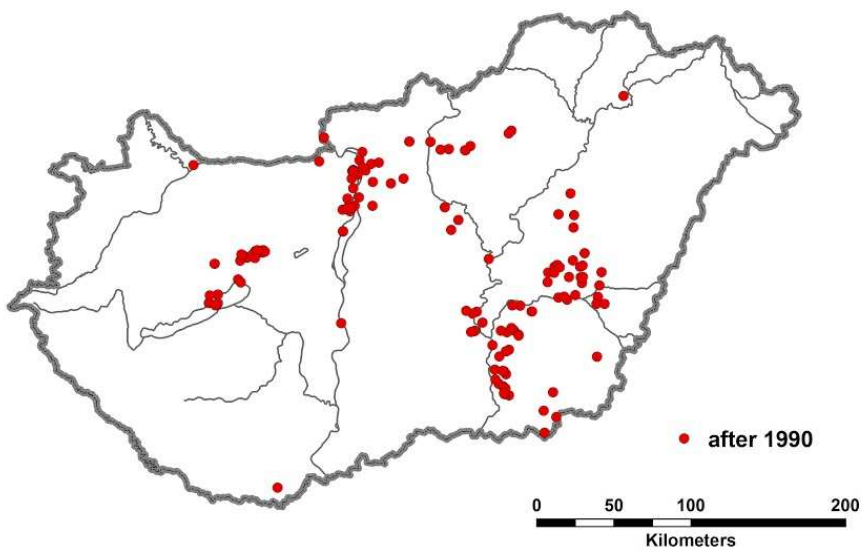
3a



3b



3c



3d

Fig. 3a-d. Distribution of *Aegilops cylindrica* according to literature data: a) before 1899; b) 1900–1949; c) 1950–1989; d) after 1990.

Based on BORHIDI's map of climatic zones of vegetation (BORHIDI 2011), 84.1% of localities lay in the forest-steppe belt (Tab. 2.). The dry forest-steppe belts (with long summer and intensive summer droughts) are also well-represented by the *Ae. cylindrica* locations (22.8% and 38.5% respectively). A significant proportion of the localities within the oak forests zone (15.1%) were concentrated at the loessy edge of the Matricum phytogeographic region. The locations in the broadleaved forest belt are situated in warm, dry slopes, where the microclimatic (edaphic) conditions ensure the survival and/or colonization of the species.

**Tab. 2. Abundance of *Ae. cylindrica* aggregate locations in the climatic zones of vegetation.**

Climatic zones of vegetation	Number of localities	Percentage of the localities (%)
I. Forest steppe belt		
I.1. Forest-steppe belt with long and intensive summer drought	83	22.8
I.2. Forest-steppe belt with long dry summer	140	38.5
I.3. Moderately dry forest-steppe along the Great Hungarian Plain margin with short dry summer	34	9.3
I.4. Forest steppe in hill and foothill areas	49	13.5
II. Broadleaved forest belt under humid climate		
II.1. Oak forest belt	55	15.1
II.2. Oak-hornbeam forest belt	3	0.8

## Conclusion

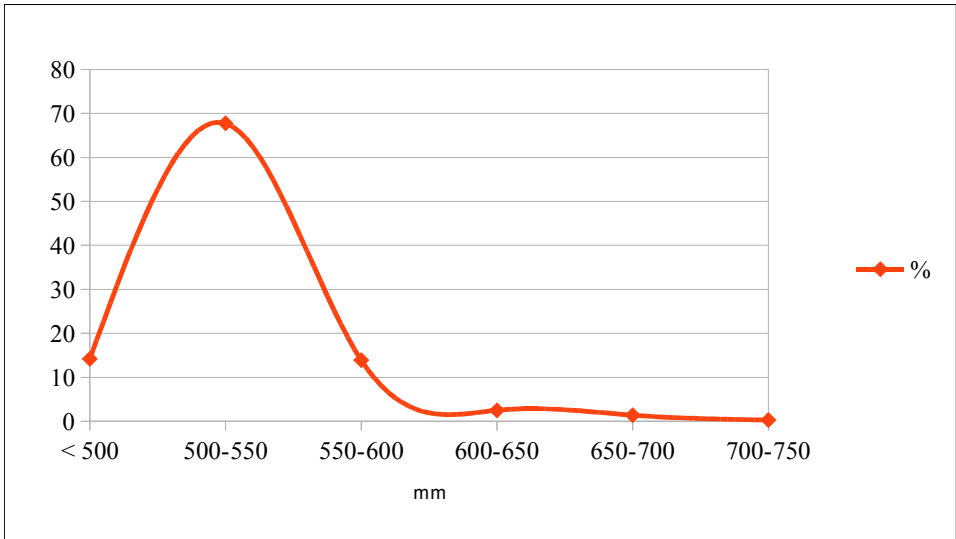
Comparison of the recent and historical data of *Ae. cylindrica* showed that its present occurrence is not threatened in Hungary. No regional regression trends, except urbanized areas around Budapest were detected. The density of locations is very variable, with the disjunct occurrence patterns in Transdanubia and the foothills of Matricum being expected. The lowland distribution gaps (esp. on the Great Hungarian Plain) could be explained by data deficiency. Further investigations, especially in the lowlands, should increase our knowledge about the present distribution of the species. Delimitation between the native and introduced occurrences of *Ae. cylindrica* within the Carpathian Basin is rather problematic. On the one hand the occurrence of *Ae. cylindrica* in its regionally disjunct distribution areas (such as Balaton Upland, Tokaj) were documented by Pál KITAIBEL in the end of the 18<sup>th</sup> and beginning of the 19<sup>th</sup> century, which indicates its native status (see Appendix 1). On the other hand, *Ae. cylindrica*

has mass occurrences following linear transport lines, esp. roadsides and railways, which are regarded as one of the main pathways for introduced plant species (HANSEN & CLEVINGER 2005, KOWARIK & VON DER LIPPE 2007). This phenomenon is not only evident in its introduced area (e.g. Germany: Thuringia (KORSCH 1994), Lower Saxony (GARVE & HARING 1988); Austria: Lower Austria (MELZER et al. 1992), Czech republic: Prague, Brno (HOLUBEC et al. 2014) and south-east Slovakia (JEHLÍK & DOSTÁLEK 2008, ELIÁS et al. 2013), but characteristic also in its native area (e.g. Great Hungarian Plain). In our opinion, according to the historical and present datasets only the occurrence on the Little Hungarian Plain should be regarded as a recent introduction in Hungary, where climatic conditions are also suitable for the species.

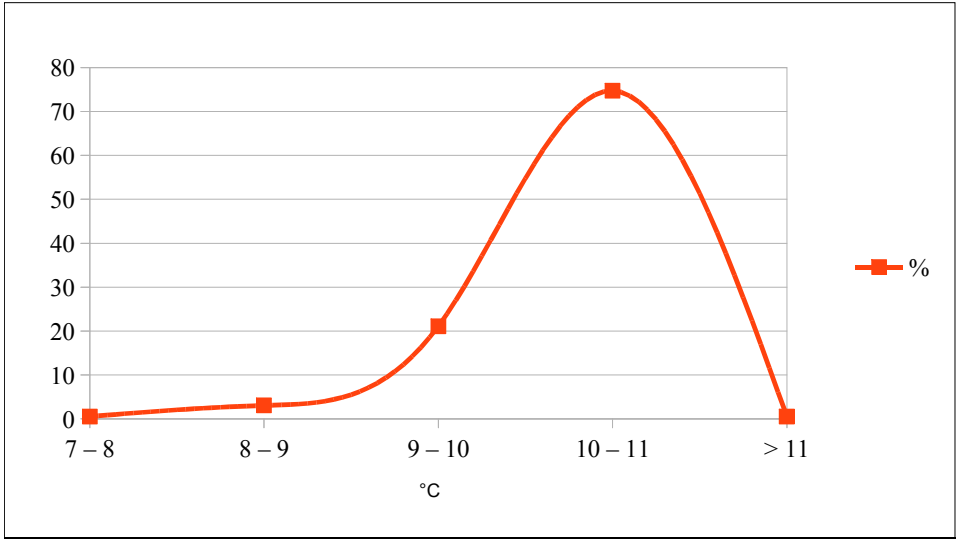
The bedrock at *Ae. cylindrica* localities is highly variable (andesite, volcanic tuff, dolomite, loess, fluvial sediments). This implies that the species is almost indifferent to the soil type. According to the habitat categorization (BÖLÖNI et al. 2011) a common feature can be seen: the majority of populations do not depend on natural or semi-natural habitats, but occur rather along roadsides, railways, dykes, canals and edges of different cultivations (e.g. vineyards, arable lands, esp. cereals, with which it can occasionally hybridize (VAN SLAGEREN 1994). Besides climatic factors (see below), the main factor determining reproduction and survival of the populations seems to be a certain degree of disturbance of the habitat. This fact is supported by the ruderal plants reproductive strategy model (GRIMME 1977), where habitat disturbance is a key factor to reduce competition from other species.

According to the climatic evaluations a two-dimensional environmental matrix was elaborated (see explanation at SKOV 2000) where y-axis corresponds to annual mean temperature and the x-axis to annual precipitation (Fig. 6.). The majority of localities (68.4%) fulfill two climatic criteria: annual mean precipitation is lower than 550 mm and annual mean temperature is higher than 10°C. According to these two criteria a predictive map was presented (Fig. 7.) which was prepared by GIS intersection of the two climatic polygons. The predicted suitable area for the species covers 31.750 square kilometres (34.1 % of the entire territory of Hungary). Outside the predicted area (on Balaton Uplands, Bakony region and the foothills of the Matricum) the stands of the species depend mostly on edaphic habitats, on dry steppic grasslands with a close relation to the *Festucion valesiacae* Klika 1931 alliance.

*Aegilops cylindrica* should be a good target species to study the effects of climate change. Climate warming should increase the risk of the establishment of populations of weed species also in northern regions. As with many typical archeophytes, the species native area border fits the Carpathian Basin. In the core area of its Hungarian distribution (mainly in the Great Hungarian Plain) the populations are very adaptable with indifferent soil and habitat requirements and good dispersal ability. The northward shift in distribution of *Ae. cylindrica* should be studied further in the Carpathian Basin.



**Fig. 4.** The frequency distribution of *Ae. cylindrica* locations according to annual precipitation. X-axis represents the annual precipitation, Y-axis represents the percentage of total number of aggregated locations.



**Fig. 5.** The frequency distribution of *Ae. cylindrica* locations according to annual mean temperature. X-axis represents the annual mean temperature, Y-axis represents the percentage of total number of aggregated locations.

Annual mean temperature (C°)	Annual precipitation (mm)					
	<500	500-550	550-600	600-650	650-700	700-750
5-6						
6-7						
7-8		1	1			
8-9		7	4			
9-10	1	41	27	4	2	1
10-11	50	198	17	5	3	
11<		1	1			

Fig. 6. Distribution of *Ae. cylindrica* in a two-dimensional environmental matrix (y-axis corresponds to annual mean temperature and x-axis to annual precipitation). Numbers and the density of the cell shading reflects the amount of the aggregate locations.

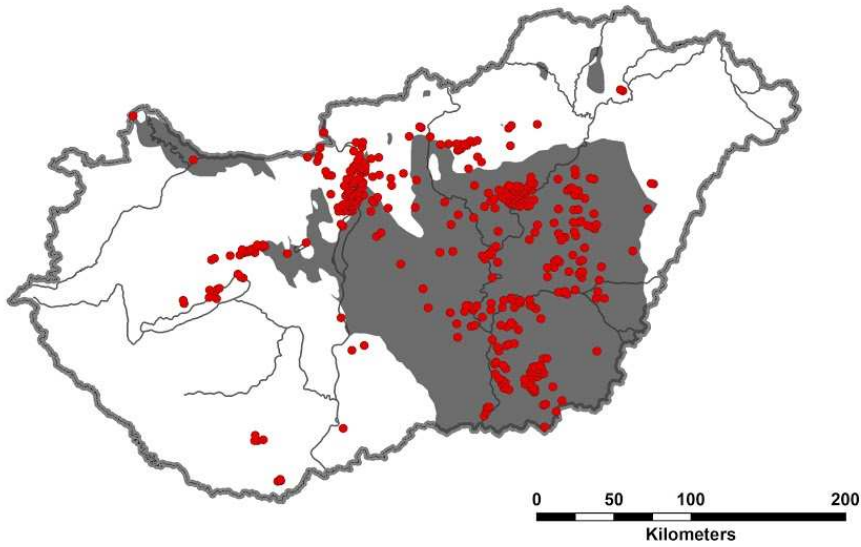


Fig. 7. Predicted distribution area of *Ae. cylindrica* based on a GIS intersection of a two-dimensional environmental matrix. The intersected area with higher isotherms than 10 °C and lower isohyets than 550 mm precipitation are indicated with gray color. Aggregated localities of *Ae. cylindrica* are represented by dots.

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**Appendix 1:** Compilation of recent and historical floristic records of *Aegilops cylindrica* Host in Hungary. Data are listed according to units of the phytogeographical division of Hungary (BORHIDI et al. 2012). The herbarium, published and unpublished (ined.) data were added separately in each phytogeographical units. The locations arranged alphabetically according to settlements and toponyms (if it is available). Herbarium abbreviations are according to THIERS, B. (sine dato). [Grid references] in brackets are followed the Mapping the Flora of Central Europe project (NIKLFELD 1971). The citation and original label texts were omitted. The not exactly localised herbarium data (mostly from Budapest) are listed at the end of the enumeracio.

## I. Eupannonicum

### 1. Arrabonicum

Herb.

**Győr:** Bácsa (SCHMIDT 2006 BP) [8271.4]; **Tát:** Tát (FEICHTINGER 1865 BP) [8277.4].

Lit.

**Győr:** Bácsa (SCHMIDT 2010) [8271.4]

Ined.

**Rajka:** Márialiget (G. KIRÁLY G. & A. KIRÁLY 2012) [8068.2]

### 2. Colocense

Herb.

**Érd:** Kakukk-hegy (NAGY 2001 BP) [8679.2]; **Ócsa:** Újerdő (SOÓ 1923 BP) [8781.1]

Lit.

**Dunapataj:** Szelidi-tó (KITAIBEL 1800 in GOMBOCZ 1945, SZUJKÓ-LACZA & KOVÁTS 1993) [9380.3]; **Dunaföldvár:** Kálvária-hegy (LENDVAI & HORVÁTH 2011) [9179.4];

**Érd:** Százhalombatta, earthwork (SZERÉNYI 2000; VÖRÖSVÁRY et al. 2005b) [8679.4]; **Harta:** Between Akasztó and Szelidi Lake (KITAIBEL in GOMBOCZ 1945) [9380.4]; **Ócsa:** Újerdő (SOÓ in SZUJKÓ-LACZA & KOVÁTS 1993) [8781.1];

**Székesfehérvár:** Székesfehérvár (FANTA 1902).

Ined.

**Százhalombatta:** Sánc (FARKAS 2005) [8679.2]

### 3. Praematricum

Herb.

**Budapest IV.:** Székes-dűlő, Óceán ditch (BŐHM 2005 BP) [8480.2]; Rákos (DEGEN 1911 BP) [8480.2]; **Budapest IX.:** Ferencváros (POLGÁR 1916 BP, PÉNZES 1924 DE) [8580.1]; **Budapest XI.:** Kamaraerdő (BARRA 1929 GAH) [8579.4]; Kőérberek (BOROS 1921 BP) [8580.3]; Kelenföld (LENGYEL 1901 in BP, PÉNZES 1947 BP) [8580.1]; **Budapest XIII.:** Rákos-patak (GOTTHÁRD 1991 in BP-M) [8480.4]; **Budapest XIV.:** Zugló (MARGITAI 1911 BP) [8480.4]; **Budapest**

**XVIII.:** Akadémiai-erdő (FELFÖLDY 1994 BP) [8581.1]; Halmi-dűlő (FELFÖLDY 1994 BP) [8581.3]; Pestszentlőrinc (PÓCS 1949, 1951 BP, SZUJKÓ-LACZA 1979 BP) [8581.3]; **Budapest XXII.:** Péter Pál street (FILARSZKY 1904 BP) [8580.3]; **Cegléd:** Varjas-dűlő (ELIÁS jun. 2008 in NI) [8885.1]; **Dunakeszi:** Dunakeszi (JÁVORKA 1944 BP, BOROS 1924 BP) [8380.2]; **Göd:** Alsógöd (KÁRPÁTI 1936 BP) [8380.2]; **Szentendre:** town (HEGEDÜS 1979 BP) [8380.1]; **Szigetmonostor:** Alsó-Merzsán (SZOLLÁT 2006 in BP) [8380.4]; Szentendre Island (incl. Horány) (ANDREÁNSZKY 1947 BP, HORÁNSZKY 1947, SOÓ 1947 BP, DE, BORSOS 1953 DE) [8380.2]; **Tápiószecső:** Magdolnatelep (SCHMOTZER 2014 Priv. SCHA) [8583.3]; **Üröm:** Puszta-hegy, cemetery (BÖHM 2001, 2003 BP) [8380.3, 8480.1]; **Veresegyház:** Veresegyház (SIROKI 1960 in DE) [8381.4].

Lit.

**Baja:** Baja (BOROS in SZUJKÓ-LACZA & KOVÁTS 1993) [9879.2]; **Budapest:** Pest (KITAIBEL in JÁVORKA 1926, KITAIBEL in SZUJKÓ-LACZA & KOVÁTS 1993) [8480.4]; (VÖRÖSVÁRY et al. 2005b) [8580.1]; **Budapest III.:** Róka-hegy (PINTÉR 2006) [8480.1]; **Budapest IV.:** Rákos (DEGEN in SZUJKÓ-LACZA & KOVÁTS 1993) [8480.2]; Káposztásmegyer (HEGEDÜS 1994) [8480.2]; **Budapest X.:** Rákospatak (PINTÉR 2006) [8581.1]; **Budapest XIV.:** Rákos (SZUJKÓ-LACZA & KOVÁTS 1993) [8480.4]; **Budapest XIII.:** Rákos-patak (GOTTHÁRD in BÁNKUTI 1999) [8480.4]; **Budapest XVI.:** Naplás-tó (HEGEDÜS 1994) [8481.3]; **Cegléd:** Cegléd (KITAIBEL in GOMBOCZ 1945, SZUJKÓ-LACZA & KOVÁTS 1993) [8884.2]; **Csörög:** Csörög (VÖRÖSVÁRY et al. 2005b) [8281.3]; **Göd:** Fen at Göd (SZOLLÁT et al. 2007) [8380.2]; **Kecskemét:** Kecskemét (KITAIBEL in LŐKÖS (2001) [9184.1]; **Lajosmizse:** Lajosmizse (KITAIBEL in LŐKÖS (2001) [9083.2]; **Lakitelek:** Kerekdomb (INSTITUTE FOR AGROBOTANY, TÁPIÓSZELE in EURISCO 1999) [9186.1]; Lakitelek (VÖRÖSVÁRY et al. 2005b) [9185.2]; **Maglód:** between Ecsér and Maglód (KITAIBEL in GOMBOCZ 1945) [8582.3]; **Örkény:** Örkény (KITAIBEL in LŐKÖS 2001) [8882.4]; **Pócsmegyer:** Pócsmegyer (VÖRÖSVÁRY et al. 2005b) [8280.4]; **Szentendre:** Szentendre (VÖRÖSVÁRY et al. 2005b) [8380.1]; **Tahitótfalu:** (VÖRÖSVÁRY et al. 2005b) [8280.2]; **Tápiószele:** village. railway station (INSTITUTE FOR AGROBOTANY, TÁPIÓSZELE in EURISCO 2007) [8685.3].

Ined.

**Budapest XIII.:** Árpád Bridge (BARINA 2013) [8480.3]; **Nyárlőrinc:** Felső-Semlyék-dűlő (FARKAS 2005) [9185.3].

#### 4. Crisicum

Herb.

**Abádszalók:** Nagykunsági-főcsatorna (SCHMOTZER 2014 Priv. SCHA) [8589.1]; **Bélmegyer:** between Bélmegyer and Fás-erdő (CSAPODY 1956 BP) [9193.1]; **Békésszentandrás:** Körös embankment (SCHMOTZER, TÁBORSKÁ & VOJTKÓ 2014 Priv. SCHA) [9188.2]; **Debrecen:** Debrecen (SIROKI 1964 DE) [8495.2]; University (Soó 1938 DE); **Detk:** Rét-szél-dűlő (SCHMOTZER 2005 DE) [8286.4]; **Egyek:** railway station Ohat-Pusztakócs (SIROKI 1948 DE) [8391.4]; **Fegyvernek:** Fegyvernek (JERMY sine data BP) [8789.1]; **Heves:** Bika-Nyilas

(SCHMOTZER 2013 Priv. SCHA) [8487.4]; **Hevesvezekény:** Rakottyás (SCHMOTZER 2014 Priv. SCHA) [8488.3]; **Hódmezővásárhely:** Hódmezővásárhely (BERNÁTSKY 1913 BP) [9587.4]; Erzsébeti-oldal (SCHMOTZER, TÁBORSKÁ & VOJTKÓ 2014 Priv. SCHA) [9588.4]; Tarjánvég (LÁNYI & SZABÓ 1913 in BP) [9587.4]; **Horgos:** Szentpéteri-major (LÁNYI – SZABÓ 1912 BP) [9886.1]; **Hortobágy:** between the fishpond and Hortobágy village (SOÓ 1947 BP) [8492.2]; **Karcag:** between Karcag and Kisújszállás (SIMONKAI 1873 BP) [8791.1]; **Királyhegyes:** Csikópuszta (ELIÁS jun. 2010 in NI) [9789.2]; **Kisköre:** Hosszú-hát-dűlő (SCHMOTZER 2014 Priv. SCHA) [8488.4]; Jászsági-főcsatorna (SCHMOTZER 2014 Priv. SCHA) [8489.3]; Tanyahely-dűlő (SCHMOTZER 2014 Priv. SCHA) [8488.2]; **Kisújszállás:** Karcag, road edge (ELIÁS jun. 2008 in NI) [8790.4]; **Kömlő:** Görbe-éri-csatorna (SCHMOTZER 2014 Priv. SCHA) [8488.2]; **Öcsöd:** Öcsöd-Békésszentandrás border (ZÓLYOMI & KOVÁCS 1959 BP) [9188.1]; **Pély:** Árendás (SCHMOTZER 2014 Priv. SCHA) [8588.1]; **Püspökladány:** main asphalt road Nr. 4. (TAKÁCS 2009 DE) [8692.4]; **Sarud:** Hídvég-puszta (SCHMOTZER 2014 Priv. SCHA) [8389.3]; Panyita (SCHMOTZER 2014 Priv. SCHA) [8489.1]; **Szarvas:** Szarvas (KOREN 1872 BP) [9189.4]; **Szeged:** Alsóváros (TÍMÁR 1948 BP) [9786.4]; Gedő (LÁNYI & SZABÓ 1912 BP, KOVÁCS 1933 BP) [9786.2]; Somogyi-telep (KOVÁCS 1933 BP, GAH) [9787.1]; Szeged town (KOVÁCS 1933 BP) [9786.2]; **Szentes:** Szentes (THAISZ 1923 BP) [9388.3]; **Tarnaszentmiklós:** Cifra-fenek (SCHMOTZER 2008 Priv. SCHA) [8488.3]; Hanyi-ér (SCHMOTZER 2013 Priv. SCHA) [8488.3]; Lepintó (SCHMOTZER 2014 Priv. SCHA) [8488.3]; Lovas-gyep (SCHMOTZER 2014 Priv. SCHA) [8488.1]; Matyó-sarok (SCHMOTZER 2014 Priv. SCHA) [8488.3]; **Tiszabura:** Tiszabura (PERLAKY 1895 BP) [8588.4]; Kömlő-fenek (SCHMOTZER 2014 Priv. SCHA) [8589.3]; **Tiszafüred:** Kócsújfalu (SIROKI 1955 DE, FELFÖLDY 1995 BP, ELIÁS jun. 2008 NI) [8390.4, 8491.4]; **Tiszanána:** Daruháti-alsó (SCHMOTZER 2014 Priv. SCHA) [8489.3]; Gulyás-csoport-legelő (SCHMOTZER 2013 Priv. SCHA) [8489.1]; **Tiszaug:** Tiszaug (ZÓLYOMI & KOVÁCS 1959 BP, VÖRÖSS 1967 HPTE) [[9185.4, 9186.3]; **Túrkeve:** Cihat-zug (SCHMOTZER 2014 Priv. SCHA) [8990.1]; **Zsáka:** Kálló canal (GULYÁS 2010 DE) [8894.2].

Lit.

**Bélmegyér:** Fáspuszta (JAKAB 2005) [9193.1]; **Bokros:** Bokros (VÖRÖSVÁRY et al. 2000, 2005b) [9286.1]; **Bucsa:** Ilonamajor (JAKAB 2005) [8892.1]; **Csanádpalota:** Kenderföld (JAKAB 2005) [9790.3]; **Csépa:** Csépa (VÖRÖSVÁRY et al. 2005b) [9186.4]; **Csongrád:** Kilenyes (JAKAB 2005) [9387.1]; **Derekegyház:** Derekegyháza (PENKSZA 1996) [9487.4]; **Dévaványa:** Dévaványa (JAKAB 2005) [8991.4]; Doszta (JAKAB 2005) [8891.4]; Ködmönös (JAKAB 2005) [8891.4]; Gabonás (JAKAB 2005) [8991.1]; Csorda-halom (JAKAB 2005) [8991.2]; Csordajárás (JAKAB 2005) [8991.2]; Halmagy (JAKAB 2005) [9091.2]; **Ecsegfalva:** Kenderes-sziget (JAKAB 2005) [8891.1]; **Egyek:** Ohat (SIROKI in SZUJKÓ-LACZA 1982) [8391.4]; **Füzesgyarmat:** Horgas (JAKAB 2005) [8992.2]; **Gyomaendrőd:** Hármaskörös (JAKAB & TÓTH 2003, DELI & LOBMÁYER 2011) [9090.4, 9091.3]; Kocsorhegy (JAKAB 2005) [9090.4]; **Hódmezővásárhely:** Hódmezővásárhely



(BERNÁTSKY 1905, SOÓ & MÁTHÉ 1938, PENKSZA 1996; VÖRÖSVÁRY et al. 2005b) [9587.4]; Darvas (JAKAB 2005) [9587.4]; Kincsestelep (JAKAB 2005) [9587.4]; Nagy-sziget (JAKAB 2005) [9688.1]; Szilléri töltés (LÁNYI 1914) [9786.2]; Kishomok (PENKSZA et al. 1997) [9687.2]; **Hortobágy:** Hortobágy (Soó in SZUJKÓ-LACZA 1982) [8392.3]; **Jánoshida:** Jánoshida (KITAIBEL in LÖKÖS 2001) [8686.1]; **Jászberény:** Öregerdő (BUSCHMANN 2013) [8584.2]; **Karcag:** Karcag (MOLNÁR 2005) [8691.4]; **Királyhegyes:** Blaskovics-puszta (MOLNÁR 1998) [9789.2]; **Körösladány:** Túzokos (JAKAB 2005) [9092.4]; Körös-zug (JAKAB 2005) [9192.2]; **Kunmadaras:** Kunmadarasi-puszta (MOLNÁR 2005, BENKOVÁ et al. 2005, VÖRÖSVÁRY et al. 2005b) [8591.4; 8590.4]; **Magyarcsanak:** Maros (BÁTORI et al. 2014) [9889.2]; **Mártély:** Mártély (VÖRÖSVÁRY et al. (2005b) [9587.1]; **Mezőhegyes:** Ballota (KITAIBEL in LÖKÖS 2001) [9690.4]; **Mezőtúr:** Felsőrészinyomás (JAKAB 2005) [8990.3]; **Mindszent:** Alsóludas (JAKAB 2005) [9487.3]; kurgan at asphalt road Nr. 45. (PENKSZA 1996) [9487.4]; **Nagytóke:** Nagytóke (VÖRÖSVÁRY et al. 2005b) [9287.2]; Mirmidó (JAKAB 2005) [9288.3]; **Orosháza:** Orosháza (Soó & MÁTHÉ 1938) [9490.1]; **Öcsöd:** Öcsöd (VÖRÖSVÁRY et al. 2005b) [9088.3]; Vásárhát (JAKAB 2005) [9188.2]; **Portelek:** Portelek (EURISCO 2013) [8585.4]; **Szabadkigyós:** Kígyósi-puszta (KERTÉSZ 2005) [9492.2]; **Szarvas:** Szarvas (BORBÁS 1881, KOREN 1882, SOÓ & MÁTHÉ 1938, Z.MOLNÁR (1994), BENKOVÁ et al. 2005 [9189.1]; **Szarvas – Orosháza:** Szarvas and Orosháza (HAYEK 1914) [9289.2]; **Szeged:** Szeged (LÁNYI in SZUJKÓ-LACZA & KOVÁTS 1993, TÍMÁR in SZUJKÓ-LACZA & KOVÁTS 1993) [9786.2, 9787.1]; Gedő (KOVÁTS in SZUJKÓ-LACZA & KOVÁTS 1993) [9786.2]; Szentpéteri major (LÁNYI in SZUJKÓ-LACZA & KOVÁTS 1993) [9886.1]; **Szeghalom:** Szeghalom canal (JAKAB 2005) [8992.4]; **Szegvár:** Sápshalom (JAKAB 2005) [9387.4]; **Szentes:** Szentes (VÖRÖSVÁRY et al. 2005b) [9387.4]; Lapistó-Fertő (TÓTH 2000, JAKAB & TÓTH 2003) [9387.4]; Belsőecser (JAKAB 2005) [9288.1]; Cserebökény (JAKAB 2005, VÖRÖSVÁRY et al. 2005b) [9288.1]; Külsőecser (PENKSZA 1996) [9288.4]; Pankotai-halom (PENKSZA 1996) [9288.4]; Szentesi-Fertő (PENKSZA 1996) [9388.3]; **Szolnok:** Tisza dam (GRUNDL 1868, TÍMÁR 1955, TÍMÁR in SZUJKÓ-LACZA & KOVÁTS 1993) [8886.4, 8887.1]; Szolnok (VÖRÖSVÁRY et al. 2005b) [8887.1]; **Tiszafüred:** Péteri-halom (MOLNÁR 2005) [8691.3]; **Tiszaug:** between Tiszaug and Cserkeszölő (TÓTH 2003) [9186.2]; **Tótkomlós:** Királyhegyesi-Száraz-ér (PENKSZA 1996) [9690.1]; **Túrkeve:** Hímesdi-zsilip (JAKAB 2005) [8890.4]; Nagy-Kaba, Kovács-tanya (JAKAB 2005) [8890.4]; Nagy-Kaba, Puszlíhodály (JAKAB 2005) [8890.4]; Pásztói-legelő (JAKAB 2005) [8990.1]; Malom-zugikert (JAKAB 2005) [8990.2]; **Vezseny:** Vezsely (KITAIBEL in GOMBOCZ 1945, KITAIBEL in SZUJKÓ-LACZA & KOVÁTS 1993) [8987.3].

Ined.

**Abádszalók:** village (A. MOLNÁR 2003) [8589.2]; **Adács:** Nagy-legelő (SCHMOTZER 2004) [8386.1]; **Békésszentandrás:** Mogyorós-halom (JAKAB sine data) [9188.2]; **Bélmegyer:** Fás legelő (FARKAS 2003) [9193.1]; **Besenyözög:** Fekete-híd-dűlő (Cs. MOLNÁR 2014) [8787.4]; Pető-ráta (SCHMOTZER 2005) [8687.4]; **Bokor:** Tóbiás tanya (JAKAB & KAPOCSI 2005) [9587.4]; **Cserkeszölő:**

Cserkei-fertő (A. MOLNÁR 2003) [9187.3]; Göboly-járás (A. MOLNÁR 2002) [9187.1]; **Detk:** Páskom-lapos (SCHMOTZER 2005) [8286.4]; **Déaványa:** Papföldek (FARKAS 2004) [8991.4]; **Egyek:** Egyek (A. MOLNÁR 2011) [8391.2]; **Gyomaendrőd:** Hármaskörös (NÓTÁRI 2014) [9090.4, 9091.3]; (SCHMOTZER, TÁBORSKÁ, VOJTKÓ & D.K. VOJTKÓ 2013) [8990.2]; **Hevesvezekény:** Hosszú-dűlő (SCHMOTZER 2014) [8488.1]; Hosszú-fertő (SCHMOTZER 2014) [8488.3]; Lenkeállítás (SCHMOTZER 2005) [8488.3]; Lukács-földek (SCHMOTZER 2014) [8488.1]; **Hódmezővásárhely:** Csala-dűlő (KAPOCSI 2013) [9589.1]; Csomorkányi út (KAPOCSI 2013) [9588.4]; Erzsébeti-oldal (KAPOCSI 2013) [9588.4]; Frank-dűlő (KAPOCSI 2013) [9589.3]; Külső-Erzsébet (KAPOCSI 2013) [9589.1]; **Jászivány:** Jászapáti-Jászivány border (A. MOLNÁR 2000) [8487.3]; **Jászkisér:** Berényi úti dűlő, Rassang-hát (URBÁN 2014) [8586.4]; **Jászkisér:** Közös-legelő (URBÁN 2014) [8587.1]; Nagy-árka (URBÁN 2014) [8587.4]; Ördög-hát (URBÁN 2014) [8587.2]; **Karcag:** Bócsai fishpond (A. MOLNÁR 2003) [8790.2]; Boros-legelő (A. MOLNÁR 2003) [8790.2]; Bugai út (A. MOLNÁR 2014) [8791.2]; Bugyogó-dűlő (DEÁK, VALKÓ & TÖRÖK 2014) [8691.4]; Ecse-halom (A. MOLNÁR 2014) [8591.4]; Kecseri-tó (A. MOLNÁR 2002) [8790.3]; Legeltetési-bizottsági legelő (A. MOLNÁR 2009) [8791.2]; Nagy-legelő (DEÁK, VALKÓ & TÖRÖK 2014) [8691.4]; Nemetéri-csatorna (A. MOLNÁR 2014) [8591.4]; Téglagyári tavak (KOVÁCS 1970) [8791.2]; Zádor-halom (KOVÁCS 1970) [8691.2]; **Kardosút:** Fehér-tó (KAPOCSI 2013) [9589.2]; Sóstói-főcsatorna (KAPOCSI 2013) [9589.2]; Szemző udvari-csatorna (KAPOCSI 2013) [9589.2]; Ficsér-dűlő (KAPOCSI 2013) [9489.4]; **Kenderes:** Nagykunsági főcsatorna (VIDÉKI 2014) [8789.2]; **Kisköre:** village, railway station (SCHMOTZER 2013) [8588.2]; Bogárzó (SCHMOTZER 2014) [8488.4]; Csikós környéke (SCHMOTZER 2014) [8488.4]; Fehérfű (SCHMOTZER 2004) [8489.3]; Gondolta (SCHMOTZER 2002) [8488.4, 8489.3]; Hattyús (SCHMOTZER 2014) [8488.4, 8489.3]; Homok-dűlő (SCHMOTZER 2014) [8488.2]; Jászsági-főcsatorna (SCHMOTZER 2014) [8488.4, 8489.3]; Kanyar (SCHMOTZER 2014) [8588.2, 8589.1]; Keri-hát (SCHMOTZER 2014) [8589.1]; Magas-határ (SCHMOTZER 2014) [8488.4]; Mike-part (SCHMOTZER 2014) [8488.4]; Nagy-állítás (SCHMOTZER 2014) [8488.4]; Nánai határra járó (SCHMOTZER 2014) [8488.2]; Patkósi-halastavak (SCHMOTZER 2013) [8588.2]; Rákhát-dűlő (SCHMOTZER 2014) [8488.4]; Sarud-Saj-foki-főcsatorna (SCHMOTZER 2014) [8488.4]; Sulymos-hát-dűlő (SCHMOTZER 2014) [8588.2, 8589.1]; Tanyahely-dűlő (SCHMOTZER 2014) [8488.2, 8488.4]; Teremkörülyéke (SCHMOTZER 2014) [8488.4]; Tisza bridge (A. MOLNÁR 2014) [8589.1]; Zsombékos (SCHMOTZER 2014) [8488.2]; **Kiskunfélegyháza:** Borsi-halom (VIDÉKI 2003) [9285.1]; Csongrád úti tanyák (VIDÉKI 2001) [9385.2]; **Kunhegyes:** Czibak (DEÁK, VALKÓ & TÖRÖK 2014) [8689.4]; Kis-szik-dűlő (A. MOLNÁR 2002) [8690.4]; **Kunmadaras:** Határ-oldal (A. MOLNÁR 1990) [8591.4]; **Kunszentmárton:** Csukati-dűlő (A. MOLNÁR 2002) [9087.4]; Papp-zug (A. MOLNÁR 2014) [9187.2]; **Maklár:** Nagy-legelő (VOJTKÓ 2013) [8288.1]; Proletár (TÁBORSKÁ & VOJTKÓ 2014) [8188.3]; Szilvafa-sorok (FARKAS 2008) [8188.3]; **Makó:** Hatrongyos (KAPOCSI 2013) [9689.1]; Komáromi-dűlő (KAPOCSI 2013) [9689.1]; **Mezőtúr:** Iskola-dűlő (A. MOLNÁR 2007) [9089.3]; **Mindszent:** Ludas tanyák (ŐZE 2013) [9487.3]; **Nádudvar:** Lapos-szeg (DEÁK, VALKÓ & TÖRÖK

2014) [8692.2]; **Nádudvar:** Sárosér-főcsatorna (A. MOLNÁR 2014) [8592.1]; Hosszúfenék-dűlő (A. MOLNÁR 2014) [8491.4]; **Nagyiván:** Nagy-telek (A. MOLNÁR 2014) [8491.4]; **Nagytóke:** Kaján (FARKAS 2003) [9287.4]; **Nagyút:** Külső-tag (SCHMOTZER 2006) [8286.4]; **Orosháza:** Gyopárosfürdő (VIRÓK 2003) [9489.2]; **Öcsöd:** embankment of Holt-Körös (SZABÓ 2005) [9088.3]; **Pély:** Aranyos (SCHMOTZER 2014) [8588.1]; Aszód (SCHMOTZER 2004) [8587.2]; village, Szabadság road (SCHMOTZER 2013) [8587.2]; Hanyi-ér (SCHMOTZER 1999) [8588.1, 8488.3]; Hevesiványi-dűlő (SCHMOTZER 2004) [8587.2]; Juhász-domb (SCHMOTZER 2014) [8588.1]; Kis-Garabont (SCHMOTZER 2014) [8588.1]; Makkoserdő (SCHMOTZER 1999) [8487.4]; Nagy-Hatrongyos (SCHMOTZER 2014) [8588.1]; Pusztahatrongyos (SCHMOTZER 2014) [8588.1]; Sarud-Saj-foki-főcsatorna (SCHMOTZER 2014) [8588.1]; **Püspökladány:** Makkodi-főcsatorna (VIDÉKI 2014) [8692.3]; Nagykun-lapos (A. MOLNÁR 2014) [8692.3]; cemetery (A. MOLNÁR 2003) [8692.4]; **Sáránd:** Kornó-halom (A. MOLNÁR 2004) [8595.3]; **Sarud:** Csárda-lapos (SCHMOTZER 2014) [8389.3]; Cserepes (SCHMOTZER 2014) [8389.3]; Csinsca (SCHMOTZER 2014) [8389.3]; Daruhát (SCHMOTZER 2014) [8489.2]; Mély-Nagy-állás (SCHMOTZER 2014) [8489.1]; Pap-tag (SCHMOTZER 2014) [8489.2]; Sarud-Saj-foki-főcsatorna (SCHMOTZER 2014) [8489.1, 8489.2]; Zabere-halmi-dűlő (SCHMOTZER 2014) [8489.1]; **Székkutas:** Barackos (KAPOCSI 2013) [9589.3]; Bogárzói-csatorna (KAPOCSI 2013) [9589.1]; Halmi-dűlő (KAPOCSI 2013) [9489.3]; Kardoskúti-csatorna (KAPOCSI 2013) [9589.1]; Sóstói-csatorna (KAPOCSI 2013) [9589.2]; Sóstói-főcsatorna (KAPOCSI 2013) [9489.4]; Sóstó-parti-dűlő (KAPOCSI 2013) [9489.3]; **Szentes:** Berek (ŐZE 2013) [9387.4]; Csorda-járás (ŐZE 2013) [9387.4]; Sáp-halom (JAKAB sine data) [9387.4]; **Szolnok:** Alcsi puszta (URBÁN 2014) [8887.1]; Paládics puszta (URBÁN 2014) [8886.2]; Tenyősziget (URBÁN 2014) [8887.4]; **Tarnaszentmiklós:** Bácsa-sarok (SCHMOTZER 2012) [8488.3]; Balog-halom-fertő (SCHMOTZER 2014) [8488.1]; Cifra-fenek (SCHMOTZER 2008) [8488.3]; Görbe-éri-csatorna (SCHMOTZER 2014) [8488.1]; Hamva-járás (SCHMOTZER 2009) [8488.4]; Ludas-dűlő (SCHMOTZER 2005) [8488.3]; Ördög-fenek-eleje (SCHMOTZER 2014) [8488.3]; Rókalyuk-dűlő (SCHMOTZER 2014) [8488.3]; Tapasztó-hát (SCHMOTZER 2008) [8488.4]; Tapasztó-hát SCHMOTZER (2008) [8488.3, 8488.4]; Temető-dűlő (SCHMOTZER 2014) [8488.3]; **Tiszafüred:** Béke-fertő (DEÁK, VALKÓ & TÖRÖK 2014) [8491.3]; Jámbor-tanya (A. MOLNÁR 2014) [8491.4]; Juhász terület (A. MOLNÁR 2014) [8491.3]; Kócsújfalu, Szik-hát (DEÁK, VALKÓ & TÖRÖK (014) [8491.2]; **Tiszanána:** Cserőközi-legelő (SCHMOTZER 2014) [8489.1]; Sáros-éri-dűlő (SCHMOTZER 2012) [8488.2]; **Túrkeve:** Cihat-hát (A. MOLNÁR & A. SCHMOTZER 2014) [8990.1]; Muszáj-kert (SCHMOTZER, TÁBORSKÁ, VOJTKÓ & VOJTKÓ D. K. 2013) [8990.2].

## II. Matricum

### 1. Tokajense

Herb.

**Tarcal:** Nagy-Kopasz (SCHMOTZER 1998 Priv. SCHA) [7894.3]; **Tokaj:** Kopasz-hegy (SRAMKÓ 2000 DE) [7894.3]

Lit.

**Tokaj:** Tokaj (KITAIBEL in KANITZ 1862, KITAIBEL in KISS 1939, VÖRÖSVÁRY et al. 2005b [7894.3]).

Ined.

**Tarcal:** Mogyorós (VOJTKÓ 2013) [7894.3]; Szarvas (VOJTKÓ 2014) [7894.3];

**Tokaj:** Tokaji-hegy (FARKAS 2002) [7894.3].

## 2. Borsodense

Lit.

**Eger:** Nagy-Eged (VOJTKÓ 1994) [8088.3]; town, castle (VOJTKÓ 2001) [8088.3].

Ined.

**Tibolddaróc:** village, wine-cellars (SCHMOTZER 2010) [8089.4].

## 3. Agriense

Herb.

**Gyöngyös:** Bene-puszta (JANKA 1863 BP) [8185.4]; Gyöngyös (JANKA 1863, 1865 BP, BIHARI 1920 BP, SCHMOTZER & TÁBORSKÁ 2014 Priv. SCHA) [8285.2]; Sár-hegy (KÁRPÁTI 1951 BP) [8285.2].

Lit.

**Abasár:** Abasár (VÖRÖSVÁRY et al. 2005b) [8186.3]; Nagy-dűlő (SRAMKÓ et al. 2003) [8186.3]; **Gyöngyös:** Sár-hegy, Cseplye-tető, (VRABÉLYI 1868, BORBÁS IN SOÓ 1937, DEGEN IN SOÓ 1937, LENGYEL IN SOÓ 1937) [8285.2]; **Gyöngyöspata:** Gyöngyöspata (VÖRÖSVÁRY et al. 2005b) [8184.4]; **Gyöngyössolymos:** village BÁNKUTI (1984) [8185.4]; **Gyöngyöstarján:** Gyöngyöstarján (VÖRÖSVÁRY et al. 2005b) [8185.3]; Mulató-hegy (MOLNÁR 2001) [8185.3]; **Markaz:** Markaz (VÖRÖSVÁRY et al. 2005b) [8186.3]; **Szurdokpüspöki:** Horka (HARMOS & SRAMKÓ 2000b) [8184.1]; Szurdokpüspöki (VÖRÖSVÁRY et al. 2005b) [8184.1].

Ined.

**Abasár:** Bánya-tábla (POZSONYI 2013) [8186.3]; Csurgó-oldal (POZSONYI 2013) [8186.3]; Hagyóka (POZSONYI 2013) [8186.3]; Réti-dűlő (TÁBORSKÁ & VOJTKÓ 2013) [8186.3]; Rónya-lapos (POZSONYI 2013) [8186.3]; **Domoszló:** Páskomiszőlők (TÁBORSKÁ & VOJTKÓ 2013) [8186.4]; Pusztatinya (MAGOS 2009) [8186.4]; **Markaz:** Laposi-legelő (TÁBORSKÁ & VOJTKÓ 2013) [8186.3]; **Visonta:** Majnikszőlők (POZSONYI 2013) [8285.2].

## 4. Neogradense

Herb.

**Fót:** Fót (GOTTHÁRD 1974 BP-M, LUKÁCS, A. MOLNÁR V. & TAKÁCS 2014 DE [8381.3]; **Gödöllő:** Gödöllő (BOROS 1926 BP) [8482.1]; **Letkés:** village, cemetery (NAGY 2004 BP) [8178.2]; **Verőce:** Katalin-völgy (DEGEN 1923 BP) [8180.3].

Lit.

**Aszód:** main road Nr. 3. (BRATEK et al. 2003) [8382.4]; **Bér:** Csirke-hegy (HARMOS & SRAMKÓ 2000a, HARMOS et al. 2001) [8183.1]; **Fót:** Fót (GOTTHÁRD in BÁNKUTI (1999, VÖRÖSVÁRY et al. 2005b) [8381.3]; Somlyó (KOVÁCS & PRISZTER

1956) [8381.3]; **Gödöllő:** Gödöllő (KOVÁCS & PRISZTER 1956, VÖRÖSVÁRY et al. 2000) [8382.3]; **Letkés:** village, cemetery (NAGY 2004) [8178.2]; **Vác:** VÖRÖSVÁRY et al. (2000) [8180.4]; Sejce-hegy (PINTÉR et al. 2010) [8180.4]; **Váchartyán:** Kávé-földek and Kiós valley (HÁZI 2012) [8281.4].

Ined.

**Fót:** Fóti Somlyó (FARKAS 2005) [8381.3]; **Kozárd:** Felső-Dubina (LANTOS 2006) [8083.4]; Pogány-vári lapos (HARMOS 2012) [8083.4]; **Tura:** Derék-hegy alja (PINTÉR 2004-2010) [8383.3].

## 5. Visegradense

Herb.

**Dunabogdány:** Csódi-hegy (BARINA & PIFKÓ 2002 BP) [8280.1]; **Leányfalu:** Postarét (BŐHM 1996 BP) [8280.3]; **Pomáz:** Messalia (BŐHM 1996 BP) [8380.1]; Tubin-kút (BOROS 1925 BP) [8380.1]; **Szentendre** (incl. **Izbég**): Vasvári P. road (SCHMOTZER & TÁBORSKÁ 2014 Priv. SCHA) [8380.1]; Kéki-dűlő (BŐHM 2004 BP) [8380.1]; Kő-hegy (DEGEN 1913 W) [8380.1]; Pismány-hegy (DEGEN 1924 BP, BŐHM 1996 BP) [8380.1, 8280.3]; skanzen (GOTTHÁRD 1988 BP-M) [8480.4]; Szentendre (DEGEN 1910, 1913 BP, W, KÁRPÁTI 1943 BP, BŐHM 2000 BP) [8380.1]; Kéki-hegy (GOTTHÁRD 1990 BP-M) [8380.1]; Kő-hegy (SZOLLÁT & BŐHM 2006 BP, KÁRPÁTI 1943 DE, KOPPÁNYI 1948 DE) [8380.1]; Nagy Kéki-hegy (GOTTHÁRD 1977, 1978, 1991 BP-M) [8380.1].

Lit.

**Pomáz:** Pomáz (VÖRÖSVÁRY et al. 2005b) [8380.3]; **Szentendre** (incl. **Izbég**): Nagy Kéki-hegy (GOTTHÁRD in BÁNKUTI 1999) [8380.1]; Kéki-hegy (GOTTHÁRD in BÁNKUTI 1999, BŐHM 2001) [8380.1]; Jegyző-kertje (SOMLYAY 2000a) [8380.1]; skanzen (GOTTHÁRD in BÁNKUTI 1999) [8480.4]; Szentendre (VÖRÖSVÁRY et al. 2005b) [8380.1].

Ined.

**Szentendre:** skanzen (FARKAS 2005) [8380.1].

## III. Bakonyicum

### 1. Pilisense

Herb.

**Budaörs:** Budaörs, vineyards (BOROS 1926 BP) [8579.2]; Kő-hegy (SOMLYAY 2005 BP) [8579.2]; Odvas-hegy (SOMLYAY 2000 BP) [8579.2]; Törökugrató (LYKA 1913 GAH) [8579.3]; Út-hegy (SOMLYAY 2003 BP) [8579.2]; **Budapest I.:** Várdomb (DARÁNYI sine data GAH) [8580.1]; **Budapest II.:** Bimbó road (JEANPLONG 1982 GAH) [8480.3]; brick yard (BERNÁTSKY 1913 BP) [8480.3]; Ferenc-hegy (FELFÖLDY 1995 BP) [8480.3]; Hármashatár-hegy (DIETZ 1894 BP, VAJDA 1922 BP) [8479.2]; Kálvária-hegy (and Szarvas-hegy) (BAKSAY 1954 BP, SZOLLÁT 2005 BP) [8479.2]; Rózsadomb (LENGYEL 1912 BP, BOROS 1919 BP, SNELL 1926 OHN) [8480.3]; Szemlő-hegy (FLATT 1900 BP, DE, GAH, JÁVORKA 1910 BP, BOROS 1919 BP) [8480.3]; Szépvölgy (DEGEN 1913 BP) [8480.3];

**Budapest III.:** Csillag-hegy (KÁRPÁTI 1946 BP) [8480.1]; Kálvária-domb (BŐHM 2003 BP) [8380.3]; Mátyás-hegy (SIMONKAI 1893 BP, KÁRPÁTI 1934 BP) [8480.3]; Pál-völgy (BOROS 1919 BP) [8480.3]; Pusztadomb (SOMLYAY 2007 BP) [8480.1]; Rupp-hegy (KÁRPÁTI 1936 BP) [8480.3]; Békásmegyer (SIMONKAI 1873 BP, POLGÁR 1921 BP, DE, ANDREÁNSZKY 1936 BP, BŐHM 2003 BP) [8480.1, 8480.3]; **Budapest XI.:** Gellért-hegy (=Blocksberg, Mt. St. Gerardi) (KERNER sine data W, KOVÁTS sine data BP, RICHTER 1805 W, THOMA 1854 BP, HAYNALD 1861 BP, ENTZ 1866 BP; DORNER 1870 BP, GJO, TAUSCHER 1871 BP, 1872, 1974 PRC, BORBÁS 1873 BP, W, STAUB 1875 BP, STEINITZ 1879 W, 1880 PRC, DIETZ 1885 BP, SZÉP 1885, 1895 NI, HORA 1891 PRC, SZÉPLIGETI 1891 BP, SINGLER 1907 G, LYKA 1908 GAH, ANDRASOVSKY 1909 BP, KORB 1912 W, VETTER 1912 W, TUZSON 1913 BP, DE, GAH, W; SOÓ 1947 DE; PAPP 1948 BP [8580.1]; Lágymányos (LYKA 1906 GAH, KÁRPÁTI 1931 BP, PÉNZES 1947 BP, SIROKI 1951 DE [8580.1]; **Budapest XI.:** Dobogó (SOMLYAY 2005 BP [8580.1]; Sas-hegy (=Adlerberg) (SADLER 1806 W, TAUSCHER 1872 PRC, STAUB 1874 BP, RICHTER 1888 PRC; LENGYEL 1926 DE, PAPP 1948 DE, SOMLYAY 2008 BP [8580.1]; **Budapest XII.:** Farkas-völgy (BOROS 1925 BP) [8579.2]; Farkasrét (RAPAICS 1917 BP, KÁRPÁTI 1948 BP) [8579.2, 8580.1]; János-hegy (incl. rack rail) (MOESZ 1907 BP, BOROS 1921 BP, GAH) [8479.4]; Kút-völgy (DEGEN 1893 BP) [8479.4]; Orbán-hegy (KÁRPÁTI 1946 BP) [8580.1]; Ördög-orom (SOMLYAY 2006 BP) [8579.2]; Széchenyi-hegy (SOMLYAY 2004 BP) [8579.2]; Táboros-hegy (SOMLYAY 2003 BP) [8579.2]; **Budapest XXII.:** Péter-hegy (RICHTER 1899 BP, PRC, W) [8580.3]; **Dorog:** Kálvária-hegy (BAUER 2006 BP) [8278.3]; **Esztergom:** Esztergom (FEICHTINGER 1860 BP, PRC) [8278.1]; Kis-Strázsa-hegy (BAUER 1999 BP) [8278.3]; **Páty:** Tót György-hegy (SOMLYAY 2002 BP) [8479.3]; **Pilisborosjenő:** brick yard (GOTTHÁRD 1985 BP-M) [8379.4]; **Piliscsaba:** Vörösvári-árok (SZOLLÁT 2001 BP) [8378.4]; **Törökbálint:** Tétényi-plató (BARRA 1929 GAH) [8579.4]; Törökbálint, railway (BOROS 1926 BP) [8579.3].

Lit.

**Budaörs:** Odvas-hegy (DOBOLYI et al. 1991) [8579.2]; **Budapest II.:** Apáthyszikla (PINTÉR 2006) [8479.4]; Csúcs-hegy (HEGEDÜS 1994) [8479.2]; Ferenc-hegy (HEGEDÜS 1994) [8480.3]; Újlaki-hegy (HEGEDÜS 1994) [8479.2]; **Budapest XI.:** Rupp-hegy (HEGEDÜS 1994, PINTÉR 2006) [8579.2]; Órmező (MOESZ & PÉNZES in TÓTH 1994) [8580.1]; **Budapest XI.:** Gellért-hegy (PANČIĆ in VÖRÖSS 1980) [8580.1]; **Budapest XII.:** Denevér road (PINTÉR 2006) [8579.2]; Martinovics-hegy (HEGEDÜS 1994) [8480.3]; Ördög-orom (HEGEDÜS 1994) [8579.2]; Sas-hegy (PAPP 1977, TÓTH & PAPP 2012) [8580.1]; **Esztergom:** Kis Strázsa-hegy (BAUER 2001) [8278.3]; **Pilisborosjenő:** Brick yard (GOTTHÁRD in BÁNKUTI 1999) [8379.4].

Ined.

**Budapest II.:** Szarvas-hegy (SOLYMOSSI 1986) [8479.2]; **Piliscsaba:** village (CSIKY & CSIKYNÉ 1999) [8379.3]; Pilisjászfalu: village (Csiky & Csiky Jr. 2013) [8378.2].

## 2. Vesprimense

Herb.

**Hajmáskér:** Szingor-aszó-völgy (BAUER 2010 BP) [8873.2]; **Inota:** Baglyaszőlőhegy (BAUER 2003 BP) [8775.3]; Belátó-hegy (BAUER 2005 BP) [8775.3]; Hajagos (BAUER 2006 BP) [8775.3]; Hideg-völgy (BAUER 2005 BP) [8775.3]; Öreg-Kálvária (BAUER 2010 BP) [8774.4]; **Márkó:** Gömbölyű-hegy alja, Kerek-hegyi-dűlő (BAUER 2007 BP) [8872.4]; **Öskü:** Hosszú-völgy alja (BAUER 2008 BP) [8874.1]; **Várpalota:** Bántai-dombok (BAUER 2005 BP) [8874.2]; Cseri-domb (BAUER 2007 BP) [8874.2]; Várpalota (LEONHARTSBERGER 2007, 2008, 2010 GJO) [8874.2]; **Velence:** Velence, vineyards (BOROS 1933 in BP) [8777.4].

Lit.

**Bakonykúti:** Baglyas-hegy, Akasztó hegy (BAUER & BÖLÖNI 2007) [8775.3]; **Bánta:** Bántai-homokbánya (MÉSZÁROS & SIMON 2009) [8874.2]; **Csór:** Kút-hegy (BAUER 2007) [8775.4]; **Inota:** Inota (VÖRÖSVÁRY et al. 2005b) [8775.3]; Baglyaszőlőhegy (BAUER 2004, 2009) [8775.3]; Belátó-hegy (BAUER 2007) [8775.3]; Gomba-hegy (BAUER 2009) [8775.4]; Hajagos (BAUER 2007) [8775.3]; Hideg-völgy (BAUER 2007) [8775.3]; Iszka-hegy (BAUER 2009) [8775.4]; **Márkó:** Peres-Nagymező (BAUER 2007, KENYERES et al. 2008) [8873.3]; **Öskü:** Felső-Bánta (BAUER 2007, KENYERES et al. 2008) [8774.3]; village border (PINKE et al. 2005) [8874.1]; **Várpalota:** Bántai-dombok (BAUER 2007) [8874.2]; Csákány-hídi-dűlő (MÉSZÁROS & SIMON 2009) [8874.2]; Loncsos (HORHI 1859, HORHI in RÉDL 1942) [8874.2]; Rétre dűlő (MÉSZÁROS 2001) [8875.1]; Várpalota (PILLITZ 1908-1910, PILLITZ in RÉDL 1942, KENYERES et al. 2008) [8874.2].

## 3. Balatonicum

Herb.

**Balatonfüred:** Tamás-hegy (BAUER 2001 BP) [9073.1]; **Balatonfüred:** Arács (HERMAN 1883 BP) [9073.1]; **Balatonkenese:** Soós-hegy, Part-fő (BAUER 2006 BP) [8974.4]; Tátorjános (A. MOLNÁR V. & TAKÁCS 2014 DE) [8974.4]; **Köveskál:** Köveskál (JÁVORKA & FELFÖLDY 1959 BP) [9171.2]; **Tihany:** Gödrös (BAUER 2001, 2007 BP) [9073.3]; Kiserdő-csúcs (FELFÖLDY 1947 DE) [9073.3]; Tihany (JÁVORKA 1932 BP, Soó 1947 BP, KÁROLYI 1948 BP) [9073.3].

Lit.

**Aszófő:** Aszófő (KITAIBEL in BORBÁS 1900) [9073.3]; **Balatonfüred:** Balatonfüred (KITAIBEL in LŐKÖS 2001, VÖRÖSVÁRY et al. 2005b) [9073.1]; **Balatonfűzfő:** Mámai-hegy (BAUER & SOMLYAY 2007) [8974.1]; **Balatonkenese:** Part-fő (BAUER & SOMLYAY 2007) [8974.3]; **Balatonszőlős:** Veken-dűlő (BAUER et al. 1999) [9072.2]; **Örvényes:** Örvényesi fás legelő (BAUER et al. 2000) [9072.4]; Örvényes (VÖRÖSVÁRY et al. 2005b) [9072.4]; **Tihany:** Rátai-csáva (BAUER et al. 1999) [9173.1]; Tihany (BORBÁS 1900, VÖRÖSVÁRY et al. 2000, BENKOVÁ et al. 2005) [9073.3].

Ined.

**Balatonfüred:** Lóczy-barlang (VOJTKÓ & D.K. VOJTKÓ 2014) [9073.1]; **Köveskál:** Mező (CSIKY & CSIKYNÉ 1999) [9171.2].

## IV. Praeillyricum

### 1. Sopianicum

Herb.

**Pécs:** Bálícsi út (VÖRÖSS 1963 HPTE) [9975.1]; Bárány-tető (VÖRÖSS 1970, 1973 HPTE) [9975.1]; Tettye (UHERKOVICH 1951 HPTE) [9975.1].

Lit.

[**Mecsek Mts:** (HORVÁT 1966)].

Ined.

**Pécs:** Szabad-föld (CSIKY 2009) [9975.2]; Szkókötető (CSIKY 2010) [9975.1].

### 2. Villányicum

Herb.

**Nagyharsány:** Szársomlyó (VÖRÖSS 1961, 1964, 1969 HPTE) [0176.3]; **Villány:** Szársomlyó (HORÁNSZKY 1968 BP, STEINER, ANDERSSON, APELGREN & NITARE 1987 UPS) [0176.1].

Lit.

**Nagyharsány:** Szársomlyó (VÖRÖSS 1963, VÖRÖSS in HORVÁTH 1976, SOMLYAY 2000b) [0176.3].

### Herbarium Data from Budapest which were not localized, due to the data deficiency:

„Pest” (JURÁNYI sine data BP; STEINITZ sine data BP, W; HANÁK 1847 BP; HAYNALD 1867 BP); „Buda” (BORBÁS sine data BP; KERNER sine data in W; KLETT sine data W; LANG sine data PRC W; MÜLLER sine data BP; RICHTER sine data BP, PRC; STAUB sine data BP; WOLNY sine data BP; FREYN 1872 BP; MAURER 1982 in GJO).

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