Bot. Helv. (2010) 120:75–78
DOI 10.1007/s00035-010-0072-2

Botanica Helvetica

Early distribution and spread of *Ambrosia artemisiifolia* in Central and Eastern Europe

Péter Csontos · Melinda Vitalos · Zoltán Barina · Levente Kiss

Received: 9 March 2010 / Accepted: 6 June 2010 / Published online: 29 June 2010

Abstract The introduction and early spread of common ragweed (*Ambrosia artemisiifolia* L.) in Central and Eastern Europe were reconstructed based on a study of all herbarium specimens of common ragweed deposited at six herbaria in Austria, Hungary and Serbia. More than 450 specimens were examined and the oldest ones, collected from 1907 to 1927, were used to map the historical spread of this highly allergenic invasive weed in this region. The herbarium records back-date the first known introduction of this noxious weed to Central and Eastern Europe as well as its early spread on the Danube-Tisza Plain, and in the North-Eastern part of Hungary. The data also confirm that the introduction of common ragweed to Central and Eastern Europe took place later than its introduction to the Western part of the continent.

Responsible editor: Sabine Güsewell.

P. Csontos
Research Institute for Soil Science and Agricultural Chemistry of the Hungarian Academy of Sciences, Herman Ottó út 15, Budapest 1022, Hungary

M. Vitalos
Department Integrative Biology and Biodiversity Research, Institute of Botany, University of Natural Resources and Applied Life Sciences, Gregor Mendel Strasse 33, 1180 Wien, Austria

Z. Barina
Botanical Department of the Hungarian Natural History Museum, P.O. Box 222, Budapest 1476, Hungary

L. Kiss (✉)
Plant Protection Institute of the Hungarian Academy of Sciences, P.O. Box 102, Budapest 1525, Hungary
e-mail: LKISS@NKI.HU

Keywords Biological invasions · Common ragweed · Distribution map · Herbarium studies · Invasive weed · Pollen allergy

Introduction

Herbarium specimens are useful tools to reconstruct the introduction and spread of invasive plant species (Pyšek 1991; Pyšek and Prach 1995; Mihulka and Pyšek 2001; Saltonstall 2002; Lavoie et al. 2007) although their use suffers from several biases such as irregular or occasional collecting intensity, accessibility of herbarium collections, or loss of specimens (Delisle et al. 2003; Chauvel et al. 2006). Maps based on information provided by historical herbarium samples can indicate points of introduction, and, thus, the localization of the founder populations, as well as the early invasion pathways, rates of spread and other data on the early distribution of invasive plants in the newly occupied geographical regions.

The invasive spread of common ragweed (*Ambrosia artemisiifolia* L., Asteraceae) in Europe and elsewhere has stirred much interest (e.g., Genton et al. 2005; Fumanal et al. 2007; Chun et al. 2010) because this species, native to North America, is well-known as an agricultural weed and as a producer of highly allergenic pollen (Déchamp and Méon 2002; Makra et al. 2004; Taramarcaz et al. 2005; Kiss and Béres 2006; Kazinczi et al. 2008). Recently, herbarium specimens were used to depict its historical spread in France (Chauvel et al. 2006) as well as in Québec, Canada (Lavoie et al. 2007). The French study (Chauvel et al. 2006) is the only detailed reconstruction of common ragweed invasion in a European country. It showed that plants were present in French botanical gardens starting from 1763 and appeared in the field as

adventive plants as early as 1863 in France. For other parts of Europe, such detailed studies have not been performed yet, and published information is largely based on personal communications and other sporadic and often unverifiable sources. In addition, there are succinct reports on the appearance of common ragweed plants in some places in Germany, Switzerland and Austria in the late 1800s but these plants apparently did not establish permanent populations in the nineteenth century (Hegi 1906; Taramarcaz et al. 2005; Kazinczi et al. 2008). According to Reznik (2009), common ragweed was found for the first time in Russia only later, in 1918, close to Black See ports, probably as a consequence of international trade. At least part of the introductions of common ragweed to Europe appear to be independent events according to molecular analyses (Genton et al. 2005; Chun et al. 2010).

For the Central and Eastern European (CEE) countries,[1] where the largest introduced and invasive common ragweed populations are currently located, early sources of information were reviewed by Makra et al. (2005), Kazinczi et al. (2008) and Déchamp et al. (2009). All available sources suggest that the establishment of common ragweed in this part of Europe took place later than in France. Some papers mention 1908 as the year of the first detection of common ragweed in this region based on a succinct report and a herbarium specimen from Orsova, a fluvial port at the Danube River close to the Iron Gate (Kazinczi et al. 2008). Other papers indicate only that common ragweed appeared here for the first time at the beginning of the twentieth century and might have been introduced through the Adriatic ports of the historic Austro-Hungarian Empire as a contaminant of agricultural products (e.g., Makra et al. 2005).

However, there is still no well-documented evidence for the time period of the introduction and early establishment of common ragweed in CEE. The main objective of this work was to reveal the early history of common ragweed invasion in this region using data from herbarium specimens and, thus, to provide a first documented study of the beginning of its spread in this part of Europe.

Materials and methods

We examined all ragweed herbarium specimens found in the following collections: Herbarium of the Hungarian Natural History Museum, Budapest, Hungary (BP); Herbarium of the Savaria Museum, Szombathely, Hungary (SAMU); Herbarium of the Ferenc Móra Museum, Szeged, Hungary (SZE); Herbarium of the Natural History Museum, Vienna, Austria (W); Herbarium of the Natural History Museum, Belgrade, Serbia (BEO); and Herbarium of the Faculty of Biology, Institute of Botany and Botanical Garden, University of Belgrade, Serbia (BEOU). The identities of the specimens examined were confirmed based on their morphologies. The data available on their labels were compiled and analyzed and those coming from the oldest specimens, collected from 1907 to 1927, were used to produce a map of the early distribution of common ragweed in CEE.

Results and discussion

Altogether, more than 450 common ragweed specimens were examined in the herbaria listed above. Among these, the oldest ones, six specimens in total, were collected between 1907 and 1912 in Orsova and Herkulesfürdő/Herculesbad, Austro-Hungarian Empire (today: Orşova and Băile Herculane, Romania). These two localities are situated approx. 40 km apart from each other and are linked by an important railway line. Four specimens out of these six are deposited at BP and two at W. No specimens collected from 1913 to 1921 were found in any of the herbaria studied during this work. This time period included the First World War (1914–1918). In contrast, a large number of herbarium specimens collected after 1921 were available in several herbaria. Among these, the oldest 20 specimens, collected between 1922 and 1927 in places which currently belong to Hungary and Croatia, were all found at BP. We decided to depict the early spread of common ragweed in CEE based on these 26 oldest herbarium specimens collected between 1907 and 1927 (Fig. 1) because those found soon after this time period came from the same, or nearby, places and thus do not contribute much to understanding the early spread of common ragweed in this area. In addition, the areas colonized by common ragweed soon after the 1930s in CEE have been reported earlier (e.g., Kazinczi et al. 2008).

The rapid spread of common ragweed after the early 1920ies is well supported by herbarium specimens (Fig. 1). This process was reported by several papers (e.g., Makra et al. 2005; Kazinczi et al. 2008) and was explained by extensive transports of agricultural products throughout Hungary after the First World War. The herbarium specimens showed that common ragweed was present in the Danube-Tisza Plain and also in the North-Eastern part of Hungary as early as 1926. This is a new result since until now it was assumed that common ragweed appeared on the Danube-Tisza Plain only after the 1960s and in Northeastern Hungary after 1965 (Kazinczi et al. 2008).

[1] The term CEE refers to all countries of the 'Eastern bloc' as well as to the countries formed after the collapse of the former Yugoslavia and three Baltic states: Estonia, Latvia and Lithuania. This work focuses on its southeastern parts, mainly on the Pannonian Basin and its surroundings.

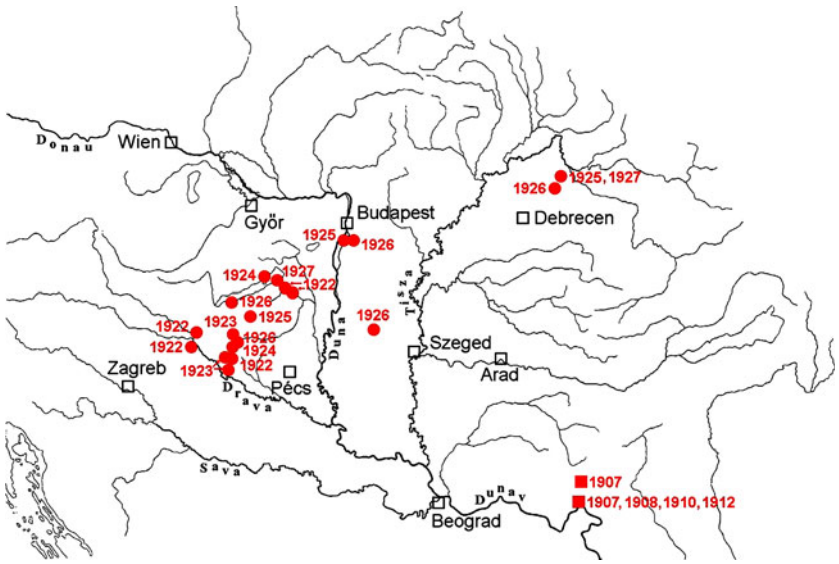

Fig. 1 Early distribution of *Ambrosia artemisiifolia* in Central and Eastern Europe (CEE) based on the 26 oldest known herbarium specimens. Specimens collected during the first 10 years of its documented presence in CEE (1907–1917) are marked by *filled squares*. Those collected during the following 10 years of its spread in this region are shown by *filled circles*. Names of the localities in chronological order: 1907—Orsova and Herkulesfürdő (today: Orşova and Băile Herculane); 1908, 1910 and 1912—Orsova; 1922—Ádánd, Görgeteg, between Légrád (today: Legrad) and Kakonya, Murakeresztúr, Városhídvég (today: Szabadhidvég); 1923—Kutas, Rinyaszentkirály, Újnép (today: Rinyaújnép); 1924—Lábod, Tihany; 1925—Nyírbakta (today: Baktalórántháza), Somogyvár, Szigetszentmiklós; 1926—Balatonkeresztúr, Dunaharaszti, Halas, Mike, Ófehértó; 1927—Nyírbakta (today: Baktalórántháza), Siófok

Each of the oldest six specimens from 1907 to 1912 was collected by a different botanist in Orsova and Herkulesfürdő, respectively. This suggests that botanists considered the study of common ragweed as an important task in the early 1900s and expected to find it in the field as a newly introduced adventive plant. By that time, it was known that *A. artemisiifolia* is native to North America and can be introduced to other places via agricultural trade (Ascherson 1874; Carriet 1880; Olivier 1904). Several herbaria, including BP and W, possessed large collections of *Ambrosia* spp. specimens, including *A. artemisiifolia*, received from North and South America and other parts of the world. Thus, botanists interested in *A. artemisiifolia* could have had examined the morphology of this species based on herbarium specimens before finding it in the field. However, there are no known specimens collected in CEE before 1907 which might suggest that the introduction of common ragweed to this region did indeed happen sometimes at the end of the nineteenth century or in the early 1900s.

The four oldest specimens collected in Orsova and Herkulesfürdő in 1907 and 1908 slightly back-date the first known appearance of *A. artemisiifolia* in CEE and also support that it was this region that common ragweed established for the first time in CEE. Among the oldest six specimens from 1907 to 1912, only one has been mentioned in the literature to date. The fact that the oldest two common ragweed specimens were collected in the same year in two localities, and then repeatedly until 1912 in one of these two localities, suggests that common ragweed was permanently established in that region by the time of its first collection. Similarly, the relatively high number of herbarium specimens collected from 1922 onwards in Hungary might also indicate that by that time, common ragweed was well established in that region.

In conclusion, our data did not contradict earlier works which assumed that common ragweed was introduced to CEE later than to France. However, it has clearly invaded far larger areas in both Hungary and Russia compared to Western Europe (Makra et al. 2004, 2005; Kiss and Béres 2006; Déchamp et al. 2009). Further studies are needed to understand the reasons of this spectacular invasion process.

Acknowledgments The authors are grateful to the two anonymous reviewers for their comments on this work.

References

Ascherson P (1874) Kleine phytographische Bemerkungen. Bot Ztg 48:768–773

Carriet A (1880) L'Ambrosia artemisiaefolia. Feuilles des Jeunes Nat 1:32–34

Chauvel B, Dessaint F, Cardinal-Legrand C, Bretagnolle F (2006) The historical spread of *Ambrosia artemisiifolia* L. in France from herbarium records. J Biogeogr 33:665–673

Chun YJ, Fumanal B, Laitung B, Bretagnolle F (2010) Gene flow and population admixture as the primary post-invasion processes in common ragweed (*Ambrosia artemisiifolia*) populations in France. New Phytol 185:1100–1107

Déchamp C, Méon H (eds) (2002) Ambrosia, ambroisies, polluants biologiques. ARPPAM-Édition, Lyon

Déchamp C, Méon H, Reznik S (2009) *Ambrosia artemisiifolia* L. an invasive weed in Europe and adjacent countries: the geographical distribution (except France) before 2009. Ambroisie 26:24–46

Delisle F, Lavoie C, Jean M, Lachance D (2003) Reconstructing the spread of invasive plants: taking into account biases associated with herbarium specimens. J Biogeogr 30:1033–1042

Fumanal B, Chauvel B, Sabatier A, Bretagnolle F (2007) Variability and cryptic heteromorphism of *Ambrosia artemisiifolia* seeds: what consequences of its invasion in France? Ann Bot 100:305–313

Genton BJ, Shykoff JA, Giraud T (2005) High genetic diversity in French invasive populations of common ragweed, *Ambrosia artemisiifolia*, as a result of multiple sources of introduction. Mol Ecol 14:4275–4285

Hegi G (1906) Illustrierte flora von mittel-Europa. 6. J.F. Lehmanns Verlag, München

Kazinczi G, Béres I, Novák R, Bíró K, Pathy Z (2008) Common ragweed (*Ambrosia artemisiifolia*): a review with special regards to the results in Hungary. I. Taxonomy, origin and distribution, morphology, life cycle and reproduction strategy. Herbologia 9:55–91

Kiss L, Béres I (2006) Anthropogenic factors behind the recent population expansion of common ragweed (*Ambrosia artemisiifolia*) in Eastern Europe: is there a correlation with political transitions? J Biogeogr 33:2156–2157

Lavoie C, Jodoin Y, de Merlis AG (2007) How did common ragweed (*Ambrosia artemisiifolia* L.) spread in Québec? A historical analysis using herbarium records. J Biogeogr 34:1751–1761

Makra L, Juhász M, Borsos E, Béczi R (2004) Meteorological variables connected with airborne ragweed pollen in Southern Hungary. Int J Biometeorol 49:37–47

Makra L, Juhász M, Béczi R, Borsos E (2005) The history and impacts of airborne *Ambrosia* (Asteraceae) pollen in Hungary. Grana 44:57–64

Mihulka S, Pyšek P (2001) Invasion history of *Oenothera congeners* in Europe: a comparative study of spreading rates in the last 200 years. J Biogeogr 28:597–609

Olivier E (1904) Ambrosia artemisiaefolia L. Revue Scientifique du Bourbonnais et du Centre de la France 17:151–153

Pyšek P (1991) *Heracleum mantegazzianum* in the Czech Republic: dynamics of spreading from the historical perspective. Folia Geobot et Phytotaxonomica 26:439–454

Pyšek P, Prach K (1995) Invasion dynamics of *Impatiens glandulifera*: a century of spreading reconstructed. Biol Conserv 74:41–48

Reznik SY (2009) Common ragweed (*Ambrosia artemisiifolia* L.) in Russia: spread, distribution, abundance, harmfulness and control measures. Ambroisie 26:88–97

Saltonstall K (2002) Cryptic invasion by a non-native genotype of the common reed, *Phragmites australis*, into North America. Proc Natl Acad Sci USA 99:2445–2449

Taramarcaz P, Lambelet C, Clot B, Keimer C, Hauser C (2005) Ragweed (Ambrosia) progression and its health risks: will Switzerland resist this invasion? Swiss Med Wkly 135:538–548