Climate change influences in the spreading and controlling of common ragweed *Ambrosia artemisiifolia* in Europe

Katalin Sörös[1], Katalin M. Kassai[1], Andrea Farkas[2] and Márton Jolánkai[1]*

[1] Szent István University, Crop Production Institute. H-2100 Gödöllő, Páter Károly utca 1.

[2] Gránátalma Alapítvány, 51 Bem rakpart, H-2016. Budapest, Hungary.

**e-mail: jolankai.marton@mkk.szie.hu*

Abstract

The present spreading and the future spatial activity of the ragweed *Ambrosia artemisiifolia* has been evaluated upon statistical assessments of recent European surveys. The study focuses basically on climatic influences rather than herbological assessments.

Evaluations have been done upon the available databases. Abundance of *Ambrosia artemisiifolia* across Europe was studied using the database derived from 10 km grid spatial pixels. Climatic constrains were evaluated by each country in Europe based on estimations regarding the calibrated climatic quality surface for ragweed and the climatic variables most strongly limiting quality (temperature – low – high, moisture and seasonality). Extinction possibilities for future abundance of ragweed have been evaluated by the modelling data of the European survey presenting annual probability of extinction and the phenology – model prediction of ability to set seeds. The results of the study suggest that the spreading of the weed species may have an Eastward direction in the future. The possibilities for controlling the weed coverage are limited, in some countries and so in Hungary there is less chance to eliminate or reduce its presence in the future.

Keywords: *Ambrosia artemisiifolia*, climatic constrains, spreading, control

Összefoglalás

Vizsgálataink során elemeztük a parlagfű Ambrosia artemisiifolis terjedésének és jövőbeli térhódításának tényezőit. Statisztikai értékeléseink során az európai adatbázisok klimatikus adatait elemeztünk herbológiai vizsgálatok mellőzésével. A parlagfű elterjedésének mennyiségi viszonyait a 10 km-es pixelű európai adatbázis alapján értékeltük. A gyom elterjedésének az

életfeltételek szempontjából fontosabb klimatikus adatait minden európai ország esetében meghatároztuk (alacsony és magas hőmérséklet, csapadék, szezonalitás). A parlagfű gyomszabályozási lehetőségeit az európai fenológiai modell eredményei alapján értékeltük. Vizsgálatunk eredményei alátámasztani látszanak, hogy a parlagfű jövőbeli terjedési iránya Európa keleti részén lesz jelentősebb. A gyomnövény irtásának, csökkentésének esélyei számos országban, így hazánkban is elenyészőek.

Kulcsszavak: *Ambrosia artemisiifolia*, klimatikus viszonyok, terjedés, szabályozás

Introduction

Common ragweed (*Ambrosia artemisiifolia*) is one of the most widespread weed species globally with a special regard to Europe. It has spread very rapidly since its first appearance in the United States. *Ambrosia artemisiifolia* became a significant weed species since it was proved, that the pollens of the plant have several harmful effects for human health. The most common places where common ragweed can be found are agricultural lands, mainly sunflower and soybean, and stubbles of early harvested crops. Besides its extensive distribution on arable lands, it can be also found in urban, ruderal and neglected areas. Its presence is regular on roadsides, railways, or construction sites. In urban areas control of common ragweed is done by mowing, since the usage of chemicals can lead to environmental pollution. Pollen production in Hungary is usually between middle of July and middle of October (Kazinczi et al., 2008). Our country is considered to be the mostly infected country in Europe. In Hungary, five National Weed Surveys (NWS) was made since 1947. The first NWS was carried out between 1947 and 1953 (Ujvárosi, 1973), where common ragweed was on the 23rd place. The fourth National Weed Survey was carried out between 1996 and 1997, where this weed species was already the first one on the list, and remained to be the most dangerous arable weed species until the fifth NWS between 2007 and 2008. Our neighbouring countries tend to have more and more attention on ragweed, as a result of increasing human health problems (Bohren et al., 2007). The basis of efficient controlling of this weed species is monitoring from time to time. The fight against *Ambrosia artemisiifolia* – mainly because of its allergic feature – is a European Union program nowadays (Bullock 2012, CABI 2017, FM 2015). Our study focused on the climatic influences in the spreading and controlling of common ragweed in European countries (Sörös, 2017).

.

Material and method

In the study the present spreading and the future spatial activity of the ragweed *Ambrosia artemisiifolia* are presented upon statistical assessments of recent European surveys (Bullock 2012, CABI 2017, FM 2015).

Three evaluations have been done upon the available databases.

- Abundance of *Ambrosia artemisiifolia* across Europe, using the database derived from 10 km grid spatial pixels.
- Climatic constrains were evaluated by each country in Europe based on estimations due to the calibrated climatic quality surface for ragweed and the climatic variables most strongly limiting quality (temperature – low – high, moisture and seasonality).
- Extinction possibilities for future abundance of ragweed have been evaluated by the modelling data of the European survey presenting annual probability of extinction and the phenology – model prediction of ability to set seeds.

Abundance and vulnerability charts were established upon the results of the database estimates. Changes in future ragweed coverage are calculated and presented in a graphical chart.

Results

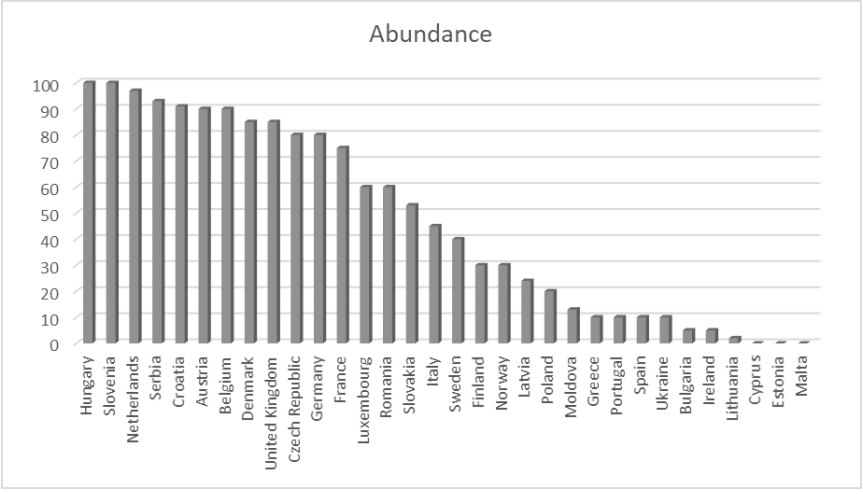

Figure 1. Estimated data processed upon the spreading of *Ambrosia artemisiifolia* in a decreasing order of European countries. Source: own research

In accordance with the results obtained we can determine, that *Ambrosia artemisiifolia* is a widespread weed species which managed to cover the whole area of Europe by the end of the 20th Century. This coverage process and its dynamics are not constant but show a variable progress. The reasons for spreading and the performance of the weed species are highly influenced by climatic constrains. Fig 1 provides data of the European survey processed upon the spreading information. Also, there is evidence that seem to support the trend of the future direction of spreading of ragweed in some of the East European countries like Romania, Moldova, Bulgaria and Ukraine.

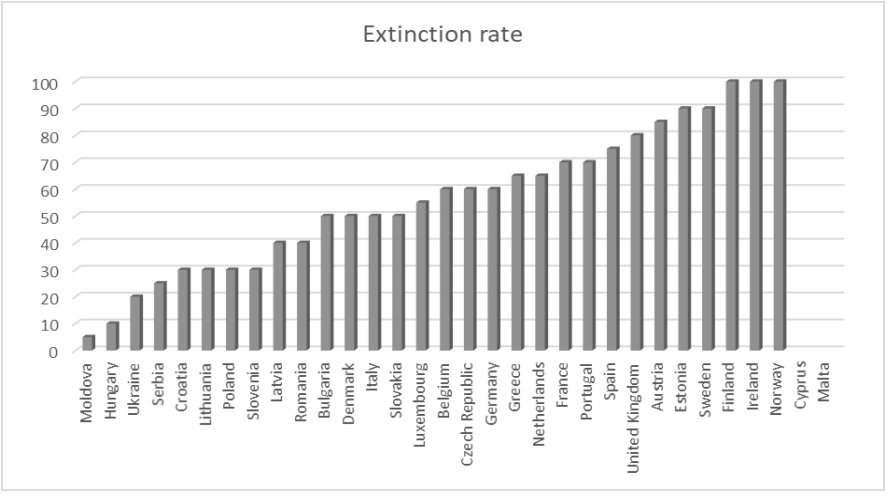

Figure 2. Predictable extinction rate of *Ambrosia artemisiifolia* in an ascending order of European countries. Source: own research

Figure 2 provides data concerning the predictable extinction rate of ragweed in European countries. It seems that apart from the ragweed free islands and some northern – Scandinavian and Alpen countries the probability of extinction is less than 50 %.

According to the research results obtained upon the data processing of the European ragweed survey (Bullock 2004, CABI 2017, FM 2015) we may state, that Hungary is among the most invaded countries in Europe, with a minimum chance for control or extinction in the future, mainly due to climatic constrains.

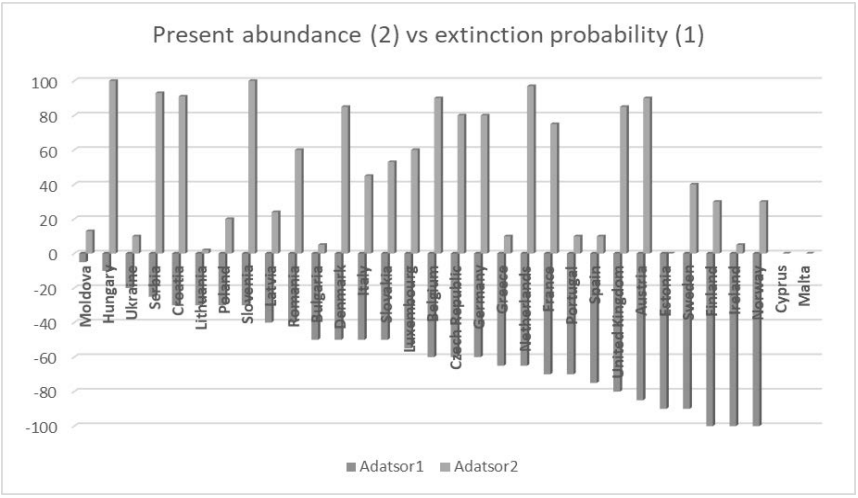

Figure 3. Present abundance *vs* extinction probability of *Ambrosia artemisiifolia* in European countries (Red – abundance; blue extinction). Source: own research

Acknowledgements

This paper presents research results gained from a study supported by TÁMOP, NVKP and VKSZ funds of the Government of Hungary.

References

Bullock, J.M. /Ed./ 2012. Assessing and controlling the spread and the effects of common ragweed in Europe. ENV.B2/ETU/2010/0037 Centre for Ecology & Hydrology, Wallingford. UK

CABI 2017. Invasive species compendium. http://www.cabi.org/isc/datasheet/4691

FM 2015. 10/2015. (III. 13.) FM rendelet. https://net.jogtar.hu

Kazinczi, G., Béres, I., Pathy, Zs., Novák, R. 2008. Common ragweed (*Ambrosia Artemisiifolia* L.): a review with special regards to the results in Hungary: II. Importance and harmful effect, allergy, habitat, allelopathy and beneficial characteristics. Herbologia 9. 93-118.

Sörös K. 2017. Examination of importance and distribution of Ambrosia artemisiifolia on the basis of European weed survey. Diplomadolgozat, SZIE, Gödöllő.

Újvárosi M. 1973. Gyomnövények. Mezőgazdasági Kiadó, Budapest.