

## **HALT Ambrosia - complex research on the invasive alien plant ragweed (*Ambrosia artemisiifolia* L.) in Europe**

*HALT Ambrosia - umfassendes europäisches Forschungsvorhaben zum invasiven Neophyten Beifuß-Ambrosie (*Ambrosia artemisiifolia* L.)*

Ulrike Sölter<sup>1\*</sup>, Uwe Starfinger<sup>2</sup> & Arnd Verschwele<sup>1</sup>

<sup>1</sup>Julius Kühn-Institut, Institut für Pflanzenschutz in Ackerbau und Grünland, Messeweg 11/12, 38104 Braunschweig, Germany

<sup>2</sup>Julius Kühn-Institut, Institut für Pflanzengesundheit, Messeweg 11/12, 38104 Braunschweig, Germany

\*Corresponding author, [ulrike.soelter@jki.bund.de](mailto:ulrike.soelter@jki.bund.de)

DOI: 10.5073/jka.2012.434.081

### **Summary**

The European Commission, Directorate-General Environment, is funding a new project on *Ambrosia artemisiifolia* L.: Complex research on methods to halt the Ambrosia invasion in Europe – HALT AMBROSIA. The project has started in spring 2011 and is executed by a consortium of German, Hungarian, Austrian, Slovenian, Danish and Swiss researchers. The overall aim of the project is to contribute to the reduction of the prevalence of Ambrosia in European countries in order to reduce the burden on public health, agriculture and biodiversity. This will consist of developing strategy elements for the reduction of *A. artemisiifolia* and its pollen in countries where the species is already established, e.g., Hungary, Slovenia, parts of Austria, and South-eastern Europe and for the prevention of further import and spread in countries not yet heavily infested, such as Germany, the Netherlands and Northern European countries. To this end the gaps in the existing information needed for understanding historical successes and failures of control and eradication activities will be analysed. Results of laboratory and field experiments will cover the germination biology and seed bank behaviour and the proportion of viable and germinable seeds produced by different populations or found in transported commodities, such as bird seed and soils. The impacts of chemical and non-chemical control measures on *A. artemisiifolia* and on adjacent plants will be investigated.

**Keywords:** Alien plant, biodiversity, control strategies, herbicides, non chemical control, ragweed

### **Zusammenfassung**

Die Europäische Kommission, Generaldirektorat Umwelt, fördert ein neues Projekt zu *Ambrosia artemisiifolia* L.: Complex research on methods to halt the Ambrosia invasion in Europe – HALT AMBROSIA. Das Projekt hat im Frühjahr 2011 begonnen und wird von einem Konsortium aus deutschen, ungarischen, österreichischen, slowenischen, dänischen und schweizer Wissenschaftlern durchgeführt. Das Hauptziel des Projektes ist, das Vorkommen von *A. artemisiifolia* in den europäischen Ländern zu reduzieren, um den Druck auf die Gesundheit der Bevölkerung, die Landwirtschaft und die Biodiversität zu mindern. Dies beinhaltet die Entwicklung von Bekämpfungsstrategien, um die Vorkommen von *A. artemisiifolia* und die Pollenbelastung in Ländern mit etablierten Beständen zu reduzieren (Ungarn, Slowenien, Teile von Österreich und Südost Europa) und die Ausbreitung und den weiteren Import von *A. artemisiifolia* in Ländern mit geringem Besatz zu verhindern (Deutschland, Niederlande und die nordeuropäischen Länder). Zu diesem Zweck werden in Labor- und Feldversuchen die Keimungsbiologie und das Verhalten der Samenbank untersucht, wie z.B. die Lebensfähigkeit von Samen und das Verhältnis von lebensfähigen und keimfähigen Samen von verschiedenen Herkünften. Dazu werden unterschiedliche Populationen oder transportierte Güter, wie Erde und Vogelfutter, beprobt. Zudem wird der Einfluss von chemischen und nicht chemischen Kontrollstrategien auf *A. artemisiifolia* und benachbarte Pflanzen erforscht.

**Stichwörter:** Biodiversität, gebietsfremde Arten, Herbizide, Kontrollstrategien, nicht chemische Bekämpfung, Unkraut

### **1. Introduction**

*Ambrosia artemisiifolia* is a tall erect annual of the daisy family (Asteraceae) native to North America. *A. artemisiifolia* has been inadvertently imported to many countries in Europe, Asia and Australia (ALLARD, 1945). In Europe, the first populations of the plant were found in the mid 1800s (BRETAGNOLLE and CHAUVEL, 2009). The species has spread over several regions in Europe, having been introduced

separately to France and Northern Italy and later to South-eastern Europe from the 1900s onward (CSONTOS et al., 2010). Information about the current distribution and densities of its appearance is scattered in national databases and publications (BRETAGNOLLE and CHAUVEL, 2009). This invasive weed has established on arable and non-cultivated land like roadway sides and construction land (STARFINGER, 2009). *A. artemisiifolia* can be a strong competitor to sunflowers, potatoes, pumpkins and legumes and can lead to high yield losses. The male flowers produce large quantities of pollen which are of high allergenic potential. Also an impact on biodiversity cannot be excluded. The burden on public health, agriculture and biodiversity by *A. artemisiifolia* cannot be denied.

The overall aim of the project is to contribute to the reduction of the prevalence of *A. artemisiifolia* in European countries. This will consist of developing strategy elements for the reduction of *A. artemisiifolia* and its pollen in countries where the species is already established, e.g. Hungary, Slovenia, parts of Austria, and South-eastern Europe and for the prevention of further import and spread in countries not yet heavily infested such as Germany, the Netherlands and Northern European countries.

## 2. Description of the Project

The project involves institutes from Germany, Hungary, Austria, Slovenia, Denmark and Switzerland and will last for three years, starting from February 2011. It is divided into six tasks: 1<sup>st</sup>: Project management and co-ordination; 2<sup>nd</sup>: Biological fundamentals; 3<sup>rd</sup>: Non-chemical and integrated control strategies; 4<sup>th</sup>: Best use of herbicides; 5<sup>th</sup>: Impact on non-target species and biodiversity and 6<sup>th</sup>: Implementation and Guidance.

Besides the coordination and management of the project, the 1<sup>st</sup> task is to inform the public about the project on its website: [www.halt-ambrosia.de](http://www.halt-ambrosia.de). Current results, events and reports are available there. The 2<sup>nd</sup> task deals with biological fundamentals of *A. artemisiifolia*. Experiments on dormancy, germination and viability of different populations are conducted. The persistence of a population depends upon the quality and quantity of seeds produced, therefore the control and eradication of *A. artemisiifolia* has to focus on this susceptible life cycle stage. Seeds are exposed to a range of environmental conditions like high and low temperatures, humidity and drought and chemical treatments. The fate of seeds in transported commodities and the resulting risk of introducing *A. artemisiifolia* populations into new areas are going to be assessed as well as the fate of seeds of cut plants where they finish their ripening process. This is an important aspect in case of the disposal of cut plant material. Investigations about seeds surviving composting or biogas process are also part of this task. The main target of the 3<sup>rd</sup> task is to improve and adapt physical methods for control of *A. artemisiifolia*. Non-chemical and integrated control strategies like hot water or flaming and mowing are conducted in small plot experiments as well as in cooperation with farmers who are cultivating highly-infested farmland. As *A. artemisiifolia* reacts very sensitive to competition, different row spacing combined with mechanical control methods will be conducted. Special focus will be set on sub-lethal effects on pollen and seed production and viability of *A. artemisiifolia* seeds. A concept for handling *A. artemisiifolia* seed contaminated soil is going to be developed. The 4<sup>th</sup> task deals with the best use of herbicides, i. e. optimal dosage and timing of herbicide application. Sustainable solutions for herbicide use in minor crops and in sensitive areas where herbicide use is restricted will be provided. Also the efficacy of bio-herbicides (e.g. pelargonon-acid, citronella-oil) is going to be tested in regard of seed viability and pollen production. The 5<sup>th</sup> task investigates the impact on non-target species and biodiversity. The interaction between *A. artemisiifolia* and its surrounding vegetation regarding plant species richness and composition of the vegetation as well as the impact of control measures on biodiversity is ascertained. The last task is devoted to implementation and guidance to successful and efficient control and eradication of *A. artemisiifolia*, mainly based on the trial results, but also derived from national databases and publications.

At the point of writing (in October, 2011), the first results of experiments carried out in the partner institutions are being evaluated. They will be discussed at project meetings coming up soon. The results relate to, *inter alia*, the fine-tuning of research methods, e.g., the conduct of seed viability tests, the implementation of mowing and herbicide tests etc. The advantage of the three-year research

period will be the opportunity to adapt experiments according to the first year findings and to gain sufficient results in case of unfavourable weather conditions etc.

### 3. Perspectives

The project will contribute to advance the knowledge on efficient control and eradication of *A. artemisiifolia*. Results will be disseminated through scientific publications, in comprehensive guidelines in six languages and on web sites related to *A. artemisiifolia*. National conferences addressed to stakeholders and farmers as well as to urban and rural administrators will be conducted. Taking into account the many other activities, such as those of the International Ragweed Society (<http://www.internationalragweedsociety.org>) or national Ambrosia control programmes (BOHREN et al., 2010; KARRER, 2010; STARFINGER, 2012), *A. artemisiifolia* will be among the most studied invasive plant species, so that chances to halt its ongoing spread in Europe should increase.

### Acknowledgements

The project "Complex research on methods to halt the Ambrosia invasion in Europe – HALT AMBROSIA" (07.0322/2010/586350/SUB/B2) is funded by the European Commission, Directorate-General Environment.

### References

- ALLARD, H.A., 1945: FLOWERING BEHAVIOR AND NATURAL DISTRIBUTION OF THE EASTERN RAGWEEDS (AMBROSIA) AS AFFECTED BY LENGTH OF DAY. *ECOLOGY* **24**, 387-394.
- BOHREN, C., N. DELABAYS AND S. WALDISPÜHL, 2010: AMBROSIA-KONTROLLE – NICHT NUR IN DER LANDWIRTSCHAFT! *AGRARFORSCHUNG SCHWEIZ* 1 (7 – 8): 260–265.
- BRETAGNOLLE, F. AND B. CHAUVEL, 2009: *AMBROSIA ARTEMISIIFOLIA* LINNAEUS, COMMON RAGWEED (ASTERACEAE, MAGNOLIOPHYTA). IN: DAISIE (ED.). *HANDBOOK OF ALIEN SPECIES IN EUROPE*, 343. SPRINGER, DORDRECHT.
- CSONTOS, P., M. VITALOS, Z. BARINA AND L. KISS, 2010: EARLY DISTRIBUTION AND SPREAD OF *AMBROSIA ARTEMISIIFOLIA* IN CENTRAL AND EASTERN EUROPE. *BOTANICA HELVETICA* **120**, 75–78.
- KARRER, G., 2010: 2. ZWISCHENBERICHT ZUM PROJEKT "AUSBREITUNGSBIOLOGIE UND MANAGEMENT EINER EINGEFÜHRTEN UND EXTREM ALLERGENEN PFLANZE, WEGE UND URSACHEN DER AUSBREITUNG VON RAGWEED (*AMBROSIA ARTEMISIIFOLIA*)" BBK-PROJEKT Nr. 100198\_4, 15.12.2010. BBK, 80.
- STARFINGER, U., 2009: CAN THE GENERAL PUBLIC HELP FIGHT THE INVASION OF AN UNDESIRED PLANT INVADER? THE CASE OF *AMBROSIA ARTEMISIIFOLIA*. *NEOBIOTA* **8**, 217-225.
- STARFINGER, U., 2012: AKTIONSPROGRAMM AMBROSIA IN DEUTSCHLAND - STATUS QUO UND AUSBLICK. *JULIUS-KÜHN-ARCHIV*, **434**, 623-626.