

# Feasibility of biological control of common ragweed (*Ambrosia artemisiifolia*) a noxious and highly allergenic weed in Europe

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## Introduction

Established in Europe for more than a century, the common ragweed, *Ambrosia artemisiifolia* L., is the most polluting invasive weed causing allergies to European populations in various countries and is causing enormous health costs. At present, there is no effort from European decision makers to implement biological control at the European level against common ragweed.

## Presentation of results of the international meeting of experts, Vienna (AGES), 27 September 2006 (Uwe Starfinger)

On the invitation of BBA, Braunschweig, and AGES, Vienna, experts from the fields of agronomy, botany, ecology, plant protection and road maintenance from seven European countries gathered for a one-day workshop to discuss the problems caused by *Ambrosia artemisiifolia* and the availability and effectiveness of control measures. Results and individual contributions are published at the BBA website ([www.bba.bund.de/ambrosia](http://www.bba.bund.de/ambrosia)). In particular, the experts

- reported impacts of *A. artemisiifolia* in several European countries on human health, plant health and nature conservation,
- expressed their concern about an ongoing spread of the species in Europe,
- urged authorities in countries concerned to prevent further import and spread or to control existing populations,
- gave a set of recommendations for all private or public bodies concerned.

The experts considered biological control as an important tool in the strategy of managing *A. artemisiifolia*:

- *A. artemisiifolia* is a suitable target for biological control in natural, ruderal and settlement areas, as well as along traffic ways.
- From a risk assessment point of view, the sub-tribe Ambrosiineae does not include crop species in Europe.
- The risk to *A. maritima*, the only native species of the sub-tribe in Europe, has to be assessed.
- Success of biological control of a closely related species (*Parthenium hysterophorus*) and *A. artemisiifolia* in Australia is a good argument to establish biological control in Europe.
- Additional suitable biological control agents have been identified in the native area of *A. artemisiifolia* and have to be investigated further.

A follow-up meeting is planned for 2008 at the next NEOBOTA conference in Prague.

## Success of biological control against common ragweed in Australia (Rachel McFadyen)

*Artemisia artemisiifolia* is classified as a declared 'class 2' weed in two eastern states of Australia: 'can potentially cause substantial economic and environmental damage and land managers must take reasonable steps to keep their land free of these weeds.' Biological controls

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have been implemented as a management option for ragweed in Australia. Several insect species have been introduced for biological control of common ragweed, two of which are established and giving good control. The leaf-feeding beetle *Zygogramma bicolorata* Pallister (Coleoptera: Chrysomelidae) was introduced from Mexico in 1980 as a biocontrol agent for the weed *Parthenium hysterophorus* L. (Asteraceae). Defoliation has immediate negative effects on plant performance and as a consequence affects the growth, reproduction and fitness of the plants. In some locations and years, *Z. bicolorata* caused 85–100% defoliation, resulting in significant reductions in plant density, growth and flower production. East coast areas receiving greater and more frequent rainfall had higher weed density and consequently higher beetle density. The stem-galling moth *Epiblema strenuana* (Walker) (Lepidoptera: Tortricidae) was introduced from Mexico in 1982 for biological control of *P. hysterophorus* and became widely established within 2 years of introduction. *E. strenuana* now occurs throughout the range of its host plants parthenium, Noogoora burr (*Xanthium occidentale* Bertol.) and annual ragweed (*A. artemisiifolia* L.) in Australia. Galls can kill seedling plants and severely reduce growth of larger plants, and as a result annual ragweed is no longer a serious weed in eastern Australia.

### **Biological control of common ragweed, *Ambrosia artemisiifolia* L. in Russia (Mark Volkovitsh)**

The ragweed leaf beetle, *Zygogramma suturalis* F. was introduced to Russia from the USA and Canada in 1978 to control the common ragweed, *Ambrosia artemisiifolia*. The initial phase of this introduction was a population explosion with more than a 30-fold yearly increase in number and population density (up to 5000 adults/m<sup>2</sup> in aggregations).

In 2005–2006, we conducted selective quantitative sampling over the whole area infested by *A. artemisiifolia* in southern Russia. The average population density of the ragweed leaf beetle was very low: 0.001 adults/m<sup>2</sup> in crop rotations and 0.1 adults/m<sup>2</sup> in more stable habitats. In an overwhelming majority of inspected populations, the impact on the targeted weed was negligible. However, having regard to the spectacular success achieved in the permanent experimental plot in 1983–1985, it is still possible that stable protected field nurseries could be a promising method of *Z. suturalis* propagation for biological control of ragweed in surrounding areas.

### **List of the known insect biological control agents (Dominique Coutinot)**

Many potential insect biological control agents exert a pressure on *Ambrosia* in its native environment

in North America. Certain of these have already been introduced and established within the framework of a classical biological control against *Ambrosia* in various countries but never in Europe. The list of all released biological control agents was presented during the workshop; the list below is those who have been reported as established:

*Epiblema strenuana* (Walker) (Lepidoptera: Tortricidae)

Introduced from Mexico in 1982 in Australia where it is widely established.

Introduced from Mexico in 1991 in China: under evaluation.

*Zygogramma bicolorata* Pallister (Coleoptera: Chrysomelidae)

Introduced from Mexico in 1980 in Australia where it is well established.

*Zygogramma disrupta* Rogers (Coleoptera: Chrysomelidae)

Introduced from the US in 1990 in Russia; the species is under evaluation.

*Zygogramma suturalis* (Fabricius) (Coleoptera: Chrysomelidae)

Introduced from Canada & US in 1978 in the Republic of Georgia and released in Abkhazia (West Georgia) and Lagodekhi region (East Georgia): the establishment needs to be confirmed and evaluated.

Introduced from Canada & US in 1978 in Ukraine: establishment is not confirmed. Introduced from Canada & US in 1978 in Russia, where the species is established. Introduced from US in 1985 in the ex Yugoslavia, where establishment needs to be evaluated.

Introduced from Canada in 1988 in China, where it was recovered in some provinces. Introduced from US in 1980 in Australia, but not established.

The use of insect biological control agents within the framework of a classical biological control program against *Ambrosia* does not seem to be under consideration to date by decision-makers in Europe.

### **List of potential fungal biological control agents for *Ambrosia artemisiifolia* & Species under consideration in Hungary (Levente Kiss)**

There are several fungal pathogens of common ragweed (*A. artemisiifolia*) that have already been considered as potential biological control agents of this noxious weed. *Protomyces gravidus*, causing an endemic stem gall disease on giant ragweed (*A. trifida*) in the USA, was evaluated as a potential mycoherbicide against both giant and common ragweed. A *Phoma* sp.

isolated from *A. artemisiifolia* in Canada performed well in inundative experiments alone and especially in combination with a leaf-eating beetle, *Ophraella communa*. *Puccinia xanthii*, a microcyclic autoecious rust reported to infect common ragweed in some parts of the USA, was proposed as a classical biological control agent outside North America. To our knowledge, none of these, or any other fungal pathogens, are currently investigated as potential biological control agents of *A. artemisiifolia* except a strain of *Sclerotinia sclerotiorum*, which is under consideration as a mycoherbicide in Hungary.

### **Biocontrol of *Ambrosia artemisiifolia* in Hungary: ideas, options and problems**

Currently, Hungary is the country where the air is most polluted with ragweed pollen in Europe. Agricultural and other control measures have not helped to reduce the amount of this airborne allergen so far. Classical biocontrol of ragweed could be a feasible way to achieve this goal because most of the natural enemies of *A. artemisiifolia*, known to occur in its native areas in North America, are missing from Europe. *Puccinia xanthii*, a microcyclic autoecious rust reported to infect common ragweed in some parts of the USA, as well as two leaf-eating beetles, *Zygogramma suturalis* and *Ophraella communa*, have already been proposed as classical biological control agents of ragweed in Hungary. In addition, a mycoherbicide product based on a strain of *Sclerotinia sclerotiorum* is under development in Hungary.

### **Species under consideration in Italy (Massimo Christofaro)**

Ragweed, *Ambrosia artemisiifolia*, an alien weed that originated from America, is now infesting the Po Valley regions in Italy. Due to the regional distribution of the plant, Italy lacks national legislation for the prevention and control of *A. artemisiifolia*. In northern Italy, regional governments as well as single municipalities have issued local laws and guidelines that establish:

- mandatory mowing in late June, late July and mid August
- general guidelines for early warning in urban areas,
- improvement of the pollen monitoring station system.

In the Lombardy region alone, the direct costs of *A. artemisiifolia* allergies on the public health system exceed 1 million euros (2003).

Mainly because of its alien origin and the territory occupied, biological control can be considered a feasible approach. The following specific steps would be required:

- evaluation of *A. artemisiifolia* distribution in Italy,
- genetic characterization of weed and insect populations in Italy and North America,

- host specificity studies of the potential selected candidate arthropods,
- selection of one or more (specific) plant-pathogens (fungi),
- insect–pathogen interaction studies,
- evaluation of the impact of potential agents on the weed in a confined field environment,
- evaluation of potential synergisms with herbicides,
- development of an information and educational network.

In conclusion, real eradication (or at least suppression) of the target weed can be achieved only if Italy becomes involved together with other European Countries in an integrated network, using biological control in combination with other different agronomic and mechanical strategies.

### **Phytosanitary status of *Ambrosia artemisiifolia*—a few examples (Pierre Ehret)**

Experts participating on the workshop to discuss the problems caused by *Ambrosia artemisiifolia* in Vienna in 2006 recommended that ‘countries should explore legal possibilities to regulate Ambrosia’.

It is clear that, because of its extremely large geographic distribution, this weed does not fit with quarantine regulations in most parts of the world. Different types of ‘official control’ and different levels of decision (national, regional or local) do exist nevertheless. Some are in the phytosanitary field; more are related to health or more global environment fields.

Local or regional approach is well adapted to an already widespread weed, and biological control seems to warrant further exploration as part of the portfolio of control methods.

## **Discussion**

Biological control could be one of the tools to control common ragweed in Europe. Taking advantage of the examples from Australia and Russia with insect biological control agents, further investigation and research on rust and other weed pathogens needs to be developed at a European level. Although the total eradication of this plant is not feasible, a European program for the biological control of common ragweed would be highly desirable.

This workshop had as objective to reply to the conclusions of the experts at the workshop organized in Vienna by OLD (AT) and BBA (OF) at the NEOBIOTA conference. The presentations and conclusions provide a basis for forthcoming discussions in future scientific or political conferences on the management of common ragweed including the feasibility of a biological control program against *Ambrosia* in Europe.