

***Ambrosia artemisiifolia* – a motivation for European-wide control**



CHRISTIAN BOHREN, Research Station Agroscope Changins-Wädenswil ACW, CH- 1260 Nyon, Switzerland

October, 2008

Introduction

Common ragweed (*Ambrosia artemisiifolia* L.) or simply ambrosia is an annual shrub of North American origin. It has been present in Europe since ~1860 (HEGI, 1908) arriving probably through polluted clover seed grains and hay and straw from North America. Highly infested regions in Europe are the French Rhone valley, the Italian Po valley and some former Yugoslavian states, as well as Hungary. For about 15 years its abundance has been increasing in other countries of Europe – among them Switzerland.

Ambrosia is a dicotyledonous agricultural annual weed. It multiplies through seeds only. Germinating in central Europe towards the end of April, it develops into a monoecious plant with twice pennatifid leaves, giving the plant an open feathery appearance. Male and female flowers are on separate heads on the same plant. The male flowers appear in crowded spike-like racemes at the summit and in its upper axils producing large amount of pollen, from the beginning of July until fall. Female flowers appear in lower axils, each containing one single flower forming achene-like fruits from the middle of August until the end of the life cycle. Ambrosia does not survive frost.

A neophyte in Europe

This neophyte is a menace for agriculture, the environment and public health. In agriculture ambrosia invades all crops, but it can be controlled by many herbicides. In cereal crops ambrosia escapes the herbicide treatments in spring, so it must be controlled immediately after the harvest in the stubbles. Sunflowers are in the same botanical family as ambrosia; therefore no herbicides are available for the control of ambrosia in sunflower crop.

The enormous spread potential of ambrosia – one plant produces up to 3000 seeds a year – makes its control in agriculture a challenge and leads to quick invasions of non agricultural zones. As a pioneer species of the secondary succession ambrosia can easily establish itself especially in riparian zones and other natural, semi natural or disturbed open areas (FUMANAL *et al.*, 2008). When in bloom its abundant pollen causes hay fever, allergic rhinitis and severe asthma. Up to 15% of the population are sensible to ambrosia pollen in heavily infested areas. The acidophilus ambrosia produces an enormous amount of pollen, which can be carried over hundreds of kilometres. Ambrosia pollen is considered in North America as the main pollen allergen. Pollen is produced in Europe mainly during August and September, leading to a severe prolongation of the hay fever season for allergic people.

Menace to human health

Ambrosia pollen has a high allergenic potential (DECHAMP & MEON, 2002). One-gram of ambrosia pollen contains about 30-35 million pollen grains, and one well-grown plant can produce more than 45 grams of pollen in one year, depending on the quality of the habitat (FUMANAL *et al.*, 2005). About 10 pollen grains per m³ of air provoke allergic rhinitis in sensitive people – compared to 50 grass pollen grains (TARAMARCAZ *et al.*, 2005). In

Hungary ambrosia generates about half of the total pollen production (KAZINCZI *et al.*, 2008b).



Switzerland is a small country in central Europe and is mainly covered by the Alps. Most of the population lives in the lower parts and valleys, which are also the best habitats for ambrosia. Agroscope ACW assessed the distribution of ambrosia in 2005 (BOHREN *et al.*, 2006). Ambrosia was found mainly in private gardens of urban areas and mostly as single plant stands. It was proved that birdseed grains containing sunflower and millet polluted with ambrosia grains were one of the reasons why the abundance of ambrosia was increasing in urban areas (DELABAYS *et al.*, 2005).

Swiss authorities reacted quickly and declared mandatory the control of ambrosia in the ordinance of plant protection in 2006. Ambrosia groups were formed in several Swiss towns like Geneva, Neuchâtel and Lugano. Representatives of agriculture, public health, road services and nature conservation discussed the impacts of ambrosia on human health and environment. The agricultural Research Station Agroscope Changins-Wädenswil, ACW in Nyon was asked to develop control strategies for agriculture and for other disciplines like road services. Herbicide efficacy was tested in field trials during several years (BOHREN *et al.*, 2008). ACW established contact with gardeners, meteorologists, allergologists, schools, agricultural extension services, road and rail services and the Swiss army to provide information about Ambrosia control. ACW informs every year the general public via television, radio and press about the strategy to control ambrosia and the importance of a rigorous ambrosia control.

Aerobiology

Aerobiologists – among them the PAA (Pan American Aerobiology Association) and the Federal Office of Meteorology and Climatology MeteoSwiss – presented in June 2007 an international project. The goal is to forge an international collaboration among aerobiologists to build and operate an Internet-based platform to forecast aerial concentration of ragweed pollen in Europe and North America. Output from the final model will be available for all aerobiologists to use (GEHRIG *et al.*, 2007).

Control strategy

One important weakness in the life cycle of this species is the fact that ambrosia multiplies only through seeds. Therefore, a simple control strategy can be formulated:

Prevent the formation of fertile seeds: non-lethal control measures allow ambrosia to produce fertile seeds.

In areas where ambrosia is not yet established but the invasion has already started: The general public has to be informed about the life cycle of ambrosia, its appearance and the beginning of the bloom. Single plant stands must be uprooted by hand before pollen production. The plants are given to the household waste and are destroyed. Trained specialists must control larger foci.

In areas where ambrosia is abundant or established: All control measures must aim at the prevention of seed production. Mechanical control methods must guarantee that the plant is destroyed. The herbicidal efficacy must be observed until the death of the plant. Any non-lethal control measure has to be supplemented with other measures to insure the complete disruption of the life cycle. See also the website of the Working Group Invasive Plants of the European Weed Research Society (EWRS, 2008).



A round trip in Europe

France: Heavily infested areas in the Rhone Valley and the Burgundy; expanding towards the northwestern regions of the country (CHAUVEL & DESSAINT, 2005). Ambrosia isn't any longer subject to further research at the Institute National de la Recherche Agronomique (INRA) (Gauvrit, pers. com.) but is still subject to observation and severe control (SAUSSE, 2007).

Italy: In the Po Valley, mainly the Lombardy is heavily infested. According to a survey of the Ambulatorio di Allergologia e Immunologia Clinica, Ospedale di Magneta, Milano, ambrosia is the main allergen, but without statistical significance relative to the most second important allergen, the grass pollen (BOTTERO *et al.*, 2006).

Hungary: Ambrosia became the most important agricultural weed during the last 20 years. Almost 80% of the agricultural surface is infested (KAZINCZI *et al.*, 2008a). In Hungary the "Interministerial Commission for a Ragweedfree Hungary" of eight Hungarian ministries created a legal base making the control of ambrosia mandatory.

Serbia: Ambrosia populations in urban and rural environments are not the only problem; pollen is dispersed mainly from agricultural areas. It arrived in Serbia from South Hungary and East Croatia. It is the dominant weed in soybean and sunflower, subdominant in maize and sugar beet. Since 1999, a greater presence of ambrosia has been determined (Konstantinovich, personal communication).

Croatia: Ambrosia is abundant in Slavonia. The extent of the infestation is also being monitored in the whole country. Ambrosia is recognized as both a principal source of pollen for autumn allergies and a noxious weed in agriculture (STEFANIC, 2008).

In *Belgium, Czech Republic, Austria, Slovenia, Germany and Switzerland* many small foci were reported. They are found mainly in urban areas and it seems that ambrosia is not yet fully established in these countries. Gehring (personal communication) reported that ambrosia was found in self pick flower fields in Bavaria, southeastern Germany.

European-wide activities:

EWRS CALL FOR ACTION – RAGWEED: The WG members gathered together for a meeting of EWRS WG on Invasive Plants in Osijek, Croatia during the 2nd International Symposium "Intractable Weeds and Plant Invaders" in September 2008. There was no question about the importance of ragweed control. We also discussed the importance of long-term control.

For example: SWITZERLAND (beginning of invasion) has adapted its ordinance of plant protection in 2006 and declared an obligation to control ambrosia (BOHREN, 2008). This enables agricultural extension services to permanently enforce an effective ragweed control in agricultural fields. In HUNGARY (highly infested country) the "Interministerial Commission for a Ragweedfree Hungary" of eight Hungarian ministries created a legal base for the obligation of control and now cooperates with non-governmental organizations: control is mandatory for each land owner before the flowering period! Belated or negligent landowners can be fined from 20'000 to 5 million HUF (DANCZA, 2008).

The attached Call for Action may help YOU motivate responsible authorities in YOUR COUNTRY to enable long-term ragweed control on a legal basis.

You will soon find the "Call for Action" on the website of the EWRS WG on Invasive Plants: <http://www.ewrs.org/IW/default.asp>



References:

- BOHREN C., Delabays N., Mermillod G., 2008. *Ambrosia artemisiifolia* L.: Feldversuche mit Herbiziden. Agrarforschung 15 (5), 230-235
- BOHREN C., Mermillod G., Delabays N., 2008. *Ambrosia artemisiifolia* L. – Control measures and their effects on its capacity of reproduction. Journal of Plant Diseases and Protection, Special Issue XXI, 311-316
- BOHREN C., Mermillod G., Delabays N. 2006. Common ragweed (*Ambrosia artemisiifolia* L.) in Switzerland: development of a nationwide concerted action. Journal of Plant Diseases and Protection. Special Issue XX, 497-503
- BOTTERO P., Bonini M., Vecchio F., Sinico R.A. 2006. Prévalence de l'allergie due à l'ambrosie dans trois différents groupes de sujets asthmatiques. 18^{ème} Colloque pluridisciplinaire de l'AFEDA, ISSN 1271-3341. Ambrosie 23, 16-17
- CHAUVEL B., Dessaint F. 2005. L'ambrosie à feuilles d'armoise, une enquête sur son passé. INRA mensuel no. 125, Journal interne, hiver 2005 16-22
- DANCZA I., Géllert G., Pécsi P.L. 2008. Spread, and control measures against, common ragweed in Hungary. Proc. First International Ragweed Conference in Budapest, Hungary. 28
- DECHAMP C., Méon H., 2002. Ambrosies – polluants biologiques. Arppam edition Lyon, France. ISBN 2.902913.37.11
- DELABAYS N., Bohren C., Mermillod G., Keimer C., Kündig C. 2005. L'ambrosie à feuilles d'armoise (*Ambrosia artemisiifolia* L.) en Suisse : aspects malherbologiques. Revue suisse Agric. 37 (1) : 17-24
- EWRS (European Weed Research Society), homepage of the Working Group on Invasive Plants. Online: <http://www.ewrs.org/IW/default.asp>, accessed October 2008
- FUMANAL B., Girod C., Fried G., Bretagnolle F., Chauvel B. 2008. Can the large ecological amplitude of *Ambrosia artemisiifolia* explain its invasive success in France? *Weed Research* 48, 349-359
- FUMANAL B., Roulain A., Gaujour E., Chauvel B. Bretagnolle F. 2005. Estimation de la production des pollens et de semences d'une plante envahissante en France : *Ambrosia artemisiifolia* L. Proc. 17^{ème} Colloque pluridisciplinaire de l'AFEDA, ISSN 1271-3341. Ambrosie 22, 12
- GEHRIG R., Isard S., Ariatti A., Clot B., 2007. Collaboration internationale pour la prévision du pollen d'ambrosie. 19^{ème} Colloque pluridisciplinaire de l'AFEDA. Ambrosie 24, 11
- HEGI G. 1908-1931: Illustrierte Flora von Mitteleuropa: mit besonderer Berücksichtigung von Deutschland, Österreich und der Schweiz. Lehmann, München
- KAZINCZI G., Béres I., Novák R., Bíró K. 2008a. Common ragweed (*Ambrosia artemisiifolia* L.): A review with special regards to the results in Hungary: I. Taxonomy, origin and distribution, morphology, life cycle and reproduction strategy. *Herbologia* Vol. 9, No. 1, 55-91
- KAZINCZI G., Béres I., Pathy Z., Novák R. 2008b. 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* Vol. 9, No. 1, 93-118
- KAZINCZI G., Novák R., Pathy Z., Béres I. 2008c. Common ragweed (*Ambrosia artemisiifolia* L.): A review with special regards to the results in Hungary: III. Resistant Biotypes, control methods and authority arrangements. *Herbologia* Vol. 9, No. 1, 119-144
- SAUSSE C., Auda Y., Chollet D., Gendrot M. 2007. Evaluation de la télédétection de l'ambrosie sur quatre communes de l'Isère. 19^{ème} Colloque pluridisciplinaire de l'AFEDA. Ambrosie 24, 19
- STEFANIC E., Rasic S., Merdic S., 2008. Aerobiological and allergological impact of ragweed (*Ambrosia artemisiifolia* L.) in north-eastern Croatia. Proc. 2nd International Symposium Intractable Weeds and Plant Invaders, Osijek. 66
- 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 Weekly* (135) 538 – 548



- **1st International Ragweed Conference**
September 10-13 2008, Budapest, Hungary
- **2nd International Symposium „Intractable Weeds and Plant Invaders“**
September 14-18 2008, Osijek, Croatia

Concerned scientists call for action on a European invasive weed - **Ragweed**

Over one hundred scientists from 24 countries gathered together for two international congresses in September 2008 to discuss a problem of national and international importance – the invasion of *Ambrosia artemisiifolia* L. in Europe. This weed, which is native to North America, has highly allergenic pollen, which causes allergic rhinitis and severe asthma in over 20% of the population of affected areas. These health problems cause losses of work time and costs of medical visits and medication. Furthermore, projected climatic change will exacerbate the current situation and lead to more widespread health problems in the near future. In agriculture, the plant is also a significant agricultural pest, causing yield loss in many crops.

Ambrosia artemisiifolia is spreading actively throughout Europe at the present time. We recognize two situations - that of presently heavily infested areas, such as Hungary and Croatia, the hosts of the international congresses, and that of areas threatened with invasions, which it may still be possible to contain.

Our purpose is to inform responsible agencies of the major costs and dangers of this invasive plant and to urge strongly the adoption of measures to prevent further spread and to control current infestations. Management measures are urgently requested, adapted to different types of invaded habitats – agricultural fields, grazing areas, field margins, construction sites, road and railway corridors, and waste areas – all of which are area associated with human activities. There are also other areas of natural regular disturbance such as river and streambeds and highly eroded slopes.

Several control measures already exist and new ones are under development. Adequate management of this weed will require the concentrated and continued development and application of these measures over a long period. They will have to be adapted to each situation based on informed advice from local scientific experts. This must be coupled with detailed monitoring of the weed presence.

We urge all governments to take this issue seriously and respond with appropriate action in their areas of responsibility.