

CAN THE WEEDS BE RECOGNIZED AS QUARANTINE PESTS? – POLISH EXPERIENCES WITH AMBROSIA SPP.

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ABSTRACT

The paper presents Polish point of view on the weeds from the genus *Ambrosia*. Three species have the highest economic importance: common ragweed (*Ambrosia artemisiifolia*), perennial ragweed (*A. psilostachya*) and giant ragweed (*A. trifida*), which seem to possess the highest potential phytosanitary risk for Poland.

The above-mentioned *Ambrosia* species are native in North America. However, they have spread with plant material to other continents. In Poland, generally their distribution is limited to ruderal places, wastelands, lawns etc. Fruits of *A. artemisiifolia* and *A. trifida* have been intercepted in many consignments of plant material imported into Poland (grain of cereals, maize, soya bean etc.).

Ambrosia spp. are weeds harmful for various crops. They cause severe drying of plants and impoverishment of the soil and in consequence yield reduction. The pollen of these weeds causes strong allergic diseases known as "hay fever".

A Pest Risk Analysis (PRA) of the territory of the Republic of Poland (as PRA area) on *Ambrosia* spp. was carried out on the basis of information compiled in the format of EPPPO.

The key conclusions from this PRA are as follows.

1. *Ambrosia* spp. are quarantine pests justifying the use of phytosanitary measures to exclude them from the PRA area:

- *Ambrosia* spp. are rare in the PRA area and they occur mainly on ruderal places;
- the entire or almost entire PRA area is suitable for establishment of *Ambrosia* spp;
- the crops, which may be infested with the weeds, occur universally in the PRA area;
- *Ambrosia* spp. are of potential economic importance of the PRA area.

2. *Ambrosia* spp. are known to cause in the world losses in crops having economic importance in the PRA area.

3. The presence of *Ambrosia* spp. in crops of the PRA area would be prejudicial to Polish trade.

4. All consignments of sowing material and grain for processing of cereals, maize, soya bean, sunflower etc. from infested areas/sources warrant phytosanitary measures.

Key word: *Ambrosia* spp., weeds, quarantine, Pest Risk Analysis

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IZVLEČEK

ALI LAHKO PLEVELE UVRŠČAMO MED KARANTENSKE ŠKODLJIVE ORGANIZME? POLJSKE IZKUŠNJE Z VRSTAMI *Ambrosia* spp.

V prispevku je prikazan pogled na oceno škodljivosti plevelov iz rodu *Ambrosia*. Med njimi so še posebej ekonomsko pomembne tri vrste: navadna ambrozija *Ambrosia artemisiifolia*, večletna ambrozija (*A. psilostachya*) in velika ambrozija (*A. trifida*), ki predstavlja za Poljsko največjo nevarnost s stališča fitosanitarnega tveganja.

Vse omenjene vrste izhajajo iz severne Amerike, kjer predstavljajo avtohtono floro. Od tam se z različnim rastlinskim materialom širijo na druge celine. Na Poljskem so njihova nahajališča zazdaj omejena na nekmetijska zemljišča, ruderalna rastišča, trate in podobno. Semena *A. artemisiifolia* in *A. trifida* so na Poljsko prišla z različnimi pošiljkami rastlinskega materiala (zrnje žit, koruze, soje fižola, i.dr.).

Vrste *Ambrosia* so plevelne vrste, ki povzročajo škodo pri gojenju številnih rastlin tako, da odvezemajo vlago rastlinam, izčrpavajo tla in posledično povzročajo zmanjšanje pridelka. Pelod omenjenih plevelnih vrst povzroča močne alergije, ki jih poznamo kot "seneni nahod".

Za območje Republike Poljske je bila opravljena ocena tveganja škodljivih organizmov (Pest Risk Analysis - PRA) za rod *Ambrosia* spp. v skladu z EPPO smernicami. V nadaljevanju so predstavljene ključne ugotovitve.

1. Vrste *Ambrosia* so karantenski škodljivi organizmi, ki opravičujejo fitosanitarne ukrepe, s katerimi bi jim preprečevali širjenje na celotnem območju Poljske:
 - *Ambrosia* so na območju, za katerega je bila opravljena ocena tveganja, redke vrste in so zastopane večinoma na ruderalnih rastiščih;
 - Celotno oziroma večji del območja je primerno za rast in širjenje vrst iz rodu *Ambrosia*;
 - Gojene rastline, ki jih *Ambrosia* spp. vrste zapleveljajo, so v Poljski splošno razširjene;
 - *Ambrosia* spp. predstavljajo za območje, za katerega je bila opravljena ocena tveganja, potencialno pomemben ekonomski dejavnik;
2. Znano je, da povzročajo *Ambrosia* vrste v svetu ekonomsko pomembne škode.
3. Zastopanost *Ambrosia* spp. v posevkih na območju Poljske bi bila škodljiva za poljski blagovni promet.
4. Vse pošiljke sadilnega materiala in zrnja ter semena za predelavo žit, koruze, soje, fižola, sončnic in drugega semena iz okuženih območij/virov morajo vključevati predpisane fitosanitarne ukrepe.

Ključne besede: *Ambrosia* spp., pleveli, karantenska analiza tveganja od škodljivih organizmov

1. INTRODUCTION

Numerous harmful organisms are recognized as quarantine pests. Lists of quarantine organisms usually contain insects, nematodes, pathogenic bacteria, fungi, viruses and virus-like organisms and only sporadically – weeds. However, no weeds are recognized as quarantine pests in numerous countries, including EU member states. Phytosanitary authorities of these countries state that only quality norms for the material for sowing or processing should contain regulations concerning weeds.

Numerous weeds cause significant economic losses. Because of intensive development of both aerial and underground parts, some weeds are likely to cause drying and impoverishment of the soil and in consequence drying and death of crop plants. Weeds are likely to be spread together with plant material being in international trade. In accordance with Polish phytosanitary regulations some weed species are recognized as quarantine organisms. There are species, which are not present in Poland or occur, but at very low prevalence. These weeds have been intercepted in numerous consignments of the plant material, such as sowing material, grain for processing, fodders, etc. They can enter the territory of the Republic of Poland with infested material and are likely to establish, causing significant economic losses in various crops.

The paper presents Polish point of view on the phytosanitary risk caused by weeds from the genus *Ambrosia* for the territory Poland. A Pest Risk Analysis (PRA) of the territory of the Republic of Poland (as PRA area) on *Ambrosia* spp. was carried out on the basis of information compiled in the format of EPPO (OEPP/EPPO, 1993), with some modification arises from the nature of the pests – the weeds. Results of the PRA are briefly presented in this paper.

2. THE HARMFUL ORGANISMS

There are over 40 species of the genus *Ambrosia*. The following three species have the greatest economic importance: the common ragweed (*Ambrosia artemisiifolia* L.), the perennial ragweed (*Ambrosia psilostachya* D.C.) and the giant ragweed (*Ambrosia trifida* L.).

Ambrosia artemisiifolia is annual plants. Its stem is erect, to 1.2 m high. Leaves are usually twice-divided into narrow segments. There are separate: male (staminate) and female (pistillate) flower heads (Frankton and Mulligan, 1970; Bassett and Crompton, 1975). *Ambrosia* spp. produce so called siconia which consist of achenes and achenes woody coat. Syconium of *A. artemisiifolia* is egg-cub-shaped, with crown of sharp and thin dents (usually 6) surrounding the apex surface, 2.5 - 5.0 mm long, 1.2 - 2.2 mm in diameter.

Ambrosia trifida is also annual plant. Its stem is erect, 1-3 m high. Leaves are usually prominently 3-lobed. Flower heads contain either male or female flowers similar to these of *A. artemisiifolia* (Frankton and Mulligan, 1970; Bassett and Crompton, 1981). Syconium of this species is large, cup-shaped and narrow at a bottom, with the crown of 5-7 thick, sharp dents at 2/3 of fruit's length surrounding the apex surface, 5.0-10.0 mm long, 4.0-8.0 mm wide.

Above mentioned species reproduce by generative means, only.

Ambrosia psilostachya is a perennial plant. Its reproduction takes place mainly by vegetative means. The stem of this plant is usually to 1 m high. Leaves are pinnately to bi-pinnately lobed. The root system of this species is well developed and consists a lot of horizontal creeping rootstocks (Frankton and Mulligan, 1970; Bassett and Crompton, 1975). Siconia of this species is inversely egg-shaped, with a crown of small knobs (instead of dents), 3.0 - 6.0 mm long, and 3.5 mm wide.

3. AREA OF ORIGIN AND GEOGRAPHICAL DISTRIBUTION OF THE PESTS

The above-mentioned *Ambrosia* species are native in North America (Frankton and Mulligan, 1970; Bassett and Crompton, 1975). However, they spread to other continents, especially in the Northern Hemisphere. For instance, *A. artemisiifolia* was recorded as early as in 1838 in Michigan, the U.S.A. (Bassett and Crompton, 1975). In 1863 it was found in Germany, in 1875 in France, in 1902 in Italy. In the first decades

of 20th century it spread into such countries as Hungary, Yugoslavia, and the former USSR (Beres and Hunyadi, 1980; Igrc, 1987; Kovalev, 1989). *A. trifida* was introduced to Europe in 18th century.

The species *A. artemisiifolia*, *A. psilostachya* and *A. trifida* have been found on the territory of Poland, so far. Their distribution of these species within the country generally is limited to ruderal places, waste lands, lawns, sea ports, places near roads and railway tracks, surroundings of warehouses, oil mill and grain processing factories, fodder industry factories etc. (Krasicka-Korczyńska and Korczyński, 1995; Poscher, 1997; Rutkowski, 1998). *Ambrosia artemisiifolia* and *A. psilostachya* have sporadically infested crop fields (Szotkowski, 1981; Poscher, 1997). The number of foci of *Ambrosia* spp. found on territory of the Republic of Poland was the following: 32 foci in 1997, 12 foci in 1998 and 6 foci in 1999. However, none of *Ambrosia* species has found extensive habitats to become widely distributed in Poland. Plants of the genus *Ambrosia* have caused no economic damage in Poland, so far (Poscher, 1997).

4. ENVIRONMENTAL CONDITIONS FOR THE PESTS DEVELOPMENT

Plants of *Ambrosia* spp. prefer temperate, warm continental climate, dryer and warmer than the climate of Poland (Oberdorfer, 1994). Their development strongly depends on temperature. For instance, after 28 days with temperatures 10, 20, 30 and 40 °C germination of *A. artemisiifolia* was 6.9, 8.6, 8.1 and 0.8% respectively (Bassett and Crompton, 1975). The germination of *A. psilostachya* starts when the soil temperature reaches 13-15 °C. Seeds of *A. trifida* starts to germinate when the soil temperature is 5-6 °C, but their best germination is observed under alternating temperatures of 20-30 °C (Bassett and Crompton, 1981).

Plants of the genus *Ambrosia* require full light. The soil moisture is also very important factor. *Ambrosia* spp. prefer dry and fresh soils (Oberdorfer, 1994).

Except of climatic conditions, the fertility of the soil is also very important factor. During studies conducted in Poland, Krasicka-Korczyńska and Korczyński (1995) found, that the development of *A. psilostachya* was the best on aerated, penetrable and fertile soils.

5. ECONOMIC IMPORTANCE OF THE WEEDS

Weeds from the genus *Ambrosia* occur in different crops such as cereals (wheat, rye, barley, oat), maize, root crops (sugarbeet, potatoes), soya bean, sunflower, fodder plants and in orchards, meadows, pastures etc. (Stefanović and Šinžar, 1993; Savotikov and Smetnik, 1995).

Ambrosia spp. frequently overgrow cultivated plants, which leads to quick drying and impoverishment of the soil, causing significant economic losses in plant production (Savotikov and Smetnik, 1995). Because of erect, hard stems these plants make difficult the harvest of cereals and another plants with agricultural machines such as combine harvesters. The weeds may have certain effect on biodiversity of the vegetation. The pollen of all plants of the genus *Ambrosia* causes strong allergic diseases. These diseases are known as "hay fever" (Bassett, Crompton and Frankton, 1976). The pollen or the oil contained in leaves of *Ambrosia* can also cause dermatitis in sensitive people (Frankton and Mulligan, 1970).

The prevalence of *Ambrosia* spp. in different crops is well known, but precise values of economic losses are difficult if not impossible to estimate (Dickerson, 1968). However, Webster et al. (1994) found, that in Ohio, USA, only one plant of *A. trifida* per 1m² reduced soya bean seed yield 45% and 77% in two successive years.

6. CONTROL OF THE PESTS

The pests are controlled using techniques of agrotechnical, mechanical, chemical and biological methods. However, the control is difficult. Numerous, alive seeds of annual plants can survive buried in soil for many, whilst horizontal roots of perennial species can remain unaffected by herbicides.

In Russia for the control of *Ambrosia* are recommended some techniques of field-crop production such as proper crop rotation, tillage system and cultivation of plants causing decrease of the number of seeds of the weeds and making impossible the re-contamination of the fields with siconia of this weed (Savotikov and Smetnik, 1995).

During experiments conducted in Northern Poland, Miziniak, Praczyk and Banaszak (2001) found that drying of rootstocks of *A. psilostachya* and their covering with thick soil layers affected their survival. For instance, no shoots emerged from rootstocks, which during drying had lost 60% of their mass and had been covered with 25-cm soil layer.

Ambrosia spp. may be controlled with different herbicides. *Ambrosia artemisiifolia* and *A. trifida* are more effectively controlled than *A. psilostachya*. During experiments conducted in Northern Poland, thirteen herbicides were used for treatments against *A. psilostachya*. In autumn, 133 days after the treatment, its single aerial shoots started to emerge, even when initial control efficiency was 100% (Miziniak and Banaszak, 1998). Very important measure is also careful examination of all consignments of plant material being in international trade for the presence of siconia of *Ambrosia* spp.

Despite of intensive control measures, there are no records of successful eradication program of the weeds from any infested places.

7. PEST RISK ASSESSMENT (PRA) ON AMBROSIA SPP. FOR THE TERRITORY OF REPUBLIC OF POLAND

The PRA process was initiated by the weeds, which have been intercepted many times in plant material imported to Poland. For instance, in the period 1996-1999 *Ambrosia* spp. were found in 532 consignments of plant material imported to Poland, especially such as grain of cereals, maize, soya bean and sunflower and soya meal (Karnkowski, 1999).

Scores obtained for the following parts of the PRA process were as follows (the lowest score = 1, the highest score = 9):

Probability of introduction..... 6.61

The average score obtained - 6.61 indicates that the probability of introduction of weeds of the genus *Ambrosia* to the PRA area with imported plant is relatively high.

Probability of establishment.....7.17

The average score obtained - 7.17 is relatively high. It indicates that *A. artemisiifolia*, *A. psilostachya* and *A. trifida* introduced into the PRA area may establish there and develop both on ruderal places and crop fields.

Economic impact.....6.10

The average score obtained - 6.10 indicates that the probability of causing economical losses by *A. artemisiifolia*, *A. psilostachya* and *A. trifida* in the crop fields is relatively high.

8. RISK MANAGEMENT

The PRA concludes with an evaluation of the risk management options to reduce the likelihood of successful transfer of *Ambrosia* spp. to PRA area.

Several management options were considered among which three:

- intensive control of the weeds in crops.
 - cleaning of contaminated plant material,
 - grinding of contaminated material for processing,
- could give adequate phytosanitary protection.

9. CONSEQUENCES OF THE PRA RESULTS.

On the basis of PRA results *Ambrosia* spp. were placed in "The list of harmful organisms subject to compulsory control" (OJ, No.15, 1996). Therefore the plant material imported to Poland is sampled and examined by inspectors (officers) of Border Points of Entry of Voivodeship Plant Protection Inspectorates. Lots contaminated with siconia of *Ambrosia* are rejected and returned to sender to avoid the spread of the weeds during transportation.

Within the country surveys for *Ambrosia* spp. are conducted by inspectors of Voivodeship Plant Protection Inspectorates on crop fields and at ruderal places, waste lands, lawns, places near roads etc.

All foci of the weeds the found during such surveys are officially controlled (eradicated). The programme of control of the weeds has been published as an official document of the Main Inspectorate of Plant Protection. It may also be found in the paper of Małuszyńska et al. (1998).

10. FINAL CONCLUSIONS

Can the weeds be recognized as quarantine pests?

Each country decides which organisms should be listed as quarantine pests. This decision is conditioned by climatic conditions, crop pattern, area of particular crops, assortment and place of origin of imported plant material etc. In Poland the area of cereal and root crops, which may be infested with *Ambrosia* spp. is considerable. Poland imports big quantities of the plant material, which is likely to be contaminated with siconia of these weeds. Big part of this material is imported from countries where *Ambrosia* and other quarantine weeds occur at very high prevalence. That is why quarantine restriction are the most effective to prevent the introduction of these weeds into the territory of Republic of Poland. Cleaning and grinding of infested plant material can be effective, but some undamaged siconia may be present in the material after such treatments.

In compliance with above, to answer to the question "Can the weeds be recognized as quarantine pests?" may be "Yes" if some weeds possess a risk for given country and recognition them as a quarantine organisms seems necessary from the point of view of this country.

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