

Achenes of common ragweed (*Ambrosia artemisiifolia*) in packages of sunflower achenes for outdoor birds

Plodovi pelinolistne žvrklje (*Ambrosia artemisiifolia*) v paketih sončničnih plodov za prostoživeče ptice

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Abstract: Common ragweed (*Ambrosia artemisiifolia*) is a highly invasive annual plant, introduced to Europe from North America. One of the important spreading vectors of *Ambrosia* is trading with contaminated sunflower achenes. We analysed the content of ragweed achenes in the packages of sunflower achenes for outdoor birds, which are available in Slovenian shops and markets. The ragweed achenes were found in 29 % of the 28 analysed packages. In three packages, the mass percentage of *Ambrosia* achenes per kg of animal feed exceeded the maximum content (50 mg/kg) allowed by EU law. The analysis showed that it is not possible to infer the presence or absence of *Ambrosia* achenes in a sample from the amount of impurities in the package of sunflower achenes for bird feed.

Keywords: *Ambrosia artemisiifolia*, *Helianthus annuus*, invasive species, ragweed, Slovenia, sunflower fruits

Izvleček: Pelinolistna žvrklja (*Ambrosia artemisiifolia*) je invazivna tujerodna enoletnica, ki je bila v Evropo prinesena iz Severne Amerike. Pomemben vektor širjenja vrste predstavlja transport in trgovanje s plodovi sončnic, ki vsebujejo primešane plodove žvrklje. V raziskavi smo preverjali prisotnost plodov žvrklje v paketih sončničnih plodov za hranjenje prostoživečih ptic. Plodovi žvrklje so bili prisotni v 29 % od 28 paketov hrane za ptice, ki smo jih kupili v slovenskih trgovinah. V treh paketih je količina plodov presejala največjo določeno količino plodov žvrklje, kot jo določa evropska zakonodaja (največ 50 mg/kg). Ugotovili smo tudi, da količina nečistoč v paketu ni povezana s prisotnostjo plodov žvrklje.

Ključne besede: *Ambrosia artemisiifolia*, *Helianthus annuus*, invazivna tujerodna vrsta, pelinolistna žvrklja, Slovenija, sončnični plodovi

Introduction

Common ragweed (*Ambrosia artemisiifolia*) is an annual plant from the family *Asteraceae*. It was introduced to Europe from North America in the 19th century (Csontos et al. 2010, Hegi 1979). In Europe it is considered an invasive alien species. It populates fields (corn, sunflower, pumpkin ...), river banks, and disturbed places such as railways and road edges (Hegi 1979). It is detrimental to human health as it produces highly allergenic pollen, which causes late summer hay fever (Kofol Seliger 2001, Taramarcaz 2005).

The first records of the presence of *Ambrosia artemisiifolia* in Slovenia are from Leskovec near Krško in 1950 (Wraber 1983). In next years some new localities were discovered, and Wraber (1983) marked this species as casual in Slovene flora, dispersed with human activities. The first data about naturalisation of the species are from Prekmurje (Wraber 1983). In the last years the species has become present in almost all lowlands in Slovenia, and it is now known as one of most invasive alien plant species in Slovene flora (Jogan and Vreš 1998, Jogan 2001, Jogan et al. 2009).

Ambrosia artemisiifolia is an annual plant, 0.2–2.5 m high. One or more male flowers are grouped in numerous much reduced capitula, which include one or more male flowers. Male capitula are grouped in racemes at the end of branches, while female flowers are located at the bases of upper leaves. *Ambrosia artemisiifolia* is a short-day plant, and its flowering time begins in late summer (Allard 1943). Its fruits are achenes, each containing one seed. That is the reason for the simplified naming of ragweed achenes as seeds in non-botanical general use (newspapers, media ...). Achenes usually drop off the mother plant, and they become part of soil seed bank, but they may also be dispersed by water or by human activities. Seeds have primary and secondary dormancy (Baskin and Baskin 1980), and can remain viable for 40 years (Darlington 1922, Telewski and Zeevaart 2002).

One of the important spreading vectors of *Ambrosia* is trading with contaminated sunflower seeds (more precisely: fruits or achenes) (Jehlik and Hejny 1974, Wraber 1983, Essl et al. 2009). Researchers in Austria have noticed that *Ambrosia* became frequent in habitats associated with bird

feeding during the period 1950–1979 (Essl et al. 2009). In the international European research performed in years 2005 to 2009, which involved institutes from Switzerland, Germany, Denmark and Slovenia, *Ambrosia* achenes were found in a large proportion of the analysed sources of bird feed (Frick et al. 2011).

The spread of *Ambrosia* in Slovenia is controlled by two legally adopted regulations. The first is Commission Regulation (EU) No 574/2011 of 16 June 2011, concerned with undesirable contents of animal feed, including *Ambrosia* seeds (Anon. 2011). The limit of intervention is 50 mg of *Ambrosia* seeds per kg of animal feed (Anon. 2011). The second is the Slovene regulation “Odredba o ukrepih za zatiranje škodljivih rastlin iz rodu *Ambrosia*” (Decree on measures to suppress harmful plants of genus *Ambrosia*), that obliges every citizen to remove all *Ambrosia* plants from his property, and he has to prevent the plants from developing flowers and fruits (Anon. 2010).

The aim of our research was to check if the packages of sunflower seeds for outdoor birds available in Slovene shops and markets contain ragweed achenes, to assess the extent of this contamination and to compare it with legally adopted regulations.

Materials and methods

In autumn of 2011 we collected 35 samples of packages of sunflower seeds for bird feed from various shops and markets in Slovenia for analyses of ragweed contamination. The samples were planned to cover: (1) different parts of Slovenia, (2) different shops and suppliers, and (3) different package sizes. Every package was numbered, and the bills from the shops were stored together with the package to keep the information about the date and locality of the purchase.

The following data have been collected from package labels: package ID, commercial name, size (weight), serial number or LOT number, country of sunflower fruit production, date of packaging, type of sunflower nuts (black, white, striped, mixed), and data about the purchase: location of shop, shop name, and date.

The first step in separating the ragweed achenes from sunflower achenes was hand-sieving. For

this purpose, a special sieve with 1.5–2.3 mm wire mesh size was made. Prior to examination of the samples, the sieve was tested with artificial (prepared) mixture of sunflower and ragweed achenes. Since no ragweed achenes stayed on the sieve, and only a few sunflower achenes were smaller than the mesh size, we considered the hand-made sieve suitable enough for fractioning the samples.

Secondly, the small fraction that presumably contained the *Ambrosia* achenes was weighted and stored in a plastic bag. The fraction with sunflower achenes was weighted as well.

A small fraction was further analysed using a stereomicroscope (20 × magnification) to sort out ragweed achenes. Achenes were weighted, counted and stored in a small plastic bag.

There are two other species from genus *Ambrosia* present in Slovenia: *A. psilostachya* and *A. trifida*, but *A. artemisiifolia* is the most common one (Buttenschön et al. 2008–09, Jogan 2001). There is a minor possibility that some of the ragweed fruits we found in bird feed belonged to other *Ambrosia* species, since no detailed species determination was made based on *Ambrosia* achenes properties. According to the frequency of all *Ambrosia* species in Europe and Slovenia, we assumed that the majority of achenes belonged to *Ambrosia artemisiifolia*.

Results

35 packages of sunflower seeds for bird food were collected in different Slovene shops. Seven packages were excluded from the analysis because it was not possible to isolate ragweed achenes by using the described methods.

Altogether, 2 packages of 5 kg, 24 packages of 1 kg, one package of 0.6 kg, and one package of 0.5 kg of bird feed were analysed (Table 1).

We included 13 different producers or importing companies of bird feed, but it is possible that they had the same source of raw material. The data about the origin of the sunflowers were absent from the majority of the packages labels. They were written only on 8 packages (23%).

The results of the analysis are shown in Table 2. Ragweed achenes were found in 8 packages of bird feed (29%). In three packages, the mass

percentage of *Ambrosia* seeds per kg of animal feed exceeded the maximum content (50 mg) allowed by EU law (Anon. 2011). Producers of these three packages were Agrolit, Semenarna Ljubljana and AnimaPet.

We have included more than one sample of bird feed from the same producer (Erdtmanns, Agrolit, Tukano, and Semenarna Ljubljana), and the same series of raw material in our analysis (Table 3). It is apparent, that there are big differences in contents of ragweed achenes in packages within the samples of the same producer, and even within the same series of the raw material (0 or 35 ragweed achenes in 1 kg of bird feed in the case of Semenarna Ljubljana, 105-PC, Table 3).

The analysis of correlation between the number of ragweed achenes and the content of the small fraction (impurities) in the sample showed that there is no clear connection between these parameters. Therefore we cannot infer the presence or absence of *Ambrosia* seeds in a sample just from the amount of impurities in the package of sunflower achenes for bird feed.

Discussion

Ragweed achenes were found in one third of the 28 analysed packages of bird feed. In three packages, the mass percentage of *Ambrosia* seeds per kg of animal feed exceeded the maximum content (50 mg) allowed by EU law (Anon. 2011). Thus, these packages should not be sold. From a biological point of view, all packages containing one or more seeds of *Ambrosia* are problematic. Only one successfully germinated seed that develops into a flowering and afterwards fruiting plant is enough to establish a new population of *Ambrosia*. Although a smaller number of the seeds reduces the possibility of such event, it still makes it possible.

The National Veterinary Institute conducted a similar investigation in 2007/08 and 2008/09, analysing 10 samples of bird feed each year (Frick et al. 2011). *Ambrosia* achenes were found in 7 and 5 samples, respectively, with the highest amount of 292 *Ambrosia* achenes per kg of bird feed. In our samples from 2011, the contamination with *Ambrosia* achenes was lower (33% of contaminated samples with maximum 198 *Ambrosia* achenes

Table 1: Information about the packages of sunflower fruits for bird feed used in the analysis. Packages no.: 2, 6, 7, 10, 11, 19 and 22 (grey shading) were excluded from the analysis (explanation in the text). × – no data, *unpacked sunflower achenes with no commercial name bought on a food market.

Tabela 1: Informacije o paketih sončničnih plodov za hranjenje zunanjih ptic, ki smo jih zbrali za analizo. Pakete 2, 6, 7, 10, 11, 19 in 22 (siva podlaga) smo iz analize izključili (razlaga v besedilu). × – ni podatkov, *nepakirani sončnični plodovi kupljeni na tržnici.

Sample number	Commercial name	Producer/Importing company	Lot/Series	Package size (kg)	Country of origin of sunflowers
1	Sonnenblumen Kerne	Erdtmanns	210910	1	x
2	Bonami	Semenarna Ljubljana	105-PC	1	x
3	Bela sončnična semena	Versele_Laga	B-9800	0.6	Belgium
4	Sončnice pisane	Roko	480-43486	1	Hungary
5	Hobby Vit	Tukano	21300040	1	Bulgaria
6	Menu Complete	Friskies	EAN	0.4	x
7	Lojna pogača	Vogel pick	21305065	0.2	x
8	Sončnična semena	Tukano	21300042	1	Bulgaria
9	Bonami, Sončnice pisane za ptičjo hrano	Semenarna Ljubljana	460-PC	5	x
10	Bonami, Hrana za zunanje ptice	Semenarna Ljubljana	P1330	5	x
11	Bonami, Mešanica semen	Semenarna Ljubljana	70507015	1	x
12	Bonami, Semena sončnic	Semenarna Ljubljana	460-PC	1	x
13	Bonami, Sončnice Mešane	Semenarna Ljubljana	P1279	1	x
14	Hobby Vit	Tukano	M1/17:21:29 /10/10/11	1	x
15	Sončnična semena	Roko	480-43486	1	x
16	Bonami	Semenarna Ljubljana	105-PC	1	x
17	Sončnice Mešane	Semenarna Ljubljana	P1278	5	x
18	Sončnice pisane	Zoo hoby Škofja Loka	0013	1	x
19	Hobby Vit	Tukano	11246	1	x
20	Sonnenblumen Kerne	Tierell	772013	1	x
21	Bonami, Mešanica semen	Semenarna Ljubljana	P1331	1	x
22	Bonami, Semena sončnic	Semenarna Ljubljana	460-PC	1	x
23	Sončnična semena	Agrolit	19. 9. 2011	1	x
24	Bonami, Semena sončnic	Semenarna Ljubljana	105-PC	1	x
25	Hobby Vit	Tukano	21300042	1	Bulgaria
26	Sončnična semena	Roko	11/210	1	Hungary
27	Sončnična semena	Agrolit	4. 12. 2010	1	EU
28	Sončnična semena	Agrolit	19. 9. 2011	1	x
29	Sonnenblumen Kerne	Erdtmanns	210910	1	x
30	Sonnenblumen Kerne	Erdtmanns	210910	1	x
31	Futter Boy	Erdtmanns	210829	0.5	x
32	Hesa Saaten	Tierell	CHA70	1	x
33	Sončnična semena	Hobby program	21300042	1	x
34	Sončnična semena 1kg	AnimaPet	598.10	1	EU
35	x*	food market	x	1	x

Table 2: Presence of ragweed achenes in the analysed packages of the bird feed.

Tabela 2: Prisotnost plodov žvrklje v pregledanih paketih ptičje hrane.

Sample number	Content of ragweed achenes (mg/kg)	Number of ragweed achenes	Mass % of the small fraction (including ragweed)
24	198	35	1.9
23	61	11	0.5
34	51	9	0.7
28	45	8	0.5
29	34	6	0.3
14	6	1	0.3
22	6	1	0.3
17	1	1	0.1
1	0	0	0.3
3	0	0	0.4
4	0	0	0.2
5	0	0	6.8
8	0	0	0.4
9	0	0	0.1
12	0	0	0.3
13	0	0	0.5
15	0	0	0.2
16	0	0	0.4
18	0	0	0.2
20	0	0	0.4
25	0	0	0.4
26	0	0	0.2
27	0	0	2.2
30	0	0	0.3
31	0	0	0.7
32	0	0	0.4
33	0	0	0.7
35	0	0	0.4

per kg of bird feed), which may indicate a gradual decrease of the contamination level in bird feed available on Slovene market.

In Slovenia, every citizen is obliged to remove all *Ambrosia* plants from his property and he has to prevent the plants from developing flowers (because of the allergenic pollen) and fruits (to limit their dispersal) (Anon. 2010). Therefore it is very important to inform people that it is highly possible to introduce *Ambrosia* into gardens with contaminated bird feed. In Slovenia this is already in progress. Informations about *Ambrosia* and the related problems were already published in public journals (Jogan 2011, Bačič

2012, Strgulc Krajšek 2013), project publications (for example: Buttenschön et al. 2008–09), and on different websites (for example: Project Thuja: <http://www.tujerodne-vrste.info>, DOPPS: <http://www.ptice.si>).

Povzetek

Pelinolistna žvrklja (*Ambrosia artemisiifolia*) je ena najbolj razširjenih invazivnih tujerodnih rastlinskih vrst na območju Slovenije (Jogan et al. 2001). Gre za severnoameriško vrsto, ki je bila v 19. stoletju nehote prinesena v Evropo in

Table 3: Differences in number of ragweed achenes among the packages of bird feed of the same producer, or the same series of the raw material.

Tabela 3: Razlike v prisotnosti plodov žvrklje med paketi istega proizvajalca in iste serije paketov sončničnih plodov.

Producer, Series	Sample number	Package size (kg)	Mass of small fraction (including ragweed) (g)	Number of ragweed achenes
Erdtmanns, 210910	1	1	2.9	0
	29	1	3.2	6
	30	1	3.0	0
Agrolit, 19. 9. 2011	23	1	5.5	11
	28	1	5.0	8
Tukano, 21300042	33	1	6.8	0
	25	1	3.6	0
	8	1	4.4	0
Semenarna Ljubljana, 105-PC	24	1	18.9	35
	16	1	3.9	0
Semenarna Ljubljana, 460-PC	9	5	4.8	0
	22	1	3.1	1
	12	1	3.5	0

se širi predvsem ob železnicah, cestah, ruderalnih mestih in poljih (Jogan 2009). Problematična je zaradi alergena peloda, ki povzroča pozno-poletni seneni nahod. Eden od pomembnejših vektorjev razširjanja je prenos plodov žvrklje skupaj s sončničnimi plodovi, ki jih prodajajo za hranjenje prostoživečih ptic (Essl et al. 2009, Frick et al. 2011).

V okviru raziskave smo pregledali pakete sončničnih plodov za hranjenje ptic, ki so na prodaj v trgovinah v Sloveniji. Naš namen je bil ugotoviti, v kolikšni meri se v njih pojavljajo plodovi (oreški) pelinolistne žvrklje. Pakete hrane za ptice smo nakupili jeseni leta 2011. Zbrali smo 35 paketov, od katerih jih 7 nismo pregledali, ker se z izbranimi metodami iz njih ni dalo ločiti plodov žvrklje. Za izolacijo plodov žvrklje smo uporabili metodi sejanja skozi sito in ročnega prebiranja vzorca. Izmed 28 pregledanih paketov ptičje hrane, smo plodove žvrklje našli v 8 paketih, kar predstavlja 29 % pregledanih vzorcev. V treh paketih je količina plodov žvrklje presegala zakonsko predpisano zgornjo dovoljeno mejo masnega deleža plodov pelinolistne žvrklje (Anon. 2011), kar ustreza 9 plodovom pelinolistne žvrklje na kilogram ptičje krme. Ugotovili smo veliko

raznolikost vsebnosti plodov žvrklje med paketi istega proizvajalca (uvoznika) in celo znotraj iste serije pakiranja sončničnih plodov, kar je verjetno povezano z načinom pakiranja plodov. Količina nečistoč, ki jih predstavlja drobna frakcija po sejanju vzorca skozi sito, v paketu ni povezana s količino plodov žvrklje.

Na slovenskem tržišču so torej v prodaji paketi sončničnih plodov za hranjenje zunanjih ptic, ki vsebujejo plodove žvrklje, celo s količinami, ki presegajo zakonsko določeno zgornjo mejo. Nujno je obveščanje potrošnikov o tem problemu, saj lahko zaradi priljubljenega zimskega hranjenja ptic posamezniki nehote razširjajo to alergeno rastlino in jo celo занesejo na svoje vrtove, od koder pa jo morajo od v skladu z odredbo iz leta 2010 odstranjevati (Anon. 2010).

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