

Ambrosia artemisiifolia L. seeds in bird food in Luxembourg: a comparative study, 2007 to 2014

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Abstract. *Ambrosia artemisiifolia* L. is an allergenic North American plant, currently invading Europe. One of its most important vectors is bird food. This study assesses the content of *A. artemisiifolia* seeds in different commercial bird food types and compares the results with previous studies conducted in Luxembourg. The levels of *A. artemisiifolia* seeds in bird food declined from 2007 to 2012 and stayed at a stable level in 2014. In 2014 four samples exceeded the limit of 50 mg/kg set by the EU commission regulation No 574/2011, three of which were labelled “*Ambrosia* controlled”.

1. Introduction

Ambrosia artemisiifolia L. is an allergenic (Laußmann et al. 2014) annual Asteraceae native to North America (Allard 1945). The first plants on European soil were found in the mid-19th century (Bretagnolle & Chauvel 2009). The species often establishes in abandoned fields, disturbed areas like roadsides (Bassett & Crompton 1975, Starfinger 2009) and particularly in corn and sunflower fields (Bassett & Crompton 1975). From the latter *A. artemisiifolia* plants or parts of them get into many agricultural products, which are often processed leaving plant seeds destroyed (EFSA 2010). Bird food, however, is mostly not processed and thus becomes one of the main vectors of spread for *A. artemisiifolia* in Europe (Vitalos and Karrer, 2008, Essl et al. 2009, EFSA 2010). This led to two studies on *A. artemisiifolia* in bird food for Luxembourg (Thommes 2008, 2009, Ries et al. 2012). This 2014 study has the objective to continue the previous work and give an overall evaluation of *A. artemisiifolia* seed content in bird food for Luxembourg.

2. Material and methods

In November 2014, 73 samples of different types of bird food were bought at the most important supermarkets, hardware stores and pet shops in Luxembourg. We tried to cover a large spectrum, so every available type of food, except specialized food for exotic birds was acquired; in total 33 seed mixture, 15 pure sunflower seed, 1 hemp seed and 24 fat ball samples. The latter include all possible shapes and variations of seeds covered in fat. Two fat balls of each type were dissolved in warm water, which only left the grains for further analysis. Every sample was processed through a sieve with a 3 mm hole diameter. The remaining fractions were analysed under a magnifying glass to identify *A. artemisiifolia* seeds, which were removed for weight measurement. All *A. artemisiifolia* seeds were counted and weighed with a laboratory scale (AB104-S Mettler Toledo, Gießen, Germany).

The current study is based on results from 2007 (Thommes 2008, 2009) and 2012 (Ries et al. 2013).

All graphics and tables were done using Microsoft Excel 365. Simple correlation

coefficients and chi-squared values were calculated using R 3.1.2 (R Development Core Team 2008).

3. Results

There has been a strong decrease in *Ambrosia artemisiifolia* seed content from 2007 to 2012 and 2014 (Fig. 1). To account for an important outlier in the 2012 dataset, we decided to choose median values rather than mean values. For sunflower seeds the median value of *A. artemisiifolia* seeds per kilogram went from 156.67 to 2.00 and 1.90 seeds/kg respectively. The same change can be observed for seed mixtures, where the content of *A. artemisiifolia* seeds declined from 20.45 to 1.00 and 2.80 seeds/kg respectively. It is, however, important to note that the 2014 value is higher than the number recorded in 2012. The number of *A. artemisiifolia* seeds in fat balls went from 67.84 seeds/kg in 2007 to 8.41 in 2012 and 6.67 in 2014.

The general distribution of samples with and without *A. artemisiifolia* seeds (Fig. 2) draws a similar picture to Fig. 1. Overall, the percentage of samples containing *A. artemisiifolia* seeds drops strongly from 2007 to 2012. The number of sunflower seed products declines from 58% of samples containing *A. artemisiifolia* seeds in 2007 to 27% in 2012 and further to 13% in 2014. In mixtures we observed a slight raise from 2012 to 2014, thus the number initially declined from 91%

containing seeds in 2007 to 17% in 2012 and rose again to 26% in 2014. For fat balls the number dropped from 44% containing seeds in 2007 to 25% in 2012 and stayed more or less stable in 2014 with 21% of samples containing *A. artemisiifolia* seeds.

All samples containing *A. artemisiifolia* seeds from 2012 and 2014 are listed in Table 1. To check compliance with the EU commission regulation No 574/2011 of June 2011, the weight of the *A. artemisiifolia* seeds was measured to determine the content in mg/kg of bird food. The EU commission's regulation sets a limit of 50 mg of *A. artemisiifolia* seeds per kg of bird food at a moisture content of 12% (Publications Office 2011). The 2012 and 2014 studies did not account for moisture, but Jakovac-Strajn et al. (2013) found, in a similar study, moisture contents of 3.42% to 11.9%, suggesting that the moisture levels are rather below the value set by the EU commission. In 2012 two samples exceeded the limit set by the EU commission of 50 mg/kg. Thus one fat ball sample contained 76.67 mg/kg and one sunflower seed sample exceeded the limit nearly hundredfold with 4813.8 mg of *A. artemisiifolia* seeds per kg of sunflower seeds. Interestingly the latter was even labelled *Ambrosia* controlled. These samples represent 5.88% of all samples. In 2014, 4 products exceeded the limit. Three seed mixture products contained 61.64 mg/kg, 87.06 mg/kg and 102.87 mg/kg respectively. The three products were labelled *Ambrosia* controlled. The highest number of 146.67mg/kg, so

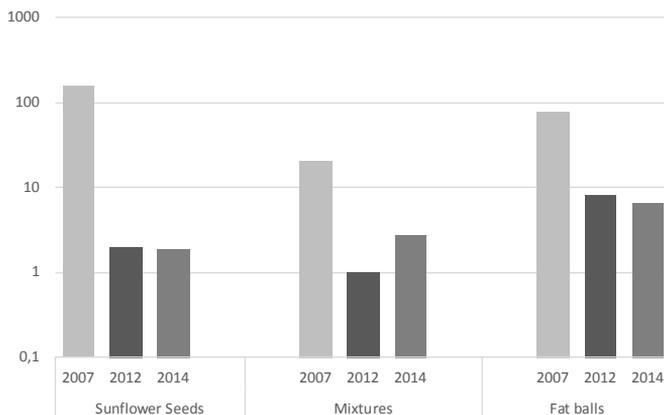


Fig. 1. Median values of the number of *A. artemisiifolia* seeds per kg for samples containing *A. artemisiifolia* seeds.

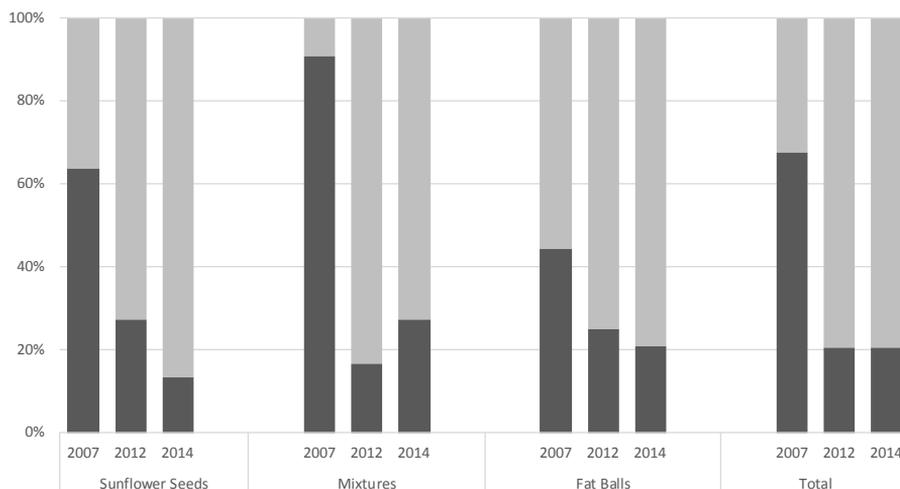


Fig. 2. Percentage values of samples with (dark grey) and without (light grey) *A. artemisiifolia* seeds for sunflower seeds, seed mixtures and fat balls from 2007, 2012 and 2014.

nearly three times the limit, was found in a fat ball sample. These samples represent 5.48% of all samples in 2014.

We further tested the correlation of price per kg bird food and the number of *A. artemisiifolia* seeds identified using R's (R Development Core Team 2014) `cor` function. For 2012 alone the correlation was -0.12, for 2014 it was -0.01 and the combination of both datasets gave a correlation value of -0.06. These values show no correlation between the price of the food and its *A. artemisiifolia* seed content, so in this case more expensive does not mean "better".

A chi-squared test performed by the `chisq.test` function in R (R Development Core Team 2014) between the proportion of samples with and without *A. artemisiifolia* seeds from 2012 and 2014 gave a chi-squared value of 0 with a p-value of 1, indicating no significant changes between these two years. More precise tests of changes in sunflower seeds, seed mixtures and fat balls were omitted due to the small number of samples.

4. Discussion

Our results show that the number of *Ambrosia artemisiifolia* seeds in bird food strongly

decreased from 2007 to 2012 and 2014. The EU commission's regulation certainly is accountable for this change. Another important factor would be public awareness. *A. artemisiifolia* has been brought to general consciousness by several media and so the number of labelled products increased from 12% in 2012 to 32% in 2014 to improve product sales. Unfortunately these labels do not guarantee that the product is actually free of *A. artemisiifolia* seeds. Due to time constraints no germination tests have been performed. However, a previous study (Thommes 2008, 2009) found germination rates between 0% and 100% with a median value of 17%. This is a crucial point, due to the fact that producers may treat their seeds in order to inhibit germination. The EU commission's regulation, however, does not give a statement on such procedures and thus the limit value of 50 mg/kg is applicable.

Furthermore, the authors got informed by a hobby gardener that he found *A. artemisiifolia* plants in his garden after using a flower meadow mixture in 2014. This could be a new and very effective pathway for the plant and may pose severe problems in the future. Therefore, further investigations concerning such mixtures are paramount.

Table 1. List of all products, and their respective stores, containing *A. artemisiifolia* seeds in 2012 and 2014 with the relative seeds/kg, mg/kg values and the information on any kind of labelling referring to *A. artemisiifolia* seed control (* values exceeding the 50 mg/kg limit of the EU commission's regulation).

	Product	seeds/kg	mg/kg	Ambrosia Label
2012	Vogelpick Sunflower seeds (Delhaize)	749.00	4813.80*	yes
	Versele-Laga Sunflower seeds (Josy Welter)	2.00	6.87	no
	Elles Sunflower seeds (Hela)	0.40	1.04	no
	Cora mixture (Cora)	1.00	4.15	no
	Bird life mixture (Delhaize)	1.00	4.05	no
	Natu'Riga Fat Balls (Auchan)	11.11	76.67*	no
	CJ Wildlife seed fatblock (Cactus Hobbi)	5.71	46.86	no
2014	Degro Sunflower seeds (Cactus Hobbi, Bâtiself, Cactus)	0.20	1.46	yes
	Bird Life Garden Bird Food	0.50	2.30	no
	Versele-Laga Menu Nature Gourmet Mix (Josy Welter)	0.67	2.90	yes
	Versele-Laga 4-Seasons (Josy Welter)	1.00	8.60	no
	Wolfs Wild Bird Food Mix (Cactus)	1.00	5.60	no
	No Name (Degro) Streufutter (Cactus Hobbi)	2.80	13.56	yes
	Elles Sunflower seeds (Hela)	3.60	15.12	no
	JR Farm Wildvogel-Schmaus (Josy Welter)	4.00	18.20	no
	Versele-Laga Fat Balls (Josy Welter)	5.56	11.11	no
	No Name Fat Balls (Cora, Auchan)	5.56	24.44	no
	Elles Stick Food Rings (Hela)	6.67	40.67	no
	8in1 Birdola Ring Menu (Fressnapf, Hela)	7.14	21.43	yes
	MultiFit Streufutter (Fressnapf)	13.60	61.64*	yes
	Degro Streufutter (Cactus Hobbi, Bâtiself, Cactus)	16.60	87.06*	yes
	Premiere Streu Mix (Fressnapf)	21.33	102.87*	yes
Cora Fat Balls (Cora)	33.33	146.67*	no	

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