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***Ambrosia artemisiifolia* L. – in Switzerland: concerted action to prevent further spreading**

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Summary

Common ragweed (*Ambrosia artemisiifolia* L.) was described in Switzerland already in the end of the 19th century. Ragweed remained hidden until changing conditions triggered its spread. The invasion of this neophyte in Switzerland is still in a stage, where an effective low cost control should be feasible. A survey of the Swiss agricultural research station, Agroscope Changins–Wädenswil (ACW), former RAC Changins, showed for 2005 a clear trend: Beside a few known foci in arable fields, ragweed grows mainly in private garden sites all over the country. Ragweed follows human activities, and it was observed that its seeds are found in bird grain mixtures. Seeds also enter the regions along the French and Italian borders by agricultural machines and excavated material from building sites.

The fact that ragweed endangers public health was one reason to follow more carefully its beginning invasion. The spread of ragweed from private house gardens via compost or via professional gardening as pathways to the fields seems to be very easy. Therefore it was necessary to act rapidly to start an effective campaign in 2005. The information on how to eradicate ragweed went to all municipalities in Switzerland and met increasing interest. This year, the aim was to eradicate ragweed in house gardens, to reduce seed production and to make ragweed known to the population. The campaign will continue in 2006.

Keywords : Invasive Plants, Common Ragweed, Ambrosia, neophytes, public health

Introduction

Common ragweed (*Ambrosia artemisiifolia* L.) presently causes growing concerns in Switzerland. Described first in the 1880s and present sporadically in the country as a neophyte, ragweed begun spreading intensively during the last decade. Besides being a weed in arable fields, the plant produces pollen with a high allergenic potential, that can potentially induce severe health problems in the population. This situation requires a strong control strategy involving not only farmers but also staff in charge of managing natural areas, road sides, building- and gravel industries.

In Europe ragweed has been known since the 1860s, in France as well as in Germany. Around 1950 ragweed began to spread in the region of Lyon (France). In the sixties and seventies it became an increasing problem of public health in France and today around 140 000 people are affected in the region Rhône-Alpes. 12,1 % of the population around Lyon is allergic (ARVALIS, 2005). In Hungary 90 % of the land area is infested, whereas in former Yugoslavia ragweed is widely distributed mostly on fallow land as a consequence of war. The Po Valley in northern Italy is nearly completely colonized (AFEDA, 2005)

This paper presents briefly the historical and current distribution of ragweed in Switzerland, some information about the presence of pollen in the air with related medical aspects and, finally, the latest information about the control campaign in Switzerland.

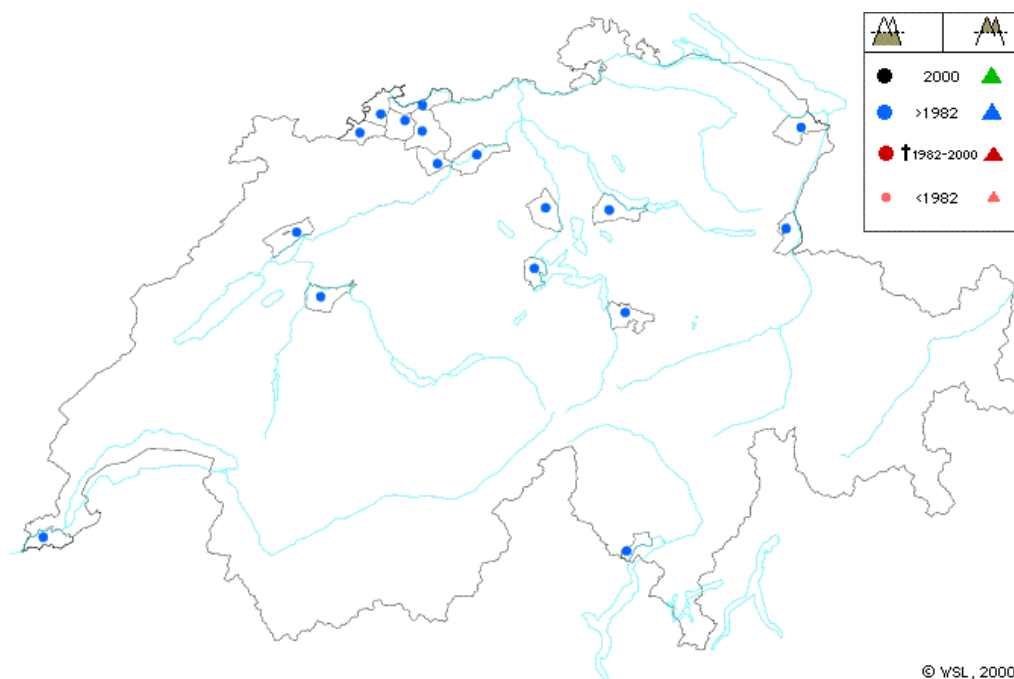
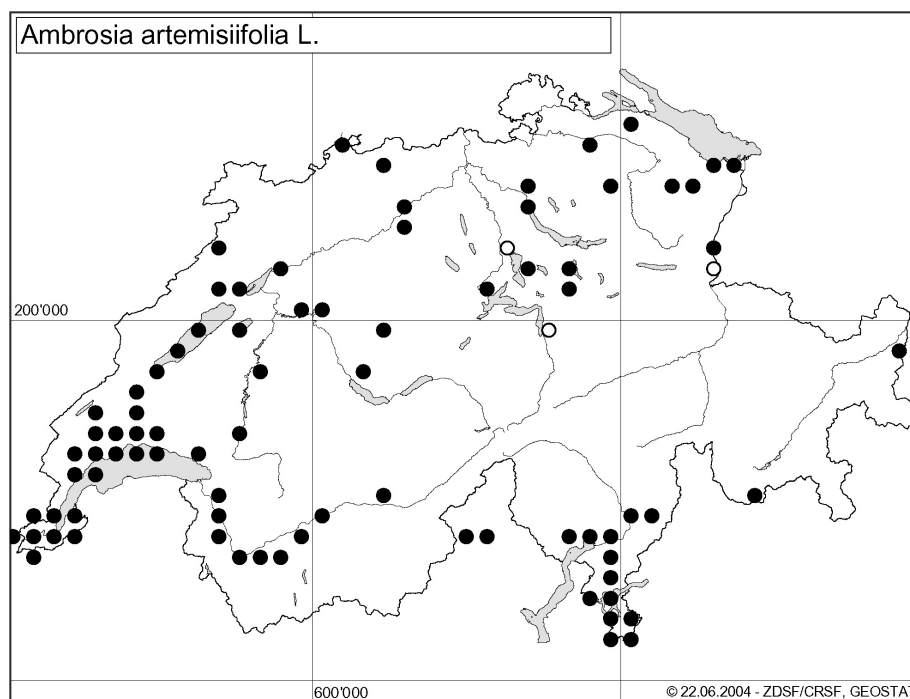


Figure 1: Distribution of *Ambrosia artemisiifolia* L. before 1982 in Switzerland

A neophyte in Switzerland

HEGI (1908) reported sporadic findings of ragweed in Geneva, Basel, Zurich and Berne in the late 19th century on fallow ground, along road banks, and in gravel pits. JAQUET (1925) described it as a sporadic species, growing in the region of Fribourg. But ragweed remained hidden. The map set up by the Centre of the Swiss Floristic Network (CRSF/ZDSF 2004) shows that three foci of ragweed were found before 1994, and about 85 after 1994. Currently, colonization of Switzerland by ragweed is described as “at the onset of an invasion” (CORDILLOT 2004) and therefore the costs to control it may be still low. But the canton of Ticino, on the southern side of the alps, is already heavily infested.

In the canton of Geneva and in the neighbouring region of the canton of Vaud, ragweed is present on agricultural fields, along road banks, and in recreational areas. Other cases – small foci with high infestation rate – have been reported for a long time in Basel, Ticino, Geneva and recently in Zurich. Ragweed seeds reached the Geneva region via agricultural machines such as combine harvesters.



Machines for soil treatment are also routinely exchanged between the French region of Lyon and the Swiss Bassin Lémanique. Excavated material from building sites is very often been transported between France and Geneva, likewise between Italy and the canton of Tessin.

Figure 2: Distribution of *Ambrosia artemisiifolia* L. in 2002 in Switzerland. ○ = observations before 1994, ● = observations after 1994.

These examples show how ragweed benefits from human activities to spread. Thus, it is not amazing to find ragweed in many private house gardens, or flower pots in urban and recreational areas. It is also present along traffic routes, growing often directly along the asphalt. Heavily infested areas are found in gravel pits where several hectares can be left untouched for a couple of years. Smaller foci are also known to be present on building sites.

A few reasons may account for ragweed spreading nowadays at a much faster rate:

- with globalisation, there is more travel, and transportation of goods is more intensive; ragweed seeds directly benefit from these to spread further;
- more environmentally-friendly agricultural practises led to less intensive crop management, in particular against weeds;

- global warming may help ragweed to grow and spread at faster rates in the northern hemisphere;
- imported bird seed mixtures, that are distributed nationwide.

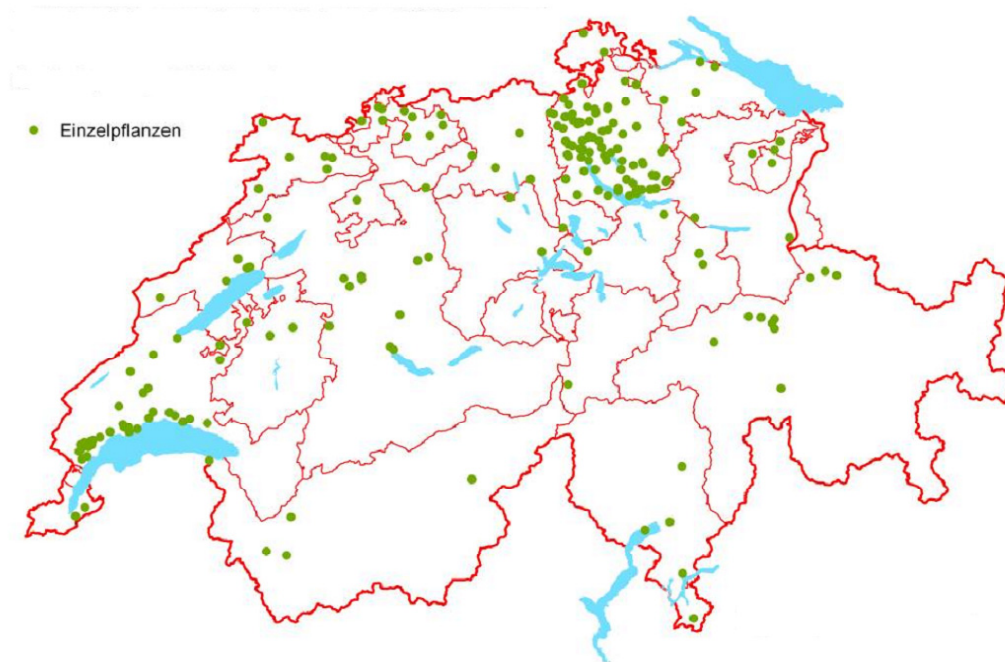


Figure 3: Distribution of *Ambrosia artemisiifolia* L. registered in 2005 by the Swiss Agricultural Research Station Agroscope Changins–Wädenswil (ACW). Einzelpflanzen = single plants.

Pollen counts

Ragweed produces pollen in large quantities from August to September which is often transported by wind over far distances. The pollen of *Ambrosia* has a high potential to provoke hay fever and in some cases asthmatic reactions. Concentrations between 6 and 10 pollen grains per m³ air represent a moderate load and more than 10 pollens per m³ a high load. By comparison, more than 49 pollen per m³ air represent a high load for grass pollen, which is the main allergen for hay fever in Switzerland.

The airborne pollen is collected with a volumetric pollen trap and analysed by light microscopy. In 1969 R.M. Leuschner initiated the pollen measurement in Switzerland with the first pollen trap in Basel. Since 1993 MeteoSwiss runs the national pollen monitoring network with 14 measuring stations. The *Ambrosia* pollen counts increased in the region of Geneva in the eighties and nineties. Most of the pollen is transported by wind from neighbouring regions, as shown by the correlated increase of pollen in Lyon (CLOT *et al.* 2002). The highest levels of *Ambrosia* pollen in Switzerland are detected in Ticino. In 2004 11 days of high

load were measured in Lugano and Locarno and in Geneva 9 days, whereas in Zurich no high concentrations of pollen were detected (CLOT *et al.* 2005).

Medical aspects

If invasion by *Ambrosia* is left uncontrolled, increase of allergies could heavily augment the estimated costs of 260 million Swiss Francs for allergy and asthma (MÜLLER *et al.*, 2000) Experiences from France and North America show that around 10 % of the population is sensitive to ambrosia pollen (DRASS 2000). A quarter of them may develop heavy asthmatic reactions. So far, ragweed allergy with evidence of sensitisation in Geneva remains low with possibly 4 to 5 potential cases in 2004 (TARAMARCAZ *et al.* 2005). Only 8 of 18 polled medical practitioners have encountered 1 or 2 patients allergic to ragweed during the 2004 ragweed pollinisation period.

An estimated 100 million CHF is spent in Switzerland to cover overall costs for treatment of allergic rhinitis (MÜLLER *et al.*, 2000). But numerous sensitive persons may not consult a doctor. Two third of the patients in Geneva – a town hosting numerous international organisations – were sensitised outside of Switzerland (HAUSER, 2004). In the St.Gall Rhine valley in eastern Switzerland 10.6 % of 15 year old students showed sensitivity to pollen of ragweed (GASSNER 2005), amongst other pollen.



Photo 2: Common ragweed (*A. artemisiifolia* L.) forms different types of flowers, probably as a result of stress.

Seed spread and distribution

French observations clearly show that bird seed mixtures contaminated with Ambrosia seed are an important pathway (CHAUVEL *et al.* 2004); up to 2500 grains were found in one kg. Another important source for spread is the feed for small animals such as rabbits and hamsters. It can contain fertile ambrosia seeds, which can directly reach the field. Seeds are also found in imported sunflower and sorghum. In most cases it is technically impossible to separate ragweed grains because weight and size could be similar to other seeds like sorghum. Grain importers and feed producers should bear the responsibility and sterilise the grains used for feed.

Seeds of Ambrosia are not airborne, normally they fall on the ground. Spread of ragweed is greatly favoured by human activities.

Ragweed has a higher spread potential than most indigenous annual dicotyledonous weed species and most indigenous grass weeds in Central Europe. Among neophytes, only South African ragwort (*Senecio inaequidens* DC.), Canadian horseweed (*Conyza canadensis* L.) and Japanese knotweed (*Reynoutria japonica* HOUTT.) show higher spread potentials (WEBER *et al.* 2005).

Ragweed is easily mistaken with mugwort species *Artemisia vulgaris* L. and *Artemisia verlotiorum* LAMOTTE.

Distribution of Ambrosia registered in different periods

The first Swiss distribution map set up by the Swiss Web Flora (Fig. 1) shows some foci of Ambrosia registered before 1982 in the region of Basel, but in the rest of the country only a few places were infested.

The map established by the Centre of the Swiss Floristic Network shows a wider distribution of Ambrosia in Switzerland twenty years later in 2002. Mainly in the western and southern part of the country large areas are infested with Ambrosia, whereas smaller foci are reported from the rest of the country.

The map of 2005 is based on the survey of the Swiss Agricultural Research Station Agroscope Changins–Wädenswil (ACW) . It does not show earlier observations. Single plant foci were found mostly in house gardens following announcement by their owners and verified by official experts. The high number of Ambrosia single plant foci reported 2005 in the canton of Zurich (top centre of the map, north) is the result of a regional publication of the Swiss house owners association (HEV) in July. It was the time when Ambrosia was grown high enough, to be recognised by the eyes of a layperson.

Control in agriculture

Control of ragweed with herbicides is difficult in some crops like sugar beet and peas, and is nearly impossible in sunflowers as both ragweed and sunflower belong to the same botanical family.

Since 2003 ACW has been performing efficacy trials with many herbicides registered in Switzerland. Table 1 shows the efficacy of the herbicides tested. Knowledge about mechanical control of ragweed could be very important for road services, as the use of herbicides along roads is highly restricted. Since 2004, we have been monitoring mowing trials where we count the seed production of ragweed after a series of various dates of cutting (BOHREN *et al.* 2005). Our first observations show that a cut in the first half of September can stop the seed production, but cannot prevent the production of pollen. It may be very difficult to inhibit coevally pollen production and seed production.

Ragweed, germinated in cereals, rests in a small stage until the crop is harvested; coming to the light, it starts to reproduce. The flowering time is obviously day length dependant and is similar for all plants: it starts from end of July. Insufficient mechanical or chemical control allows ragweed to sprout quickly from the base of the stem.

Table 1: Trial site La Petite Grave: Efficacy of various herbicides 2003 – 2007

La Petite Grave

application of products in field trials of small plots (4 replications); application time according to label for crop

efficacy in %

X= registered in CH

product	dosage	active ingredient		efficacy 2003	efficacy 2004	efficacy 2005	efficacy 2006/7	mean (estimated)	faba bean	set aside	peas	cereals	potatoes	corn	beetroot	soya	grassland	sugar beet	vegetables and others
Atrazin	2 l/ha	Atrazin	500 g/l			100	100							X					
Lontrel	1 l/ha	Clopyralid	100 g/l			100	100										X	X	ecol. comp.
Banvel 4 S	0.5 l/ha	Dicamba	480 g/l			100	100		X		X			X					
Basta	5 l/ha	Glufosinate	200 g/l				100												
Roundup	3 l/ha	Glyphosate	360 g/l				100												
Afalon	3 kg/ha	Linuron	47.50%				100	100				X	X						div.
Sencor	1 kg/ha	Metribuzin	70%			97	100	100					X						tomatoes
Gardo Gold	4 l/ha	Terbuthylazin, S-Metolachlor	187.5 + 312.5 g/l					100						x					
Venzar	2.5 kg/ha	Lenacil	80%			99	99								X				leek
Arelon	3 l/ha	Isoproturon	500 g/l			96	96					X							
Golaprex	4 l/ha	Orbencarb, Metribuzin	803.4 + 66.9 g/l			96	96	X		X		X				X			carottes/tulips
Topper	3.5 l/ha	loxynil	240 g/l			95	95												chicorée etc
MCPB	4 l/ha	MCPB	400 g/l			85	100	95			X	X	X				X		berries
Equip	2 l/ha	Foramsulfuron	22.5 g/l			94	94							X					
Callisto	1.5 l/ha	Mesotrion	100 g/l			92	92							X					
Tomigan	1 l/ha	Fluroxypyr	259 g/l (~180 g/l acide)	80				85				X							
Basagran	3 l/ha	Bentazon				81	40	75			X	X	X	X		X	X		flax
Terano	1 kg/ha	Flufenacet, Metosulam		70		70	65	75						X					
Concert	60 g/ha	Metsulfuron, Thifensulfuron						75											
Lanray	5 l/ha	Orbencarb, Linuron				88	40	75	X		X	X	X						
Rasantan	1 kg/ha	Bromoxynil, DFF, Amidosulfuron			65			65				X							
Orkan	3 l/ha	MCPB, loxynil, DFF			65			65				X							
Primus	0.15 l/ha	Florasulam					40	60				X		X					
Goltix compact	4 kg/ha	Metamitrone					50	60							X				X
Equip+ Terano	2l+1kg/ha	Foramsulfuron + Flufenacet/Metosulam					50+	55						X					
Maister	150 g/ha	Foramsulfuron, Iodosulfuron		65			38	50						X					
Bolero	1 l/ha	Imazamox			40			50		X									

Refine extra	40 g/ha	Thifensulfuron, Tribenuron		35	50				X								
Goltix triple	2 kg/ha 2x	Metamitron, Ethofumesate, Phenmedipham		15	15							X					X
Ally Class	50 g/ha	Metsulfuron, Carfentrazon		15	15				X								
Debut	60 g/ha	Triflurosulfuron		7	25	15						X					X
Lotus	0.25 l/ha	Cinidon-ethyl		10		10			X	X							
Titus	40 g/ha	Rimsulfuron	5		0	10						X					
Dual-Gold	2 l/ha	S-Metolachlor			0	10						X		X			X
Aurora	40 g/ha	Carfentrazon		5		5			X								
Tramat flow	2.6 l/ha	Ethofumesat		5		5								X			X
Bandur	5 l/ha	Aclonifen		0	0+	0	X		X		X						
herbicides applied in autumn in cereals		Arelon, Herold, Malibu, Fenikan, Herbaflex, Lanray, Banaril, Stomp, Boxer, Concert		0		0						X					
Racer	3 l/ha	Flurochloridon			0	0						x					
Stomp	4 l/ha	Pendimethalin	0		0	0	0		X	X	X	X					
Boxer	5 l/ha	Prosulfocarb		0	0+	0				X	X						
Express	40 g/ha	Tribenuron		0		0				X							
Trifluralin	3.5 l/ha	Trifluralin		0		0				X							
all registered a.s. in winter oil seed rape applied in autumn				0		0											

Concerted action

Several factors have to be respected to launch an effective control of ragweed. On one hand it might not be sufficient for public health to apply control strategies in agriculture for ragweed as for any other weed, because we do not know anything about a limit of tolerance which guarantees that the amount of ragweed pollen will not rise above the high load limit of >10 grains per m^3 air. On the other hand it might not be sufficient to apply control strategies along roadsides or in natural reserves to prevent ragweed becoming a weed in agricultural areas.

The danger of ragweed pollen to human health requires a concerted action of several disciplines:

- In cantons of Ticino, Neuchâtel, and Geneva, “Ambrosia Groups” were created to discuss control strategies. The initiators of such groups often belong to agricultural services, meteorology agencies and medical services. Members of the “Ambrosia Group” in Geneva studied in-depth the dissemination routes of ragweed seeds. Botanists, environmentalists, road services, medical and agricultural services take part. Meanwhile the group in Geneva is officially registered by the cantonal government. Within this group, the Swiss federal research station ACW, was appointed to work out control strategies for agriculture (DELABAYS *et al.* 2005).
- The Swiss Agency for the Environment, Forests and Landscape has organised multidisciplinary workshops to learn more about ragweed.
- Cantonal offices have also organised workshops to instruct the personnel working with road services and environmental agencies.
- In 2005 the Federal Department for Economic Affairs adapted the ordinance on animal feedstuff with the restriction that all type of feedstuff put into circulation must be free from ragweed seeds. 2006 the Federal Council amended the ordinance on plant protection and declared *A.artemisiifolia* subject to official control (BUND, 2006).
- Agricultural advisory services are now forced to control every focus of contamination in the fields because of the invasive behaviour of ragweed.
- Meteorologists are well equipped to measure pollen in the air, and they edit periodically a pollen report (METEOSWISS) for allergic persons which is also broadcasted by the radio stations.
- Medical services study more about the allergic symptoms intensively in order to treat future patients properly.
- Road services support the information campaign in 2006 financially.

Information campaign 2005

Experiences from France and elsewhere show that once ragweed is in the fields, it can no longer be fully controlled. Consequently we must control ragweed in this stage of early spread, to stop it infesting our fields.

The question in 2005 was, where and how ragweed is located in Switzerland. To answer this question, ACW published in spring an article on ragweed in the house-owners journal (BOHREN, 2005). The possibility was also offered to send

suspect plants to ACW for determination. We have registered in 2005 mostly single plant foci in house gardens throughout the country. But we have also registered the infestation of 6 agricultural plots and 22 public facilities with several hundreds of plants. A massive infestation was discovered in a gravel pit in the region of Basel.

The echo of the campaign 2005 with more than 120 new foci detected, showed, that people are very vigilant. A flyer – edited in three different languages – with a description of the plant and its danger has been printed and sent to all municipalities. 130,000 copies were distributed within 2 weeks.

Several institutions do continuously edit data sheets and leaflets on ragweed to inform their clientele. Individual measures often do not solve the real problem.

Private house gardeners are often good observers, and they decide clearly to tolerate or not a certain plant species in their garden. People sensitive to hay fever and other allergies will even control public areas. Readers of the house-owners journal sending plants to our research stations frequently wrote in their accompanying letter how happy they are to do something good for their health.

The elimination of many single plant foci may help to reduce the number of seeds produced and may therefore slow down the spreading of ragweed.

The very successful campaign of 2005 will be continued in 2006, aiming at maintaining fields in Switzerland free of ragweed as long as possible.. Agricultural institutions must be active with the objective to keep ragweed away from our fields.

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Photo 3: Common ragweed (*A. artemisiifolia* L.) growing on a building site near Geneva, Switzerland



Photo 1: Common ragweed (*A. artemisiifolia* L.) grown in an agricultural field near Geneva, Switzerland.

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