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Ambrosia artemisiifolia (ragweed) in Germany – current presence, allergological relevance and containment procedures

Jeroen TM Buters[1, 2], Beate Alberternst[3], Stefan Nawrath[3], Maria Wimmer[1, 2, 4], Claudia Traidl-Hoffmann[2, 4, 5], Uwe Starfinger[6], Heidrun Behrendt[1, 2], Carsten Schmidt-Weber[1], Karl-Christian Bergmann[7]

[1]ZAUM – Center of Allergy & Environment, Helmholtz Zentrum München/Technische Universität München, Germany; [2]CK CARE, Christine Kühne Center for Allergy Research and Education, Davos, Switzerland; [3]Working Group Biodiversity and Landscape Ecology, Friedberg, Germany; [4]Institute of Environmental Medicine, UNIKA-T, Technische Universität, Munich, Germany; [5]Outpatient Clinic for Environmental Medicine, Klinikum Augsburg, Germany; [6]Julius Kühn-Institute, Braunschweig, Germany; [7]Foundation German Pollen Information Service, Berlin, Germany

Keywords
Germany – ambrosia – ragweed – pollen – climate change – sensitization – Amb a 1

Abstract

Ambrosia artemisiifolia (ragweed) is a neophyte in Europe and Germany, which originated from the United States of America. In the USA the rate of sensitization against ragweed equals that of grass pollen, and without containment the rate of allergic sensitizations against ragweed pollen will clearly increase. Currently, the most frequent sensitizations in Germany are against grass pollen, followed by sensitizations against house dust mite and birch pollen. Ragweed pollen evokes symptoms at about 10 pollen/m^3, grass pollen at about 15 pollen/m^3. These concentrations of ragweed pollen are only reached on limited occasions in Germany.

Ragweed cross-reacts with mugwort (*Artemisia vulgaris*) and a correct diagnosis is only feasible with the ragweed specific allergen Amb a 1. Due to cross reactivity with mugwort, new sensitizations against ragweed pollen are not needed to evoke allergic symptoms. The neophyte encounters an already mugwort-sensitized population, extends the pollen season and may provoke new sensitizations. Ragweed sensitizations are characterized by an increased tendency to also affect the lower airways, which is less with mugwort sensitizations.

Thus containment of ragweed is needed. Ragweed seeds are imported or spread by contaminated bird feed, the transport of ragweed contaminated soil (also in tyre treads) and agricultural products from infested areas. States bordering on ragweed positive areas, like Brandenburg and Bavaria, are especially at risk and invasion is already underway. Ragweed seeds survive up to 40 years in soil, and so extended timescales for eradication and observations are needed.

Germany is, compared to other countries like France (Rhone-Valley), Italy (Po-Valley), Ukraine and Hungary, limited in respect to ragweed infestation. Conditions in Germany are therefore favourable for the containment of ragweed. Switzerland implemented legislation against birdseed contamination by ragweed early during the plants expansion, and obligatory ragweed registration- and eradication showed that ragweed containment is possible. Without counter measures ragweed expansion in Germany will take place, resulting in

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Abbreviations

IgE	Immunglobulin E
OR	Odds ratio
PID	German polleninformation service
RAST	Radioallergosorbent-Test
SIT	Specific Immunotherapie

more allergic disease. Considering the increasing number of allergic individuals, even without ragweed invasion, containment of the neophyte should be actively persued. Unfortunately, time is running out.

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Introduction

Ragweed is a plant genus including about 50 species, of which *Ambrosia trifida* ("giant ragweed"), *Ambrosia psilostachya* (perennial, Cuman or western ragweed) and *Ambrosia artemisiifolia* (common or short ragweed) are most abundant. *Ambrosia artemisiifolia* is the most common Ambrosia species globally, with populations in Europe [1, 2], Asia [3] and Australia [4]. Thus ragweed is used as a synonym for *Ambrosia artemisiifolia* throughout this article.

Ragweed pollen are one of the dominant pollen species evoking allergic reactions in North America in late summer and autumn, and approximately 26 % of the US-population is sensitized against ragweed pollen [5, 6]. The number of ragweed-sensitized indivuals is also increasing steadlily in Europe [7], although the number of sensitizations in different European countries varies substantial (2–54 %) [8]. In Europe, the main populations of ragweed are found in Russia, Ukraine, Hungaria and Po and Rhone-Valleys. From these areas long-range pollen transport is feasible (see **Fig. 1**).

Ragweed is an annual plant and its propagation depends on successful building of new seeds. Its seeds are 2-4mm in size (see **Fig. 2**) and have limited dispersal by wind. Thus the natural expansion of ragweed populations is slow. This changes when humans interfere: transport of agricultural products and the transport of contaminated soil, as encountered during building, rapidly increases plant distribution. Another source of propagation is contaminated birdfeed with ragweed seeds [1].

Ragweed is frequently found along highways. Ragweed causes crop loss with economical consequences and elimination of ragweed is agronomically sensible [1]. In addition, ragweed causes detrimental health effects [1]. In the USA, ragweed is one of the most sensitizing pollen species and thus a major allergen [6, 9, 10].

Ragweed releases ample pollen, which could be due to its efficient pollen emissions system (see **Fig. 3**). Ragweed pollen evokes allergic symptoms at low concentrations (about 10 pollen/m^3) [11, 12]. In comparison: grass pollen has a symptom threshod

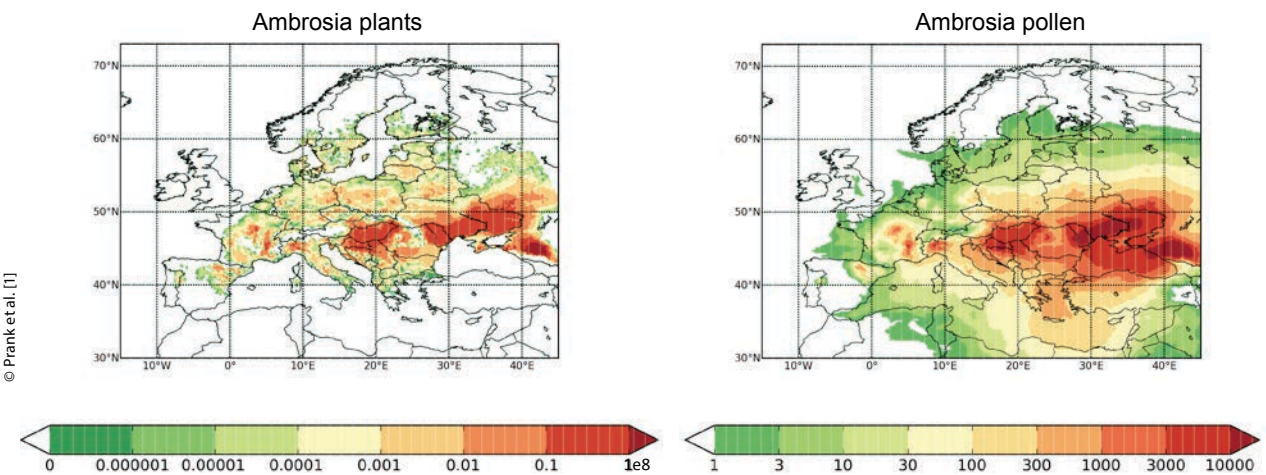

Fig. 1: Spread of ragweed in Europe. Yearly modelled ragweed pollen emission (pollen/m^2/year, a measure for plant presence) and modulated pollen concentration (pollen index, sum of daily concentrations) in Europe. Averaged 2005–2011. Courtesy of Prank et al. [1]

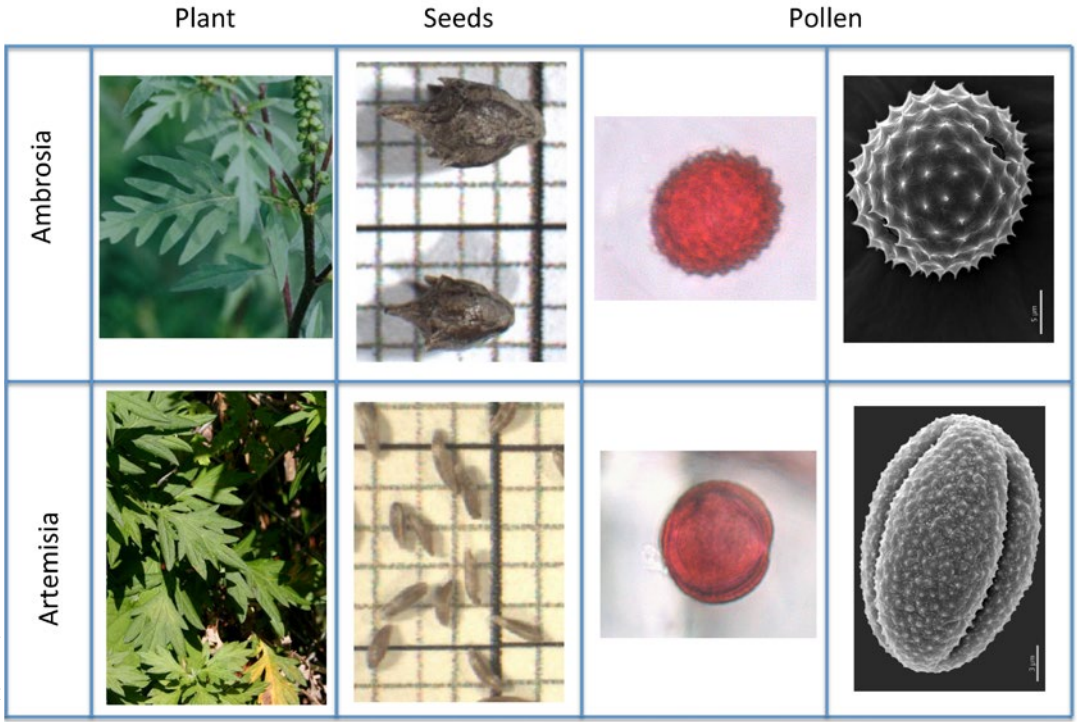

Fig. 2: Appearance of the plant. Morphology of *Ambrosia artemisiifolia* (ragweed) and the very similar *Artemisia vulgaris* (mugwort). Plant, seeds, microscopic image after safranin staining (red) and electron microscopic image of pollen of both species. Ambrosia seeds are 2–4 mm, Artemisia seeds are smaller. Both Asteraceae look similar but can be discriminated by the leaf bottom that is white with mugwort and similar green as the topside for ragweed. Aerobiologic and immunologic both pollen species are clearly different.

of about 15 pollen/m^3, and birch pollen of about 30 pollen/m^3 [13]. Thresholds vary between countries: in Switzerland 10 ragweed pollen /m^3 are considered a high exposure, in Hungary this value is 50 pollen/m^3. This phenomenon was also reported for other pollen species [14].

Ragweed and mugwort (*Artemisia vulgaris*) are botanically close and both belong to the subfamily Asteroideae in the family of Asteraceae (see **Fig. 2**). Ragweed allergens show cross-reactivity with mugwort allergens (see below "molecular biological characteristics of ragweed").

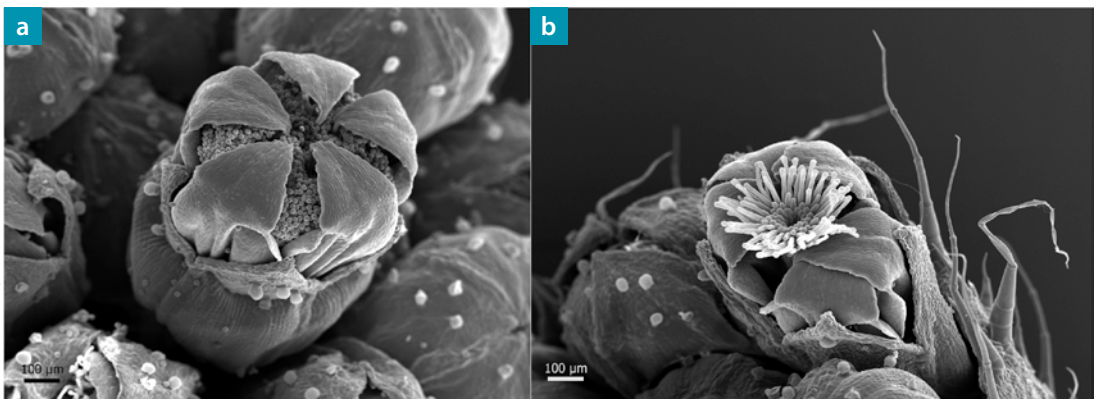

Fig. 3: Electron microscopic image of the liberation of ragweed pollen. Due to a mechanism, different from anthers of other pollen species, pollen of ragweed is pushed out of the anthers. **a:** anther during opening. **b:** empty anther. Source: Weichenmeier, I. / ZAUM

Skin prick testing is not sufficient to discriminate between ragweed and mugwort sensitization. In Germany the rate of sensitization to both mugwort and ragweed sensitization is 11.2%. The rate of sensitization against grass and tree pollen (mainly birch) is about 19 % each [15, 16].

It is beyond doubt that increased exposure against ragweed pollen results in increased rates of sensitization. In Buchs, Switzerland, the community planted *Alnus spaethii* (a hybrid between *A. japonica* x *A. subcordata*) along its main street where school children coming from the railroad station passed on their way to school [17]. During the years, unexpected increases in sensitization rates appeared against Aln g 1, the major allergen of Alnus [18]. The same was reported for ragweed: areas in Northern Italy with high ragweed pollen counts close to Tessin (Switzerland) showed higher rates of sensitization then neighboring areas in Tessin (about 60 km distance) with less ragweed pollen [11]. The same was reported from Vienna, Austria [19]. More important is the lag-time between exposure and allergic sensitization. The lack of an increase in allergic sensitization against ragweed pollen, despite an increasing pollen exposure in newly invaded areas, is often misunderstood. The phenomenon "ragweed but no sensitization" is due to the lag-time between exposure and sensitization. It may take years before exposure results in sensitization. It was reported that rates of sensitization in areas with an established ragweed population were much higher than in recently invades areas [7, 11, 20, 21], or increased with ragweed expansion [4]. When sensitization rates in ragweed infested areas start to increase, it is mostly too late to eliminate established ragweed populations. This happened in the Po Valley, where ragweed is so well established that elimination is no longer feasible. The same happened in the Rhone Valley.

It is therefore essential to recognize the incursion of ragweed early, in order to be able to fight the invasion. Airborne ragweed pollen are a marker of limited use for ragweed invasion: as soon as pollen traps register ragweed pollen these could be either due to long range transport or because local populations must be present. This can be concluded from pollen data from Berlin and Bavaria: In Bavaria limited populations of ragweed are present (see **Fig. 5**), but ragweed pollen is rare (**Fig. 6**). In Berlin and its surroundings, extensive ragweed populations are reported and ragweed pollen indexes > 200 are measured. Thus detecting and eliminating ragweed plants is the cornerstone of prevention. This is not only advantageous for allergic individuals; the elimination of ragweed is also sensible from an agricultural point of view [1].

Some German states are more active than others in eliminating ragweed. Nevertheless in Bavaria, despite substantial investments in ragweed elimination, only a reduction in ragweed expansion was achieved. Switzerland also found that voluntary elimination of ragweed had limited effectiveness, and that successful elimination of ragweed needs a legal framework. Indeed, Switzerland, the only state in Europe with legal measures implemented at the beginning of the ragweed invasion, was able to stop the expansion of the plant [22, 23]. Still, legal measures are kept in place as complete ragweed eradication is unlikely and it prevents new invasions from neighboring areas where ragweed reduction has been less effective.

Ragweed in Germany

Areas with large populations of ragweed plants have high concentrations of airborne ragweed allergens. Knowledge of the presence of pollen emitting plants is therefore essential for their localization and subsequent elimination. Ragweed is rare in Germany, although the number of populations has increased since 2000. Extensive populations are encountered in the Southeast of Brandenburg, i. e. Niederlausitz, where ragweed particularly populates agricultural areas and roadside verges (see **Fig. 4**). There are large gaps in the knowledge of ragweed distribution, due to the lack of compulsory reporting of ragweed and local differences in observational accuracies. Only a few federal states like Bavaria [24, 25], Baden-Württemberg [26] and Nordrhein-Westphalia [27] have data of the current situation. **Fig. 5** shows ragweed populations in Bayern, Hessen and other selected areas in Germany. Only counties with > 100 plants/population are depicted. Smaller populations are not depicted because these are often encountered around bird feeders in local gardens and seldom lead to ragweed establishment. The main populations were detected in the south and the east of Germany. Central Germany and higher altitudes are almost free of ragweed due to the heat requirements of the plants. Local analysis among 217 larger ragweed populations (without highway populations) in Bavaria showed that 94 % of the populations flourish with yearly average temperatures between 8.1°C and 10.1°C. As yet, no larger ragweed populations have been detected in areas with lower yearly average temperatures, like the Bavarian Forest or the Alps. The clear absence of ragweed in Thuringia is most likely explained by lack of knowledge.

Few federal states like Bavaria, Berlin and Baden-Württemberg execute eradication campaigns with subsequent success monitoring [25]. In these states, the expansion of ragweed has been prevented. Highway roadsides are problematic because common eradication methods cannot be applied

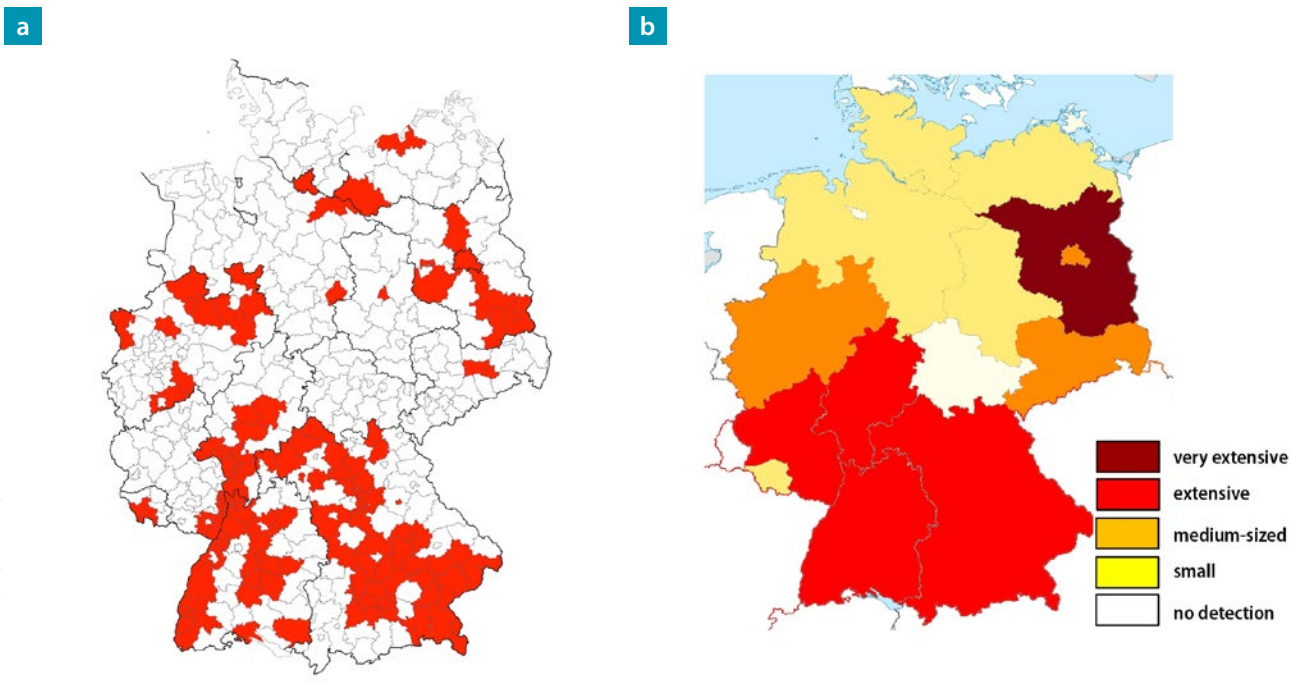

Fig. 4: Ragweed populations in Germany. **a:** Reported ragweed populations > 100 plants during 2000–2010. Countries are colored red when at least one population was reported. **b:** The situation in 2014 [25]: the classification included size, number of individuals, persistence, expansion tendency and presence at roadsides. Source: own measurements, literature and unpublished data from third parties.

and control is insufficient. No legal obligation for registration, monitoring or eradication is in force in Germany. Without these, expansion of ragweed in Germany can be expected [24, 25].

Molecular biology of ragweed

The major allergen of ragweed, Amb a 1 is a member of the pectatelyases that catalyzes the breakdown of pectin (the major plant cellular wall component). Over 95 % of ragweed allergic patients react to Amb a 1 with a positive skin prick test or show increased Amb a 1 specific immunoglobulin E (sIgE) [28]. The homologue pectatelyase Art v 6 from mugwort is of minor importance. Amb a 11 is the second major allergen to which 66 % of Ambrosia sensitized patients react [29]. Amb a 3 and Amb a 7 are plastocyanines that play a role in photosynthesis but are only described as minor allergens. Amb a 4 is homologue to the major mugwort allergen Art v 1. Amb a 6 (lipidtransferprotein), Amb a 8 (profilin), Amb a 9 and Amb a 10 (calcium binding proteins) belong to the cross-reacting panallergens, also present in mugwort (Art v 3, Art v 4 and Art v 5) (see **Tab. 1**) [28].

Allergies to ragweed and mugwort are linked due to the similarities between Amb a 1 and Art v 6, or Art v 1 and Amb a 4, and both pollen types present panallergens. Clinical and serological studies showed that almost all patients that are sensitized against mugwort also react to ragweed pollen. Conversely, most ragweed sensitized individuals show no reactivity against mugwort allergen [30]. Discriminating between ragweed and mugwort due to seasonal differences in symptoms or clinical criteria is almost impossible, as both flowering periods are almost identical. Routine tests like SPT or RAST are currently performed using whole pollen extracts making discrimination between co- and primary sensitization virtually impossible as single sensitized patients react to pollen extracts of both plants. This complicates the decision to which allergen (or to both) to desensitize the patient. Asero et al. [30, 31] postulated that a sensitization against both Amb a 1 as to Art v 1 indicates a co-sensitization to both pollen species. Component-resolved diagnosis, which is based on recombinant and thus pure allergens, could be a valuable addition in the direction of individualized medicine. Here, a sensitization against Amb a 1 implies a primary sensitization against ragweed [32]. When a patient shows symptoms of allergic rhinitis during the ragweed pollen season and specific IgE or a positive skin prick test against Amb a 1 are detected, immunotherapy against Ambrosia can be safely recommended.

Clinic of Ambrosia allergy

The American medical doctor Morrill Wyman (1875) first described ragweed pollen allergy as "autumnal catarrh" [33]. Since then, allergies against Ambrosia are second to grass pollen allergic rhinitis in several areas of the USA [10] and Canada [34]. The importance of ragweed rhinitis noticeably increased in the last decades in Europe [7].

In Europe, regional studies confirm an increasing trend in sensitization rates to previously rare pollen. For example, ragweed sensitization in Austria increased from 8.5 % to 17.5 % [20].

In a multicenter European study with over 3.000 patients (patients with medically confirmed respiratory symptoms) 66 % were sensitized against ragweed allergens [35]. Between countries substantial difference exist: from about 19.5 % in South-Bavaria [36] to 60 % in Hungaria [37].

Thus ragweed pollen is an important source for allergic sensitizations and disease in Europe. A ragweed allergy can have following forms:

- Allergic rhinoconjunctivitis ("ragweed hay fever"). The symptoms are similar to a classic hay fever with an itching nose, sneezing, runny nose, congested nose, eye redness, itching eyelids, tearing, itching palate. Not all symptoms occur simultaneously. In most cases affected individuals suffer from nasal and ocular symptoms simultaneously.
- Allergic asthma ("ragweed asthma") Normally the development of asthma due to ragweed is preceded by a ragweed pollen allergic rhinitis. Wrongly or insufficiently treated allergic ragweed rhinitis (i. e. immunotherapy) can advance into asthma (organ progression). This change of affected organ is not obligatory, the allergic rhinitis can remain or the changing of organs can be incomplete. In the beginning, the allergic rhinitis (i. e. dry cough, airway obstruction, chest impairment, nocturnal awakening and reduced physical endurance) is seasonal and only during the ragweed pollen season. After a few years (the interval is dependent on the individual and other factors like smoking, amount of exposure, genetic background etc.) the periodical asthma progresses into whole year asthma, unless sufficient pharmacological treatment was initiated. There are no epidemiological data that show that ragweed pollen is more likely than other pollen (i. e. birch) to induce asthma without previously inducing allergic rhinitis.
- Oral allergy syndrome (a. k. a. "pollen associated food allergy" or "food-allergen-syndrome"). Due to cross-reactivity with allergens from ragweed or mugwort certain foods like celery, spices (aniseed, parsley, pepper, bell peppers, caraway) or carrots induce an itching in the mouth; tickling or burning, edema of the lips or the tongue, seldom also cough and respiratory distress during 15–30 min. During the pollen season the symptoms are mostly more severe compared to outside the pollen season, symptoms vary in severity. About every second adult with a ragweed-allergy also suffers from an oral allergy syndrome [38].
- Allergic dermatitis (contact dermatitis, contact eczema). Ragweed belongs to the sesquiterpenoid plants, which may contain phyto-contact allergens. In direct contact to plant parts like leaves it may induce eczema on the hands, underarms and

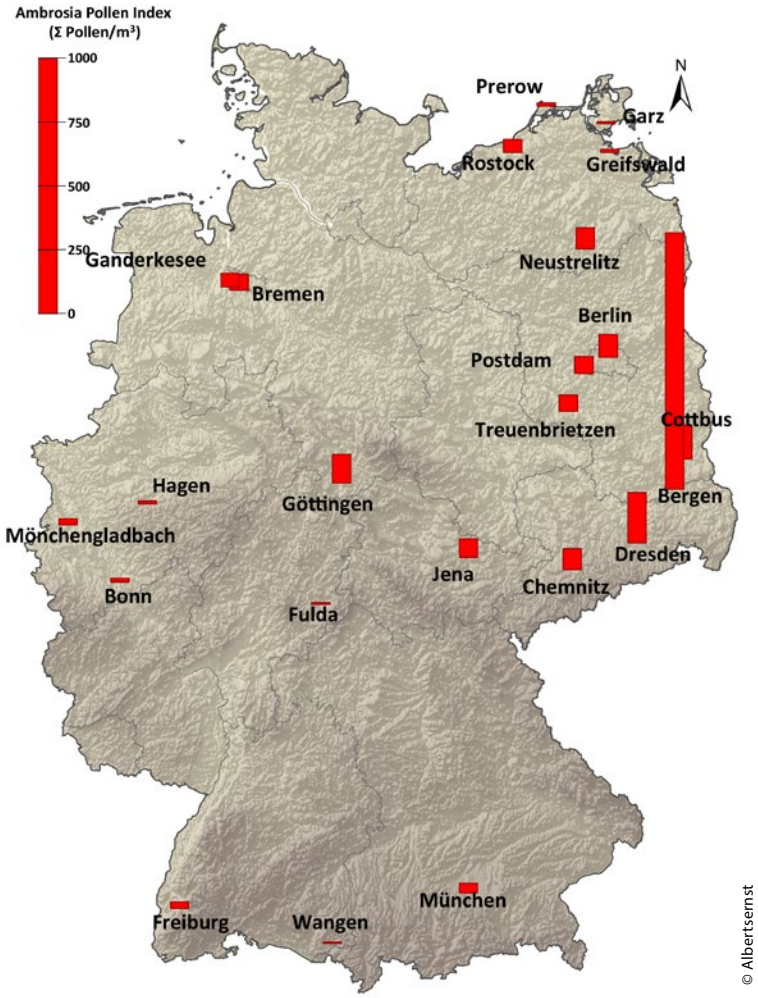

Fig. 5: Ragweed pollen index (yearly sum of pollen/m³, average 2012–2014 of those stations with values from all years) of PID-stations. Pollen can be introduced by long-range transport and are no evidence of presence of ragweed plants in a certain area. Monitoring sites without ragweed pollen are not shown. Bars represent the amount of Ambrosia pollen. (max. 1,000 ragweed pollen/m³). For Berlin and Munich that have several stations only the highest numbers were depicted.

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Fig. 6: Extended population of ragweed in a sunflower field in Niederlausitz. Essential for Germany is the active detection of ragweed populations by botanists. Calls to the general public are useful but insufficient as the reports stem mostly from the direct environment of the observer and the number of reports correlated with journalist activities. After random sampling it was calculated from test areas in Bavaria [54] that the actual ragweed populations probably exceed the known population by two- to four-fold. Legal regulations for ragweed control are lacking in Germany.

face (especially eyelids) with papulo-vesicles, but also chronic hyperkeratotic eczema [39].

The recommendations for the therapy of allergic rhinitis or asthma due to ragweed are similar to the recommendations for rhinitis and asthma evoked by other pollen species.

Risk factor for ragweed sensitization

According to Rueff [36] the highest risk of sensitization occurs with individuals that already have a mugwort sensitization ("odds ratio" [OR] 5.02), and have their major symptoms between September and October (in Germany) (OR: 4.03) and possibly already have antibodies against other pollen, animal dander or house dust mite, i. e. that are polysensitized. It is epidemiologically and medically interesting how much time passes between exposure to new pollen – like ragweed – in a region and the appearance of measurable sensitization rates. According to Jäger [19] this is about 10 to 15 years. Furthermore, it can be assumed that about 5 years pass between clinically silent sensitizations and the appearance of symptoms [11].

This shows that the invasion of a region with ragweed does not immediately lead to health problems; instead it takes about 20 years. Knowing of the existence of this time frame is important, because it is essential not to underestimate the danger of ragweed expansion due to the current lack of diseased individuals in a region.

Tab. 1: Allergens in pollen of ragweed and mugwort (modified according [28])

Species	Allergen	IgE-Reactivity (%)	Description
Ragweed (*Ambrosia artemisiifolia*)	Amb a 1	> 90	pektatlyase; major-allergen, Art v 6 homologue
	Amb a 3	30–50	plastocyanine
	Amb a 4	30	"defensin-like protein", Art v 1 homologue
	Amb a 5	10–20	
	Amb a 6	20–35	lipidtransferprotein; panallergen
	Amb a 7	20	plastocyanine
	Amb a 8	35	profilin; panallergen
	Amb a 9	10–15	calciumbinding protein; panallergen
	Amb a 10		calciumbinding protein; panallergen
	Amb a 11	66 [29]	cysteine protease
Mugwort (*Artemisia vulgaris*)	Art v 1	95	"defensin-like protein"; major-allergen, Amb a 4 homologue
	Art v 2	33	
	Art v 3	36–40	lipidtransferprotein; panallergen
	Art v 4	36	profilin; panallergen
	Art v 5	10–15	calcium binding protein; panallergen
	Art v 6	20–26	Pektatlyase; Amb a 1 Homologue

Controlling ragweed

Due to its detrimental effects on humans and agriculture, ragweed has long been the goal of many control and eradication programmes [40]. An eradication programme was run in the plant's North American homeland, on the Gaspesie-peninsula in Canada, which kept the peninsula free of ragweed for a long time [41].

The success rate of controlling or the eradication depends on three factors:

1. Choice of method

Because ragweed is an annual flower, it is easier to eradicate than other perennial plants. Eradication schemes have been investigated in several European and national programmes, like the EUPHRESCO-Project Ragweed, the EU-commission funded "HALT AMBROSIA" [42] and the current COST Action "FA1203-SMARTER" [23]. In Austria, many aspects of ragweed eradication in several yearlong projects were evaluated [43]. Sufficient knowledge of the technical side of eradication of ragweed has been available. Chemical, physical and biological methods are available. The aim of permanently reducing ragweed must be the depletion of the long-term seed bank. This implies the optimal time for mowing [44, 45]. Recommendations on the method of eradication can be found on the website "invasive species compendium". Eradication methods were published the EUPHRESCO-project in five languages.

2. Public relations

Ragweed occupies several biotopes (roadside verges, farmland, gardens, city parks, and ruderal surfaces (surfaces where the original vegetation has been disturbed such as construction sites)) and so it is not guaranteed that local officials alone are able to track the plant. Populations regularly begin at bird feeding locations, which are often private. Thus the involvement of the public by information of the risks and available eradication methods is necessary. Several institutes in Berlin executed the "Aktionsprogramm Ambrosia" that led to many reports of the presence of ragweed and the plants were often destroyed [46]. Smaller populations can be removed by hand, but larger populations need concerted action. In both cases populations should be reported to the authorities (**Tab. 2**). No new sensitizations occurred in Berlin, where a small group of workers known as "Ambrosia-Scouts",removed ragweed professionally [47]. On the spot elimination of plants by motivated pedestrians can be recommended without danger to the health of passers by. Nevertheless, contaminated spots should be reported to the authorities (**Tab. 2**). Cases where mugwort is removed by accident can be considered happy coincidences, as mugwort is also a known aeroallergen in Germany [48]. However, environmental protection organizations object to the removal of larger mugwort populations.

3. Legal regulations

The control of ragweed is technically feasible and is supported by the community. Still, experience in Germany and other countries show that legal regulations specific for ragweed are necessary for ragweed control [49]. The early implementation of an eradication- and reporting obligation in the frame of plant protection in Switzerland [50], substantially aided the rapid success of ragweed control. Participants of the expert meeting on ragweed in Berlin in 2013 also requested similar legal regulations for Germany [51]. Cornerstones of these laws are obligatory reporting, the prohibition of spread, the separation of contaminated and not-contaminated soil and an obligation of eradication. Reimbursement of lost crops for affected farmers would aid acceptance. The law limits the use of herbicides on roadsides. Here, the hot water method was successfully applied and in many cases a carefully controlled mowing regimen could be the method of choice.

Controlling ragweed has, besides health advantages, also agricultural advantages.

Ophraella communa

The leaf beetle *Ophraella communa* has potential for biological ragweed eradication as it mainly feeds on ragweed but no other plants. The beetle was used as classic biological control of ragweed in some countries [52] and was recently spotted in Northern Italy and Switzerland [53]. Whether this method is suited for Germany, or whether the devil is cast out with Beelzebub needs to be determined. Investigations are currently ongoing to determine under which climatic conditions the beetle is effective and whether infestation of sunflowers is posssible. These days, the release of species for biological control is limited by extensive test- and approval procedures.

Future of ragweed in Germany

It is unlikely that ragweed can be eradicated in Germany. Successful control depends on targeted actions. The implementation of laws for reporting and obligatory eradication is important. Until this is achieved, voluntary efforts in some federal states show that the expansion of ragweed can be successfully reduced. Allergologist can do the following to support these voluntary actions,:

1. Make sure you recognize ragweed (**Fig. 2**). Both sides of a ragweed leaf are a similar colour. Whereas the underside of a Mugwort leaf has a

Tab. 2: List of Authorities in Germany to report the presence of ragweed (*Ambrosia artemisiifolia*) (online also: Ambrosia-Scout-App: www.lugv.brandenburg.de/cms/detail.php/bb1.c.331296.de or www.ambrosiainfo.de)

State	Authority	Address
Germany	_ Web-Atlas for Schadorganismen: http://watson.jki.bund.de/Start;jsessionid=C1B14B3C2181CE7233EB1A8D1427C68E _ http://ambrosia.met.fu-berlin.de/ambrosia/fund_melden.php	Julius Kühn-Institut, Bundesforschungsinstitut für Kulturpflanzen Messeweg 11/12 38104 Braunschweig E-Mail: ambrosia@jki.bund.de Tel.: (05 31) 2 99 33 80
Baden-Württemberg	_ www.lubw.baden-wuerttemberg.de/servlet/is/26314/ (report form) _ Mobilee: Meine-Umwelt-App (Apple and Android)	LUBW – Landesanstalt für Umwelt, Messungen und Naturschutz Baden-Württemberg Dr. Harald Gebhardt Referat 23 Postfach 100163 76231 Karlsruhe E-Mail: ambrosia@lubw.bwl.de Tel.: (07 21) 56 00 12 22
Bayern	_ www.lfl.bayern.de/ips/unkraut/027800/ (report form)	LfL – Institut für Pflanzenschutz Stefan Thyssen Lange Point 10 85354 Freising E-Mail: Pflanzenschutz@LfL.bayern.de
Berlin	_ http://ambrosia.met.fu-berlin.de/ambrosia/fund_melden_info.php?ort=berlin& (Online and report form) _ Mobile: App fors Smartphone (Apple und Android): https://itunes.apple.com/de/app/ambrosia-scout/id441943132?mt=8	Freie Universität Berlin Institut for Meteorologie AP Ambrosia Carl-Heinrich-Becker-Weg 6–10 12165 Berlin E-Mail: td@met.fu-berlin.de
Brandenburg	_ http://ambrosia.met.fu-berlin.de/ambrosia/fund_melden_info.php?ort=brandenburg& _ Mobile: App for Smartphone (Apple und Android): https://itunes.apple.com/de/app/ambrosia-scout/id441943132?mt=8	Freie Universität Berlin Institut for Meteorologie AP Ambrosia Carl-Heinrich-Becker-Weg 6-10 12165 Berlin
Bremen	_ www.gesundheitsamt.bremen.de/detail.php?gsid=bremen125.c.3231.de	Lebensmittelüberwachungs-, Tierschutz- und Veterinärdienst Bremen (LMTVet) Pflanzenschutzmittel-Verkehrskontrolle Hans Puckhaber E-Mail: hans.puckhaber@veterinaer.bremen.de Tel.:(04 21) 36 11 06 89
Hamburg	–	No authorities responsible. Reports can go to: Botanischer Verein zu Hamburg e.V. E-Mail: hans-helmut.poppendieck@web.de
Hessen	_ www.ambrosiainfo.de/kontakt.html (only Ambrosia outside gardens)	
Mecklenburg-Vorpommern	_ www.lallf.de/fileadmin/media/PDF/ps/antraege/06LALLF_Melde_Formular_Ambrosia.pdf (Report form)	Landesamt für Landwirtschaft, Lebensmittelsicherheit und Fischerei Mecklenburg-Vorpommern Pflanzenschutzdienst des LALLF M-V Dr. Armin Hofhansel Graf-Lippe-Str. 1 18059 Rostock E-Mail: armin.hofhansel@lallf.mvnet.de Tel.: (03 81) 4 03 54 39

Tab. 2 – continuation: List of authorities in Germany to report the presence of ragweed (*Ambrosia artemisiifolia*)

Niedersachsen	–	Pflanzenschutzamt der Landwirtschaftskammer Niedersachsen Dr. Dirk M. Wolber Fachreferent Herbologie Wunstorfer Landstr. 9 30453 Hannover E-Mail: dirk.wolber@lwk-niedersachsen.de Tel.: (05 11) 40 05 21 69
Nordrhein-Westfalen	_ www.lanuv.nrw.de/natur/arten/ambrosia.htm	Landesamt für Natur, Umwelt und Verbraucherschutz Nordrhein-Westfalen (LANUV NRW) Carla Michels Leibnizstr. 10 45659 Recklinghausen E-Mail: carla.Michels@lanuv.nrw.de
Rheinland-Pfalz	_ www.pollichia.de/index.php/component/content/article/9-nicht-kategorisiert/133-ambrosia-artemisiifolia-in-rheinland-pfalz-vorstellung-des-aktuellen-erfassungsprojekts-mit-dem-artenfinder _ www.artenfinder.rlp.de (Internet-Report form; also other species)	Pollichia Bismarckstr. 33 67433 Neustadt a. d. Weinstr. E-Mail: ambrosia@flora-rlp.de Tel.: (0 63 21) 92 17 75
Saarland	_ www.saarland.de/dokumente/ressort_umwelt/Ambrosia.pdf (call for reporting)	Landesamt für Umwelt- und Arbeitsschutz des Saarlandes Außenstelle: Zentrum for Biodokumentation des Saarlandes Franz-Josef Weicherding Am Bergwerk Reden 11 66578 Landsweiler-Reden E-Mail: fj.weicherding@biodokumentation.saarland.de Tel.: (06 81) 5 01 34 52
Sachsen	_ http://fs.egov.sachsen.de/formserv/findform?shortname=sms_sms_04600&formtecid=2&areashortname=SMS (Report form) _ www.smul.sachsen.de/lfulg/1143.htm	Sächsisches Staatsministerium für Soziales und Verbraucherschutz (SMS) Sächsische Landesanstalt for Landwirtschaft Dr. Ewa Meinlschmidt E-Mail: ewa.meinlschmidt@smul.sachsen.de Tel.: (03 51) 4 40 83 17
Sachsen-Anhalt	_ www.sachsen-anhalt.de/fileadmin/Elementbibliothek/Bibliothek_Politik_und_Verwaltung/Bibliothek_LAV/Hygiene/flyer_ambrosie.pdf (call for reporting)	Landesanstalt für Landwirtschaft, Forsten und Gartenbau (LLFG) Sachsen-Anhalt Strenzerfelder Allee 22 06406 Bernburg E-Mail: Pflanzenschutz@llfg.mlu.sachsen-anhalt.de Tel. (0 34 71) 33 43 41
	_ Reports of invasive neophytes in Sachsen are possible with UfU e.V.: http://85.214.60.79/korina.info/?q=node/123 (Internet-Report form; also other Neophytes)	Koordinationsstelle Invasive Neophyten in Sachsen bei UfU e.V. Große Klausstr. 11 06108 Halle www.korina.info E-Mail: kontakt@korina.info Tel.: (03 45) 2 02 65 30 Fax: (03 45) 68 58 52 16
Schleswig-Holstein	_ www.schleswig-holstein.de/LLUR/DE/Service/MedienCenter/Pressemeldungen/2013/0813/LLUR_130813_Beifuss_Ambrosie.html (call for reports)	Landesamt für Natur und Umwelt Abteilung Naturschutz und Landschaftspflege Dr. Silke Lütt Hamburger Chaussee 25 D-24220 Flintbek E-Mail: sluett@lanu.landsh.de Tel.: (0 43 47) 70 43 63
Thüringen	_ www.thueringen.de/de/publikationen/pic/pubdownload1430.pdf (call for reports)	Report to local authorities like Thüringer Landesanstalt für Umwelt und Geologie (TLUG)

white colour. If you accidentally remove mugwort, some allergic individuals will be pleased too.

2. Remove ragweed when you spot it. Populations with less than 100 plants can be manually eradicated. Removed plants should be put on places that prevent new rooting (i. e. streets). Populations of > 100 plants need mechanical assistance in eradication.
3. Report ragweed populations to the authorities. The addresses of the authorities concerning ragweed can be found in **Tab. 2** or at www.ambrosia-info.de. Report large as well as small populations. Infested sites need years of monitoring to guarantee the depletion of long surviving seeds. Have the address of the authorities concerned with ragweed in your county ready at hand.
4. Foster public relations for ragweed eradication wherever you can, e. g.: journalists, politicians, biology teachers, allergic individuals and their organizations, environmental unions.
5. Treat sensitized and symptomatic patients with specific immunotherapy (SIT) for the prevention of organ change (asthma).

Experience in other countries has shown that it takes years after infestion with ragweed before sensitizations start to occur in an area. The deceptive conclusion that the presence of ragweed does not lead to allergic sensitization is fatal. It is too late to eradicate ragweed when allergic sensitization starts to increase, as its seeds survive up to 40 years in soil and populations are then firmly established.

Prof. Dr. Jeroen Buters
ZAUM – Center of Allergy & Environment
Biedersteinerstr. 29
80802 München, Germany
E-Mail: buters@tum.de

Remark

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Conflict of interests

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