Allergenic plants and their relevance to human health in a changing climate – Ambrosia as a case study

or: How green space can negatively influence health

11.30-12.00

Prof. Dr. med. Regina Treudler
Most important allergenic plants in Germany

Pollinating

- Winter/ Spring
  Hazel, Alder, Birch

- Summer
  Grasses, Rye

- Autumn
  Weeds

Inhalative allergens
**Allergic rhinitis/ Hayfever**

<table>
<thead>
<tr>
<th>Immediate signs or symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Runny, itchy nose</td>
</tr>
<tr>
<td>Sneezing</td>
</tr>
<tr>
<td>Itchy, watery eyes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Obstructive signs or symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congested nose</td>
</tr>
<tr>
<td>Snoring</td>
</tr>
</tbody>
</table>

**Complications**

- Sleep disturbance
- Daytime tiredness/poor concentration
- Headaches
- Recurrent ear/sinus infections

**Individual burden:** reduced quality of life

**Population based:** economic burden due to reduced activity/performance
One airway – one disease

From Hayfever to Asthma

Reduced quality of life for the individual
Economic burden for the society
Prevalence of clinical allergies in adults in Germany

DEGS – Deutsche Gesundheitsstudie /Erwachsene, RKI
about 8000 participants

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percentage</th>
<th>Females &lt; 30 years</th>
<th>&lt; 30 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>5%</td>
<td>females &lt; 30 years</td>
<td>6.7%</td>
</tr>
<tr>
<td>Hay fever</td>
<td>12%</td>
<td>&lt; 30 years</td>
<td>14.6%</td>
</tr>
</tbody>
</table>

Tab. 3 Prävalenz von Asthma bronchiale, anderen atopischen und allergischen Erkrankungen in den letzten 12 Monaten nach Geschlecht und Altersgruppen

<table>
<thead>
<tr>
<th>Erkrankung</th>
<th>Geschlecht</th>
<th>18 bis 29 Jahre</th>
<th>30 bis 39 Jahre</th>
<th>40 bis 49 Jahre</th>
<th>50 bis 59 Jahre</th>
<th>60 bis 69 Jahre</th>
<th>70 bis 79 Jahre</th>
<th>Gesamt</th>
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</thead>
<tbody>
<tr>
<td>Asthma bronchiale</td>
<td>Frauen</td>
<td>6.7 (4.6–9.5)</td>
<td>6.4 (4.3–9.6)</td>
<td>6.7 (4.7–9.6)</td>
<td>4.6 (3.0–6.8)</td>
<td>8.2 (5.9–11.4)</td>
<td>5.2 (3.5–7.7)</td>
<td>6.3 (5.4–7.3)</td>
</tr>
<tr>
<td></td>
<td>Männer</td>
<td>4.0 (2.4–6.5)</td>
<td>4.6 (2.6–7.9)</td>
<td>3.4 (2.3–5.0)</td>
<td>3.1 (1.9–5.0)</td>
<td>4.5 (3.0–6.7)</td>
<td>2.3 (1.3–4.0)</td>
<td>3.7 (2.9–4.6)</td>
</tr>
<tr>
<td></td>
<td>Gesamt</td>
<td>5.3 (3.9–7.0)</td>
<td>5.5 (4.0–7.6)</td>
<td>5.0 (3.9–6.5)</td>
<td>3.8 (2.7–5.3)</td>
<td>6.4 (4.8–8.5)</td>
<td>3.9 (2.8–5.4)</td>
<td>5.0 (4.4–5.6)</td>
</tr>
<tr>
<td>Heuschnupfen</td>
<td>Frauen</td>
<td>17.1 (14.0–20.7)</td>
<td>18.2 (14.4–22.8)</td>
<td>15.9 (12.9–19.4)</td>
<td>10.5 (8.2–13.3)</td>
<td>10.2 (7.7–13.3)</td>
<td>6.5 (4.3–9.6)</td>
<td>13.3 (12.1–14.6)</td>
</tr>
<tr>
<td></td>
<td>Männer</td>
<td>12.2 (9.3–15.9)</td>
<td>16.2 (12.6–20.6)</td>
<td>12.9 (10.5–15.9)</td>
<td>9.7 (7.4–12.5)</td>
<td>6.1 (4.4–8.4)</td>
<td>3.1 (1.9–4.9)</td>
<td>10.6 (9.5–11.9)</td>
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<tr>
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<td>Gesamt</td>
<td>14.6 (12.4–17.1)</td>
<td>17.2 (14.6–20.2)</td>
<td>14.4 (12.5–16.5)</td>
<td>10.1 (8.5–11.9)</td>
<td>8.2 (6.5–10.3)</td>
<td>5.0 (3.6–6.8)</td>
<td>12.0 (11.1–12.9)</td>
</tr>
</tbody>
</table>
Hayfever in population based cohort LIFE-Leipzig

N = 10,000

Lifetime

Last 12 months

<table>
<thead>
<tr>
<th>Geschlecht</th>
<th>N</th>
<th>Prozent</th>
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<tbody>
<tr>
<td>Heuschnupfen, 12MP*</td>
<td>1328</td>
<td>13.3%</td>
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</table>

*12MP: 12 Monatsperiode
Pollen

Pollen are fine powdery substances comprising pollen grains used for transferring haploid male genetic material. They are observed under a microscope for analysis and identification of their respective plants.
Pollen may lead to IgE antibody production
Tree pollen

- **Hazel**
- **Alder**
- **Ash-tree**
- **Hornbeam**
- **Birch**
- **Beech**
- **Oak**

- **Sporadic exposure**
- **Moderate exposure**
- **Strength exposure**
Grass- and weed pollen

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<tr>
<th></th>
<th>DEZ.</th>
<th>JAN.</th>
<th>FEB.</th>
<th>MÄRZ</th>
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<th>MAI</th>
<th>JUNI</th>
<th>JULI</th>
<th>AUG.</th>
<th>SEPT.</th>
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<td>Rye</td>
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<td>Ribwort</td>
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<tr>
<td>Stinging Nettle</td>
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<td>Goosefoot</td>
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<td>Mugwort</td>
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<td>Ragweed</td>
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</table>

- sporadic exposure
- moderate exposure
- strength exposure
### Scientific classification

<table>
<thead>
<tr>
<th>Kingdom:</th>
<th>Plantae</th>
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<tr>
<td>(unranked):</td>
<td>Angiosperms</td>
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<td>(unranked):</td>
<td>Eudicots</td>
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<td>Asteroideae</td>
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<td>Tribe:</td>
<td>Heliantheae</td>
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<td>Subtribe:</td>
<td>Ambrosiinae</td>
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<tr>
<td>Genus:</td>
<td><em>Ambrosia</em></td>
</tr>
</tbody>
</table>

**Neophyte in Europe and Germany**

**Originated from the United States of America**
Ragweed spread in Germany

• Seeds are imported or spread by
  • contaminated bird feed
  • transport of ragweed contaminated soil
    (also in tyre treads) and
  • agricultural products from infested areas

• Ragweed seeds survive up to 40 years in soil, and so extended timescales for eradication and observations are needed
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.
Experiences from other countries

- In the USA, ragweed is one of the most sensitizing pollen species and thus a major allergen
- USA: every second patient with pollen allergy suffers from ragweed
- High rate of asthmatics
- Ragweed sensitization in Austria increased from 8.5 % to 17.5 % within a few years
Focus of plants in Eastern Europe, pollen travel a long way
Ragweed populations in Germany

States bordering on ragweed positive areas, like Brandenburg and Bavaria, are especially at risk and invasion is already underway

Jeroen TM Buters et. al

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

Allergo J Int 2015; 24: 108–20
Ragweed pollen counts 2012-14

Ragweed pollen evoke allergic symptoms at low concentrations (about 10 pollen/m³)

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.

Ambrosia artemisiifolia (ragweed) in Germany – current presence, allergological relevance and containment procedures
Allergo J Int 2015; 24: 108–20
Ambrosia-Brandenburg, Sachsen, Sachsen-Anhalt und Thüringen (Pollenflugbelastung)


Dekaden-Mittel des Pollenflugs 2016

2015 - 2016
Time lag between Ambrosia sensitisation and Ambrosia allergy

A 20-year study (1989–2008) in Legnano, northern Italy

Anna Tosìa, Brunello Witthrich, Maira Bonini, Barbara Pietragalla-Köhler

METHODS: The sensitisation of patients to Ambrosia and other aeroallergens was tested by a skin prick test. The patients were interviewed about their clinical symptoms and the time of incidence of the symptoms. On average, 1100 patients per year were included in this study in the years 1989–2008. The daily pollen concentration was measured with volumetric Hirst type pollen traps.

RESULTS: The sensitisation rate to Ambrosia increased from 24% to over 70% among the patients whose skin prick tests were positive to pollen. In 1989, about 45% of the Ambrosia sensitised patients suffered from respiratory symptoms (rhinitis and/or asthma) in late summer. After 5 years, this percentage increased to 70% and finally reached 90%. The prevalence of asthma was initially 30% among the Ambrosia sensitised patients and increased slightly to 40%.

CONCLUSION: The extent of the consequences of high Ambrosia pollen concentrations is not ascertainable over the short term. Sensitisation rates have constantly increased over a period of more than 15 years, and moreover the incidence of allergy is delayed during the first years.

Anna Tosia et. al
Swiss Med Wkly. 2011;141:w13253
Time lag between Ambrosia sensitisation and Ambrosia allergy
European population sensitized to ragweed

Percentage of population sensitised to Ambrosia pollen; At baseline and in the Far Future; Averaged results for RegCM and CHIMERE; RCP4.5; Reference Invasion scenario. Data source: GISCO - Eurostat (European Commission). Administrative boundaries: © EuroGeographics © UN-FAO © Turkstat.

Lake IR et al.
Climate Change and Future Pollen Allergy in Europe
DEGS 1: Ambrosia Sensibilisierung 8.2%

Gesundheit Erwachsener in Deutschland; n=7800, 18-71 Jahre

Haftenberger M et al. Bundesgesundheitsblatt 2013;56:687

Hauptallergen Ambrosia (nAmb a 1) 0.4 (0.2-0.5)

Prävalenz einer Sensibilisierung

6-7 Mio subjects / D

Haftenberger M et al. Bundesgesundheitsblatt 2013;56:687
Angriff der grünen Invasoronen

Viele, was heute in heimischer Gefilden grün, wurde erst aus anderen Ländern eingeschleppt.

Und einige dieser Arten machen richtig Ärger. Von Roland Herold

Ingolf Kühn (46) vom Heinholz-Zentrum für Umweltforschung fällt so etwas wie ein Unruhestrom. Er ermittelt gegen Noppenblütler. Das sind Pflanzen, die durch Menschen direkt oder indirekt nach Deutschland eingeführt wurden, wo sie natürlicheweise nicht vorkommen. Rund 700 davon gibt es gegenüber 270 einheimischen. Dazu mussen von ihnen verwildern und sich unverschämt vermehren. Aber jedem sagt Kühn: „Und was dann?“

Kühn und Kollegen sitzen auf einer Bank, an einem Tisch. „Es ist eine Weltwirtschaft. Aber auch ein Vererbungssystem, das nicht genau funktioniert“, sagt Kühn. „Die Menschen können davon profitieren. Aber auch die Natur.“

Zwei Pflanzenarten, die Kühn besonders interessieren, sind Ambrosia- und Ragweed. „Diese Pflanzen sind weltweit verbreitet und können in Deutschland durch ihre Staubtropfen oder Blüten bestäuben. Die Pollen können durch den Wind über große Distanzen transportiert werden und reizen die Atemwege Menschen, die allergisch reagieren.“

Kühn betont, dass es wichtig ist, die Pflanzen frühzeitig zu erkennen und zu bekämpfen. „Die Pflanzen müssen frühzeitig entfernt werden, bevor sie sich ausbreiten und überschwemmen.“

Promotion of eradication programs

Detection of plants
Summary

• Ragweed plants show a spread from Southern Europe to Germany
• increased exposure ► increased rates of sensitization
• Ragweed is a potent inhalative allergen (hay fever, asthma)
• low pollen concentrations needed for symptoms
• Pollination season July – November
• It may take years before exposure results in sensitization
• When sensitization rates start to increase, it is mostly too late to eliminate established ragweed populations
• ► detecting and eliminating ragweed plants: cornerstone of prevention
• Eradication campaigns only in few federal states (e.g. Bavaria, Berlin, Baden-Württemberg)
Thank you for your attention!