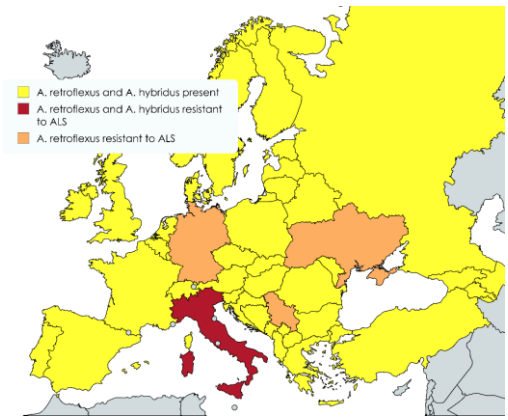
# Weed Fact Sheet:
# *Amaranthus retroflexus*
# *Amaranthus hybridus*

*Amaranthus retroflexus* and *Amaranthus hybridus* are the most noxious and abundant species of this genus in arable summer crops. They are native or now naturalized across all European countries, leading to important yield losses. In some countries, herbicide resistance to ALS inhibitors has been confirmed.




## Weed Biology

| | |
|---|---|
| EPPO-codes (Latin and common names) | AMARE - *Amaranthus retroflexus;* redroot pigweed<br>*AMACH – Amaranthus hybridus;* smooth pigweed |
| Life cycle | Annual |
| Germination window | (March) April – September (October) |
| Max. generation/year | 1, rarely 2 |
| Occurrence in crop or cultivation system | Maize, soybean, horticultural crops, forages, road and field margins |
| Yield loss | 0.5 plant/m² = 5 % yield loss in maize, soybean<br>0.7 plant/m² = 41 % yield loss in cotton (AMACH)<br>1.5 plants/m² = 31 % yield loss in sugar beet (AMARE)<br>2 plants/m² = 12.3 % yield loss in soybean (AMARE)<br>12 plants/m² = 12.3 % yield loss in sorghum (AMARE)<br>>30 plants/m² = 90 % yield loss in maize and soybean |
| Preferred environmental conditions | Associated with cultivated fields; common in fertile, well-drained soils, or in loams and sandy loams. Tolerates a wide pH range (~5.5–8.0). |

| | |
|---|---|
| Ploidy | Diploid (2n = 34 & 32, AMARE & AMACH respectively) |
| Type of reproduction | Monoecious |
| Pollination | Primarily self-pollination |
| Pollen dispersal | By wind or gravity |
| Seed shattering | >20% at Harvest |
| Fecundity *(seeds/plant)* | 10.000-500.000 |
| Seed dispersal | Wind / machinery / water / birds / animals / manure |
| Distance of seed dispersal | 0.2 – 2.0 metres |
| Dormancy | Low primary, but strong secondary dormancy present |
| Seed bank longevity | 2-3 years AMARE (up to 40) and 2-6 years AMACH |
| Seed decline per year | 36% |

## Impact of Agronomic Measures on Occurrence and Spread

**Germination & dormancy**

- Germination predominantly from May to July
- Primary dormancy lasts from a few weeks to a few months
- Warm temperatures and light break dormancy. Far-red light and darkness can inhibit germination
- Emergence occurs from 0 to 5cm below the soil surface

**Soil cultivation**

- Both species thrive in all cultivation systems
- Ploughing seed to a depth of 40-60cm can be effective in controlling AMARE and AMACH
- For AMARE, a one-year fallow period can result in 50% seedbank depletion, and 75-94% in 24 months

**Crop sowing date & Seed set**

- Later plantings are better than earlier sowings
- Delayed drilling is recommended, with stale seedbed preparation
- Plants surviving herbicides should not be allowed to set seed

**Crop rotation, cover crops and competitiveness**

Crop rotation (ALS-tolerant crops not recommended), cover crops, maximizing crop competitiveness and any measure which prevents weed emergence are useful control tools.

# Weed Fact Sheet:
# *Amaranthus retroflexus*
# *Amaranthus hybridus*

HRAC Europe

## Observed Resistance in Europe

- Resistant populations have been confirmed across Europe and are increasing in both species
- ALS target site resistance blocks the binding of Group 2 herbicides and can confer broad cross-resistance across multiple Group 2 chemical sub-classes. This has been reported in Germany, Italy, Serbia and Ukraine for AMARE and in Italy for AMACH
- Resistance to PSII inhibitors, specifically Group 5 (Serine-264 Binders), has been reported in Bulgaria, Czech Republic, France, Germany, Greece, Italy, Poland, Spain and Switzerland for AMARE; it has been reported for AMACH in France, Italy, Spain and Switzerland

### Target-site Resistance (TSR) to ALS

- Mutations Asp-376-Glu and Trp574Leu have been reported in AMARE; Trp574 to Leu, Met or Arg has been reported in AMACH

### Resistance to PSII inhibitors

- There are no detailed studies on the potential mechanisms involved, but there is evidence of TSR mechanisms

## Best Management Practices

- To prevent and mitigate resistance development, follow the Guideline to the Management of Herbicide Resistance published by Global HRAC
- Rotate herbicides from different modes of action (MoA) throughout the crop rotation and apply when the plants are below 5–7 cm tall
- The use of residual herbicides (pre-emergence and early post-emergence) in combination with other MoAs is recommended
- Monitor the results of herbicide applications to allow for a timely adjustment of weed control strategies when necessary
- Integrate non-chemical methods:
  - Occasional ploughing down of seeds to a depth of 40 - 60 cm is an effective weed control method
  - Do not let plants which have survived herbicide treatments to set seed
  - Delaying crop planting and (multiple) shallow tillage passes are effective in stimulating the germination of *Amaranthus* species to allow for control pre-planting (stale seed bed preparation)
  - Fallowing affected field can deplete the seed bank better for AMARE than it can for AMACH
  - Cover crops can significantly reduce the germination and emergence of *Amaranthus* seedlings
  - Planting crops at the highest practical density to avoid impacts on yield can increase competition
  - Shallow inter-row tillage 4-6 weeks after planting can be viable for certain vegetable crops (earlier tillage is possible for certain transplanted vegetable crops)
  - Consider a drip irrigation system (crop-row) integrated with a inter-row plastic mulch in some high-value vegetable crops

# Weed Fact Sheet:
# *Amaranthus retroflexus*
# *Amaranthus hybridus*

## References:


Coleman, M., Kristiansen, P., Sindel, B., Fyfe, C. 2021. Amaranth (Amaranthus spp.): Weed management guide for Australian vegetable production. School of Environmental and Rural Science, University of New England, Armidale.

Costea, M., Weaver, S.E. & Tardif, F.J. (2004). The biology of Canadian weeds. 130. Amaranthus retroflexus L., A. powellii S. Watson and A. hybridus L.. Canadian Journal of Plant Science. 84(2): 631-668.

Taab, A., & Royo-Esnal, A. (2023). Modelling seedling emergence of Amaranthus retroflexus affected by soil depth. Spanish Journal of Agricultural Research, 21(2), e1001. https://doi.org/10.5424/sjar/2023212-19814.

Heap, I. The International Herbicide-Resistant Weed Database. Online. Tuesday, December 2, 2025. Available www.weedscience.org.

Milani, A., Scarabel, L. and Sattin, M. (2020), A family affair: resistance mechanism and alternative control of three Amaranthus species resistant to acetolactate synthase inhibitors in Italy. Pest Manag Sci, 76: 1205-1213.

Sarangi, D., Jhala, A.J., Govindasamy, P. & Brusa, A. (2021) Chapter 2 - Amaranthus spp.. In Biology and management of problematic crop weed species; Chauhan, Bhagirath (Eds.); Elsevier, Academic Press: Amsterdam, Netherlands; pp. 21-42.

Scarabel, L., Varotto, S. & Sattin, M. (2007), A European biotype of Amaranthus retroflexus cross-resistant to ALS inhibitors and response to alternative herbicides. Weed Research, 47: 527-533.