

A wide-angle photograph of a lush green soybean field. In the center of the frame, a single pigweed plant stands out among the rows of soybeans. The pigweed has a distinct growth habit with a central stem and smaller, more upright leaves compared to the surrounding soybean plants. The background shows a flat horizon with some distant buildings and trees under a clear sky.

# **Pigweed Identification:**

## **A Quick Guide for Common Species in NY**

---

*Funding generously provided by the New York Corn &  
Soybean Growers Association*

*NYCSGA 2021 Corn Research and Education Grant*

# Why Pigweed Identification?

## *Competition and Yield Loss*

Pigweeds are some of the most commonly occurring and troublesome weeds that US growers encounter. Several pigweed species can grow very quickly, often overtaking the crops that they emerge with.

## *Seed Production and Seedbank Growth*

Pigweeds can produce a lot of seed. Under optimal growing conditions, these species can produce tens to hundreds of thousands of seeds; female Palmer amaranth plants have been reported as producing up to a million seed. This leads to the development of large seedbanks.

## *Herbicide Resistance*

As of December 2021, there are 162 confirmed cases of resistance across all pigweed species, herbicides, and states in the US. 40 of these reports detail resistances to multiple herbicide groups within a single plant population ([weedsience.org](http://weedsience.org)).



# Why Pigweed Identification?

Pigweeds (*Amaranthus* spp.) are difficult to identify from each other. But identification is crucial for developing a successful weed management program, particularly in an agricultural landscape that is heavily reliant on herbicides (and where resistance is common). Species can also differ in their growth rates, which can impact the success of physical management, like cultivation. When thinking about pigweed identification, focus on a few key characteristics:

*The shape of the leaf blade and the length of the petiole, as well as the hairiness of the stem.*

*The presence of male and female flowers on the same (monoecious) or separate (dioecious) plants and the structure of the flower heads (inflorescence).*

*The size of the plant.*

Despite similarities across species, there are traits/combinations of traits that can be used to distinguish among the pigweeds to successfully identify them



|                         | <b>Palmer</b>  | <b>Waterhemp</b>   | <b>Powell</b>   | <b>Redroot</b>                                       | <b>Smooth</b>  |
|-------------------------|--|--|---|--|--|
| Leaves                  | Diamond-shaped   | Long and linear  | Diamond-shaped  | Oval- to egg-shaped with wavy margins                | Oval- to egg-shaped with wavy margins                                    |
| Petioles                | LONGER than leaf blade   | Shorter than leaf blade  | Shorter than leaf blade   | Shorter than leaf blade                              | Shorter than leaf blade  |
| Stems and Plant Height  | Smooth<br>Up to 10 feet  | Smooth<br>Up to 10 feet  | Sparsely hairy<br>3 to 6 feet   | Sparsely to very hairy<br>3 to 6 feet                | Very hairy<br>3 to 6 feet  |
| Male and Female Flowers | SEPARATE plants  | SEPARATE plants  | Same plant  | Same plant   | Same plant   |
| Flower Heads            | Thick branches and tightly clustered flowers, female flowers have SHARP bracts | Branches are thinner than Palmer amaranth, flowers are less tightly clustered, no bracts | Sparsely branched, but branches can be long and flowers have bracts resembling Palmer | Branches on flowerheads are compact and short/stubby | Many branched flower heads with branches longer and thinner than redroot |

# Palmer amaranth (*Amaranthus palmeri*)

**Leaves:** Diamond-shaped and sometimes exhibiting a white or purple, V-shaped watermark (chevron) on them. Leaf petioles (especially older leaves) are as long/longer than the leaf blades.

**Stems:** Smooth (not hairy) and green, red, or green-red striped.

**Height:** Can grow very tall, up to 10 feet, especially in competition with corn.

**Flowers:** Produces male and female flowers on separate plants. Flowers are primarily produced on long (up to 2-3 feet, or more, in length) terminal flower heads. Flower heads may also develop in upper leaf axils. Male flowers will have yellow anthers with pollen. Female flowers will have sharp bracts associated with them. Males and female flower heads may have many branches.

**Herbicide resistances in US:** WSSA Groups 2, 3, 4, 5, 9, 10, 14, 15, 27.

# Palmer amaranth (*Amaranthus palmeri*)



*Palmer amaranth has diamond shaped leaves with petioles longer than the blades*

# Palmer amaranth (*Amaranthus palmeri*)





# Palmer amaranth (*Amaranthus palmeri*)



# Palmer amaranth (*Amaranthus palmeri*)



*Male flower head*



*Anthers full of pollen*



*Male Palmer in corn*

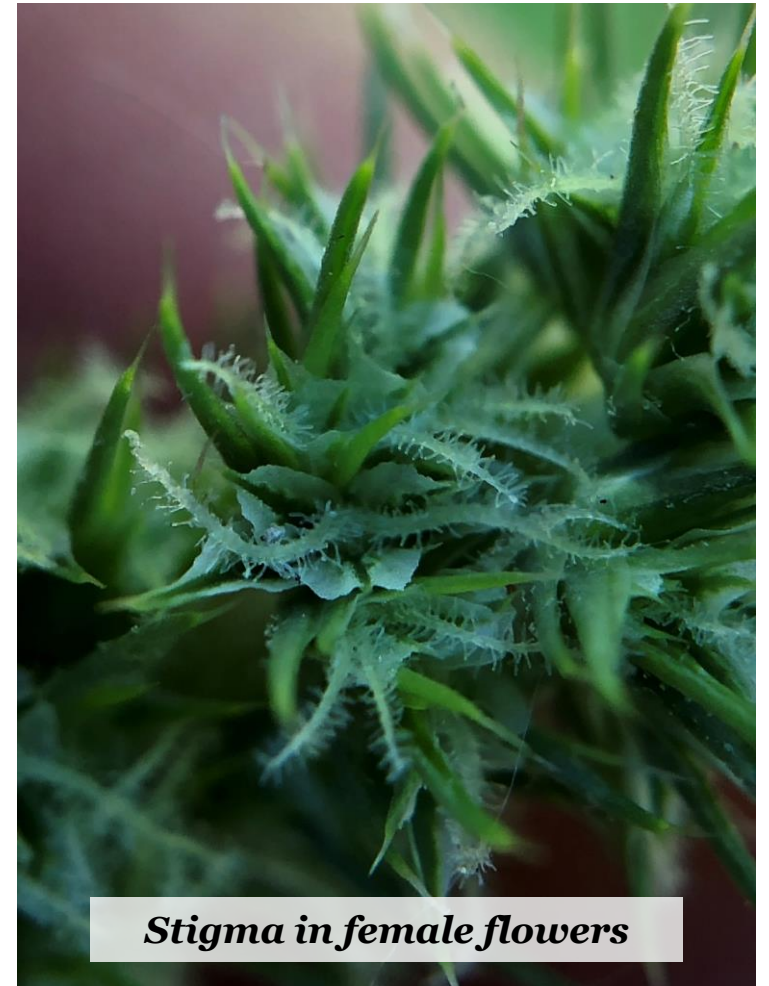
# Palmer amaranth (*Amaranthus palmeri*)



*Female flower head*



*Female flowers with bracts*



*Stigma in female flowers*

# Palmer amaranth (*Amaranthus palmeri*)



*A large female Palmer amaranth plant in the Cornell Greenhouse exhibiting multiple flower heads that are many branched*



# **Waterhemp (*Amaranthus tuberculatus*)**

**Leaves:** Long and linear and sometimes oval-shaped. Leaf petioles are shorter or no longer than the leaf blades.

**Stems:** Smooth (not hairy) and green, red, or green-red striped.

**Height:** Can grow very tall, up to 10 feet, especially in competition with corn.

**Flowers:** Male and female flowers on separate plants. Flowers are primarily produced on long (up to 1-2 feet or more, in length) terminal flower heads. Flower heads may also develop in upper leaf axils. Female flowers do not have sharp bracts associated with them. Waterhemp flowers clusters are more widely spaced apart than those of Palmer amaranth. Flower heads may have multiple branches.

**Herbicide resistances in US:** WSSA Groups 2, 4, 5, 9, 14, 15, 27.

# Waterhemp (*Amaranthus tuberculatus*)



*Linear leaves*



*Linear leaves*



*Linear leaves*

# Waterhemp (*Amaranthus tuberculatus*)



# Waterhemp (*Amaranthus tuberculatus*)



*Male (L) and female (R) flowers*



*Male flowers*



*Male flowers*

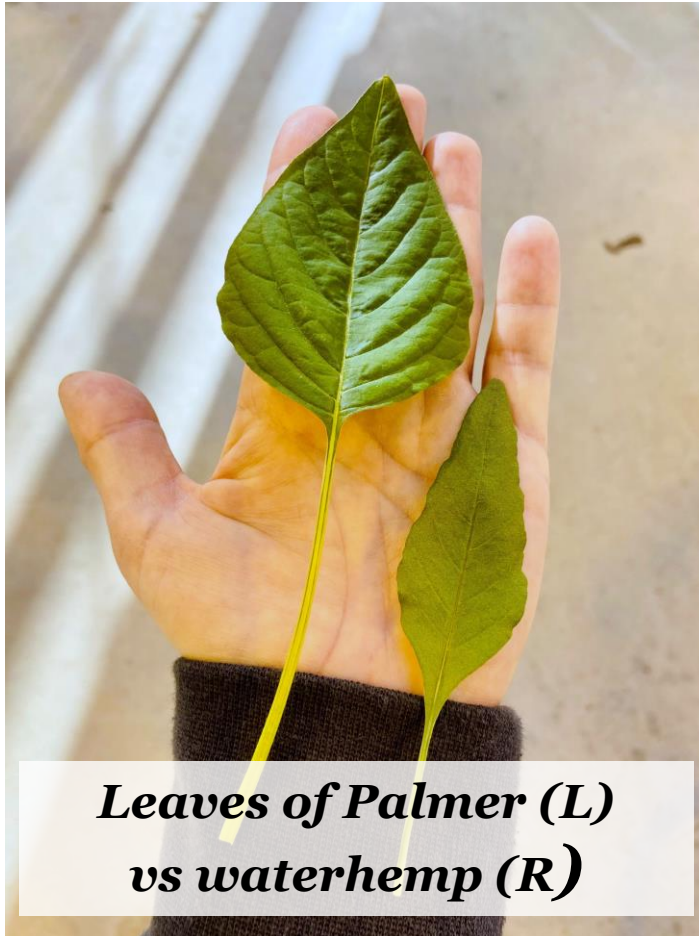


# **Waterhemp (*Amaranthus tuberculatus*)**



*Herbicide resistant waterhemp in soybean*

# Differentiating Palmer from Waterhemp



# **Powell amaranth (*Amaranthus powellii*)**

**Leaves:** Diamond-shaped, maybe darker green. Leaf petioles are shorter or no longer than the leaf.

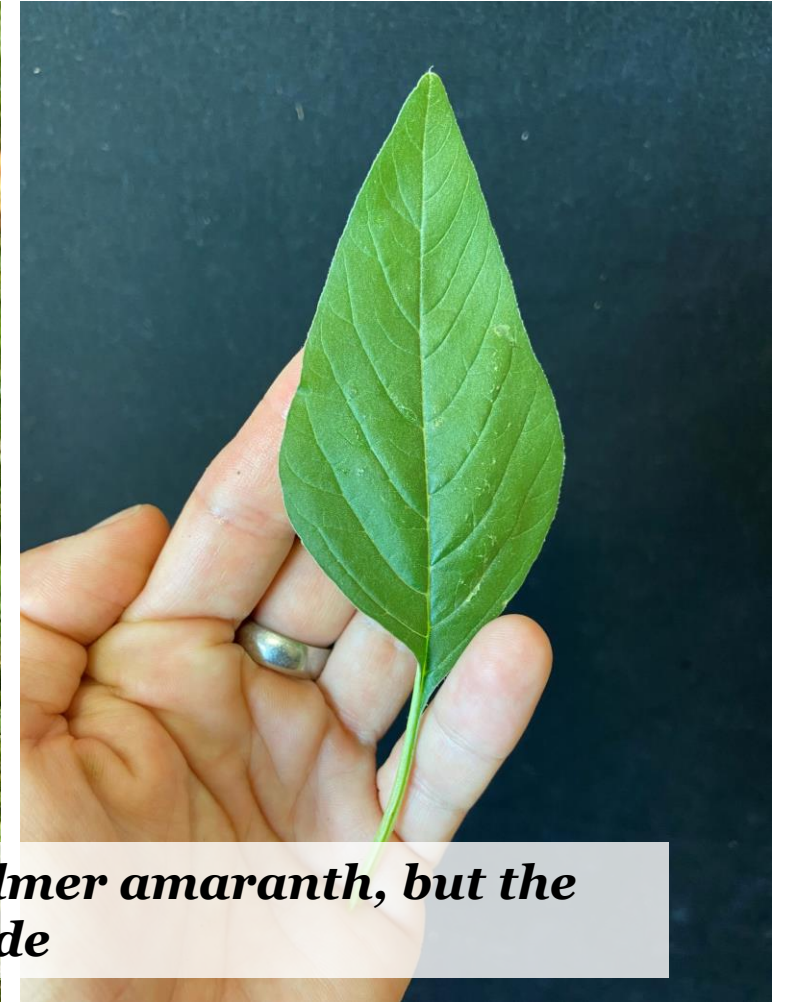
**Stems:** Sparsely hairy to smooth.

**Height:** 3 to 6 feet tall.

**Flowers:** Male and female flowers are produced on the same plant in terminal flower heads with fewer, prickly, branches. May be confused with Palmer amaranth; distinguish by petiole length, presence of male and female flowers on the same plant, as opposed to separate plants.

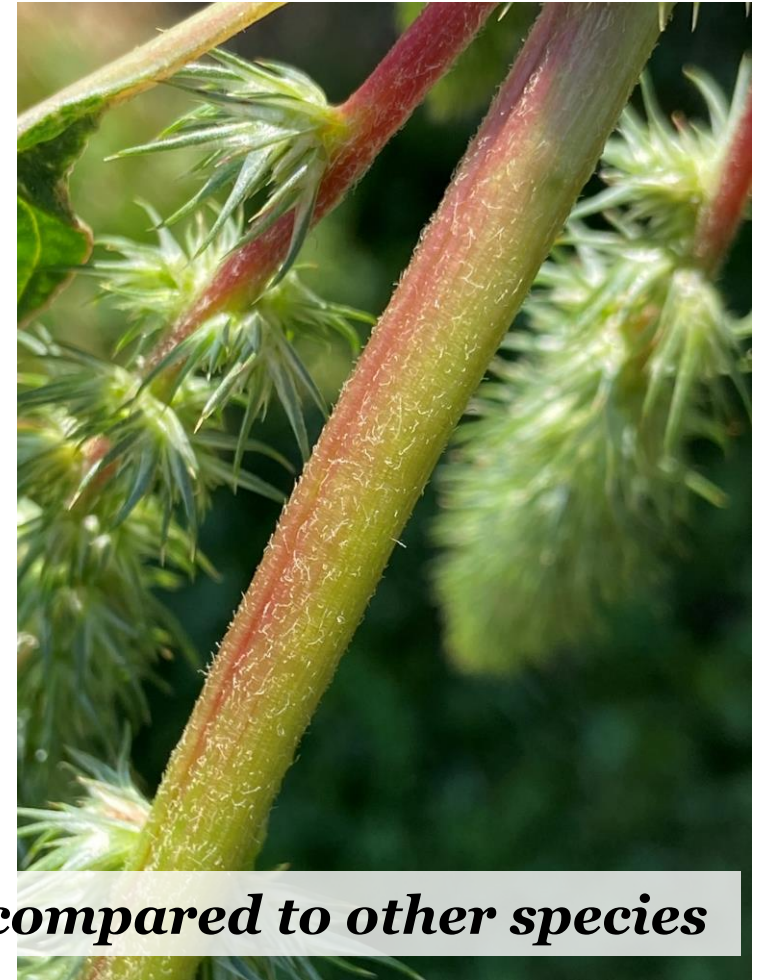
**Herbicide resistances in US:** WSSA Groups 2, 5.

# **Powell amaranth (*Amaranthus powellii*)**



*Powell amaranth leaves are diamond shaped, like Palmer amaranth, but the petioles are shorter than the blade*

# Powell amaranth (*Amaranthus powellii*)



*The stems of Powell amaranth are minimally hairy, compared to other species*

# **Powell amaranth (*Amaranthus powellii*)**



***Powell amaranth flower heads are not highly branched, flowers have bracts***

# Redroot pigweed (*Amaranthus retroflexus*)

**Leaves:** Oval- to diamond- to egg-shaped with prominent veins and wavy leaf margins. A V-shaped watermark can sometimes be seen on the blade surface. The undersides of leaves (especially the main vein) may be hairy. Leaf petioles are shorter or no longer than the leaf

**Stems:** Very hairy.

**Height:** 3 to 6 feet tall.

**Flowers:** Male and female flowers are produced on the same plant (monoecious) in terminal flower spikes that are comprised of short, thick, and compact branches. Easily confused with smooth pigweed; look to the presence of hairs and the flowerhead for confirmation.

**Herbicide resistances in US:** WSSA Groups 2, 5, 14.

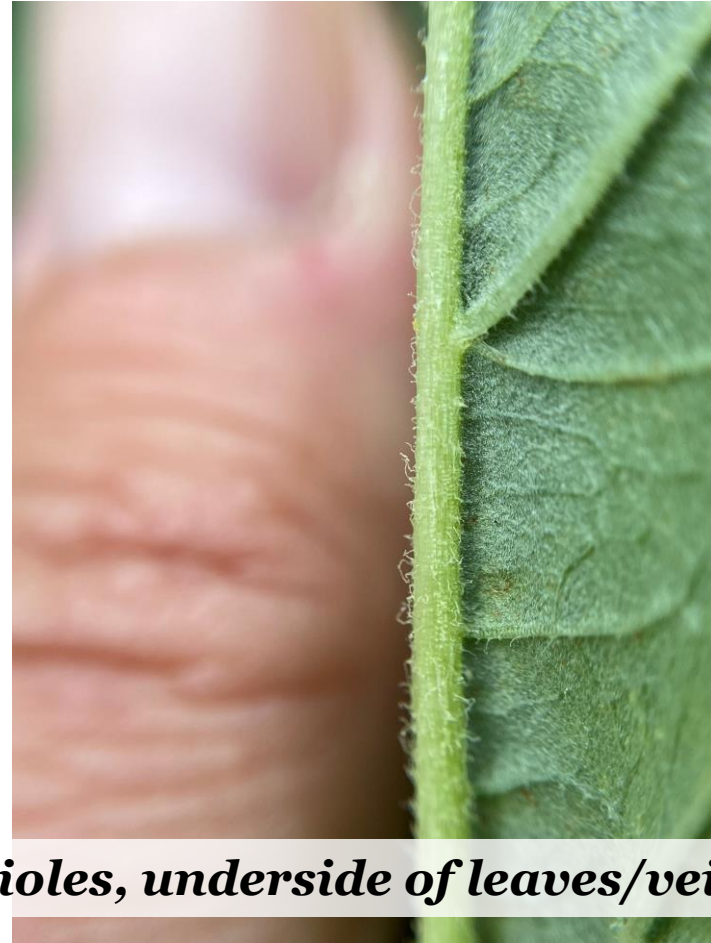
# Redroot pigweed (*Amaranthus retroflexus*)



*Oval/round- to egg-shaped leaves with wavy margins*

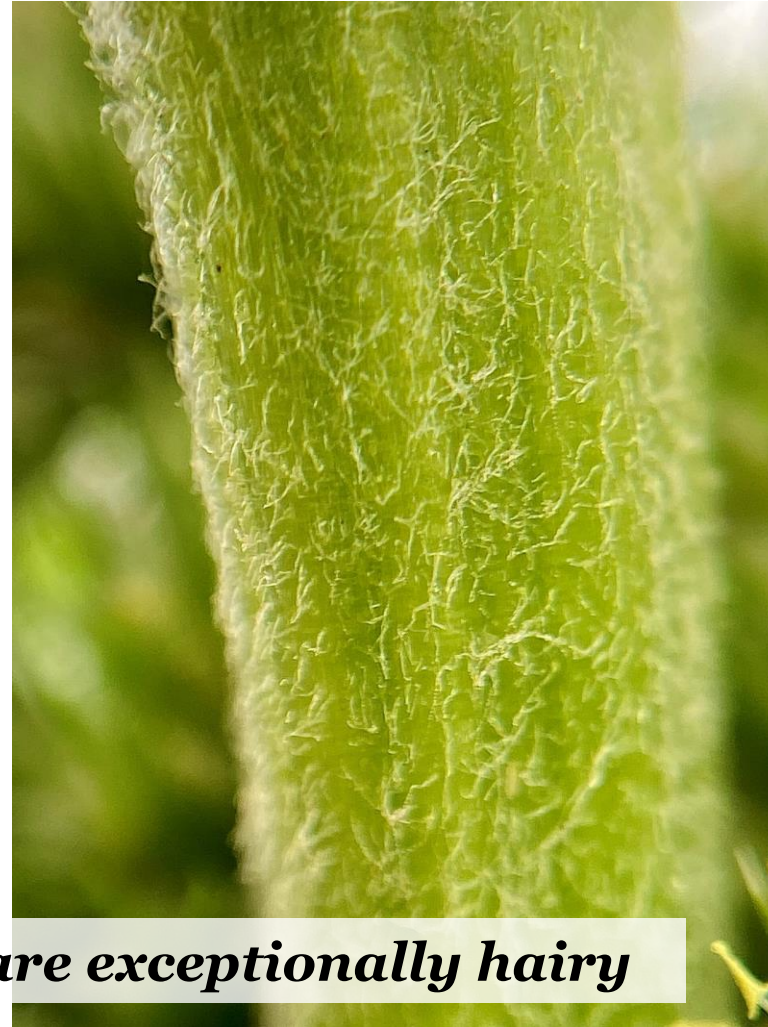


# Redroot pigweed (*Amaranthus retroflexus*)



*Stems, petioles, underside of leaves/veins can be very hairy*

# Redroot pigweed (*Amaranthus retroflexus*)



*Redroot pigweed stems are exceptionally hairy*

# Redroot pigweed (*Amaranthus retroflexus*)



*Redroot pigweed flower heads can have many short and stubby branches*

# Smooth pigweed (*Amaranthus hybridus*)

**Leaves:** Oval- to diamond- to egg-shaped with wavy leaf margins. The undersides of leaves are not hairy. Leaf petioles are shorter or no longer than the leaf.

**Stems:** Sparsely hairy to hairy, especially upper stems (but less hairy than redroot pigweed).

**Height:** 3 to 6 feet tall.

**Flowers:** Male and female flowers are produced on the same plant in terminal flower spikes with branches that are thinner and less compact than redroot pigweed

**Herbicide resistances in US:** WSSA Groups 2, 4, 5, 9, 14.

# Smooth pigweed (*Amaranthus hybridus*)



# **Comparison Photos**



***Smooth***



***Powell***



***Redroot***







***Smooth***



***Powell***



***Redroot***



***Palmer***



***Waterhemp***



*Smooth vs Powell vs redroot*



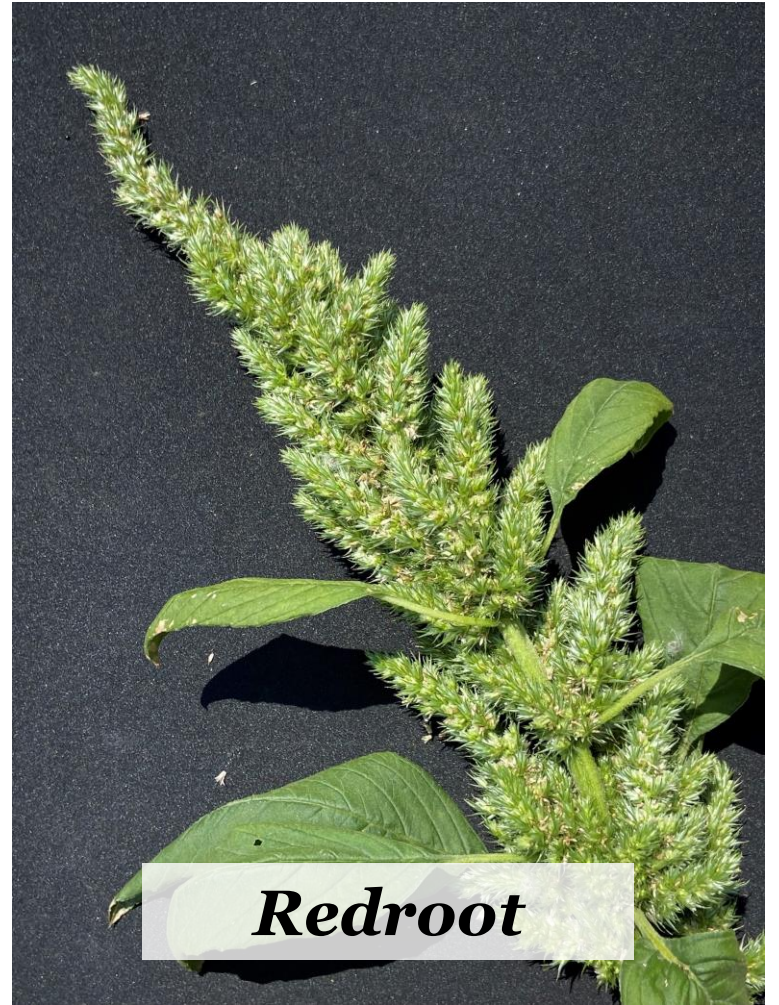
*Smooth vs Powell vs redroot*



***Powell vs smooth vs redroot***



***Powell vs smooth vs redroot***





**Waterhemp**



**Palmer amaranth**



**Waterhemp vs Palmer  
(female flowers)**



# In 2021, pigweed ID classes reached more than 1000 regional stakeholders in-person and virtually





## **CONTACT US:**

Dr. Lynn M. Sosnoskie  
Cornell AgriTech  
635 W. North Street  
Geneva NY 14456  
Email: [lms438@cornell.edu](mailto:lms438@cornell.edu)

Generous support of this outreach effort was provided by the New York Corn and Soybean Growers Association

