

# Pigweed

## Identification:

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



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# Why Pigweeds?

## Competition and Yield Loss

Pigweeds are some of the most commonly occurring and troublesome weeds that US growers encounter. Several pigweed species, like Palmer amaranth, 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. For example, 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)).



# 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.*



In the above two pictures, the top row shows the leaves and flower heads of smooth pigweed, redroot pigweed, and Powell amaranth (L to R). The bottom row shows the leaves and male and female flowers of waterhemp (L) and Palmer amaranth (R). Despite similarities across species, there are traits/combinations of traits that can be used to distinguish among the pigweeds to successfully identify them.

<b>Trait</b>	<b>Palmer</b>	<b>Waterhemp</b>	<b>Redroot</b>	<b>Smooth</b>	<b>Powell</b>
<b>Leaves</b>	Diamond-shaped	Long and linear to sometimes oval	Oval- to egg-shaped with wavy margins	Oval- to egg-shaped with wavy margins	Diamond-shaped
<b>Petioles</b>	LONGER than leaf blade	Shorter than leaf blade	Shorter than leaf blade	Shorter than leaf blade	Shorter than leaf blade
<b>Stems</b>	Smooth	Smooth	Very hairy	Sparsely hairy to very hairy	Sparsely hairy
<b>Male and Female Flowers</b>	SEPARATE plants	SEPARATE plants	SAME plant	SAME plant	SAME plant
<b>Plant Size and Notes About Flower Heads</b>	Up to 10 feet tall Flower heads have thick branches, flowers are tightly clustered, female flowers have sharp spines	Up to 10 feet tall Flower heads have thinner branches than Palmer, less tightly clustered flowers, and no spines on female	3 to 6 feet tall Flower heads branched but compact and branches are short, stubby	3 to 6 feet tall Flower heads are branched with branches longer, thinner than redroot	3 to 6 feet tall Sparsely branched but branches are long, flowers have bracts resembling Palmer amaranth

# 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 or spikes. Male flowers will have yellow anthers with pollen. Female flowers will have sharp bracts associated with them. **Herbicide resistances in US:** WSSA Groups 2, 3, 4, 5, 9, 10, 14, 15, 27.



## 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, green-red striped. **Height:** Can grow very tall, up to 10 feet in, 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. Female flowers do not have sharp bracts associated with them. Waterhemp flowers clusters are more widely spaced apart than those of Palmer amaranth. **Herbicide resistances in US:** WSSA Groups 2, 4, 5, 9, 14, 15, 27.



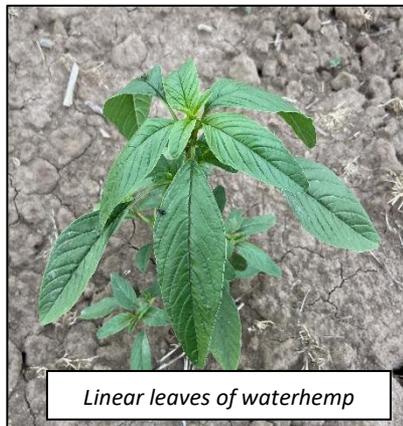
Linear leaves of waterhemp



Smooth (hairless) waterhemp stems (Palmer can look similar)



Waterhemp flower heads



Linear leaves of waterhemp



*Palmer (L) vs Waterhemp (R)*



*Waterhemp (L) vs Palmer (R)*

*Leaves of Palmer amaranth are more distinctly, diamond-shaped as compared to waterhemp, which has long and linear leaves which can sometimes approach oval-shaped.*



*Waterhemp  
Male (L) and Female (R)*



*Palmer amaranth  
Male (L) and Female (R)*

*Male flowers will have anthers full of yellow pollen grains. These may be best observed in early morning (before the sacs break open and pollen is released). Female flowers will have white, branched stigmas, which catch the pollen. Waterhemp flowers are less tightly clustered on the stem compared to Palmer. Palmer amaranth female flowers will have SHARP, stiff bracts.*

# 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:** 3-6 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.

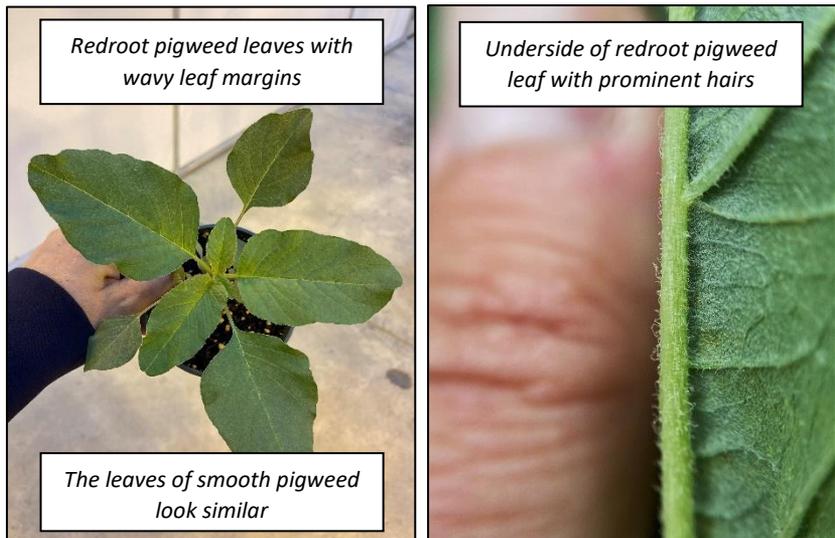


## Redroot Pigweed (*Amaranthus retroflexus*)

**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:** Covered in many fine hairs. **Height:** 3-6 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 2, 5, 14.

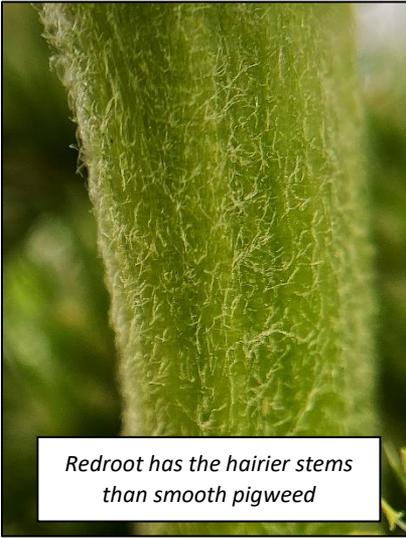
## Smooth Pigweed (*Amaranthus hybridus*)

**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:** 3-6 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.

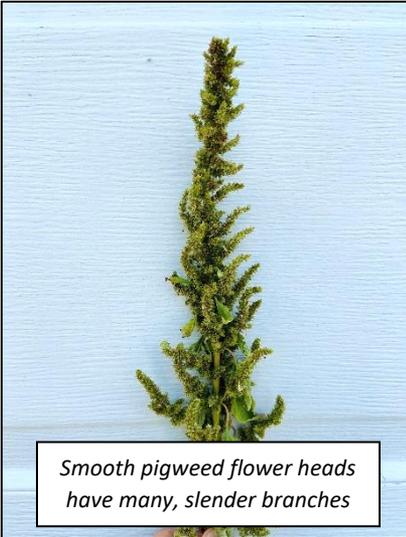




*Stems of smooth pigweed are hairiest on the upper stems*



*Redroot has the hairier stems than smooth pigweed*



*Smooth pigweed flower heads have many, slender branches*



*Redroot pigweed flower heads have short, stubby branches*

*Smooth pigweed and redroot pigweed are difficult to differentiate from each other, especially when plants are young and actively growing. Before flowering, look for the presence of hairs on stems and petioles and leaf midribs (redroot pigweed).*

*At flowering, look for thin, pencil-sized branches (smooth pigweed) or thick, short branches (redroot pigweed).*



## What is Herbicide Resistance?

Herbicide resistance is the inherited ability of a plant to survive and reproduce following exposure to a dose of herbicide normally lethal. Think of it this way”

*“We USED to be able to kill this plant with this herbicide...*

*...but NOW WE CAN’T.”*

Herbicide resistance develops when the same herbicide or herbicide groups are used, repeatedly, over space and time. The genes that confer herbicide resistance are already present in a field when herbicides are applied. Susceptible plants are killed while resistant plants continue to grow and set seed. Over time, seed produced by resistant plants dominate the seedbank.

## How do you Recognize Herbicide Resistance on Your Farm?

Ask yourself if you have done everything right (i.e. right herbicide at the right rate against the right species, sprayer calibrated properly, , appropriate adjuvants used, etc..) and then look to see if you have dead plants intermixed with live plants of the same species (that were treated at the same time) and a problem with an uncontrolled species that is growing with time... if you can't rule out human error, adverse weather events that reduced herbicide performance, and equipment malfunction. Get in touch with your cooperative extension personnel about next steps/best management practices.

## Contact Us:

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