

Virtual Creature Festival: Black Widow

Get to know some of New Jersey's spine-tingling spiders.

Black widow. Just the thought of this patent leather looking arachnid can conjure fear in the hearts of even the most intrepid souls. Despite its small size (just a ¼ in. in diameter and an inch and a half from one leg tip to another), its reputation as one of the world's most venomous spiders is legendary. The black widow spider's venom is reported to be 15 times stronger than that of a rattlesnake. While there are more than 30 species of black widows worldwide, only two species (the southern, *Lactrodectus mactans* and the northern, *Lactrodectus variolus*) are found in New Jersey. Both are black with red hourglass markings on their abdomens. The major difference is that shape of the hourglasses varies slightly on each of them.



Female black widow spider with egg sac
(photo courtesy of Google Free Images)

Black widows spin haphazard webs that are more than just a trap to ensnare prey; they are also a source of communication. By feeling vibrations traveling through the silken threads, the arachnid can sense if it has caught a meal or a possible mate. Since spiders extrude their webs from their bodies, they can also change the stiffness, tension, and other properties of the silk depending on the physical conditions of the surroundings and adjust if prey or potential mates are involved. The black widow's entire body acts as a sensor. It's covered with thousands of sensing organs called **slit sensilla**, which appear as tiny cracks in the exoskeleton. As vibrations pass through its body, the cracks narrow and widen, and those minuscule movements of the cracks are picked up by sensitive cells inside the slits. These slits are everywhere on the spider's body, but they're mostly concentrated in the joints of the legs.

Sensing the vibrations with its body alerts the spider to predators and prey. Their prey consists mostly of flies, mosquitoes, grasshoppers, beetles, and caterpillars. Black widows are comb-footed spiders, which means they have a set of serrated bristles (*setae*) on the feet of the fourth leg. They use the bristles to comb their silk to enshroud their prey once it has been trapped. To feed, black widows puncture their insect prey with their fangs and pump venomous digestive enzymes into the trapped insects. The spiders liquefy their prey's bodies and suck up the resulting fluid.

The venom of the black widow spider is a combination of biologically-active proteins. The primary toxin found in the venom of the black widow is called alpha-latrotoxin which causes the release of neurotransmitters, poisoning the prey. Not all bites from a black widow spider result in **envenomation** (insertion of the fangs). These spiders can choose when to inject venom into their perceived attackers, and how much to inject. Black widows tend to reserve venomous bites for extreme threats. If the threat is less severe, the black widow may deliver a dry, or nonvenomous, bite.

Black widow females also use their webs to attract mates. They will spread pheromones on their silk, to attract males to their webs. Black widows live solitary lives until late spring when mating occurs. Female spiders can live up to three years while males only live for one or two months. Only female black widows bite, adult males are harmless. Males do not have the hourglass markings and spend their short lives wandering in search of females.



*Black widow spiderlings soon after hatching
(Photo courtesy of BugGuide.net)*

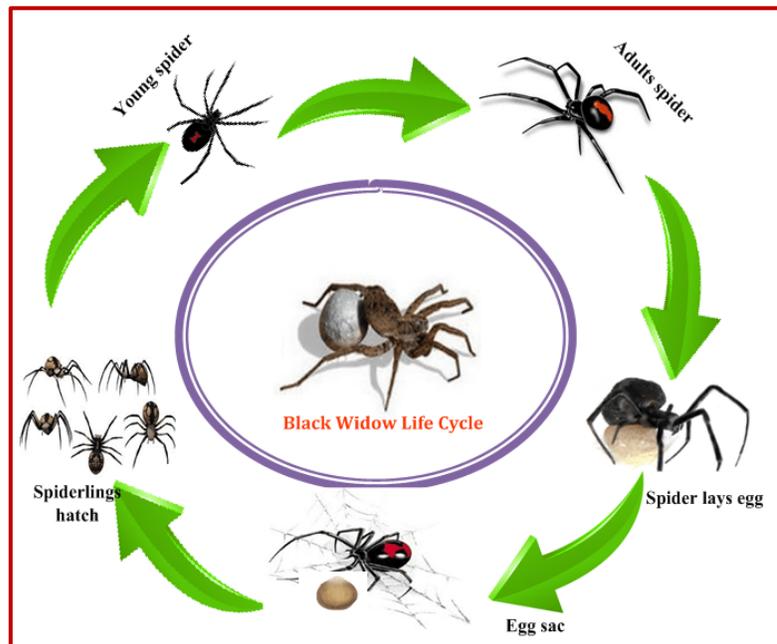
Black widows get their name because the female sometimes kills and eats the male after mating. Scientists theorize the cannibalism occurs so that the female gets an extra source of protein to benefit the offspring developing inside her. The female lays her eggs in cocoons of silk made from spinnerets on her abdomen. They are soft white sacs that are about a ½ inch around that later turn to pale brown. One female usually



produces five to ten sacs per summer with hundreds of eggs per sac. When the spiderlings hatch, they are yellow orange in color. They disperse soon after they leave their eggs.

Despite their terrifying reputation, black widows pose very little danger to humans. They are reclusive and shy by nature and only bite when they perceive a grave threat. Yes, they are venomous, but typically the reaction is swelling at site of the bite. Sensitive people may have a stronger reaction and experience abdominal cramping, fever, excessive sweating, nausea, vomiting, high blood pressure, and spasmodic pain. Contrary to popular belief, being bitten by a black widow rarely results in death. Elderly people, children, and immunocompromised individuals usually have more violent reactions than other people.

The primary habitat of the black widow spider is outdoors, where they spin their webs in brush piles, firewood, garages, leaf piles, gardening equipment, outdoor equipment, outhouses, and on outdoor furniture. Sometimes they find their way into our basements or sheds. The best way to protect yourself is to wear gloves when you are working outdoors and to be wary when moving wood or brush that's been sitting around a while. Black widows are not hanging around waiting to pierce you with their venomous fangs, but if you happen to touch one by mistake, it will probably bite you.



Black widow life cycle (photo courtesy of Black Widow Optimization at transpireonline.blog)

Activity: Spider Senses

Experience how a spider senses and evaluates the size of its prey.

Materials: Yarn or string; two chairs facing back-to-back, ~two feet apart

1. Tie a piece of string between two chairs so it is very taut. Pretend this is a spider web thread.
2. Now have one person put a finger on the string near the end tied to one of the chairs and close their eyes. (This person will be the spider.)
3. Have a person pluck the string at the other end near where it is tied to the second chair. Pluck the string lightly first, wait a few seconds, then a little more firmly a second time. Finally pluck it very hard a third time. (This person is pretending to be a predator or prey.)
4. The person with the eyes closed should be able to feel the vibrations and the difference in degrees or strength of the vibrations without looking at the string. Make sure this person can feel the difference in the strength of the plucks.
5. Have the two people switch places and do the experiment again.

What is going on here?

When the string is plucked, it vibrates. A light pluck causes a weak vibration along the string. A firmer pluck will cause a stronger vibration.

Spiders sense the difference in strength of vibrations with special organs on their bodies. If the vibrations seem very weak, the spider may ignore it. If the vibration is very strong the spider will sense it is a predator and may hide. If the vibration is somewhere in between, it will probably treat the intruder as a potential meal. Have fun sensing like a spider! Activity adapted from [Buggy and Buddy](#).

More about Spider Senses

Science writer, Ed Yong, begins his article entitled *The World Shifts When a Black Widow Squats* by explaining the connections between the spider and its web:

“A spider’s web is more than a trap or a home. It is also an extension of the spider’s senses. By paying attention to vibrates traveling through the silken threads, the

arachnid can learn about its surroundings. Certain

vibrations might mean ensnared prey. A different frequency might reveal a nearby mate. And since spiders extrude their webs from the bodies, they can also change the stiffness, tension, and other properties of the silk to bring certain details into focus. Changing its posture on its web, the arachnid can tune vibration in its legs to different frequencies.”

You can read more of Ed Yong’s article [here](#).



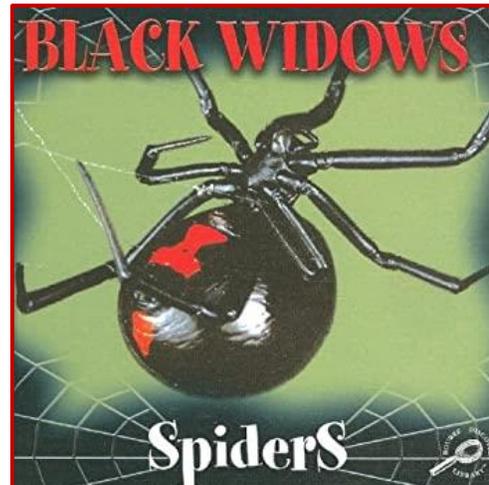
Photo courtesy of Natasha Mhatre, *The Atlantic*, January 9, 2019

A Colorful Book to Pique Your Interest...

Spiders: Black Widows

By Jason Cooper

As stated in Good Reads, “Some people are terrified of spiders, while many more are fascinated by them. Read about how spiders turn from eggs into adults, and why spiders spin their webs and how they do it. Find out about poisonous spiders and the harmless ones you may find anywhere in your home.”



Additional Resources

- [Nat Geo Black Widow Spiders](#)
- [Comb footed spiders](#)
- [Black Widows: Virginia Cooperative Extension](#)
- [Black Widow Spider Toxicity](#)

Learning about the black widows that may be at Duke Farms and native to New Jersey aligns with numerous learning standards including those newly adopted for NJ K-12 public schools focused on climate change.

Adopted 2020 New Jersey Student Learning Standards (NJSLS)

Climate Change

New Jersey is the first state in the country to require climate change curriculum across all content areas and at a K-12 level. As stated by the NJDOE:

On June 3, 2020, the State Board of Education adopted the 2020 NJSLS in the following content areas:

- [Career Readiness, Life Literacies, and Key Skills;](#)
- [Comprehensive Health and Physical Education;](#)
- [Computer Science & Design Thinking;](#)
- [Science;](#)
- [Social Studies;](#)
- [Visual and Performing Arts;](#)
- and [World Languages.](#)

These standards truly represent a foundation from which districts will build coherent curriculum and instruction that prepares each New Jersey student with the knowledge and skills to succeed in our rapidly changing world. They will put New Jersey again at the forefront of national education by including the following:

- Climate Change across all content areas, leveraging the passion students have shown for this critical issue and providing them opportunities to develop a deep understanding of the science behind the changes and to explore the solutions our world desperately needs.

New Jersey Student Learning Standards - Science

This lesson could be used in third grade, and others, when addressing heredity and the inheritance of traits.

- 3-LS3 Heredity: Inheritance and Variation of Traits Students who demonstrate understanding can: 3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms. [Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans. 3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.
- Disciplinary Core Ideas LS3.A: Inheritance of Traits ♣ Many characteristics of organisms are inherited from their parents. (3-LS3-1) ♣ Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3-LS3-2) LS3.B: Variation of Traits ♣ Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1) ♣ The environment also affects the traits that an organism develops. (3-LS3-2)

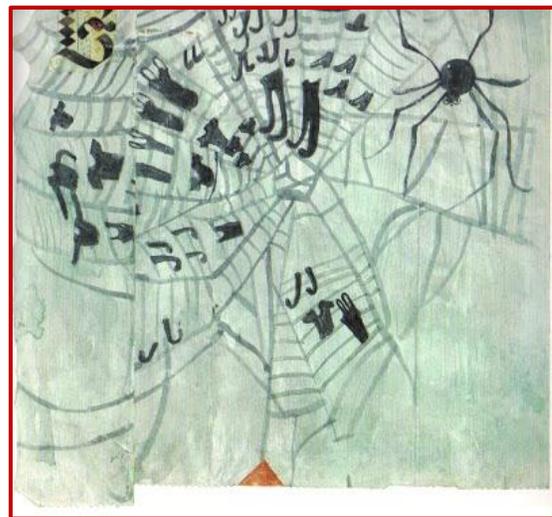
Language Arts and the Visual and Performing Arts - Connections

Language Arts and Fine and Performing Arts curriculum can include environmental topics. Many students are inspired to create when introduced to subject matter that sparks their interest!

The Black Widow Spider

I am a widow-
I always wear black,
From my eight dainty legs
To my shiny round back.
Do not disturb me.
My fangs carry venom.
I am a widow-
I don't wear denim.

-Douglas Florian, from *Insectlopedia*, Copyright 1998



For more ideas on how to integrate climate change curriculum or other environmental topics into your lessons or activities, contact Kate Reilly, Manager of Education, Duke Farms at kreilly@dukefarms.org