# University of Kentucky Department of Entomology

**Insects in the Classroom - Lesson Plan**

# The GREAT SPIDER DEBATE

**For Middle School (grades 6-8)**

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## *Activity Description*

**Field investigation of spider diversity and adaptations, followed by presentation/discussion**
**For Kentucky Middle School Science Curriculums, Grades 6-8**

## *Objectives*

- **Students will learn about the hunting and survival adaptations of several different kinds of spiders. Students will also be introduced to scientific classification of spiders and will deliver a formal group presentation.**
- **Students will search outdoor and indoor environments and record numbers and types of spiders that they discover.**
- **Students will write a brief report about one of the spider families that they observe.**
- **Students will gather in groups during the following class period to communicate and discuss the pros and cons of different spider hunting and survival techniques.**

## *Academic Expectations*

**The above objectives fall under the following KERA Academic Expectations:**

2.2 Identify, analyze, and use patterns such as cycles and trends to understand past and present events and predicting possible future events.

2.3 Identify and analyze systems and the ways their components work together or affect each other.

## *Program of Studies*

S-7-LS-4 investigate biological adaptation and extinction

S-8-LS-5 analyze diversity and adaptations

## *Core Content*

SC-M-3.4.1 Biological change over time accounts for the diversity of species developed through gradual processes over many generations. Biological adaptations include changes in structure, behaviors, or physiology that enhance survival and reproductive success in a particular environment.

# THE GREAT SPIDER DEBATE

**All spiders are predators. They eat insects, earthworms, and even other spiders. Large species prey on vertebrates like fish, rodents, and birds. All spiders have fangs and most of them use venom to immobilize their prey. Many spiders snare prey with webs.**

**But not all spiders use webs. Some spiders are active hunters that patrol the ground for crickets and beetles. Others sit camouflaged on flowers, waiting to ambush bees. And the ones that use webs have hunting strategies that vary tremendously depending of the type of spider. Different types of spiders have different behavioral and structural adaptations which help them capture prey and survive in their environment.**

**Thanks to their many hunting adaptations, spiders are very successful creatures. In fact, spiders can be found almost anywhere. There are spiders in caves, barns, streams, and trees. Some spiders are able to dive underwater in search of food. Spiders do very well inside homes, too.**

**This lesson is divided into two main parts. A "Spider Safari" will allow students to introduce themselves to different kinds of spiders. The "Spider Debate" which follows will allow students to consider the pros and cons of different survival adaptations exhibited by each kind of spider.**

**In addition to introducing students to spider diversity and adaptations, this exercise will reinforce such concepts as: scientific classification of organisms, food chains, interactions between organisms in their environment, ecological niches, and structure and function in living systems. This exercise also requires library or Internet research, and allows students to present and discuss their findings.**

**Essential question for this activity:** "What kinds of spiders live in my (schoolyard, house, neighborhood) and what adaptations to they use to hunt and survive?"

**Spider Safari:** Kentucky is full of spiders. A short hike through the woods or a walk through a meadow or garden will reveal dozens of different kinds of spiders. Spiders are also easy to find in homes and other man-made structures- if you look in the right places.

For this exercise, take a few minutes to describe the Spider Safari to students. Explain that the Students will be looking for eight different kinds of spiders, which are described below. These represent different spider families. All of these kinds of spiders will occur outdoors and indoors, but some are more likely to occur in one or the other. Make sure that students know the basics about spiders: eight legs, two body-parts, the fact that they are predators, etc. But don't spend too much time on the different kinds of spiders: the goal for this exercise is to let students learn about the different kinds of spiders through their own observations, research, and during the follow-up presentations. The "Spider Safari Survey Sheet" that you hand out will have the name of each kind of spider, and what it (or it's web) looks like. That's all the students need for the safari.

First, arrange a trip to a local forested area, garden, or a meadow. Even a small patch of woods will do or a weedy fencerow near the school. This safari will involve a search of at least one indoor and outdoor environment for 30 minutes each. Note that the time may be longer or shorter than 30 minutes depending on

your schedule, but keep the searching times between the two environments equal. The best time to look for spiders in Kentucky is September.

You could also assign the safari as homework, especially for the “indoor” search. Encourage the students to try a number of different environments, and to search during both the day and night (if they dare!). Barns and work sheds count as "indoor" environments, and will invariably have lots of spiders. Tell students that they don't have to go into creepy, dangerous places like basements or attics to find spiders- spiders are very common in living rooms and bedrooms if you look hard enough! It is not necessary for everyone to find all eight different kinds of spiders, but they should be able to find at least three. Also remember to warn students not to handle the spiders. Spiders are normally not dangerous, but they are wild animals, and should be treated with respect. Give the students a few days or a weekend for the Spider Safari if you assign it as homework.

As part of the Spider Safari, the students will be asked to pick one of the eight different types of spiders that they will be looking for. They will then find some information about this type of spider, including the family name and the adaptations that the spider uses to capture prey and survive in its environment.

**Spider Debate:** When students come back to class with their Spider Safari Survey Sheets and reports, divide the students into groups based on which kind of spider that they choose to do a report on. Or, it may be best to divide them into just two groups: "web-building spiders" vs. "hunting and ambush spiders". Hand out the "Spider Debate Case File" sheets and give the groups a few minutes to prepare a "case" for their kind of spider: why they think their spider type has the best type of hunting/survival strategy. Then, allow each group to present to the other an “opening argument” for why their spider type is the best hunter. Following these presentations, the students should discuss the pros and cons of the different types of spiders. Encourage students to pick a spokesman, or to only contribute when recognized. Recruit a small group of students to be impartial judges who will decide which kind of spider has the best strategy (or they may decide that all of the strategies are equally valid!).

Some points that might help keep the discussion rolling:

- many of the spiders that are common indoors would probably not be as common if humans became extinct, whereas many spiders that live outdoors are not as dependant on people.

- Spiders that build webs in the air are for the most part dependent on flying insects for food.

- Which spiders are better at defending themselves from other predators? How can a spider’s hunting adaptations influence its ability to defend itself from predators?

- Some of the spiders with the most interesting hunting strategies (like trapdoor spiders) are very rare: is their strategy a good one?

Of course, scientists will tell you that there is no "best strategy" for spiders, but a good debater might disagree!

Below are some basic facts about each of eight very common spider families. This information is for you – let the students find it on their own in the references listed on their “spider report” page! There are plenty more spider families than this, but these are the ones that are probably the easiest to find and recognize in Kentucky. Remember that in scientific classification, "family" is just below "order" in terms of decreasing generality (Kingdom, Phylum, Class, Order, Family, Genus, Species). You can recognize a family name because it always ends in "idae." All spider families are in the order “Araneae,” which is in the class “Arachnida.”

## WEB-BUILDING SPIDERS

When most people hear the word "spider," they think of web-building spiders. Orb-weavers, cobweb spiders, and others produce strands from silk glands located on their abdomens that they use to create prey-snaring structures. The type of structure varies with age, species, and (especially) spider family. Web-building spiders are probably the ones that we see the most, but that doesn't mean that they are the most common. Generally, web-building spiders have small eyes and poor eyesight: since their webs catch food for them, web-building spiders don't need to see as well as other kinds of spiders.

**Family Arneidae (Common name- Orb Weavers):** Spiders in this family (and a few other uncommon families) are the only ones that build "orb-webs." Compared to other kinds of spider webs, orb webs appear the most organized to human eyes. Orb webs consist of a series of rays and connectors that looks like a group of concentric circles. Orb-weavers typically have large, robust abdomens. Orb weavers tend to be found outdoors where they have plenty of space for their intricate webs.

**Theridiidae (Common name- Cobweb Spiders):** Cobweb spiders are similar to orb-weavers, but their webs are not constructed in recognizable geometric patterns. Cobwebs also tend to be more three-dimensional than orb-webs, which are usually flat. Cobweb spiders and orb-web spiders look very similar, and the best way to tell them apart is by their webs. Cobweb spiders are fairly common inside homes, probably because they don't need much space for their webs. The notorious "black widow" is a member of this family, but all of the other cobweb spiders found in Kentucky are not dangerous.

**Pholcidae (Common name- Cellar Spiders):** Cellar spiders are very common in homes where they build webs that look very much like cobwebs. Cellar spiders are much larger than most cobweb spiders though, and have very long, skinny legs. These spiders are often called "daddy-long-leg" spiders, but these spiders are not related to the other kind of daddy-long-legs (which are not really spiders at all, and do not build webs).

**Agelinidae (Common name- Funnel Weavers):** Funnel weavers typically build a flat, dense web close to the ground that curls into a funnel. These spiders usually wait deep inside the funnel, and when something falls or stumbles into the web, the spider rushes out and grabs it. The end of the funnel often dips into a crevice or underneath a rock, which provides the spider with protection. Funnel webs are often especially visible on late summer mornings thanks to heavy dewfall.

## HUNTING/AMBUSH SPIDERS

Wolf spiders, crab spiders, and others don't rely on webs to catch their food. Instead, these spiders actively hunt for prey, or lie in ambush. These spiders often have very keen eyesight. Although these spiders don't use silk to hunt, many of them will wrap their egg cases in webbing, or have other uses for silk. Because of this, a little webbing may be present where these spiders are found, but not enough to snare prey.

**Family Lycosidae (Common name- Wolf Spiders):** Wolf spiders are extremely common both indoors and outdoors. They are often seen under rocks and pieces of wood. These spiders run quickly over the ground in search of prey. Most wolf spiders are gray, black, or brown, and are somewhat hairy. After laying her eggs, female wolf spiders of many species will carry their egg sacs until the eggs hatch. Upon hatching, the spiderlings will then "ride" on the mother's back until they are ready to hunt on their own.

**Family Pisauridae (Common name- Fishing Spiders):** Fishing spiders are very similar to wolf spiders, but tend to be a little lankier. They are commonly encountered near streams and ponds, where they will sometimes catch small fish, tadpoles, and other aquatic creatures. Fishing spiders are able to "walk on water." They are also able to go underwater to escape predators. Fishing spiders can get to be very large, with leg spans approaching three inches!

**Family Salticidae (Common name- Jumping Spiders):** Spiders in the family Salticidae have a distinctive, flat-faced appearance. Jumping spiders also have very large eyes: of all insects and spiders, jumping spiders may have the best eyesight. Jumping spiders are also characterized by a "herky-jerky" way of moving around. In fact, it looks like they are hopping small distances every time they move. Although they hop most of the time, jumping spiders are able to jump long distances as well. Jumping spiders are very common inside homes and in yards and gardens, and are very easy to find. Unlike many other kinds of spiders, jumping spiders are active during the day. Although jumping spiders don't use webs to catch food, they will use a strand of silk to secure themselves when they are jumping long distances (like Spider Man!).

**Family Thomisidae (Common name- Crab Spiders):** Crab spiders don't use webs, but they aren't really active hunters either. Crab spiders are ambush predators. They sit and wait for prey. Most crab spiders are camouflaged, and are able to hide in flowers without being seen. When a bee or fly visits the flower, the crab spider is able to grab it. Crab spiders have potent venom, and

are able to catch insects that are much larger than themselves. Crab spiders look a little like crabs, with long front legs and flat bodies. Many of the common crab spiders in Kentucky are brightly colored. Bright green, yellow, and orange varieties are often seen.

## SPIDER RESOURCES

These online and print resources have additional information about spiders. This list is reprinted on the "spider report" section for the students to use. You may find other resources in the library or online, but these are some of the best.

1. **Spiders and Their Kin (A Golden Guide)** by H. Levi and L. Levi
   This inexpensive guide contains detailed drawings of all of the common spider families (and many species) that occur in the Eastern United States.
2. **University of Kentucky Spider Files:**
   http://www.uky.edu/Agriculture/CritterFiles/casefile/spiders/spiderfile.htm
   This online guide contains pictures and information for most of the common types of spiders found in Kentucky.
3. **National Audubon Society Field Guide to North American Insects and Spiders** by L. J. Milne and S. Rayfield
   Contains photos of many spider families and species. Not all of the spiders listed in this book live in Kentucky, but many of them do.
4. **BugGuide: Spiders**
   http://bugguide.net/node/view/1954
   BugGuide.net is an online picture gallery with images of many insects and their relatives. The spider section contains many spider that live in Kentucky.

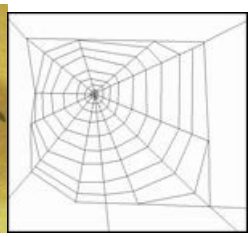
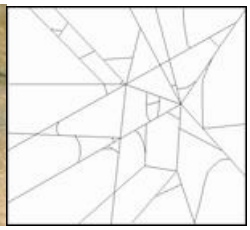
NAME_____

# SPIDER SAFARI

***SPIDER SAFARI SURVEY SHEET (40 points):***

**Find as many of the different kinds of spiders listed below as you can. Place a tally mark beside each kind of spider each time you find one. You don't have to find all of them, but you should be able to find at least three kinds. And make sure you find at least one web-builder and one hunting/ambush spider. Write down where you observed the spider, and anything else interesting as well: What color was the spider? What was it doing?**

**REMEMBER: "Daddy-long-legs" aren't real spiders!**

| **WEB-BUILDERS: Catch prey in webs** | **TALLY and OBSERVATIONS** |
|---|---|
| **ORB-WEAVER**<br>   <br>**Webs are intricate and geometric. These spiders are very common in gardens and barns, but are found almost everywhere.** | |
| **COBWEB SPIDER**<br>   <br>**Usually have spherical abdomens. Webs look messy and unorganized. Cobweb spiders are very common in garages, inside homes, and in sheds and barns.** | |
| **CELLAR SPIDER**<br>  <br>**Long, skinny legs, small bodies. Webs are messy, like cobwebs. These spiders are much larger than cobweb spiders, though. Very common in attics, basements, and pantries.** | |
| **FUNNEL WEB SPIDER**<br>**Many species also called "grass spiders." Usually brown. Look somewhat like wolf spiders, but wolf spiders do not live in webs. These spiders run very fast. Common low to the ground on lawns and near piles of rocks. As their name suggests, these spiders make webs that look like funnels.**<br>  | |

NAME_____

# SPIDER SAFARI

| HUNTING/AMBUSH SPIDERS: No webs | TALLY and OBSERVATIONS |
|---|---|
| **WOLF SPIDER**<br>**Large, hairy spiders. Usually brown, gray, or black. Look like funnel web spiders, but do not live in webs. Wolf spiders are also more common than funnel web spiders. Found under rocks, leaves, and logs.**<br>  | |
|  <br>**FISHING SPIDER**<br>**Similar to wolf spiders, but usually larger and skinnier. Found beside creeks, ponds, and streams under rocks and out in the open. Very fast.** | |
| **JUMPING SPIDER**<br>**Distinctive, flat-faced, big-eyed appearance. Move in a spastic, "herky-jerky" fashion. Usually hairy and colorful, with large eyes. Common indoors and outdoors. Look on tree trunks, the sides of buildings, and on fences.**<br>  | |
|  <br>**CRAB SPIDER**<br>**Resemble crabs, with flat-bodies and long front legs. Often "neon" green, yellow, orange, or bright white. Found in flowers.** | |

**All photos courtesy R. Bessin and B. Newton, Department of Entomology, University of Kentucky**

**NAME**_____

# SPIDER REPORT

***PICK A SPIDER*** *(60 points):*

Pick one of the kinds of spiders that you observed and find some information about it.

The first step is to figure out which kind of family your spider is. For instance, "wolf spider" is the common name for a certain family of spiders, which also has a scientific name. If you look up wolf spiders in a book about spiders or on the internet, you will probably be able to find the family name. Remember that scientific family names always end in "idae."

**FAMILY:**_____

**Hunting and Survival Adaptations:** After you find out the family name for your spider, find out how your spider is adapted to surviving and catching prey and answer these questions:

1. Does your spider use a web to catch prey?

2. If your spider builds a web to catch prey, what shape is the web, and how might this influence its ability to catch certain types of prey? For instance, funnel weaver spiders build webs close to the ground, and probably catch creatures on the ground, whereas orb-weaver spiders often build webs high in the air to catch flying creatures.

3. If your spider does not use a web to catch prey, what other adaptations does it use to catch prey (such as: jumping, waiting in ambush, good eyesight)?

4. Many spiders that build webs have fat, round bodies. Hunting and ambush spiders are often have a flattened shape. How do you think these different shapes are adaptive for the way that these spiders hunt?

**NAME**_____

# SPIDER REPORT

5. What color is your spider, and how might its coloration be an adaptation for hunting? Would your spider's coloration help protect it from predators?

6. In what kind of environment did you observe your spider? Outdoors? Indoors? Under a rock? On a tree? Near water? Write down as much detail as you remember.

7. What other adaptations help your spider survive in its environment? For instance, many spiders quickly drop from their webs if they are threatened by predators.

**Some places to look for spider information:**

**Spiders and Their Kin (A Golden Guide)**
by H. Levi and L. Levi
**The University of Kentucky Spider Files:**
http://www.uky.edu/Agriculture/CritterFiles/casefile/spiders/spiderfile.htm
**National Audubon Society Field Guide to North American Insects and Spiders** by L. J. Milne and S. Rayfield
**BugGuide: Spiders**
http://bugguide.net/node/view/1954

# SPIDER DEBATE: EVIDENCE FILE

Names of the people in your group:

**SPIDER TYPE:**_____

**HUNTING STRATEGY:**_____

**HUNTING ADAPTATIONS:**

**PROS and CONS:**
For your opening argument, hink about the good points and the bad points about your spider's hunting strategy. Even though you are trying to argue that your spider is the best kind, it is good to think about its weaknesses as well. Use your spider's hunting adaptations as evidence to back up your claims.

**Some points to consider:**

1. **Spiders that build webs are often conspicuous: it is easy for predators to find them because they are out in the open.**
2. **Spiders that are active hunters have to use lots of energy to run around and catch food.**
3. **Ambush predators have to get lucky! If no food comes to them, they can't eat.**

**PROS:**

**CONS:**