

OUR LOCAL POLLINATORS: THE CARPENTER BEE

Teacher:

Grade Level(s): 3rd-6th

Time: 1 hour

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Next Generation Science Standards:	3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
Enduring Understandings:	LS2.A: Organisms and populations are dependent on their environmental interactions both with other living things and with nonliving factors any of which can limit their growth. Competitive, predatory, and mutually beneficial interactions vary across ecosystems but the patterns are shared.
Content Objective:	Students will observe and record their findings concerning flower and carpenter bee structure and function. Students will observe and measure carpenter bee nests from the sotol stalk.

Vocabulary	Materials
Pollination, Mutualistic Relationship, Anther, Filament, Pollen, Carpenter Bee, Larvae, Native	Journals, Rulers, Magnifying Glasses (optional), Flowers with pronounced anthers holding pollen, Examples (either real or color-printed pictures) of Carpenter Bees, Carpenter Bee Nests

Seasonality: Abandoned carpenter bee nests from the agave, sotol, and other woody structures can be found throughout the year. If these materials are not available, color-printed pictures work well.				
Monsoon July-Sept.	Autumn Oct.-Nov.	Winter Dec.-Feb.	Spring Mar.-Apr.	Dry Summer May-June

Engage: Guiding Question: What types of animals do you know to be pollinators? Give students 30 seconds to work with their table groups and brainstorm as many pollinators as they can think of. Share with the class and record responses on the board. From the board, ask students to select one pollinator they have seen before. Guiding Questions: What special characteristics does your pollinator have that connect it to a flower? What characteristics does that flower have that might attract that specific pollinator? For video examples, visit *The Beauty of Pollination Video* found here: <https://www.youtube.com/watch?v=1ZnOvqzu3Zc>. Ask students to closely observe which pollinators are visiting which flowers and any characteristics of each plant or animal that allow it to do so in the video. After the video, ask anyone that has made a connection between pollinator and plant characteristics to stand up; find a partner that is still seated and discuss with them the connection you have made. This is something we will continue to discuss today.

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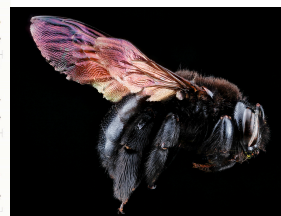
Explore: Guiding questions: What happens to a plant once it is pollinated? (Think: flower, fruit, seeds). Without these seeds, there would not be the genetic makeup for a new baby plant. So how does a pollinator, like the ones we discussed, help a plant produce seeds?

Pass around real flower example and magnifying glasses to each table group. Ask students to use all of their senses to observe the flower, and specifically the parts of a flower they believe may be important for attracting a pollinator. In their science journals, have students record (write or draw) two observations about their flower and how it is designed to attract a pollinator.

Students may specifically note the filaments and anthers (holding pollen).

Explain: Normally when people think of pollinators, they may think of the bee. Picture a bee in your head. Is it a European Honey Bee? “They live in big hives and make honey. They are very cool insects. However, did you know that the European honey bee is not native to the US? It was introduced to our continent when Europeans first came over here after Columbus. But there are many, many types of bees that are *native* to North America. In fact, there are around 4,000 species of bees in North America! The images below show just a few of the native bees in the U.S. These native bees *do not* live in hives. Most of them are solitary, meaning that their nests are made by one female all by herself, and once her eggs develop into adults, these bees fly away to find mates and build new nests. One that *is* native to the U.S. is the *Xylocopa Californica*, the Desert Carpenter Bee” (Kathryn Busby).

Guiding Question: What type of plant do you think the carpenter bee likes to visit? What does it eat? Where does it live? Use your observations and any experiences with carpenter bees to predict these answers.



Images from left to right: European Honey Bee (credit: Kathryn Busby); a small subset of native U.S. bees (credit: Alex Surcica); the Desert Carpenter Bee (credit: Sam Droege).

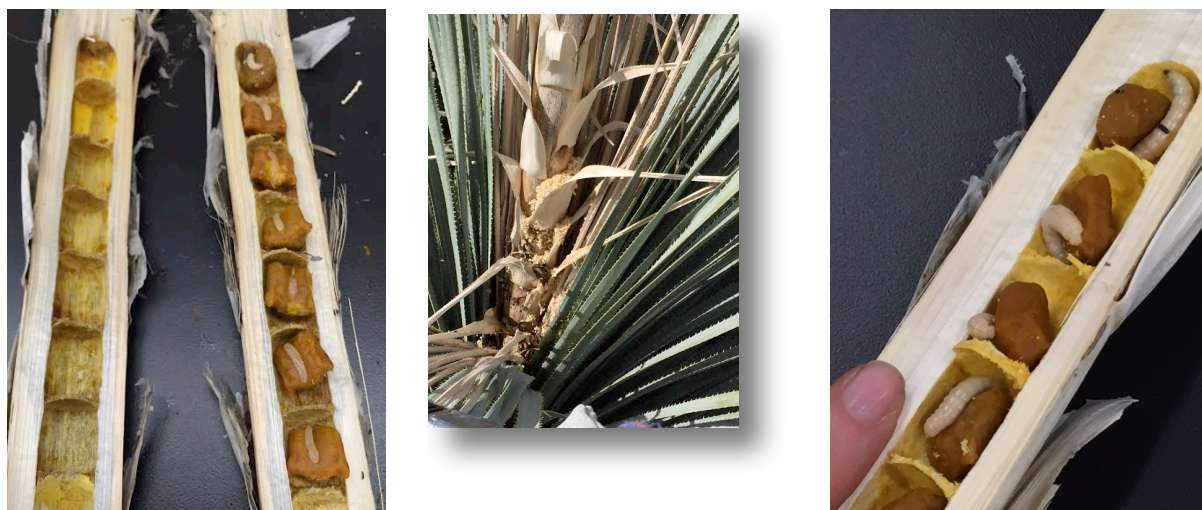
Elaborate: “Carpenter bees are the largest bees. They’re not what most people think of when they think ‘bee.’ They are native to the US. They can pollinate many kinds of flowers, including those that require a special kind of buzzing to pollinate. They can survive all kinds of tough conditions” (Busby).

Pass around specimens of carpenter bees at this time and/or color-printed images of the carpenter bee. Ask students to write and/or draw the carpenter bee in their journal, especially any structures on the bee that may help it be a pollinator. Guiding Questions: Why are bees one of the best-known pollinators

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and what makes them so good at it? Allow time for observing, drawing and sharing. Bees have fuzzy hairs on their legs; these are pollen-collecting structures called scopa. They see different colors than you and I, and flowers that have a strong fragrance, large enough openings and petals to crawl into and land on, and petals that have designs almost like a landing pad for an airplane are specially designed to attract bees.

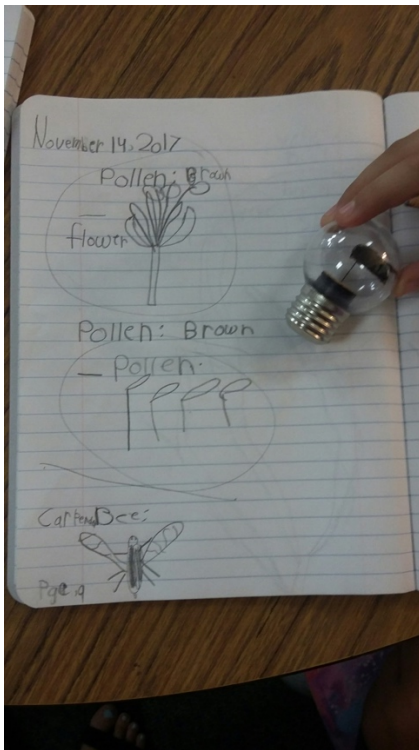
Guiding Question: Why do you think their nickname is “carpenter” bee? Carpenter bees are solitary bees; they build their nests by drilling into dried wood such as agave stalks, sotol stocks, and other woody structures. Female carpenter bees will drill an entrance hole into the side of the stalk or woody structure and make a long, narrow tunnel. Inside of that nest, the carpenter bee will create small cells, like rooms for her baby bees. The carpenter bee will lay one egg in each cell and give the egg (soon to be larvae) a large provision of food (see pictures below).



Images from left to right: Sotol stalk with carpenter bee cells, pollen provisions, and larvae; sotol stalk with wood shavings on outside indicating a carpenter bee nest; close up of carpenter bee larvae and pollen balls inside of sotol stalk. Photo credit: Kathryn Busby.

Guiding Question: What does the carpenter bee feed its babies? We know that bees make good pollinators, and we know why pollination is important for plants, but *are bees visiting flowers just to do the plants a favor?* Remember, carpenter bees’ hairy legs collect pollen as they go from flower to flower and eat nectar. Oftentimes, you can see a big pollen ball forming on the bee’s legs. This all happens for a reason—the bees feed pollen to their babies (pollen can be seen in images above). This creates something called a mutualistic relationship, meaning that the bee and the flower both benefit from their relationship with each other.

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Evaluate: Pass out real examples or color-printed pictures of the sotol stalks containing carpenter bee nests.

Ask students to count: 1) the number of cells (or baby bee rooms); 2) the number of entrance holes; and 3) the number of pollen balls (if any remain). Record findings in their journals.

Ask students to measure: 1) the length of the cells; 2) the length of the tunnel from the entrance hole; and 3) the size of the entrance hole.

Draw or write one example of how the carpenter bee and a flower have a mutualistic relationship. Think-pair-share!

