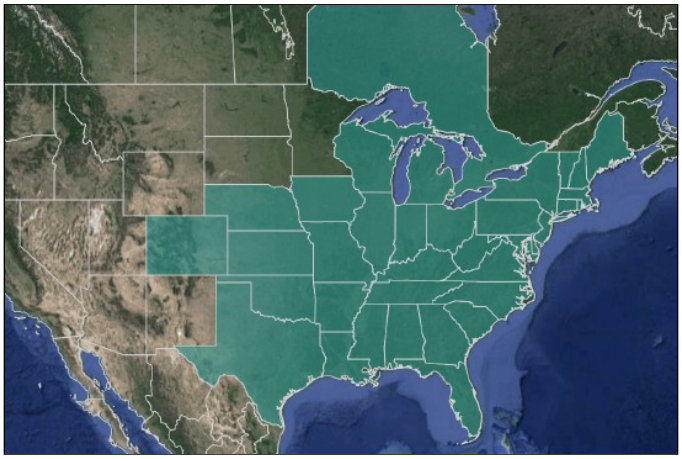
PennState Extension

The Eastern Carpenter Bee: Beneficial Pollinator or Unwelcome Houseguest?

The eastern carpenter bee, Xylocopa virginica, is a native pollinator found throughout eastern North America, as far south as Florida and Texas and north into Maine and southern Canada.

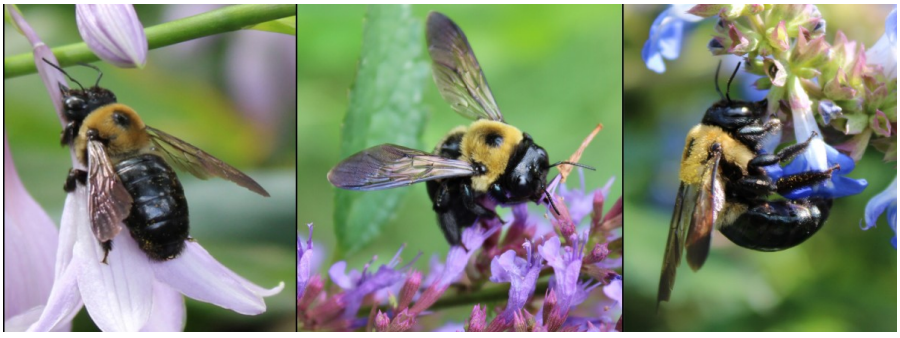
While there are numerous species of large and small carpenter bees native to North America, *Xylocopa virginica* is the only large carpenter bee found in Pennsylvania. Carpenter bees are important pollinators of many flowering plants found in our gardens, natural areas, and on farms. In fact, 15% of our agricultural crops are pollinated by native bees such as carpenter bees. Carpenter bees are often considered pests because of their potential to damage wooden structures. By developing an understanding of their behavior and by choosing preventative strategies that take their natural lifecycle into account, we can ensure safety to both manmade structures and these beneficial insects.



Geographic range of the eastern carpenter bee (green) Image: Melanie Allen Kammerer

Appearance

Eastern carpenter bees are often mistaken for bumble bees because of their similar size and appearance. However, it is easy to distinguish the two with just a little bit of training! Carpenter bees have shiny abdomens, while bumble bee abdomens are fuzzy. Bumble bees are social insects who live in colonies underground and cooperatively care for the nest and rear offspring. In contrast, the eastern carpenter bee is a less social species that nests above ground in cavities they create in wood.



Carpenter bees have shiny abdomens and distinct black circles on the thorax. Images: J. Lana Mejias

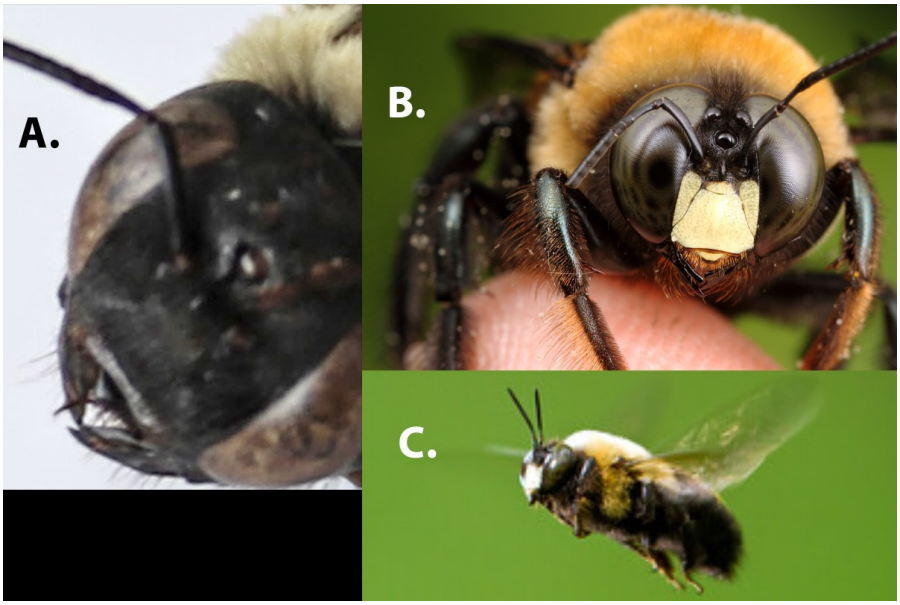
Eastern Bumble Bees have entirely fuzzy bodies. Images: J. Lana Mejias and Kate Anton

Nesting

The name *Xylocopa* translates to "wood-cutter". They acquired their name because they create nests by chewing perfectly round holes into the wood with their powerful mandibles, which is an unusual habit in the bee world. In fact, most bee species live underground in cavities or nests they excavate in the soil or inhabit preexisting above-ground cavities such as reeds, stems, or tree hollows. By manipulating the environment around them to suit their lifestyle, carpenter bees construct durable homes that can be reused over many years.

Using her mandibles, the female carpenter bee excavates a series of tunnels with chambers to house her offspring. She even uses the shavings from her excavation to create walls between the chambers. Within each chamber, the female carpenter bee lays an egg on a ball of pollen and nectar she collected. The egg will hatch into a larva and eat the pollen ball as its only source of food. Carpenter bees often nest in small groups, and the same nests are used year after year, growing more elaborate with each generation. On average, a carpenter bee can excavate one inch of tunnel per day - large nests are the product of many years of work!

As with all living organisms, behavior is influenced by reproductive success. For female carpenter bees, reproductive success is directly related to the size of their nest. The construction of a new nest requires a lot of time and energy that will decrease the number of offspring a female will be able to produce during her lifetime. Carpenter bees who defend an existing nest, or usurp a nest from a neighbor, are rewarded by having more space, time, and energy to raise offspring. The labor required for new nest construction, combined with the reproductive benefits of inhabiting an existing nest, make pre-established nesting sites desirable.



(A.) Powerful mandibles allow carpenter bees to chew perfectly round holes into wood. Image: Kate Anton, Penn State. (B.) Male carpenter bees have distinctive white facial markings, (C.) they hover and harass intruders to defend their territory. Images: Alex Wild/ alexanderwild.com

Behavior and Lifecycle

For many years, scientists believed these bees were a solitary species that did not engage in social behavior. However, more recent research shows that they sometimes live cooperatively in loosely knit social groups.

When nesting resources are abundant, eastern carpenter bees typically live as solitary bees, with one reproductive female inhabiting each nest. When a new nest is started, a lone female will excavate the nest until there are sufficient chambers to begin rearing offspring. If the nest is started from scratch, she will be able to rear four to five offspring in a season. If she is using an existing nest, she will expand it and rear more offspring.

When the availability of nesting sites or material is limited, it becomes advantageous for carpenter bees to cooperatively live together in small, related groups. The structure of the carpenter bee nest is unlike the organization of honey bee or bumble bee colonies, where sterile, female worker bees collectively care for the nest and brood. Instead, all female carpenter bees can mate and raise offspring. When carpenter bees share the same nest, there is usually just one primary queen who lays eggs and forages for the food to feed her offspring. The other, subordinate queens defend the nest from predators, parasites, or competing carpenter bees and do not contribute to the care and feeding of the young. In fact, the primary queen sometimes feeds other adult females in the nest, in addition to feeding herself and her offspring! Sometimes, there is more than one primary queen in a nest, which is more common in very large nests with multiple branches.

When carpenter bees live as solitary bees their lifespan is usually one year. Subordinate queens who nest socially can live for up to three years! The lifespan of carpenter bees is tied to the wear and tear imposed on their bodies. The health of the primary queen, who works very hard, declines after a season of nest construction and foraging for her offspring. The death of the primary queen allows a subordinate queen to inherit the nest. In the case of solitary nesting bees, the nest becomes available for a new occupant. Having a lifespan of several years allows subordinate carpenter bees to simply wait to inherit a nest in which to rear their offspring, rather than risk reproductive failure by living on their own.

Carpenter bees survive winter by hibernating as adults inside the nest. In Pennsylvania, the bees begin foraging in April and May. Springtime is the season for nest construction and mating. Foraging continues throughout the summer so that by the end of July, brood chambers are provisioned with pollen balls and larvae that will develop into adult bees. In August, the new adults emerge. They begin foraging within a week or two of emergence and continue to forage through the fall until cold temperatures and lack of floral resources trigger hibernation.

Anyone who has carpenter bees living around their home is familiar with the bold behavior of the bees when they feel that their territory is being threatened. The most defensive carpenter bees are actually the males, who cannot sting, defending their mating territory! Male carpenter bees have distinctive white facial markings that make them easy to identify. They choose locations that give them the best access to females and ward off any threats or competitors with defensive flight maneuvers. Female carpenter bees will defend themselves and their nests if directly threatened, though they are unlikely to sting unless they are aggressively handled or physically threatened.

Management of Carpenter Bees

The best management strategy is prevention. Carpenter bees are abundant throughout the eastern United States and they are particularly attracted to nesting in pine and cedar lumber. Applying paint or stain to wood surfaces deters bees from constructing a new nest. An annual springtime application of almond oil over wood surfaces is an excellent deterrent for those who prefer a natural wood finish. These surface treatments make the wood unattractive to the carpenter bee. In addition to reducing the appeal of the wood structures around the home, providing alternative nesting options in the back yard can help further reduce the chances of negative bee-human interactions while providing suitable habitat for these native pollinators. Untreated pine or cedar can be used to lure female carpenter bees away from wooden structures - and it can be arranged as simply or elaborately as desired. Understanding and accommodating the behaviors of the bees can help reduce conflict and even provide an opportunity to enjoy our native pollinators in the backyard.

Unfortunately, paint, stain, and almond oil are not effective for deterring carpenter bees who are already residents in established nests, as the excavated nest is unaffected by a surface treatment. In this case, the homeowner must determine the best course of action. If the nest is in a location that is not posing a threat to the structure, it can be left in place. Alternatively, it may be possible to relocate the nesting board and replace it with one that has been painted or stained. This is an excellent choice for those wishing to establish native bee habitat on their property.

If there is an infestation that poses a threat to the structure, insecticidal treatment may be required. Chemical pesticide applications should always be performed by an expert. Applying a powdered formulation of insecticide inside the nest is the most effective method for chemical destruction, and it limits the risk of non-target exposure to other beneficial insects in the environment. Following chemical treatment, existing entrances should be sealed, and surfaces should be treated with paint, stain, or almond oil to prevent any further excavations by carpenter bees.

Carpenter bees are managed most successfully when their natural behaviors are taken into consideration. Killing individual bees or indiscriminate pesticide applications are unlikely to provide satisfactory results. Preventative maintenance, choosing building materials such as composite materials, and providing alternative nesting sites are the most effective measures for managing and living peacefully with the eastern carpenter bee.

More information about honey bees, bumble bees, and other native bees can be found at the following websites:

- Penn State Extension
- Center for Pollinator Research
- Penn State Extension Pollinator Series Webinar: Bumble Bee Biology and Management
- Bees in Pennsylvania: Diversity, Ecology, and Importance
- Identifying and Observing Pollinating Insects in Pennsylvania
- Checklist of Bees in Pennsylvania

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