UTAH PESTS fact sheet
EXTENSION UtahStateUniversity
Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-229-21 March 2021

Blue Orchard Bee (*Osmia lignaria*): Commercial Pollinator for Orchards

Theresa Pitts-Singer, Research Entomologist

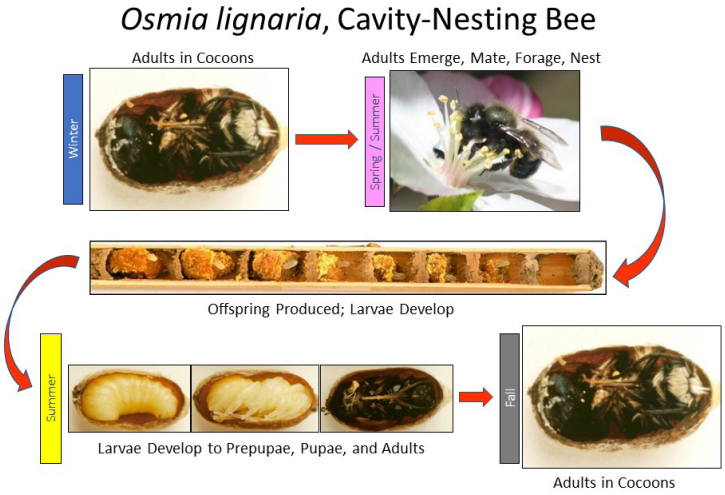
GENERAL LIFE CYCLE

The blue orchard bee (*Osmia lignaria*) is native to North America and is a highly efficient pollinator of orchards (Bosch and Kemp 2001; Peterson and Artz 2014). These bees reliably visit rosaceous orchard and caneberry flowers, especially in western U. S. growing regions. It is a solitary bee species, meaning that it does not live in a colony like honey bees or bumble bees. Instead, females independently build nests in existing cavities that occur in nature, such as holes in dead or dying trees from which beetles have burrowed out. They also readily nest in artificial holes made specifically for bee nesting, such as tunnels of wooden blocks, hollow reeds, or cardboard tubes; these tubes can be distributed throughout orchards at sheltered sites (Bosch and Kemp 2001). When many nesting tunnels are provided in or around orchards or fields during bloom, bees will nest in aggregations, lending them to management for commercial pollination. Offspring in new nests develop to adulthood over the summer, and after wintering, emerge as a new pollinator population for the spring.

TEMPERATURE MANAGEMENT

Blue orchard bees spend the winter as adults in cocoons and emerge naturally in early spring when temperatures warm. Under managed conditions, adult emergence can be manipulated to occur when the bees are needed by controlling the temperature (Bosch and Kemp 2001; Orchard Bee Association). This ability is particularly valuable for flexibility in timing this bee to match a narrow bloom window. Research supports that blue orchard bees are locally adapted to their local climate; therefore, it's a good idea to try to get bees from a supplier in the region of the crop. If not possible, careful inspection of bees in the summer to determine when they reach adulthood can indicate when the bees need to be assigned to a regimen of two weeks at cool temperatures (60°F for 1st week and 50°F for 2nd week) followed by a cold storage temperature so that an adult bee's fat will be preserved for surviving the winter. For winter, the bees are kept at constant cold temperature (40°F) for about 180 days. With a good prediction for the onset of spring bloom, wintered bees can be exposed to a warm temperature (82-85°F) to stimulate them to chew out of cocoons in just a few days so they can be released in orchards at about 10% crop bloom. Ongoing and future research will help in understanding if bee behavior and physiology can be adapted to a new crop environment, if that adaptability is characteristic of bees that originate from specific U.S. regions, and if populations that remain in the new situation adapt over multiple generations.

Blue orchard bee on a flower



NESTING REQUIREMENTS

Blue orchard bees use resources from the crop habitat: flowers for nectar and pollen, and moist soil for partitioning their cells and plugging the end of the nest. Each of these resources are essential for the bees to remain in the crop vicinity and to produce offspring that can be carried over for the next year's pollination season. The spring-emerged males and mother bees only live for about 4-6 weeks in which they build nests, and, thereby, visit crop and other flowers. If crop bloom period is short and there are no other floral resources, or if the ground becomes dry, the bees can no longer nest and will leave or die. The nesting season can be extended by adding plots of spring flowers with extended bloom (e.g., *Phacelia* spp., chinese houses, baby blue eyes, five spot; Lundin et al. 2017, Boyle et al. 2020) near orchards and by assuring a water source near soil (e.g., rain, natural, water reservoir, irrigation sprinklers, constant drip from a water storage tank, etc.).

Water truck adding water to an almond orchard

NATURAL ENEMIES AND DISEASE

There are several natural enemies that attack bees when they are immature. Many of these are parasitic wasps that paralyze and lay eggs on a bee larva; wasp larvae then consume the bee. Others are wasp and bee kleptoparasites that lay 1-2 eggs on the bee provision, and then the pest larva kills the bee egg and eats the food intended for a bee larva. Other pests feed on pollen in the nest and/or scavenge on other contents including dead bees and larvae (e.g., mites, beetles, moths, and flies). To clean out and help prevent future outbreaks of natural enemies and to sort out cocoons containing healthy females and males, it is prudent to strip all nest contents from tunnels during the fall or winter. Splitting open reeds or peeling paper straws can be done but is time-consuming. Use of bee blocks made of layers of grooved boards can offer a more efficient removal process, including use of specialty equipment made for automated cocoon stripping. After cocoons are removed, quickly rinsing them in light bleach solution not only clears mud and other debris, but also kills fungal spores that can cause chalkbrood disease.

Wood block nest

POLLINATOR STOCKING DENSITY

Using blue orchard bees for pollination in almond and cherry orchards along with honey bees is becoming more widely adopted. Although standard use of blue orchard bees still being optimized, early adopters are successfully pollinating California almond orchards that have their February mass bloom event. The pollinator stocking for these orchards is about 1,000 blue orchard bees plus one hive of honey bees per acre. The blue orchard bees at this stocking rate essentially replace one honey bee hive (for the usually recommended 2 honey bee hives per acre). As long as the cost of using blue orchard bees is equal to or less than the cost of a hive rental, this is a winning combination of co-pollinators. The same tactic can be applied to cherry orchards in California, Washington, and Utah. Apple orchards can also benefit from the addition of blue orchard bees, although many apple orchards have sufficient local native pollinators. The desire to produce large apples means that not all flowers should be pollinated, but multiple pollinator visits per flower are needed to create the large fruit. Additionally, managers can thin the number of developing fruits to assure fewer but larger apples at harvest.

MORE INFORMATION

For more details on the blue orchard bee, see other BOB FACT SHEET. For how to manage bees in your area, find local blue orchard bee suppliers via the internet for their best management practices and recommendations. Also visit the "Why Blue Orchard Bees?" video.

REFERENCES

Bosch, J., and W. Kemp. 2001. How to Manage the Blue Orchard Bee. Sustainable Agriculture Network, Beltsville, MD. https://www.sare.org/resources/how-to-manage-the-blue-orchard-bee/

Boyle, N.K. Artz, D.R., Lundin, O., Ward, K.L., Picklum, D., Wardell, G.I., Williams, N.M., and Pitts-Singer, T.L. 2020. Wildflower plantings promote blue orchard bee, *Osmia lignaria* (Hymenoptera: Megachilidae), reproduction in California almond orchards. Ecology and Evolution 10: 3189–3199. https://doi.org/10.1002/ece3.5952

Lundin, O., Kimiora L. Ward, K.L. Artz, D.R., Boyle, N.K., Pitts-Singer, T.L., and Williams, N.M. 2017. Wildflower plantings do not compete with neighboring almond orchards for pollinator visits. Environmental Entomology 46: 559-564. doi: 10.1093/ee/nvx05

Orchard Bee Association: Standards: Development, Pollination. https://www.orchardbee.org/

Peterson, S.S., and Artz, D.R. 2014. Production of solitary bees for pollination in the United States, pp. 653–681. In J.A. Morales-Ramos, M.G. Rojas and D.I. Shapiro-Ilan (eds.), Mass Production of Beneficial Organisms: Invertebrates and Entomopathogens. Elsevier Science, London, United Kingdom.