UTAH BEES fact sheet
UtahState University COOPERATIVE EXTENSION

Published by Utah State University Extension and Utah Plant Pest Diagnostic Laboratory ENT-162-12 April 2012

Blue Orchard Bee
(Osmia lignaria)

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Do You Know?

- Blue orchard bees are solitary (do not live in a hive) and nest in pre-existing cavities.
- Blue orchard bees prefer fruit trees from the family Rosaceae, including apple, cherry, and peach.
- Blue orchard bees live about a year; eggs laid in the spring develop into adults by fall, overwinter as adults, and become active the following spring.
- Blue orchard bees are easily managed on a small scale in a back yard or on a large scale in a commercial orchard.

Bees from the genus *Osmia*, commonly known as mason bees, nest singly in pre-existing cavities, such as hollow plant stems (e.g., raspberry canes or reeds) or holes left behind by woodboring beetles. The most common mason bee in Utah is the blue orchard bee, *O. lignaria* (Fig. 1). Blue orchard bees collect pollen from a large variety of flowering plants, but prefer fruit trees from the family Rosaceae.

Recent concerns about honey bees, coupled with the blue orchard bee's superior pollination of tree fruits, have increased interest in blue orchard bees with both homeowners and commercial growers.

LIFE HISTORY

Solitary, Cavity-nesting Bees

Blue orchard bees are solitary and do not live in colonies like honey bees. Instead, each blue orchard bee female seeks out an existing cavity, such as a hollow plant stem or a hole left behind by a woodboring beetle, in which she will construct a nest consisting of a linear series of cells, with no assistance from other blue orchard bees. However, blue orchard bees are gregarious and prefer to nest near each other. They are attracted to previously used nests and also to other actively nesting blue orchard bees.

Fig. 1. Blue orchard bee males are smaller than females. Males have longer antennae and more white hairs, particularly on the face.[1]

Nest Construction

Once a blue orchard bee female chooses a cavity, she makes a linear nest which consists of several cells separated by mud partitions (Fig. 2). Each cell contains a provision of pollen and nectar, on which an egg is laid. Female eggs are typically laid at the rear of the nest, and males are at the front. Usually, a female blue orchard bee will construct two to four nests, each with two to four female eggs and five to eight male eggs.

Fig. 2. A linear blue orchard bee nest built in a reed. Cells are partioned with mud and contain pollen-nectar provisions. Larger cells in the rear (on the left) contain female eggs, while smaller cells in the front contain male eggs.[2]

Life Cycle

Blue orchard bees live about a year; eggs laid in the spring develop into adults by fall, overwinter as adults, and become active the following spring (Fig. 3).

- When spring temperatures begin to rise, males will begin emerging (Fig. 4), with females following one to three days later.

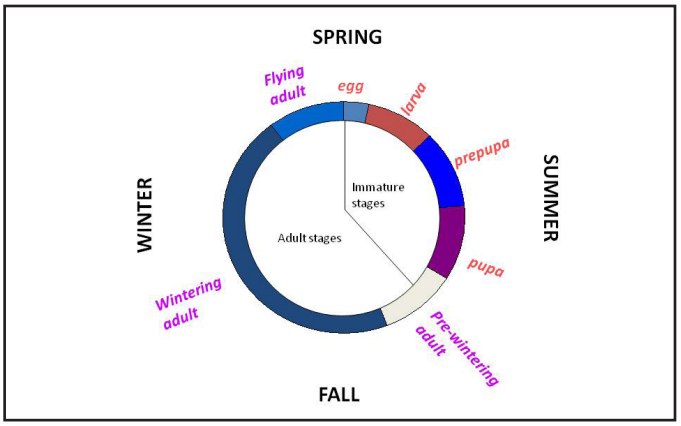

Fig. 3. Blue orchard bee life cycle.[3]

- After mating, females begin nesting. A nesting female lives an average of 20 days.
- Development of the offspring takes place over the summer. The first larval stage actually occurs within the egg, which hatches in about a week, followed by four more larval stages. The fifth stage larva will spin a cocoon, after which it undergoes a two to six week period of dormancy; the duration of this dormancy depends on local temperatures and also the geographic origin of the population. The dormant larva inside the cocoon is often referred to as a prepupa. By late summer, the prepupa molts into a pupa. One month later, the pupa molts into an adult, which will remain dormant until the following spring.

Fig. 4. The larger cocoons in the rear (left side) of this nest, which was built in a paper straw, contain female blue orchard bees, and the smaller cocoons in the front contain males. The mud partitions that separate the cells and feces within each cell are also visible.[2]

POLLINATION

Blue orchard bees collect pollen from a large variety of flowering plants, but prefer fruit trees from the family Rosaceae, such as apple, apricot, almond, plum, prune, cherry, peach, nectarine, and pear. They are particularly efficient pollinators of fruit trees because they move from row to row, as opposed to down a single row. This promotes cross-pollination and increases yield in cultivars that require cross-pollination. Nectar robbing, in which bees collect nectar but do not collect or spread pollen, decreases pollination efficiency. Nectar robbing is a behavior that is common in honey bees, but not in blue orchard bees.

MANAGEMENT

Artificial Nest Cavities

Blue orchard bees can be attracted and established from a wild population, or you can purchase them from a local or online distributor. Whichever you choose, you will need to provide them with suitable nesting cavities. They will nest in wood, masonry, or plastic, but seem to most readily nest in wood or other materials of plant origin. Nest cavities and protective shelters both must be tightly sealed at the back. Not only is this preferred by nest-seeking females, but it will help protect against parasites. Ideally nests and shelters should be placed facing south or southeast. Nests should be protected from wind, rain, and direct sunlight.

- Homeowners may choose to simply drill holes into a log (Fig. 5). This is an easy option, but it limits the number of bees possible and makes parasite control more difficult. Holes should be about 0.75 in (2 cm) apart.

Fig. 5. Drilling holes into a log. Because there is no way to remove parasites and old nests, logs have to be replaced frequently.[3]

- Hollow reeds can be placed in a protected shelter (Fig. 6). Reeds should be split longitudinally so nests can be inspected for parasites.
- Holes can be drilled into wooden blocks (Fig. 7), which are then placed in a shelter (Fig. 8). Placing paper drinking straws into the holes is useful for later removal of parasites and dead bees (Fig. 7).
- Manmade cavities should be about 5/16 in (7.5 mm) in diameter and 6 in (15 cm) long.
- To facilitate bees' navigation to nests, ends of reeds or tubes should be offset, rather than flush (Fig. 6), or holes in blocks should be 3/4 in (2 cm) apart (Fig. 7).

Fig. 6. Reeds placed in a shelter. Offsetting the ends of the reeds will aid bees in finding their nests. Thick, sturdy shelter material may discourage some parasites.[2]

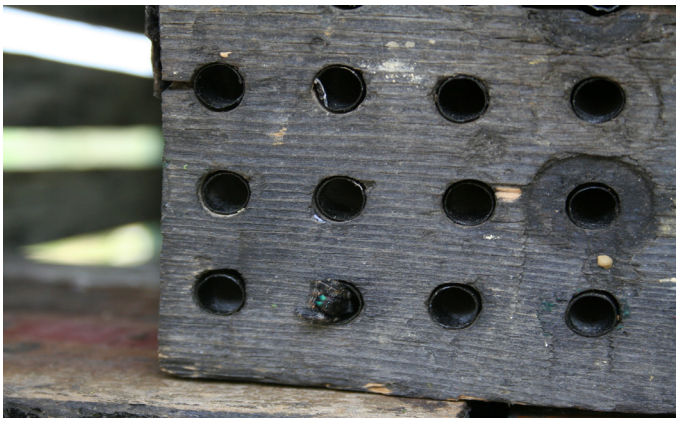

Fig. 7. Nest cavities made by drilling holes in a block of wood. Paper straws have been inserted into the holes to facilitate removing nests for parasite screening. A female bee can be seen exiting the second hole on the bottom row.[1]

Parasite Control

Parasites can be a major problem. Keep in mind, your management decisions can have far reaching consequences. If you do not control parasites in your blue orchard bee population, they can spread to wild populations.

- To discourage parasites that can lay eggs deep into wood or other materials, holes in blocks should be 3/4 in (2 cm) from the edge (Fig. 7), and reeds or tubes should be placed in a shelter that is thick and sturdy.
- Soon after petal drop, remove bee nests to a protected area to decrease infestation with parasites. The same shed used for overwintering will be adequate, as long as temperatures within the shed are sufficiently warm.
- Leave nests in reeds or thick tubes. If nests are in straws, leave the straws in blocks or use a black light trapping system to kill emerging parasites (Fig. 9).
- Some parasitic wasps can be trapped by placing easily made PVC traps within the orchard (Fig. 10).
- While the bees are in winter storage, screen a sample of nests for parasites. Randomly select 10% of the nests to look for and remove chalkbrood cadavers (Fig. 11), beetles, and mites. Visually inspect cocoons and remove any that do not look like blue orchard bee cocoons (Fig. 12). Roll cocoons between your thumb and forefinger; remove any that feel as though they may contain anything other than an adult bee. If more than 10% of the sample that you examine is parasitized or diseased, you must screen <u>all</u> of your nests to remove parasites.

Fig. 8. Shelters should protect nests from wind, rain, predators, and too much direct sun and can be made from a variety of materials.[4 (left), 3 (right)]

Fig. 9. Black light system for trapping and killing parasites: Blue orchard bee nests are placed in a darkened room during overwintering. A tray of soapy water or mineral oil is placed between the nests and a black light. Emerging parasites drown as they move toward the light.[2]

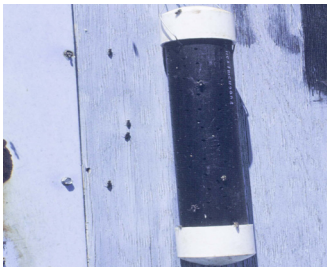

Fig. 10. To trap sapygid wasps, a length of PVC pipe is drilled with ~0.3 inch diameter holes and capped at both ends. The bottom is filled with mineral oil, and the trap is hung in the orchard. *Sapyga* spp. will enter the trap to spend the night and drown in the oil.[2]

Fig. 11. The pathogenic fungi of the genus *Ascosphaera* cause a disease commonly known as chalkbrood. Bee larvae become infected when they eat contaminated pollen-nectar provisions. The disease is spread by adult bees that are dusted with spores as they emerge from the nest.[2]

General Guidelines

Whether on a large scale in a commercial orchard or on a small scale in a back yard, following basic management guidelines will promote healthy bees and improve pollination.

- Overwintering - Bees should be kept cool and sheltered in the winter. An unheated shed will provide protection from moisture, parasites, and predators, without holding in excessive heat, which may be harmful to bees. Commercial orchardists may benefit from more precise temperature and humidity control, as provided by an incubator.
- Timing - To increase pollination and decrease bee dispersal, place overwintered bee nests in a shelter in the orchard or yard as the blooms start to open.

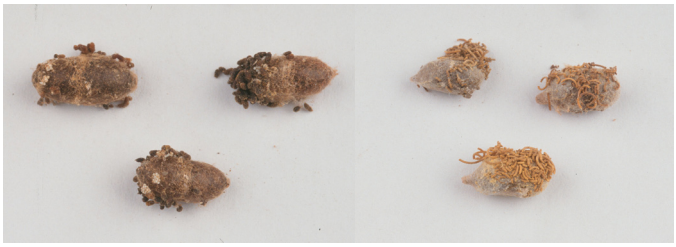

Fig. 12. The cocoons of some parasites, such as *Sapyga* sp. (left) and *Stelis montana* (right), can look similar to blue orchard bee cocoons. It is very important that these cocoons are removed.[2]

- Remember that blue orchard bees need mud to create nests. If there is not a naturally occurring source of mud, you can add water to a tub with a clay/loam mixture. Tilt it to one side, creating a gradient of mud with different moisture contents from which the bees can choose. Another option is to dig a hole near the bee shelter and periodically add water (Fig. 13).
- Parasite protection - Following the parasite control steps described previously is crucial.
- Predator protection - To protect from mammals such as skunks, place shelters well above the ground. To protect from birds, cover front opening with wire screen. It is helpful to attach the screen such that it can be easily pulled aside to allow access to bee nests.
- Pesticide protection - In general, pesticides should only be sprayed when absolutely necessary, and should be sprayed late in the evening to avoid actively foraging pollinators. "Softer" pesticides with short residual periods are safest. Try to time pesticide application before or after bloom. If pesticides must be sprayed while blue orchard bees are present, wait until night when bees have returned to their nests. Cover bee shelters before spraying and do not remove covers until the pesticide's residual period has ended.

In summary, it is important to protect bee nests from moisture, parasites, predators, and pesticides while mimicing outside temperatures. Bees need to be warm in the summer and cool in the winter.

Fig. 13. A small hole (about 1 ft^3) can be dug to provide a mud source (left). Be sure the sides are sloped and add water only as needed to create mud; if the bees can't access mud easily or if there is too much water, they will drown. If bird predation becomes a problem, cover the mud hole with a screen with holes big enough to stll allow bees to enter (right).[4]

ADDITIONAL RESOURCES

The following resources provide additional and more detailed information. You are especially encouraged to use these resources if you intend to keep large numbers of blue orchard bees (i.e., in a commercial or orchard setting).

- Bosch, J., and W. Kemp. 2001. How to Manage the Blue Orchard Bee. Sustainable Agriculture Network, Beltsville, MD. http://www.sare.org/Learning-Center/Books/How-to-Manage-the-Blue-Orchard-Bee
- Dogterom, M. 2002. Pollination with Mason Bees: A Gardener's Guide to Managing Mason Bees for Fruit Production. Beediverse Publishing, Coquitlam, BC, Canada.
- Logan Bee Biology and Systematics Laboratory. http://www.loganbeelab.usu.edu/

Images:
[1]Theresa Pitts-Singer, USDA-ARS Bee Biology and Systematics Laboratory, Logan, UT
[2]Glen Trostle
[3]Jim Cane, USDA-ARS Bee Biology and Systematics Laboratory, Logan, UT
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