BEEKEEPING 101 FOR CRANBERRY GROWERS

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Why would it benefit a cranberry grower to know the basics about bees and beekeeping? If growers understand what the honey bees are doing in those boxes and why, it will be much easier to ensure that the cranberries receive adequate pollination. Beekeeping is an art and a science that has been practiced by man as long as history has been recorded. Most people keep bees to harvest honey from them. But bees provide an enormous service as pollinators. Currently the value of honey bee pollination to US agriculture is over 14 billion.

Beekeeping has lots of lingo. A *colony* of bees lives in a *hive.* The hive usually refers to the equipment and the colony to the bees. As many cranberry growers know, the presence of lots of hive boxes doesn't always mean there are lots of bees in the colonies. Hive boxes have standard and very specific dimensions that mimic the natural architectural instincts of the bees. As a colony grows, the beekeeper adds new boxes on top to allow the colony to expand. Bees naturally build parallel, vertical hanging combs made of beeswax that they secrete from glands on their abdomens. However, beekeepers provide colonies with wooden frames and *foundation* of beeswax or plastic to encourage the bees to draw out wax comb within the frames, so that the beekeeper can easily remove the frames to inspect the colony. Each box can hold 10 frames, although most beekeepers keep 9 frames per box, which makes it easier to remove frames without damaging bees. Bee colonies are kept in *apiaries*; generally a commercial beekeeper will maintain 32-40 colonies per apiary, whereas a hobby beekeeper may maintain an apiary of 1-2 colonies in their backyard. Many commercial beekeepers keep their colonies on pallets, 4 colonies per pallet, to facilitate transporting colonies to different locations for pollination or honey production. The pallets are lifted with a bobcat onto a truck, which can usually carry about 400 colonies in one load.

Colonies generally start out in one box, or one *deep hive body* containing the *queen* and about 10-20,000 *workers*, or sterile female bees. The queen is the only reproductive female in the colony and can lay up to 15000 eggs per day for the duration of her lifetime of 1-3 years. As the colony population grows, the beekeeper will add a second deep box to allow the queen to expand her *brood chamber*. The beekeeper must provide room for the bees to expand in advance of when the bees will need it. If a colony outgrows its hive, it will *swarm*. The queen and about half of the bees will leave the hive and land in a tree for a day or two while they search for a new nest site. When they find one, which could be a hollow tree, the walls of a house, or discarded beekeeping equipment, they will build new comb and continue growing. The bees that remain in the colony rear a new queen bee from the female larvae of the old queen that left with the swarm. They feed some chosen larvae *royal jelly* and due to the nutritional change in quality and quantity of food, these larvae develop into queens rather than a sterile workers. The first queen to emerge from her cell kills the other rival queens while they are still in their cells. When this new queen is a week old, she flies from the hive to take her one and only mating flight. She will fly up to a mile in search of male bees, or

drones. A strong colony will rear about 100 drones for every 10,000 workers. These males do not sting, do not collect pollen and nectar, and do not secrete wax. Their sole purpose is to propagate their genes. When mature, they leave the colony every afternoon, and fly to a *drone congregation area* where they meet up with other drones from other colonies located within a 1-2 mile radius. When a virgin queen flies into one of these congregation areas, she will mate with up to 20 different drones, which ensures she will outcross and avoid mating with her own sons. She stores sperm from all the males in a structure called a *spermatheca* and will fertilize her eggs with these sperm for the remainder of her lifetime. If an egg is fertilized, it will develop into a diploid female, either queen or worker depending on how it is fed as a larva. If an egg is not fertilized, it will develop into a haploid male. *Diploid* means having 2 sets of chromosomes, one inherited from the father, one from the mother. *Haploid* means having only 1 set of chromosomes, and in the case of drones, they come only from the mother. In essence, drones are flying queen gametes. They have no fathers, but do have grandfathers. If you can figure that out, you're ahead of many beekeepers!

The most important information for growers concerns the diet of bees. A bee's diet requires 3 things: Pollen, nectar, and water. Nothing more. Pollen is their sole source of protein, nectar is their sole source of carbohydrate, and water is water (they need a continuous source of it). As a bee visits a flower, the sticky pollen collects on her fuzzy, hairy body. She grooms the pollen from her body with her legs, and packs it into a ball on her hind legs. Her hind legs have special features (collectively called a *pollen basket*) that allow her to carry large balls of pollen back to the colony. She will find an empty cell in the brood chamber to unload the pollen, and will return to the same kind of flower over and over to collect more pollen, ensuring pollination. To attract bees to flowers, flowers have developed a reward system: they produce sweet, rich nectar for the bees. The nectar is produced in nectaries, usually located at the base of the reproductive structures of the flower, so that to reach the nectar the bee has to brush against the anthers and pollen. She will sip up the nectar with her tongue, and carry the undigested nectar back to the colony in her *crop*. Bees can forage up to 5-8 miles to collect nectar and pollen, but if sufficient flowers are available, they prefer to forage within a mile or two of the colony.

In the colony, she will regurgitate the nectar to a hive bee (a bee not yet old enough to forage), and the hive bee will store the nectar in a vacant cell. During this nectar transfer and strorage, enzymes produced by the bees break down the sugars into more simple sugars, and the bees evaporate excess water from the nectar by fanning their wings. When the nectar contains around 18% moisture, we call it honey. When the cells are filled with honey, the bees cap the cells with a wax capping. When beekeepers notice that the bees are sealing honey cells with brand new white wax, they give the colony more hive boxes. These boxes are called *supers*, which are different than the deep brood chambers because they are used exclusively to store honey. Most colonies used for pollination come with 2 deep brood chambers and may have several honey supers on top.

Bees store huge amounts of honey to ensure their survival during the winter months. bees are the only bees that survive the winter as a colony; in other bee species such as bumble bees, only the queens survive the winter by hibernating in the ground. Honey bee colonies remain in their nest boxes, and will consume 50-100 lbs of honey over the winter, from October to April. So when beekeepers harvests honey, they must

leave sufficient stores for the bees to survive the winter. When temperatures drop below 55°F, the bees cluster together and using the energy from honey consumption, shiver their flight muscles to produce heat. They will not fly from the nest unless ambient temperatures are at least 40°F, and even then they only fly out to defecate, and return immediately. Inside the cluster, they can maintain the temperature between 70-94°F, and so are essentially "warm blooded" as a colony. Even when temperatures drop to –30°F outside, the temperature in the middle of the cluster will be around 80°F. The queen stops laying eggs around October, but will resume egg laying, slowly, as early as late January. When there is a little brood in the nest, the bees must maintain the temperature around the brood at 94°F, or it will not survive.

These are some of the basics of bees and beekeeping. If you are interested in learning more about beekeeping, you might consider taking out Beekeeping in Northern Climates short course; a 3 day class offered every March at the University of Minnesota, St. Paul Campus. Look under Short Courses at www.entomology.umn.edu