Honeybees

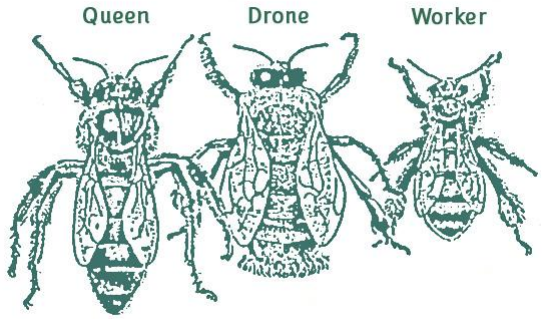
History

Human interaction with honeybees dates back to the end of the last ice age. Early honey hunters gradually became beekeepers as they learned to remove honeycomb from the nest without destroying the colony. This allowed honey collection from the same hive year after year. People eventually learned to induce wild bees to inhabit hollow tree trunks or artificial hives made of mud and straw.

Bees and honey have been revered throughout civilization. The Ancient Greeks and Romans were avid beekeepers since honey was their primary sweetener. Beekeeping flourished in the Medieval British Isles, where honey was used to make mead, a rather powerful liquor. The word honeymoon comes from an ancient custom of giving newlyweds enough mead to drink for the first month of marriage.

When Europeans immigrated to the New World in the 17th century, they introduced true honeybees to the Americas. Honeybee swarms soon moved out into natural nesting sites. The pioneers carried beehives with them as they moved west, and today the bee is a major pollinator of food crops in the U.S.

Modern beekeeping began in 1851 when the Reverend L.L. Langstroth, an amateur beekeeper in Philadelphia, solved the problem of cutting the comb from artificial hives. He discovered that bees would not deposit propolis, a sticky building material, in any space that was 3/8" or narrower. He called this width bee space, and created a box-shaped hive with removable, wooden frames that were separated from each other and from the hive walls by bee space. The Langstroth hive is still used by most commercial and hobby beekeepers.



Honeybees

There are four recognized species of honeybees in the world. *Apis mellifera* is the common, domesticated honeybee. There are several races within *Apis mellifera*, including: *A.m. ligustica* (Spinola-Italian), *A.m.*

caucasica (Pollman-Caucasians), *A. m. carnica* (Pollman-Carniolians), *A.m. mellifera* (Latrielle-German Dark Bees) and *A.m. adansonii* (Latrielle-West African Bees).

Italians, Latrielle, Carniolians, and Caucasians are found in the U.S. Italian honeybees are preferred by many beekeepers because they are easy to handle and slow to swarm. In 1956, some queens of the African species were transported to Brazil. Their progeny escaped, increased and spread rapidly. Referred to as 'killer bees,' they are very aggressive and quick to swarm. They may become less ferocious as their generations breed with gentler domesticated bees.

The Colony

A colony of honeybees consists of several thousand workers, up to a few hundred drones, and a single queen. The survival of the colony depends on the labor of individual bees.

The queen's sole purpose in life is to lay eggs. When the queen is young, she takes a mating flight and receives enough sperm to fertilize eggs for the rest of her life. A queen will lay an average of 1,500 eggs per day during the summer, and from 175,000-200,000 per year. Queens lay two types of eggs. Fertilized eggs become workers or queens, and unfertilized eggs become drones.

Drones are the males, and they are maintained in a hive for mating with the queen. Drones die after mating, so only the unsuccessful ones return from mating flights. They are usually allowed to live until food begins to become scarce, and then they are driven from the hive.

Worker bees have a job as soon as they emerge. Their body covering takes a day or two to harden, so during this time, they will stay in the hive and clean cells. Older bees feed the new workers, who develop glands in their heads when they are about three days old. These glands are the source of a very rich food known as royal jelly. The young bees feed royal jelly to the larva. Worker and drone larva receive royal jelly for two or three days. When worker larvae are selected to become queens, they are fed royal jelly until they pupate.

Young worker bees also develop wax glands used for sealing cells and building comb. There are two types of cells in the comb; larger ones for the drone larvae and smaller ones for worker larvae and food storage.

After two to three weeks of secreting wax; the young worker bees begin to receive pollen and nectar from foraging bees. The nectar, stored in their honey-stomachs, is passed from bee to bee. During this process, the bees expose thin films of nectar on their tongues, reducing its water content. An enzyme is added to the condensed nectar, converting it to honey. A good colony should produce 50-100 pounds of surplus honey for the beekeeper. The colony should also produce about 60 pounds for itself to overwinter.

When the worker bees are about three weeks old, they will begin to forage. Bees forage for pollen, nectar, water, and plant resins used to make propolis. Propolis is used to plug or reduce openings in the hive. Water is used to cool the hive and dilute the honey consumed by bees. Pollen is mostly used to feed brood, the immature stages of bees. Nectar is stored as honey for the winter months when other food is unavailable.

Bees have evolved a body perfectly suited for collecting pollen. They have tiny hairs all over which traps the pollen. When a bee gets ready to leave a flower, or while in flight, she combs her body hair with special bristles on her hind legs. She then kneads this pollen together with the nectar she has gathered, and glues the sticky pollen ball onto special stiff hairs called "pollen baskets." When the baskets are full, she returns to the hive and pries off the pollen with a hook on her legs. It takes about 38,000 collecting trips to gather one pound of pollen. An average hive needs about 50-75 pounds of pollen per year.

Bee Dances

Honeybees communicate food locations through a series of dances performed on the comb surface. The round dance indicates a food source near the hive. The dancing bee walks in circles, alternating clockwise and counterclockwise. The bee occasionally stops and regurgitates some of its nectar. Potential foragers learn the odor of the food from the nectar, and soon leave the hive in search of the source, flying in increasingly larger circles around the hive. Better food sources result in more vigorous dancing.

The waggle dance is used for a food source that is farther than 100m away from the hive. The dancing bee moves in a straight line called a run, vibrating its abdomen, then moves in a semicircle to its starting point, where it repeats the run, returning in the opposite direction of the first semicircle. These moves are repeated several times. The length of the run and the momentum of the vibrations increase with the energy needed to get to the food source.

Pollination

The astounding success of the flowering plants we see today is the result of their ability to form a mutually beneficial relationship with insects. For hundreds of thousands of years, plants had been dependent on wind and water for their pollination. These restrictions gave them a narrow range of possible habitats. When the first insect blundered into a plant, picking up pollen, it dramatically changed the course of botanical history. Since then, plants and insects have been shaping each other to such a degree that today some plants are totally dependent on only one insect for their existence.

The relationship which developed between plants and insects was possible because plants had something very attractive for the insects: food in the form of pollen and nectar. Pollen is a rich stew of proteins, starch, sugars, fats, minerals, vitamins and free amino acids. Nectar is an aqueous solution of sucrose, fructose and glucose. Both are tempting bribes.

Bees tend to confine their attention to one flower species during a single foraging trip, but they move from plant to plant, favoring cross-pollination. Cross-pollination results in greater genetic variation, which can mean stronger, more vigorous plants.

Floral Attractions

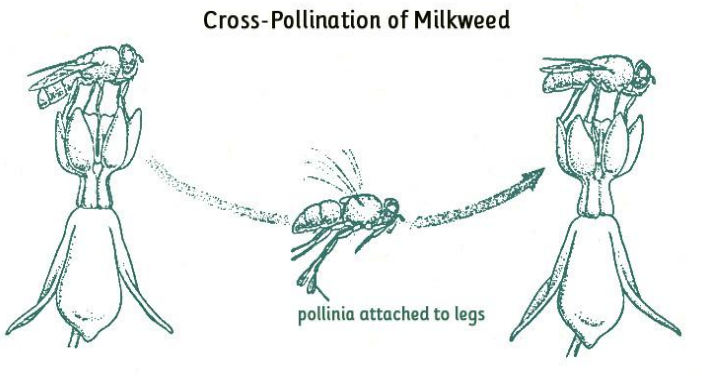
The relationship between insects and the flowers they pollinate have great interest to botanists, biologists and ecologists who study plant evolution. Primitive flowers allowed their nectar to be stolen by any passerby. Over time the flowers evolved structures that ensured that their valuable food was taken only in exchange for cross-pollination. Saucer-shaped flowers (like poppy and wild rose) have petals that are all alike and their pollen is easily accessible on the flower. These flowers have no nectar, but have an abundance of rich pollen, so they are visited by so-called “lower” insects including beetles and flies who predated bees. Bell-shaped flowers evolved to enclose their nectar-producing glands and force insects to collect pollen as they seek nectar at the base of the bell. Tube-shaped flowers restrict access to a few specialized insects.

Bee pollinated flowers tend to be brightly colored in the blues and yellows. Bees see red as gray, or as the absence of color. Bees, who are visiting a red flower, are in all likelihood, seeing ultraviolet markings invisible to us. Many flowers which to our eyes appear as one color, have stripes going from the outer petal edge down into the center. These markings serve as directional pointers to the source of the nectar.

Flower shape and color guide bees from a distance, and scent provides the stimulus to alight. Bees are attracted to the blooms with the highest sugar concentration; nectar with a high water content is not worth the energy spent to collect it.

Attracting Bees in the Garden

Humankind is developing a greater sense of our dependence on bees for the crops that we find essential. About 15 percent of the cultivated food plants in the U.S. depend upon or benefit from insect pollination. Bees are a main pollinator of fruits, nuts, and cotton. Bees pollinate alfalfa, clover, lespedeza, and trefoil. These plants fix nitrogen in the soil, reducing the need for chemical fertilizers. Bees are also valuable in the pollination of plants used for pharmaceuticals.



The homeowner's pear, peach and apple trees, berries, melons, squash, peppers and other fruiting vegetables need the services of bees to produce their bountiful harvests. Some favorite food plants for attracting bees to the home landscape include:

Flowers and Herbs

Anise hyssop
Balsam
Bee balm
Borage
Butterfly weed
Cleome
Coral bells
Cosmos
Globe thistle
Gloriosa daisy
Great lobelia
Hyssop
Lantana
Lavender
Lily
Marigold
Nicotiana
Rosemary
Salvia
Snapdragon
Sunflower
Sweet allysum
Sweet rocket
Thyme
Verbena
Zinnia

Trees and Shrubs

Alder
Apple
Autumn olive
Bay laurel
Black locust
Blueberry
Butterfly bush
Eucalyptus
Golden-rain tree
Huckleberry
Linden
Maple
Mesquite
Peach
Privet
Raspberry
Russian olive
Serviceberry
Spicebush
Sour cherry
Sumac

Catalpa
Chastetree
English holly
Pear
Persimmon
Plum
Tartarian honeysuckle
Tree of heaven
Willow

Wildflowers and Meadow Plants

Alfalfa
Aster
Birdsfoot trefoil
Buckwheat
Cranberry
Dandelion
Goldenrod
Lupine
Milkweed
Motherwort
Purple loosestrife
White clover
Wild strawberry
White sweet clover

Threats to the Honeybee Population

Beekeepers have noted that the size and diversity of the bee populations is diminishing, adversely affecting crop pollination. Some likely reasons include the loss of nesting places and wild nectar plants to provide pollen sources. Parasitic mite epidemics also endanger the bee population.

Today, one of the major threats to beekeeping in the U.S. is from herbicides sprayed on wild flowers, and pesticides sprayed on food or textile crops. In many states where agriculture is big business, it has become impossible to keep bees because of aerial spraying of pesticides. Cotton was a valuable source of nectar for bees in Arizona. However, due to the liberal use of pesticides, beekeeping has virtually been eliminated.

It is possible to spray and still protect the majority of bees. If beekeepers are given advance warning, they can close down the hives the night before and keep bees out of the field or orchard for twenty-four hours which allows most of the chemicals time to break down or dissipate.

Tips for Protecting Bees From Insecticides

1. Use spray applications instead of dusts.
2. Apply sprays when plants are not in bloom or late in the day when the bees are not out.
3. Use insecticides less toxic to bees and which have a short residual life.
4. Direct spray toward the target plants with the nozzle as close to the target as feasible.
5. Reduce insecticide drift with the proper application procedures.

The following is a list of cultivated crop plants that are pollinated by honeybees. Bold names indicate that honeybees are the primary pollinators of these plants.

alfalfa
almond
apples
apricot
artichoke
asparagus
avocado
blackberry
blueberry
buckwheat
caraway
coriander
cotton
crabapple
cucumber
currant
dill
eggplant
fennel
flax
grapes
lantana
peach & nectarine
peanut
pear
pepper
persimmon
pimento
plum
pumpkin & squash
quince
radish
rape (canola oil)

celery
chayote
cherry
chervil
chicory
chives
citrus
clover
clove
coconut
coffee
cole crops
lavender
lespedeza
lettuce
lima beans
lupine
macadamia
muskmelon
okra
olive
onion
pawpaw
passionfruit
raspberry
safflower
sesame
sweet alyssum
spicebush
strawberry
sunflower
tomato
tung (oil)
turnip & rutabaga
vetch
watermelon

Fewer observations have been recorded on honeybee pollination of wildflowers and ornamentals, but the following plants are dependent on insect pollination for seed production.

aster
birdsfoot trefoil
barrel cactus
organpipe cactus
stock
sheep laurel
bleeding heart
redbud
mistletoe
california poppy
cyclamen
sandcherry
foxglove
petunia
periwinkle
milkweed
carnation
marigold
sedge
mountain laurel
gentian
scotch broom
purple loostrife
phlox
mignonette
Missouri currant
linaria
pansy
calla
bellflower
spiderwort
candytuft
buffaloberry
rhododendron
freesia
lobelia
orchids
primrose
juneberry
snapdragon
penstemon