

The Big Buzz on Bumble Bees!

Grades: 4-6

Subjects: Science, Communication Arts

Approximate Time: 1 50 minute period

Montana Standards: Science Content Standard 3: Benchmarks 3.3 and 3.5.

Communication Arts 2: Benchmarks 2.1 – 2.7 and 2.14; Communication Arts 5.

Objectives: Students will differentiate between bumble bees, leafcutter bees, blue orchard bees, and honeybees. Students will understand the role of bumble bees in pollination, and their importance in pollinating food crops. Students will understand the unique qualities of bumble bees, which set them apart from other bees. Students will be given the opportunity to construct bumble bee domiciles.

Materials:

World of Pollinators poster

e-mail; Lbrenneman@mt.gov

or order from:

<http://www.pollinator.org/posters.htm>

Vocabulary: eusocial, eusociality, pollen basket, colonies, solitary bees, buzz pollination

INTRODUCTION

Have you ever, on a hot summer day, or maybe early in the spring, stopped to watch the flowers for a moment and noticed insects scrambling around on them? You wonder, "Are they bees? They don't exactly look like bees to me?" Did you know that there are more different kinds (different species) of bees than all of the mammals, lizards, frogs, and birds put together? Most of these bees do not form large family colonies, as do our familiar honey bee. Instead, the majority of bees are solitary, living a life alone and where every female is a queen. And these bees do not produce honey, so some people call them the pollen bees. A couple of common solitary bees are the alfalfa leafcutting bee and the blue orchard bee. Bumble bees are another common bee, and they also come in a large variety: fat ones, skinny ones, big ones, little ones. Most of them are black and yellow, but some with more black than yellow, while others have more yellow than black, and still others have white or red markings -- but all of them are furry. They form colonies like the honey bee, but only small colonies, and they only produce enough honey to feed themselves for a few days!



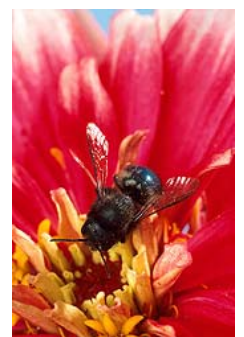
Honey Bee
Apis mellifera Linnae



Bumble Bee
Bombus sp



Leafcutting Bee
Megachile sp.



Blue orchard bee
Osmia lignaria.

FACTS ABOUT BUMBLE BEES – GENUS *BOMBUS* sp



Bumble bees possess three attributes that will help you to distinguish them from all other bees in the region: they are big, they are furrier than most other bees, and females transport pollen as a wet mass held in a “pollen basket” on the hind leg. The pollen basket of the hind pair of legs is broadened and concave like a shallow, elongate spoon. If empty, its polished surface can be seen reflecting light. Only the honey bee in our fauna has a similar pollen

basket; all other bees here that collect pollen carry it in a dense brush of hairs either on the hind leg or under the abdomen. Bumble bees are much furrier than the honey bee, the only other bee here that has a pollen basket.

You will find that bumble bees are a cut above other insects, such as honeybees, when complete pollination is your goal. They work faster, visiting many more flowers per minute. Their large size lets them carry huge pollen loads, allowing longer foraging trips, and achieving better contact with flowers. Bumble bees will also work under conditions that other pollinators find intolerable. First of all, they can pollinate in a greenhouse. More importantly, bumble bees can work in temperatures below 50 degrees F, the perfect solution for pollinating your early spring blooms. Honeybees have not proved to be effective in either of these environments. Not even strong wind or moderate rainfall will prevent the bumble bees in your GARDEN from going about their pollination duties! Bumble bee identification guide available at:

<http://www.ars.usda.gov/Services/docs.htm?docid=10749>

SOCIAL BEHAVIOR

All of the *Bombus* species are eusocial. Eusociality is characterized by a reproductive division of labor, consisting of queens, workers and males; overlap of generations; and cooperative care of offspring. *Bombus* workers are usually smaller than the queen, but otherwise they are similar morphologically. This is considered a relatively primitive level of sociality compared to other eusocial Hymenoptera (e.g. ants and honeybees) that have morphologically differentiated workers and queens ([Wilson, 1971](#)). Bumble bees are solitary bees, meaning they don't congregate in a hive, which makes them less likely to be aggressive as they are not guarding a hive.

COLONY LIFE CYCLE

The colony cycle of a bumble bee starts in the spring. Queens, which have over-wintered in protected locations, will initiate a new colony. Queens emerge very early in the spring in Montana. The queens will often locate a preexisting cavity in the soil, such as an abandoned rodent nest. Locating a suitable location often takes considerable time. *Bombus* queens are visible

in the spring flying close to the surface of the ground searching for a cavity. It is common for *Bombus* queens, even of different species, to fight for a nesting location (Heinrich,1979).

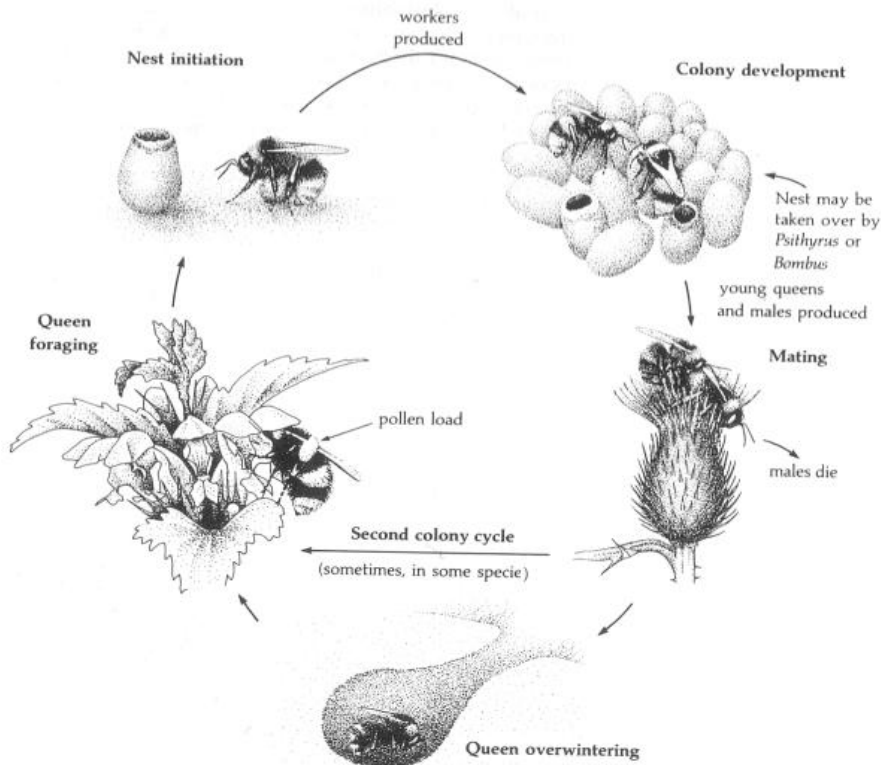
Workers, which are smaller than queens and remain unmated, are produced during most of the summer. The queen will forage for pollen for her first group of workers. Following that, workers will do most of the foraging. In the nest, the pollen is placed in a ball, and several eggs are laid in it. The queen, or workers, can incubate the pollen mass to speed the development of the young. As the summer proceeds, the colony will start producing males and new queens. The new queens mate in the fall, and then overwinter in protected locations.

BODY TEMPERATURE AND WORK

At rest a bumble bee's body temperature will fall to that of its surroundings. To raise the temperature of the flight muscles high enough to enable flight the bumble bee shivers, rather the same as we do when we are cold. This can easily be seen in a grounded bee as her abdomen will pump to ventilate the flight muscles. The rate of pumping can give an indication of the temperature of the bee. Ranging from around 1 pump per second when she is at 10°C, to 6 pumps per second when she reaches 35°C. The time taken to raise the thorax temperature has been studied and is laid out in the table below.

Bee/air temp. °C	Time taken to reach 30°C
24	a few seconds
13	5 minutes
6	15 minutes

When food is plentiful and outside temperatures fall below 10°C bumble bees generally stay inside the nest and live off their stores. At times when food is scarce or stores are low they will forage



when the outside temperature is as low as 6°C, and queens will forage at even lower temperatures. In severe conditions they have even been known to vary their flying height to and from the nest to take advantage of any temperature differences.

LESSON: **ACTIVITY 1: STUDENT READING EXERCISE**

BENEFITS OF BUMBLE BEES

Excerpt from: Befriending Bumble Bees

“Most people raise bumble bees to benefit from their impressive pollination services, a service that is vital to both food production and the health of our ecosystem. With a large variety of problems afflicting the honey bee industry such as pests, pesticides, diseases, and poor financial returns, it is important to broaden the range of bee species used for commercial pollination.

Unlike honey bees, which were imported to the Americas by European colonists, there are many bumble bees that are native to North America. Having evolved along with our native plants, bumble bees are efficient and important pollinators of many native wildflowers and crops such as cranberries, blueberries, raspberries, squash, and melons.

Buzz Pollination

Bumble bees ensure the perfection of tomatoes by performing a special feat called "buzz pollination." The bumble bee grabs the anther cone (the flower part containing the pollen) and shakes it, releasing pollen that would otherwise stay trapped in the anther cone. The pollen is then available to fertilize flowers so that fruit can be produced. Good pollination produces large, evenly shaped, attractive fruits.

Greenhouse Heroes: Bumble bees are used to pollinate most tomatoes grown in commercial greenhouses. Bumble bees adapt well to use in greenhouses. Commercial bumble bee rearing companies produce bumble bee colonies year-round to serve greenhouse tomato production.

One of the qualities that sets bumble bees apart from many other pollinators is a special behavior called "buzz pollination" that some flowers, such as tomatoes, require for pollination. During buzz pollination, bees grab the flower and shake it, releasing pollen that would otherwise remain trapped within the flower. Most other bees, including honey bees, are incapable of performing buzz pollination, so bumble bee colonies are used to pollinate most tomatoes grown in commercial greenhouses.

There are also rare native wildflowers that depend on bumble bees for pollination. As natural habitats become more fragmented by housing and other land developments, wild bumble bee populations are likely to decline and some native wildflowers may lose their pollinators. Without pollination, plants cannot produce seeds. Loss of native pollinators can lead to a decline in native plants, which means less forage for the remaining native pollinator species in the coming years, creating a vicious cycle. We can help break this cycle by planting natives in our gardens to ensure local bee populations have ample forage and raising native pollinators to ensure adequate pollination of these plants.

Bumble Bees and Native Flowers: Although bumble bees are a common sight in most flower gardens, not all bumble bee species have adapted well to changes that have taken place in the landscape due to the spread of agriculture and urbanization. Several European countries have documented declines in their bumble bee

Bumble bees are creatures of undeniable beauty and charm. You are sure to become fascinated while watching their interactions and marveling at the ever-changing sculptures of wax inside their nests. Observing the bumble bees you raised foraging in your fields or gardens will have a deeper meaning when you understand more about these avid pollinators.” Evans, Burns, and Spivak, 2008

ASSESSMENT: STUDENT WORKSHEET ON READING COMPREHENSION FOR ACTIVITY 1.

1. List two main reasons people raise bumble bees.

a. _____

b. _____

2. List two places that bumble bees are more effective than honeybees for pollination.

a. _____

b. _____

3. List two unique qualities of bumble bees.

a. _____

b. _____

4. After reading this article, why do you think it is important to try and protect bumble bees?

5. What is the main idea of the article?

6. What may be lost if bumble bee populations decline. List as many as you can!



BUILDING A BUMBLE BEE NEST BOX

THE FOLLOWING LINKS PROVIDE DETAILED INSTRUCTIONS ON BUILDING A BUMBLE BEE NEST.

<http://happyfarming.com/2009/01/02/how-to-build-a-bumble-bee-nest/>

THE FOLLOWING LINKS PROVIDE DETAILED INSTRUCTIONS ON BUILDING A BUMBLE BEE NEST AND INFORMATION ON SUCCESSFUL TIPS FOR BUMBLE BEE NEST BOXES CAN BE FOUND AT:

[http://www.ars.usda.gov/SP2UserFiles/Place/54280500/Bumble beeRearingGuide.pdf](http://www.ars.usda.gov/SP2UserFiles/Place/54280500/Bumble%20beeRearingGuide.pdf)



PLANTING A POLLINATOR GARDEN/ PROTECTING POLLINATORS MOVIE

<http://www.mt.nrcs.usda.gov/technical/ecs/plants/pollinator/index.html>



GENERAL INFORMATION ON BUMBLE BEES:

<http://www.bumblebee.org/behaviour.htm#crops>



BUMBLE BEE (BOMBUS sp) BIOLOGY

<http://academic.evergreen.edu/projects/ants/TESCBiota/kingdom/animalia/phylum/arthropoda/class/insecta/order/hymenoptera/family/apidae/bombus/biology.htm>



BECOME PART OF A BUMBLE BEE NEST BUILDING COMMUNITY

http://www.bumblebeeconservation.org.uk/nest_boxes.htm

Many of the materials used in this lesson are from: <http://bumblebee.org/>

Works Cited:

Elaine Evans, Ian Burns, and Marla Spivak 2008

Befriending Bumble Bees

Kweskin, Matthew 1996

The Bumble bees of Evergreen

Wilson, E. O. 1971.

The Insect Societies. Harvard University Press, Cambridge.