

## **Bumble Bee Ecology**

Transcript:

There is a partnership between wild bees and native plants. Bees require pollen and nectar for nutrition, and many plants depend on bees for cross-pollination.

To explore the interactions between wild bees and native plants, we visited Chiwaukee Prairie, near the western shoreline of Lake Michigan.

This beautiful mosaic of wetland plant communities has been designated a National Natural Landmark.

It has more than 400 plant species, and a diverse community of wild bees.

One of the most beautiful flowering displays occurs in May when the prairie is covered with tens of thousands of shooting star flowers.

These flowers are primarily pollinated by queen bumble bees.

Bumble bee diversity in this Natural Area is high, and queens of at least 5 species pollinate shooting star.

As bees forage for pollen, they unintentionally transport some of the pollen among plants, promoting cross-fertilization.

Pollen is collected from the male part of a flower, the anther cone, and then transferred to the female part of a flower, the stigma, on a different plant.

On the right you can see hundreds of tiny pollen grains that have been deposited onto a stigma.

A bee collects pollen from shooting star flowers by rapidly vibrating the anther cone. This causes hundreds of thousands of pollen grains to be released explosively onto the underside of the bee.

To remove pollen from the flower the bee grabs hold of the anther cone with her front and middle legs. She also bites the cone with her mouthparts.

The bee then uses the powerful muscles in her thorax, her mid-section, to vibrate the anther cone.

These vibrations occur at rapid frequency, typically 300 – 400 times per second. The muscle contractions causing these vibrations require as much energy as flight.

We have used mechanical vibration in the laboratory to further explore how pollen grains are released. As the flower is vibrated, the tiny grains bounce against the inner walls of the anther cone.

The grains then burst out of openings at the base and sides of the anther cone.

Although shooting star is primarily pollinated by bumble bees, small solitary bees, such as these tiny green sweat bees, are also effective pollinators.

In early May when shooting star begins flowering, Queen bumble bees investigate the flowers, but don't land on them.

To understand why this is, we need to go back to late summer of the previous season, earlier in the bumble bee life cycle.

In late August and September, bumble bee colonies produce new queens and males.

After foraging for nectar for a few weeks, they will soon be ready to mate.

Here you can see a new queen bumble bee mating with the much smaller male. They typically mate on the ground for 30 minutes or more.

Sometimes, a second male will try to get in on the act, but they are usually not successful.

The newly mated queen forages for nectar to increase her fat reserves. She then digs a small hole to spend the winter.

New queens are the only members of the colony that survive the harsh winter months.

In late April, queen bumble bees emerge from hibernation.

As the prairie becomes green from spring rains, the new queens begin searching for an old rodent burrow that can serve as a nest site.

Their search behavior follows a zig-zag pattern, with periodic stops to investigate potential nest sites.

While searching for nest sites, queens only require sugary nectar to fuel their flight. So they visit nectar rich plants such as wood betony and hoary puccoon.

Since shooting star doesn't produce nectar, bees hunting for nectar don't land on the flowers.

A few weeks later, many of the queens have established their nests. They now need to collect protein rich pollen to provision their young.

Since shooting star flowers have large quantities of pollen, these flowers now become a preferred resource for the queens.

The bee's pollen baskets are often laden with large quantities of pollen to take back to the nest.

Visits to the majority of flowering plants place pollen on the face or head of a bumble bee. The pile, or fur of the bee, is then meticulously groomed by the bee's legs.

By contrast, visits to shooting star flowers deposit several hundred thousand pollen grains across the underside of the bee. Many of these locations are difficult for the bee to groom effectively.

She begins by cleaning her proboscis.

Next she scrapes the pollen towards her abdomen.

The grooming often continues during flight, as she transfers pellets of pollen into her pollen baskets.

Not all of the shooting star pollen on the bee's fur is removed by grooming. A small fraction remains on her fur until the bee visits a flower on another shooting star plant.

This cross-pollination leads to fruit and seed production.

Here we can see the tiny seeds in the fruit capsule.

When the seeds have ripened, they are blown by the wind to establish the next generation of shooting star plants.