

Plant Adaptations For Pollination And Seed Dispersal

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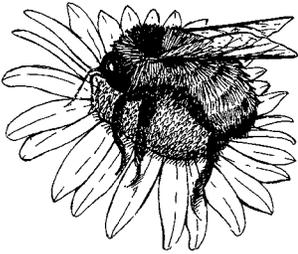
Plants and Animals

Plants and animals need each other. It's not hard to see why animals need plants – most animals eat plants and cannot live without them. Even animals that eat other animals are dependant on plants because without them their plant-eating prey would not exist. Plants, on the other hand, make their own food with photosynthesis – using sunlight, water and the carbon dioxide. Yet if all the animals disappeared from the planet, most plants would disappear as well. *Why?*

Plants need help to pollinate and spread their seeds. Some plants – about 10% – use the wind for pollination – from the mightiest redwood to the smallest blade of grass. Yet most plants the help of animals to get the job done.

The Pollination Situation

Some plants are pollinated by birds – like the hummingbird. A few are pollinated by bats. But by far, more plants are pollinated by insects than anything else. Plants have adapted many traits to attract pollinators. Bright colored blossoms attract bees, flies, butterflies, and moths inside to collect nectar and pollen. Sometimes lines on their petals will guide the insects down into the blossom or a sweet smell will attract pollinators from a long way off.



In turn, moving from blossom to blossom, collecting nectar, the insects spread the plants' pollen to other blossoms on that plant and others nearby. Most plants are not picky about who pollinates them and have open flowers with ray or disc blossoms – like asters, daisies or black-eyed Susans – where any insect can land, collect nectar and carry pollen on to another flower.

The Honeybee and the Treefoil Pea

Some plants, however, want just one type of insect to pollinate them. This is true of birdsfoot trefoil. Birdsfoot trefoil is a common pea plant grown all over North America for feeding livestock and covering farm fields. Though common, it has a complicated flower, making it difficult to get inside to collect nectar or pollinate. Only bees can figure out how to enter a birdsfoot trefoil blossom and the honeybee is especially good at it.

When a honeybee lands on a birdsfoot trefoil blossom, it looks for nectar inside the top petal, called the flag, because it has guiding lines pointing to its base, but the nectar isn't there. While it stands on the fused side petals looking for nectar, the bee's feet work the petals open exposing a keel petal inside. (See illustrated handout.)

When the bee steps down onto the keel, its weight triggers the keel to bounce down – like a trampoline, and the petals spread. Then the stamens inside the keel that are covered with pollen will pop up and dust the bee's belly. If the bee has been to another blossom already, the pistol, which also touches the bees belly, gets a dose of the pollen already stuck there. Pollination has occurred!

Some might wonder what the advantage is of having only one kind of insect to pollinate a plant. Why wouldn't the plant want every insect that lands on it to pollinate it? Some scientists hypothesize that when a honeybee finds a flower where the nectar is ready, it signals the other bees and they all come to collect nectar at once so a lot of pollination occurs. A difficult flower makes it more likely that the nectar will be there for a visiting honeybee.

Spreading Seeds

Getting its seeds spread is even harder for plants, as they are much larger than pollen and need to move away from the parent plant to avoid competing for sunlight and water. Besides for pollination, the wing does help spread many seeds. Those plants have adapted seed shapes to ride the wind as far away from their parent plant as possible. It's fun to see how plants have adapted their seeds for wind dispersal.

The seeds of the sugar maple are built into a flat propeller, called a *samara*, that helicopter away from the parent tree. The elm has a round samara that works in much the same way, where the linden tree has a long, flat wing attached to its seed stem that spins it away like a wind-driven top.



Some plants – like fuzzy goats beard and dandelions – have a globe of fluff that break up into a mass of parachutes, each holding one seed, called an *achene*, spinning off far and wide in the wind.

Sometimes seeds burst from a pod, like the milkweed, and float off on silken strands. Fluffy seeds burst off the rod-like head of a cattail too – each spike releasing a million seeds. Even the giant cottonwoods release seeds attached to a tuft of fluff to float away on the breeze.



A few seeds are carried by water, like the mango or coconut. Others spread their seeds explosively with catapulting seedpods – like jewelweed.

Putting the Animals to Work

Plants are also tricky about getting animals to carry off their seeds. Many plants develop a fleshy fruit around their seeds to attract animals to eat them. The seeds are spit out nearby or can survive the animal's digestive tract. When they are "deposited" at the other end, they will sprout into seedlings. Plants like apples, pears, raspberries, and many, many others use this trick to get animals to help disperse their seeds. This works especially well with animals like squirrels and chipmunks that collect the seeds and "hide" them for later use. For an acorn, this is not only spreading the seed, but getting it planted in the ground as well.



A few plants even get their seeds spread by making them stick to whom ever walks by. They use hooks, barbs, spurs and burs. You have probably seen the seeds of cockleburs, beggar's-ticks, or burdocks stuck in your dogs' fur or even on your own socks. Even many grasses, like foxtail barley and bur-grass, have hooked seeds.

Plant adaptations for pollination and dispersal makes for a fascinating look at form and function.

Activity - Looking at Seed Dispersal Adaptations

Age: Adapt for any age

For a seed to successfully grow it must have water, sunlight and soil, just like its parent plant – whether it is a daisy or a redwood. However, it is not always ideal for a seed just to drop to the ground under the parent plant. If it sprouts and grows right next to the parent plant it will be competing for water, nutrients and light (unless it is an annual that will not come back the next season). Ideally the plant wants to spread its seeds as far and wide as possible. This will allow more offspring to spread throughout the habitat and not compete with its own resources.

Plants have developed many ingenious ways to successfully disperse their seeds. We will look at some of the structures they have developed to accomplish those goals and how they work.

Objectives:

Students will observe, study and hypothesize about the adaptations of seed structures to aid in their dispersal.

Materials:

1. Hand lens for each team (pair of students)
2. Paper plates for each seed
3. Seed samples displayed at different stations (acorns, maple seeds, burrs, nuts in shells, coconut, milkweed pod and seed, berries, grass seeds off wild grass – the more the better)
4. Fuzzy sock or material at each station
5. A bowl or cup of water at each station
6. Paper on clipboards and pencils

Optional: provide a puffball mushroom that is ready to puff out spores for students to see.

Procedures:

1. Inspect each seed with the hand lens.
2. Draw a picture of what you see.
3. Describe its shape and structures.
4. Explain how these might help it move away from the parent plant.
5. Does it have structures that will help it move by wind, water, attach to animals, be consumed by animals or be planted by animals? Explain.

Experimenting with Dispersal:

6. Try touching seed to the sock. Does it stick?
7. Hold the seed at arms length over the plate and drop it. Does it drop straight down onto the plate, or move away.
8. Hold the seed in the palm of your hand and blow lightly on it. Does it float away?
9. Drop the seed in the bowl of water. Does it float? Blow on the water. Does the seed move away in the water?
10. Is the seed edible to an animal? If the animal eats it, how will this affect where it is dispersed?
11. If the animal “hides” it (buries it in the ground), how will this affect where it is dispersed?

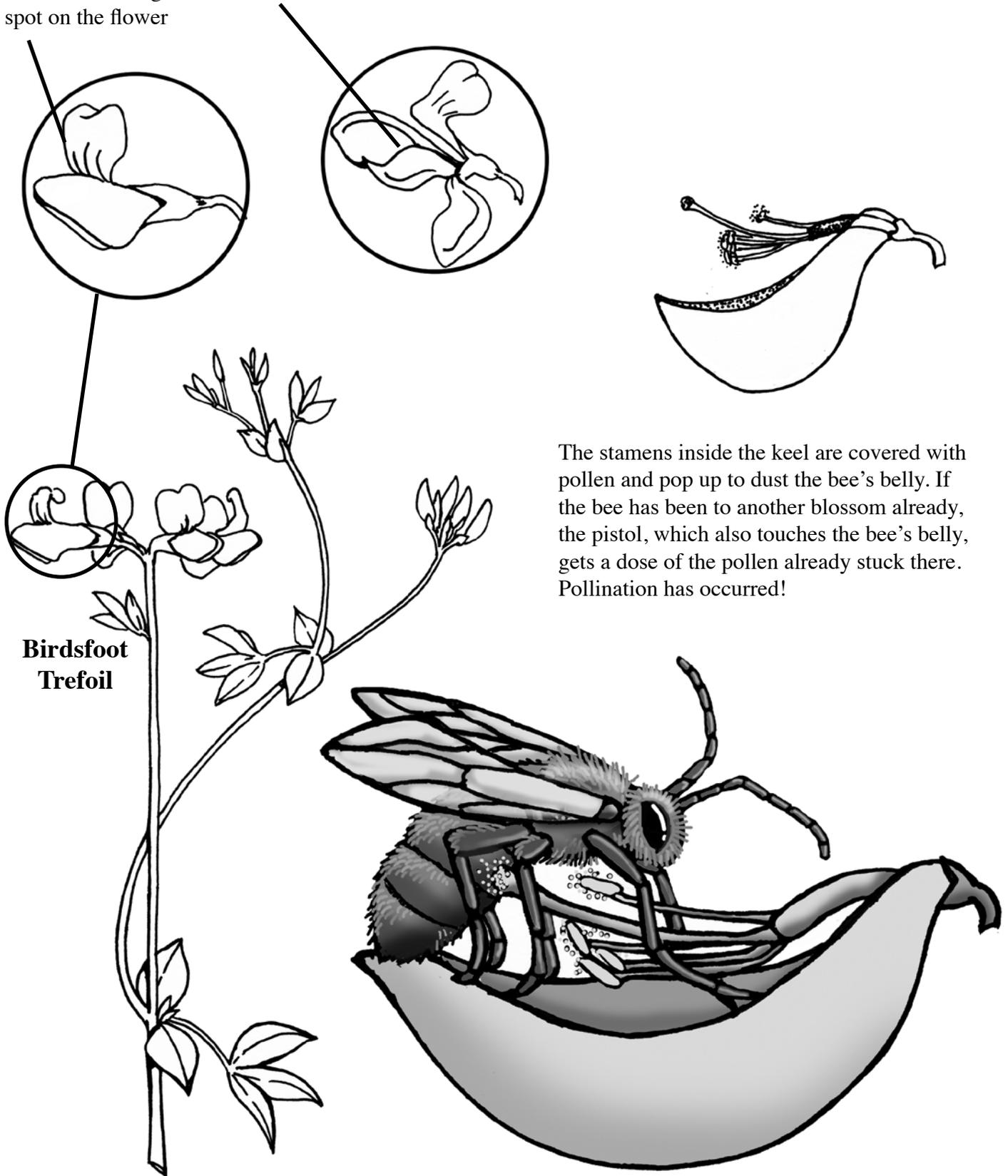
Discussion:

Be prepared to discuss each seed and how it responds to your “dispersal” techniques.

Plant Adaptations and Pollinators

The *flag petal* with lines leading downward to focus the bee on the right spot on the flower

The bee's feet work the fused side petals open exposing a *keel petal* inside. When the bee steps down onto the keel, its weight triggers the keel to bounce down – like a trampoline, and the petals spread.



**Birdsfoot
Trefoil**

The stamens inside the keel are covered with pollen and pop up to dust the bee's belly. If the bee has been to another blossom already, the pistil, which also touches the bee's belly, gets a dose of the pollen already stuck there. Pollination has occurred!