Lesson: “Why are there so many different kinds of flowers?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hey, it's Esther from the Mystery Science team. A few years ago, I decided to plant a flower garden in my front yard. I picked a spot, dug up the grass there, and turned up the soil to make a good flower bed—but then came the hard part. I had to pick which kinds of flowers to plant. And there are so many different kinds of flowers to choose from. It's true that some flowers are small and cute, like these apple blossoms, but not all flowers around the world look like that. They can also be huge and alien-looking, like this corpse flower. Some flowers look like strange undersea creatures. Some are frilly, some are spiky, some are shaped like lips and some look like monster claws. Some are long and tubular. Some are round and flat. Some are tiny, some are enormous. Any color or any shape you can imagine, there's probably a flower that looks like that. As different as they are, these flowering plants do have some things in common. For one, they didn't always look like this. All of these flowers started out as seeds. Take a close look at what happens to these two different seeds as time goes by. What changes do you notice? What's different about how they grow? What's the same?

EXPLORATION VIDEO 2

Both of these plants started life as seeds buried in the ground. As the days went by, they sprouted and grew bigger. Eventually, they grew buds, which bloomed into flowers. These

changes happen for every flowering plant, but the adult plants can look so different from one another. That's part of why I like to garden. You never quite know how a plant will surprise you as it grows. But humans aren't the only ones who are drawn to flowering plants. Check this out. See that bee? Watch what she does as she flies around this garden. She's flying from one flower to another, then another, then another, all around the garden. It's almost like she's stopping to smell the flowers, but let's take a closer look. Watch what this bee does when she lands on this flower. See that? That's the bee's tongue. She's not just smelling this flower, she's drinking from it. Many flowers produce a special kind of sugary juice called nectar. This bee drinks this nectar as food. Bees don't just fly from flower to flower because they smell good. Visiting flowers helps bees get something they need to survive. But how do bees know what flowers have nectar? It might help to think about this. Imagine you're walking down an unfamiliar street and all of a sudden your stomach starts growling. You need a snack. How do you know where to go to get something good to eat? You might see something like these. These signs help catch your attention and tell you, "Hey, there's food over here." Imagine you see these three restaurant signs for pizza. Which restaurant would you go to? Why?

EXPLORATION VIDEO 3

Signs attract customers to their businesses in different ways. Some signs are bright and colorful. They grab your attention because they're easy to spot. Some signs might advertise food customers already know and love. Like this place has tacos. You know tacos, you love tacos. Go here. And maybe you've even been attracted to advertisements that aren't signs at all but smells. Like the mouthwatering smell of pizza from a pizzeria or the sweet smell of a cinnamon roll wafting out from a stand at the mall. Flowers attract bees in a similar way. A bright, colorful flower is easy for a bee to spot. Because similar plants have similar flowers, a bee might start to

recognize a particular kind of flower as a place they can get nectar. But flowers don't just attract bees with the way they look. They sometimes also attract them with smells. People love to stop to smell sweet-scented flowers, but to a bee, those same sweet smells are a hint that there's delicious nectar to drink inside. So colorful, sweet-smelling flowers are helpful to bees that drink nectar, but is it helpful to the plant? You'd think it would annoy a plant to have tiny creatures crawling around inside it, stealing its nectar all the time. And yet, plants have all these different features that attract bees to them. Does the plant get anything out of this? Can you think of any reason why bees visiting flowers might be good for the plant?

EXPLORATION VIDEO 4

There are lots of things plants need as they grow. This is a strawberry plant, but it didn't start out looking like this. About a month ago, this plant was just a tiny seed. To grow from a seed to what we see now, it needed soil to grow in and the right amount of water and sunshine. Without these things, the seed might never have sprouted or the seedling might have wilted and died. As an adult plant, this strawberry plant still needs soil, water, and sunlight, but those aren't the only things it will need. You might notice something big missing from this strawberry plant. It hasn't grown any strawberries yet. If you planted this in your garden, you'd probably want it to grow fruit. Strawberries are delicious, but growing fruit is also important for the plant. Fruit contains a plant's seeds. Most fruits have seeds inside, but strawberries actually have seeds on the outside. Seeds are how a plant makes more baby plants. Not all plants grow fruit humans can eat, like strawberries, but all flowering plants can grow some kind of fruit that contains their seeds. It might seem like fruit just appears out of nowhere, but growing fruit and seeds can actually be a pretty complicated process for a plant. Growing fruit requires two parts of a plant. These parts are really tiny, so we have to zoom in close to a flower to see them. The first part is

a tiny egg that usually grows in here. The second is a powder that usually grows out here. Scientists call this pollen. When these ingredients are combined, watch what happens. At first, it almost looks like the flower is dying. The petals fall off and it starts to droop. But keep watching, something is starting to grow here. The flower slowly transforms into a fruit. But here's the tricky part: most plants can't combine these two parts on their own. Something needs to move the pollen to where the eggs are, and to grow seeds that will become the healthiest baby plants, it's best if the pollen comes from another flower of the same kind. That means that for this strawberry flower to grow into a strawberry with super healthy seeds, it will need to get pollen from another strawberry plant. Scientists call this process pollination. If a plant doesn't get pollinated, it can't make more baby plants. So how does pollen get from one flower to another? How many ways can you think to move pollen across a garden from one flower to another?

EXPLORATION VIDEO 5

Maybe the simplest way pollen can move from one flower to another is by wind. Some pollen is so light and small that a breeze can carry it long distances, but the wind can blow in all different directions. Moving pollen from one flower to another using the wind is a bit like trying to pass your friend a handful of glitter by blowing it at them. What the flower really needs is a way to move the pollen directly from one flower to the right spot on another flower. This is where those nectar-drinking bees come in. Remember that bee we saw drinking nectar from all those flowers? Each time that bee pops into a flower to drink, she might get a little dusting of pollen stuck to her. When she flies to the next flower, she'll carry that pollen with her, spreading it to that flower and the next one and the next. By flying from flower to flower to drink nectar, she's pollinating this whole garden. So by attracting bees to their colorful flowers and sweet nectar, plants get what they need. Bees fly from flower to flower, drinking nectar and carrying pollen as

they go. The pollinated flowers turn into fruits. The fruits have seeds. Eventually, those seeds get buried in the ground and grow into more plants. Bees drink nectar from the new plants. Those plants get pollinated and grow fruit. And the whole thing starts over again, right? But here's the tricky thing, not all bees can pollinate all flowers. Just like there are many different kinds of flowers, there are also many different kinds of bees. In fact, there are 20,000 different kinds of bees in the world. Some kinds of bees pollinate lots of different kinds of flowers, but other kinds of bees only pollinate a few kinds of flowers. So even if a flower is swarmed by bees, if none of them are the right kind of bee, the flower won't get pollinated and it won't grow seeds. So if you were planting a garden with different kinds of flowers, what would your garden need for those flowers to be pollinated?

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to play a game called Future Flowers. You and a partner will pretend to be gardeners. You'll collect different kinds of plants that can live in your very own Tiny Garden. Your garden has plenty of water and sunshine so that your plants can grow and be healthy. But you don't just want pretty flowers, you want delicious fruits. To make sure your flowers turn into fruits, you'll need another key ingredient: bees. Bees visit and pollinate certain types of flowers. Pollinated flowers will turn into fruits with seeds inside. To make the best fruit with the healthiest seeds, you need two matching plants and the right bee. Each time you play the game equals one year for your garden. You'll play the game twice, which equals two years. But you'll have to be careful because at the end of each year, all of the adult plants in your garden will die. They can't survive the cold winter weather. But if the adult plants made fruits, the seeds in those fruits can survive the winter. So if you want your garden to grow year after year

after year, you need seeds. Can you keep your Tiny Garden full of flowers, fruits, and seeds for both years? We'll show you how to get started, step by step.

ACTIVITY STEP 1

For this activity, you'll work with a partner. Decide who will be Gardener A and who will be Gardener B. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

Get your supplies.

ACTIVITY STEP 3

First, you need to get your plant cards ready to play the game. Gardner A, find this sheet of paper and cut along the thick black line like this. Place the card station in the center of the table between you and your partner. Then, both of you cut along all the dotted lines of the Plant Cards. You should have a total of 24 Plant Cards when you're done.

ACTIVITY STEP 4

Gardner A, turn all 24 Plant Cards so that they're face down on the table. Gardner B, shuffle all the Plant Cards like this, then make one stack. Place that stack facedown on the Card Station where it says Plant Cards.

ACTIVITY STEP 5

Okay, let's finish setting up all the game pieces. Gardener A: cut along all the dotted lines on this sheet so that you have two Scorecards and seven Bee Cards. Gardener B: turn the Bee

Cards face down on the table and shuffle them. Place the Bee Cards in one stack on the Card Station where it says Bee Cards. Make sure to keep them separate from the Plant Cards.

ACTIVITY STEP 6

You're almost ready to start playing the game. Both you and your partner should check to make sure your game is set up like this. Each player should have a Tiny Garden in front of them. The Card Station with the stacks of Plant Cards and Bee Cards should be in between the two of you. You can set the Scorecard off to the side for now. In the next few steps, we'll walk you through how to play the game.

ACTIVITY STEP 7

Let's walk through the first few turns together, so you know how to play the game. You and your partner will take turns. On your first turn, you'll get a Plant Card and place it to the left side of your Tiny Garden in the Plant Zone. Gardner A, go ahead and take a Plant Card and put it in your Plant Zone. Then Gardner B, you can also take a Plant Card and put it in your Plant Zone. Go to the next step to see how the rest of the game is played.

ACTIVITY STEP 8

You and your partner will continue taking Plant Cards on your turns until you find a match. Gardner A, go ahead and take a second Plant Card. Then Gardner B, you can also take a second Plant Card. If you have a matching pair of the same type of plant, like these two tomato plants, you can immediately add them to a spot in your garden, like this. If you don't have a match you can't play them in your garden yet. Just keep them in your Plant Zone.

ACTIVITY STEP 9

Once you have plants in your garden, you can choose either a plant or a bee on your next turn. If you take a Bee Card, read it to find out what plants that bee can pollinate. This one says it can pollinate tomato plants. If your bee can pollinate what lives in your garden, pretend the bee flies around those two flowers and pollinates them. Those flowers can now turn into fruits with seeds. You can move those cards to your Fruit and Seed Basket. This is how you score points in the game, but don't put your Bee Card in the Basket. That bee will live in your garden for the rest of the game. After your bee pollinates flowers, you can keep it in the Bee Zone like this.

ACTIVITY STEP 10

Now that you know how it works, go ahead and play the game. On each turn, you can take a Plant Card or a Bee Card. If you can, you also want to add plants to your garden and pollinate the flowers on your turn. If you need a reminder on how to play, check out the Rule Sheet. Remember, your goal is to gather as many fruits from your garden as you can. You'll keep playing until you run out of both Plant and Bee Cards. When you're done, don't clean up just yet. Keep all your cards where they are because you'll have some new rules for the second time you play the game.

ACTIVITY STEP 11

During the winter every year, when it gets cold, all the adult plants in your garden will die. The only way to grow adult plants next year, in year two, is if you have seeds. Take a look at your Tiny Garden and discuss which plants in your game can't be used in year two. Why not?

ACTIVITY STEP 12

Now it's time to figure out your score for year one and set up for year two. As you may have discussed, you can only use plants in year two that made seeds during year one. So if you and your partner have any Plant Cards that are not in your Seed Basket, set them off to the side. Those plants didn't make seeds to grow in your garden during year two.

ACTIVITY STEP 13

Okay, it's time to see who scored the most points during year one. You get a point for each Plant Card in your Fruit and Seed Basket. So count each type of Plant Card that's in your Basket and write that number on your Scorecard under Year One. Then add up those numbers to figure out your total score. Whoever has the largest total number wins.

ACTIVITY STEP 14

Now it's time to set up the game for year two. Because they were pollinated and turned into fruit with seeds, the rest of the Plant Cards make it to year two. Gardner A: shuffle all the Plant Cards that made it to year two and put them facedown in one pile on the Card Station. Gardner B: shuffle all the Bee Cards and put them facedown in one pile on the Card Station.

ACTIVITY STEP 15

Okay, it's time to play the game again. Remember, on your turn, you can only take Plant Cards to start. After you have plants in your garden, you can then either choose a Plant Card or a Bee Card on your following turns. Each turn, check to see if you can add plants to your garden, pollinate those plants with your Bee Cards, and move them to your Fruit and Seed Basket. Look

at the Rule Sheet if you need a reminder on how the game is played. When you completely run out of Plant and Bee Cards, go to the next step.

ACTIVITY STEP 16

Okay, it's time to see who won the game in year two. Each plant that was pollinated had flowers that turned into fruits with seeds. So count the number of Plant Cards in your Basket. Write that number next to each plant on your Scorecard for year two. Count up all those numbers and write down your total score. Whoever has the largest number is the winner of year two. If you'd like, you can also add up the scores of both years to see who wins the whole game.

ACTIVITY STEP 17

Discuss.

ACTIVITY STEP 18

If you removed all the Bee Cards from your game, you wouldn't score any points, but what about a real garden? Discuss.

WRAP-UP VIDEO 1

Growing a garden isn't easy. Even if you have two healthy tomato plants, or two thriving pumpkin plants, they won't grow fruit without the right bee to pollinate them. Only plants that get pollinated grow fruit, only plants that grow fruit have seeds, only seeds can grow into new young plants, and only young plants can grow into new adult plants. This happens over and over again. Seeds grow into plants. Plants make seeds, which grow into more plants, which make more seeds. Every plant eventually dies. But if a plant makes seeds, those seeds will keep

growing into new plants. Scientists call this circle of life a life cycle. Each stage of the cycle depends on all the other stages before it. If any one stage doesn't happen, the whole cycle stops. Plants that don't get pollinated don't grow fruit. Plants that don't have fruit don't have seeds. No new seeds means no new baby plants. And no baby plants means no new adult plants later. So it makes a lot of sense that so many plants have developed unique ways of attracting bees to pollinate them, from flashy blossoms to sweet smells. But check this out. This is a corpse flower at a botanical garden. Notice the expression on these people's faces as they sniff it. These flowers don't smell sweet at all. They smell awful, like stinky garbage, or even rotting meat. Why would a flower do that? How could smelling like garbage help the corpse flower? What do you think?

WRAP-UP VIDEO 2

To humans, a corpse flower smells terrible, like garbage. But if you've ever tossed a piece of trash in a full trash can on a hot day, you might have noticed these: flies. Flies eat garbage and rotting meat. It turns out, bees aren't the only creatures that carry pollen from flower to flower. Many other animals do this too: flies, moths, butterflies, beetles, even some birds and bats. Scientists call pollen-carrying creatures pollinators. Specific flowers attract specific pollinators with their appearance and smells. These corpse flowers live in a place where most of the nearby pollinators are flies and beetles. They need to attract as many flies to their flowers as possible so they can get pollinated and eventually grow more corpse flowers. To attract flies, a stinky garbage smell might work better than a sweet scent. Remember the garden I'm growing at home? Before I planted it, I chose my seeds carefully. I didn't just pick seeds that would grow into pretty flowers, I thought about which plants would grow best where I live. I thought about the conditions the seedlings would sprout in, like how much water and sun they'd need to grow

into flowering plants. And I researched the common pollinators in my area, such as hover flies, sweat bees, and monarch butterflies. I made sure to plant flowers that attract those pollinators. This helps keep the pollinators in my area well-fed and healthy, but it also keeps my garden growing because all those local bees and butterflies buzzing around pollinate my flowers so they can grow fruit and make more plants with their seeds. Plants may not grow colorful flowers because we humans like to look at them and smell them, but that doesn't mean we can't appreciate them. Next time you bite into a strawberry, imagine all the things that had to go right for that fruit to grow. The original strawberry seed needed to land somewhere it could sprout. The plant needed to get enough water and sunlight to grow from a seedling to a flowering plant. Then a pollinator needed to fly by this strawberry plant. And even once a pollinator did fly by, it had to stop to drink the nectar from this particular strawberry flower. If just one of these things didn't happen, the fruit in your hand wouldn't exist. Years and years of growing and good luck went into making that one strawberry so it could one day grow more strawberries. So when you bite into that strawberry, remember to savor it. Have fun, and stay curious.