

HELP PROTECT OUR PLANTS

with Izzy the Inspector



Written by Duncan Allen & Rachel Yale, illustrated by Mandy Riley



WHY PLANTS ARE SO IMPORTANT



Hi, I'm Izzy the Inspector and I love my fascinating job as a plant inspector. I look at plants in garden centres, trees in the woods and fruit and vegetables arriving at airports. I look to see if there are any pests on them, or if they are healthy or sick. A pest is a living thing that can hurt plants. Let me tell you why plants are important and why we need to keep them healthy. Maybe you can help?

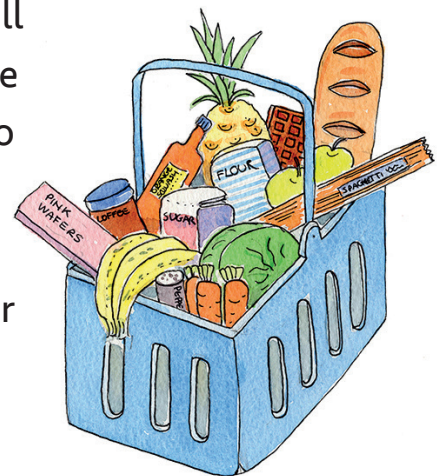
DID YOU KNOW...

-  **Plants feed us:** 80% of the food we eat comes from plants.
-  **Plants help us breathe:** plants produce 98% of the oxygen we breathe.
-  **Plants reduce pollution:** plants help remove pollution from the air, which means we have cleaner air to breathe.
-  **Plants are home to wildlife:** oak trees in the UK can have over 2,000 different animals, plants and fungi living on and in them.

ACTIVITY

Around our homes we rely on lots of different plants from all around the world, from exotic fruits to vegetables. Trees give us wood for furniture and buildings. Some plants are used to make our clothes too. How many can you find?

Get a pen or pencil and some paper. Have a look around your home, look for all the things that are plants or made out of plants. See if you can find out where they were grown. Write a list of 5 and draw them.



THERE'S A CATERPILLAR ON EACH PAGE, CAN YOU FIND THEM ALL?



OUR PLANTS ARE UNDER ATTACK!



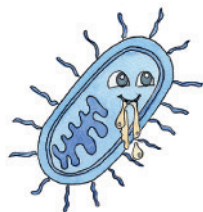
Just like us plants can get sick too! If you catch a cold you might have a runny nose or a cough. Plants can also show signs of being unwell and we call these symptoms. Plant symptoms can range from spots and holes to lines on the leaves and oozing sores that cause the plant to not grow very well.

HOW CAN PLANTS GET SICK?

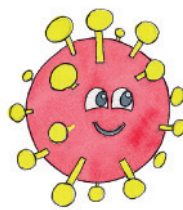
Plants can be damaged by getting too much, or not enough, water and sunlight. The weather can damage them too. Humans can cut them down, mammals, insects and tiny worms called nematodes can eat them, or microbes can infect them. Microbes are tiny living things such as bacteria, viruses and fungi. They are found all around us and are too small to be seen by the naked eye.



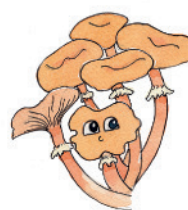
INSECTS



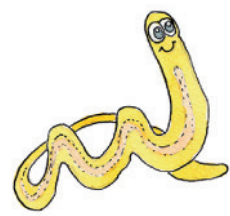
BACTERIA



VIRUSES



FUNGI



NEMATODES

HOW DO INSPECTORS HELP PLANTS?

Plants are strong both inside and out and are able to fight off most of the threats they face. Sometimes insects or microbes attack plants and they can't fight back. That's where inspectors like me can help! We look for insects that want to eat plants, and symptoms of tiny microbes. In the UK we have scientists who can tell if the insects or microbes found on the plants are a pest or not. It's a very important job!

TRY MY PLANT HEALTH WORD SEARCH



Well done for all that reading! There were a lot of big words. Can you remember them all? Let's see if you can find them below in my word search.

CAN YOU FIND THEM ALL?



FOOD ✓

PEST

BACTERIA

PLANTS

DISEASE

IZZY

TREES

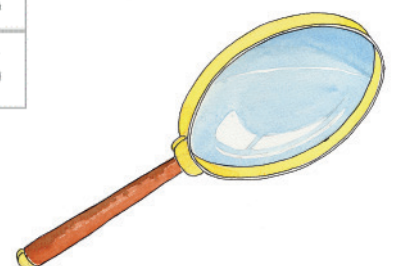
FUNGI

OXYGEN

INSECT

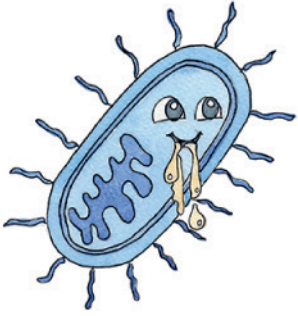
VIRUS

SYMPTOM



Answers on page 16

BACTERIA



Bacteria are tiny microbes, even smaller than a full stop, so we can't see them on plants with the naked eye. Scientists can only see bacteria with a microscope which makes them appear bigger.

ACTIVITY

Oh no! These plants have been infected by bacteria! Look at these six pictures and help Izzy match the right symptom to each picture by choosing the best word from the list to describe what you can see.

Spotty, Slimy, Rotten, Burnt, Scabby, Lumpy



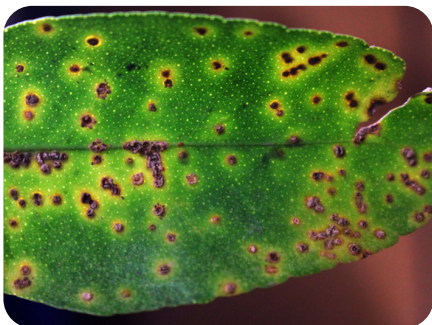
1 _____



2 _____



3 _____



4 _____



5 _____



6 _____

Answers: 1. Rotten 2. Scabby 3. Slimy 4. Spotty 5. Burnt 6. Lumpy

MR SMITH'S PLANTS



Izzy receives a phone call from Mr Smith. He sounds very worried! He tells Izzy that the plants he brought back from his holiday have spots. To make the plants feel better he put them in his garden, but now the spots have spread to other plants. He doesn't know what to do!

ACTIVITY

Can you circle all the leaves in Mr Smith's garden that have spots caused by bacteria?



Izzy tells Mr Smith that bringing plants back from holiday is not a good idea, as pests could be on them. Mr Smith asks Izzy what he can do to help. She tells Mr Smith to dig up the plants and destroy them to stop the spots spreading to his neighbour's garden.

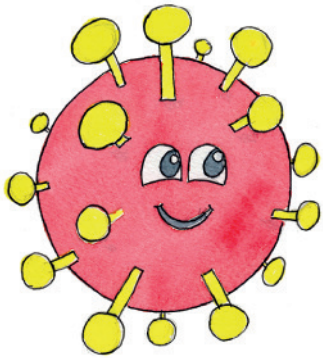
HELP ME DO SOME COLOURING IN



As Mr Smith learned, bringing plants back from your holiday can be dangerous as there could be pests that could affect our plants at home. Help me by colouring in the poster below to warn people at airports about the risk.



VIRUSES



Viruses are tiny (even smaller than bacteria) and they can't be seen with an ordinary microscope! They have a very simple structure and can't grow outside living plants. Symptoms of viruses on plants can look very different depending on the virus and the particular plant they are found on. The symptoms can appear on all parts of the plant.

ACTIVITY

All of these plant parts have symptoms of a virus. See if you can match the plant part to the correct picture.

Fruit, Stem, Leaves, Flower



1 _____



2 _____



3 _____



4 _____

Izzy goes to see her Aunt Anne for lunch. She shows Izzy the new cucumber plants she bought off the internet - they were a bargain! However, when Izzy looks at the plants in Aunt Anne's greenhouse she thinks they might have a virus as some of the leaves look unhealthy.



Answers: 1: flower, 2: stem, 3: leaves, 4: fruit

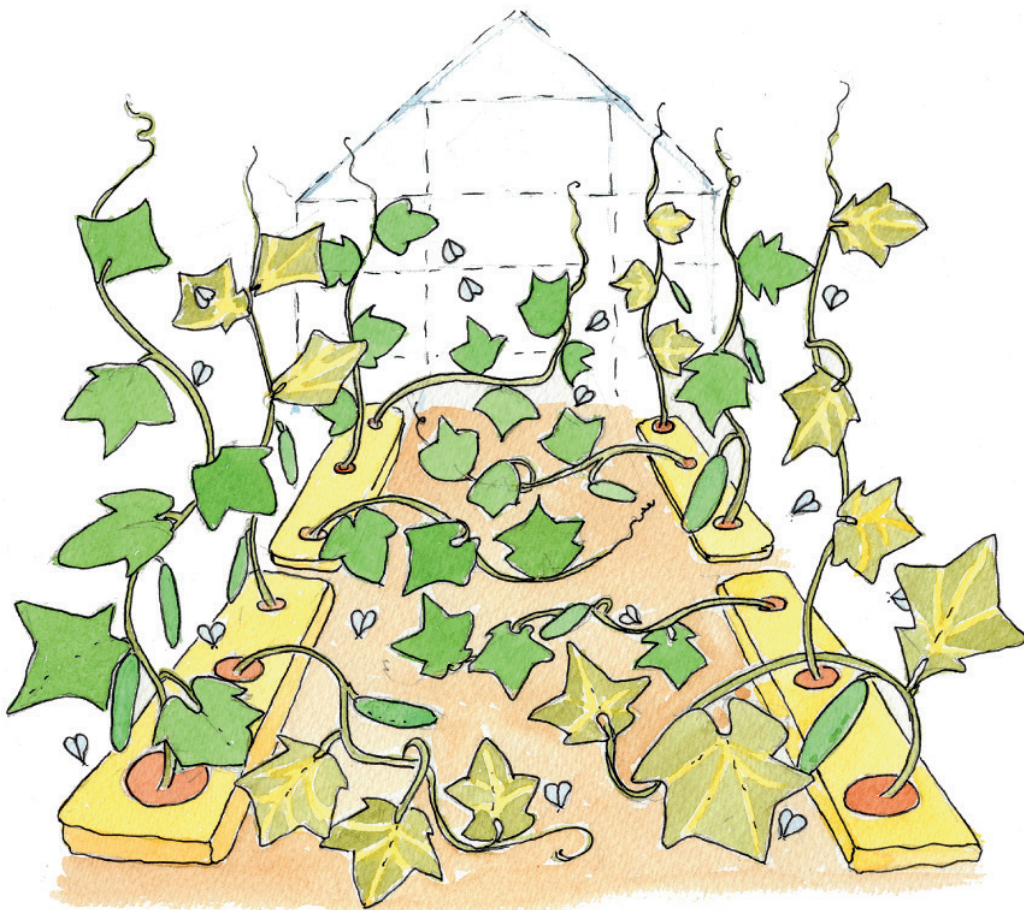
VIRUSES



Viruses are often spread from infected plants to healthy ones by insects. Insects pick up the virus by sucking on the plant juices of an infected plant. They then suck on the juices of the next healthy plant and spread the virus to that plant too.

ACTIVITY

Look at this picture of Aunt Anne's greenhouse. Can you count the number of unhealthy leaves and number of insects?



Izzy picks a few leaves to send to the laboratory and find out which virus they have. Aunt Anne wishes she had gone on the website of the local garden centre, as she knows they are careful where they buy their plants from and they always look healthy.

INSECTS



Insects are everywhere! No doubt you'll have seen them in your home and garden. While most are helpful, some insects can travel into the country in fresh food, timber or packaging. Some of these insects can cause damage to our plants. Young insects (larvae) are very small and we might not see them, but we can see the damage they cause. It's often the larvae of insects that cause the most damage!

TRUE BUGS



True bugs have mouths that act like a sharp straw which they use to pierce into plants or fruit to suck up juices. They feed on many different plants so if a plant is infected with a disease they can spread that disease to other plants. Plant's attacked by true bugs often have a faded area where the juices have been sucked out.

FLIES



Fruit flies are really good at finding fruit! The flies don't feed on the fruit, but lay their eggs inside. Fly larvae are called maggots and they tunnel into fruit and feed on the inside. They leave behind small holes and bruises on the outside of the fruit.

BEETLES



This Colorado potato beetle loves to feed on potato leaves. The beetle larvae have very strong scissor-like mouths that cut away large pieces of the leaf to eat, leaving big holes behind. There are lots of different types of beetle with some feeding on roots while others feed on plant stems or fruits.

CATERPILLARS



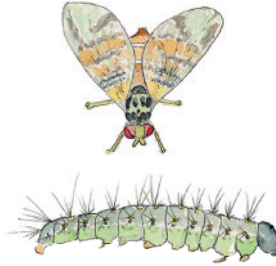
Caterpillars are the larvae of moths and butterflies. Like beetle larvae, they have strong mouths to cut up plants to eat. Some like to tunnel inside fruit and vegetables to feed. Caterpillars are eating machines and if there are enough of them on a plant, they can eat all of the leaves!

INSECTS

ACTIVITY

Using the information you've learned about the damage insects cause to plant's, can you draw a line between the pest and the type of damage they cause?

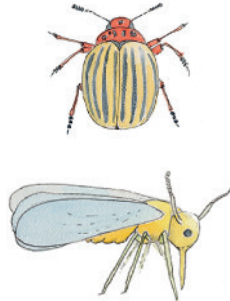
1



2



3



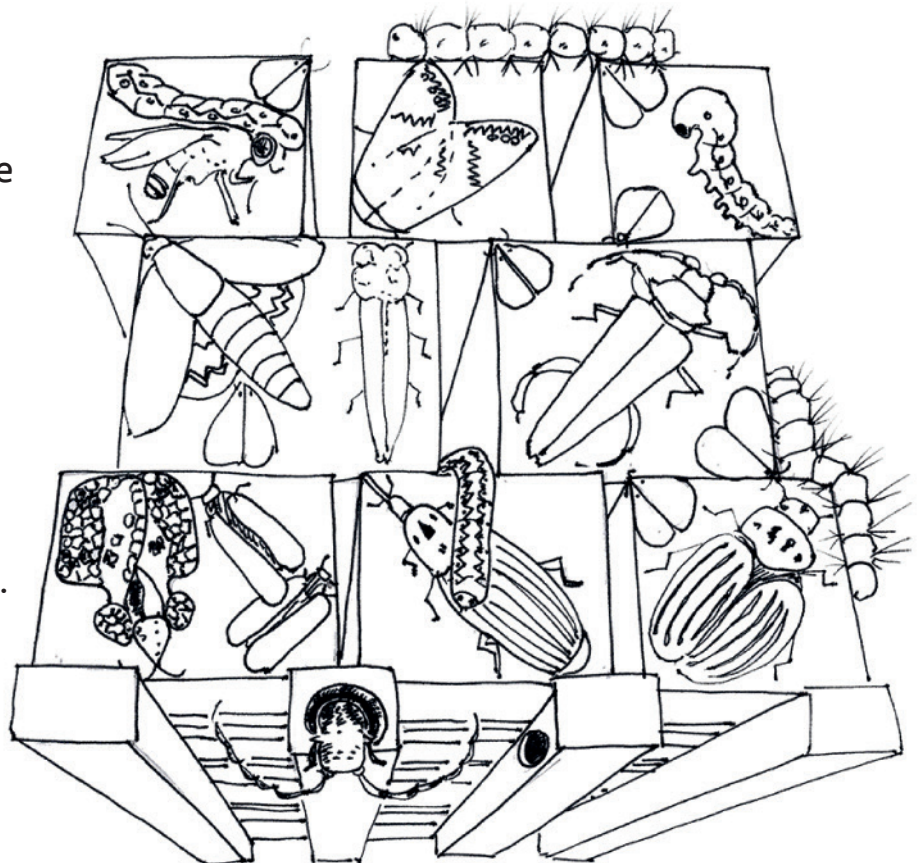
4



COLOUR IN AND COUNT

Izzy gets a call to inspect some boxes of fruit and vegetables that have arrived in the UK from abroad. She hopes there are no insects hiding inside!

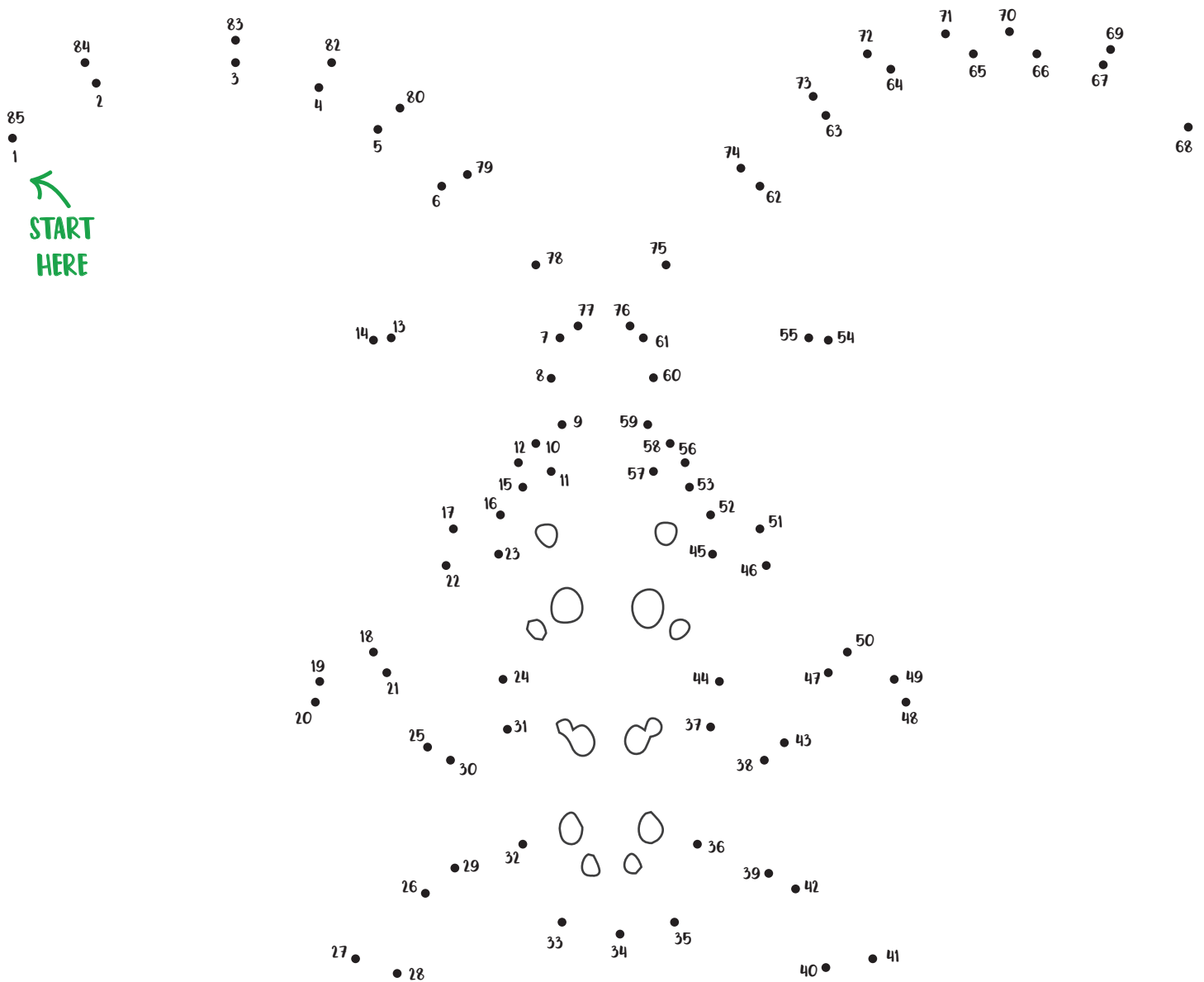
Colour in the boxes and count how many insects you can see.



Answers: 1: True Bug, 2: Caterpillar, 3: Beetle, 4: Fly

JOIN THE DOTS

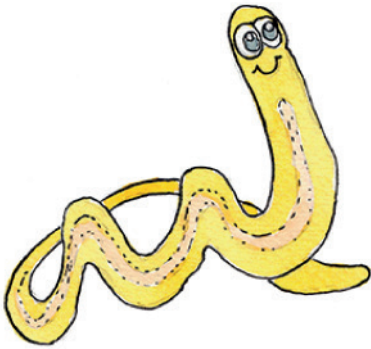
Connect the dots and discover one of the insects that was hiding in the boxes, can you guess what type of insect it is?



Did you work it out? Izzy says the insect is a longhorn beetle. They are serious pests which damage trees. Their larvae feed on wood and the adults can hide in wooden pallets.



NEMATODES



Nematodes are microscopic worms which are so small you can only see them with a microscope! Most of them live in plants and soil. As they are so small, they are able to get inside plants and cause damage to the stems and roots. Nematodes that feed on roots often damage the plant.

ACTIVITY

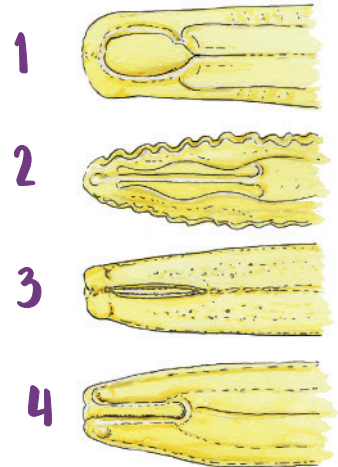
Not all nematodes are pests. Some of them are helpful because they feed on other tiny pests. Nematodes feed on many different foods, so they have mouths that are adapted to what they eat. See if you can match up the correct description of the mouth to the picture.

Very slim oval mouth for feeding on fungi **A**

Long thin mouth for feeding on plant roots **B**

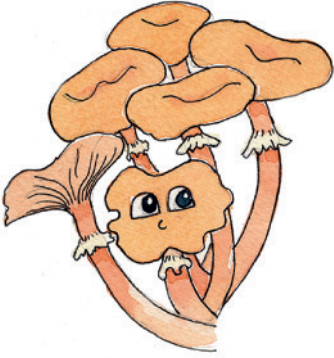
Short straight mouth for sucking up bacteria **C**

Large mouth for swallowing other nematodes **D**



Izzy has been called to look at a crop of carrots. She pulls some out to check for pests and symptoms. Hmmm, this one looks a bit strange. The knobbly carrot roots and the yellow floppy tops look like nematode damage. Izzy suspects some naughty plant feeding nematodes have been at work here!

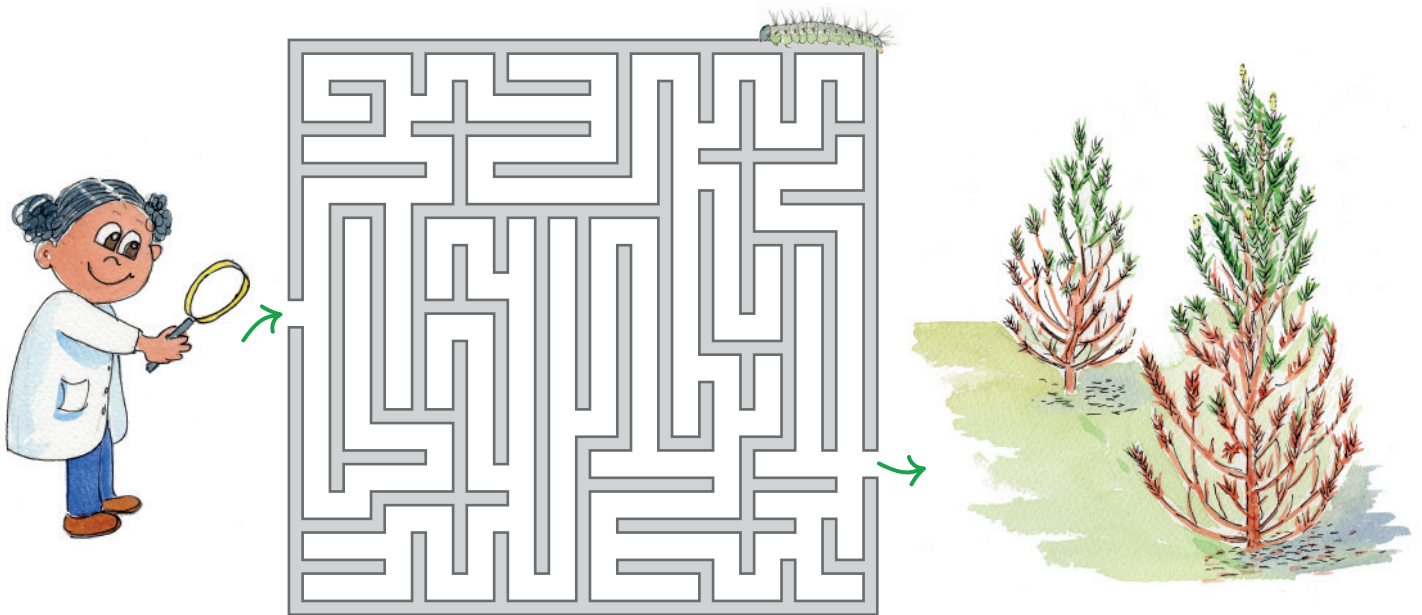
FUNGI



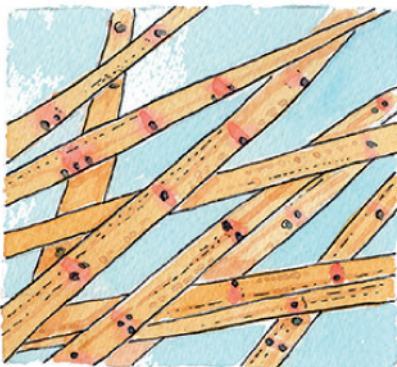
Fungi are a large group of living things from yeast that helps bread to rise, to moulds that grow on our food and mushrooms that we eat. Fungi are very important for the growth of most plants. There are some types of fungi that can hurt plants and can be seen as symptoms on the plant.

ACTIVITY

Izzy has a call from Mr Khan about some Christmas trees that are looking very unwell and have red leaves (called needles) at the bottom. Can you help Izzy through the maze to reach the poorly Christmas trees?



Solution on page 16

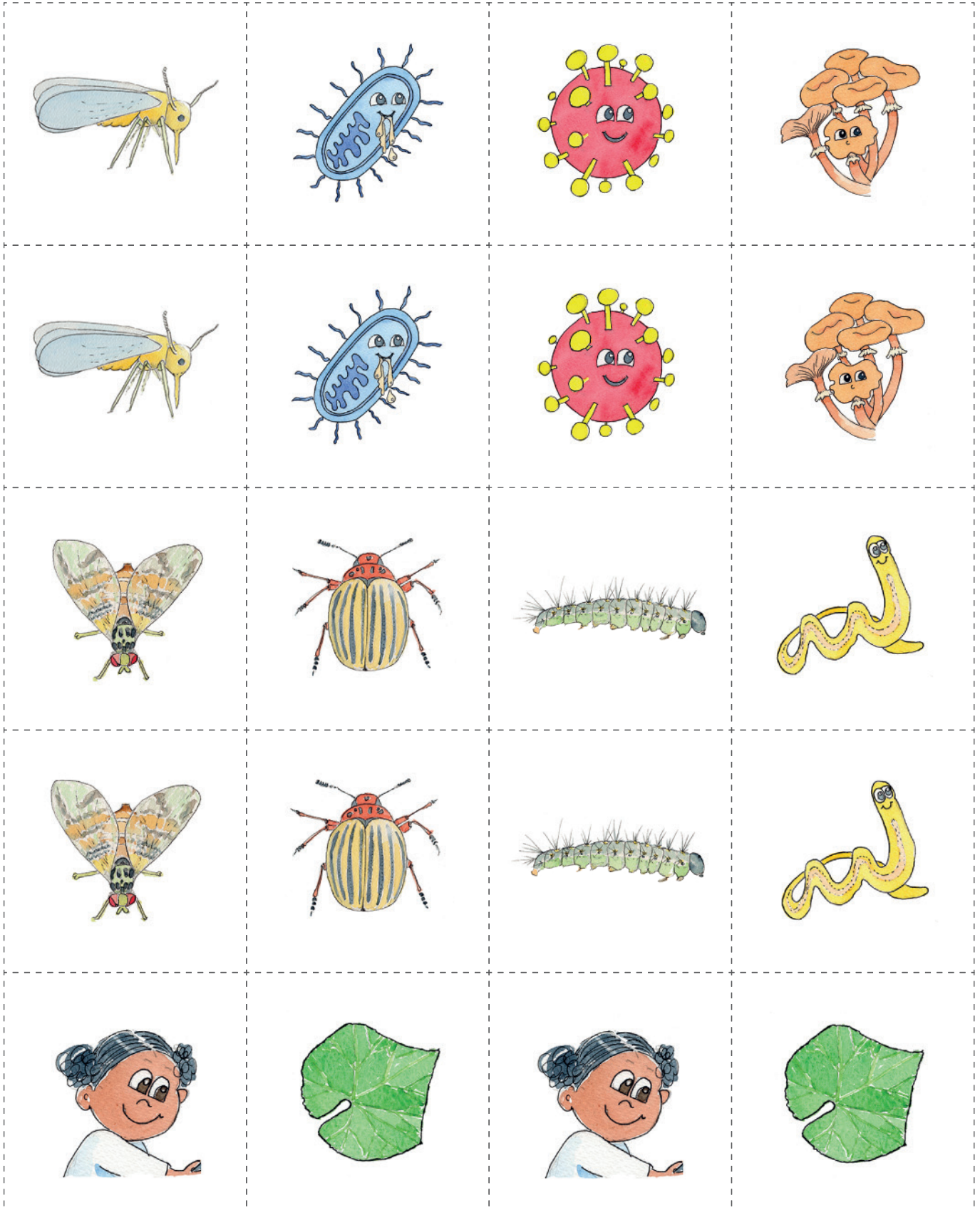


When Izzy looks at the needles with her magnifying glass, she can see little black dots. Izzy knows that fungi can spread by releasing these little black dots called spores. The spores can be carried on the wind or by water. To help stop it spreading further, Izzy sends some needles off to the laboratory so that she can identify what the fungus is.

PLANT HEALTH SNAP

Cut out the pictures below and play a game of snap with your family and friends.

Make sure you ask an adult if you need help with scissors! ✂



THANK YOU



Izzy has had a very busy day and thanks you for all your help with her inspections. She couldn't have done it without you! Izzy thinks that with all your new found plant health knowledge you're well on your way to becoming an inspector yourself. Remember to keep an eye out for pests and diseases on plants next time you're outside.

Below is a Junior Inspector certificate for you to print out. Cut it out, put your name on it and display it with pride!



JUNIOR PLANT INSPECTOR

This certificate is awarded to



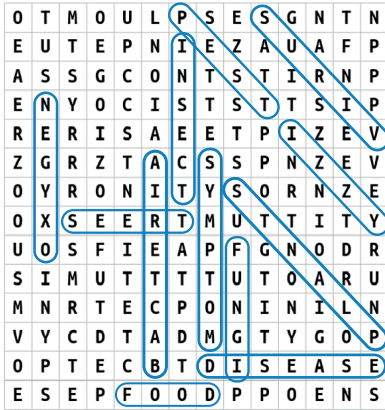
for learning how to protect our plants
and becoming a Junior Plant Inspector!

Signed: **IZZY THE INSPECTOR**

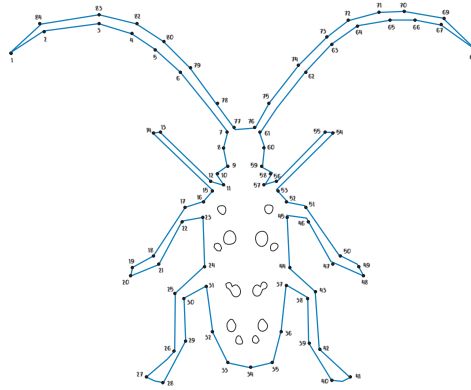


ANSWERS

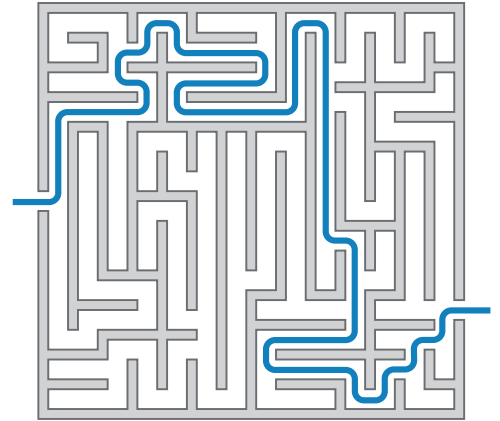
PAGE 3



PAGE 11



PAGE 13



PHOTOS COPYRIGHT OF BUGWOOD.ORG

Bacteria (page 4)

- 1 - Paul Bachi, University of Kentucky Research and Education Center
- 2 - Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo
- 3 - Gerald Holmes, Strawberry Center, Cal Poly San Luis Obispo
- 4 - Rui map Zheng
- 6 - William Jacobi, Colorado State University

Viruses (page 7)

- 1 - R.K. Jones, North Carolina State University
- 2 - Paul Bachi, University of Kentucky Research and Education Center
- 3 - Dr Parthasarathy Seethapathy, Tamil Nadu Agricultural University
- 4 - William M. Brown Jr.

Insects (page 10)

- 1 - Jim Baker, North Carolina State University
- 2 - Whitney Cranshaw, Colorado State University
- 3 - USDA APHIS PPQ - Oxford, North Carolina, USDA APHIS PPQ
- 4 - Alison Morris

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