

Research
Based
Curricula



**How do plants fight against
diseases and pests?**
Key Stage 4 Biology
Resource

2019



Resource One Overview



Topic	Plant pathogens and pests
GCSE Modules	Detection and identification of plant diseases, fungal diseases.
Objectives	After completing this resource, you should be able to: <ul style="list-style-type: none">✓ describe pests that target plants✓ describe symptoms and causes of plant disease.✓ explain think about how diseases might spread.✓ explain how pests are adapted to cause disease.
Instructions	<ol style="list-style-type: none">1. Read the data source2. Complete the activities3. Explore the further reading



Resource One

Data Source



Section A

Powdery mildew



Powdery mildew is a pathogen which targets many crop plants and causes disease in salad crops like cucumbers and tomatoes, fruits such as grapes, cereal crops such as wheat and barley and crops high in protein such as beans, peas. Powdery mildew has a wide range of host plants because it can live on crops from multiple plant families. The disease is caused by a fungus which is spread by wind and settles on plant surfaces as a dusty, white coverage over leaves, fruit and seeds.

As a fungus, powdery mildew typically reproduce by making a dispersal structure called spores. Fungal spores are dispersed via wind or insects/bird feet and spores can survive over winter in soil. Over-wintering fungal spores can germinate the following year, normally in spring, when the temperature warms up (above 12°C) and in humid conditions when there is moisture in the air. When spores germinate in soil, any plants which may be planted here can become diseased during that season. Fungus on infected crops which are touching healthy crops can easily be transferred to the new host to spread the disease further. Nearby crops can also quickly be affected as wind carries the fungal spores from one host plant to another.

Plant growth is affected as there is less surface area of leaves available to capture sunlight for photosynthesis. Fruit and seeds covered in powdery mildew start to degenerate and turn yellow through to brown as they die off and lose their nutritional value. 40% of cereal from cereal crops is lost due to powdery mildew attack and is no longer edible or profitable for farmers to sell at market.



Figure 1

Powdery mildew

Resource One

Data Source



Section B

Aphids

Aphids are insect pests, which feed on the sugary components of a plant. They have a mouthpiece called a stylet, which is used to stab into the plant tissue to access the sugar made by photosynthesis. Aphids can stab into the leaf to get at the veins in the leaf carrying sugary sap, or they can stab into the stem itself to tap into the phloem, the plant sugar transport system between roots and leaves. They are sucking insects, which cause damage by this feeding habit and suck out nutrients from the plant.

Different species of aphid attack different plants, some attack only one type of plant and therefore have a narrow host range but many have a broad host range, which means they can attack many different plant families including fruit trees, cabbage family crops like Brussel sprouts and broccoli, lettuce, pepper, onion, and many others. Unfortunately, this means that if different plants are grown close together, aphids can move between them and attack several plant families and become a real problem for farmers, which is the reason why we call them pests.

Aphids can be green, pink, white, grey or black and may be camouflaged so that they cannot be seen on their host; they also hide under leaves and in curled parts of the plant, hiding inside fruits, leaves or stems. Some aphids have wings and are very small and light so they can be blown around by the wind easily and can travel long distances to reach new target crops. They also detect the colours yellow and green to be able to recognise when they are landing on a potential plant.



Figure 2
Aphids

Resource One

Data Source



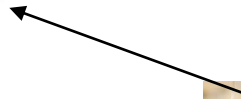
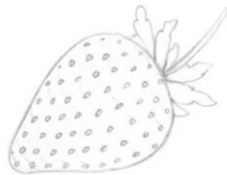
They reproduce very quickly and build up large populations, which become difficult to control without damaging the crop itself. They cause damage due to the stabbing of their stylets but they are also major carriers of diseases such as viruses, which, during feeding, are directly introduced into the plant's circulatory system, and can quickly lead to plant death. During feeding, aphids secrete a honeydew on the plant surface, which looks similar to mould and may attract other pests such as ants. Plants, which have been attacked by aphids, produce lower quality food, which may look damaged and mouldy. Ladybirds are above aphids in the food chain so increasing habitats for ladybirds in the growing area could be a possible way to control aphid populations.

Resource One Activities



Activities Below is a picture of powdery mildew producing spores.

1. Draw some of the fruit and vegetables around it that are susceptible to powdery mildew. One has been done for you.



2. True or false.

Powdery mildew:

- a. Spreads by spores - _____
- b. Are carrier of viruses - _____
- c. Attack only cucumber plants - _____
- d. Lives inside the plant - _____
- e. Effect the plant's ability to do photosynthesis - _____

Aphids:

- f. Are carried to different plants by water in the soil - _____
- g. Live inside the plant - _____
- h. Are a problem all over the world - _____
- i. Effect the plant's ability to do photosynthesis - _____
- j. Introduce other pests to the damaged plant - _____

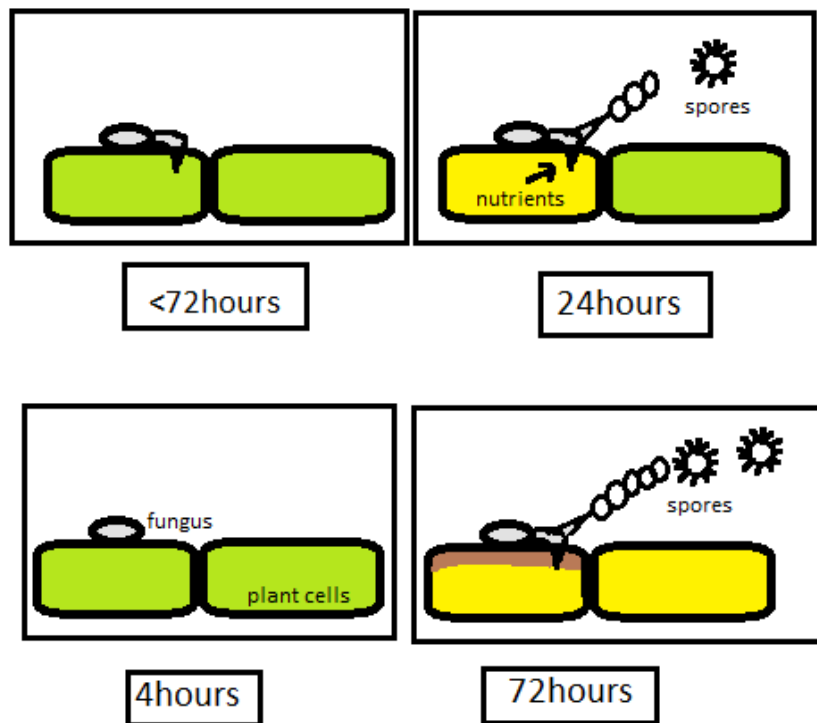
Resource One Activities



Activities

3. What adaptations do aphids have that make them a successful plant pest? Think about what features they have to be able to recognise plants, cause damage to plants, spread to new plants and to enable themselves to survive.

4. Below is a diagram of the powdery mildew infection process. The images and times are in the wrong order. See if you arrange them to make an accurate storyboard of the infection.



5. Describe what is happening in your storyboard at each time point. You might want to think about what the fungus is doing and what its effects are on its plant host. Include why you think that fungi make spores.

Resource One

Further Reading



Explore Further reading:



- introduction to controlling plant pests.

<https://www.bbc.com/bitesize/guides/zsf82hv/revision/4>

- more information on the Biology of aphids and killing them.

<http://www.biology-resources.com/aphid-01.html>

- Black rose spot, a different type of fungal pathogen, and how to kill it.

<https://www.rhs.org.uk/advice/profile?pid=270>

- Mealy bugs – another type of sucking insect which effects plants.

<https://www.rhs.org.uk/advice/profile?PID=201>

- information about tobacco mosaic virus, a type of virus which causes disease in plants.

https://www.bspp.org.uk/downloads/education/BSPP_TMV_Info.pdf

- video about xanthomonas, a devastating bacteria which is destroying bananas in Africa.

<https://www.bing.com/videos/search?q=xanthomonas+in+banana&&view=detail&mid=4B3E47ABAB6D476704FB4B3E47ABAB6D476704FB&&FORM=VDRVRV>



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100 Black Prince Road
London, SE1 7SJ



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