NSW Department of Primary Industries
SCHOOLS PROGRAM

Let's talk about aphids -
Teacher's Guide

In this video – synopsis

6 mins 31 secs

This video considers the effects and occurrence of aphids in Australia as well as the work that NSW DPI does to monitor or control the impacts of aphids on primary industries. We also answer the question 'why are aphids such a problem when they are so common?'.

Careers highlighted: entomologist and scientific curator.

We recommend that teachers watch these videos before showing them to students to assess their suitability. There are some scientific terms used in the videos that your students may not be familiar with. We have provided some definitions in this document for teachers who would like to use the videos as an opportunity to develop the scientific literacy of their students.

Other videos in this series include:

- The Scientific Collection at the Orange Agricultural Institute
- Preserving the Scientific Collection of the NSW Department of Primary Industries
- Biosecurity monitoring and surveillance with the NSW Department of Primary Industries

curriculum links

This video can support students understanding of the following outcomes:

Stage 3

Science and Technology

A student:

ST3-10LW - describes how structural features and other adaptations of living things help them to survive in their environment

ST3-11LW - describes some physical conditions of the environment and how these affect the growth and survival of living things

Stage 4

Science and Technology

A student:

SC4-14LW relates the structure and function of living things to their classification, survival and reproduction

SC4-15LW explains how new biological evidence changes people's understanding of the world

Geography

A student:

GE4-5 discusses management of places and environments for their sustainability

GE4-3 explains how interactions and connections between people, places and environments result in change

Agricultural Technology

A student:

4.1.2 outlines the interactions within and between agricultural enterprises and systems

4.3.3 identifies and uses skills to manage the interactions within plant production enterprises

Stage 5

Geography

A student:

GE5-3 analyses the effect of interactions and connections between people, places and environments

GE5-5 assesses management strategies for places and environments for their sustainability

Agricultural Technology

A student:

5.1.2 explains the interactions within and between agricultural enterprises and systems

5.3.3 explains and evaluates the impact of management decisions on plant production enterprises

Vocabulary used

Unless otherwise stated definitions are from the Free Online Dictionary (http://www.thefreedictionary.com/)

Note: Where (biology) appears in brackets before a definition, this indicates that there are other definitions (usually in different disciplines) but that this definition relates to the way the term is used in this video.

Beneficial insects Beneficial insects (sometimes called beneficial bugs) are any of a number of - species of insects that perform valued services like pollination and pest control.

Clone Clone (cell biology), a group of identical cells naturally derived from a common parent cell

Ecology The relationship between organisms and their environment.

Faba beans Faba bean (and broad bean) have traditionally been grown in the southern grains region of Australia however, this area has now expanded due to the recent release of varieties adapted to the northern grain region. Faba beans and broad beans belong to the same genus but differ in their growth requirements, markets and end-uses. (from http://www.pulseaus.com.au/growing-pulses/bmp/faba-and-broad-bean)

Genus - (Biology) A taxonomic category ranking below a family and above a species and designating a group of species that are presumed to be closely related and usually exhibit similar characteristics.

Invasive - (Biology) Tending to spread widely in a habitat or ecosystem. Used especially of non-native species

Monoculture - an agricultural system in which a single crop (e.g. wheat) is grown to the exclusion of other crops.

Mutualistic - the biologic association of two individuals or populations of different species, both of which are benefited by the relationship and sometimes unable to exist without it. adj., adj mutualis´-tic

NSW DPI - New South Wales Department of Primary Industries

Oviposit - To lay eggs; applied especially to insects

Parthenogenetically (noun, Biology) development of an egg without fertilisation (from http://www.dictionary.com/browse/parthenogenetically)

Parasitoid - An organism, usually an insect that lives on or in a host organism during some period of its development and eventually kills its host

Peri-urban - Peri-urban areas are largely defined as the areas that surround our metropolitan areas and cities - neither urban nor rural in the conventional sense. They are the fastest growing regions in many countries. In Australia, they frequently extend 100 kilometres beyond the suburban edge and it is estimated that over a quarter of million Victorians live in peri-urban areas (from http://www.latrobe.edu.au/periurban/about/focus)

Predator - any animal that lives by preying on other animals from (usually) a lower TROPHIC LEVEL.

Symbiosis - the biologic association of two individuals or populations of different species; it is classified as mutualism, commensalism, parasitism, amensalism, or synnecrosis, depending on the advantage or disadvantage derived from the relationship

Trophic - Of or relating to nutrition

Trophic level - *noun.* The position of a species or a group of species within a food chain or food web.

Urban - (adjective) of, relating to, or designating a city or town (from http://www.dictionary.com/browse/urban)

Transcript of Video

Text: - Let's talk about Aphids … with the NSW Department of Primary Industries.

Ainsley: - Another interesting phenomenon that we can see here in this little weedy plant in this patch of dirt is that you have a symbiosis between some aphids and some ants that are tending them. Sometimes with invasive species we can find them working together - there is a mutualistic relationship where the ants take care of the aphids and defend them from predators and in return the aphids provide sugary food for the ants.

Peter: - Aphids are important because we keep on finding new records of them. A lot of the aphids that we have in the country are highly specific on a small range of hosts. We… in peri-urban environments or in urban environments most of the plants associated with people are from North American or European origins.

There's a range of aphids that don't care too much, they can live on a wide range of hosts. They came here - they were the first aphid invaders - they're the ones that came here the quickest. But we keep on finding records of new aphids that are turning up on exclusive hosts, that we didn't think were there or we didn't know - that need publication because they are not recorded from Australia but we have found them as part of our surveillance activities.

Ainsley: - But things like this, like the aphids and the elm leaf beetle, they may not be an economic threat because elm trees or poplars not necessarily something that we grow for a lot of revenue in this country but they help us to figure out what different invasion pathways are possible. And that gives us a way to look at potential introductions from other way more economically damaging species.

Peter: - These aphids here, these little black blobs in the middle of the slide, are a new genus of aphids found that infests only faba beans. We grow a lot of faba beans. Recorded from a backyard in Sydney - we haven't yet got out to an area where they have large scale production of faba beans. It is found commonly basically from Russia right throughout Europe and we've only just recorded them from Sydney.

Ainsley: - But this means that we are ready when a farmer sends in 'what's this aphid on my broad beans? I've never seen these here before' We'll be able to say 'Oh we know exactly what they is, where it's from and now we can look at the literature from that country to see how they control it there.'

It's worth pointing out that they can reproduce clonally or parthenogenetically so a female can just give birth to live young that come directly out without having mated before and she can just produce baby after baby after baby. And each of those grows up and produces more clonal offspring. And so it's possible for their populations to just explode.

Peter: - That's correct but the amazing thing about that is that it allows them to exploit their resources and you get one aphid into a crop and very quickly - as Ainsley's just explained - they can fill the crop. But a lot of their sexual development is also to do with other pressures like the time of the year and also the density they're in. So if they find they are competing with lots of their other sisters there's intense pressure to go off and find new, fresh, virgin crops that they can infest so there's an ecological parameter about suddenly producing winged forms. So aphids can come in wingless and winged forms and so they form wings and they can fly away and look for new crops. So it's a way of relieving the pressure.

Ainsley: - If you find aphids on a plant near your school or your home or your garden you often notice that there are others insects around them at all times. Some of those are predators to the aphids and some of those are beneficial insects - well beneficial to the aphids - who take care of them or farm them. Ants for example will often tend aphids like a herd of little cows you'll see them tending aphids, scale insects, mealybugs and other similar insects that feed on the fluids from plants and as they're sucking that fluid that comes from the plant they are essentially taking up a whole bunch of extra sugar that they don't even need from sap that comes out the back of the aphids. So in return for the sugary treat the ants will defend the aphids and similar insects from their predators such as beetles or lacewings or parasitoid wasps.

Peter: - So the other part of that ecology is there's a bunch parasites that come in there on aphids particularly. It's easy to see parasitised ones - they are frequently called mummies and that's a throwback to Egyptian mummies - the funny little black or green aphid suddenly blows up into this big rounded lump and it's got a little wasp inside it. And you can see them fairly regularly and they suddenly don't move and they just become a sort of dull, brownish lump so you can see the parasitised ones. That's a really easily observable thing by children and they can see that ecology. There's a number of genera of wasps that go exclusively for aphids and nothing but aphids. You'll see them when they get in there - you'll often see the little wasps going 'round stinging the aphids as well (offscreen 'they implant their larvae) they insert the egg in there or the larvae and it grows up and just basically kills the thing and eventually the wasp eats its way out of the little mummy and all that's there is a little skeleton that was the little cage for the wasp to grow. But you can see them

and they're tiny little wasps but they're fairly … often when you find a colony of aphids you don't just get one or two you get hundreds of them … and you'll see all these little wasps going around and the aphids are pretty dumb they just sit there doing what they're doing, getting stung.

Ainsley: - My personal favourite part of this, you mention the parasitoid wasps, is that fact that in this whole ecosystem and these different things that defend aphids, not only are there the parasitoid wasps that oviposit into the aphid and their young grows up inside that, there are hyperparasitoid wasps that oviposit into the parasitoid wasp inside the aphid so it's a wasp in a wasp in an aphid. And these have been described up to - wait for it - I think seventeenth degree hyperparasitoid so it's like a Russian nesting doll of wasp wasp wasp wasp wasp wasp wasp wasp host. So for something like that you might want something a little bit bigger than an aphid.