Lettuce

Images and Lesson Plan

Keystage 2

A bit about SAW....

The Science, Art and Writing (SAW) Trust is an international science education charity that breaks down the traditional barriers between science and the arts. SAW lesson plans use themes and images from science as a starting point for scientific experimentation, art and creative writing.

Using the cross-disciplinary SAW approach, our lesson plans are accessible to individuals of varied interests and learning styles.

The following lesson plan is designed to be delivered across an entire school day but can be adapted into separate sessions.

This lesson plan was developed as part of the Lunchbox Science series and was designed with support from scientists Anna Jordan and Jake Stone (John Innes Centre), writer Julia Webb and artist Lara Nicole.

Anna Jordan

I work in the Entomology department at the John Innes Centre. My work involves maintaining insect populations, carrying out research for a number of scientists at JIC as well as businesses offsite and our own research projects.
A lot of the research we carry out is testing whether plant breeding or new products can produce crops which are more resistant to pests and pathogens in the future. I maintain many native plant pests such as aphids and a number of DEFRA licensed pest species and plant pathogens from around the world for use in research. I also look after tropical species such as leafcutter ants which are being studied by Professor Matt Hutchings for research into new sources of antibiotics that are carried on the ant's bodies.

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Jake Stone

When this project was developed, Jake worked in the Entomology Department at the John Innes Centre. Previously he worked mainly with beetles (*Coleoptera)* and gained experience at the Natural History Museum and the University of East Anglia. He largely focussed on maintaining pest invertebrate species and studying their interactions with plants and pathogens. He also specialized in British terrestrial molluscs and as well as being the local county recorder; carried out work concerning invasive species and population dynamics. Jake has since taken a PhD position in the Department of Zoology at the University of Cambridge.

Lesson outline

This lesson is intended to introduce key concepts of crop pests, including the use of insecticide and biological pest control.

Included in this lesson plan pack:

- **Lunchbox Science Lettuce Lesson Plan**
- **Lunchbox Science Lettuce accompanying PowerPoint**

A nice addition to this project is to grow your own lettuce or Chinese cabbage plants in advance

Lettuce

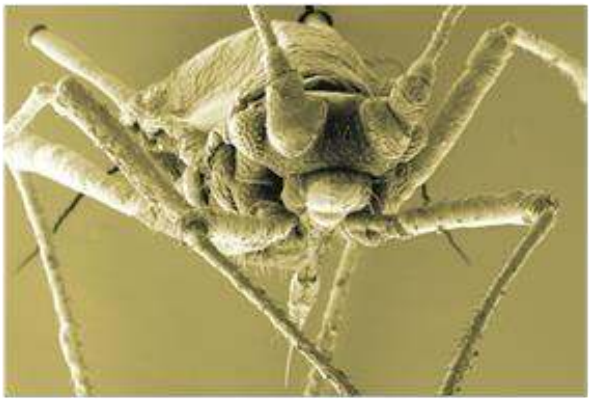
Key vocabulary for the day:

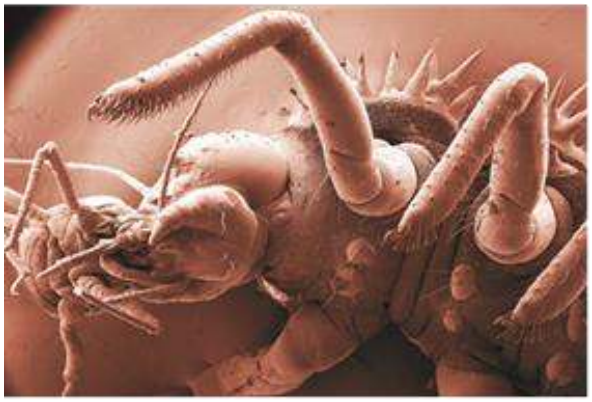
Adaptation	An **adaptation** is a mutation, or genetic change, that helps an organism, such as a plant, survive in its environment	*Organic*	In this context, plants produced without the use of chemical fertilizers, pesticides or other artificial chemicals.
Aphid	A small green insect that feeds on the sap of specific plants.	*Population*	The number of animals living together in one place
Biocontrol	Using natural enemies of plant pests as predators to control their population	*Predator*	A living thing who preys on others to survive
Colonies	A group of one specific species all living in one area	*Species*	Specific kinds of living things who are able to exchange genes and interbreed.
Ladybird	A small insect who feeds on aphids	*Sustainable*	A way of describing something that can be maintained at a certain level or rate
Mouthpart	The parts of a mouth, in this context the insect's mouth.		

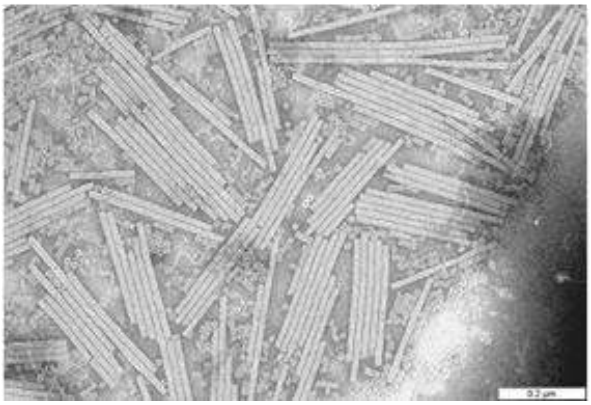
Lettuce

Images

- The following images are used to continue the theme of crop pests throughout the lesson activities. We highly recommend having these on display throughout the session for students to view and discuss.







Lettuce

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1 Harlequin Ladybird larvae are ferocious predators and unrecognisable from the adult ladybird.

By Quartl, CC-BY-SA-3.0

https://commons.wikimedia.org/wiki/File:Harmonia_axyridis_qtl1.jpg

2 Scanning Electron Microscope (SEM) image of an aphid.
By John Innes Centre, Entomology Department, Norwich.
https://commons.wikimedia.org/wiki/File:Aphid_micro.jpg

3 SEM image of Harlequin Ladybird Larvae eating aphid.
By John Innes Centre, Entomology Department, Norwich.

4 Ladybirds gathered on branch in Stevens Creek, CA, in early spring
By Lettersee, CC-BY-SA-4.0
https://commons.wikimedia.org/wiki/File:Ladybug_closeup_on_branch.JPG

5 Enlarged main veins of lettuce leaf caused by Lettuce Big-vein Virus, transmitted by sap feeding insects.
By Gerald Holmes, California Polytechnic State University at San Luis Obispo
CC BY NC 3.0 US
https://www.invasive.org/browse/detail.cfm?imgnum=1571813

6 Tobacco Mosaic Virus
Author: T. Moravec, Source: en:user:Xmort, Public Domain.
https://commons.wikimedia.org/wiki/File:TMV.jpg

Science Session (~1 hour and 30 minutes)

Objectives

Lower KS2:

- setting up simple practical enquiries, comparative and fair tests
- identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat
- construct and interpret a variety of food chains, identifying producers, predators and prey.

Upper KS2:

- planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
- identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution
- describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals

Introduction

Begin the session by introducing the students to the science images using the accompanying PowerPoint and begin to discuss what each could be.

Activity One – Comparing Salad Leaves (~10-15 mins)

During this activity students will use their senses to describe and identify a variety of different salad leaves. We recommend using a variety of salad leaves (approximately 5) that show an array of characteristics, a suggested selection is; mint, chicory, rocket, kale, spinach and iceberg lettuce.

Materials

Variety of lettuce leaves

Pencil and paper

Ask the students to taste, smell, touch and look at the leaves. Can they identify some of them or describe one to a friend?

Having discussed their thoughts, move on using the PowerPoint; discuss what a lettuce plant might need to grow, what (if any) pests it may have, pest management and finally, inform them that you will be looking more closely at the relationship between aphids, ladybirds and lettuces.

Before moving onto the second science activity, pause to create a word bank of the vocabulary used during the science introduction (as a class or individually).

Activity Two - Biological Control Experiment

Building the tube cage

For this activity we suggest that children work in groups of 2-3 with adults circulating to help. After an introduction to the science topic and exploring the images using the PowerPoint (Lunchbox Science Lettuce ppt.) inform the children that they are now going to establish their own mini biocontrol colonies of aphids and observe ladybird predators controlling them.

Materials for groups of 2-3 children

- 1 sample (lettuce plant)
- Plastic magnifying glasses
- Pair of ladybirds
- Aphids
- Small paintbrush
- Plastic tweezers
- Plastic tube cage (remove top and bottom of a plastic bottle)
- Tube cage cover (mesh or muslin and rubber band)
- Lab coat and gloves - *not compulsory

Teacher experiment notes

Samples used and suggested alternatives

Plant

We suggest young lettuce plants grown in plant pots for several weeks. Shop bought lettuces can be used but make sure they are organic, otherwise they could have been sprayed with pesticides that will interfere with the study.

Ladybirds

Small 2-spot ladybirds (adults and juveniles), can be ordered online but they can often be less aggressive predators than native 7 spots or harlequins. These may be sourced commercially but harlequins could also be collected from the garden. They are a new invasive species already very common in England. Ident guide; http://www.harlequin-survey.org/recognition_and_distinction.htm

Lettuce

Aphids

The Lettuce Aphid (*Nasonvia ribisnigri*) used in the pilot project are hard to culture and so our entomologists are favouring the use of the Peach Potato aphid (*Myzus persicae)*. These will readily adapt to feeding on lettuce. As this is the 'pest' part of the experiment it is not something that people generally want to buy, they obviously want to get rid of them! We have found one commercial suppliers of pea aphids listed on the last page of this lesson plan.

Plant research facilities and entomology departments at Universities may be able to supply some aphids. Wild collections could work but many aphid species feed on only one plant species which is fine if you find them on lettuce! As aphids are widespread pests, lettuce plants could be grown outside the school to act as 'bait' for your experiment. The best time of year for doing this would be in the late spring to summer months. Others, like the Peach Potato aphid, feed on hundreds of plant species so test to see if wild collections will feed on lettuce plants.

There is an extra activity on page 12 involving snails and so if sources of aphids are limited you could get the children to set up just a couple of ladybird experiments working in groups.

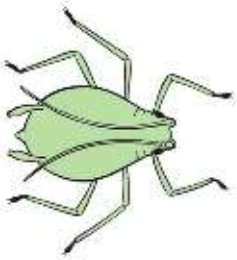
We suggest printing enough of the following two pages (checklist for the ladybird experiment and ladybird instructions) for each group.

Checklist for Ladybird experiment

Lettuce plant in Pot

Fine Paintbrush

Aphids



A pair of Rubber Gloves

Plastic Tweezers

A Magnifying Glass

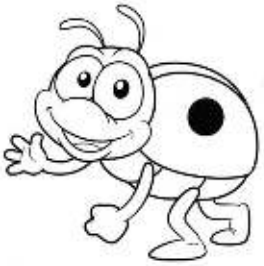
A Plastic Tube Cage **

A Mesh Cage Lid *

A Pair of Ladybirds

A Labcoat

A Pencil and Paper



* Alternative: Use a muslin cloth and a rubber band.

** Alternative: Cut off the top and bottom of a large plastic bottle.

Ladybird experiment

1. Collect the items you will need on your experiment checklist (e.g. potted plant, paintbrush, etc.).

2. Put on your gloves and lab coat and then using the tweezers or your fingers loosen the soil around the edge of the pot.

3. Get your plastic tube cage ready and check that it will fit around your plant.

4. A group member needs to carefully hold the lettuce plant leaves up and together as the tube cage is placed over the plant.

5. Pop on the mesh lid and carefully push the tube cage into the soil. Not too hard or the cage will collapse. Once in the soil the lid can be popped off.

6. Using a fine paintbrush, take it in turns to collect moving aphids and place them on to your plant. Only try and collect moving aphids as those that are still, could be feeding and moving them could damage their mouth parts. You will need 15 to 20 aphids.

7. Now carefully add your pair of ladybirds. Pop the lid on and observe.

Questions

? How fast are your ladybirds in finding aphids? Where are the ladybirds going to find their aphids? Continue to monitor them over the following days.

Extension activities

Go outside

If time (and the weather) allows, after the ladybird experiments are set up, go outside with the magnifying glasses and look for insects on plants in the school garden/playground.

?

What shape/colour are they?

How many legs do they have?

Do they have wings?

Can you see the mouthparts?

Do you think it is a plant eater?

Fun with snails

Snails are great creatures to observe and are easy to handle due to their shells.

Set up a food choice experiment by putting a selection of leaves into a tray and then release some snails to see what leaves they choose to eat.

Make sure to release the snails after the experiment and then wash your hands.

Once you know their favourite food, you could set up a group snail race!

?

How do they move…can you see their feet!

Are all the shells the same?

What patterns can you see?

Activity notes for teachers

*These activities use live insects and so the children should be told to treat them very gently

Ladybird Experiment

When the children are picking up aphids using fine paintbrushes, they should only try to pick up aphids that are moving. Aphids that are stationary are likely to be feeding on the leaf and due to the fact that the needle-like mouthpart goes far enough into the leaf to access the sap, the aphid, particularly the mouthparts can be injured if it is moved whilst eating.

It is important that the children remain calm as they do this. Sometimes an aphid may begin to escape but there's no need to panic, their only food source is the plant and so they won't go far and can be easy re-caught and put back.

If the cage works well, the lettuce will continue to grow and the aphids will reproduce, meaning there is a sustainable supply of food for the ladybirds. However, predator-prey populations are in fine balance and so it's worth keeping an eye on the aphid population, as you don't want to starve the ladybirds. Cages with lots of aphids can be used to re-stock more empty ones using the paintbrush technique as before to transfer aphids across.

Go Outside

Some children may have 'issues' with insects and so following the Ladybird experiment it's a good opportunity to get the children to look more closely at insects and appreciate their weird and wonderful forms. Food webs can be explored. By focussing on them as a 'scientist', it is the detail that captures their interest and they are less likely to be scared of them. They can look for mouthparts that may suggest the insect feeds on sap, they can observe what plants the insects are feeding/living on and look to see what other insects are also on those plants. Does one look like a predator? No touching is required!

The Writing Session (~1 hour and 30 minutes)

Objectives

Lower KS2:

- Gain, maintain and monitor the interest of the listener(s)
- Composing and rehearsing sentences orally (including dialogue), progressively building a varied and rich vocabulary and an increasing range of sentence structures
- Read their own writing aloud, to a group or the whole class, using appropriate intonation and controlling the tone and volume so that the meaning is clear.

Upper KS2:

- Identifying the audience for and purpose of the writing, selecting the appropriate form and using other similar writing as models for their own
- Selecting appropriate grammar and vocabulary, understanding how such choices can change and enhance meaning
- Using expanded noun phrases to convey complicated information concisely

Resources for this session:

- Pencils or pens to write with
- Books, lined paper or plain paper for drafting and presenting work
- Dictionaries and thesauri for checking and improving vocabulary

The aim of the session is to use the concepts, experiences, images and new vocabulary from the science as a starting point for writing poetry. This gives children a chance to make a personal response using their best, descriptive language to create a first draft. Spelling, grammar and further editing of work can be done later.

Begin with a recap on things the children remembered from the science session, what phrases or words do they remember? We suggest writing their responses on a whiteboard to share as a class.

Ask the children to imagine what it might be like to be an insect, where one plant or one patch of the garden could be your whole world, your own mini planet. Using the images, get them to think about being a predator or prey, where the next meal, or 'being' the next meal could be around every corner! Then Switch to thinking about being the lettuce plant and read the following poem by Julia Webb;

Lettuce

Lettuce's Lament by *Julia Webb, 2015*

It's dark in here
And I wish those carrots would budge up,
And there's something sludgy underneath me –
I think it used to be a parsnip once,

And every time I nod off
You open the fridge door
And the light comes on,
But you never pick me, not even once.

Don't you know I'd be great
In your lunchbox sandwich,
Or jazzing up your teatime salad,
Me and tomatoes we're the perfect match.

But no you only have eyes
For that carton of juice, milk for your tea
Or last night's leftover
Shepherd's pie and peas.

I'm a depressed lettuce;
With no one to love me
I'm growing soggy round the edges,
It'll be the bin or the compost heap for me.

Then ask the children to write single words or phrases related to lettuce or insects on strips of paper and place them in an empty cup on their table. Shake the cups to mix the words and then draw out a few strips and experiment with arranging them on the table to make a poem.

Allow them to change their words if they are too difficult to use or can't fit into the poem. This warm up activity takes around 10 – 15 mins and is useful for reluctant writers as it creates a starting point. Children begin to see how certain words work well and sound good together.

Support the children to help them see the structure of their poems emerging and invite them to write a poem by either adding more words to the lines created from the warm up activity or to start a new one.

Allow the children to spend at least 30 minutes writing and use the last 15 minutes to give the children a chance to read their poem aloud to the class, making sure all are met with applause.

Example poems

The following poems were produced by students of Milecross Primary School

Crunchy aphids *by Martyna*

Spotty red ladybird,
Eats tasty crunchy aphids,
Lays smooth white eggs.
Whitefly eats crinkly green lettuce,
Flies around the vegetable garden,
Looking for more food.

Lettuce

Ladybird life *by Zack*

Eggs laid,
Larvae hatching,
Larvae eating,
Larvae growing,
Larvae pupating,
Larvae final stage,
Greenfly, greenfly,
Leave me alone,
Let me grow on my own.

Aphid *by Owen*

Annoying creatures,
Pupated enemies.
Horrible lettuce ruiners,
Infecting food.
What am I?

This poem was inspired by the story of the lifecycle of a parasitic wasp. The wasp lays its eggs inside an aphid and when the larvae hatch, they eat the aphid from the inside out!

Aphid *by Cuchulainn*

Hi, I'm an aphid,

I feed on lettuce and other crops,
Nom nom nom, yummy.
Unfortunately, farmers like to protect them,
Like that wasp…. oh no!
No no……not the inside out treatment!
I'm going to die.
I can feel it
- 1 week later –
I'm a mummy…. I'm not well,
RIP aphid.

Ladybird *by Lewis*

Orange and black spotted ladybirds
eating infected green aphids that make microscopic patterns.
Shiny orange and black ladybirds
eating all the aphids, finding the shiny patterns in the leaves.

The Art Activity – Lettuce (~1 hour and 45 minutes)

Objectives

- produce creative work, exploring their ideas and recording their experiences

Key Stage 1

- to use a range of materials creatively to design and make products
- become proficient in drawing, painting, sculpture and other art, craft and design techniques

Key Stage 2

- to improve their mastery of art and design techniques, including drawing, painting and sculpture with a range of materials

The following art session was designed by Lara Nicole and focuses on insect faces.
First, have the children draft ideas for an insect mask on white paper. They could research different types of faces in books or on the internet. Ask them to consider the eyes and mouthparts of their insects and the proportions. Then cut out the shape of their mask and use coloured pens to play around with the best combinations of colours.

This planning stage gives the children a chance to develop and shape their creations before they use more expensive and limited materials to build their masks. We suggest using a sheet of coloured foam as the base part of the mask. Children can use their paper mask shape as a template to draw around and then cut out of the foam.
Children can ask a friend to help them locate where the eye holes should be by holding their foam over their face and getting their friend to make two dots with a felt tip pen. Then a circular template, like a glue stick can be placed over the dots so the children can draw circles to cut out as eye holes.
Next, make holders for their ears (like arms on glasses) by making two holes in the foam sheet and attaching two pipe cleaners to it (elastic can also be used).

Once the basic shape is ready, children can decorate their masks with a range of craft materials (pipe cleaners, pompoms, wiggly eyes, ribbons, wool, etc.).

End the session by getting all the class to wear their insect masks and compare their insect faces! What insects could your friends be? Are they a predator insect, a pest?

Lettuce

Useful links

Organisations

www.sawtrust.org	The Science Art and Writing trust
https://leafuk.org/education/leaf-education	LEAF Education
www.jic.ac.uk	John Innes Centre, Norwich

Useful resources

http://www.greengardener.co.uk/	Biological control (e.g. ladybirds)
http://www.dartfrog.co.uk/livefoods.html	Pea aphid supplier
http://www.harlequin-survey.org/default.htm	Harlequin Ladybird Survey
www.countrysideclassroom.org.uk	Countryside Classroom Resources
www.images.norwichresearchpark.ac.uk	NRP Image Library

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