

Ladybirds and their natural enemies

A female ladybird can lay up to 1,500 eggs during her lifetime. This is quite an achievement for such a small minibeast. Many eggs will survive and develop into adult ladybirds. However, a small number will not survive beyond the pupal stage of the ladybird's life cycle.

Ladybirds go through three different stages in their life cycle before becoming an adult ladybird.

1. Egg
2. Larva
3. Pupa

We are going to take a close-up look at stage 3 – the pupal stage of their life cycle. You can find out more about their other life stages in the teacher's notes for this term.

Introduction to the ladybird parasite survey

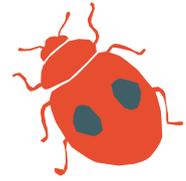
The pupal stage begins with the ladybird larva attaching itself to a leaf, stem or similar surface. The larva hunches over, sheds its skin and becomes a pupa. This stage lasts for 6–10 days, during which an amazing transformation occurs, and ends with the emergence of a fully grown adult ladybird. But, if one of their natural enemies, a parasite, has laid its eggs within that pupa, a parasite will emerge instead.

Here is a survey for pupils to carry out and find out more about a ladybird's natural enemies during the pupal stage of their life cycle.

Timing

Ladybird pupae can be found from late May to October with peak times occurring from June to August. The national results of our part in this survey will be published on the ladybird survey website, first round of results in July and final results in November this year.

www.ladybird-survey.org



What equipment will we need?

You don't need lots of specialist equipment for this survey.

- If you want each child to take part individually, they will each need some collecting pots to take outside e.g. petri dish or small, clean plastic tubs with lids to collect the pupae in. You could use small empty yogurt pots or margarine tubs with lids if you don't have petri dishes.
- The children will need scissors to cut the leaf or stem around the pupa.
- We recommend pupils wearing long sleeves and trousers when searching in different habitats. They should also wear closed-toe shoes.
- A hand magnifying glass up to 10x will be useful to keep an eye on things as some of the pupae are very small.
- If your school has a digital camera, taking photographs of the different stages of each experiment helps as a visual record. (Download the **getting good photos of small creatures** activity sheet to get some hints on photographing small creatures.)

The ladybird parasite survey

Step 1

- Take a look in your school grounds or a nearby park for ladybird pupae. The best places to find them are on the leaves of broad-leaved trees (they love lime trees and sycamore trees in particular), conifers, herbaceous plants and low-growing vegetation. They are also very fond of nettles, but we do not recommend school children looking in nettles, for obvious reasons. You will need a clean container e.g. a petri dish or small, plastic pot with a lid, to collect the pupae in. Only one pupa should be placed in each container.

– What do they look like?

Pupae vary in size and can be anything from 5 to 10mm long and 4 to 8mm wide. They vary in colour, and some may have spots or patterns. Here are pictures of four of the most commonly found ladybird pupae to help you identify them:



Harlequin ladybird pupa
Harmonia axyridis



2-spot ladybird pupa
Adalia 2-punctata



7-spot ladybird pupa
Coccinella 7-punctata



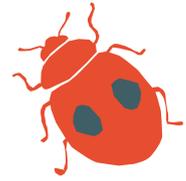
10-spot ladybird pupa
Adalia 10-punctata

– Helpful identification tips

All ladybird pupae are yellow at first, like the yellow pupa in the top left picture above.

Look out for very spiky bits of skin at the base of a harlequin pupa. It may help you to identify this species more easily.

It can be difficult to see the difference between some pupae so don't worry if you don't know which species it is. You can wait to see if an adult ladybird emerges and you will then be able to tell what it is.



Step 2

- When you have found a pupa, gently remove the leaf or stem that it is on. Place it in your container making sure the pupa is upright. There is no need to touch the pupa. If you do accidentally touch it, the pupa may flick up and down quickly, but do not worry, this is a defence mechanism to try to frighten off anything that may harm it. Take it back to the classroom.

Step 3

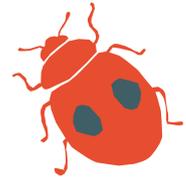
- Carefully cut a small section of leaf or stem, about the size of a ten pence piece, around the pupa then place it back in the container, pupa side up. When cutting, hold the leaf or stem and not the pupa. Do not add anything else to the container.

Step 4

- Put the lid on and place the container in a room out of direct sunlight, but not in the dark. Make sure it is not too hot or too cold. You do not need to put oxygen holes in the lid, as lifting the lid each day to check the pupa will allow enough air in.

Step 5

- A recording sheet for you to print out can be found on the last three pages of this document. Children can use this to help keep a record of what is happening with their pupae. One form per pupa should be filled in. They can also use this information to contribute to scientific research by entering the details of their experiments online. We will tell you more about this later.
- Each pupil can monitor his/her own pupa each day and note any changes in colour or shape as it develops. Photographs can be taken at each stage to assist with this. Pupils can also record how many days it takes for either the ladybird, or parasite of a ladybird, to emerge. The pupa will take about one week to develop if a ladybird is inside, depending on how developed it was when collected. Parasites may take longer to develop within the ladybird pupa. Carefully lift the lid and peek in to see what, if anything, has happened each day. Monitor your pupa for two weeks.



Step 6

- Look for what emerges from the pupa. Either you will see a ladybird, which you can identify using the ladybird identification guide provided to you by BBC Breathing Places Schools, or you will see one of the ladybird's parasites emerge instead of a ladybird. If this happens, it means that the parasite has grown inside the pupa and replaced the ladybird – no ladybird will hatch. It is also possible that nothing will emerge.

– Parasites that may emerge instead of a ladybird:



Chalcid wasp
Tetrastichus coccinellae

- A commonly found parasite of ladybird larvae and pupae
- Eggs are laid in the larva or pupa by the wasp
- The wasp larvae develop inside the pupa and emerge as adults through a single exit hole, usually in the top of the pupa.
- Up to 40 adult wasps (2mm long) will emerge from a single pupa
- In the wild, chalcid wasps live for less than one week
- Chalcid wasps have no sting



Phorid fly
Phalacrotophora fasciata

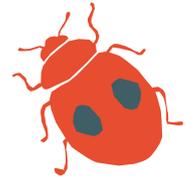
- A commonly found parasite of ladybird pupae
- Eggs are laid by an adult fly in the ladybird pupa
- 5–10 small (about 4mm long) yellow maggots (the fly larvae) will emerge from the ladybird pupa. They will turn into hard, brown pupae within 24 hours of hatching from the ladybird pupa
- One adult fly should emerge from each fly pupa about one week later
- The tiny (1mm long) adult flies live for less than one week in the wild



Braconid wasp
Dinocampus coccinellae

- A very rare parasite of ladybird larvae and pupae, but you may see this one emerge if you are lucky!
- One single wasp larva would emerge from the pupa
- The larva looks like a large, yellow maggot, about 10mm long
- The wasp larva spins a cocoon soon after emerging from the pupa
- An adult wasp emerges approximately one week later and can live for up to two weeks in the wild
- Adult braconid wasps are approximately 10mm long
- Braconid wasps have no sting

If you want to find out more about ladybirds' natural enemies, go to:
<http://www.ladybird-survey.org/enemies.aspx>



Step 7

- Note down what emerges from the pupa and take a photographic record of what is happening if you can.
- If a ladybird emerges, it may take up to 12 hours for the full colour to develop on its wing cases, and then you can identify it.
- If chalcid wasps emerge, you will be able to identify them easily because they leave the pupa as adult wasps.
- If a single braconid wasp larva emerges, you will see it spin a cocoon, and an adult will emerge approximately one week later.
- If phorid fly larvae emerge, they will turn into small, brown-coloured pupae within 24 hours and emerge as adults about a week later.
- These are fascinating transformations to watch. Please see the information in this document on each of these species for more detail.

Step 8

- Release any adult ladybirds, phorid flies, parasitic wasps or remaining ladybird pupae where you originally located them.

Step 9

- The UK Ladybird Survey scientists want to know the results of your survey – even if nothing emerges! This will help them learn more about ladybirds and their natural enemies, and to see how they are adapting to the newly arrived harlequin ladybird. To help them do this, please use the web address at the end of your recording worksheet to upload your results online.

More about this survey:

Pupils will be able to:

- Learn how to design an ecological survey
- Collect pupae and monitor them over a short period of time (two weeks)
- Observe an adult ladybird emerging from a pupal case
- Observe a parasite/parasites emerging from the pupal case
- Record and summarise data, then communicate data to others
- Look at different parasites that attack ladybird pupae in the UK
- Document their natural history observations
- Compare and document the occurrence of ladybirds versus parasites that emerge from the pupae
- Share their data with other schools and researchers across the UK

What age children can carry out this survey?

This scientific survey can be carried out by children of all ages.

When can we do this?

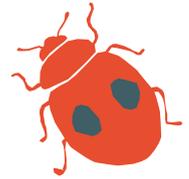
Ladybird pupae can be found from late May until October with peak times occurring from June to August.

Will the survey harm the ladybird pupa?

If instructions are followed, it will not harm the ladybird pupae or interfere with the ladybird or parasite's life cycle.

Photographs courtesy of Ken Dolbear, Mike Majerus, Bill Phillips. Remy Ware, Gilles San Martin.

Illustrations courtesy RSPB, © Chris Shields and Andy Hamilton.



Ladybird parasite survey recording sheet

Fill in this recording sheet to help you keep track of your survey.
Make sure you record only one pupa per recording sheet.

Pupil Name:

Date pupa collected:

Habitat pupa

found in: Park Garden Woodland
(circle one) (trees, hedges, long grass, weeds) (flowers and vegetables) (dense trees)
Other (describe)

Pupa found

on/in: Tree trunk Tree leaf Branch of tree Plant stem Plant leaf Grass Other (describe)
(circle one)

Full name of place you found your pupa:

(e.g. your school name, park name etc)

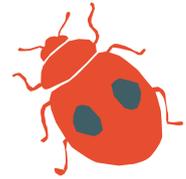
Full address of place you found your pupa:

(make sure you include the postcode as this will be important if sharing your information with UK Ladybird Survey scientists!)

Species of pupa found	Scientific name	What the pupa looks like	Length of pupa	Describe the colour and patterns on the pupa you have collected	Tick here if you have found this pupa
Harlequin ladybird pupa	<i>Harmonia axyridis</i>		8-10mm		
7-spot ladybird pupa	<i>Coccinella 7-punctata</i>		8-10mm		
2-spot ladybird pupa	<i>Adalia 2-punctata</i>		5-6mm		
10-spot ladybird pupa	<i>Adalia 10-punctata</i>		5-6mm		

If you are not sure which pupa you have found, take a photograph of it and email it to the UK Ladybird scientists who should be able to help. You can email them at ladybird-survey@ceh.ac.uk

Write the name of the pupa species here:

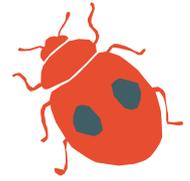


Ladybird parasite survey – Monitoring form

You may need to use all of these dates to record the development of your pupa or you may not, depending on when a ladybird or parasite emerges.

	Changes in pupa appearance (E.g. colour changes, size changes etc)	Ladybird or parasite emerged? (Yes or No)
Day 1		
Day 2		
Day 3		
Day 4		
Day 5		
Day 6		
Day 7		
Day 8		
Day 9		
Day 10		
Day 11		
Day 12		
Day 13		
Day 14		

Please note: If nothing emerges from your pupa after 14 days, make a note of this and return the pupa to where you found it. This is still interesting information for the UK Ladybird Survey scientists. It means that whatever was inside the pupa was unable to develop and emerge.



Which species emerged from the pupa? (tick)

Ladybirds

Ladybird species	Latin name	What it looks like	This emerged from the pupa	Date it emerged from the pupa
Harlequin ladybird	<i>Harmonia axyridis</i>			
7-spot ladybird	<i>Coccinella 7-punctata</i>			
2-spot ladybird	<i>Adalia 2-punctata</i>			
10-spot ladybird	<i>Adalia 10-punctata</i>			

If a ladybird emerges and it is not one of these four ladybirds, please identify it using the BBC Breathing Places Schools Ladybird Identification chart sent to your school. Don't worry if the ladybird is not the same species that you identified as a pupa. Adult ladybirds are easier to identify. Go back and correct the 'Species of pupa found' section on this worksheet so you have the right information.

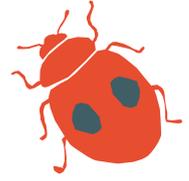
Write the name of the ladybird here:

Parasites

Ladybirds' natural enemy	Latin name	What it looks like	This emerged from the pupa	Date it emerged from the pupa	Number that emerged from pupa
Phorid fly	<i>Phalacrotophora fasciata</i>	 5-10 will emerge as larvae but will turn into pupa immediately			
Chalcid wasp	<i>Tetrastichus coccinellae</i>	 Many will emerge as adult wasps			
Braconid wasp	<i>Dinocampus coccinellae</i>	 One larva will emerge and spin a cocoon in which it changes into a wasp			

If something else emerges from the pupa, please take a photograph of it and make sure you upload it when sharing your results with the UK Ladybird scientists.

If nothing emerged from your pupa after 14 days, please tick here:



Share your information with UK Ladybird Survey scientists!

Once you have collected the information, you can send it to scientists to help with their research into ladybirds' natural enemies. This will be tremendously useful, so many thanks for sharing it with them.

Uploading photos is part of reporting results. The scientists would also like to see a photograph of any parasite that emerges from your pupa so, if you can take a picture of it, you can upload it on the UK Ladybird Survey website. See our **getting good photos of small creatures** download sheet on the BBC Breathing Places Schools website to help you do this.

Go to bbc.co.uk/breathingplaces/schools and follow the links to input your results in the **ladybird parasite survey** section. Look out for the national results of our part in this survey on the UK Ladybird Survey website.