2009

An ASAB resource for GCSE Biology

Showing off -

the art of Communication

Powerpoint

Worksheets

Worksheet 1 - the life cycle of ladybirds
Worksheet 2 – ladybirds as predators
Worksheet 3 – aposematism in domestic chicks
Worksheet 4 – colour patterns in adders

Notes for teachers

Patterns for Life WARNING COLORATION

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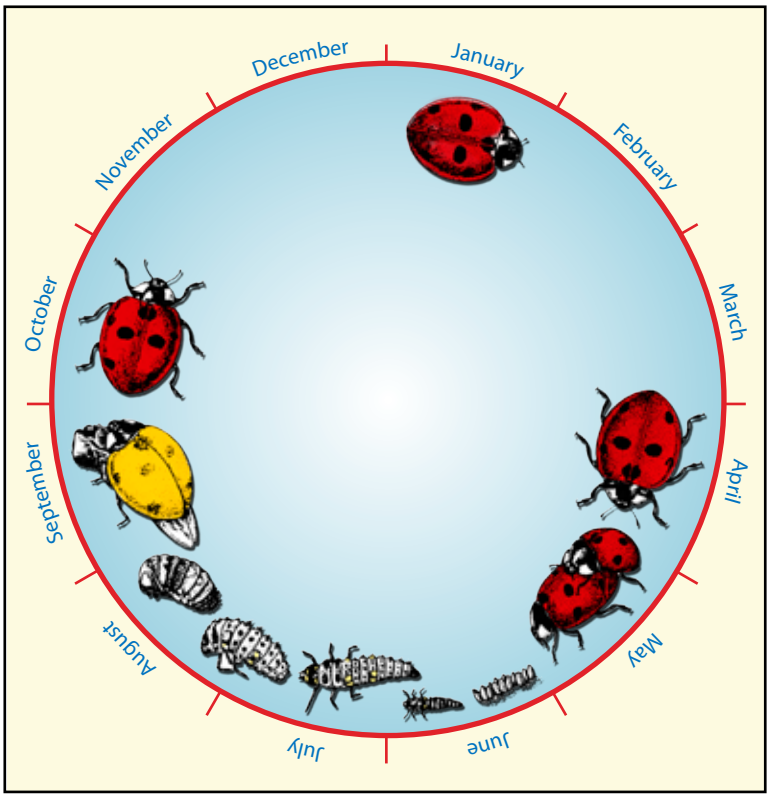
Worksheet 1 - the life cycle of ladybirds

1. Like many other insects, ladybirds have 4 stages in their life cycle. Figure 1 shows roughly the number of weeks spent in each of the 4 stages. Using the diagram, estimate the number of weeks spent in each stage.

Figure 1 Typical life cycle development of a 7 spot ladybird



egg ☐ weeks,

larva ☐ weeks,

pupa ☐ weeks,

adult ☐ weeks

2

2. Table 1 shows the time spent (days) in the early stages of development of 7 spot ladybirds at different temperatures. (Data from Hodek, 1973).

   i) For the time spent at the egg stage, roughly how many times faster is development at 30° C compared with 15°C?

   ☐ times

1

   ii) Figure 2 is an incomplete graph, drawn from the data in Table 1, showing the development time for a 7 spot ladybird to pass through four larval instars and become a pupa and temperature. Add the missing point to the graph and complete the line.

1

Figure 2 Development time for a 7 spot ladybird and temperature

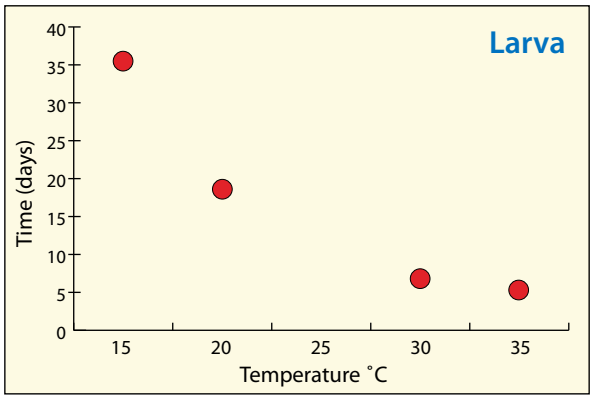


Table 1 Time spent (days) in the early stages of development of 7 spot ladybirds at different temperatures

Temperature ° C	Egg	Larva	Pupa
15	10.3	35.5	15.0
20	5.0	18.6	8.4
25	2.6	8.7	4.0
30	1.9	6.7	2.9
35	1.8	5.4	2.5

Worksheet 1 - the life cycle of ladybirds

iii) What does the graph show about the relationship between temperature and the rate of development of ladybird larvae.

2

iv) A 7 spot ladybird larva sheds its skin three times before pupating. What name is given to the stages between shedding, or moulting, of the old skin? Complete the word.

i _ _ t _ _ 1

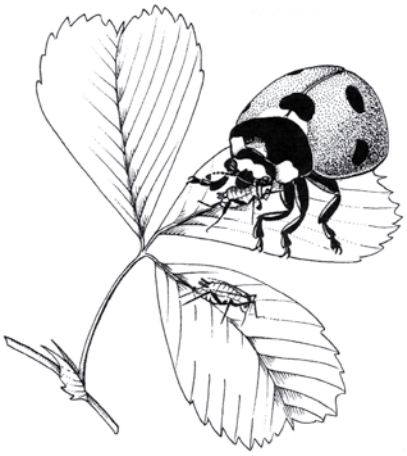
3. Here are the key changes from a ladybird pupa to the adult stage. Unfortunately they are in the wrong order. Put them in the correct order by putting the correct letter in the sequence below.

i) the elytra (wing cases) change colour from yellow to bright red
ii) adult ladybird takes its first flight
iii) pupal case splits
iv) the ladybird pulls itself out of the case
v) adult rests after emergence from the case

The correct sequence should be: ____, ____, ____, ____, ____ 1

4. Adult ladybirds live for many weeks and their main source of food is aphids. An aphid is a small insect that feeds on plant sap. Aphids have soft bodies which are easily punctured by the jaws of ladybirds, both larvae and adults, see Figure 3.

Figure 3 A ladybird eating an aphid



Anne Bebbington

i) What type of animal is a ladybird. Underline your answer.

a) omnivore b) carnivore c) herbivore 1

ii) Suggest **ONE** plant on which aphids may be found.

1

iii) Look at Figure 4, showing a leaf. Knowing how aphids feed, put a cross on **ONE** suitable part of the leaf where an aphid might find food and explain why this part of the leaf is suitable for the aphid.

Figure 4 A leaf

1

Worksheet 2 – ladybirds as predators

Most ladybirds in Britain are predators, like the 2 spot ladybird in Figure 1.

Figure 1 A 2 spot ladybird

Mick Hoult

1. Give a definition of a predator.

1

2. Female ladybirds lay their eggs close to aphid colonies. Why do they do this?

1

3. When ladybirds are searching for aphids on a plant they tend to walk upwards. Name **TWO** factors that ladybirds might use to indicate that they are moving upwards along a plant stem.

i) ii) 2

4. When animals move towards or away from a stimulus it is called a TAXIS. Taxes can be either positive or negative. Write down what a positive taxic effect and a negative taxic effect are.

A positive taxic effect

A negative taxic effect 2

5. Aphids don`t just sit and wait to be eaten when a ladybird approaches. Suggest **ONE** thing an aphid might do to escape being eaten by a ladybird.

1

6. Ladybirds are, in turn, eaten by other predators. Suggest **TWO** vertebrate predators of adult ladybirds.

i) ii) 2

7. Suggest **TWO** behaviours that ladybirds might show if they are attacked by a predator when they are on a plant.

i) ii) 2

Worksheet 2 – ladybirds as predators

8. Ladybirds have a special anti-predator tactic that they use when attacked. They can produce a fluid from the area around their leg joints: this type of defence is called reflex bleeding, see Figure 2. The fluid is yellow in colour, is smelly, is sticky and tastes bitter: the fluid can stop the predator from continuing the attack.

Figure 2 A ladybird showing reflex bleeding

Mike Majerus

i) What types of signals are ladybirds giving bird predators by using this fluid BEFORE the bird touches the ladybird. Underline the best answers.

a) visual signal b) sound (auditory) signal

c) touch signal d) odour (smell) signal

2

ii) The fluid produced by a ladybird carries additional information which a predator detects when it picks up and tries to eat a ladybird. Suggest **TWO** other types of signals or information that the fluid gives during this process.

a)

b)

2

9. Parasites also attack ladybirds. The parasites may live on the surface of the ladybird or they may live inside the ladybird.

i) What is a parasite?

1

ii) Parasites do not usually kill the animal they are living on or in. Give **ONE** reason why parasites do not do this.

1

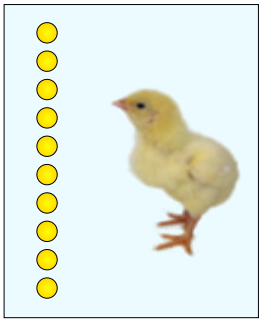
Worksheet 3 – aposematism in domestic chicks

In the Powerpoint presentation, you saw a number of caterpillars resting on a tree during the day. Why might the caterpillars be clumped together?

One reason might be that if a predator attacks the group then the chance of any one caterpillar being attacked and eaten is less if it is in a large group of caterpillars. [This is called a dilution effect.]

Another reason could be that if the caterpillars clump together they make their signal more obvious or impressive, so a predator is much more likely to see the scary signal and not attack them!

A study was carried out to test this idea that clumping a signal has a stronger effect. In this study chicks pecked at grains of two different colours, either red or yellow. Forty chicks were tested in all, in 4 groups of 10. Each test chick was placed on an A4 sheet of thin card on which 10 grains were placed, see Figure 1. The 10 grains were either arranged in a clump or spread out in a line. Ten chicks were tested with clumps of red grains, ten chicks with clumps of yellow grains, ten chicks with a line of red grains and ten chicks with a line of yellow grains.



Nicola Marples

Figure 1 The set-up with a test chick and yellow grains spread out

Each chick that was tested had a `buddy chick` behind a wire mesh barrier. The test chick was placed in the centre of the card and the scientists recorded how long it took (in seconds) for each test chick to peck at the first grain. The time taken to peck at the first grain is called the latency. Table 1 shows the mean latencies (seconds) for the clumped and spread out arrangements of the red and yellow grains. Table 2 shows the individual latencies for the ten chicks that pecked at yellow grains.

Table 1 Mean latencies for each group of chicks

	Yellow grain	Red grain
Grain spread out	?? seconds	20 seconds
Grain clumped	125 seconds	180 seconds

Table 2 Latencies for the 10 chicks in each of the yellow grain groups

Grain spread out	40, 16, 124, 3, 21, 62, 180, 12, 70, 52
Grain clumped	45, 224, 130, 65, 130, 186, 110, 144, 88, 128

1. From table 2, calculate the mean latency for the yellow group which had grain that was spread out on the card.

1

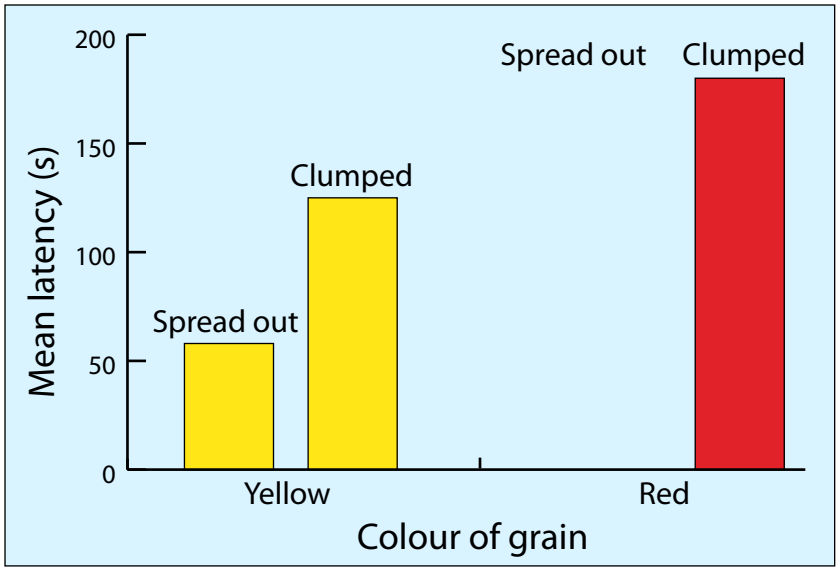
2. What is the modal latency of the group of chicks that had yellow clumped grain?

1

Worksheet 3 – Aposematism in domestic chicks

3. Draw a bar onto the chart below (Figure 2) to indicate the mean latency for chicks that had red grain that was spread out. Colour the bar red. 1

Figure 2 Chart to show the mean latency (seconds) for each group of chicks



4. When you have drawn your bar on the chart, give **TWO** observations about the mean latencies that are evident in the pattern of the bars. 2

5. Using the bar chart and Table 1, write down what effect clumping the grain has on the latency to peck in chicks. 1

6. Using the bar chart and Table 1, write down what effect the colour of the grain has on the latency to peck in chicks. 1

7. Why do you think the scientists used a `buddy chick` in the test set-up? 1

8. Cigarette packets carry the message `Cigarettes can kill`. Using the idea of warning coloration, design an aposematic cigarette packet that would reinforce this message. 2

Worksheet 4 – colour patterns in adders

Some patterns can be both warning colours and camouflage. It depends on what background they are seen on. If the colour used for the warning mark isn`t too conspicuous, for instance if it`s black not bright red, then the animal may be able to use the pattern in both ways. It can sit on some backgrounds and blend in, like an adder on leaves, but if it sits on other backgrounds its black markings stand out, and can be used to warn its predators that it`s dangerous and shouldn`t be attacked. A few years ago scientists wanted to find out if the bright colours and patterns on adders could be used as both camouflage and as a warning signal.

Mick Hoult

Figure 1 An adder

Adders are predators but adders have predators too, like buzzards (birds of prey) and crows. The scientists wanted to see if the zig-zag pattern along the back of the adder, see Figure 1, did reduce attacks by predators.

To do this the scientists used plasticine models of snakes. They used two colours of plasticine, grey and terracotta, which is a browny-red colour, like a brick. Each plasticine snake was about 20 cm long and about 1 cm diameter. Half the models had a zig-zag marking drawn along the back with black paint, the other half had no markings. The models had a thin tail and slightly fattened head and were made into an S-shape, to make them look more snake-like. The models were placed on the ground at sites in the UK and Finland. Half the model snakes were simply placed on the ground but each of the snakes in the other half was placed on a sheet of white card. The models were all > 10 m away from each other. Each week the sites were visited and the number of beak marks on each plasticine model snake was counted.

1. The scientists used plasticine models in this study, not real snakes. Give **ONE** advantage and **ONE** disadvantage of using plasticine models.

2

2. The scientists used plasticine models to determine whether predators avoid nasty or poisonous prey if the prey have bright colours or markings. What term is used to describe the process by which bright colours and patterns of nasty or poisonous prey make attacks by predators less likely. Underline the answer you think is correct.

   i) avoidance ii) terror iii) communication iv) aposematism v) coloration

1

3. The plasticine models were S-shaped and around the same length as a real adder.

   i) Why did the scientists make the models the same length as the real snakes?

1

   ii) Why did the scientists make the plasticine models into S-shapes?

1

   iii) Using evidence from the photograph only, what is the key feature of the adder`s body that would deter a predator?

1

Worksheet 4 – colour patterns in adders

4. Adders are sit-and-wait predators. What do you think a sit-and-wait predator is?

1

5. Adders are camouflaged against the background they are resting on when they are sitting and waiting. What is the advantage to an adder of being camouflaged?

1

6. In this study, half the models were placed on the ground and half were placed on a sheet of white card. Why do you think half the models were placed on white card. Underline the best answer below.

i) The models looked splendid against white card.
ii) The scientists had run out of black card.
iii) The scientists wanted the white card to act as a control for camouflage.
iv) So the scientists could easily find the plasticine snakes again.
v) To test whether predators like white card.

1

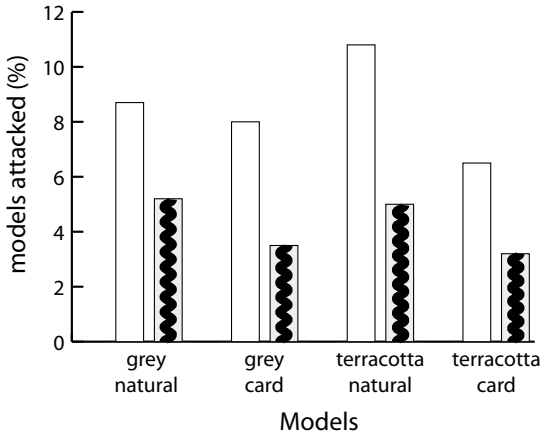
7. Half the snake models the scientists used were plain and had no markings and half had the zig-zag pattern. Why did the scientists use this procedure?

1

8. The scientists counted the number of beak marks on each model once a week and their findings are seen in Figure 2.

Figure 2 The percentage of the different models attacked by birds.

[White columns show plain models, hatching columns show models with the zig-zag pattern.]



Adapted from W. Wüster *et al. Proc. R. Soc. Lond.* B (2004) **271**, 2495-2499.

i) Estimate how many grey plasticine models on natural background with zig-zag markings were attacked.

1

ii) Which type of model with zig-zag patterns was attacked least?

1

iii) Comment on the graph.

2

9. The scientists found that most attacks took place at the head end of a plasticine model. Why was this?

2

Other images were provided by Nicola Marples and Mick Hoult.