

What happened to the holly leaf-miner?

INTRODUCTION

VOLUME 1 ISSUE 1

THE FOOD WEB WEEKLY

THE LIFE AND DEATH OF THE HOLLY LEAF-MINER

Next time you walk past a holly tree look closely. You may find a small invader feasting on the cells of the leaf.

The invaders are the larvae of the holly leaf-miner fly (*Phytomyza ilicus*). These larvae have hatched from eggs laid on the holly leaves by the adult fly in June and July. They make tunnels inside the leaf over the autumn and winter, feeding on the soft tissue under the leaf's surface. Around March the larvae turn into the pupae. In May and June the adult flies emerge from the leaf, leaving a large hole on the mine, and the life cycle starts again.

Sadly not all leaf-miner larvae miners are successful. Some birds, such as the blue tit, feed on the larvae, and leave a v-shaped tear on the leaf as evidence. Blue tits are predated by sparrowhawks.

Parasites also feed on the miners. A parasitic wasp called *Chrysocharis gemma* inserts a single egg through the leaf and into the body of the miner. The wasp larva hatches inside the leaf-miner larvae, feeding on it and eventually killing the leaf-miner. After the leaf-miner has died, the wasp larva becomes a pupa. Eventually the adult wasp emerges from the leaf. Evidence of this is a very small neat hole left on the leaf. Not all wasp larvae become adult wasps. Sometimes an even smaller parasitic wasp called *Pleurotropis amyntas* feeds inside the first parasitic wasp.



LIFE AND DEATH? ANSWER THE QUESTIONS

1. Draw the life cycle of the holly leaf-miner.
Use the following words: larva, egg, adult fly, pupa.
2. (a) What is a parasite?
(b) How do parasites stop the holly leaf-miner from maturing into an adult fly?
3. (a) Draw the food chain that the holly leaf-miner is part of
(b) Some energy does not continue along the food chain.
Where does this energy go?

What happened to the holly leaf-miner?

HOLLY LEAF-MINER PHOTOGRAPH TRAIL

START HERE

Tear or hole found on upper or lower surface of mine

YES

Is there a V-shaped tear on the leaf?

YES



No remains of miner inside mine
Predation by blue tits

Tally
A

NO

NO

Is the hole at least 1mm across?
(Use a ruler!)

YES

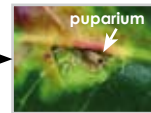


Large emergence hole
Successful adult

Tally
B

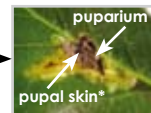
NO

OPEN THE MINE



Brown puparium
Pupa killed by parasitic wasp

Tally
C



Black pupal skin*
Larva killed by parasitic wasp

Tally
C



A puparium is a protective case. It protects the larva as it becomes a pupa.

Is there a puparium in the open mine?

YES

Is the puparium light brown and shiny?

YES



Light brown puparium
Successful pupa

Tally
B

NO

Is black pupal skin* present?

YES



Pupal skin present*
Pupa killed by parasitic wasp

Tally
C

NO



Brown puparium
Other death of pupa

Tally
D



The larva may be alive (top) or dead (bottom)

Is the larva present (alive or dead)?

YES

Is the larva shiny and lemon yellow?

YES



Larva is shiny and lemon yellow
Living larva

Tally
B

NO

Are the larval remains a dirty yellow colour and/or is black pupal skin present?

YES



May be pupal skin*
Larva killed by parasitic wasp

Tally
C

NO



Larval remains a dirty green colour
Other death of larva

Tally
D

* This is the black pupal skin of a parasitic wasp.

If the wasp died before it became an adult, there will be no parasite emergence hole in the leaf.

NO



Empty mine
Other death of larva

Tally
D

What happened to the holly leaf-miner?

INDIVIDUAL RESULTS SHEET

Choose the first 10 leaves. Record the number that have mines. Remove those leaves which have mines.

		Branch number									
		1	2	3	4	5	6	7	8	9	10
Number of leaves without mines											
Number of mines											

What other plants are found near the holly tree you are studying?

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Suggest how these other plants might affect the holly tree.

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List any difficulties you had in doing this practical.

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What happened to the holly leaf-miner?

WHAT DO THE MINES TELL US? (CLASS RESULTS SHEET)

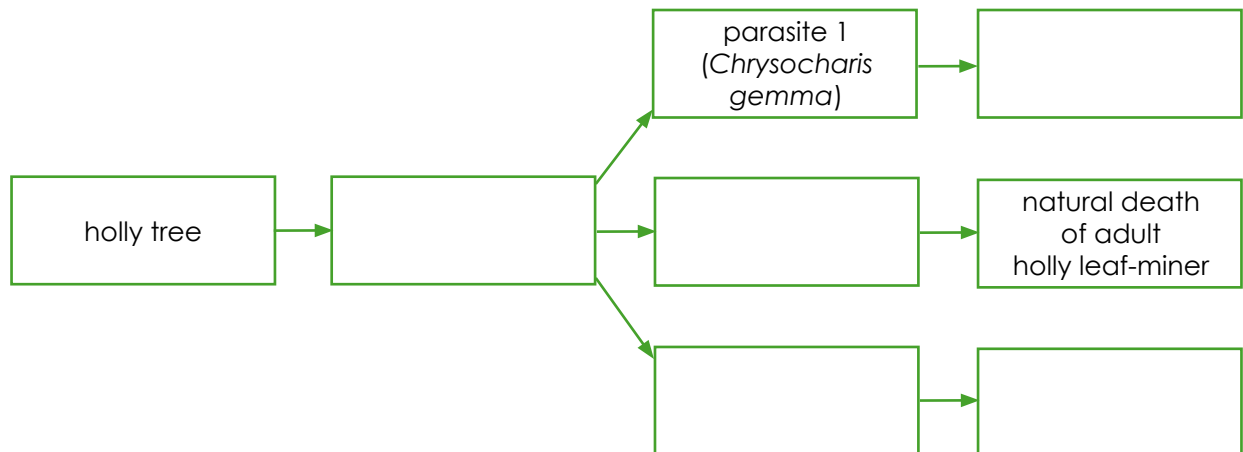
	Group Number / Tally Totals						Class Total
	1	2	3	4	5	6	
A Predation by blue fits							
B Successful larva, pupa or adult leaf mine							
C Larva or pupa killed by parasitic wasp							
D Other death of larva							
E Number of leaves without mines							
Total number of mines sampled (A + B + C + D)							
Total number of leaves and mines sampled (A + B + C + D + E)							

What happened to the holly leaf-miner?

CONSIDERING YOUR RESULTS

1. Label the flow diagram to cover the possible pathways for energy from a holly tree. Use each one of the following labels **once** on the diagram.

- holly leaf-miner larva
- blue tit
- sparrowhawk
- adult leaf-miner fly
- parasite 2 (*Pleurotropis amyntas*)



2. Now use the class results to help you draw one **pyramid of numbers** diagram. Label each level with the species name and the type of feeder that it is (e.g. producer, primary consumer)

3. Use your results to help **explain** your answers to the following.

(a) If the parasite (*Chrysocharis gemma*) numbers decreased rapidly, what effect would this have

- (i) on the number of holly leaf-miners?
- (ii) on the number of blue-tits?

(b) If the parasite (*Pleurotropis amyntas*) numbers increased rapidly, what effect would this have

- (i) on the number of holly leaf-miner?
- (ii) on the number of other parasites?

(c) If more sparrowhawks were introduced into the ecosystem by humans, what effects would this have on the food chain?