

EXOTIC PEST ALERT



Horse chestnut leaf miner, *Cameraria ohridella* Desch. & Dem.
(Lepidoptera: Gracillariidae)

The first sighting in the UK of the leaf mining moth, *Cameraria ohridella*, was on chestnut trees, *Aesculus hippocastanum*, in the London Borough of Wimbledon in July 2002. Signs of adult moth activity in the same area were noted in mid May 2003.

C. ohridella was first reported in Macedonia in 1985, although its precise geographical origin is unknown, and since then it has spread across Europe resulting in the premature defoliation of many horse chestnut trees. Horse chestnuts are widely used in prominent amenity plantings and the incidence of pests and disease problems associated with this tree species have previously been very low. It has been suggested that the rapid expansion of this moth is linked to human transportation, particularly of infested leaves accidentally carried on vehicles.

Recognising the Symptoms

As the common name suggests, the larvae of this moth produce mines within the leaves, feeding between the upper and lower surfaces (epidermises). The resulting serpentine mines, which are at first translucent, may reach 4 cm in length. On heavily infested trees with multiple attacks on the same leaf, the mines often merge together. This leads to browning and drying of the leaves, which eventually curl upwards and inwards at the edges and fall prematurely. Early leaf-fall can affect 70—100% of the leaves on a single tree. By August, the entire tree can appear autumnal.

Apart from the North American species, *Cameraria aesculisella*, *C. ohridella* is the only other lepidopteran species that mines *Aesculus*.

Damage caused by the fungus *Guignardia aesculi* may be confused with that of *C. ohridella*. *G. aesculi* produces large red-brown blotches that tend to be concentrated at the tips and margins of the leaflets, superficially resembling leaf mines. Unlike *C. ohridella* mines, the blotches caused by the fungus are often outlined by a conspicuous yellow band and do not appear translucent when held up to the light.



Cameraria ohridella
damage
© J. Metzger (LWF)



Damage caused by
Guignardia aesculus and
Cameraria ohridella
© Th. Lohrer

Later, *Guignardia* infections produce tiny black pimples (pycnidia) on the browned parts, mostly on the upper surface. Leaflets severely affected by *Guignardia* roll upwards longitudinally and, like leaves infested by *C. ohridella*, may fall prematurely.

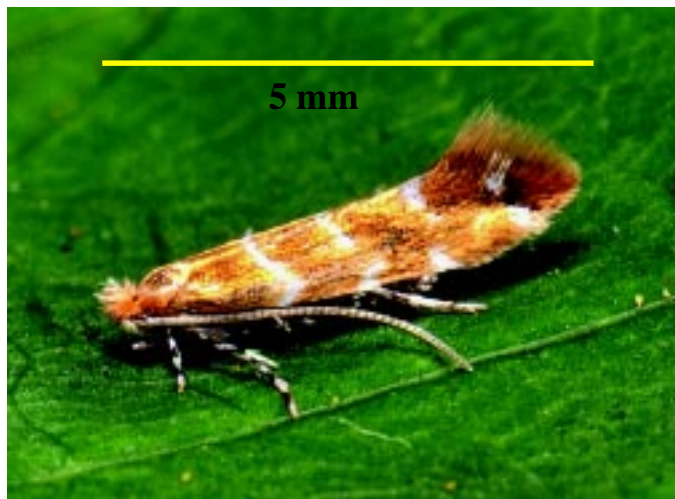
Unlike *C. ohridella*, the damage, although unsightly, occurs after most of the growth of the tree has taken place. *Guignardia* leaf blotch is widespread and common in the southern half of England, becoming less frequent northwards.

Occasionally a horse chestnut tree is seen with its leaflets browned around the edges but with no yellow-margined blotches. This condition has not been explained.

Life Cycle of *Cameraria ohridella*

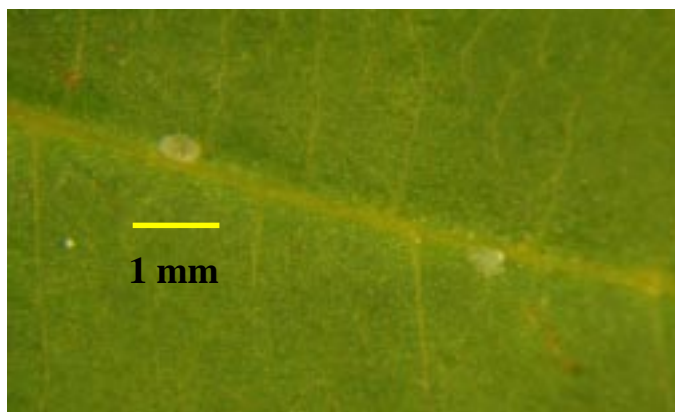
Depending on weather conditions and climate, up to five overlapping generations per year have been reported, especially in hotter and drier conditions. In Western Europe, up to three generations per year seems to be the average. A series of years with above average summer temperatures and below average rainfall across Europe may well have contributed to *C. ohridella* becoming a significant pest.

Adults appear from April onwards, initially from pupae that have over-wintered. The adults are up to 5 mm long. The forewings are metallic chestnut-brown with silvery white transverse stripes edged in black. The hindwings are dark grey with long fringes.

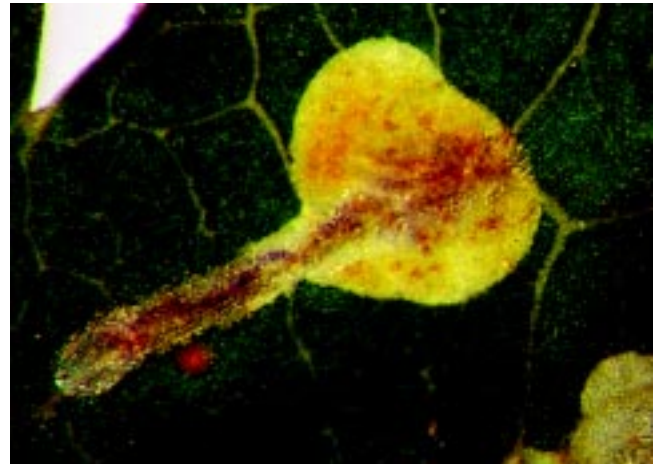


Adult *Cameraria ohridella*. © P. Roose

Eggs are laid from May to August along the lateral veins on the upper side of the leaflet; each female lays 20–40 eggs. Between 200 and 300 eggs per leaflet and 700 per compound leaf have been counted. Eggs hatch in 2-3 weeks.



Upper side of horse chestnut leaflet showing eggs laid along vein. © J. Freise

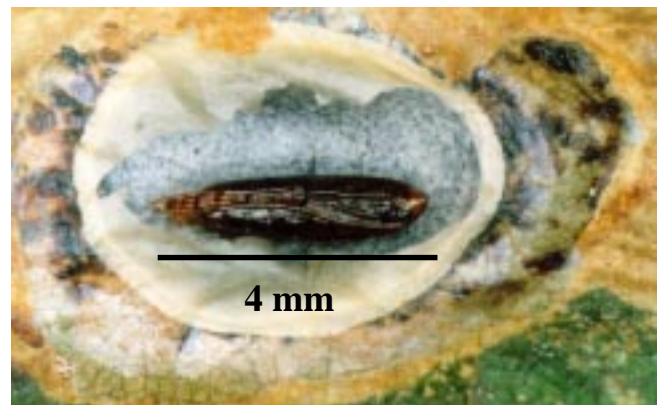


Early stage of larval mining close to site of egg hatch. © J. Freise



Larva of *Cameraria ohridella*. © P. Roose

Larvae pass through five stages (instars) and complete their development in about 4 weeks. They feed inside the leaf tissue, leaving only the upper and lower epidermises intact. In heavy infestations, competition for space and food can be great and many larvae fail to survive.



Pupa of *Cameraria ohridella*. © K. Hellrigl

Pupae develop in a silken cocoon in the mine, and generally complete development in about 2 weeks, but this stage can last for 6-7 months in the over-wintering generation. The over-wintering pupae survive among the fallen leaves and are known to be extremely frost tolerant.

Throughout the summer it is possible to find all developmental stages present in attacked leaves.

Spread of Infestation

Once established in an area, population densities can increase very rapidly although the natural rate of spread in an undisturbed population is slow. Passive carriage on vehicles from infested areas has been shown to be a highly effective and speedy method of dispersal.

The Threat

In the UK most tree species have associated leaf miners. While infestations can be disfiguring, even severe attacks are not regarded as affecting the overall health of the host tree in a significant way.

However, *Cameraria ohridella* may prove to be of greater consequence to the health of *Aesculus hippocastanum* (and its other known hosts *Aesculus pavia*, *Acer platanoides* and *A. pseudoplatanus*) due to a combination of the following factors:

- Multiple, overlapping generations can result in rapid infestation of leaves and both the primary and the second flush of leaves may fall prematurely.
- Horse chestnut and the other known hosts are significant amenity trees in urban and suburban areas so that both visual damage and loss of growth are more serious than in rural locations.
- Pupae appear to be extremely frost tolerant, reportedly surviving winter temperatures as low as -23°C in Hungary. This can lead to increasing populations from year to year even when winters are severe.
- Numbers can build up rapidly following establishment in a new location, e.g. the heavy damage in Brussels during 2000, even though the moth was not noted in the previous year.
- Rapid long distance dispersal arising from passive transportation on vehicles can lead to new infestations at locations remote from known centres of attack.

- The pest does extremely well in hot dry conditions when the tree may already be suffering drought stress. *C. ohridella* can therefore be a contributory factor in further tree decline.
- Spread via vehicles tends to favour establishment in urban areas where growing conditions are less than ideal, trees are less able to withstand the effects of additional stresses and ambient temperatures may be higher.

The reported death of trees heavily attacked by *C. ohridella* has been found to involve other factors e.g. root disease caused by *Phytophthora*. Continuing repeated defoliation, especially when it occurs early in the growing season, may lead to an overall gradual decline in tree vigour. Reduced growth of young trees has been noted.

Control Options

- Biological control. Approximately 15 species of natural enemy (mainly parasitic wasps) have been identified within the known distribution area of this pest. However levels of parasitism and predation within established populations appear to be low (1-8%).
- Chemical insecticides. Various chemical agents, including diflubenzuron (Dimilin), have been tried but it is unlikely that these can be used successfully or routinely in urban situations.
- Good hygiene. Removal and destruction of dead leaves in the autumn and winter (in cities for example) has reduced damage locally. It has been estimated that 1 kg of over-wintering leaves could result in the emergence of 4500 moths the following spring and, assuming a 1:1 sex ratio, 80 000 eggs being laid. However in the long term this could also decrease the numbers of natural control agents that over-winter in the leaves.

Although it is now known that the moth has arrived in Great Britain, further vigilance is essential in helping to detect spread into new locations so that the biology and potential impact of the moth can be evaluated and the possible need for appropriate control measures determined.

Conclusions

This pest has spread rapidly across mainland Europe. The limits of its potential distribution and climatic tolerance are not yet known. Here in the UK, it appears likely that *C. ohridella* would be able to complete two or three generations in a warm dry summer. However, neither the rapid spread across Europe nor the damage done in temperate parks were anticipated. This pest seems to be showing more climatic tolerance than would be predicted on the basis of current knowledge. Such climatic tolerance, combined with any increase in frequency of hot dry summers, means that *C. ohridella* may pose a greater threat than was originally foreseen.

What to do/How you can help.

If you suspect the presence of this leaf miner please contact **immediately** one of the following:

- Entomology Branch,
Forest Research, Alice Holt Lodge,
Farnham
tel. 01420 22255, fax. 01420 23653,
e-mail christine.tilbury@forestry.gsi.gov.uk
- Your local defra Plant Health and
Seeds Inspector (contact number in the
local phone book)
- Central Science Laboratory
contact Jeanne Robinson,
tel. 01904 462364, fax 01904 462250,
email j.robinson@csl.gov.uk)

If possible it would be extremely helpful if you could send, by 1st class letter post, a sample of any affected leaves to either:

Forest Research, Alice Holt Lodge,
Wrecclesham, Farnham, Surrey, GU10 4LH
or

Central Science Laboratory, c/o Invertebrate
Diagnosis Section, Sand Hutton, York YO41
1LZ.

Samples should be packed dry, wrapped in paper and sealed in a polythene bag; please remember to enclose your name and address plus contact telephone number and a note of the date and location at which the sample was collected.

Christine Tilbury
Hugh Evans

June 2003

Acknowledgement and Web links

We are grateful to Dr Werner Heitland for permission to reproduce the photographs from the Controcam Website;

<http://www.cameraria.de/controcam.html>

We are also grateful to colleagues at the Central Science Laboratory for helpful comments on the text. Other photographs are acknowledged in the text where appropriate.