

# Field Identification Guide

## Elm zigzag sawfly



Photograph: Max Blake, Forest Research

## Elm zigzag sawfly

The elm zigzag sawfly (*Aproceros leucopoda*) is native to eastern Asia but has been spreading in Europe and poses a serious threat to elm trees (*Ulmus* spp.) in the UK. The sawfly larvae feed on the foliage of healthy trees, and while it is thought that infestations do not cause fatality to hosts, they can reduce their productivity and vitality and make them more vulnerable to other pests and diseases. In extreme cases, this invasive pest can cause severe defoliation and dieback of shoots and branches in the crowns of infested trees. The threat posed by the elm zigzag sawfly is compounded because UK elm populations have already been weakened and are still under attack from Dutch elm disease (*Ophiostoma ulmi* and *O. novo-ulmi*).

Species affected	All types of elm can be attacked by the elm zigzag sawfly including cultivated forms. The three elm species commonly found in the UK – wych elm ( <i>U. glabra</i> ; more common in northern and western uplands of the UK), the smooth leaved or field elm ( <i>U. minor</i> ) and English elm ( <i>U. procera</i> ; both more common in lowland Britain) – are all at risk from this pest.
Signs and symptoms	<p>Voracious feeding by the elm zigzag sawfly larvae on the foliage of elm trees can result in trees with high crown transparency, defoliation and dieback of shoots and branches. Elms can be attacked regardless of their age and location with damage caused by this pest occurring in both forest and urban situations. There is some evidence that levels of defoliation by this pest are related to light levels, with trees in open parkland and urban situations possibly being more severely affected than forest trees.</p> <p>The entire life cycle of the elm zigzag sawfly from laying of the eggs to emergence of the adults only takes approximately one month, but this may be variable depending on the weather. In Europe, four generations a year have been reported allowing populations to grow and build up rapidly to damaging proportions.</p> <p>Approximately 50 eggs are produced and deposited at leaf margins by each adult sawfly, all of which will become females with no males ever having been reported for this species. The eggs are light green in colour and less than 1 mm long. After just one week of incubation the eggs hatch, light green larvae emerge and immediately start feeding on the foliage of the host tree. The larvae, which develop a dark stripe on both sides of their head and a 'T'-shaped</p>

	<p>marking on the second and third pair of true legs, commonly feed while holding on to the inside edge of the leaf tissue.</p> <p>A conspicuous early indicator of the elm zigzag sawfly is a characteristic feeding trace left by the removal of the soft tissue of the leaf as the larva moves and feeds in a zigzag pattern from the outside edge of the leaf inwards. The larvae continue to feed as they mature through four to seven larval stages and increase in size from 4 to 10 mm long. As the immature larvae increase in size, the width of their feeding traces also increases. These early feeding traces are often obscured by the feeding habits of more mature larvae which tend to eat away all of the leaf tissue, often leaving just the leaf veins behind. The damage caused by older larvae is more difficult to recognise than that of early-stage larvae and can be confused with damage caused by other insects.</p> <p>After just two to three weeks from hatching the larvae become fully mature, stop feeding and build a loosely spun, reticulated summer cocoon in which to pupate to adulthood. These usually occur on the underside of leaves and are approximately 8 mm long. Adult sawflies emerge from the cocoons after just four to seven days to begin the whole process again. Thick-walled, closely spun winter cocoons can also be seen at the end of the season on the undersides of leaves in the litter layer. These more robust cocoons provide protection and security during hibernation of the overwintering generation. The adult sawflies are 6–10 mm long with brown/black bodies and wings. They have three-part antennae and light-coloured legs.</p> <p>A number of factors, other than elm zigzag sawfly, can cause defoliation and crown dieback in elm trees: e.g. abiotic factors such as drought, waterlogging, and adverse cultural and environmental conditions. Various diseases, such as honey fungus (<i>Armillaria</i> spp.), and root and butt rots can cause similar crown symptoms and could be confused with those caused by the elm zigzag sawfly. However, the presence of zigzag feeding traces and reticulated cocoons on the leaves are two key indicators of the sawfly which can differentiate it from other possible causes. While the zigzag feeding traces are a specific indicator of this pest, the indistinctive feeding</p>
--	---

	<p>holes left by mature larvae could be confused with other insects such as winter moths (<i>Operophtera brumata</i>, <i>Erannis defoliaria</i> and <i>Alsophila aescularia</i>). These moth larvae produce feeding holes in the leaves of a number of tree species, including elm, during the summer months. Leaf miners, e.g. the elm leaf miner (<i>Fenusa ulmi</i>) and <i>Stigmella lemniscella</i>, are native insects that feed on the tissues in between the outer layers of elm leaves, causing browning and leaf drop. They can also leave feeding traces as they consume internal parts of the leaf. However, they do not penetrate the upper or lower surfaces of the leaf or have the characteristic zigzag pattern of the elm zigzag sawfly.</p>
Timing	<p>The overwintering generation of sawflies will emerge in the spring, and the presence of larvae and feeding damage on the leaves will be seen shortly after that and persist throughout the summer with adults emerging continuously between mid-May and mid-September. During this time, active and aborted summer cocoons will also be visible on the leaves with the stronger, winter cocoons occurring in the leaf-litter over winter.</p>
Biosecurity	<p>Spread of elm zigzag sawfly populations occurs by flight as these insects are strong flyers, and it is also thought that they can be carried fairly long distances passively by the wind and along roads with the traffic.</p> <p>It is extremely important that no foliage or leaf-litter from host trees is removed from a potentially infested site and that all boots and vehicle tyres are brushed/washed down prior to leaving. Vehicles and clothes should also be checked for live insects.</p> <p>If any host tree material is intentionally removed from a site, e.g. for sampling, then it should first be triple-wrapped in strong and robust plastic bags, or double-wrapped in bags which then must be secured within a plastic container. For insects, please package in a secure, robust plastic container labelled with date, location and contact details and send to Tree Health Diagnostic and Advisory service (T.H.D.A.S), Forest Research, Alice Holt Lodge, Farnham GU10 4LH.</p>



Reporting requirements	<p>If you find this pest, please report it through TreeAlert (<a href="https://treealert.forestresearch.gov.uk">https://treealert.forestresearch.gov.uk</a>).</p> <p>In Northern Ireland, please report via the TreeCheck website (<a href="http://www.treecheck.net">www.treecheck.net</a>), phone app, or by emailing <a href="mailto:planthealth@daera-ni.gov.uk">planthealth@daera-ni.gov.uk</a></p> <p>For traded plants and any non-tree hosts, please email <a href="mailto:planthealth.info@apha.gov.uk">planthealth.info@apha.gov.uk</a> (England and Wales) or <a href="mailto:hort.marketing@gov.scot">hort.marketing@gov.scot</a> (Scotland).</p>
------------------------	---

Based on information available in November 2018.

## Signs and symptoms



Photograph: Dr. Doris Hölling, Swiss Federal Institute WSL, Swiss Forest Protection

Defoliation of a mature wych elm infested with elm zigzag sawflies.



## Signs and symptoms



Photograph: LELF/Pfannenstill

Feeding damage and defoliation of young elm trees by the elm zigzag sawfly.

## Signs and symptoms



Photograph: Suzanne Sancisi-Frey, Forest Research



Photograph: Max Blake, Forest Research

Characteristic feeding traces produced by early stage/young elm zigzag sawfly larvae.



## Signs and symptoms



Photograph: Suzanne Sandisi-Frey, Forest Research



Photograph: Peter Crow, Forest Research

Early stage elm zigzag sawfly larvae producing characteristic patterns as they feed.

## Signs and symptoms



Photograph: Andrew D. Liston Sendenbergl German Entomological Institute



Photograph: Ewald Altenhofer/Wikimedia

Multiple feeding traces, with young larvae of elm zigzag sawfly, on elm leaves.



## Signs and symptoms



Photograph: Stephan M Blank

Mature elm zigzag sawfly larva feeding and causing damage to elm leaves.



Photograph: Peter Crow, Forest Research

Mature larvae of the elm zigzag sawfly feeding on and causing damage to elm leaves. Note that the initial zigzag feeding traces can now not be seen.

## Signs and symptoms



Photograph: Max Blake, Forest Research



Photograph: Dr. Doris Hölling, Swiss Federal Institute WSL, Swiss Forest Protection

Extensive feeding damage to elm leaves caused by mature larvae of the elm zigzag sawfly.



## Signs and symptoms



Photograph: Max Blake, Forest Research



Photograph: Dr. Doris Hölling, Swiss Federal Institute WSL, Swiss Forest Protection

Cocoons containing developing adult elm zigzag sawfly on the underside of an elm leaf.

## Signs and symptoms



Photograph: Suzanne Sancisi-Frey, Forest Research

Evacuated elm zigzag sawfly cocoon on the underside of an elm leaf.



## Signs and symptoms



Photograph: Suzanne Sandis-Frey, Forest Research

Evacuated cocoon on the upper surface of an elm leaf. This is unusual as cocoons usually occur on the underside of leaves.



Photograph: Max Blake, Forest Research

Adult elm zigzag sawfly laying her eggs on the margins of an elm leaf.

## Look-alike signs and symptoms



Photograph: D H Phillips, Forestry Commission

Crown dieback in an elm tree infected with Dutch elm disease (*Ophiostoma novo-ulmi*).



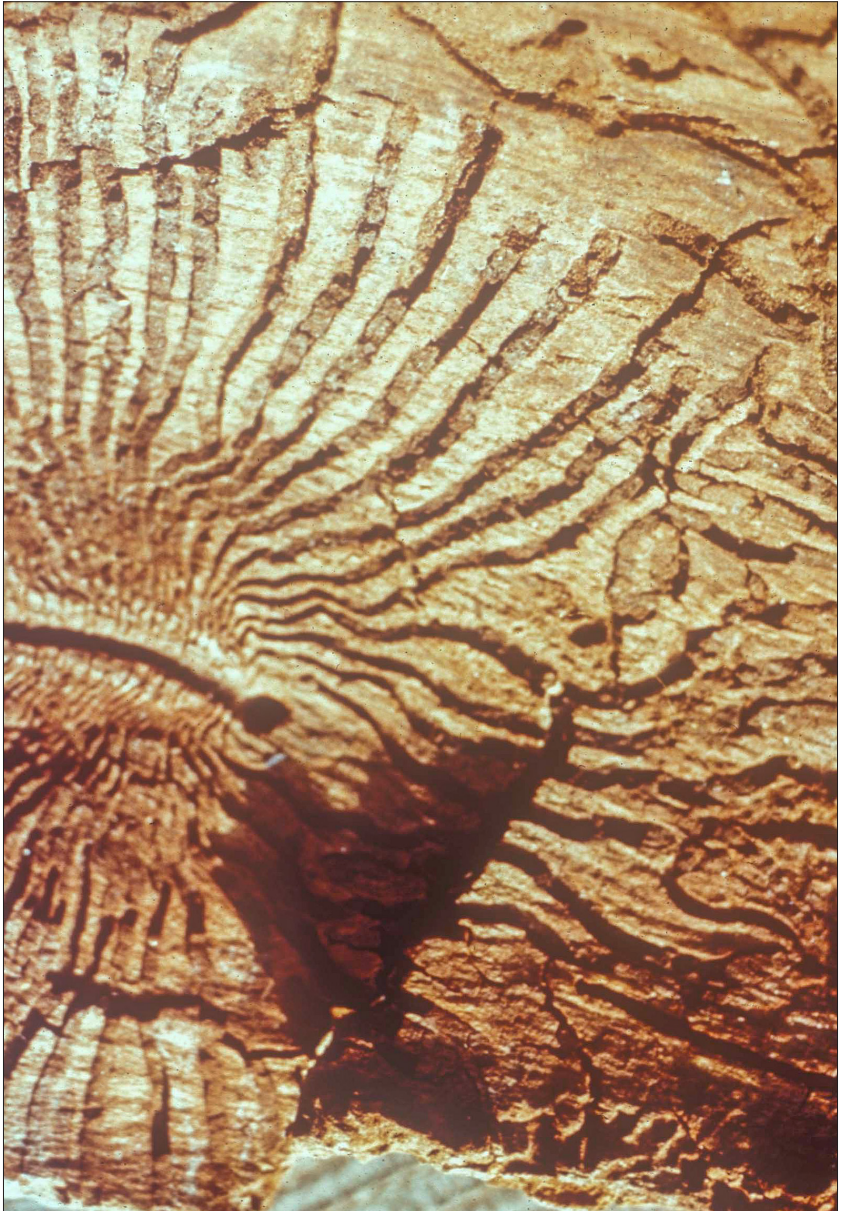
## Look-alike signs and symptoms



Photograph courtesy of Forestry Commission

Wilting, discoloured and dying foliage on an elm tree infected by Dutch elm disease.

## Look-alike signs and symptoms



Photograph: Thelma Evans, Forestry Commission

A characteristic maternal/larval gallery of the elm bark beetle (*Scolytus* spp.) which vector Dutch elm disease.



## Look-alike signs and symptoms



Photograph: Max Blake, Forest Research

Feeding damage from other herbivorous, leaf-chewing insects.



Photograph: Thelma Evans, Forestry Commission

Elm leaf aphid (*Eriosoma ulmi*) damage on elm leaves.

## Look-alike signs and symptoms



Photograph: Max Blake, Forest Research

Feeding trace between upper and lower surface of an elm leaf produced by a leaf miner (possibly *Stigmella lemniscella*).



Photograph: Max Blake, Forest Research

Damage to elm leaves possibly caused by abiotic factors.



## Look-alike signs and symptoms



Photograph: Robert Strouts, Forestry Commission

Leaf blotches and premature defoliation caused by the fungus *Mycosphaerella ulmi* on elm leaves.

© Crown copyright 2019.

Published by Forest Research as part of the Observatree project.

Observatree aims to create a tree-health early-warning system using citizen science.

Observatree is a partnership project led by Forest Research, the research agency of the Forestry Commission. Project partners are the Animal & Plant Health Agency (APHA), Department for Environment, Food & Rural Affairs (Defra), Fera Science Ltd, the Forestry Commission, the National Trust, Scottish Forestry, the Welsh Government and the Woodland Trust. Supporting the project is Natural Resources Wales. The first four years of this project was 50% funded by the EU's LIFE programme.

#### Acknowledgements:

Dr Suzanne Sancisi-Frey, Forest Research, for compiling this guide based on a review of current literature and with technical contributions from experts across the Observatree partnership.

All those who have given permission for images to be used within the guide.

The Communications Team, Forest Research, for the original design and creation of the guide.

This booklet forms part of a set that supports Observatree volunteers when out looking for priority pests and diseases. It supplements face-to-face training and is not intended as a full or detailed description. It will also be useful for others who have some knowledge of the particular pest or disease and understand how to look for these. Further information is available online from the websites listed below:

**[www.observatree.org.uk](http://www.observatree.org.uk)**

**[www.forestresearch.gov.uk/tools\\_and\\_resources/fthr/pest-and-disease-resources/](http://www.forestresearch.gov.uk/tools_and_resources/fthr/pest-and-disease-resources/)**

**[www.gov.uk/guidance/prevent-the-introduction-and-spread-of-tree-pests-and-diseases](http://www.gov.uk/guidance/prevent-the-introduction-and-spread-of-tree-pests-and-diseases)**

**<https://planthealthportal.defra.gov.uk>**