Elm tree (*Ulmus* spp.) pests and diseases

Elm zigzag sawfly (*Aproceros leucopoda*)

Introduction

The elm zigzag sawfly is a species of sawfly that gets its common name from the characteristic pattern it makes on leaves: a zigzag or meandering-river pattern carved out by a young larva feeding between the leaf veins.

The elm zigzag sawfly is a native of eastern Asia, including Japan and China. It is now found in many parts of Europe, most likely introduced through imported plants in 2003, and the US and Canada since 2020 [see distribution]. Adult sawflies can fly, which allows them to travel long distances. They are projected to spread further via wind currents, road networks, and elm plant imports.

In large numbers and the right environmental conditions, larvae can severely defoliate elms, jeopardising tree health. Elms of all ages and in a variety of settings can be affected, including both forest and urban environments. Trees growing in close proximity, such as street plantings, are particularly vulnerable to outbreaks of this pest.

Host

This pest affects nearly all species of elm (*Ulmus* genera), including cultivated forms.

Biology

No males have been found in this species, which indicates that it reproduces through parthenogenesis, a form of asexual reproduction. Populations consist entirely of females, each capable of producing viable, unfertilised eggs. All offspring are genetic clones of their female parent. This reproductive strategy enables populations to increase rapidly.

The elm zigzag sawfly has a short life cycle, with larval growth occurring in the spring and summer.

Females lay eggs in the serrated edges of elm leaves, which hatch in 4-8 days. After emerging, larvae start feeding on the leaves for approximately 15-18 days. Pests will develop through six larval stages before forming cocoons on the undersides of leaves. Adults emerge from these cocoons within about 7 days.

Multiple generations can occur in a single summer. In North America, one to two generations have been reported, whereas in Europe there may be four to six generations per year, allowing infestations to develop quickly.

Symptoms

For details of the symptoms, scan or click on the QR code to access the accompanying poster.

More information

- Forest Research: https://www.forestresearch.gov.uk/tools-and-resources/fthr/pest-and-disease-resources/elm-zigzag-sawfly-aproceros-leucopoda/
- Observeatree: https://www.observatree.org.uk/media/1240/18_0061_one-off-literature-observatree-guide-elm-zigzag-sawfly_wip11.pdf
- NatureSpot: https://www.naturespot.org/species/zig-zag-elm-sawfly

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Elm spanworm (*Ennomos subsignaria*)

Introduction

The elm spanworm is a moth species that is characterised by its unmarked white or creamy upper wings, which distinguish it from the darker British *Ennomos* species.

Native to the US and Canada, this pest is associated with a history of outbreaks in the US dating back to the 1800s. In the UK, the species has been recorded only once, with a single specimen documented in London in 1984. Beyond this isolated occurrence, the elm spanworm remains primarily a North American pest.

This moth impacts deciduous species, including forest, shade, and fruit trees. Damage to plants occurs in the larval stage, when caterpillars feed on the leaves of host trees. During outbreaks, larvae are capable of completely defoliating trees and large areas of mixed forest.

Host

In North America, this pest affects a wide range of tree species, including elms. In areas of high larval densities, nearly all hardwoods, except *Liriodendron tulipifera* (yellow poplar) and *Magnolia acuminata*, are subject to attacks.

In high-infestation areas, larvae can spread onto practically all vegetation, stripping the trees and many understory plants.

Biology

In North America, the elm spanworm has one generation per year. Eggs are laid in early July and over winter, hatching only the following year between late April and early June. Larvae in their first developmental stage disperse by hanging on a silk thread, which the wind typically carries higher and further away – this mechanism is known as ballooning.

Larvae feed for six weeks, initially eating only tender foliage. During development, they moult four times, occasionally five for females. By the fifth larval stage, they can feed on leaves as large as a mature red oak leaf.

Mature larvae pupate in loose silken cocoons within leaf litters, bark fissures, or surrounding structures. Adults emerge approximately 10-14 days after pupation, between July and August, with males appearing before females. Mating occurs within 24 hours of emergence, and females then lay an average of 50–60 eggs in compact clusters.

Adults are active at night. In urban areas, large numbers of male moths may be attracted to artificial light, sometimes forming “summer snowstorms”.

Symptoms

For details of the symptoms, scan or click on the QR code to access the accompanying poster.

More information

- PennState Extension: https://extension.psu.edu/elm-spanworm
- DEFRA: https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/downloadExternalPra.cfm?id=4585

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Dutch elm disease (*Ophiostoma novo-ulmi*)

Introduction

Dutch elm disease got its name from the team of Dutch pathologists researching the disease in the 1920s. The disease is caused by the pathogenic fungus *Ophiostoma novo-ulmi*.

Thought to originate from Asia, this fungus was introduced to the UK from North America in the late 1960s through imported infected plants. It is also present in other parts of continental Europe and New Zealand [see distribution]. In the UK, Dutch elm disease has killed millions of elm trees over the last 50 years.

The disease is mainly transmitted by elm bark beetles, which carry fungal spores after breeding in infected or dead elm trees, and transmit them to healthy trees when feeding. The pathogen then infects the tree's water-conducting tissue (xylem), disrupting water transport and thus jeopardising tree health.

Host

Its hosts are both *Ulmus* genera species (e.g., American, English, Chinese, or Siberian elm) and *Zelkova* genera species (e.g., Japanese elm).

Biology

O. novo-ulmi can spread along hedgerow elms through root grafts formed between adjacent trees. However, its primary transmission route is via elm bark beetles, particularly *Scolytus scolytus*. These beetles breed in dead and dying elms, including those killed by the disease, laying their eggs under tree bark. Larvae then tunnel in the bark and outermost wood, forming galleries in which the fungus produces sticky spores. These spores contaminate newly emerged adult beetles. Mature beetles then fly to healthy elms, where they feed on young bark and introduce the pathogen into the tree's xylem. These fungal spores germinate and grow within the xylem, spreading through the wood vessels and blocking the flow of water. As a result, the tree rapidly wilts and may eventually die. Trees can also become infected repeatedly over time.

Susceptibility to elm bark beetles may be influenced by stem diameter, with studies showing that elms with smaller stem diameters are significantly less vulnerable to beetle attacks. This helps explain why an elm can persist as a hedgerow shrub, but rarely survives long enough to reach tree stature. Indeed, once stems grow beyond a certain diameter threshold, they become far more attractive to *Scolytus scolytus,* and the disease cycle takes hold.

Despite the devastation wrought across Europe and North America, certain isolated elm populations have remained healthy and disease-free, likely as a result of geographic isolation limiting beetle dispersal. Moreover, certain Asiatic elm species, such as *Ulmus pumila* and *U. parvifolia*, exhibit strong natural resistance to the pathogen. In a push to revive badly affected European and North American elms, these species have often been hybridised with native elms, increasing their overall resistance and offering hope for long-term restoration.

Symptoms

For details of the symptoms, scan or click on the QR code to access the accompanying poster.

More information

- Woodland Trust: https://www.woodlandtrust.org.uk/trees-woods-and-wildlife/tree-pests-and-diseases/key-tree-pests-and-diseases/dutch-elm-disease/
- RHS: https://www.rhs.org.uk/disease/dutch-elm-disease
- Frontiers: https://www.frontiersin.org/journals/forests-and-global-change/articles/10.3389/ffgc.2021.679104/full
- Arboricultural Advisory & Information Service: https://arbtest.oomi.co.uk/Trees.org.uk/files/90/90f2d2f6-3d77-459c-8288-d951b0bf9782.pdf

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