Hawthorn (*Crataegus* spp.) Sampling Protocol

IPSN International Plant Sentinel Network

BOTANIC GARDENS CONSERVATION INTERNATIONAL

Forest Research

the tree council Working together for the love of trees

fera

Contents:

Sampling campaign

Call for Hawthorn Disease Samples: Help Support Tree Health Research

Forest Research, Fera, The Tree Council, and the International Plant Sentinel Network (a technical initiative of Botanic Gardens Conservation International) are collaborating on a two-year Defra-funded project to investigate the resilience of hawthorn in the UK, with a particular emphasis on hedgerows.

As part of this research, we are seeking **samples of hawthorn showing symptoms of disease** for laboratory testing. Specifically, we are looking for:

- **Fireblight** (*Erwinia amylovora*): A serious bacterial disease that affects a wide range of hosts, including hawthorn, apple, pear, and many ornamental plants.
- **Rusts** (*Gymnosporangium* species): Fungal diseases that can infect hawthorn.
- **Viruses**: We are also supporting a Defra/Euphresco initiative focused on the detection of viruses in forest and amenity trees, including hawthorn.

🗓️ Sampling timeframe: 2025 - 2026

If you are interested in contributing to this important tree health research, please use the instructions provided to collect and submit samples.

For more information or if you have any questions, please contact:

📧 Jordan.rydlewski@forestresearch.gov.uk

Forest Research

the tree council
Working together for the love of trees

fera

IPSN
International Plant Sentinel Network

Hawthorn: An Overview

Hawthorn is primarily represented by two native species: common hawthorn (*Crataegus monogyna*) and midland hawthorn (*Crataegus laevigata*). Both are small deciduous trees or large shrubs native to UK and much of Europe.

Identification & Characteristics

Hawthorns typically grow as dense, thorny shrubs, though they can also develop into small trees up to 15 metres tall with a single stem. Their branches are armed with sharp, woody thorns.

Their leaves are around 6 cm long, with common hawthorn having deeply lobed, toothed leaves (Figure 1a), and midland hawthorn featuring shallower lobes (Figure 2a).

In late spring, around May, hawthorns produce abundant clusters of five-petaled flowers, usually white, though sometimes appear pale pink. Common hawthorn flowers have a single stigma (Figure 1b), while those of midland hawthorn have two (Figure 2b).

By autumn, the flowers mature into bright red berries known as haws. Common hawthorn berries contain a single seed (Figure 1c), whereas midland hawthorn berries usually contain two (Figure 2c).

The two species often hybridise, and the resulting hybrid displays intermediate characteristics. The leaves may have moderately deep lobes, the flowers often have two stigmas (though this can vary), and the fruit may contain either one or two seeds.

Figure 1. Common hawthron (*Crataegus monogyna*) a) leaves, b) flower, c) fruits.

Figure 2. Midland hawthron (*Crataegus laevigata*) a) leaves, b) flower, c) fruits.

Importance

In Britain, hawthorns have long been a key species in traditional hedgerows (Figure 3), forming the backbone of many rural field boundaries. Their tough, thorny growth makes them ideal for hedge laying, creating dense, stock-proof barriers that are highly effective for containing livestock. Hawthorn hedges also help prevent soil erosion and serve as natural windbreaks.

Figure 3. Hawthorn as hedgerow.

Hawthorns also play a vital role in supporting biodiversity. Their dense, thorny branches provide safe nesting sites for many bird species. In spring, the flowers offer nectar and pollen for bees and other pollinators, while in autumn, the bright red fruits are a rich food source for birds and small mammals.

Beyond their ecological importance, hawthorns also hold cultural and medicinal significance. They have been used for centuries in traditional herbal medicine, often associated with heart health, and feature prominently in British folklore and rural heritage.

Hawthorn Diseases & Sampling protocol:
Fireblight

Cause: Bacteria - *Erwinia amylovora*

Distribution: Western Europe (Including the UK), North America, most of the countries around the Mediterranean sea, and New Zealand [See map].

Spread: pruning tools, rain, wind, insects and birds.

Symptoms:

- Brown to black necrotic or burned appearance of leaves, flowers and fruits, but remain attached to the plant (Figure 4 & 5).
- Shoot tips wilt and bend over, forming a hook or “shepherd’s crook” shape (Figure 5).
- When the bark is peeled back, the outer wood and cambium shows a foxy reddish-brown colour (Figure 6).
- Sometimes exudates might appear on the branches (Figure 7).

Figure 4. Leaves and shoot tip wilting from the tip

Figure 5. Shepherd’s crook symptom, with bent shoot tip and brown leaves that remain in the stem.

Figure 6. Feddish-brown inner bark and cambium.

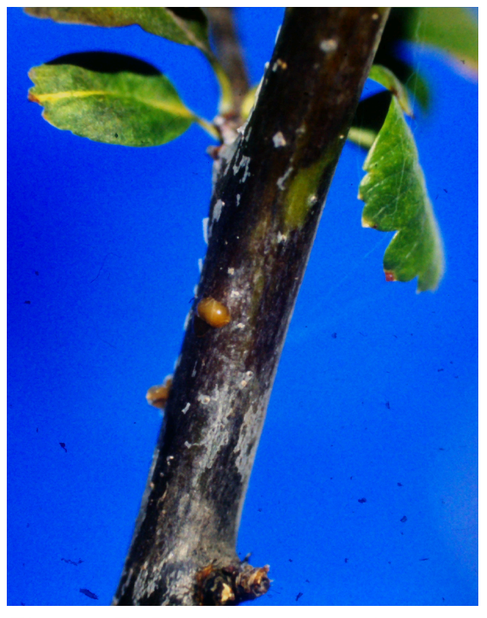

Figure 7. Droplet emerging from an infected stem.

Sampling process:

1 **Take photographs:**
Take photographs of the symptoms as well as the tree or shrub to provide context.

2 **Collect the sample:**
Using a clean cutting tool, cut a shoot approximately 20 cm long. Include both symptomatic (or dead) and healthy living tissue around the lesion edges. Disinfect your tool after each use, especially before sampling another tree.

3 **Package the sample securely:**
Place the shoot in a padded envelope (ideally between two sheets of card) or a small cardboard box with padding to prevent damage during transit. Clearly mark the outer packaging with ‘Hawthorn Project’.
Important! Do not discard infected material elsewhere.

4 **Include Sample Information:**
Include a sheet of paper with the following information (please also photograph this paper). Find a sampling sheet template at the end of the document.

- Your name and contact details (optional)
- Date the sample was collected
- Site name and county
- Location details (postcode, what3words, or grid reference)
- Brief description of the symptoms observed
- Brief description of the tree’s context (e.g., isolated tree, hedgerow, nearby landmarks)

5 **Post your package:**
Address: Brian Carter – (FPPH), Plant/Soil Sample Reception 04G06, Fera Science Ltd, York Biotech Campus, Sand Hutton, York YO41 1LZ

If you require postage costs to be covered, please email Jordan.rydlewski@forestresearch.gov.uk, and we will provide a prepaid postage label for you to print.

6 **Submit Photos and Information via Email:**
Please send your photos of the tree, the surrounding context, and the sample information to Jordan.rydlewski@forestresearch.gov.uk

Hawthorn Diseases & Sampling protocol:
Gymnosporangium rust

Cause: Fungus - *Gymnosporangium* species, such as: *G. clavipes*, *G. globosum*, *G. clavariiforme, G. sabinae, G, confusum.*

Distribution: Present in the UK

Spread: Requires two host plants to complete its life cycle: junipers and rosaceous species. Its spread depends on environmental conditions, host proximity, and spore dispersal.

Symptoms:

- Bright orange-yellow spots on the upper surface of leaves, sometimes with a brown or black dot at the centre (Figure 8).
- Red swollen spots on the leaf (Figure 9).
- Small, pale brown, finger-like structures with hair-like edges (called aecia) grow from swollen areas. They can be found on leaves, fruits, petioles, and shoots (Figure 10).
- Rarely on hawthorn, swelling or galls on the leaves or stems appear (Figure 11).

Figure 8. Bright orange-yellow rust spots on the upper surface of the leaves.

Figure 9. Upper side of leaf with red swollen spot.

Figure 10. Aecia emerging from a, b) leaves, c) fruit.

Figure 11. Gall on twig .

Sampling process:

1 **Take photographs:**
Take photographs of the symptoms as well as the tree or shrub to provide context.

2 **Collect the sample:**
Using a clean cutting tool, cut at the base of the petiole of a minimum of 6 (more if possible):
- Fruits,
- Leaves (both healthy and symptomatic or dead) OR
- Short pieces of twigs with galls

Disinfect your tool after each cut, especially before sampling a different tree.

3 **Package the sample securely:**
Place the tissues in a clean, dry envelope and seal it OR wrap the sample in clean paper with the ends securely fastened. The envelop or paper is important to catch all the spores that are needed for analysis.
Separate tissues types: If multiple types of infected tissues are present on the same tree (e.g. leaves, fruits, twigs), package each type separately. Label your envelopes with a sample number (1,2,3 etc)

Place the envelope or paper with samples into a padded envelope (ideally between two sheets of card). Clearly mark the outer packaging with 'Hawthorn Project'.
Important! Do not discard infected material elsewhere.

4 **Include Sample Information:**
Include a sheet of paper with the following information (please also photograph this paper). Find a sampling sheet template at the end of the document.
- Your name and contact details (optional)
- Number of samples (for multiple samples from the same plant)
- Date the sample was collected
- Site name and county
- Location details (postcode, what3words, or grid reference)
- Brief description of the symptoms observed
- Brief description of the tree's context (e.g., isolated tree, hedgerow, nearby landmarks)

5 **Post your package:**
Address: Debra Frederickson Matika, Northern Research Station, Roslin, Midlothian EH25 9SY

If you require postage costs to be covered, please email Jordan.rydlewski@forestresearch.gov.uk, and we will provide a prepaid postage label for you to print.

6 **Submit Photos and Information via Email:**
Please send your photos of the tree and the sample information to Jordan.rydlewski@forestresearch.gov.uk

Hawthorn Diseases & Sampling protocol:
Viruses

Cause: Apple necrotic mosaic virus (ApNMV), Apple mosaic virus (ApMV), Apple stem pitting virus (ASPV)

Distribution: Some virus have been detected in the UK affecting other hosts.

Spread: By vegegative propagation such as grafting.

Symptoms:

- Leaf yellowing in mosaic pattern, line patterns (Figure 12a, b).
- Ring-like markings (Figure 12c)
- Pale yellow to bright cream-colored irregular spots (Figure 12d, f, g).
- General chlorosis (Figure 12e).
- No visible disease symptoms (Figure 12h).

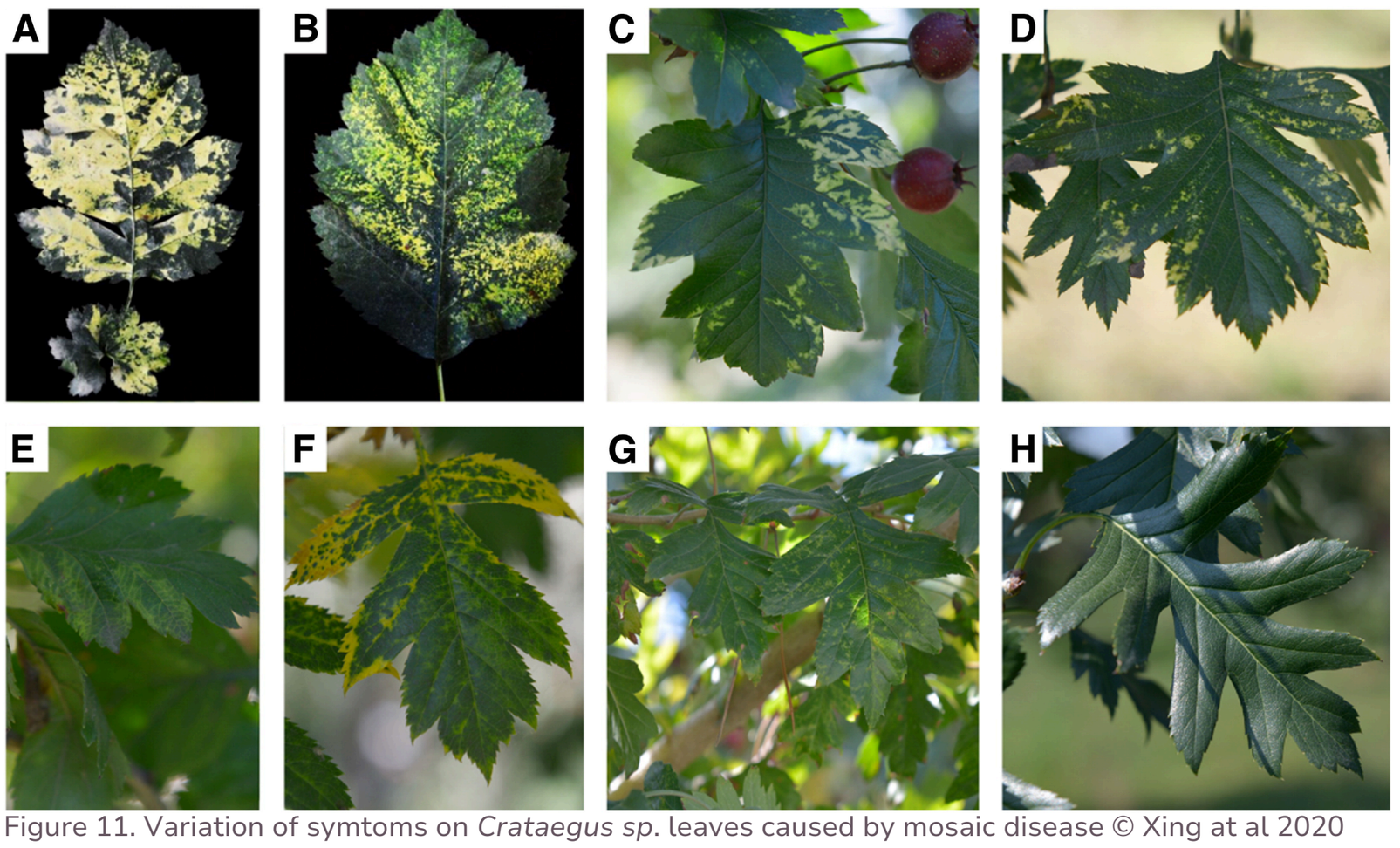

Figure 11. Variation of symtoms on *Crataegus sp*. leaves caused by mosaic disease © Xing at al 2020

Sampling process:

1 **Take photographs:**
Take photographs of the symptoms as well as the tree or shrub to provide context.

2 **Record GPS Location:**
Take a 10-figure GPS reading at the site of the affected tree or shrub.

3 **Collect Leaf Samples:**
Remove between 5 to 10 leaves per tree which have the suspected symptoms.
These can be collected from different branches if symptoms are widespread.
Collect a mixture of some younger leaves and some older leaves if symptoms extend to both.

4 **Prepare Leaves for Posting:**
Place the leaves between dry absorbent paper (e.g. kitchen roll), seal in a plastic bag and store in a refrigerator prior to posting.
Important: Do not collect leaves when they are wet, they will rot during transit.

5 **Label the bag:**
On each bag, write clearly:

- Your name
- The 10-figure GPS reference
- “Tree virus survey 2025 (Hawthorn survey)”
- The date of sampling

6 **Post your package:**
Address: Aimee Fowkes, Fera Science Ltd, York Biotech Campus, Sand Hutton, York YO41 1LZ.

7 **Submit Photos and Information via Email:**
Email any photos to aimee.fowkes@fera.co.uk and lisa.ward@forestresearch.gov.uk with the email subject Tree virus survey 2025 (Hawthorn survey).
Please also include your name, the GPS reference, the date and the words sample collected.

Appendix:
Samplinng sheet template

Collector name (optional):	
Collector email (optional):	
Date of collection (DD/MM/YY):	
Number of samples (in case different tissue types from same plant were collected)	
Site name, County:	
Grid reference, what.3.words or postscode:	
Observed symptoms:	
Tree context:	

Thank you for your participation!

For any questions, please contact:

Forest Research:
Jordan.rydlewski@forestresearch.gov.uk

FERA:
aimee.fowkes@fera.co.uk
lisa.ward@forestresearch.gov.uk

International Plant Sentinel Network (IPSN):
lara.salido@bgci.org
itxaso.quintana@bgci.org