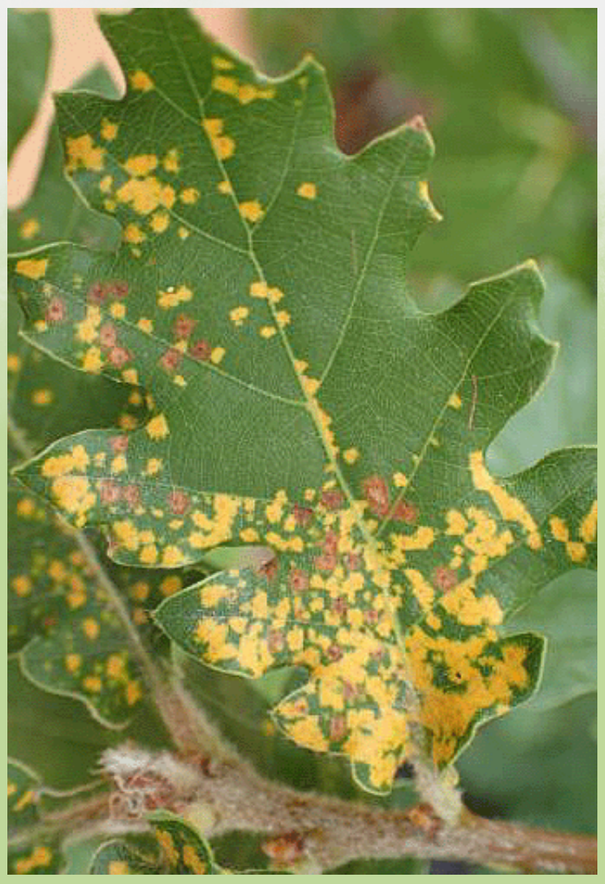
Holm oak (*Quercus ilex*) Monitoring Protocol



IPSN International Plant Sentinel Network

BOTANIC GARDENS CONSERVATION INTERNATIONAL

fera

Contents:

www.fulhampalace.org

Monitoring survey

Fera and the International Plant Sentinel Network (a technical initiative of Botanic Gardens Conservation International) are collaborating on one-year Defra-funded project to investigate the spread and distribution of key holm oak pest species in the UK.

As part of this research, we are looking to carry out monitoring of specimens of this species in live plant collections on Botanic Gardens and Arboreta in the UK to determine a baseline of the presence and spread of particular pest species of holm oak in the UK. Specifically, we are looking for:

- **Holm oak bark scale** (*Nidularia pulvinata*): A scale insect that feeds on sap of holm oak trees. Though not widespread, in the UK, outbreaks can be lethal to stressed trees, particularly in urban areas.
- **Holm oak gall midge** (*Dryomyia lichtenstenii*): A small gall midge whose larvae induce distinctive galls on the leaves of evergreen oak trees. they can weaken the host tree health by altering nutrient distribution through sap sucking, potentially leading to stress that makes host plants more susceptible to other diseases.
- **Holm oak Phylloxera** (*Phylloxera quercus* group): Aphid-like, sap-sucking insects that feed mainly on holm oaks and in severe cases, heavy infestations can lead to general decline in the tree's vigour, especially in the case of young or stressed trees.

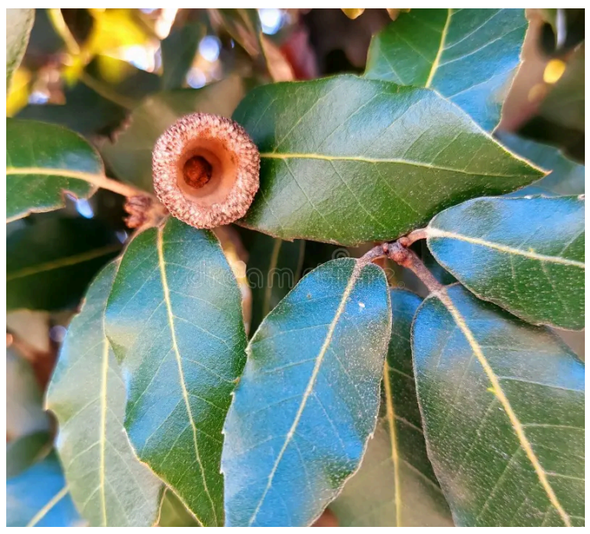
🗓️ Monitoring timeframe: July 2025 - February 2026

If you are interested in contributing to this important tree health research, please use the instructions provided to run the surveys and submit your data.

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

📧 lara.salido@bgci.org / itxaso.quintana@bgci.org

📧 chris.malumphy@fera.co.uk



Holm oak: An Overview

Identification & Characteristics

The holm oak (*Quercus ilex*), also known as holly oak, is an evergreen broadleaf tree native to the Mediterranean but widely planted in the UK since its introduction in the late 1500s.

Mature trees can reach heights of 20-28m and develop a large, rounded crown with dense foliage (Figure 1a). The bark is black and finely cracked (Figure 1b), while young twigs are slender and covered with light brown, felt like hairs (Figure 1c).

Figure 1. Holm oak (*Quercus ilex) a)* tree, *b)* bark, *c)* twig.

Leaves are distinctive: dark green, glossy and leathery on the upper surface, with a paler, downy underside (Figure 2a). Unlike UK native oaks, holm oak leaves lack lobes; instead, they are oval, often with holly-like toothed edges (Figure 2b), especially on young leaves. Leaf size varies, but they are generally small and tough. Holm oaks produce acorns (Figure 2c), which are elongated and mature in autumn. The tree is easily identified in winter by its evergreen canopy, which persists year-round.

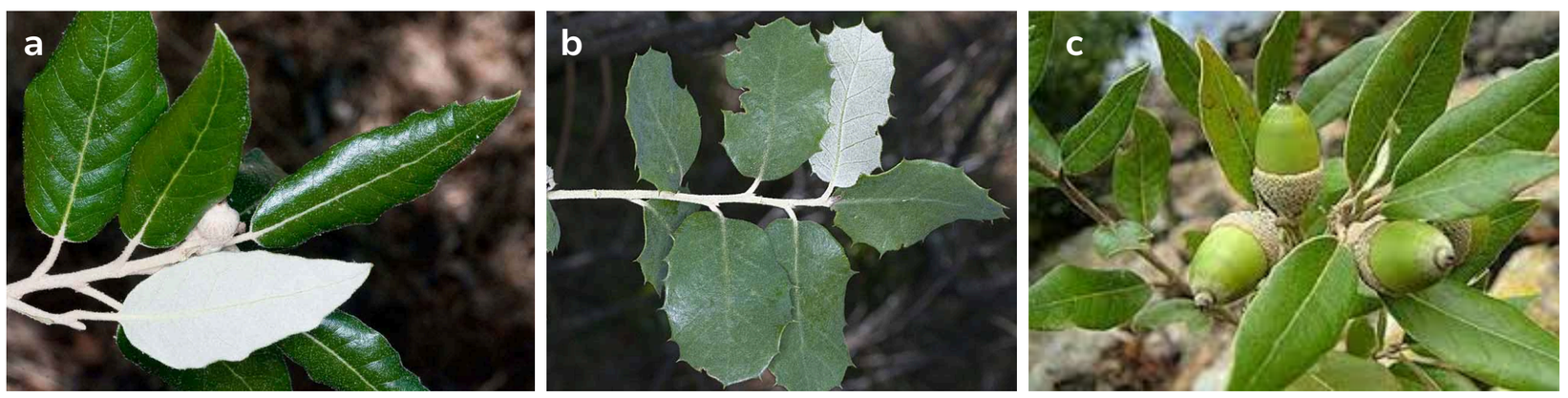


Figure 2. Holm oak (*Quercus ilex*) a) mature leaves, b) young leaves, c) acorns.

The tree's adaptability allows it to thrive in various forms - standard trees, multi-stemmed, clipped shapes or as hedges (Figure 3).

Figure 3. Holm oak (*Quercus ilex*) a) standard tree, b) multi-stemmed tree, c) clipped cylinder shaped, d) hedge.

Importance

The holm oak is highly valued as an ornamental tree, particularly in urban and coastal settings. Its evergreen foliage brings year-round structure and colour to parks, streetscapes, and gardens, making it a long-standing favourite for stately homes and public spaces. The dense canopy provides excellent shade, while a deep root system contributes to strong drought resistance.

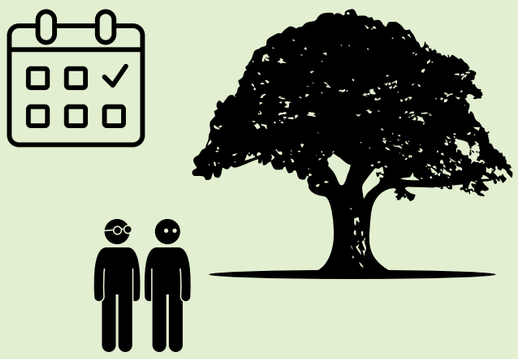
Well adapted to salt spray, air pollution, and a variety of well-drained soils, holm oak is especially suited to challenging environments. Its resilience, combined with its evergreen character, makes it an important species for strengthening urban green infrastructure and supporting climate-adaptive cities in the UK.

However, recent research has identified concerning decline trends across holm oak populations in Europe, including the UK. These are largely attributed to climate change, which weakens trees and increases their vulnerability to secondary threats such as pests and diseases. Hence the importance of establishing effective monitoring systems to track population health and identify emerging threats to ensure the continued vitality and resilience of this valuable species.

Key monitoring details

Purpose: To monitor holm oak trees for signs of pest infestation, helping establish a baseline for presence and enabling early detection and management. This supports the protection of tree health and overall biodiversity.

By following this protocol, staff will help safeguard the health of holm oak trees in their living collections, as regular monitoring is key to early pest detection and effective collection management.



1

When to survey?

The three pests, or symptoms of the pests, may be detected throughout most of the year.

However, the best survey periods would be:

- Spring (Apr-Jun): New leaves emerge, coinciding with the peak activity for many of the pests.
- Summer (Jul-Aug): Holm oak gall midge and Phylloxera are most conspicuous at this time.
- Autumn (Sep-Oct): Before leaf fall, to detect late-season pests.

Frequency:

- Conduct monitoring at least once per season during the periods listed above.
- Increase survey frequency if pests or their symptoms are detected.

2

How many and which trees to survey?

Select a representative sample of holm oak trees across the collection.

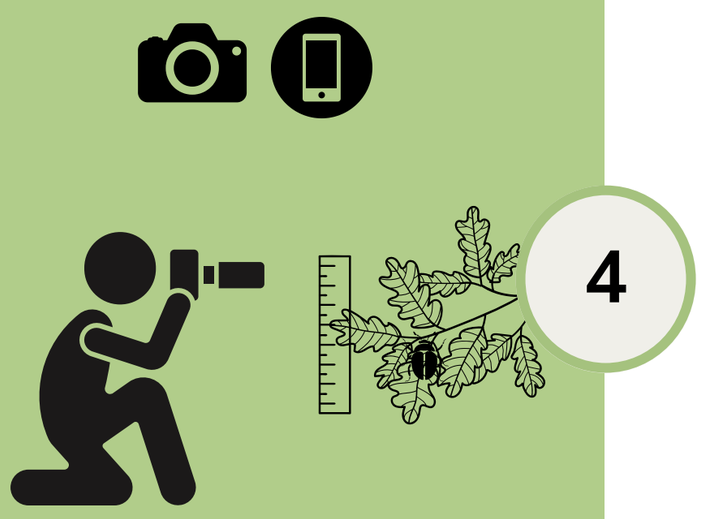
- Include trees of different ages and locations (e.g. shaded vs exposed).
- Prioritize old or visible stressed trees as they may be more vulnerable.

3

Visual Inspection

Carefully examine the following parts of each tree for signs of key symptoms (refer to the following pages for details on each target organism):

- Leaves (inspect both the upper and underside)
- Bark
- Twigs and branches
- Crown (assess overall health, for signs of dieback)



4

Diagnostic Pictures

Use a smartphone or digital camera with good resolution. Aim to document both the symptoms and their context for accurate diagnosis.

Take a CLEAR, CLOSE-UP picture of:

- The pest or insect, if visible
- Symptoms of damage (e.g. galls, defoliation, exit holes...)
- The entire affected part (e.g. full leaf, twig, or tree crown)

Tips for Effective Photos:

- Include a scale reference (e.g. ruler or coin) when possible
- Take multiple angles of the same symptom to aid diagnosis

5

Data Recording

Use the survey forms provided in the Annex to collect monitoring data.

Ensure to include the following:

- Tree ID/ location to be able to do any required follow-ups.
- Date of survey, weather conditions and any signs of pest presence or damage.

6

Who to contact?

If you find ANY SUSPECT pest or unusual symptoms, immediately:

- Notify the Botanic Garden/Arboretum Plant Health Officer or the designated pest monitoring coordinator.
- Email photos and/or key observations to the project coordinators for further assessment: lara.salido@bgci.org or itxaso.quintana@bgci.org.

These reports will be forwarded to the technical team for accurate identification and diagnosis.

Target organism:
Holm oak bark scale

Scientific name: - *Nidularia pulvinata*

Distribution: Mainly found in the Mediterranean region (France, Italy, Spain, Portugal, Turkey and Algeria) [See map]. It has recently been found in one location in southern England.

Impact: Infestations weaken trees by draining sap, causing stress and increasing susceptibility to other diseases. Damage appears to be mainly restricted to trees growing in urban environments, where they are likely to be stressed by other abiotic and biotic factors

Symptoms:

- Presence of adult female scales with white ovisacs in the cracks of the truck and stems (Figure 4 a&b).
- Wilting, yellowing or drooping leaves and branch dieback (Figure 5).
- Abnormal swellings (galls) on the apical stems (Figure 6).
- Reduce growth.
- Occasional death of infested trees.

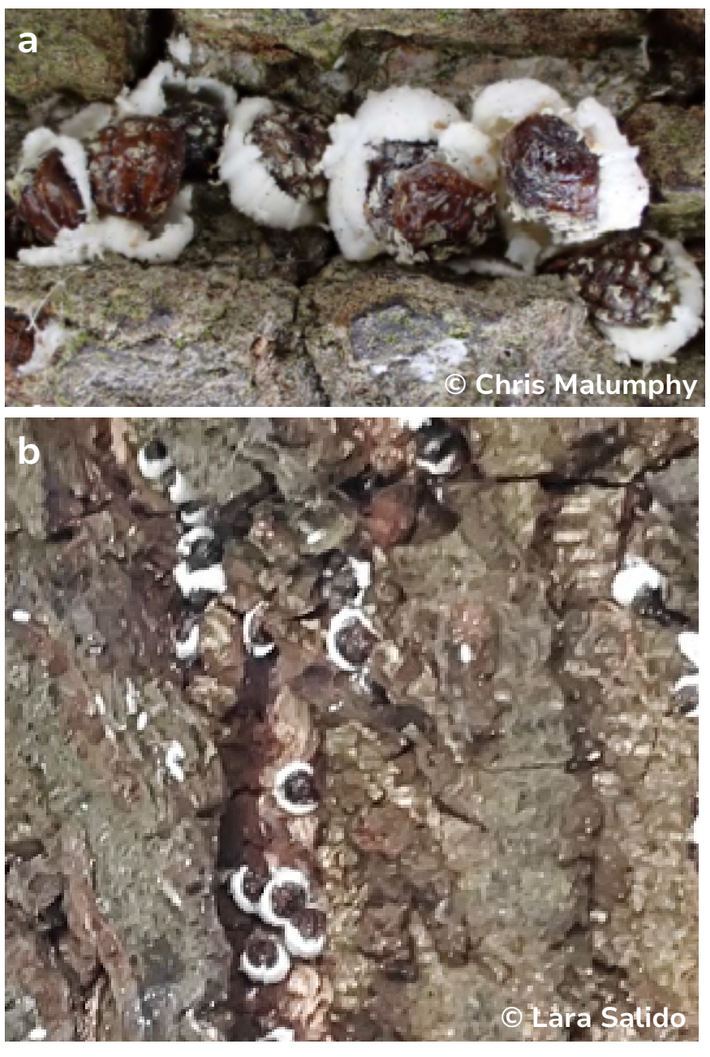


Figure 4. a,b) Adult females *Nidularia pulvinata* in *Q. ilex* truck crevices.

Figure 5. Branch dieback and flagging on *Q. ilex* due to *Nidularia pulvinata* infestation.

Figure 6. Galling of apical stems.

Target organism:

Holm oak gall midge

Scientific name: *Dryomyia lichtenstenii*

Distribution: Primarily distributed across the Mediterranean Europe (France, Italy, Spain, Portugal) and North Africa (Morocco, Turkey, Algeria), with recent records in southern UK (2022).

Impact: Infestations disrupt nutrient flow by inducing gall formation, , stressing the tree and making it more vulnerable to the attack of diseases and pathogens.

Symptoms:

- Distinctive galls emerging from the leaf surface. These are fleshy, hairy structures often displaying a reddish or yellowish hue (Figure 7 a&b).
- Distortion of affected plant parts/stunted grow (Figure 8).

Figure 7. Galls on *Q. ilex* a) upperside and b) underside on the leaves.

Figure 8. Leave galling and distorted growth on stems of *Q. ilex.*

Target organism:
Holm oak Phylloxera

Scientific name: *Phylloxera quercus group*

Distribution: Mainly found in southern Europe (Italy, Spain, France), North Africa (Algeria), and the Middle East (Iraq).

Impact: Heavy infestation can lead to general decline in the tree's vigour, especially in the case of young or stressed trees. The related species oak leaf phylloxera (*P. glabra*) causes similar symptoms on English oak (*Q. robur*)

Symptoms:

- Small, yellowish or reddish spots on the leaf surface around the feeding zone (Fig. 9a&b), that causes leaf discoloration.
- Tiny (<1mm) orange-yellow aphids (Fig. 10a) and nymphs (Fig. 10b) on leaf underside.
- Premature leaf drop and stunted growth (Fig 11).

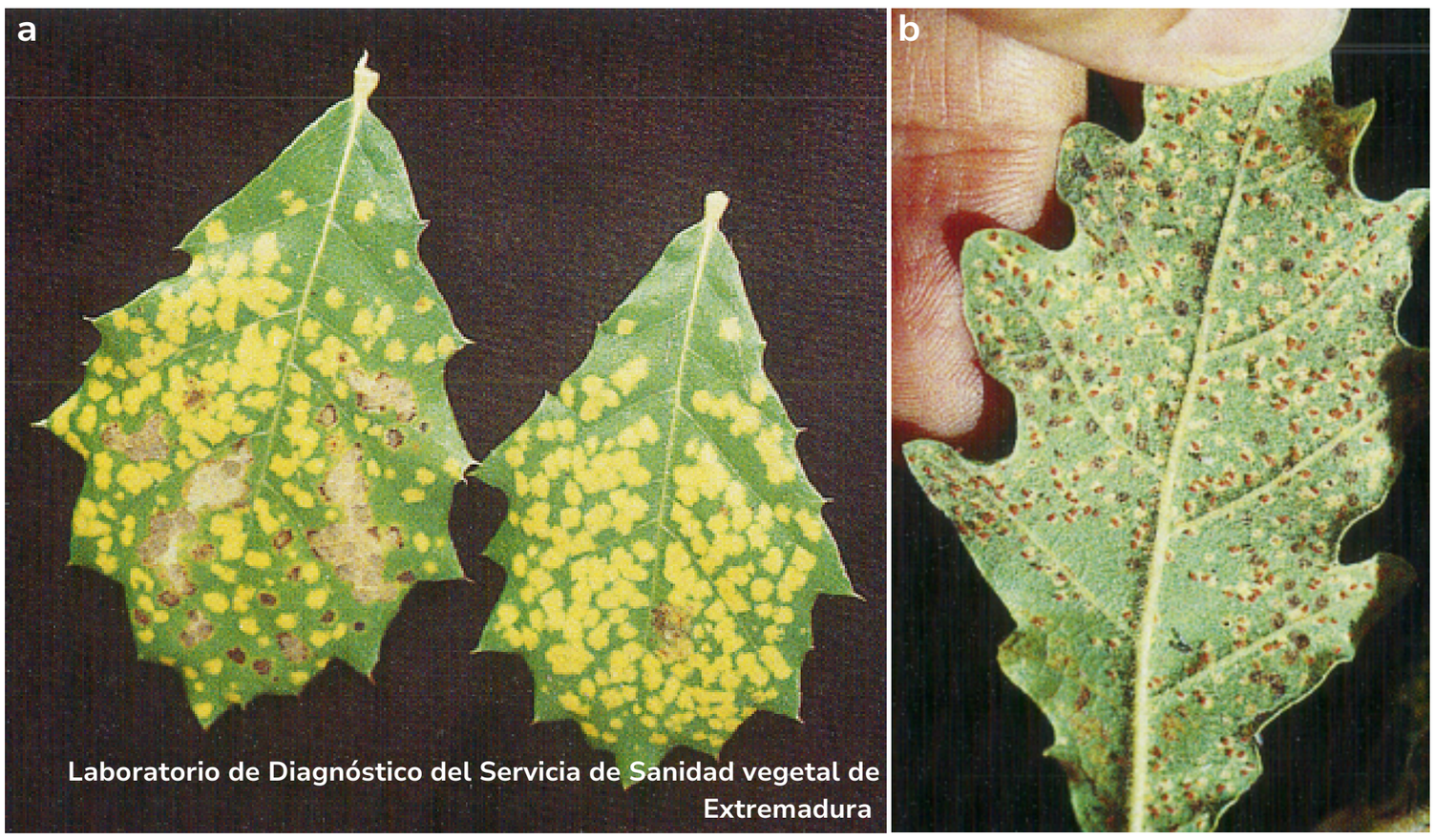


Figure 9. Yellow and brown spots on the a) upper surface and b) underside of *Q. ilex* leaves. .

Figure 11. . Stunted growth on *Q. ilex.*

Figure 10. . Presence of a) aphids and b) nymphs of *Phylloxera quercus.*

Appendix:
Other information support resources

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For more information on the described organism, scan or click on the QR code to access the accompanying factsheets.

Holm oak (*Quercus ilex*) pests

The Holm oak (*Quercus ilex*) is a hardy evergreen tree native to the Mediterranean, growing 20-25 meters tall. Its leaves vary in shape, with a dark green upper surface and a greyish, downy underside, becoming smooth-edged as they mature. The dark grey bark develops fissures over time.

Highly drought-resistant and long-lived, often surviving for centuries, the Holm oak is prized for its ornamental value and ability to thrive in coastal climates and urban environments, though it requires careful management to flourish.

Holm oak bark scale (*Nidularia pulvinata*)

Background

The Holm oak bark scale is a scale insect that feeds on sap from evergreen oak trees (*Quercus* spp.), particularly Holm oak.

Mainly found in the Mediterranean region (France, Italy, Spain, Portugal, Turkey, and Algeria). It has recently been found in one location in southern UK.

Infestations weaken trees by draining sap, causing stress and increasing susceptibility to other diseases. Damage appears to be mainly restricted to trees growing in urban environments, where they are likely to be stressed by other abiotic and biotic factors.

Symptoms

- Presence of adult female scales with white ovisacs in the crack of the trunk and stem (Fig. 1 a&b).
- Abnormal swellings (galls) on the apical stems (Fig. 2).
- Wilting, yellowing or drooping leaves and branch dieback (Fig. 3).
- Reduced growth.
- Occasional death of infested trees.

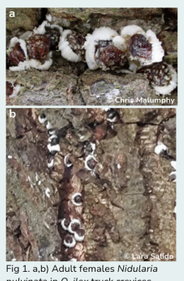

Fig 1. a,b) Adult females *Nidularia pulvinata* in *Q. ilex* truck crevices.

Fig 3. Branch dieback and flagging on *Q. ilex* due to *Nidularia pulvinata* infestation.

Fig 2. Galling of apical stems.

Holm oak gall midge (*Dryomyia lichtenstenii*)

Background

The Holm oak gall midge is a small fly whose larvae induce distinctive galls on the leaves of some evergreen oaks (*Quercus* spp.).

Primarily distributed across the Mediterranean Europe (France, Italy, Spain, Portugal) and North Africa (Morocco, Turkey, Algeria), with recent records in southern UK (2022).

Infestations disrupt nutrient flow by inducing gall formation, , stressing the tree and making it more vulnerable to the attack of diseases and pathogens.

Symptoms

- Distinctive galls emerging from the leaf surface. These are fleshy, hairy structures often displaying a reddish or yellowish hue (Fig. 1 a&b).
- Distortion of affected plant parts/stunted growth (Fig. 2).

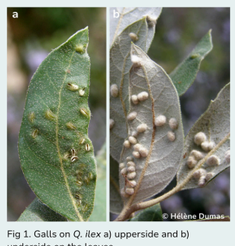

Fig 1. Galls on *Q. ilex* a) upperside and b) underside on the leaves.

Fig 2. Leave galling and distorted stems on *Q. ilex*.

Holm oak Phylloxera (*Phylloxera quercus*)

Background

The Holm oak Phylloxera is an aphid-like, sap-sucking insect, that feeds on the leaves of holm oak and other oak trees (*Quercus* spp.).

The insect is found in southern Europe (Italy, Spain, France), North Africa (Algeria), and the Middle East (Iraq).

These insects feed on the leaves. Heavy infestation can lead to general decline in the tree's vigour, especially in the case of young or stressed trees. The related species oak leaf phylloxera (*P. glabra*) causes similar symptoms on English oak (*Q. robur*)

Symptoms

- Tiny (<1mm) orange-yellow aphids (Fig. 1a) and nymphs (Fig. 1b) on leaf underside.
- Small, yellowish or reddish spots on the leaf surface around the feeding zone (Fig. 2a&b), that causes leaf discoloration.
- Premature leaf drop and stunted growth (Fig 3).

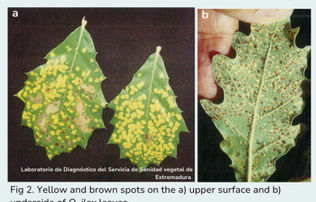

Fig 2. Yellow and brown spots on the a) upper surface and b) underside of *Q. ilex* leaves.

Fig 1. Presence of a) aphids and b) nymphs of *P. quercus*.

Fig 3. Stunted growth on *Q. ilex*.

Latest edition: March 2025

Click or scan the QR code to access **Holm oak pests poster**:


IPSN FACTSHEETS

Holm oak (*Quercus ilex*) pests

Holm oak bark scale
(Nidularia pulvinata)

Introduction

The Holm oak bark scale (*Nidularia pulvinata*) is a scale insect that feeds on sap of oak trees. Although not widespread, outbreaks can be lethal to stressed trees, particularly in urban areas.

The insect is currently distributed in the Mediterranean region (France, Italy, Spain, Portugal, Turkey and Algeria) and has recently been reported at one location in southern UK.

Infestations by the Holm oak bark scale weaken the host tree by sucking sap, potentially leading to stress that makes host plants more susceptible to other pests and diseases.

Host

The main host is the holm oak (*Quercus ilex*) , and it has also been found on Kermes oak (*Q. coccifera*) and Mount Tabor oak (*Q. ithaburensis*). It does not feed on English oak (*Q. robur*) or sessile oak (*Q. petraea*).

Biology

The life cycle of the Holm oak bark scale, follows a typical pattern seen in many scale insects. It begins with eggs laid by sessile adult females, usually in a protective wax structure called an ovisac. Upon hatching, the mobile crawlers disperse across the host plant or to neighbouring plants. Once settled, they feed on the phloem.

Adult males undergo a pupal stage before emerging as short-lived, winged adults focused on mating. The wingless mated adult females overwinter. They are yellowish brown before turning dark reddish brown, convex and oval with maturity. This species generally completes one generation per year, synchronized with the host plant's growth and environmental cues, ensuring optimal exploitation of nutritional resources.

Feeding by the insect can cause branch dieback, flagging, reduce growth rates and occasional death of trees.

Symptoms

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

More information

- Scalenet: http://scalenet.info/catalogue/Nidularia%20pulvinata/
- UK Plant Health Risk Register: https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/viewPestRisks.cfm?cslref=54375

Acknowledgements
This factsheet was written by Lara Saltido (BSCI) and Chris Malumphy (Fera Ltd). Edited and produced by IPSN, March 2025.


IPSN FACTSHEETS

Holm oak gall midge
(Dryomyia lichtenstenii)

Introduction

The Holm oak gall midge (*Dryomyia lichtenstenii*), is a gall midge from the family Cecidomyiidae, a small fly whose larvae induce distinctive galls on the leaves of evergreen oak trees (*Quercus* spp.).

The insect is currently distributed in the Mediterranean region (France, Italy, Spain, Portugal) and North African region (Morocco, Turkey and Algeria) and has been recently recorded in the south of the UK (2022).

Infestations by the Holm oak gall midge can weaken the host tree health by altering nutrient distribution through sap sucking, potentially leading to stress that makes host plants more susceptible to other diseases and creating entry points for pathogens.

Host

It only develops on three species of evergreen oak: Holm oak (*Quercus ilex*), Ballota oak (*Q. rotundifolia*), and Cork oak (*Q. suber*). It does not develop on English oak (*Q. robur*) or sessile oak (*Q. petraea*).

Biology

The Holm oak gall midge life cycle begins when adult midges lay eggs on a suitable host. After hatching, the larvae induce the formation of small galls (about 3x2 mm) on the leaves, which provide both protection and nutrients.

Unlike scale insects that directly feed on plant sap, *Dryomyia lichtensteinii* manipulates plant tissues to create these specialized growths. These are usually several galls per leaf and each gall contains a single larva.

The larvae feed, develop and pupate inside the galls, before emerging as adult midges. They complete one generation per year. The cycle then repeats as new adults lay eggs on suitable host plants.

This process is closely tied to the holm oak's growth and environmental conditions, ensuring optimal survival and reproduction.

Symptoms

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

More information

- British Journal of Entomology & natural History: https://www.researchgate.net/publication/343697775_Dryomyia_lichtensteinii_Diptera_Cecidomyiidae_a_bud_in_oak_gall_midge_new_to_the_British_Isles
- Plant Parasites of Europe: https://bladmineerders.nl/parasites/animalia/arthropoda/insecta/diptera/nematocera/cecidomyiidae/cecidomyiinae/lasiopteridi/dasineurini/dryomyia/dryomyia-lichtensteinii/

Acknowledgements
This factsheet was written by Lara Saltido (BSCI) and Chris Malumphy (Fera Ltd). Edited and produced by IPSN, March 2025.


IPSN FACTSHEETS

Holm oak Phylloxera
(Phylloxera quercus)

Introduction

The Holm oak Phylloxera (*Phylloxera quercus*), is an insect in the Phylloxeridae family. There are several closely related species in Europe and their taxonomy has not been fully resolved. They are aphid-like, sap-sucking insects that feed mainly on oaks.

Phylloxera quercus is primarily found in southern Europe (Italy, Spain, France), North Africa (Algeria) and the Middle East (Iraq). It has been intercepted in England on several occasions on holm oak trees imported from the Mediterranean, but there is uncertainty regarding whether it is present or not in the UK.

They feed on the leaves of oak trees and in severe cases, heavy infestation can lead to general decline in the tree's vigour, especially in the case of young or stressed trees.

Host

Holm oak (*Quercus ilex*) is the main host for *P. quercus*. Other recorded hosts are: English oak (*Q. robur*), Kermes oak (*Q. coccifera*), Downy oak (*Q. pubescens*) and Pyrenean oak (*Q. pyrenaica*). In Britain, the oak leaf phylloxera, *P. glabra*, is common on English oak (*Q. robur*), but this species does not occur on holm oak.

Biology

The Holm oak Phylloxera has a complex life cycle involving sexual and asexual (parthenogenetic) generations and winged and wingless adults. The life cycle typically begins with eggs that overwinter in bark crevices or other sheltered areas of the host plant.

As spring arrives and the leaves emerge, the eggs hatch into nymphs that migrate to the foliage, where they begin feeding on the underside of the leaves. This feeding activity causes visible damage, such as yellowish necrotic spots or bronzing of the leaf surface. Asexual reproduction enables rapid population growth during the growing season.

The insects undergo multiple generations throughout the warmer months, with the final generation returning to the bark or other protected areas to lay overwintering eggs. This cycle ensures their survival and continued infestation of host plants year after year.

Symptoms

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

More information

- UK Plant Health Register: https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/downloadPlanterraPra.cfm?id=1966
- EPPO Global Database: https://gd.eppo.int/taxon/PHYXQU
- Plant Parasites of Europe: https://bladmineerders.nl/parasites/animalia/arthropoda/insecta/hemiptera/sternorrhyncha/phylloxeridae/phylloxerinae/phylloxera/phylloxera-quercus/

Acknowledgements
This factsheet was written by Lara Saltido (BSCI) and Chris Malumphy (Fera Ltd). Edited and produced by IPSN, March 2025.

Click or scan the QR code to access **Holm oak pests factsheets:**

Appendix:
Survey form

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PESTS of Holm oak

The IPSN is carrying out a survey of Holm oak (*Quercus ilex*) in UK botanic gardens in order to gain a better understanding of the impact of three pests, which are known to impact this oak species both in Europe and potentially in the UK. We would be most grateful if you could survey the holm oak trees in your collection using this survey form. Please use one form per tree and refer to the accompanying protocol, poster and factsheet for further pest identification help.

Pest 1: The Holm oak bark scale is a scale insect that feeds on sap from evergreen oak trees (Quercus spp.), particularly Holm oak. Mainly found in the Mediterranean region (France, Italy, Spain, Portugal, Turkey, and Algeria). It has recently been found in one location in southern UK. Infestations weaken trees by draining sap, causing stress and increasing susceptibility to other diseases. Damage appears to be mainly restricted to trees growing in urban environments, where they are likely to be stressed by other abiotic and biotic factors.

Pest 2: The Holm oak gall midge is a small fly whose larvae induce distinctive galls on the leaves of some evergreen oaks (Quercus spp.). Primarily distributed across the Mediterranean Europe (France, Italy, Spain, Portugal) and North Africa (Morocco, Turkey, Algeria), with recent records in southern UK (2022). Infestations disrupt nutrient flow by inducing gall formation, , stressing the tree and making it more vulnerable to the attack of diseases and pathogens.

Pest 2: The Holm oak Phylloxera is an aphid-like, sap-sucking insect, that feeds on the leaves of holm oak and other oak trees (Quercus spp.). The insect is found in southern Europe (Italy, Spain, France), North Africa (Algeria), and the Middle East (Iraq). These insects feed on the leaves. Heavy infestation can lead to general decline in the tree's vigour, especially in the case of young or stressed trees. The related species oak leaf phylloxera (P. glabra) causes similar symptoms on English oak (Q. robur)

Survey Details	
Name of Botanic Garden / Arboretum:	
Country: Address:	
Survey carried out by:	
Date of survey:	
Best description of season:	

Tree Details	
Species (cultivar)	
Accession number:	
GPS (if available)	
Country/region species is native to:	
Age (years):	

General Description of Health			
Generally healthy	√	Some damage	√
Dying	√	Dead	√

Any recent changes in health or overall look:

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PESTS of Holm oak

Symptoms Check Holm oak bark scale	**Symptom observed?** If possible please rate the severity of the symptoms from 1-6; 1= No visible symptoms and 6= severe symptoms	**Symptoms Check Holm oak gall midge**	**Symptom observed?** If possible please rate the severity of the symptoms from 1-6; 1= No visible symptoms and 6= severe symptoms	**Symptoms Check Holm oak Phylloxera**	**Symptom observed?** If possible please rate the severity of the symptoms from 1-6; 1= No visible symptoms and 6= severe symptoms
Symptom 1: Presence of adult female scales with white ovisacs in the cracks of the trunk and stems.		**Symptom 1:** Distinctive galls emerging from the leaf surface. These are fleshy, hairy structures often displaying a reddish or yellowish hue.		**Symptom 1:** Small, yellowish or reddish spots on the leaf surface around the feeding zone that cause leaf discoloration.	
Symptom 2: Abnormal swellings (galls) on the apical stems		**Symptom 2:** Distortion of affected plant parts/stunted growth.		**Symptom 2:** Tiny (<1mm) orange-yellow aphids and nymphs on leaf underside.	
Symptom 3: Wilting, yellowing or drooping leaves and branch dieback				**Symptom 3:** Premature leaf drop and stunted growth.	
Symptom 4: Reduce growth					
Symptom 5: Tree mortality					
Do you think this tree is infested with holm oak bark scale?	Yes/No	**Do you think this tree is infested with holm oak gall midge?**	Yes/No	**Do you think this tree is infested with Holm oak Phylloxera?**	Yes/No

Notes:

Thank you for your participation!

For any questions, please contact:

FERA:
Chris.malumphy@fera.co.uk

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