

FOREST Pest LEAFLET

Pacific Forestry Centre

Oak Leaf Phylloxera

By R.W. Duncan

Introduction

The oak leaf phylloxera, *Phylloxera glabra* (Heyden), is a small yellow-to-orange aphid-like insect (Fig. 1) that causes chronic mid-summer scorching, defoliation, and ultimately death of severely affected Garry oak, *Quercus garryana* Douglas. This European insect was first discovered in British Columbia at Victoria in 1961 and by 1974 severe scorching and defoliation of area oaks was observed for the first time. The oak leaf phylloxera now occurs in the Okanagan Valley and throughout most of south coastal British Columbia.

A second less common species of oak leaf phylloxera, *Phylloxera* sp. also occurs on Garry oak. It is similar in appearance to *Phylloxera glabra* but prefers feeding sites adjacent to the major veins in contrast to the more randomly distributed feeding sites of *Phylloxera glabra*. Although this veinal feeding species causes little damage to Garry oak in natural settings it has become a serious pest of Garry oak in nursery culture.

Hosts

Although Garry oak is the most common host in British Columbia, numerous exotic species of white oaks planted as ornamentals are also

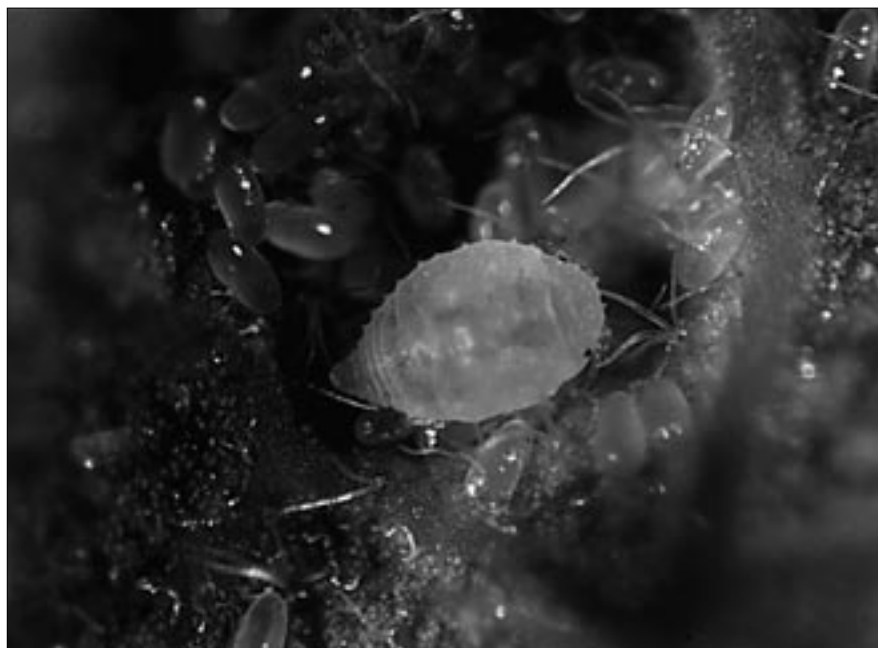


Fig. 1. *Phylloxera glabra* adult and eggs on Garry oak leaf.

attacked by the oak leaf phylloxera. Non-native species attacked include: English oak, *Quercus robur* L.; Oriental white oak, *Quercus aliena* Bl.; bur oak, *Quercus macrocarpa* Michx.; valley oak, *Quercus lobata* Nee; and blue oak, *Quercus douglasii* Hook and Arn.

The veinal feeding oak leaf phylloxera occurs on Garry, valley and blue oaks.

Distribution

The oak leaf phylloxera is native to northwestern Europe including the United Kingdom, France and Germany. It has been recently introduced to New Zealand. In North America, it is only known to occur in Washington and British Columbia. The confirmed distribution of the oak leaf phylloxera in British Columbia includes all of southeast Vancouver Island, the Gulf Islands, the lower Fraser Valley and the Okanagan



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Valley. The oak leaf phylloxera is readily transported on nursery stock and likely now occurs in all areas of the province where English oak is grown as an ornamental.

The veinal feeding oak leaf phylloxera occurs from California to British Columbia.

Description

Egg: Elongate oval, orange in colour, 0.3 mm long.

Nymph: Yellow, pyriform similar to adult.

Adult: Orange-yellow, pyriform, 1.5 mm.

Life history and habits

The oak leaf phylloxera has a complex life cycle that includes both asexual (parthenogenetic) and sexual forms. It overwinters as eggs laid in bark crevices on twigs (Fig. 2) or as first instar nymphs in sheltered locations on the branches. During bud break and shoot elongation, first instar nymphs of the first (fundatrix) generation migrate onto the newly unfolding leaves (Fig. 3). Fundatrix adults (stem mothers) feed near the margin of the leaf causing the leaf margin to fold under (Fig. 4), or at other locations on the lower surface of the leaf. The stem mother lays her eggs near the feeding site during May. Upon hatching, first instar nymphs of the second (virginoparae) generation disperse on the underside of the leaf and begin to feed (Fig. 5). A chlorotic yellow spot develops at each feeding



Fig. 2. Overwintering eggs in bark crevice.



Fig. 3. First instar fundatrix nymphs on new flush.



Fig. 4. Stem mother adjacent marginal leaf fold and nearby eggs.

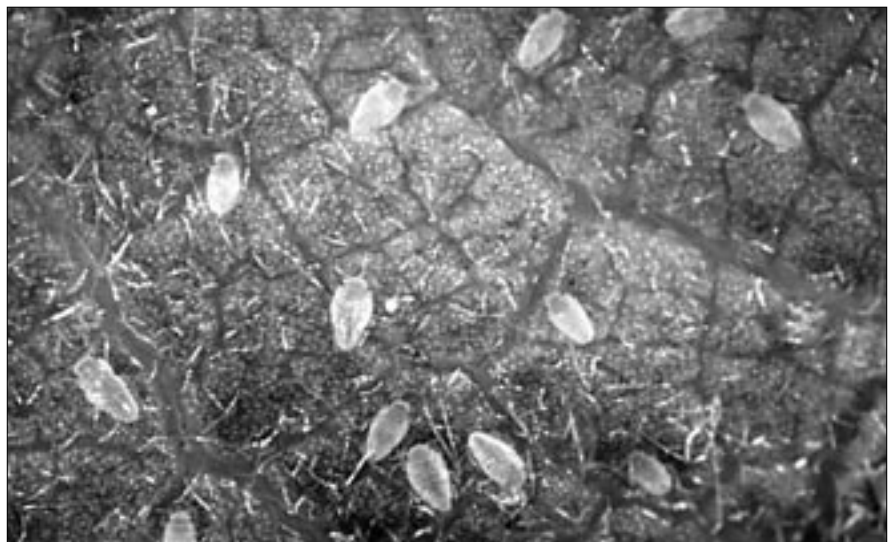


Fig. 5. Settled, first instar nymphs of the virginoparae generation.

site. The mature virginoparae female lays eggs in late June that give rise to the sexuparae generation. On Garry oak, eggs are laid individually (Fig. 6); on English oak they are laid in concentric circles (Fig. 7). The small hairs (trichomes) on the lower surface of a Garry oak leaf prevents the female from ovipositing in concentric circles there. Adults of the winged (sexuparae) generation appear in late July (Fig. 8). At this time population densities are very high and damage is highly visible (Fig. 9). Winged sexuparae adults disperse and lay eggs which give rise to the non-feeding sexual (sexuales) generation in September (Fig. 10). After mating, the sexual female lays a single overwintering egg.

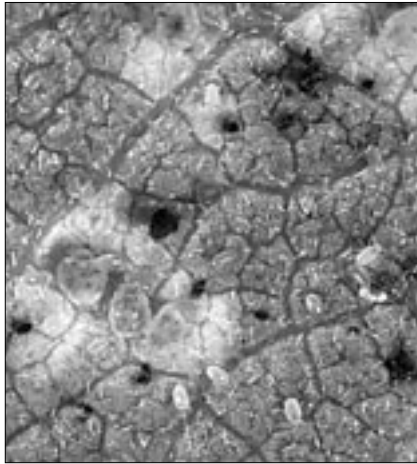


Fig. 6. Virginoparae adults and randomly dispersed eggs on lower surface of a Garry oak leaf.

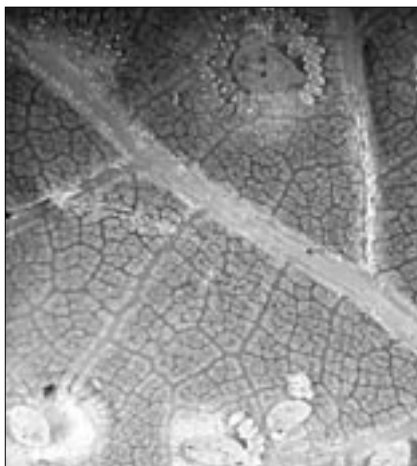


Fig. 7. Virginoparae adults surrounded by concentric circles of eggs on lower surface of an English oak leaf.



Fig. 8. Winged sexuparae adults.



Fig. 9. Dense concentration of oak leaf phylloxera.

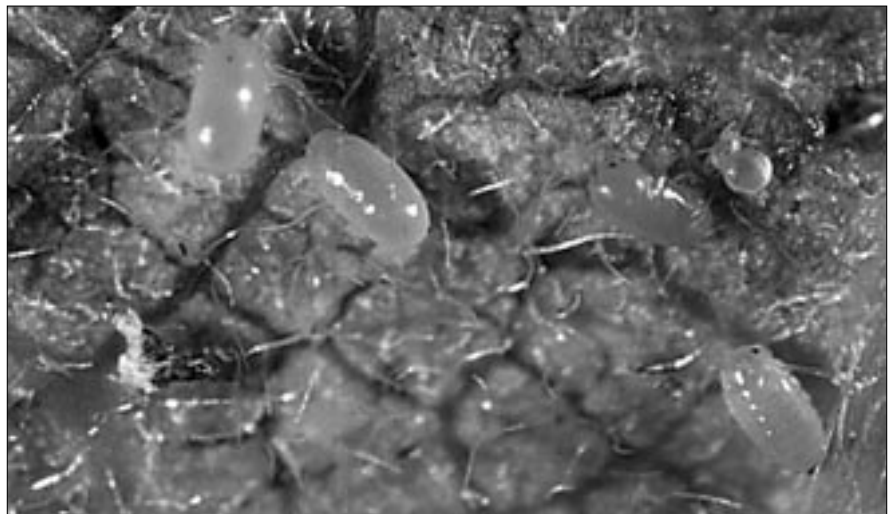


Fig. 10. Females (ovipara) of sexual generation on Garry oak leaf.

The veinal feeding oak leaf phylloxera appears to have a similar life cycle except that the winged sexuparae generation appears much later in the season (late September or October).

Damage

As phylloxera populations increase through June and July, damage becomes increasingly visible — initially as chlorotic spotting of the leaves (Fig. 11) in June and eventually as complete scorching of the tree by late July (Fig. 12).



Fig. 11. Chlorotic spotting on Garry oak leaf.



Fig. 12. Severely scorched (susceptible) and adjacent green (non-susceptible) Garry oak trees.

Specific trees appear to be genetically predisposed to phylloxera attack and suffer severe and chronic damage (Fig. 13). By late July these trees are completely scorched, and by early August have dropped all of their leaves. In late August or September most defoliated trees produce a weak and chlorotic new flush of leaves. This late flush does not turn brown in fall, the green leaves remaining on the tree until December. Trees suffering chronic defoliation and subsequent refoilation over many years are gradually drained of stored energy reserves resulting in a weakening of the tree. Weakened trees may exhibit symptoms such as a weak and chlorotic new flush in spring, dying back of twigs and branches in the upper crown and sprouting of old buds on the trunk and larger branches

(epicormic growth). Chronically defoliated trees eventually die after ten or more years damage.

On some trees, only specific branches support heavy populations which are chronically scorched and defoliated. Most trees, however, support very low non-damaging populations.

The same pattern occurs in Europe where only specific trees or branches are chronically damaged in outbreak years. Epidemic populations in Europe collapse after a relatively shortlived outbreak, whereas in North America, chronically high populations and severe damage persist until severely affected trees die. Studies in the Victoria area have shown that about ten percent of the Garry oak



Fig. 13. Single susceptible Garry oak in grove.

population is susceptible to phylloxera attack and that very little spread to adjacent non-susceptible oaks occurs (Fig. 13).

Damage caused by the veinal feeding oak leaf phylloxera usually amounts to little more than light chlorotic spotting adjacent to the major veins on leaves of Garry oak. In nursery culture, however, where continuous growth is promoted with high nutritional regimes and continuous irrigations, the veinal feeding oak leaf phylloxera has become a serious pest. Experience in British Columbia and California nurseries have shown that high populations of phylloxera (Fig. 14) build up through the summer months followed by a delayed winged sexuparae generation in late September or October. Populations developing on nursery stock initially prefer feeding sites adjacent to major veins but, gradually disperse to interveinal feeding sites as the population increases in late summer (Fig. 15).

Foliar scorch or chlorotic spotting similar in appearance to phylloxera damage may also be caused by the jumping gall wasp.¹

Management options

Biological control

Although a number of predators (Figs. 16–21) feed on the oak leaf phylloxera in British Columbia, none of these has provided effective control. In 1993, an Asian ladybird beetle, *Harmonia axyridis* (Pallas), was recovered for the first time in British Columbia. By 1994 large numbers of larvae (Fig. 22) and adults were observed feeding on oak leaf phylloxera between May and September. Observations in 1995–96 showed that although foliar scorching on susceptible oaks was not eliminated, it was delayed until late August or September and complete defoliation did not occur. The longterm

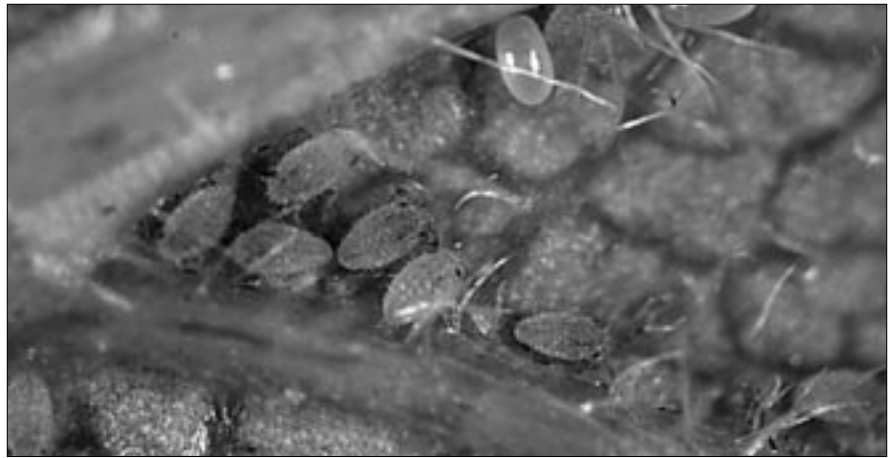


Fig. 14. Veinal feeding oak leaf phylloxera on nursery grown Garry oak seedling.

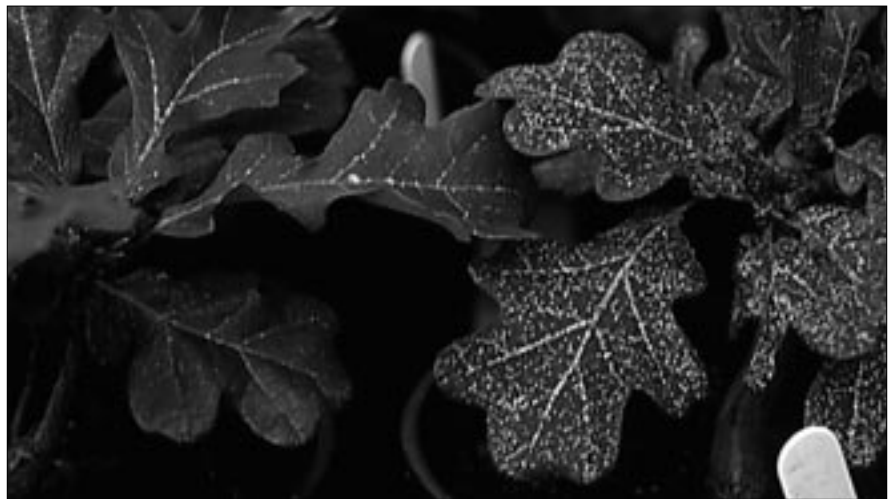


Fig. 15. Veinal feeding oak leaf phylloxera damage on nursery stock is initially concentrated along the major veins (left), but gradually spreads over the entire leaf surface as the phylloxera population increases in late summer (right).



Fig. 16. Pirate bug, *Anthocoris antevolans* nymph.

¹ See Forest Pest Leaflet 80.



Fig. 17. Predaceous bug, *Deraeocoris fasciolus* nymph.



Fig. 18. Predaceous bug, *Plophorus perplexus* adult (left), and nymph (right).



Fig. 19. Predaceous bug, *Campyloneura virgula* adult.

effectiveness of the Asian ladybird beetle as a biocontrol agent against the oak leaf phylloxera is unknown at this time but appears promising. In Europe, two predators, a ladybird beetle, *Scymnus auritus* Thunberg and a dusty-wing *Conwentzia psociformis* Curt., effectively control periodic outbreaks.

Host resistance

For the most part, the Garry oak population on south Vancouver Island appears to exhibit field resistance to the buildup of damaging oak leaf phylloxera populations. Observations indicate that about five percent of the oaks support damaging populations throughout the crown of the tree and will eventually die, while a further five percent of the trees support damaging populations on individual branches or a portion of the crown. The remaining ninety percent of the trees support very low non-damaging populations. Trials where seedling oaks were grown understorey to infested oaks or where oak leaf phylloxera were placed on seedlings also showed that about ten percent of the trees supported damaging populations. In a second experiment, scions of a field resistant oak continued to resist buildup of damaging populations when grafted onto a tree supporting chronically high oak leaf phylloxera populations. These trials suggest that an appropriate approach to reducing long term problems in new plantings would be to rogue out any trees showing severe mid-summer scorching damage early in the life of a new plantation.

Chemical control

In nursery culture populations of the veinal feeding oak leaf phylloxera can be controlled using any pesticide effective against aphids. In young plantations, trees exhibiting severe leaf scorching in July should be removed rather than sprayed. It generally is not practical to spray large chronically scorched trees.

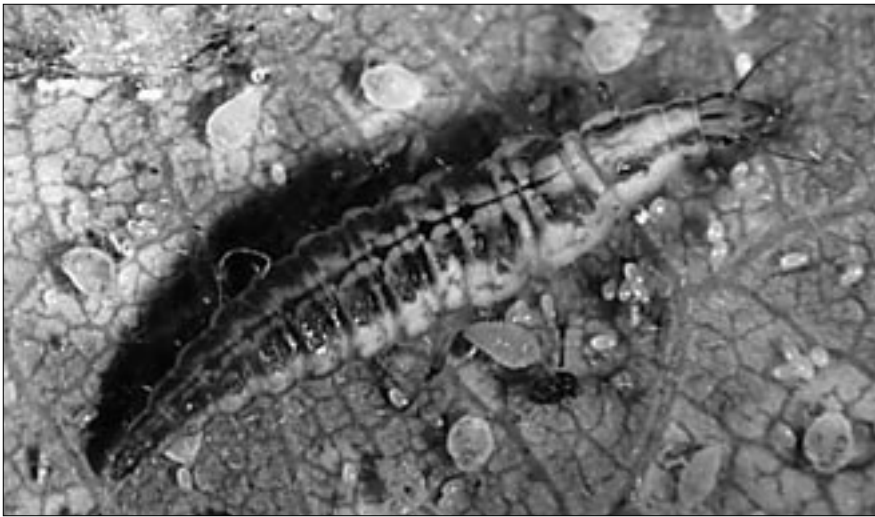


Fig. 20. Brown lacewing, *Hemerobius pacificus* larva.



Fig. 21. Green lacewing, *Chrysopa carnea* larva.



Fig. 22. Oriental ladybird beetle, *Harmonia axyridis* larva.

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Predators observed feeding on oak leaf phylloxera in the Capital Regional District
(listed in order of frequency)

Oriental ladybird beetle	<i>Harmonia axyridis</i> (Pallas)
Minute pirate bugs	<i>Anthocoris antevolans</i> White <i>Anthocoris confusus</i> Reuter
Predaceous bugs	<i>Deraeocoris fasciolus</i> Knight <i>Pilophorus perplexus</i> Douglas & Scott <i>Campyloneura virgula</i> Herrich-Schaffer
Brown lacewing	<i>Hemerobius pacificus</i> Banks
Green lacewing	<i>Chrysopa carnea</i> Steph.
European earwig	<i>Forficula auricularia</i> L.
Predaceous midge	<i>Aphidoletes</i> sp.

Additional information

Additional copies of this and other leaflets in this Forest Pest Leaflets series, as well as additional scientific details and information about identification services, are available by writing to:

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