



## CHAPTER 4 - HEALTH

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### INTRODUCTION

There are a number of insect pests and fungal pathogens that have been recorded in New Zealand on cypress species, but apart from cypress canker, few have significant impact on cypress health. Minor pests and pathogens are mentioned, but most of this chapter will be devoted to the major threat to the health of cypress species – cypress canker.

### CYPRESS CANKER

The most important disease of cypresses in New Zealand is cypress canker, which affects a number of species and hybrids, and is the main reason that macrocarpa is not planted more widely as a valuable plantation species. Damage results from infection of stems and branches by two microscopic fungi, *Seiridium unicorne*<sup>1</sup> and *S. cardinale*. *Seiridium cardinale* has been present in this country since at least the 1930s, while *S.unicorne* was reported here in the 1950s. Both species occur on cypresses throughout New Zealand, but *S. cardinale* has been recorded less frequently, except in Canterbury where it appears to be as common as *S. unicorne*.

The disease cycle is not fully understood. Minute fruitbodies are present on diseased tissue during much of the year, and asexual spores are carried by rain splash to adjacent trees and branches. Spread by this means appears to be slow and localised, but *S. unicorne* also produces sexual spores, which may be dispersed more widely by means of air currents. Infection is believed to take place

through cracks or wounds, though direct entry through softer undamaged tissues may also be possible, and this leads to the formation of purplish and brown patches on branches and stems, which develop into sunken cankers.

Infected branches eventually die back due to the damage caused by the cankers, and apparently also due to a toxin produced by the fungi. The disease may, therefore, be recognised by the appearance of irregular dieback and browning across the crown and by the canker symptoms on stems and branches, accompanied by resin bleeding and bark discoloration. This damage leads to growth loss, limb and stem breakage, malformation, and reduced wood quality, particularly when infection is present in the stem. Mortality may occur in young stands.

A survey throughout New Zealand in 1981-82 found cypress canker at different levels of severity in 36% of plantations and 53% of shelterbelts. A grower survey conducted in 1999-2000 identified the disease in 53% of small rural plantations of macrocarpa. The disease occurs in trees of all age classes. The removal of diseased trees during the operational thinning of young infested macrocarpa stands may reduce the incidence of spores carried to remaining trees, creating an impression that older stands are less susceptible. Cypress canker can be locally severe in some woodlots, but limits to spore dispersal mean that it is still possible to grow stands of macrocarpa free of infection, although more widespread planting could change this situation.

<sup>1</sup> More needs to be known about the fungi that cause cypress canker in New Zealand. The species traditionally called *Seiridium unicorne*, and referred to here as such, may actually be *S. cupressi*, and there is debate as to whether or not there may in fact be three species of *Seiridium* present. This issue has more than just academic interest, since practically it is important to clarify potential differences in virulence towards different cypress hosts.



A 10-year-old macrocarpa, badly damaged by cypress canker

Despite significant research, much remains unknown and anecdotal. Inoculation studies with *S. unicorn* have confirmed that symptoms are more severe at higher temperatures. Surveys have found that the disease tends to be more prevalent in warmer northern parts of the country. There are clear differences in susceptibility between cypress species and hybrids. Lawson cypress, Leyland cypress, and particularly macrocarpa are all prone to disease, but lusitanica shows some resistance. The *ovensii* hybrid may also be less susceptible, but this requires further testing. According to records held on the Forest Health Database (New Zealand Forest Research Institute), *S.*

*unicorn* has been found mostly on Lawson cypress, Leyland cypress and macrocarpa, while *S. cardinale* has been observed mainly on macrocarpa and has also been reported in New Zealand on Leyland cypress. Lawson cypress is reported overseas to have low susceptibility to *S. cardinale*. Five database records on lusitanica are all of *S. unicorn*.

A number of disease management options are available to those wishing to grow cypresses. In regions particularly prone to the disease, such as warmer parts of the North Island, consideration should be given to using less susceptible species like *Cupressus lusitanica*.

Whichever cypress species is used, planting stock should be healthy, vigorous, free from obvious symptoms of disease, and come from a nursery that is not surrounded by old diseased Lawson cypress, Leyland cypress and macrocarpa trees or shelterbelts. The disease is favoured when trees are physically stressed and subject to warm conditions, so it is important to give some thought to the planting site. Cooler south-facing sites have been suggested as more likely to discourage the disease, and plants should be protected from both wind and animal stock damage (stock may also physically spread spores between trees). They should not be established near older diseased cypress trees that may allow the disease to spread into the new crop.

If the disease does appear, it is important to remove infected limbs and fell diseased trees as soon as possible. If this procedure is neglected, spores from diseased trees will spread infection to adjacent trees, and the incidence of affected trees may rise rapidly. Even then, the removal of diseased trees during routine operational thinning may still enable a healthy residual crop to be brought through to an economic harvest. Pruning should not be excessive in infested stands as the resultant stress is likely to encourage the disease on infected trees. Fungicide spraying has been recommended in association with the removal of diseased plant material, but this also has been little tested and is unlikely to be of economic value in plantations, woodlots or shelterbelts, although it may be a worthwhile procedure in nurseries.

Research is currently under way to find genetic stock of macrocarpa and lusitanica that is more resistant to the disease, but it may be some years before commercial material becomes available (see below). Even moderate gains through breeding, in conjunction with other disease management procedures, may be sufficient to effectively reduce the rate of disease build-up in a stand, minimising the exposure of residual healthy trees to spores. However, breeding for resistance must take into account the demonstrated differences in virulence within the pathogen populations, particularly for *S. unicolorne* where the possession of a sexual spore stage is likely to

enhance changes in the natural variation. It is important that any potentially enhanced disease resistance in new releases of cypress stock should be comprehensive and durable, i.e. able to withstand the full range of pathogen virulence, including any response that may develop during the course of a rotation.

## Cypress Canker Screening Programme

To overcome the cypress canker problem, many genetically diverse genotypes with multiple resistance mechanisms must be identified. If limited numbers of resistant genotypes are deployed, there will always be the risk of resistance being quickly overcome. Selection for resistance is complex as there are likely to be many different strains of the pathogen, and also, the pathogen may be rapidly evolving. This means that simple resistance mechanisms may be easily overcome by existing genetic diversity in the pathogen (if resistant genotypes were not screened against all known strains of the pathogen) and also by subsequent genetic changes in the pathogen populations. It is, therefore, vitally important that durable resistant mechanisms are developed.

Pathologists from Forest Research (now Ensis) have developed a system to screen large numbers of clones for canker resistance in a greenhouse. They are using an inoculation procedure and have collected and isolated as many of the virulent strains of the pathogen as possible. The aim is to identify resistant genotypes by screening clones that are derived from families showing resistance in the breeding programme. At the same time, tree breeders and propagators have established clonal field trials, with the same clones, to validate the effectiveness of early screening (and also allow for further selection for growth, form, and wood traits). Royalties from sales of canker-resistant cypress clones will help finance further breeding and delivery of superior cypress planting-stock to industry.



Inoculation of a macrocarpa rooted cutting with canker in an early screening programme for resistance to cypress canker.



Macrocarpa rooted cuttings, one month after inoculation. Some clones are immediately susceptible, other clones are showing resistance to this particular strain of cypress canker.

## DISEASES OTHER THAN CYPRESS CANKER

Three species of fungi may cause minor dieback on cypresses, but do not produce cankers, they are *Phyllosticta spinarum*, *Stigmina thujina* and *Kabatina thujae*.

None of them are regarded as major pathogens. *Chamaecyparis* species are also susceptible to attack from the fungus *Stigmina thujina*. This, has led to the death of some *Chamaecyparis lawsoniana* on the west coast of the South Island. However, elsewhere in New Zealand, the disease has not proved to be serious. Symptoms first appear on the older inner foliage, resulting in the crowns taking on a hollow appearance.

## INSECT PESTS

### Insect pests on cypress in NZ

There are three species of insect pests that cause damage to cypresses in New Zealand. These are the introduced cypress bark beetle (*Phloeosinus cupressi*), the native huhu beetle (*Prionoplus reticularis*), and the native two-toothed longhorn beetle (*Ambeodontus tristis*). The cypress bark beetle is stout, dark brown

to black, 3 mm in length and 1.5 mm wide; and the larvae are white curved grubs (length up to 3-4 mm). Both the adult and the larvae do minor feeding resulting in small patches of red foliage, but are considered to be of minor economic importance and control measures are deemed unnecessary.

The native huhu beetle can cause more serious damage. The larvae (grubs) bore into stumps, logs, dead parts of living trees, and untreated sawn timber. In cypresses, the heartwood of living trees can sometimes be seriously damaged if the larvae can gain access via mechanical damage or dead branch stubs. The larvae cannot bore in living sapwood. Similarly, larvae of the native two-toothed longhorn beetle can normally only bore into timbers and dead trees. Again, successful infestation occurs in living trees only where access to the heartwood can be gained through mechanical wounds and dead branch stubs.



Stump of a young lusitanica tree revealing damage by huhu larvae

### Insect pests overseas

Cypress stands in Africa, particularly, Kenya and Malawi, have been decimated by aphid (*Cinara cupressi*) attack. The recent arrival of this pest in South America is a concern, but to date this is not expected to be a problem in New Zealand provided no green material is imported into New Zealand (J. Bain pers comm.).

## Key Points

- Cypress canker is the most important disease of cypresses in New Zealand.
- Cypress canker causes growth loss, malformation, and mortality.
- While significant in most parts of New Zealand, severity appears to be somewhat greater in the warmer northern parts of the North Island.
- Establishing stands on sites with a cool southerly aspect can help reduce the risk of cypress canker developing.
- Most cypresses are susceptible to some degree to the disease, but macrocarpa and Lawson cypress are particularly affected. Leyland cypress is also susceptible, but not to the same degree. Lusitanica is largely resistant and the ovensii hybrid may also have resistance, but there are not enough data to verify this.
- Breeding for resistance to cypress canker has been under way for some time.

Management to reduce the impact of the disease should include the following procedures:

1. If establishing cypresses on potentially disease-prone sites (eg. warmer, north-facing slopes) choose a more resistant species.
  2. Plant healthy vigorous stock from disease-free nurseries away from diseased trees, shelterbelts, or woodlots that may provide a spore source.
  3. Protect plants from undue stress due to causes such as wind exposure, stock damage, excessive pruning, especially in stands in which the disease is present.
  4. Remove any trees or branches with symptoms of cypress canker as soon as possible during silvicultural operations, to prevent a rapid and unmanageable build-up of infestation within the stand.
- There are fungal pathogens, other than cypress canker, which are associated with minor dieback in cypresses, but none of them are regarded as major pathogens.
  - Care must be taken to avoid damage to cypress trees, including animal damage.
  - Larvae of the huhu beetle and the two-toothed longhorn beetle can cause some damage to standing trees. Infestation occurs in living trees only where access to the heartwood can be gained through mechanical wounds and dead branch stubs.

## Suggested reading:

Aimers-Halliday *et al.* 2006

Newhook 1962

Fuller 1954

Self 2000

Gea and Low 1997

Van der Werff 1984

Hood *et al.* 2001

Van der Werff 1988