CHAPTER 4 - HEALTH

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Of the 240 eucalypt species in New Zealand some individual species are more prone to health problems than others, either insect attack or fungal. Siting can also influence the likelihood of some health issues. This makes species and site selection important factors in the health of eucalypt plantations. Insect attack is a natural part of the eucalypt forest in Australia, something the trees have evolved to cope with, so ecological balance is maintained. Some minor insect attack is therefore acceptable within a plantation, but not when major parts of the crown are lost.

Because of our proximity to Australia, we can expect new health problems to arrive. To maintain healthy plantations, the best strategy is to select more insect-resistant groups of species, planted on the right site.

Insects

Any farm forester who has grown eucalypts is probably aware of their susceptibility to insect pests. Some of these are now well established in this country - many more exist across the Tasman Sea and may enter New Zealand at any time. Commentators have suggested that the eucalypts are not an appropriate genus for forestry purposes in this country because there is a seemingly endless supply of pests located a relatively short distance up-wind.

Even when apparently good biological control systems have been put in place, the arrival of hyper-parasites (parasites of the controlling organisms) can upset the balance and counteract their effect. This has happened with *Paropsis charybdis* and *Cardiaspina fiscella*.

Eucalypt species do vary in their susceptibility to pests. Many recent insect arrivals have attacked *E. botryoides* in particular and also *E. saligna*, but have not caused much damage to other species. There are currently no serious insect pest problems with stringybark eucalypts or most of the ash group. This may be partly fortuitous, but if some eucalypt species are more attractive than others, this should be a major factor to consider during species selection, ranking equally with growth rate, tree form and wood properties.

Some groups of eucalypts are healthier than others. Most eucalypt taxonomists agree that the genus can be divided into seven or eight subgenera. The two major ones are the *Symphyomyrtus*, the *Monocalyptus* (or *Eucalyptus)* subgenera. The *Corymbia* subgenus has now been separated out as a separate genus, but for our purposes can still be regarded as a "eucalypt". *Symphyomyrtus* is the largest subgenus, containing more than 500 of the 800 recognised eucalypt species. Many of these are obscure and consist of small trees found in isolated corners of Western Australia. Others are timber and fibre species e.g., *E. nitens*, *E. globulus* and *E. saligna*, or common farm and ornamental trees e.g., *E. viminalis*, *E. ovata*, *E. leucoxylon*, *E. cinerea* (silver dollar). Most of the eucalypts used internationally in plantation forestry are *Symphyomyrtus* species and this has given rise to the unsupported view that only *Symphyomyrtus* species are suitable for plantation forestry.

The second-largest subgenus is *Monocalyptus* (or *Eucalyptus)*, referred to here as "monocalypts". This subgenus contains some 135 species including the ashes, the stringybarks, and the true peppermints. The subgenus *Corymbia* includes about 113 species, many from tropical areas, the best-known locally being *C. ficifolia* and *C. maculata*.

The monocalypts are considered to be the most highly evolved group. They retain fewer of the features of their eucalypt rain forest predecessor(s). Many of the features separating subgenera relate to the flowers and other reproductive structures, but differences in natural plant chemicals that occur in the leaves and elsewhere are also recognised. These chemical differences are probably important in influencing insect preference which seems to favour *Symphyomyrtus* species.

A quick survey of accessible literature suggests a 10:1 preference for *Symphyomyrtus* species as hosts for 50 common insect pests in south eastern Australia. The larger numbers of *Symphyomyrtus* species found in that area do not account for the imbalance. Some *Symphyomyrtus* species are attacked by nearly every eucalypt pest. Notable in this group are *E. saligna, E. botryoides, E. viminalis, E. camaldulensis* and other closely-related species. Even possums seem to show a distinct preference for *Symphyomyrtus* eucalypts.

The monocalypt species are not free from attack. Some quite serious monocalypt pests exist in Australia and the commercially important *E. regnans, E. obliqua* and *E. pilularis* are frequently mentioned as insect hosts in the literature. This may reflect more intense observation of forestry species. Monocalypt insect pests in New Zealand include the blackbutt leafminer (*Acrocercops laciniella)* which also attacks *Symphyomyrtus* eucalypts, and a number of other insects that do not discriminate between species, e.g. leafrollers. Some *Symphyomyrtus* pests also attack monocalypts. The emperor gum moth (*Opodipthera eucalypti)* is found on ash or stringybark eucalypts, where it rarely causes major damage. On the other hand it can totally defoliate small *Symphyomyrtus* trees. Very few, if any, insect pests are restricted to monocalypts, whereas numerous examples can be found that only attack *Symphyomyrtus* species.

To summarise, *Symphyomyrtus* species seem to be more susceptible to insect attack. Some, including *E. botryoides, E. camaldulensis, E. viminalis, E. grandis* and *E. globulus* appear to attract large numbers of insect pests. Three of these species represent the bulk of the world's plantation eucalypt resource. *E. nitens* also seems to be a popular insect target.

Nothocalyptus, with its single species *E. microcorys,* is a subgenus that appears to be relatively unattractive to insects.

Most entomologists are aware of the possibility of a relationship between subgenus and vulnerability to insect attack, but taxonomic groupings do not seem to have been included as risk factors during selection of species for plantation forestry. In the meantime, the planting of stringybark and ash eucalypts in preference to *Symphyomyrtus* species may reduce the risk of serious damage from insect attack.

Although monocalypts may be less vulnerable to insect attack than other eucalypt subgenera, they are more likely to be damaged by soil-borne fungal pathogens, especially *Phytophthora* species, when grown on wetter sites and in heavier soils. The ashes and stringybarks are known to perform better on free-draining sites.

Almost all the monocalypt eucalypts have blond or brown-coloured timber. None of the red-coloured timbers that seem to appeal to Kiwi taste are found among the species currently established in New Zealand. Red timber is found mainly in *Symphyomyrtus* species, the best known being *E. saligna* and *E. botryoides*. Two monocalypts with red timber are well known in Western Australia. These are *E. marginata* (jarrah), which has never thrived in New Zealand, and *E. jacksonii* (red tingle). The latter has highly-regarded timber but its natural occurrence is very restricted. With more trial, error and research, this might be a red timber species for New Zealand in the future. At this stage little is known about its vulnerability to pests and diseases.

P. charybdis **on eucalpt foliage with typical scalloped leaf edges**

Eucalyptus Tortoise Beetle *(P. charybdis)*

The Eucalyptus Tortoise Beetle is the most serious defoliator of eucalypts in New Zealand. A native of Australia, it was first detected in the Port Hills in 1916 and is now distributed throughout the country. The beetle feeds on the foliage of about 60 eucalypt species, mainly those of the subgenus *Symphyomyrtus*. It is particularly attracted to *E. nitens* and *E. globulus*. Feeding is restricted to the adult foliage and results in characteristic scalloping of leaf edges. Severe defoliation of flush foliage gives trees a sparse 'broom top' appearance. Two generations are produced each year, the female beetles beginning to lay eggs a few weeks after the onset of the spring foliage flush.

Since 1987 the beetle has been controlled in many parts of New Zealand by the primary parasitoid wasp *Enoggera nassaui.* This insect lays its eggs in the beetle eggs and reduces *P. charybdis* populations in late summer. In 2001 the wasp *Baeoanusia albifunicle* was identified in New Zealand as a hyper-parasitoid which appears to have reduced the impact of *Enoggera nassaui* on *P. charybdis*. A second primary parasitoid wasp, *Neopolycystus insectifurax*, was also detected in 2001. In the upper North Island parasitism of *Paropsis* by *Enoggera nassaui* tends to increase between November and January, declining in February. Activity of the hyper-parasitoid follows a similar trend, while that of *N. insectifurax* peaks later in the summer when temperatures are at their highest. The presence of *N. insectifurax* may therefore compensate for some of the decline in *Ennogera nassaui* populations in late summer.

Baeoanusia albifunicle does not develop successfully on *N. insectifurax* and cannot develop in unparasitised *P. charybdis* eggs. *Enoggera nassaui* has been recorded from Northland to Southland and is probably well

established throughout the country. Recently, *N. insectifurax* and the hyper-parasitoid have been found in the South Island, confirming a national distribution. Information about their distribution will help to identify sites where the hyper-parasitoid is likely to interfere with biological control of *P. charybdis*, and where *N. insectifurax* populations may counteract this interference.

P. charybdis eggs

P. charybdis larva

P. charybdis adult

Enoggera nassaui parasitizing *P. charybdis* eggs

P. charybdis eggs

Images showing the colour change which results from presence of *N. insectifurax*.

Gum Leaf Skeletoniser *(Uraba lugens)*

Gum leaf skeletoniser is an Australian moth that was first found in New Zealand in 1992 at Mount Maunganui. After several years it was eradicated from there but in 2001 it was found in Auckland. It is not known whether the Auckland population originated from the Mount Maunganui ones or represents a separate incursion from Australia. It has now spread throughout the greater Auckland region as far north as Warkworth, with additional recordings in Waikato and Bay of Plenty. For a map of the distribution, please see http://gis.scionresearch.com/maful/viewer.htm). Modelling work carried out at Scion predicts that *Uraba* has the potential to survive in all the commercial eucalypt growing regions of New Zealand and is thus a threat to the expanding eucalypt industry as well as amenity trees.

Uraba has been recorded from nearly 50 species of *Eucalyptus* in New Zealand and as the common name implies these are the main hosts. However, it has been recorded from other genera as well.

In 2004 Scion gained approval to import four parasitoids of *Uraba* into containment, and work began to determine if any of these would be suitable biological control agents. Since then many problems have been encountered with mating and rearing the parasitoids, and with hyper-parasitoid contamination of the parasitoid shipments from Australia. In addition, rearing *Uraba* in the laboratory as hosts for the parasitoids has been difficult, with disease

affecting the colony at various times. Two of the four potential parasitoids have been ruled out, one (*Euplectrus* sp. (Eulophidae)) because a hyper-parasitoid is present in New Zealand, and the other (*Eriborus* sp. (Ichneumonidae)) because of difficulties obtaining enough from Australia. However, progress has been made with the remaining two species (*Cotesia urabae* and *Dolichogenidea eucalypti* (Braconidae)) over recent summers with further host range testing underway. Currently further work is continuing as part of a Sustainable Farming Fund project.

Assessment of blackbutt leafminer (*Acrocercops laciniella*) damage in high-value hardwood eucalyptus species in Northland

A project of the Eucalypt Action Group of the New Zealand Farm Forestry Association supported by the Ministry of Agriculture Sustainable Farming Fund and the Neil Barr Foundation.

The first New Zealand record of *A. laciniella* was made in 1999 in Auckland. The pest spread rapidly throughout the North Island and was detected in the South Island in June 2004. Blackbutt leafminer is a small moth (Lepidoptera: Gracillaridae) whose larvae cause leaf damage in a wide range of eucalyptus species. It is related to New Zealand species of the same genus. Ten species of *Acrocercops* were present in this country prior to the introduction of *A. laciniella*.

Although Blackbutt Leafminer attacks all eucalypts present in Northland, this project which was based in the Kerikeri area, focussed on damage to 5- to 8-year-old trees of the major timber species *E. pilularis*, *E. muelleriana*, *E. globoidea*, *E. agglomerata* and *E. microcorys*. The aim was to classify the extent of leaf damage, to monitor changes over time, and to compare the susceptibility of different eucalypt species.

Conclusions

- Over time, *E. pilularis* was the most susceptible of the monocalypt eucalypts.
- High levels of damage were recorded in all species examined except *E. microcorys* and *C. maculata*.
- Backbutt leafminer is the most serious pest recorded to date on stringybark eucalypt species in Northland.
- It is likely that the leafminer reduces timber productivity by restricting photosynthetic activity, especially in the more susceptible eucalypt species.
- The leafminer causes damage throughout the year in Northland. Peak population levels occur during late summer and early winter.
- High levels of damage recorded after initial colonisation were not sustained.

Source: www.nzffa.org.nz

The Southern Ladybird *(Cleobora mellyi)*

Cleobora mellyi, the southern ladybird, was introduced into New Zealand from Tasmania in 1977 for control of the eucalypt tortoise beetle, *P. charybdis*. It was only established in the Marlborough Sounds. This predator diets on psyllids and tortoise beetles, both pests of eucalypts, and it shows some promise for general control of eucalypt pests.

The NZ Farm Forestry Association, with support from the MAF Sustainable Farming Fund has distributed and released this ladybird to sites in the North Island to assess its effectiveness as a biological control agent.

Eucalypt Shoot Psyllids *(Ctenarytaina spatulata)*

The eucalypt shoot psyllid (*C. spatulata*) was first identified in New Zealand in 1990. It appears to have arrived here without its own natural parasitoids, unlike the blue gum psyllid (*C. eucalypti*) which is well controlled by a small parasitoid (*Psyllaephagus pilosus*). So effective was *P. pilosus* in New Zealand, it has now been introduced into California as a biocontrol agent for the blue gum psyllid.

Another common eucalypt shoot psyllid is *Blastopsylla occidentalis* (first identified in New Zealand in 1977) which probably came from Western Australia. This species can produce copious white flocculence when feeding. It is reported that both psyllids (*C. spatulata* and *B. occidentalis*) attack many species of eucalypts in Northland, and can cause damage to species within the subgenus *Symphomyrtus*. The very wide range of hosts includes many species of economic significance.

It appears that psyllid damage has become more prevalent in recent years. Some damage possibly caused by shoot psyllid infestations includes stunting of young plants, shedding of young leaves, and leaf and stem spots. Moderate psyllid attack throughout the Northland summer may cause leaf senescence and premature shedding, resulting in a thinning of the crown. Winter growth flushes suffer minor attack, with some leaf distortion and spotting, which may contribute to an overall loss of vigour in the affected eucalypts.

Leaf mining sawfly *(Phylacteophaga froggatti)*

This insect was first identified at Auckland airport in 1985 and has since spread throughout the country. The principal hosts of this insect are *E. nitens*, *E. saligna*, and *E. botryoides*, with defoliation damage being commonly confined to the bottom 3 m of the tree. A successful biological control programme was undertaken using an imported *Bracon* sp.

Eucalypt gall wasp *(Ophelimus* sp.*)*

This is a more recent import than the sawfly, observed at Wellington in 1987. The main hosts are *E. saligna*, *E. botryoides*, and *E. grandis* In the early phase of its spread, a few attacks were so severe that some trees trees were killed. No control was attempted for this insect. Although the insect is still present on susceptible species, its effect appears less significant in recent times.

Brown lace lerp *(Cardiaspina fiscella)*

Another insect found close to Auckland airport, this was recorded in 1996. It moved rapidly throughout the North Island, but was soon under some biological control, which also appeared in the country soon afterwards, however this was also hyper-parisitised. While still present the lace lerp is not as devastating as it was in its initial spread.

Gum Emperor-moth *(Antheraea eucalypti)*

The caterpillar of the gum emperor-moth feeds on the foliage of the host plants. The main hosts are eucalypts. The moth, however, appears to be selective when laying eggs and caterpillars have been recorded from only 24 of the 60 species of *Eucalyptus* that have been examined in New Zealand. In 1977 it was reported that of the species that have been considered promising for plantations in New Zealand (*E. delegatensis*, *E. fastigata*,

E. obliqua, E. regnans, E. saligna, E. botryoides, E. muelleriana, E. pilularis, E. nitens, and *E. oreades*), only *E. obliqua* and *E. muelleriana* have yet to be recorded as having gum emperor-moth attack.

The moth was first found in Wanganui in 1915 and has since spread slowly from that area. By 1960 it had become distributed in the wide coastal strip from New Plymouth through Palmerston North to Levin, with records also from Wellington, isolated areas on the east coast of the North Island up to Ruatoria, and the Waikato region centred on Cambridge. The insect has frequently been used for biology studies in schools and teacher training establishments, as well as in the home. Much of the spread of the moth has resulted from intentional or accidental releases from these situations. The gum emperor-moth was first recorded as being established in the South Island in Nelson in 1968. Widespread outbreaks of the gum emperor-moth have not been recorded, and it is thought that populations are probably regulated by natural biological control agents. Caterpillars are often found infected with a polyhedral virus and, under conditions suitable for mycelial growth, may succumb to a parasitic fungus (*Beauveria* sp.).

Pinhole Borer *(Platypus apicalis* and *P. gracilis)*

When eucalypts are grown within a few kilometres of native forest, especially those with native beech, the eucalypt trees can be attacked by native pinhole borers. Although attack by these beetles is usually abortive, it can result in kino production which can degrade the appearance of the timber.

Ghost moth *(Aenetus virescens)*

This native insect, which only occurs in the North Island, can burrow into the stem of young trees, but such damage is usually confined to the knotty centre of the stem, and is of minor consequence.

Eucalypt Diseases

With increasing eucalypt plantations established in New Zealand since the 1960s, new recordings of fungi on eucalypts have been a regular occurrence. Growth in trade and the increasing mobility of people have created greater opportunities for the spread of pathogens in addition to self-introductions on trans-Tasman wind currents.

With the establishment of these trees has come a diverse invertebrate fauna and mycoflora. There are approximately 220 species of fungi recorded from eucalypts in New Zealand. These can be broken down as: about 10 mycorrhizal species; 110 foliage and stem fungi; 70 wood decay fungi, and about 30 others (sapstain, litter saprobes, nursery root associates).

Australian introductions

Many of the fungi, particularly the foliar pathogens, are easily recognisable introductions. A few examples are tabulated below in chronological order of detection. Some have proved capable of causing profound defoliation of plantation trees.

Table 10: Chronological order of Australian foliar pathogens recorded in New Zealand

Fungal pathogen	First NZ collection
Mycosphaerella cryptica	1955 on *E. delegatensis*
Aulographina eucalypti	1980 on *E. regnans*
Mycosphaerella nubilosa	1981 on *E. globulus*
Phaeophleospora eucalypti	1981 on *E. nitens*
Mycosphaerella suberosa	1998 on *E. muelleriana*
Leptomelanconium australiense	2002 on *C. ficifolia*

Others have been described for the first time in New Zealand. Whether these are uncommon and unrecognised in their native land, or whether they originated in New Zealand is currently unknown.

Table 11: Chronological order of new foliar pathogens first recorded in New Zealand

Fungal pathogen	First NZ collection
Trimmatostroma bifarium	1981 on *E. fastigata*
Pseudocercospora crousii	1981 on *E. regnans*
Phytophthora captiosa	1986 on *E. botryoides*
Sarcostroma mahinapuense	1988 on *E. nitens*
Pseudocercospora acerosa	1999 on *E. nitens*

The most significant diseases on plantation eucalypts, at the present time, are detailed below.

Stem Diseases

Silverleaf Disease (*Chondrostereum purpureum*)

Chondrostereum purpureum has a very wide host range and is most well known as the cause of silverleaf disease of fruit trees such as peach and cherry. Plantation hosts include *Eucalyptus, Acacia, Cupressus, Fagus, Fraxinus, Nothofagus* etc. In eucalypts it was first recognised during a thinning operation where outwardly healthy trees had internal decay. It is associated with pruning wounds with the infection spreading up and down from the point of entry.

It can cause silvering of foliage, stain and decay, branch death, timber degrade and the death of young trees. Symptoms are not so obvious in eucalypt species with silvery leaves e.g., *E. delegatensis*.

Chondrostereum purpureum enters through pruning stubs. Fruiting bodies, which have a purplish underside when fresh and moist, develop on dead wood - both branch and stem. Spores are released during periods of rain or high relative humidity (>95%) and are dispersed on moist wind currents. Most infection occurs in spring, decreasing through summer and autumn and seldom occurring in winter. Time of pruning can therefore influence attack. Winter is the most suitable (in fine, dry weather), or in fine weather during other seasons, but pruning should not be done when the weather is warm and wet. Prevention can be managed by pruning branches <2.5 cm diameter. Applying horticultural fungicide on pruning wounds may reduce infection.

Silverleaf has sometimes been found in unpruned trees so not pruning is not a guarantee of preventing infection.

Sarcostroma (*Sarcostroma mahinapuense)*

This disease has only been found on *E. nitens* on the west coast of the South Island where it has caused branch cankers and dieback. Although the fungus is present in other parts of the country it is not associated with extensive cankering.

Foliar Diseases

Eucalypts vary in their susceptibility to foliar diseases but as a general rule species that come from summer dry areas of Australia are particularly susceptible when grown in summer wet areas. In general terms, areas south of Sydney and across to southern Western Australia tend to have winter maximum rainfall and areas north of this, particularly along the eastern coastline, tend to have summer maximum rainfall – a trend which becomes stronger as you move further north. In areas of New Zealand with warmer, wet and humid summers (Northland, Bay of Plenty), species from northern coastal NSW may well prove more successful than species from summer-dry Victoria, South Australia and southern Western Australia, especially inland areas of these states.

There are many different foliar fungi on eucalypts with more arriving every year because of our proximity to Australia. Some have very distinctive symptoms (e.g., *Aulographina eucalypti)*, some have very

similar symptoms, while others can only be identified by microscopic examination. Some foliar diseases may occur at low levels and have no significant effect on tree health, and often occur on older leaves and in the lower part of the crown. Foliar disease symptoms are most severe in areas where there are extended periods of leaf wetness and they can occur regionally and locally (in valleys and gullies and at high altitude). Common foliage diseases are:

- *Mycosphaerella cryptica*
- *Mycosphaerella nubilosa*
- *Aulographina eucalypti*
- *Pseudocercospora* spp.
- *Phaeophleospora eucalypti*

Mycosphaerella spp.

There are about 28 species on eucalypts, with only eight species recorded in New Zealand. Of these only two are associated with serious defoliation and dieback. These are *M. cryptica* and *M. nubilosa* which tend to have a different host range. (Table 12)

Table 12: Summary of *Mycosphaerella cryptica* and M. nubilosa hosts and symptoms

Mycosphaerella species	*M. cryptica*	*M. nubilosa*
Hosts	*Eucalyptus delegatensis, E. diversicolor, E. fastigata, E. globulus, E. nitens, E. obliqua, E. regnans*	*Eucalyptus globulus, E. nitens, E. viminalis*
Symptoms	Early lesions red-brown, often prominent purple margin. With age, lesion becomes grey. Old infected leaves may have holes, leaf buckling and distortion. Some hosts: shoots and twigs infected - cankers. Cankers can girdle shoots and twigs - thin crown and dead tops. Stunts growth and results in a bushy multi-leadered crown. Can look like frost damage.	Creamy-yellow – pale brown irregular lesions. Later lesions grey-black (perithecia on underside), 5-25 mm diameter and may coalesce. Severe on juvenile foliage, adult foliage mainly resistant. Primarily *E. globulus* and subspecies also *E. nitens.*
Comments	Has caused serious defoliation of *E. delegatensis.* Also affects *E. regnans* and other ash group eucalypts. Young trees are susceptible, Tasmanian provenances of *E. delegatensis* are much more resistant than Victorian provenances. Spores are spread by water splash. Continuous high RH or high rainfall are favourable conditions for attack.	Has caused serious defoliation in plantations in Australia.

Target spot *(Aulographina eucalypti)*

The main hosts of this fungus in New Zealand are *E. delegatensis, E. fastigata, E. globulus, E. nitens* and *E. regnans.*

The symptoms are a corky leaf spot, roughly circular in shape with a raised corky centre. The spots often do not go right through the leaf. Lesions can also form on petioles and twigs. Other fungi, such as *Trimmatostroma* spp. can often be found on the lesions with *Aulographina.*

Eucalypt Leaf Spot (*Pseudocercospora* spp.)

Major hosts are *E. delegatensis, E. fastigata, E. globulus, E. nitens, E. obliqua,* and *E. regnans.*

The symptoms are angular brown lesions which are first visible in January on new leaves, and the main infection period is January – March. The spores, which are wind dispersed, are produced on leaf spots.

Septoria Leaf Blight *(Phaeophloeospora eucalypti,* previously called *Septoria pulcherrima, Kirramyces eucalypti)*

Septoria was first found in New Zealand in 1981, but became important in the 1990s in young *E. nitens* plantations. The hosts of this fungi include *E. globulus, E. nitens, E. viminalis, E. grandis* and several other species, but the most significant is *E. nitens.*

The symptoms are leaf spots extending to both sides of leaf which are initially yellow, then turn a crimson colour. Both juvenile and adult foliage are affected, resulting in the infected leaves being cast. It can also be associated with *M. cryptica.*

The disease development in a severely diseased plantation is as follows:

- Infection of new leaves occurs from spring onwards (from spores on leaves remaining from the previous infected season).
- New juvenile leaves become resistant after several weeks.
- Spore production is ongoing during spring and summer until leaf shed, i.e. general increase in inoculum.
- Epidemic build up of stand infection during growth season; spots yellow, then crimson in January, later brown.
- The cycle slows down as temperatures cool after the end of summer.
- In the worst areas foliage is lost within one year.
- In the worst areas, half or less of the current foliage is retained compared to healthy sites.
- This impacts on growth, especially but not solely in coastal areas of the Bay of Plenty region.

Control mechanisms

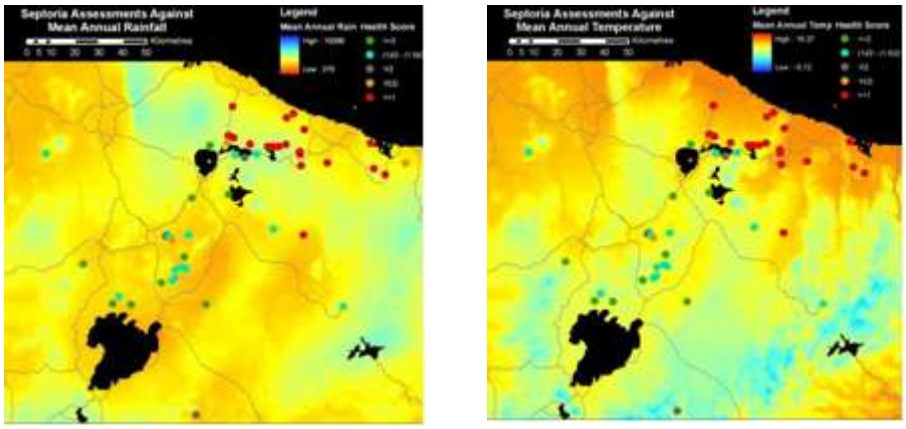
- In field trials of host resistant material, *E. nitens* from NSW was better than from Victoria.
- *E. globulus* ssp. *maidenii* showed low infection by *P. eucalypti* and *Mycosphaerella* spp.

E. nitens stand survey

in April 2005 Forty-nine 8- to12-year-old stands were visited and assessed for leaf spotting by *P. eucalypti* (categorised as trace, low, medium, high).

The results were that:

- Infection by *P. eucalypti* was widespread.
- Stands were worse within 20 km of the coast.
- Stand condition appeared to relate to mean annual temperature and mean daily temperatures for January and July, and to elevation.
- Stand condition was not affected by rainfall humidity or extreme temperatures.



Mean Annual rainfall | Mean Annual Temperature

Interaction of *P. eucalypti* with mean annual rainfall and temperature (from Hood and Alexander, 2006)

Summary

- In the absence of a more intensive survey, further cultivation of *E nitens* cannot be encouraged within a zone extending 20 km in from the Bay of Plenty coast.
- Further inland, ridge tops or valley floors should be avoided.
- It is probable that improved eucalypt planting stock will become available for such risk sites, even if it may not be from within *E. nitens*.
- Prospects are now limited for *E. nitens* in the Bay of Plenty region as a result of the impact of *P. eucalypti* and *P. charybdis*.

Foliar *Phytophthora* spp.

This disease was investigated after extensive foliage death in a stand of 18-year-old *E. botryoides* was recorded in the spring of 1986. Similar symptoms were found in nearby *E. macarthuri, E. sieberi* and *E. saligna*. Defoliation and dieback was also recorded in a stand of young *E. fastigata* in spring of 1987. Extensive defoliation of *E. delegatensis* was recorded from Southland, and minor infection of *E. nitens* has been recorded.

Symptoms are infection of leaves, petioles and twigs followed by defoliation and dieback. The symptoms are initiated in mid - late winter or in early spring, but with few symptoms in summer.

Two species of *Phytophthora* have been found associated with leaf and twig lesions and pathogenicity has been demonstrated. The species differ in morphology, temperature-growth patterns, host species and in location within New Zealand. The method of dissemination has not been determined.

Barron Rd Syndrome *(an eco-physiological disorder)*

This problem was identified on *E. regnans*, *E. fastigata* and other species. The symptoms are foliage loss, shoot galling, shoot abortion, leaf spots, dieback and mortality. The primary cause is thought to be planting the species in environmental conditions that differ from those in the source locations in Australia and are not suitable for the species. A range of fungi develop on the leaves with the most common being *Aulographina eucalypti* and *Pseudocercospora* spp.

Key Points

- Some eucalypt species are more resistant to insect pests than others.
- Insect resistance should be considered during species selection of eucalypts and is as important as growth rate, tree form and wood properties.
- The planting of stringybark and ash eucalypts in preference to *Symphyomyrtus* species may reduce the risk of serious damage from insect attack.
- Leaf spot diseases can be reduced by species selection and careful siting.

Suggested reading:

Alma 1977

Gadgil & Dick 1999

Hood & Alexander 2006

Nicholas & Hay 1990

www. nzffa.org.nz