Pests and Diseases of *Eucalyptus macrorhyncha*

Report prepared for the Marlborough Research Centre
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16th August 2023

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Te Whare Wānanga o Waitaha

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Front Cover: *Eucalyptus macrorhyncha*, photo by Chris Lindorff, iNaturalist.

Executive Summary

This report provides an overview of known pests and pathogens that are associated with *Eucalyptus macrorhyncha*. Information was sourced from scientific literature searches (Google scholar and Scopus), general Google searches, requests for information from unpublished databases, e.g., Forest Health Database and the Australian Plant Pest Database, and direct requests to researchers in New Zealand and Australia.

Key results

- A total of 58 species, including 37 invertebrates, 19 pathogens, and 2 parasites are known to be associated to some degree with *E. macrorhyncha.*
- For most species little is known regarding the potential severity of damage that may occur on *E. macrorhyncha*. The exception is paropsine beetles with confirmed observations of *Paropsis charybdis* and *Paropsisterna cloelia* (nothing known with respect to other established species) that have been studied in the Hawke's Bay and Marlborough. Field observations suggest that *E. macrorhyncha* is one of the least preferred host species, but on certain sites and under certain conditions moderate defoliation (25 to 50%) of leaves has been observed. The drivers of this remain unknown.
- From a pathogen perspective, foliar pathogens, e.g., leaf spot diseases, and soil-borne *Phytophthora* are the most concerning with multiple species already established in New Zealand. Such pathogen issues are likely to periodic and most severe on warmer/wetter sites. Climate change may thus exacerbate pathogen effects in some regions.

Future work/Recommendations

- It would be beneficial to undertake a systematic national survey of currently established pests and pathogens of *E. macrorhyncha* under a range of climate conditions (temperature and rainfall).
- Any survey should consider the severity of impacts (under a range of conditions) and where relevant link impact severity with known genetic provenance to determine if a genetic basis of resistance and/or tolerance exists.
- Such a survey could form part of a future PhD project but would require collaboration beyond the School of Forestry to ensure access to appropriate laboratory facilities for pathogens. This could incorporate stress testing of *E. macrorhyncha* to foliar pathogens under simulated future climates.

Introduction

Eucalyptus macrorhyncha is one of the preferred species of the New Zealand Dryland Forests Initiative (NZDFI). To date there is no known systematic or ad hoc survey of the pests and pathogens associated with *E. macrorhyncha* in either its native Australian range or areas where it has been established beyond its natural range, e.g., New Zealand. This report compiles information available from published sources, e.g., peer reviewed papers and reports, online databases, requests for information from Australian scientists and non-public databases, e.g., NZ Forest Health Database and the Australian Plant Pest Database. In addition, ~400,000 records from the Atlas of Living Australia of either *E. macrorhyncha* or invertebrates in the groups Chrysomelidae, Cerambycidae, and Hemiptera were screened for any documented host associations.

Known pest or pathogen associations

A total of 58 species of predominantly invertebrate pests and fungal pathogens are known to be associated with *E. macrorhyncha* (Appendix 1). A total of 37 invertebrates, comprising 1 Blattodea (termite), 12 Coleoptera (beetles), 1 Diptera (fly), 17 Hemiptera (true bugs), 5 Lepidoptera (moths), and 1 Nematoda (nematodes) were identified. Two plant parasites (mistletoe species) are associated with *E. macrorhyncha*, however there is a negligible likelihood of establishment of those species in New Zealand. At least 19 pathogens are represented by a range of diseases, including foliar (mainly leaf spot) and stem or root rot fungi and water moulds, e.g., *Phytophthora*. Despite the diversity of species known to be associated with *E. macrorhyncha* there is almost no knowledge on the potential impact that they have on survival or productivity.

Quantitative data of the impact of pests on *E. macrorhyncha* is limited only to paropsines. A comparative assessment by Lin et al. (2017) surveyed 11 species of *Eucalyptus* for paropsine browse. It was not possible to attribute damage to individual species with three species (*Paropsisterna cloelia*, *Paropsis charybdis*, or *Trachymela sloanei*) present that have similar damage. Noting also that adult *Gonipterus* damage can also look similar. Lin surveyed 149 *E. macrorhyncha* spread throughout three sites (NZDFI sites, Alexander, HBRC and McNeill) in the Hawke's Bay. It was observed that *E. macrorhyncha* was the least defoliated of species assessed overall (Lin et al. 2017). Site specific differences were observed with no (<5%) or light (5-25%) browse at HBRC and Alexander respectively, but more than 50% of trees exhibiting 26-50% defoliation attributable to paropsine browse at the McNeil site. Hence, under certain site conditions moderate defoliation by paropsine beetles can occur.

Counts of *P. cloelia* eggs, larvae, and adults were taken by Lin et al. (2017) at the three sites between the 18-26th January 2017. Lin et al. (2017) acknowledge that the timing of sampling was not optimal to observe eggs and larvae, however comparisons between eucalypt species show comparatively few adult *P. cloelia* observed on *E. macrorhyncha* compared to preferred hosts, e.g., *E. bosistoana*, *E. tricarpa*, and *E. quadrangulata*. More importantly, no eggs or larvae were observed despite their presence on the preferred species. Collectively the defoliation and pest abundance data are indicative that *E. macrorhyncha* is less preferred than other species at these sites.

Leslie Mann continued the comparative assessments of paropsine defoliation by examining 7 species (*E. quadrangulata*, *E. bosistoana*, *E tricarpa*, *E. globoidea*, *E. macrorhyncha*, *E. camaldulensis* and *E.*

cladocalyx) of *Eucalyptus* at the Dillon and Lissaman trial sites in Marlborough. Initial work counted the abundance of adult paropsines and found that *E. macrorhyncha* had the least number of adults, but this was only significantly lower than the most preferred species, *E. tricarpa* (Mann and Pawson 2020). Coarse visual assessments (same method as (Lin et al. 2017)) showed *E. macrorhyncha* to be the least defoliated with 24 of the 30 trees sampled showing less than 25% defoliation (Mann and Pawson 2020). The semi-quantitative Crown Damage Index (CDI) classified *E. macrorhyncha* as the least affected by paropsine browse (Mann and Pawson 2020). Analysis of a second season of monitoring by Mann and Pawson (2022) showed that *E. macrorhyncha* was less browsed (CDI assessment) than *E. quadrangulata* ($P < 0.001$), *E. camaldulensis* ($P < 0.001$), *E. tricarpa* ($P < 0.001$). and *E. bosistoana* ($P < 0.001$). Height gain of *E. macrorhyncha* was not correlated with paropsine browse, unlike the heavily browsed *E. tricarpa* ($P = 0.02$) and some evidence of paropsine browse affecting height gain in *E. bosistoana* ($P = 0.07$) was observed. Broadly speaking the work of Mann and Pawson (2020) and Mann and Pawson (2022) at two Marlborough sites is consistent with that of the three Hawke's Bay sites assessed by Lin et al. (2017). Collectively this suggest that *E. macrorhyncha* is not a favoured species of currently established paropsine beetle pests.

Key risks

Current pest

Currently there are no known highly damaging pests or diseases of *E. macrorhyncha* in New Zealand. The most likely candidates are paropsine beetles, however research to date suggests that *E. macrorhyncha* is amongst the least preferred species. However, we have no data to determine if the limited foliar browsing observed in small experimental stands, e.g., NZDFI trial plots, will hold true if *E. macrorhyncha* is planted in stands of tens or hundreds of hectares. Indeed, Hood and Bulman (2018) note that the list of known pests and pathogens of *Eucalyptus* is biased towards species that affect the most widely planted species. This no doubt reflects a sampling bias and highlighted the need for a systematic survey of current pests with a view to understanding which have the potential to cause problems if *E. macrorhyncha* was to be planted at scale.

From a pathogen perspective it is difficult to determine which pathogens maybe the most detrimental to large-scale *E. macrorhyncha* planting. There are anecdotal reports of increasing prevalence of leaf-spot fungi associated with warm/wet conditions on other species of *Eucalyptus*. However, there has been no recent systematic survey of the diversity of foliar leaf pathogens or their impact on *Eucalyptus* in New Zealand. Currently, at least 9 species of known foliar pathogens have been associated with *E. macrorhyncha*, including several species from New Zealand *Aulographina eucalypti*, *Teratosphaeria ovata*, *Mycosphaerella cryptica* that are known to cause minor to moderate damage to other species of *Eucalyptus* (Appendix 1). It has been asserted that moncalypts, such as *E. macrorhyncha*, are less susceptible to insect browse, however they are potentially more susceptible to soilborne *Phytophthora* (Hood and Bulman 2018). This has not been tested in *E. macrorhyncha* to date.

Future threats

Eucalyptus has a diverse herbivore fauna, including some that have invaded *Eucalyptus*-growing areas in other parts of the world (Paine et al. 2011). Novel associations between native herbivores

and introduced *Eucalyptus* has been widely recorded (Paine et al. 2011), however in New Zealand these have not resulted in any substantial pest impacts. Termites and pinhole borers have been observed on various species of *Eucalyptus* (Milligan 1979, Milligan 1984), but no major impacts of native species are known in *Eucalyptus.* It seems unlikely that an existing native species will adapt to *E. macrorhyncha*

Due to its proximity and downwind location relative to Australia, it is likely that there will be periodic introductions of new species with uncertain consequences (Hood and Bulman 2018). Clear aerial pathways that can transport small insects or fungal spores have been demonstrated (Fox 1978, Pretorius et al. 2023). Similarly, trade is a known historical pathway, particularly of foliar species before cut foliage imports were stopped (Withers 2001). More recently trade cannot be discounted as more recent introductions of species like *Paropsisterna cloelia* have a tendency to 'hitchhike'.

Climate change

The effects of climate change will differ throughout New Zealand. All areas will become warmer, however some are likely to become wetter and others drier. Warmer, wetter, conditions will increase the prevalence and rate of development of pathogens with historical observations of severe disease impacts on *E. delegatensis*, *E. nitens*, and *E. fastigata* (Hood and Bulman 2018). The full range and severity of impacts of fungal pathogens currently present on *E. macrorhyncha* in New Zealand has not been established. It would be advisable to structure any systematic survey of pathogens to incorporate the effects of temperature and moisture on the presence of disease. In doing so, it may provide insights as to how the pathogen load of *E. macrorhyncha* may respond in future climatic scenarios. Whilst such a survey would be suitable for a PhD, also stress testing *E. macrorhyncha* with pathogens under potential future warm/wet climates could be useful.

Future work

To date there has been no systematic survey of either the diversity of pests or pathogens that affect either foliage or wood. Neither has there been a comprehensive survey of the impact that key pests have on the productivity of *E. macrorhyncha*. The obvious next steps are:

- Undertake a national survey to quantify the diversity of invertebrate, fungal, and oomycetes associated with *E. macrorhyncha*.
- Quantify the severity of damage of key pest and pathogen species and understand how severity varies with temperature and rainfall, both current conditions and potential future climates.
- Quantify the variation in susceptibility that is linked to genetic relatedness, e.g., amongst families or provenances within the NZDFI *E. macrorhyncha* breeding programme.

Conclusions

One of the key conclusions of Hood and Bulman (2018) is that the combination of good species selection, appropriate siting, sound management and proficient breeding is the optimal strategy for managing pest and pathogen risks in eucalypts. Current available published information and datasets suggests that *E. macrorhyncha* is a suitable species choice. At present it has not suffered any known significant pest or disease outbreaks and appears to be one of the least preferred species for paropsine leaf beetles. However, significant uncertainties remain as there has been no systematic nationwide survey of pests and pathogens with quantification of their impact on productivity. Pathogen impacts are the least understood. As a long-lived crop species, we know that it will be

subjected to future climates that are likely to be more amenable to pathogens, e.g., warmer and wetter. Hence, stress testing for these maybe useful.

Acknowledgements

This report has benefited from the provision of pest and disease records by Helen Nahrung (University of the Sunshine Coast), Toni Withers (Scion), and Stephanie Sopow (Scion).

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Appendix 1. Known invertebrates and pathogens associated with *Eucalyptus macrorhyncha* with brief notes and source of information.

Order	Family or Class	Species	Notes	References
Blattodea	Termitidae	*Nasutitermes exitiosus*	Widespread mound forming wood feeding termite, distributed throughout southern half of Australia. Unlikely to establish in New Zealand due to pathway controls	(Plant Health Australia. 2001)
Coleoptera	Cerambycidae	*Aesiotyche favosa*	Broadly distributed in south-eastern and southern Australia, probably an unusual association, not a species that is regularly associated with *E. macrorhyncha*. Unlikely to establish in New Zealand due to pathway controls	(Plant Health Australia. 2001)
Coleoptera	Curculionidae	*Austroplatypus incompertus*	Slowly developing ambrosia beetle, requires 4 years per generation. Widespread throughout south-eastern Australia and will attack live, healthy, trees. Unlikely to establish in New Zealand due to pathway controls	(Kliejunas et al. 2003).
Coleoptera	Chrysomelidae	*Cadmus aurantiacus*	Adults likely to feed on leaves and flowers, larvae likely to be detritivores in litter. Known to feed on *E. macrorhyncha* and is implicated as the causal agent of seedling defoliation and girdling of related *E. fraxinoides* with larval densities reaching 1000 m^2.	(Reid 1999)

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Coleoptera	Bostrichidae	Lyctid beetles (timber)	*E. macrorhyncha* sapwood is known to be affected by lyctid beetles. NZ has established species of Lyctidae, including *Lyctus brunneus*. Lyctids are well known to feed on dry sapwood where they extract starch. They are less likely to be a problem as *E. macrorhyncha* is being grown for the durable heartwood that is not generally susceptible to these species	(Hassan 2020)
Coleoptera	Buprestidae	*Melobasis splendida*	A diverse genus of jewel beetles. Larval stages develop in recently deadwood. Not likely to be a problem in plantations as unlikely to attack live *E. macrorhyncha.* Not known to be present in NZ, however an unidentified species of *Melobasis* has established in Auckland in the last 5 years. Thus, there are potential pathways for these species to establish.	(Hawkeswood 2011, Turner and Hawkeswood 2011)
Coleoptera	Chrysomelidae	*Paropsis aegrota*	*E. macrorhyncha* is a known host. Has a broad host range and wide climatic envelope from Queensland to King Island in the Bass Strait. Can be distinguished from currently established paropsines as it lays its eggs in small clusters on the edge of leaves. Described as common in some areas of Australia.	(Maywald 2015)
Coleoptera	Chrysomelidae	*Paropsis atomaria*	This species has a very diverse host range of over 25 species of *Eucalyptus* and related genera. *E. macrorhyncha* is a known host. Carne 1966 commented that they do not oviposit in field on *E. macrorhyncha*, hence suitability as larval host plant remains ambiguous. It has a wide climatic envelope from Queensland to Adelaide. It also has	(Carne 1966, Maywald 2015)

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			known invasive populations in California. Eggs are laid as a mass around small twigs.	
Coleoptera	Chrysomelidae	*Paropsis charybdis*	Widespread throughout NZ, known to cause damage to *E. macrorhyncha* (see main discussion)	
Coleoptera	Chrysomelidae	*Paropsis cloelia*	Recently established and spreading in the eastern/central North Island and upper South Island. Known to cause damage to *E. macrorhyncha* (see main discussion)	
Coleoptera	Chrysomelidae	*Trachymela spp.*	No published records of *Trachymela* on *E. macrorhyncha*. Three species are present in NZ. *T. sloanei* that is widespread and two other species with restricted distributions in the East Cape and in Nelson. It is more difficult to associate damage to *Trachymela* as the larvae hide in bark crevices during the day and then migrate to the canopy at night to feed.	
Coleoptera	Cerambycidae	*Phoracantha semipunctata*	Present in NZ, known to cause problematic damage in *E. macrorhyncha* in severely drought affected stands, e.g., record 1965 drought. Beetles attack drought stressed trees and are thought to be significant contributing factor to the decline of drought affected trees. Potentially problematic on highly drought prone sites in NZ	(Pook and Forrester 1984)
Coleoptera	Curculionidae	*Gonipterus platensis*	Present in NZ with related species also invasive in many other countries, e.g., South Africa. Noted by Poynton (1979) that *E. macrorhyncha* was largely unaffected by *Gonipterus*, to date no survey of its abundance on *E. macrorhyncha* has been undertaken in NZ. Egg parasitoid is present in NZ.	(Poynton 1979)

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Diptera	Fergusoninidae	*Fergusonina nicholsoni*	*Fergusonina* flies have obligate *Fergusobia* nematodes, in conjunction they form galls that can affect shoot buds, inflorescence buds, flower buds, leaves, or stems, depending on which species are involved. *Fergusonina nicholsoni* has been reared from an *E. macrorhyncha* flower gall. It is unknown what impacts this may have.	(Scheffer et al. 2004)
Hemiptera	Coreidae	*Amorbus obscuricornis*	Coreid bugs are known to be generally rare or at best locally common. They are not known to have any economic impacts in their natural Australian range. They are phytophagous leaf feeders that insert their stylet into leaves. *A. obscuricornis* is known to feed on *E. macrorhyncha* and has a modelled (CLIMEX) Australian climatic that overlaps with proposed NZ growing areas	(Steinbauer et al. 2002)
Hemiptera	Coreidae	*Amorbus rubiginosus*	This is the most widely distributed species of *Amorbus* and has been recorded from all Australian states, except Tasmania. Unlikely to establish in NZ or be a problem.	(Steinbauer et al. 2002)
Hemiptera	Eriococcidae	*Apiomorpha intermedia*	*Apiomorpha* is a diverse genus of gall forming scale insects. They are renown for the spectacular size of the female gall. Restricted to *Eucalyptus* and not currently present in NZ. Adult females are flightless, thus it is unlikely that any species of *Apiomorpha* will establish in NZ, as long as adequate import requirements do not allow fresh plant material.	http://scalenet.info/catalogue/Apiomorpha%20intermedia/

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Hemiptera	Eriococcidae	*Apiomorpha ovicola*	See *Apiomorpha intermedia*	(Plant Health Australia. 2001), http://scalenet.info/catalogue/Apiomorpha%20ovicola/
Hemiptera	Eriococcidae	*Apiomorpha pharetrata*	See *Apiomorpha intermedia*	Australian Plant Pest Database, online database, accessed 3-6-2023 http://scalenet.info/catalogue/Apiomorpha%20pharetrata/
Hemiptera	Eriococcidae	*Apiomorpha sessilis*	See *Apiomorpha intermedia*	http://scalenet.info/catalogue/Apiomorpha%20sessilis/
Hemiptera	Eriococcidae	*Apiomorpha spinifer*	See *Apiomorpha intermedia*	http://scalenet.info/catalogue/Apiomorpha%20spinifer/
Hemiptera	Eriococcidae	*Apiomorpha thorntoni*	See *Apiomorpha intermedia*	iNaturalist (3 observations around Melbourne); http://scalenet.info/catalogue/Apiomorpha%20thorntoni/
Hemiptera	Aphalaridae	*Australopsylla revoluta*	Reported by Burns (2009) the two described species of this genus are known to feed on *E. macrorhyncha*, no information is known on their potential impacts. Two undescribed species of *Australopsylla* were abundant in her study of *Eucalyptus polyanthemos, E. melliodora*, *and E. blakelyi*. *E. revoluta* is also recorded elsewhere as associated with *E. macrorhynca* https://biodiversity.org.au/afd/taxa/Australopsylla_revoluta	(Burns 2009)
Hemiptera	Aphalaridae	*Australopsylla carinata*	Refer to *A. revoluta*	(Burns 2009)

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Hemiptera	Aphalaridae	*Glycaspis (Synglycaspis) sp. nov.*	This undescribed hemipteran produces spherical, ostiolate galls on the leaves of *E. macrorhyncha*. Observed in the central western tablelands (NSW) it has two generations per year. It is unknown what affect this species has on productivity	(Sharma et al. 2015)
Hemiptera	Aphalaridae	*Glycaspis (Synglycaspis) inclusa*	Observed from *E. macrorhynca* in NSW North Coast, Mangrove Mountain, 300 m.a.s.l	Referred to in Table one of Sharma et al. (2015)
Hemiptera	Aphalaridae	*Glycaspis (Synglycaspis) occulta*	Observed from *E. macrorhynca* in SE Highlands, Black Mountain, 800 m.a.s.l	Referred to in Table one of Sharma et al. (2015)
Hemiptera	Eriococcidae	*Heathcotia crypta*	Small (1.6mm) soft scale insect observed under the bark of *E. macrorhynca* twigs*. Little known.*	http://scalenet.info/catalogue/Heathcotia%20crypta/
Hemiptera	Pseudococcidae	*Pseudococcus hypergaeus*	Present in NZ. Has a broad host range from at least 9 plant families. Known from *E. macrorhyncha* and other eucalypts including melliodora, viminalis, and lanigerum. Nothing known of its impact on *E. macrorhynca* in NZ or elsewhere.	http://scalenet.info/catalogue/Pseudococcus%20hypergaeus/
Hemiptera	Eriococcidae	*Subcorticoccus beardsleyi*	Coccid scale reported from beneath bark on twigs of *E. macrorhyncha*. Nothing much known other than its taxonomic description	http://scalenet.info/catalogue/Subcorticoccus%20beardsleyi/
Hemiptera	Cicadidae	*Thopa saccata*	One of Australia's largest cicada species, nothing known other than *E. macrorhyncha* is a potential nymphal host plant. Unlikely to ever establish in New Zealand.	(Elliot et al. 1998)

Order	Family or Class	Species	Notes	References
Lepidoptera	Gracillariidae	*Acrocercops laniniella*	Commonly known as the black butt leaf mining moth. First observed in NZ in 1999 and now widely distributed. Satchell (2006) assessed damage on 14 eucalypt species, but not *E. macrorhyncha*, in Northland. Likely to cause some damage, however to determine if this meets an economic damage threshold would require further investigation.	(Kliejunas et al. 2003)
Lepidoptera	Limacodidae	*Doratifera quadriguttata*	The four-spotted cup moth is a striking species that feeds on a range of species. They have stinging hairs as caterpillars. Larvae have been photographed on *E. macrorhyncha*, however it is unknown whether this is a preferred host. Current biosecurity practices should prevent its movement to NZ, however natural dispersal is possible, though unlikely.	https://commons.wikimedia.org/wiki/File:Doratifera_quadriguttata_larva_1.jpg
Lepidoptera	Notodondidae	*Epicoma melanospila*	Recorded as associated with *E. macrorhyncha*, caterpillars rest (sometimes gregariously) on trunks and feed on foliage at night. Noted as the food plant for *E. melanospila*, little else is known regarding potential impacts.	(Benson and McDougall 1998)

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Lepidoptera	Saturniidae	*Opodiphthera eucalypti*	The gum emperor moth is present in NZ and has been recorded feeding on *E. macrorhyncha*. This species can consume large volumes of foliage, but its impact on *E. macrorhyncha* has not been quantified.	(Robinson et al. 2023)
Lepidoptera	Nolidae	*Uraba lugens*	Foliar feeding moth that is present in NZ. Distributed in Northland, Auckland, Waikato, Bay of Plenty, Hawke's Bay, Manawatu, and Nelson. A polyphagous species that can cause periodic substantial defoliation, however its impacts of *E. macrorhyncha* have not been assessed. The larval parasitoid, *Cotesia urabae*, was released in 2011 and is established in both the North and South Islands.	(Elliot et al. 1998, Robinson et al. 2023)
Nematoda	Aphenenchoidoidae	*Ptychaphelenchus eucalypticola*	This is a bark inhabiting nematode that is described from *E. macrorhyncha*. Nothing else is known apart from its description as a monotypic genus.	(Hodda 2009)

Order	Family or Class	Species	Notes	References
Parasite	Santales	*Amyema miquelii*	*Eucalyptus* and *Acacia* are known hosts of box mistletoes. It affects bark/cambium and sapwood but is not likely to establish in NZ.	(Kliejunas et al. 2003)
Parasite	Santales	*Amyema pendulum*	Not known from NZ, this species of parasitic mistletoe has a broad host range of eucalypts and *Acacia.* It affects bark/cambium/sapwood, but is not likely to establish in NZ.	(Kliejunas et al. 2003)
Pathogen	Physalacriaceae	*Armallaria luteobubalina*	Not known from NZ, however congeneric species are present. A root rot pathogen, known to be a primary pathogen in natural eucalypt forests. Affects bark, cambium, sapwood, and heartwood. Like other *Armillaria* there is a relationship between the number of infected stumps and disease incidence.	(Kliejunas et al. 2003) (Park et al. 2000)

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Pathogen	Teratosphaeriaceae	*Aulographina eucalypti*	One of the most common and distinctive leaf spot fungi of eucalypts with a broad host range. Known to cause moderate to sever premature defoliation in some species, generally affects leaves but is sometimes symptomatic on petioles, twigs, fruits, and bark. Present in NZ. Severity on *E. macrorhyncha* has not been assessed but it is a known host and monocalypts are known to be sensitive to the point that they may require management within plantation contexts. Variation in disease resistance has been reported in *E. globulus*. One record for *Aulographina* sp. is entered into the NZ Forest Health Database and is listed as widespread and severe with 100% incidence in 2016 in the Bay of Plenty (provided by Stephanie Sopow, Scion).	(Plant Health Australia. 2001) (Kliejunas et al. 2003) (Park et al. 2000)
Pathogen	Cryphonectriaceae	*Aurantiosacculus sp.*	Presents as small irregular lesions with purple-black margins. A species is known from the APPD records to be from *E. macrorhyncha*. Only known from Australia and described as rare.	(Plant Health Australia. 2001) (Park et al. 2000)
Pathogen	Teratosphaeriaceae	*Teratosphaeria ovata (Coniothyrium ovatum)*	Leaf spot pathogen, known to cause minor economic damage on various eucalypts in Sth Africa. Present in NZ, however impacts on *E. macrorhyncha* have not been assessed.	(Kliejunas et al. 2003) (Crous et al. 2009)

Order	Family or Class	Species	Notes	References
Pathogen	Nectriaceae	*Cylindrocladium scoparium*	Nonspecialised fungi, associated with a range of symptoms. Was previously reported to have caused serious damping-off in forest nurseries. It is a pathogen that attacks succulent stems or first leaves and below ground parts of plants. Described as a very weak wound pathogen. Widely distributed in NZ it is a potential issue in the nursery production of *E. macrorhyncha*.	(Plant Health Australia. 2001) (Gadgil 2005) (Park et al. 2000)
Pathogen	Valsaceae	*Cytospora eucalypticola*	Present in NZ. Associated with dieback and stem/branch cankers. Known NZ hosts are *E. grandis* and *E. nitens*, but it has been reported from *E. macrorhyncha* elsewhere. Causes minor damage and considered to be a 'weak' pathogen	(Kliejunas et al. 2003) (Dick 1998{Old, 2000 #18609)
Pathogen	Hymenochaetaceae	*Inonotus rheades*	Wood decay fungi with a wide host range. Nothing known on potential impacts	(Kliejunas et al. 2003)
Pathogen	Coelomycetes	*Martinella eucalypti*	Reported from the Australian Plant Pest Database, but nothing else known regarding its association with *E. macrorhyncha*	(Plant Health Australia. 2001)
Pathogen	Mycosphaerellaceae	*Mycosphaerella cryptica* (anamorph *Colletogloeum nubilosum*)	Affects leaves and bark/cambium. Present in NZ, however its impacts on *E. macrorhyncha* have not been quantified. Species of *Mycosphaerella* are known to be the more important foliar pathogens of eucalypts.	(Plant Health Australia. 2001), (Kliejunas et al. 2003)

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Pathogen	Omphalotaceae	*Omphalotus nidiformis*	A charismatic fungus with notable bioluminescent fruiting bodies. It is a saprophyte and/or parasite that has a wide host range. It has a broad host range and is known to cause heartwood rot in *E. macrorhyncha*. Known from the southern half of Australia it has established in Kerala (India) and Norfolk Island.	(Kliejunas et al. 2003)
Pathogen	Teratosphaeriaceae	*Pachysacca samuelii*	A leaf spot fungus. Recorded from South Australia and Tasmania. Known associations with *E. macrorhyncha* in Australia. No known significant damage in NZ.	(Plant Health Australia. 2001)
Pathogen	Coelomycetes	*Phomachora eucalypti*	Present in NZ, known associations with *E. macrorhyncha* in Australia. Not known what impact is in NZ, however notes on hosts other than *E. macrorhyncha* indicate no significant damage.	(Plant Health Australia. 2001) (Park et al. 2000)
Pathogen	Phyllachoraceae	*Phyllachora sp.*	Known associations with *E. macrorhyncha*.	(Plant Health Australia. 2001)
Pathogen	Peronosporaceae	*Phytophthora cinnamomi*	Known to be associated with *E. macrorhyncha* and is described as destructive to some species of monocalypts, including *E. macrorhyncha*. Although present in NZ, nothing is known of its severity on *E. macrorhyncha* in NZ, however if it were to be problematic it is likely to occur on wetter sites.	(Park et al. 2000) (Old and Davison 2000)
Pathogen	Teratosphaeriaceae	*Readeriella mirabilis*	Present in NZ (reportedly common) and reported on *Eucalyptus fastigata*, *E. fraxinoides*, *E. nitens*. Reported in Australia on *E. macrorhyncha*. Described as a secondary invader of tissue already dead. Noted as common on *E. nitens*, but impact on *E. macrorhyncha* unknown.	(Plant Health Australia. 2001)

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Pathogen	Coelomycetes	*Vermisporium biseptatum*	Not reported from NZ, presents as angular, vein-limited leaf spots, known from monocalypts and Symphyomyrtus. All *Vermisporium* (which is generally considered a synonym of *Allelochaeta*) are necrotic pathogens of eucalypts, pathogenicity is poorly understood, some may be secondary colonisers. Impacts of all species are unknown.	(Kliejunas et al. 2003) (Park et al. 2000)
Pathogen	Coelomycetes	*Vermisporium orbiculare*	Not reported from NZ, presents as angular leaf spots, only found on monocalypts.	(Plant Health Australia. 2001) (Park et al. 2000)
Pathogen	Sporocadaceae	*Allelochaeta obtusa* (Syn. *Vermisporum obtusum*)	Present in NZ, presents as small angular vein-limited or larger round leaf spots, purple raised margins present. Only known from monocalypt species.	(Kliejunas et al. 2003) (Park et al. 2000)
Pathogen	Sporocadaceae	*Allelochaeta walker (*Syn. *Vermisporum walker*)	Known from NZ, presents as angular, vein limited, leaf spots. Several species of *Vermisporum* are associated with monocalypts. Impact unknown.	(Kliejunas et al. 2003) (Park et al. 2000)