Needle disease strategy Research Programme

SCION forests · products · innovation

Monitoring red needle cast and its relationship with weather factors

Authors:
Nari Williams, Christine Todoroki, Martin Bader, Judy Gardner, María Hance, Craig Brown, Bill Wheeler, James Tennant, Lindsay Bulman, Margaret Dick, Ian Hood, Benjamin Cleary-Schipper

Date: June 2016.

Publication No: - ND-T013

Milestone No: 1.1.1. Monitoring. Disease expression timing.

supported by forestgrowers commodity levy

FOREST OWNERS ASSOCIATION

PUBLIC REPORT INFORMATION SHEET

Report Title	Monitoring red needle cast and its relationship with weather factors
Authors	Nari Williams, Christine Todoroki, Martin Bader, Judy Gardner, María Hance, Craig Brown, Bill Wheeler, James Tennant, Lindsay Bulman, Margaret Dick, Ian Hood, Benjamin Cleary-Schipper
ISBN No	-
Scion Publication No	-
Sidney Output Number	57710
Signed off by	Lindsay Bulman
Date	June 2016.
Copyright	
Intellectual Property Category	General IP

Disclaimer

Cover

Trees affected by red needle cast at an inoculum bait trap site off Maxwell Road, Wharerata Forest ('North Island, east coast southern' region). Photo, María Hance, September, 2013

EXECUTIVE SUMMARY

1.1 The Problem

Red needle cast is a comparatively new foliage disease in plantations of *Pinus radiata* in New Zealand. While it does not cause mortality, evidence indicates that infection leads to a loss in growth increment. Research is underway into finding methods of managing the disease, including the possibility of employing a chemical control approach. For this to be effective it is necessary to acquire a comprehensive understanding of disease aetiology, including the life cycle of the causal agent, *Phytophthora pluvialis*, as well as that of the associated *P*. *kernoviae*, in relation to weather variables. Observations have demonstrated that the disease varies significantly in different regions, with time of year and in separate years. An awareness of the influencing factors will assist in determining the optimum timing of fungicide applications for best effect.

1.2 This Project

A monitoring project consisting of three studies was established in *P*. *radiata* plantations in the North Island and northern South Island in order to investigate how disease development is associated with weather factors over time. In one study, the severity of the disease symptoms, as well as the level of crown "transparency" due to associated defoliation, were assessed on selected trees at each location at regular intervals for a period of approximately two years. In a related study, the production and dispersal of infective propagules (sporangia and/or zoospores) of both *Phytophthora* species were monitored indirectly over a three year period in two North Island regions by means of foliar bait traps. Receptive, detached needles and leaves were floated in water for one- or two-week intervals and then returned to the laboratory to test for presence or absence of each *Phytophthora* species by means of isolation onto a selective growth medium. In the third study, bait traps were monitored in plots that had been aerially sprayed with phosphite fungicide to see if this treatment had any effect on the production and release of *Phytophthora* inoculum. Traps placed in untreated plots acted as experimental controls. In the first two studies, disease data were compared with virtual daily data over the same periods from notional climate stations within a distance of 5 km supplied by the National Institute of Water and Atmospheric Research (NIWA), in order to investigate any associations between disease development and weather variables.

1.3 Key Results

Both *P*. *pluvialis* and *P*. *kernoviae* were collected in bait traps over much of the year, with generally a lull phase at some point between spring and autumn. However, there was substantial variation between locations, seasonally, and between years. Only one of each *Phytophthora* species was trapped at each of two Rotorua sites, mainly during the first year. However, in bait traps on the east coast of the North Island, *Phytophthora pluvialis* predominated at all sites through much of the trapping period. Presence of both phytophthoras in traps was associated with cooler temperatures and greater rainfall, but the importance of these weather variables varied between locations. At the two Rotorua sites, the probability of *Phytophthora* spp. being present in traps was ca. 0.5 at an average minimum temperature of 2°C but only ca. 0.03 at one of 14°C. Rainfall was not associated with presence or absence of the phytophthoras at these sites. Temperature was also relevant at some sites on the North Island east coast, but in this region the relationship with rainfall was stronger. At two of three sites the probability of *P*. *pluvialis* being present in the traps was 0.84 following 7 days of rainfall > 2 mm in a 14 day period, but only 0.07 if there was no rain. Spraying with phosphite had no perceptible effect on the presence or absence of *P*. *pluvialis* in bait traps.

Disease severity and crown transparency varied greatly between locations in different seasons and years during the monitoring period. There was no observable association with rainfall or temperature.

1.4 Final Conclusions and Implications of Results

The main finding from this work is that the release of viable propagules of both *P*. *pluvialis* and *P*. *kernoviae* is more likely at lower temperatures during periods of surface wetness, using increased rainfall events as proxy. Continuing work, in both the field and laboratory, will define these parameters precisely and enable this information to be integrated with outcomes from research on other aspects of disease development. It appears that any effect of phosphite application in inhibiting the release of inoculum from needles infected by *P*. *pluvialis* is transitory. The best way to reduce inoculum is therefore to control the disease. The benefit of the results from the monitoring of red needle cast in selected trees will be realised through their inclusion with further similar data gathered in the longer term, in helping to explain the regional and annual variation in outbreaks of the disease. The ultimate goal is to develop reliable disease forecasting.

1.5 Further Work

- Consider possible further statistical analyses and evaluation, particularly of disease monitoring data from selected trees.

- Continue field monitoring using bait traps and selected trees for assessment of disease severity, but additionally employing on-site meteorological stations for accurate, real weather data; and also using periodically exchanged potted plants of susceptible clones to determine when infection occurs and how it relates to inoculum availability.

- Continue the laboratory environmental tolerance studies initiated to define the parameters regulating survival periods for sporangia and other propagules of *P*. *pluvialis* and *P*. *kernoviae*.

- Undertake definitive studies in cabinets by inoculating susceptible potted plants with suitable inoculum (standardised suspensions of sporangia and zoospores) under a range of controlled environmental conditions to determine under which parameters infection occurs.

- Explore other factors besides environmental variables that may influence the disease e.g. the role of oospores.

- In due course collate the resultant information into mathematical models that will predict when and where disease outbreaks are likely to be more severe.