

## ***Phomopsis castanea* infection of chestnut in New Zealand**

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### **Abstract**

*Phomopsis castanea* (Sacc.) causes nut rots of chestnut in both Australia and New Zealand. The pathogen is endophytic within otherwise healthy trees and the disease is less of a problem in some regions of New Zealand than in others. The aim of this study was to determine the levels and location within the trees of *P. castanea* infection throughout the season. The data were collected from six chestnut lines from the North and South Island growing areas of New Zealand. A general decline in the levels of 'detected' infection was found in all plant parts during the summer growing season, and there were varietal differences in both levels of infection, and in the rate of infection decline. Infection levels differed between the North and South Island sites and in the embryos in response to pollen source.

### **Key words**

*Phomopsis castanea*, chestnut, endophytic.

### **Introduction**

There are four major species of chestnuts; *Castanea mollissima* Bl.; *C. crenata* Sieb. & Zucc.; *C. sativa* Mill.; and *C. dentata* (Marsh.) Borkh. However, natural hybrids occur readily. Most chestnuts in New Zealand are of hybrid origin (4). Oraguzie et al. (5) reported that most South Island selections were mainly *C. sativa*-like, while North Island selections were more *C. crenata*-like. *P. castanea* is a major storage rot fungus in New Zealand (3). This organism reduces storage life, limits export and market potential, and is a potential producer of the undesirable mycotoxin "Phomopsin" (3). Several studies (7, 3) have attempted to quantify the levels of infection and develop control measures by understanding the disease cycle of *P. castanea*. In New Zealand, there are few data available that quantify fungal infections in chestnut (2). This, they suggested, was due to the problem of pellicle adhesion to the chestnut kernel, which makes it difficult to assess mould infections.

### **Materials and Methods**

During the 1998-1999 and 1999-2000 growing seasons, *P. castanea* infection levels were measured in several chestnut trees from November to the end of April. Sites used were; "The Lincoln University Chestnut Trial", Lincoln and, the Waikato Research Orchard, Hamilton. The North Island site was only sampled in the 1999/00-growing season. Six lines were sampled, three South Island lines (Long Bay-4, Don Whelan, and Crewenna-3), and three North Island lines (1005, 1015, 1002). For each, four randomly chosen trees were sampled. Twigs about 30-40 cm long, with leaves and flowers were cut for processing. All samples were removed from the tree up until the final sample date when the nuts and burrs were collected from the ground. Some flowers of 1002 were also bagged and pollinated with pollen from known varieties to determine whether this affected nut rot rate.

### **Isolation**

For each twig, four samples were obtained from the following material: last seasons' wood; this seasons' wood; old leaves; young leaves; male catkins and female parts (divided into burrs and embryo) when available. All samples were surface sterilised (1), plated onto potato dextrose agar (39g/litre) and incubated at 25°C under a 12-h light/dark regime. Samples were also taken from nuts after various

periods of storage. After 6 and 7 days, the plates were examined for fungal growth. Fungi were identified on the basis of colony morphology and confirmed as *Phomopsis* using the methods of Wadia et al. (6).

## Results and Discussion

Growing season rainfalls were; S.I. 1998/99; 220mm, 1999/2000; 353mm; N.I. 1999/2000; 419mm.

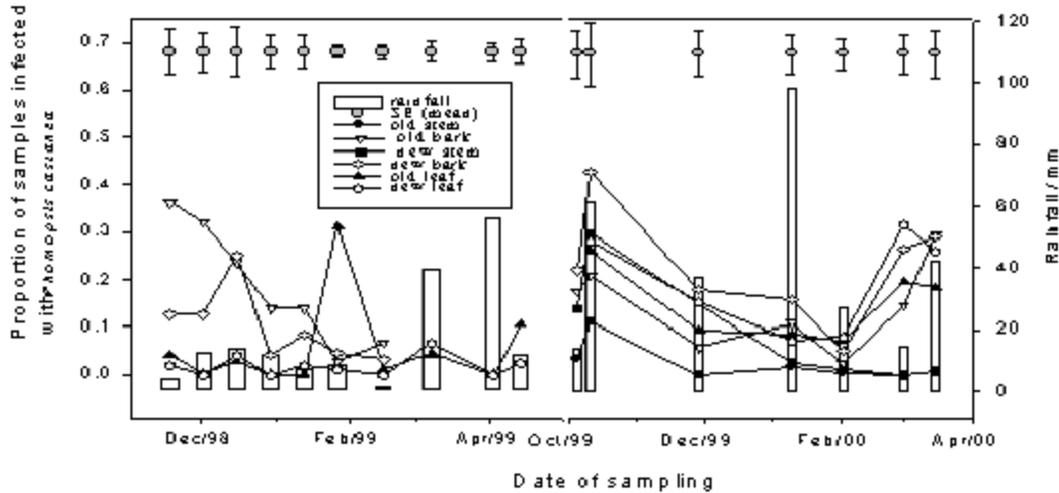
Table 1 shows the results from nuts of '1002' derived from flowers pollinated by other varieties. The infection was worst in the pellicle layer with similar results for both ends of the nuts, which may indicate that infection arises from the maternal plant and not the spore. This is in contrast to the findings of Washington et al. (8) who isolated *Phomopsis* more frequently from the hilum end of the nut and shell. Pollination by hybrid lines resulted in decreased levels of nut infection suggesting that the manipulation of pollen source may be a means for reducing nut infection. However, across the three test environments, chestnut line did not have a consistent effect on level of endophytic infection. All varieties were infected with no obvious relationship to whether they were hybrids or not (results not shown).

**Table 1. Effect of pollen source on level of '1002' nut infection at a South Island site, 1999/2000 season**

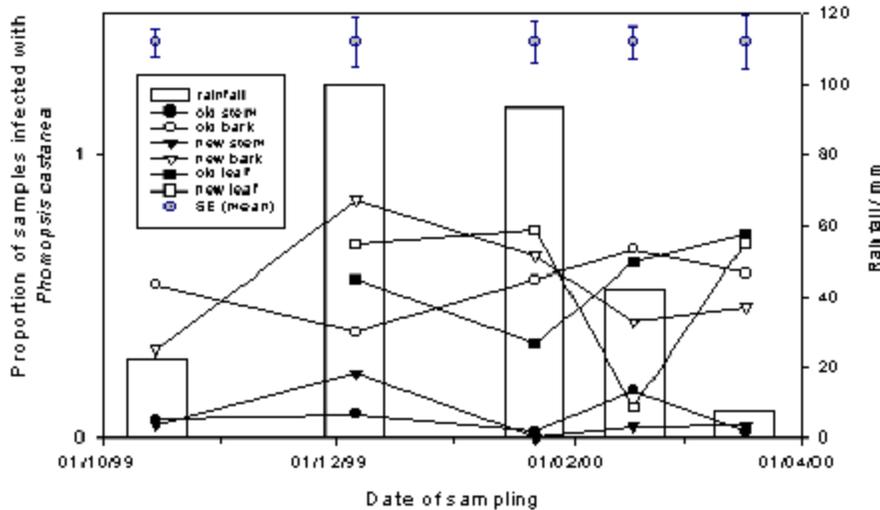
Pollen source	Open	1005 hybrid	1015 hybrid	Crew. 3 <i>sativa</i>	L B <i>sativa</i>	D W <i>sativa</i>	Significance	SE
% infected samples								
	5	6	3	15	12	9	0.005	2%
Location	Apex	Middle	Basal	Pellicle				
	7	2	8	16			0.000	1%

In the South Island there was a general decline in the levels of "detected" infection in all vegetative plant parts sampled from the start of the season. Infection levels were low in all samples during the peak of the summer (January/ February) when temperatures and solar radiation were high and rainfall low. The extent of this decline matched the level of seasonal rainfall being greatest in the dry South Island season and not being observed at all in the wet North Island season (Figures 1 and 2). Total level of infection was also significantly affected by site ( $\chi^2=29$ ,  $P=0.000$ ) being highest in the wetter North Island site. Averaged across all lines for each sample time and organ 5%, 23% and 57% of the samples showed more than 20% detectable infection going from the driest to wettest environments. The association of *Phomopsis* infection with warm moist environments has been noted in a national survey by Wadia et al. (6).

**Figure 1:** Proportion of vegetative samples collected from Lincoln University orchard infected with *Phomopsis castanea*. Means of six varieties, across 2 growing seasons. Rainfall between sample dates is indicated by the histogram bars.



**Figure 2:** Proportion of vegetative samples infected with *Phomopsis castanea* throughout the 1999/00 growing season. Rainfall between sample dates is indicated by the histogram bars



**CONCLUSION**

Establishment of orchards may be better in cooler drier areas with irrigation. Selection of appropriate pollen sources may reduce nut rot.

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