Survey of Banks Peninsula for Nectria flute canker – Progress Report June 2009

Anna Hopkins & Dave Henley

Client Report No. 16907

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EXECUTIVE SUMMARY

This report provides an update on a survey programme being carried out on the Banks Peninsula to determine the extent of Nectria flute canker in the region.

Objective

The objective of this study is to determine the dispersal capacity of *Neonectria fuckeliana* and the distribution of the Nectria flute canker disease by intensive examination of infection and disease development on the Banks Peninsula. Specifically, the work is divided into three studies. The first examines the distribution of Nectria flute canker throughout the Banks Peninsula and attempts to find relationships between the development of the disease and environmental conditions. The second study looks at the level of disease within stands with known infection to determine the severity of the disease on the Banks Peninsula. The third study aims to determine the rate of spread of the pathogen and of disease development by monitoring recently pruned trees within the known infected area.

Key Results

Although not yet complete, the studies described in this report have revealed new information about the distribution and severity of Nectria flute canker on the Banks Peninsula. Of the 11 sites examined, *N. fuckeliana* was successfully isolated from trees at seven sites. Along with clear flute canker symptoms, this confirms the presence of the Nectria flute canker disease at these sites and includes four new forest location records for the pathogen (Port Levy 2, Port Levy 3, Ellangowan and Le Bonns Bay). In addition, the more intensive surveys conducted in Study Two, indicate that not only are Nectria flute canker and *N. fuckeliana* more prolific in some regions of the peninsula than previously recorded, but the pathogen is also likely to have been present in the region for 3-5 years, much longer than previously thought.

Further Work

It is anticipated that this survey of the Banks Peninsula will continue for at least another year. During the next six months, it is anticipated that 3-5 more sites will be surveyed in the south Canterbury region. The data from these new sites will add considerably to analyses to be conducted on the results from all sites to examine the environmental conditions suitable for the development of Nectria flute canker (Study One). In particular, sites will be selected that are warmer and drier than those found on the Banks Peninsula. Further surveys are also planned for early 2010, re-examining the distribution of disease symptoms at sites where the pathogen has the potential to spread (Study Three).

TABLE OF CONTENTS

Information for Scion abstracting:

Contract number	
Client Report No.	**16907**
Products investigated	Nectria flute canker
Wood species worked on	*Pinus radiata*
Other materials used	*Neonectria fuckeliana*
Location	Banks Peninsula, New Zealand

INTRODUCTION

Nectria flute canker is a disease of radiata pine that is present in the South Island of New Zealand (Dick and Crane 2009). It is characterised by long, narrow stem cankers, or flutes which are usually associated with pruned branch stubs. Formation of cankers associated with natural injuries on the stem internodes has rarely been observed (Dick and Crane 2009). Flutes can range in size from minor depressions to deep incisions which can extend for several meters above and for a shorter distance below a pruned stub. Although tree crowns generally remain healthy, affected trees are susceptible to decay, to wind breakage at infected whorls, and wood quality can be affected (Hopkins *et al.* 2008). In less severe cases, flutes may appear similar to 'normal' stem fluting and are likely to occlude over time.

Neonectria fuckeliana (formerly called *Nectria fuckeliana*) is the causal agent of Nectria flute canker (Dick and Crane 2009). This fungus was introduced into New Zealand, probably in the early 1980s (Hopkins *et al.* 2008), from the Northern Hemisphere where it occurs naturally on spruce and fir species. *Neonectria fuckeliana* is believed to be spread primarily by spores that form in fruitbodies on infected stems (Hopkins 2008). Moisture is thought to play a key role in their dispersal as the spores are released and dispersed under wet conditions (Hopkins 2008). The fruitbodies of *N. fuckeliana* are distinctive, although they only form on approximately 5% of affected trees. If fruitbodies are not present, Nectria flute canker can be distinguished from other 'normal' fluting by examination of the affected wood for staining and/or by isolation of *N. fuckeliana* from the affected region.

In New Zealand, Nectria flute canker is considered a threat to *Pinus radiata* production in affected regions. Nectria flute canker currently costs the forestry sector a significant amount in increased management costs and lost wood quality. Scion has carried out a significant monitoring programme for Nectria flute canker from 2004 to 2008. During that time, the disease spread north from Otago and Southland, up through southern Canterbury (Bulman 2009). In February 2007, *N. fuckeliana*, the causal agent of Nectria flute canker, was first recorded on the Banks Peninsula. This was significantly further north than the previous most northerly record of the fungus near Geraldine in South Canterbury. In April 2008, *N. fuckeliana* was found at 3 new locations on the Banks Peninsula. This provided a unique opportunity to study the spread of *N. fuckeliana* and Nectria flute canker within a fairly isolated region. As Nectria flute canker is very new to the Banks Peninsula and the region is located a considerable distance from other known locations of the pathogen, this means that there are few conflicting infection sources. In addition, the peninsula contains a wide variety of microclimatic conditions over a relatively small area.

The objective of this study is to determine the dispersal capacity of *Neonectria fuckeliana* by intensive examination of infection and disease development on the Banks Peninsula. Specifically, the work is divided into three studies. The first examines the distribution of Nectria flute canker throughout the Banks Peninsula and attempts to find relationships between the development of the disease and environmental conditions. The second study looks at the level of disease within stands with known infection to determine the severity of the disease on the Banks Peninsula. The third study aims to determine the rate of spread of the pathogen and of disease development by monitoring recently pruned trees within the known infected area. This report outlines progress towards these objectives and outlines what further research is required.

MATERIALS AND METHODS

Pathogen dispersal and disease development was examined at both a regional scale and a local, site specific scale. Studies at the regional scale looked at the current distribution and rate of spread of the pathogen within the Banks Peninsula and in the southern Canterbury near Geraldine. The relationship between disease development and microclimate conditions at individual sites was also examined. Site specific studies examined the infection level of *N. fuckeliana* within a stand and the level of Nectria flute canker disease, providing useful baseline data for future monitoring of tree to tree movement of the pathogen and severity of the disease in this region.

Sampling techniques

For all three studies described below, similar sampling techniques were used. At each site, 100 trees were selected in a series of strip transects, the location of which was determined primarily by the geography of the site and/or previous records of diseased trees. The selected trees were then numbered 1-100 and assessed visually for the presence of fluting. All fluting was recorded, from severe cankers to small depressions and basal fluting. The presence of fruitbodies of *N. fuckeliana* was noted as well as any other interesting features such as excessive resin production.

When trees were sampled to determine the presence of *N. fuckeliana*, a core borer was used to remove a 6-8 cm long core from the tree. Where possible, this core sample was taken from within the flute canker or depression, directly above the branch stub, maximising the chance of successful isolations of the pathogen. If the recorded flute cankers were above 2 m height, coring became difficult and so a core was taken from the stem directly below the flute canker at an accessible height. The core borer was rinsed in a solution of bleach, followed by water in between samples. Cores were then plated onto 2% MEA (a fungal medium) and plates were incubated for 21 days at 20ºC to determine the presence of *N. fuckeliana*. Where *N. fuckeliana* was found on plates, it was subcultured and the cultures were retained in case further analysis was required.

Study 1) Distribution throughout the Banks Peninsula

This study aimed to determine the distribution of Nectria flute canker on the Banks Peninsula and to examine whether the presence of the disease is linked to any known environmental variables. Eleven survey plots were selected throughout the Banks Peninsula with a complimentary site near Geraldine in south Canterbury (Figure 1, Table 1). Site selection was based on the following attributes:

1. Stands must be *Pinus radiata* plantations or woodlots.
2. Stands must have been pruned (at least one lift) between 2004 and 2006.
3. The range of stands should attempt to encompass as much of the climatic and environmental variation as possible including a range of rainfall, temperatures, aspects and elevations.

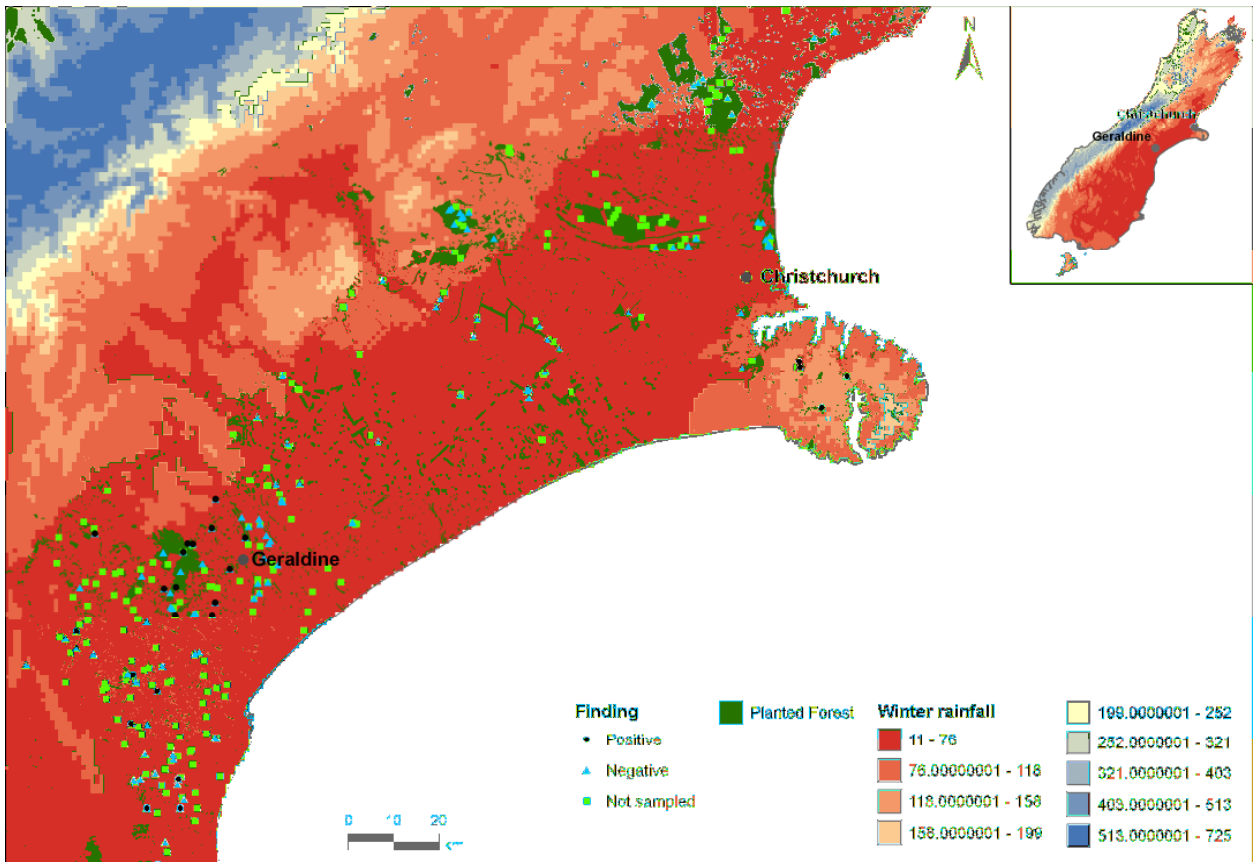

Figure 1. Map showing average winter rainfall (June-August) in Canterbury and Banks Peninsula regions. Black dots indicate previous positive findings of *N. fuckeliana* as part of other surveys. Triangles denote locations where *N. fuckeliana* has not been found and squares are forests or woodlots which were examined but were not sampled.

Table 1. Sites surveyed to examine the distribution of Nectria flute canker disease.

Site ID	Forest/ Location	Aspect	Altitude	Approx Age of Stand	Thinned	Years Since Pruning
PL1	Port Levy	NE	580	15	Y	3-5
PB	Pigeon Bay	NW	200	13	Y	2-4
RV	Reynolds Valley Road	NW	320	10	Y	1-4
OK	Okains Bay	NE	240	9	Y	3
QV	Mc Queens Valley	W	90	15	Y	3
LB	Le Bons Bay	NW	80	8	Y	2
OV	Okuti Valley	NE	300	13	Y	3
PL2	Port Levy	NE	280	15	Y	3
HIN	Hinewai	W	400	13	Y	1 to 3
ELL	Ellangowan	NW	405	13+	Y	3
PL3	Port Levy	NW	100	7	Y	1
GER	Geraldine	N	530	10	Y	2 to 3

Surveys were undertaken by visiting 100 trees at each site to look for Nectria flute canker symptoms or any *N. fuckeliana* fruitbodies. Where one or both of these were seen, core samples will be taken from the affected tree and taken back to the lab and plated onto media to determine the presence of *N. fuckeliana* as described above. Where no flute canker symptoms were observed on a site, at least 4 core samples were still taken for detection of asymptomatic infection of *N. fuckeliana*. It is anticipated that further sites will be added to this study, particularly sites from drier regions in mid-Canterbury that have a lower winter rainfall.

Study 2) Distribution within a stand

Three sites on the Banks Peninsula (Table 2) were selected for this study, each containing at least one tree on which *N. fuckeliana* has been recorded previously. In each stand, 100 permanent sampling trees were marked in a grid-like fashion, with the known-infected tree/s close to the centre of the grid. All trees at each site were sampled by removing a core sample from the stem of the tree with a sterile core borer and plating the core as described above.

Table 2. Sites surveyed to examine the level of infection of *N. fuckeliana* within stands with known Nectria flute canker.

Site ID	Forest/ Location	Approx Age of Stand	Thinned	Years Since Pruning
PL1	Port Levy	15	Y	3-5
PB	Pigeon Bay	13	Y	2-4
RV	Reynolds Valley Road	10	Y	1-4

Study 3) Spread and disease development within stands

This study aimed to examined the distribution and subsequent spread of Nectria flute canker in stands that had been recently pruned (and, therefore, where there was potential for new infections and for disease levels to increase). It is anticipated that the sites used in this study will be surveyed over a number of years to examine progression of the disease over time.

Three permanent monitoring sites were selected, two on the Banks Peninsula and one in Geraldine Forest in southern Canterbury (Table 3). At each site, one 100-tree long-term sample plot was established. Site selection was based on the following attributes:

1. Stands must be *Pinus radiata* plantations or woodlots.
2. Stands must have been pruned (at least one lift) between 2007 and 2009.
3. The range of stands should encompass as much of the climatic and environmental variation as possible including a range of rainfall, temperatures, aspects and elevations.

Sampling was undertaken by visiting all trees within a plot to look for Nectria flute canker symptoms or any *N. fuckeliana* fruitbodies. Where one or both of these things were observed, core samples were taken from the affected tree and taken back to the lab and plated onto media to determine the presence of *N. fuckeliana* as described above. Where no flute canker symptoms were observed on a site, at least 5 core samples were taken for detection of asymptomatic infection of *N. fuckeliana*.
As previously mentioned, it is anticipated that these sites will be sampled at yearly intervals to determine the presence and spread of *N. fuckeliana* over time and to look for symptoms of Nectria flute canker disease.

Table 3. Sites surveyed to examine the level of infection of *N. fuckeliana* within stands with known Nectria flute canker.

Site ID	Forest/ Location	Approx Age of Stand	Thinned	Years Since Pruning
HIN	Hinewai	13	Y	1 to 3
PL3	Port Levy	7	Y	1
GER	Geraldine	10	Y	2 to 3

RESULTS AND DISCUSSION

Study 1) Distribution throughout the Banks Peninsula

Nectria flute canker was much more widely distributed throughout the Banks Peninsula than previously recorded. Evidence of fluting was observed at all of the sites examined in this study. Further, *N. fuckeliana* was isolated from trees at seven of the 11 sites where results were available, confirming the widespread distribution of Nectria flute canker throughout the region (Table 4). This included sites ranging from as low as 80 m a.s.l to 580 m a.s.l. The sites surveyed were predominantly north-facing due to the distribution of plantation forests on the Banks Peninsula, however they did cover a large area of the peninsula as can be seen from Figure 2.

More sites have been selected for this study in the mid- and South Canterbury regions and these will be surveyed later in 2009. These sites represent drier and warmer areas and are generally in locations where Nectria flute canker has not been confirmed. Once all sites have been surveyed, a more thorough analysis will be undertaken, comparing the distribution of confirmed records of Nectria flute canker with environmental conditions.

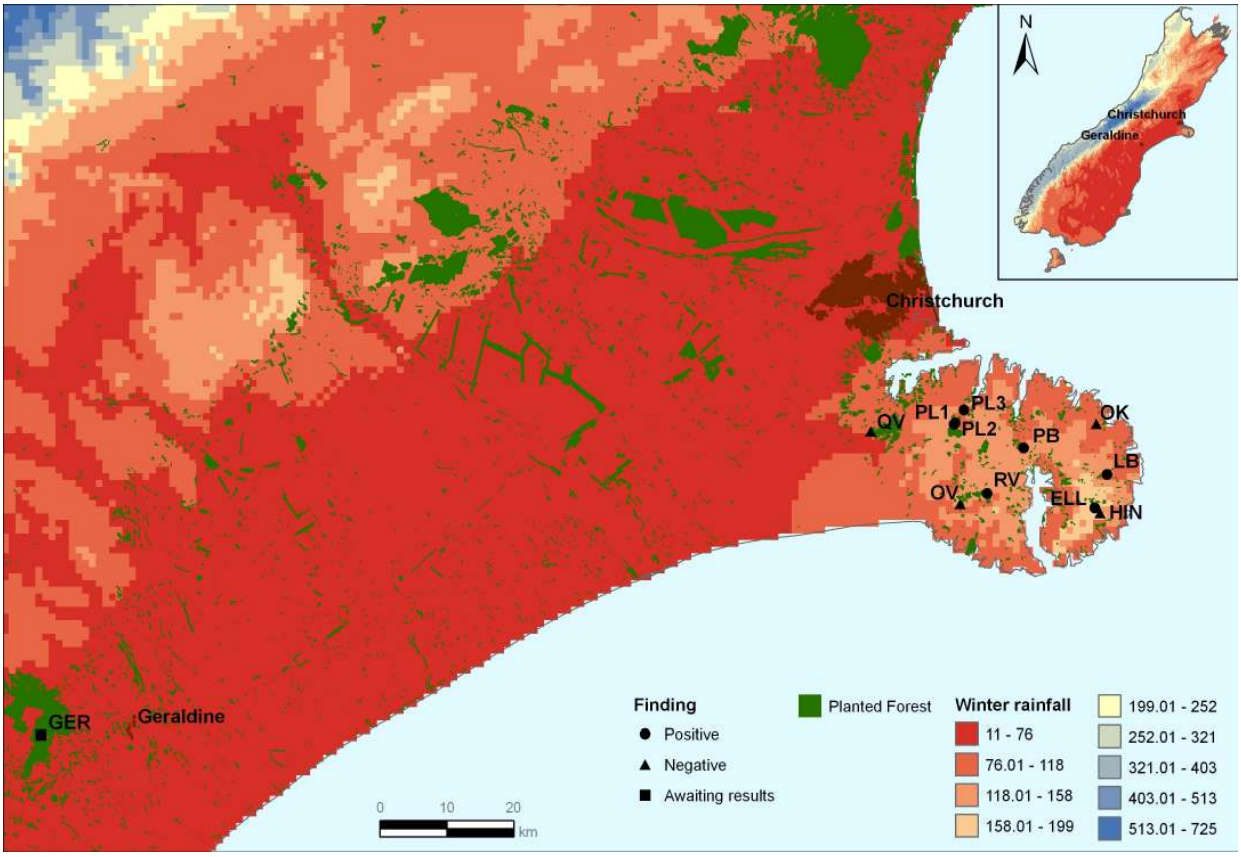

Figure 2. Map showing location of sites surveyed during Study One. Average winter rainfall (June-August) in Canterbury and Banks Peninsula regions is overlayed on the map. Black dots indicate positive findings of *N. fuckeliana,* triangles denote locations where samples were taken but *N. fuckeliana* was not found and squares are forests or woodlots for which results are pending. Site IDs refer to those used in Table 4.

Table 4. The number of positive records of Nectria flute canker for sites on the Banks Peninsula and South Canterbury. At each site 100 trees were examined. Samples were usually only taken where symptoms were observed although a minimum of 4 samples per plot was required.

Site ID	Forest/ Location	Aspect	Altitude	Fruiting bodies seen	No. of Samples Taken	No. of trees observed with fluting*	No. of samples positive for *N. fuckeliana*
PL1	Port Levy	NE	580	Y	100	20	17
PB	Pigeon Bay	NW	200	N	100	12	5
RV	Reynolds Valley Road	NW	320	N	100	10	1
OK	Okains Bay	NE	240	N	5	3	0
QV	Mc Queens Valley	W	90	N	4	3	0
LB	Le Bons Bay	NW	80	N	5	4	3
OV	Okuti Valley	NE	300	N	5	5	0
PL2	Port Levy	NE	280	Y	10	10	3
HIN	Hinewai	W	400	N	10	10	0
ELL	Ellangowan	NW	405	N	6	6	2
PL3	Port Levy	NW	100	N	7	7	4
GER	Geraldine	N	530	N	11	11	Awaiting results

*Observations of fluting may include natural fluting that occurs as the result of large branches or other defects and basal fluting. A more detailed record of tree observations can be found in Appendix 2.

Study 2) Distribution within a stand

Evidence of Nectria flute canker was observed at all three sites examined in this study as had been recorded previously. The presence of *N. fuckeliana,* the causal agent of this disease*,* confirmed this (Table 5). Of the three sites, Port Levy had the highest level of disease with more than 20 trees observed with flutes and 17% of all trees positive for *N. fuckeliana*. One tree also supported extensive fruitbodies of the pathogen. In contrast, only 12% of trees at Pigeon Bay and 10% of trees at Reynolds Valley Road showed any type of fluting and positive isolations were made from 5% and 1% of trees respectively.

Table 5. The number of positive records of Nectria flute canker for each of three sites on the Banks Peninsula. At each site 100 trees were examined and sampled for *N. fuckeliana.*

Site ID	Forest/ Location	Fruiting bodies seen	No. of Samples Taken	No. of trees observed with fluting*	No. of samples positive for *N. fuckeliana*
PL1	Port Levy	Y	100	20	17
PB	Pigeon Bay	N	100	12	5
RV	Reynolds Valley Road	N	100	10	1

*Observations of fluting may include natural fluting that occurs as the result of large branches or other defects and basal fluting. A more detailed record of tree observations can be found in Appendix 2.

This study indicates that there may be a much higher incidence of Nectria flute canker on the Banks Peninsula than previously recorded. For example, in previous surveys of the Port Levy Forest only one or two diseased trees were recorded. However in this study, 17% of trees in one small area were found with symptoms. This level of disease is comparable to disease levels found in Otago and Southland where the disease has been present for a considerably longer time; There sites can have over 25% of trees infected in particularly prone areas. It is likely however that the Port Levy site is not typical of the incidence across the entire peninsula. Both Pigeon Bay and Reynolds Valley Road Forests showed much lower incidence of fluting and very low number of trees with *N. fuckeliana* and these are similar levels of disease to those observed in the other forest sites on the Banks Peninsula in Study One. Of all the sites examined on the Banks Peninsula, Port Levy 1 showed the highest levels of snow damaged trees and, due to its high altitude, is likely to be extremely cold and misty. This may account for the higher levels of Nectria flute canker there compared with nearby sites.

The results from this study also indicate that *N. fuckeliana* may have been present on the Banks Peninsula for longer than previously thought. At the Port Levy site, the majority of diseased trees had flute cankers throughout the lower part of the stem, indicating that infection is most likely to have occurred during or prior to first lift pruning. Although no firm dates are available for this pruning, from the size and appearance of the trees it is likely to have been 3-5 years ago, between 2004 and 2006.

Study 3) Spread and disease development within stands

Since *N. fuckeliana* is thought to infect trees prior to, or closely following pruning, it was important for this study that trees be recently pruned. This meant that only two sites on the Banks Peninsula were of an appropriate age to be included, as the majority of the estate is much older and is unlikely to show any new disease development in the future.

Of the three sites examined in this study, results have only been confirmed for two to date. Of these two sites, Hinewai and Port Levy 3, *N. fuckeliana* has only been isolated from trees at Port Levy 3 (Table 6). This is despite a reasonable level of fluting being observed at Hinewai. Of the 10 fluted trees recorded there however, half are recorded as having basal flutes. Recent work by McConchie *et al.* (2009) indicates that basal flutes are unlikely to be caused by Nectria flute canker and this concurs with results from the current study. Of the remaining five trees at Hinewai Forest from which samples were collected at least three had severe flute canker symptoms typical of Nectria flute canker so it is surprising that *N. fuckeliana* was not isolated from any of these trees.

Table 6. The number of positive records of Nectria flute canker for sites on the Banks Peninsula and south Canterbury that have been recently pruned. At each site 100 trees were examined. Samples were usually only taken where symptoms were observed although a minimum of 4 samples per plot was required.

Site ID	Forest/ Location	Aspect	Altitude	Fruiting bodies seen	No. of Samples Taken	No. of trees observed with fluting*	No. of samples positive for *N. fuckeliana*
HIN	Hinewai	W	400	N	10	10	0
PL3	Port Levy	NW	100	N	7	7	4
GER	Geraldine	N	530	N	11	11	Awaiting results

*Observations of fluting may include natural fluting that occurs as the result of large branches or other defects and basal fluting. A more detailed record of tree observations can be found in Appendix 2.

CONCLUSIONS

Although not yet complete, the studies described in this report have revealed new information about the distribution and severity of Nectria flute canker on the Banks Peninsula. The pathogen *N. fuckeliana* has been found at four new locations (Port Levy 2, Port Levy 3, Ellangowan and Le Bonns Bay) along with severe flute canker symptoms. In addition, the more intensive surveys conducted in Study Two, indicate that not only are Nectria flute canker and *N. fuckeliana* more prolific in some regions of the peninsula than previously recorded, the pathogen is also likely to have been present in the region for 3-5 years, much longer than previously thought.

During the next six months, it is anticipated that 3-5 more sites will be surveyed in the south Canterbury region as party of Study One. Once these data are collected, some analyses will be conducted on the results from all sites to determine whether Nectria flute canker is more prolific under particular environmental conditions. In early 2010, a second survey will be carried out on the long-term sampling plots established as part of Study Three to determine whether the pathogen has spread within each stand. More sites may also be added to Study Three if any become available.

ACKNOWLEDGEMENTS

Forest owners on the Banks Peninsula are acknowledged for allowing us access to their stands. In particular we thank Manjula Andrews (Okains Bay), Paddy Cotter (Pigeon Bay), Geoff Ettrick (Reynold Valley Road), Malcolm Fraser (McQueens Valley), Tony Gregg (Port Levy 3), Richard Haley (Ellangowan), Doug Menzies and Laura Boulton (Le Bons Bay), Joe Power (Okuti Valley), Owen Springford from Southern Forestry (Port Levy 1 & 2) and Aaron Gunn from Blakely Pacific Ltd. (Geraldine Forest). Mike Tapley from NovaSylva Forestry assisted in tracking down landowners on the Banks Peninsula. Lucy Manning produced the map figures used. Lindsay Bulman and Margaret Dick provided useful feedback on methodology and analysis.

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APPENDICES

Appendix A – Stand information for all stands examined Nectria flute canker.

Site ID	Forest/ Location	Region	Date Surveyed	Aspect	Altitude	Easting	Northing	Fruiting bodies seen	Approx Age of Stand	Thinned	Years Since Pruning	No. of Samples Taken
PL1	Port Levy	BP	18/02/2009	NE	580	2492288	5723357	Y	15	Y	3-5	100
PB	Pigeon Bay	BP	18/02/2009	NW	200	2502724	5719859	N	13	Y	2-4	100
RV	Reynolds Valley Road	BP	17/02/2009	NW	320	2497242	5713003	N	10	Y	1-4	100
OK	Okains Bay	BP	17/03/2009	NE	240	2513582	5723440	N	9	Y	3	5
QV	Mc Queens Valley	BP	16/03/2009	W	90	2479842	5722286	N	15	Y	3	5
LB	Le Bons Bay	BP	18/03/2009	NW	80	2515175	5715878	N	8	Y	2	5
OV	Okuti Valley	BP	19/03/2009	NE	300	2493220	5711425	N	13	Y	3	5
PL2	Port Levy	BP	19/03/2009	NE	280	2492504	5723594	Y	15	Y	3	10
HIN	Hinewai	BP	20/03/2009	W	400	2514138	5710064	N	13	Y	1 to 3	10
ELL	Ellangowan	BP	24/03/2009	NW	405	2513370	5710867	N	13+	Y	3	6
PL3	Port Levy	BP	5/05/2009	NW	100	2493785	5725545	N	7	Y	1	7
GER	Geraldine	SC	19/06/2009	N	530	2355882	5676936	N	10	Y	2 to 3	11

Appendix B – Fluting observations and isolation results for trees examined in studies 1-3 for Nectria flute canker.

Site	Tree Sampled	Positive for *N. fuckeliana*	Fruitbodies present	Fluting Observed
PL1	9	Y	N	Mild flute canker first lift
PL1	28	Y	N	Flute canker first lift
PL1	29	Y	N	Flute canker first lift
PL1	36	Y	N	Slight depression
PL1	63	Y	N	Flute canker first lift
PL1	65	Y	N	Flute canker first lift
PL1	67	Y	N	Flute canker first lift
PL1	68	Y	N	Flute canker first lift
PL1	70	Y	N	Flute canker first lift
PL1	71	Y	N	Flute canker first lift
PL1	73	Y	N	Severe flute canker
PL1	77	Y	Y	Severe flute canker
PL1	78	Y	N	Severe flute canker
PL1	83	Y	N	Flute canker present
PL1	85	Y	N	Flute canker present
PL1	86	Y	N	Flute canker present
PL1	87	Y	N	Severe flute canker
RV	5	Y	N	Fluting present in first lift
PB	3	Y	N	Severe flute canker
PB	27	Y	N	Severe flute canker
PB	34	Y	N	Slight depression
PB	71	Y	N	Slight depression
PB	78	Y	N	Severe flute canker
PL2	22	Y	N	Severe fluting from 3.5-4.5m height
PL2	47	Y	Y	Flute canker from 0.5-2m height
PL2	50	Y	N	Fluting at 1.8m
PL2	10	N	N	Flute from base to 1.4m
PL2	12	N	N	Depression from large branch
PL2	16	N	N	Flute from base to 1m
PL2	35	N	N	Fluting possibly above large branch
PL2	36	N	N	Flute at 4.5m
PL2	71	N	N	Slight depression
PL2	82	N	N	Fluting at 2m
ELL	43	Y	N	Severe fluting
ELL	101	Y	N	Severe fluting
ELL	54	N	N	Slight depression at 2.5m
ELL	64	N	N	Possible scar at 4.5 m
ELL	70	N	N	Small depressions
PL3	3	Y	N	Depression above large branch
PL3	5	Y	N	Depression above large branch
PL3	81	Y	N	Depression above large branch
PL3	94	Y	N	Depression above medium branch
PL3	6	N	N	Slight depression above medium branch
PL3	24	N	N	Slight depression
PL3	48	N	N	Depression from base for 1m
OK	1	N	N	Depression above large branch
OK	14	N	N	Slight depression above branch
OK	51	N	N	No canker
OK	66	N	N	Slight depression above large branch
OK	93	N	N	No canker
QV	46	N	N	Minor fluting from 2-3m

QV	50	N	N	Depression above pruning wound
QV	71	N	N	No canker
QV	79	N	N	Slight depression above branch at 3.5m height
LB	2	Y	N	Fluting above large branch -1.5 m long
LB	13	Y	N	Fluting in first and second lift
LB	24	Y	N	Fluting round large branches
LB	56	N	N	Flute possibly caused by large branch
LB	57	N	N	Resin bleeding, appears to be borer holes, depressions in stem
OV	4	N	N	Slight depressions all over stem
OV	24	N	N	Flute possibly cause by large branch at 3m height
OV	28	N	N	Depression possibly from large branch
OV	85	N	N	Minor depression
OV	94	N	N	Minor depression
HIN	16	N	N	Depression from base to 1m
HIN	31	N	N	Depression from base to 1m
HIN	38	N	N	Severe fluting
HIN	44	N	N	Depression from base to 1m
HIN	55	N	N	Depression from base to 1.4m
HIN	66	N	N	Depression possibly from large branch
HIN	68	N	N	Depression from base to 2m
HIN	73	N	N	Severe fluting
HIN	78	N	N	Depressions above whorl
HIN	82	N	N	Depression above large branch
GER	6	Awaiting results	N	Mild flute above large branch.
GER	13	Awaiting results	N	Mild flute above large branch @approx 4m.
GER	15	Awaiting results	N	Mild flute above large branch @ approx 5m.
GER	22	Awaiting results	N	Possible Nectria flute canker @ 4.5m.
GER	31	Awaiting results	N	Possible Nectria flute canker @ 4m.
GER	37	Awaiting results	N	Mild flute above large branch @ 5m.
GER	40	Awaiting results	N	Mild flute above large branch @ 2.5m.
GER	67	Awaiting results	N	Mild flute above large branch @ 3m.
GER	68	Awaiting results	N	Mild flute above large branch @ 3.5m.
GER	82	Awaiting results	N	Mild flute above large branch @ 1.7m.
GER	93	Awaiting results	N	Possible Nectria flute canker @ 5m.