Know-how for Horticulture

The extent and cause of parsnip canker

Dr. Elizabeth Minchinton
VIC Department of Primary Industries

Project Number: VG05045

Horticulture Australia Project No:	VG05045
Project Leader:	Dr Elizabeth Minchinton
Contact Details:	Department of Primary Industries, Knoxfield Centre Private Bag 15, Ferntree Gully DC, Victoria 3156 Tel: (03) 9210 9222 Fax: (03) 9800 3521 Email: liz.minchinton@dpi.vic.gov.au
Project Team:	Desmond Auer, Fiona Thomson and Slobodan Vujovic
Address:	Department of Primary Industries, Knoxfield Centre, Private Bag 15, Ferntree Gully DC, Victoria 3156.

Purpose of project:

This report details the outcomes of a 24-month project investigating parsnip canker. This project carried out surveys to investigate both the cause and extent of parsnip canker in Victoria, Western Australia and Tasmania.

Report completed: January 2008

Funding acknowledgments

The researchers acknowledge the financial support for this project from Horticulture Australia Limited (HAL), AUSVEG, the Federal Government and the Department of Primary Industries.

Acknowledgments

We acknowledge the financial contributions from the National Vegetable Levy (AusVeg), Horticulture Australia (HAL) and the Federal Government. We thank participating growers Peter, Darren and Paul Schreurs; Russell Lamattina, Joe Kelly, and Silvio and Glenn Favero for supplying field sites and advice. We also thank Mark Milligan and Karl Riedel for their helpful discussions. The input of past and current state IDO's is gratefully acknowledged, including Alison Anderson (NSW), David Ellement (Western Australia), Craig Feutrill (South Australia), Craig Murdoch (Victoria) and Stephen Welsh (Tasmania).

Disclaimer

Table of Contents

Media Summary

Ground breaking research into parsnip canker in Australia

Scientists have taken the first step in determining the cause and extent of parsnip canker in Australian parsnip production. Parsnip canker can cause crop losses up to 80 %. Parsnip is a long-term crop, harvested after 5–7 months. It is a difficult crop to grow and there are few major growers in Australia. Victoria produces over 80 % of the total parsnip production in Australia.

Surveys of parsnip canker at harvest in 2006 and 2007 showed that canker levels peaked between September and November, on crops sown in February to March. The peak average losses due to canker for this period were 45 % for 2006 and 23 % for 2007. This represents a potential loss of A$3 million for the parsnip industry over the two years.

Several fungi were isolated from cankers and there was strong evidence that the debilitating disease is caused by more than one organism. The fungi isolated included *Itersonilia perplexans*, the main cause of this disease overseas, and fungi such as *Cylindrocarpon* spp., *Fusarium* spp., *Mycocentrospora acerina*, *Pythium* spp. and *Rhizoctonia* spp.

Observations in the field, as well as laboratory studies, indicated that superficial damage to the roots predisposed parsnips to fungal attack and canker.

Symptoms of parsnip canker are large black lesions on mature parsnip roots, mostly on the shoulder or crown that can spread to other sections of the root and in extreme cases, cover the entire root, making the product unusable.

Information resulting from this research was presented in conference posters, at Steering Committee meetings and field days.

This research was led by scientists at the Department of Primary Industries Victoria Knoxfield Centre. The project was facilitated by Horticulture Australia Limited (HAL) in partnership with Federation of Potato and Vegetable Growers Australia Limited (AUSVEG) and was funded by the National Vegetable Levy. The Australian Government provides matched funding for all of Horticultural Australia's Research and Development activities. The researchers gratefully acknowledge the financial support of the Department of Primary Industries through Primary Industries Research Victoria.

Technical summary

Little or no research into parsnip canker has been undertaken in Australia despite the fact that growers have reported persistent crop losses in spring-harvested crops of up to 80 % for 40 years.

This 24 month scoping study:

- Surveyed parsnip crops in the major cropping regions of Victoria, Tasmania and Western Australia to identify the extent of parsnip canker affecting production;
- Identified the causes of parsnip canker in Victorian crops by conducting pathogenicity tests (Koch's postulates) on fungi isolated from cankers;
- Used field trials to confirm pathogen trials;
- Determined that root damage predisposed parsnip roots to canker.

Systematic surveys involving four growers in Victoria, as well as one in Tasmania and two in Western Australia showed that parsnip canker was a major problem in Australia. In Victoria, where 80 % of Australian parsnips are grown, parsnip canker accounted for losses of up to 45 % in spring-harvested crops, and in one case, losses were over 85 %. This represented a potential loss of A$3 million for the parsnip industry over two years.

Pathogenicity tests were conducted on fungi that were consistently isolated from diseased parsnip roots in Victoria. The confirmed overseas pathogens *Itersonilia perplexans*, *Cylindrocarpon* spp., *Mycocentrospora acerina* and *Phoma* spp. all caused canker-like symptoms on fresh parsnip roots. Other fungi such as *Acremonium* spp., *Fusarium* spp., *Microdochium* spp., *Pythium* spp. and *Rhizoctonia* spp. caused similar lesions. Pathogen trials also established that root damage predisposed parsnip to pathogen attack.

Trials involving growers' own seed and a commercial variety, Tusk, showed that there was potential to alleviate canker levels using resistant cultivars. The use of Tusk reduced canker levels by 45 % compared to some of the growers' own seed stocks.

The effectiveness of metalaxyl-m in one out of three trials, in reducing canker incidence by 77 %, reinforced the notion of root damage contributing to parsnip canker. In a second trial, metalaxyl-m reduced canker incidence by 34 %, although, in this case, it was not significantly different from the control. These results, as well as the pathogen tests, indicate that oomycete fungi such as *Pythium* spp. may have a role in predisposing parsnip roots to canker.

Future directions

Our research has increased knowledge of parsnip canker but it has revealed how little we know about this disease complex.
Future investigations need to determine the:

- Predisposing nature of *Pythium* species and other pathogenic fungi;
- Biological succession of fungi on parsnip root to determine the time of initial infection, by microbiological sampling;
- Influence of predisposing abiotic factors such as soil moisture, temperature, pH, nutrients and fertilization on canker development;
- Initiation of field infections, using targeted fungicides;
- Cultural, biological and alternative soft chemical controls.

Chapter 7

Technology transfer and recommendations

Summary

This chapter reports the benefits of a project advisory group established to oversee research projects. This group increased communication and cooperation between growers, researchers and allied support businesses and resulted in an accelerated impact of research and development within the parsnip industry. Recommendations for future research are presented.

7.1 Introduction

The research reported herein is the result of collaboration between parsnip growers, industry advisory groups and project steering committees. These groups consisted of vegetable growers, crop consultants and chemical resellers, with diverse experiences which they brought to the project. The groups provided an opportunity for researchers to describe their approach and current progress thus promoting the impact of research and development projects. The advisory groups also enabled growers and allied industries to ensure that their needs were being met by the research project. The advisory group approach worked very well and is DPI's preferred method of involvement with the vegetable industry. This interaction and collaboration with growers and vegetable industry development officers (IDOs), along with the subcontracting of sections of work to industry experts has been of enormous benefit to the project. The IDOs identified parsnip growers in other states. The advisory committee encouraged the researchers to promote results of the research to growers nationally in industry publications.

7.2 Industry advisory group

The Department of Primary Industries Victoria took the approach of inviting growers and private allied support business representatives to volunteer their time and join with researchers to plan and discuss parsnip disease issues first hand. Not all growers were in the position of being able to volunteer their time due to the demands of growing and marketing vegetables and consequently the researchers are extremely grateful to those who were able to contribute. The parsnip growers were very supportive of the project and provided many field sites for trials, which was enormously appreciated by the researchers.

The advisory group members who supported project VG06046 were:
Silvio and Glenn Favero – Market Gardeners, Hillcrest Farm, Cranbourne, Vic.
Peter, Darren and Paul Schreurs – Market Gardeners, Peter Schreurs and Sons, Devon Meadows, Vic.
Karl Riedel – Vegetable Crop Agronomist, EE Muir and Sons, Cranbourne, Vic.
Russell Lamattina – A and G Lamattina and Sons Market Gardeners, Boneo, Vic.
Mark Milligan – Farm Manager, A and G Lamattina and Sons Market Gardeners, Boneo, Vic
Ross Arnott – Market Gardener, R, C, G, and D Arnott, Boneo, Vic.
Joe Kelly – Market Gardener, Tullamore Gardens, Cranbourne, Vic.
Glenn Moore - Market Gardener, Scottsdale, Tas
Carlo Galati - Market Gardener, Galati Produce, Anketell, WA.
Figaro Natoli - Market Gardener, Natoli Produce Farms, Wanaroo, WA.

7.3 Dissemination of information to industry

The current project was enthusiastically received by all growers and new insights into this devastating disease were gleaned. Adults acquire information in different ways such as reading, talking and visual cues. Some forms of information distribution will be more useful or accessible than others. There are many methods for distributing information to growers, such as field days, industry publications,

workshop meetings and steering committees. During the course of this project we have endeavored to utilize a broad range of information delivery methods and take every opportunity to report to industry. Records of publications and extension activities are listed below.

Publication list

Extension:

Minchinton L (2006) Growers, researchers seek parsnip canker control. Good Fruit and Vegetables, Vegetableplatter, p. 17.

Minchinton L (2006–07) Parsnip growers check their R and D project. Victorian VegeLink Newsletter **28**, 5.

Minchinton L (2007) Parsnip growers check their R and D project. Good Fruit and Vegetables, January, Vegetableplatter, p. 18.

Minchinton E (2006) Parsnip canker project under way. Good Fruit and Vegetables, Vegetableplatter, p. 11.

Auer D, Minchinton E, Cunnington J, and Thomson F (2007) Identification of the extent and cause of parsnip canker. Poster, AUSVEG Conference Sydney 29–31 May 2007.

Auer D, Minchinton E. First steps in parsnip canker management. In press.

Workshops:

5th May 2006: Parsnip Canker Steering Committee Meeting No 1, Vic.

15th September 2006: Parsnip Canker Steering Committee Meeting No. 2, Vic.

20th April 2007: Parsnip Canker Steering Committee Meeting No. 3, Vic.

14th December 2007: Parsnip Canker Steering Committee Meeting No. 4, Vic.

Field Day:

8th October 2007: Field day discussing the evaluation of trials to combat parsnip canker

Scientific:

Auer D, Minchinton E, Cunnington J, and Thomson, F (2007) Identification of the extent and cause of parsnip canker. Abstract. Proceedings 16th Biennial Australian Plant Pathology Society Conference. Back to Basics: Managing Plant disease. Adelaide 24–27 September 2007, p. 198.

7.4 Recommendations

The major recommendations to growers from this work are:

- Long-term management of the disease may rely on resistant cultivars.
- On specific sites, 2 applications of metalaxyl may be effective for controlling parsnip canker. The influence of metalaxyl on canker incidence suggests water moulds (oomycetes) are involved in the development of parsnip canker, but not consistently at all sites.
- Avoid planting parsnips in February. Parsnip canker levels were high in spring-harvested crops, representing crops sown in February–March. This reiterated previous anecdotal evidence from parsnip growers.
- *Itersonilia perplexans* is not the only fungus responsible for parsnip canker in Australia, with the possibility of a consortium of fungi being responsible. The complexity of the problem highlights the need for a more holistic approach to the management of this disease.

Areas of future research which would benefit the industry are:

Future research needs to have a national focus due to the extent of parsnip canker in southern Australia. We suspect that a complex of organisms is responsible for parsnip canker in Victoria, with the water moulds, such as *Pythium* spp., having a leading role in predisposing parsnips to canker. We also suspect soil moisture, soil temperature, pH and nutrients may have an influence on canker development. Future work on canker should be aimed at how and when the disease is occurring, conditions promoting it, control options including IPM, as well as extension.

Areas of future research of benefit to industry should:

- Determine if combinations of pathogens, such as *Pythium* spp., are predisposing parsnips to canker.
- Determine the influence of pH, nutrients and irrigation on parsnip canker, as they could be predisposing parsnips to canker.
- Establish the electrotaxic behaviour of *Pythium* zoospores, as Ca^{++} interferes with root infection by zoospores.
- Establish when canker first attacks the crop and tailor control measures to this time.
- Establish optimal seed treatment regimes.
- Test a range of biocontrols for efficacy against canker.
- Test parsnip cultivars for canker tolerance under a wider variety of conditions, nationally.
- Identify cultural, biological and alternative soft chemical controls.
- Conduct systematic surveys for carrot rust fly as it is a biosecurity issue.
- Develop a national management strategy for parsnip canker and ensure it is economical.
- Benchmark control measures and establish the economics of IPM strategies
- Produce and publish a user-friendly protocol on best practice integrated management of parsnip canker.