

Current research programme - microbiology

Andy Pitman
Plant & Food Research

The New Zealand Institute for Plant & Food Research Limited

Plant & Food
RESEARCH
RANGAHAU AHUMARA KAI



**Psyllid & *Liberibacter* on Solanaceous crops:
Current research programme – a microbiological bias**

Andrew Pitman

The New Zealand Institute for Plant & Food Research Limited

Plant & Food
RESEARCH
RANGAHAU AHUMARA KAI



Acknowledgements



Gabby Drayton
Simona Kraberger
John Anderson
Russell Genet

Sally Harrow
Shirley Thompson
Sandra Visnovsky
Lia Liefing
Gerrard Clover
Ian Scott

HorticultureNZ
The New Zealand Institute for Plant & Food Research Limited

Ca. *Liberibacter* sp. closes exports of Solanaceous crops

- Initial identification of a *Ca. Liberibacter* sp. associated with a new disease of tomato and capsicum in New Zealand






- NZ\$40 Million export market closed indefinitely

The New Zealand Institute for Plant & Food Research Limited

MAF accreditation for *Ca. Liberibacter* testing of Solanaceous crops



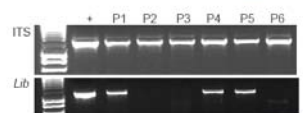
- Industry initiative to reclaim access to export markets for tomato and capsicum
- Compliance programme drafted, including establishing areas of freedom for exports of tomato and capsicum
- Ca. Liberibacter* testing regime a core component of compliance programme
- Ca. Liberibacter* specific PCR used for testing (Liefing et al., 2009)

The New Zealand Institute for Plant & Food Research Limited

Zebra Chip of Potatoes associated with *Ca. Liberibacter solanacearum*

- Discovery of zebra chip in potatoes associated with *Ca. Liberibacter solanacearum* in New Zealand

The New Zealand Institute for Plant & Food Research Limited

Comparing diagnostic protocols for *Ca. Liberibacter solanacearum*

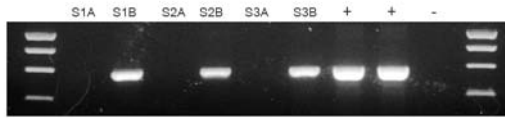
- Single step PCR is insufficient to reliably detect the presence of *Ca. Liberibacter solanacearum* in potato plants

	S1	S2	S3	S4	S5	S6	S7	S8	S9	+	+	-
ITS												
Single-step PCR												
Multiplex PCR												
Nested PCR												

The New Zealand Institute for Plant & Food Research Limited

Sampling for detection of *Ca. Liberibacter solanaceum*

- Samples from the same infected plant do not produce reproducible detection of *Ca. Liberibacter solanaceum* using PCR



- Low titre of bacterium in potato tissue?
- Uneven distribution of bacterium in potato tissue?

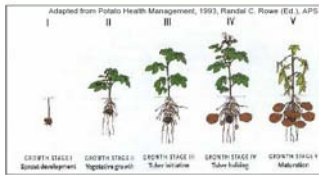
Seed Transmission of *Ca. Liberibacter solanaceum* in potato crops: Ongoing trials

- Seed transmission trials are being conducted in Canterbury in the absence of the psyllid



Seed Transmission of *Ca. Liberibacter solanaceum*: Development of disease symptoms

- Preliminary observations from the trial
- 20% of *Liberibacter* positive mother tubers developed symptomatic plants



	Preplant status of mother tuber	Growth Stage at which symptoms developed				
		I	II	III	IV	V
ca. Lib negative	72	1* (0)	0	0	?	?
ca. Lib positive	28	4 (2)	1 (0)	1 (1)	?	?

* Due to soft-rotting

Seed Transmission of *Ca. Liberibacter solanaceum*: Transmission to daughter tubers

- Liberibacter* can pass to daughter tubers in symptomatic plants
- Only small daughter tubers are developed in symptomatic plants

Growth Phase	No. tubers showing a defect at growth stage	No. tubers producing daughter tubers	<i>Liberibacter</i> present in daughter tubers
I	4	2	1
II	1	0*	N/A
III	1	1	1
IV	?	NT	NT
V	?	NT	NT

* Daughter tuber attached to surface of tuber

Seed Transmission of *Liberibacter*: Disease symptoms

- Ca. Liberibacter solanaceum* is associated with developmental retardation throughout growth of potato plants



Disease symptoms are consistent with previous observations

- Normal plants grow from tubers produced by psyllid-infested plants (Richards, 1926)
- Additional small tubers (pea size) may form on the spindling tuber, severely affected tubers may fail to sprout (Snyder et al., 1946).
- Affected tubers may fail to sprout but still produce roots. (Sanford, 1952)

Seed transmission of *Ca. Liberibacter solanacearum* to progeny tubers in Symptomatic Plants

- Transmission of *Ca. Liberibacter solanacearum* can occur between mother tubers and the progeny tubers in the absence of the psyllid.
- *Ca. Liberibacter solanacearum* is associated with the symptoms of psyllid infestation and zebra chip in the absence of the psyllid.
- *Ca. Liberibacter solanacearum* is associated with disruption in the growth of potatoes throughout various stages of development

Not reported in presentation

- Progeny tubers from symptomatic and asymptomatic plants exhibit zebra chip associated with the presence of *Ca. Liberibacter solanacearum*
- An individual potato plant infected with *Ca. Liberibacter solanacearum* after transmission by the tomato/potato Psyllid can produce asymptomatic and symptomatic progeny plants.

Future Work

- Does the incidence and severity of foliar and tuber symptoms vary in different growing regions in New Zealand?
- Is there tolerance or resistance to zebra chip symptoms amongst potato varieties in New Zealand?
- What environmental cues lead to the development of symptoms?

Liberibacter in Psyllid populations in New Zealand

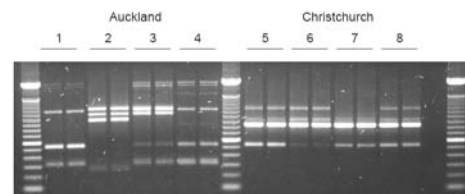
TPP populations screened for *Liberibacter*

Host Plant	Location	How	Lib Status
Tomato	Ness Valley, AUCK	Glasshouse	-
Capsicum	Templeton, CHCH	Glasshouse	-
Potato	Pukekohe	Sticky trap	-
Potato	Karaka	Sticky trap	+
Tomato	South Auckland	Glasshouse	+
Potato	Pendarves, CANT	Field	-
Tomato	Hastings	Field	-
Capsicum	Hastings	Field	-
Potato	Hastings	Field	+
Black Nightshade	Hastings	Field	-
Potato	Lincoln, CANT	Sticky trap	-
Potato	Mid Canterbury (4 sites)	Field	-
n/a	Lincoln, CANT	Suction Trap	-

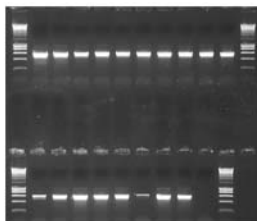
Liberibacter in Psyllid populations in New Zealand

Variation between TPP in NZ (ISSR)

8 individuals, 6 biotypes



Liberibacter testing of breeding lines showing no discernable above ground symptoms



- Progeny tubers from symptomatic and asymptomatic plants exhibit zebra chip associated with the presence of *Ca. Liberibacter solanacearum*