

Viral Diseases of Canola Surveys and Screening for Resistance

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Scoping Study on Canola Viruses in Northern Australia: Occurrence and Variety Performance (DAN00179)

- Australia's northern grain region has a climate that is favourable for plant viruses and virus vectors.
- Canola cultivation in the northern region has increased considerably over the last decade.
- Little is known on the occurrence of viruses in the northern region and even less on the virus resistance / susceptibility of modern canola cultivars.
- Viruses are an increasing problem in the northern pulse industry, particularly in chickpeas.
- Does the cultivation of canola increase the risk of virus infection in chickpea crops?

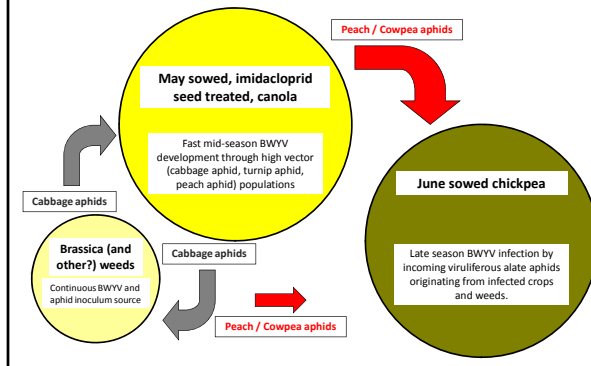
Canola viruses reported in Australia

- *Beet western yellows virus (BWYV) / Turnip yellows virus (TuYV)*
 - Persistently transmitted
 - Wide host range (> 150 species)
 - Early infection can cause yield loss
 - Frequently reported, but generally low levels
- *Turnip mosaic virus (TuMV)*
 - Non-persistently transmitted
 - Very wide host range
 - Can cause severe losses
 - High levels reported in juncea, rarely (so far) in canola
- *Cauliflower mosaic virus (CaMV)*
 - Non-persistently transmitted
 - Limited host range
 - Only low levels reported

Severe virus symptoms in chickpea during 2012 and 2013 were related to BWYV infection



BWYV / Canola – Brassica weeds / Chickpea pathosystem (hypothetical model)



Beet western yellows virus (BWYV, syn: Turnip yellows virus, TuYV)



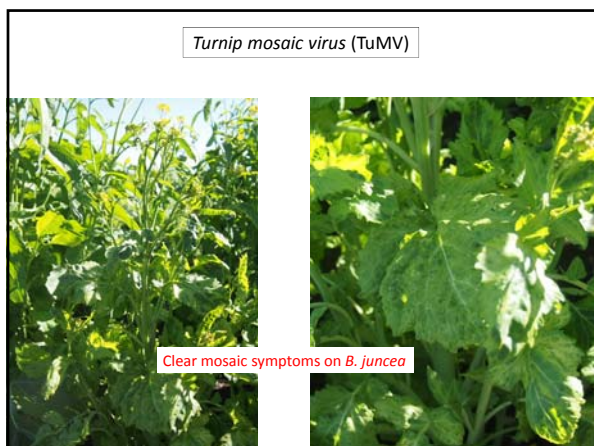


Table 1. Survey for canola viruses in the New South Wales, 2013

Survey period Region ¹	Sites	Canola				cruciferous weeds ²						
		BWVY		TuMV		BWVY		TuMV		CaMV		
		Ave	Range	Ave	Range	Sites	Ave	Range	Ave	Range	Ave	Range
July												
North	19	0.1	0-2	0.0		10	0.0		9.1	0-83	0.0	
Liverpool Plains	1	0.0										
South	5	2.2	0-9	0.0								
August - mid September												
Liverpool Plains	11	0.7	0-6	3.6	0-28	8	0.0		27	0-67	3.3	0-17
South	5	1.6	0-4	0.0		4	0.8	0-3	4.3	0-10	2.0	0-8
mid September - October												
North	3	40	23-55	0.7	0-2	1	0		96		0	
Liverpool Plains	3	21	2-38	44	0-100	2	4.0	0-8	44	31-55	11	0-22
South	15	63	6-100	0.0		8	17	0-50	33	3-100	5.8	0-22

¹ North: Moree, Narrabri, Gwydir shires. Liverpool Plains; Liverpool Plains and Gunnedah shires. South; Warrumbungle, Gilgandra, Wellington shires and further south.
² Mainly turnip weed (*Rapistrum rugosum*), some wild radish (*Raphanus raphanistrum*) and unidentified species.

Table 2. Virus development¹ in NVT / Blackleg sites in New South Wales, 2013

Site	Location		Early sampling		Late sampling	
	Lat	Lon	Date	%BWVY	Date	%BWVY
Bellata ²	29.97	149.79	17-07	0.0	01-10	23
Mullaley ³	31.18	149.81	17-07	0.0	01-10	1.7
Parkes	33.04	148.26	16-07	1.7		
Cudal	33.25	148.79	16-07	0.0	05-11	45
Grenfell	33.86	148.09	24-07	0.0	05-11	57
Cootamundra	34.63	148.15	24-07	0.0	05-11	87
Wagga Wagga	35.12	147.37			06-11	100
Lockhart	35.24	146.78	24-07	9.3	06-11	100
Geogery ⁴	35.82	147.00			06-11	99

¹ % positive plants based on random sampling of 3 replicates of border plots with 20-25 plants / replicate.
² Additional early and late sampling of *B. juncea* plots in blackleg trial; no virus in early sampling, 45% BWVY and 35% TuMV in late sampling.
³ Additional early sampling of *B. juncea* plots in blackleg trial; no virus found.
⁴ One plant in late sampling found to be CaMV positive.

- Survey for canola viruses in the Northern Grain Region, 2013**
Preliminary Conclusions
- No indication of an interaction between BWVY development in canola and in chickpea crops.
 - Development of BWVY in canola was relatively late and will not have had an impact on yield.
 - Development of BWVY in cruciferous weeds was similar to canola crops.
 - Higher BWVY incidences in southern compared to northern NSW.
 - TuMV present in cruciferous weeds throughout the northern region.
 - **Strong indication of the presence of a TuMV strain on the Liverpool Plains that is virulent on current canola varieties.**

- Screening of canola and juncea varieties for virus resistance, Liverpool Plains Field Station and Greenhouse, 2013**
- 40 canola and 8 juncea varieties tested in a randomised complete block design with 3 replicates.
 - Over years the Liverpool Plains Field Station has shown to be a 'hot-spot' for the development of a range of plant viruses.
 - Virus development monitored by regular sampling of selected plots and determining virus presence by Tissueblot immuno-assay (TBIA).
 - All plots tested on 24 September for presence of BWVY and TuMV by TBIA test on a random sample of 15 plants.

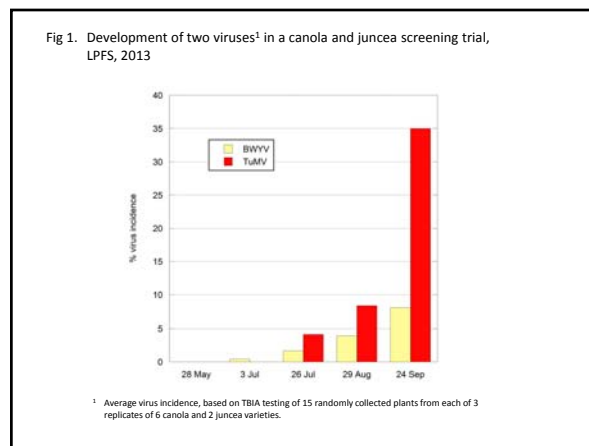
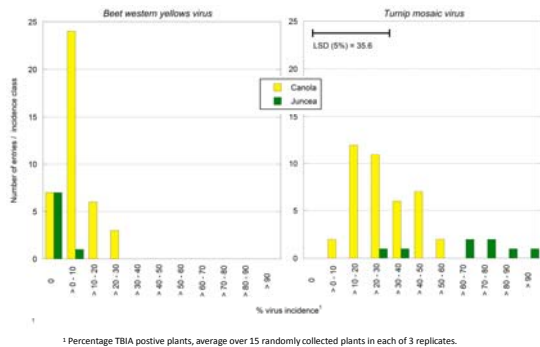
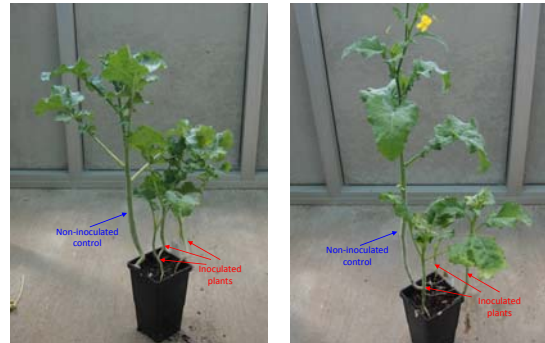


Fig 2. Infection level of *Beet western yellows virus* and *Turnip mosaic virus* in 40 canola and 8 juncea varieties, LPFS, 24 Sep 2013



Greenhouse screening for TuMV resistance:
Effect on plant growth of two canola varieties



Screening of canola and juncea varieties for virus resistance.
Conclusions

- BWYV development in 2013 too late and too low to differentiate between genotypes.
- Presence of a highly virulent TuMV strain confirmed.
- No complete resistance TuMV resistance found among the tested germplasm.
- Indications of differences in TuMV resistance in field screening.
- Pre-emptive screening of canola varieties and parental material for TuMV resistance is warranted.

Plans for 2014

- Surveys to be continued
 - Commercial paddocks in contrasting environments.
 - Blackleg evaluation sites.
- Field screening of canola varieties for resistance to BWYV and TuMV at the LPFS.
- Greenhouse testing of canola germplasm for resistance to a highly virulent TuMV strain.

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