

Fungicide resistance in Australian *Leptosphaeria maculans* populations


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Fungicides have become an integral part of controlling blackleg disease in Australia


- Fungicide options available
 - Seed dressings
 - Fungicide amended fertilizer
 - Both have been available and readily used for 15+ years
 - 94% of survey respondents use at least one of these regardless
 - Foliar fungicides
 - Released in 2011. First in-crop control option for blackleg
- Previously all fungicides belonged to the same chemical group
 - DMIs (triazoles)



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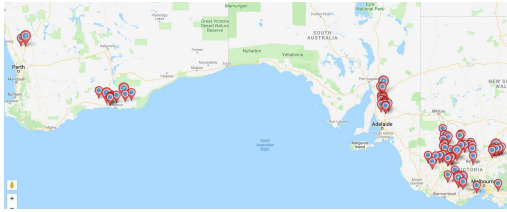
Fungicide use can lead to the evolution of fungicide resistance

- Recently and in the near future, a range of new fungicides are coming on the market
- New fungicides have actives belonging to different chemical groups
 - SDHIs
 - Strobilurin (+ DMI)
- The release of new chemistries provides a unique opportunity to establish a baseline of potential fungicide resistance before their widescale use



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107 stubble populations submitted for screening from across Australia




- Information collected includes location, cultivar use and fungicide use

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in planta screen allows millions of isolates to be screened per population



Prosaro	Aviator XPro
Veritas	Miravis
Maxim	Flutriafol
Untreated	ILeVo
Saltro	Jockey





Treatments randomised
3 replicate trays



30 hrs

5

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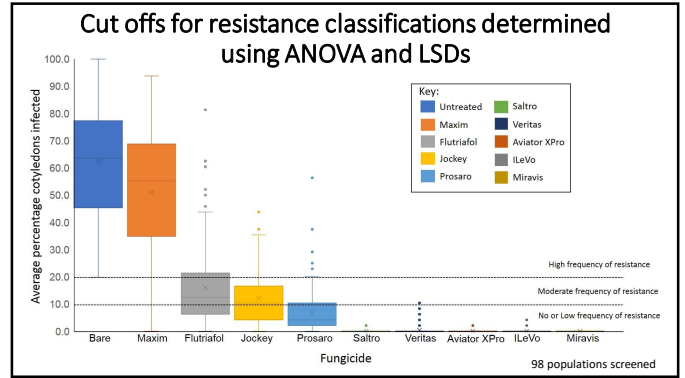
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Percentage of infected cotyledons is recorded 17 days post infection and used to determine frequency of populations with fungicide resistance



Untreated Miravis (SDHI) Flutriafol (DMI) Jockey (DMI)


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No resistance detected towards new chemistries

Fungicide	Class	High	Mod.	Low
Saltro	SDHI	0%	0%	100%
Veritas	Strobolurin + DMI	0%	1%	99%
Aviator XPro	SDHI + DMI	0%	0%	100%
ILeVo	SDHI	0%	0%	100%
Miravis	SDHI	0%	0%	100%



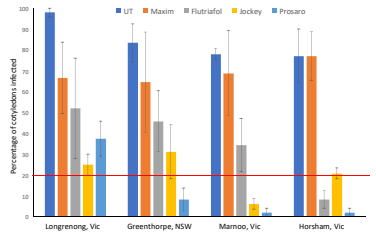
Untreated (UT)

Miravis

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High levels of resistance are being detected for the DMI fungicides

Fungicide	Class	High	Moderate	Low
Jockey	DMI	22.4%	31.6%	45.9%
Flutriafol	DMI	28.6%	31.6%	39.8%
Prosaro	DMI	7.1%	17.3%	75.5%



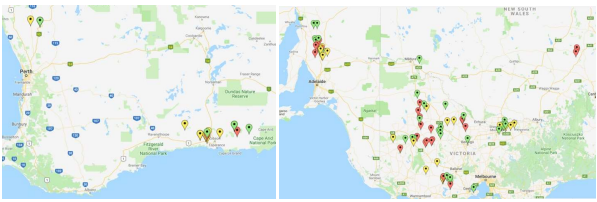
Percentage of cotyledons infected

Longrenong, Vic Greenethorpe, NSW Marmoo, Vic Horsham, Vic

Untreated (UT) Jockey

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Distribution of populations with Flutriafol resistance



- No obvious correlations with fungicide use, cultivar choice or location
- Only collected last years data
- Will target specific growers and try and get whole farm history

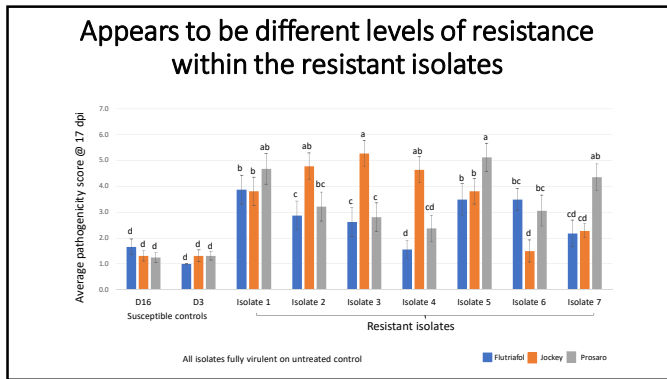
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Need to determine whether isolates are resistant to single chemicals or have cross resistance.

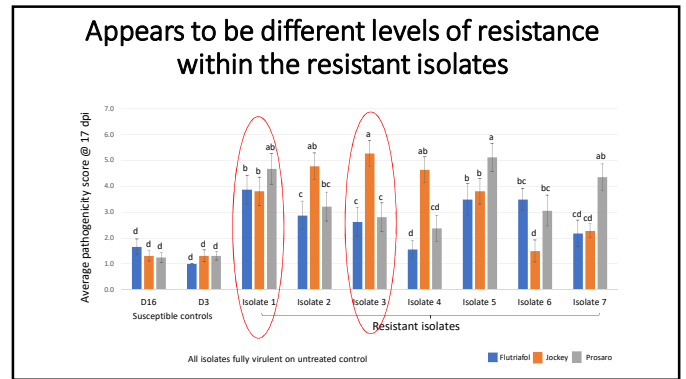
- 5% of populations have high levels of resistance to all three fungicides
 - Are these isolates resistant to all three fungicides or does the population consist of isolates that are resistant to each of the individual fungicides?
- Isolates have been cultured from these populations and tested for cross resistance to each of the fungicides

Flutriafol	Jockey	Prosaro	%
High	High	High	5.1
High	High	Mod/Low	8.2
High	Mod/Low	High	2.0
High	Mod/Low	Mod/Low	13.3
Mod/Low	High	Mod/Low	9.2
Mod/Low	Mod/Low	High	0
Mod/Low	Mod/Low	Mod/Low	62.2

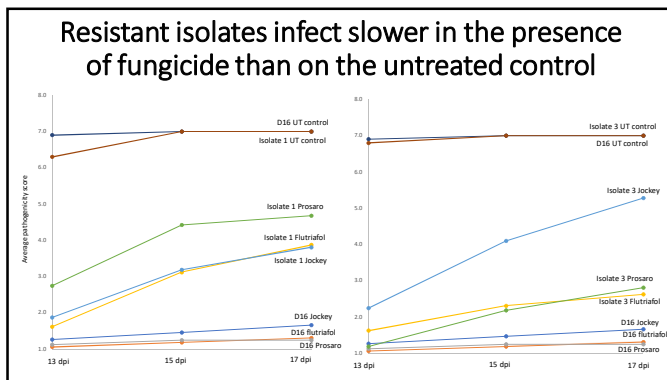
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- ### Baseline survey suggests no or extremely low levels of resistance to new chemistries at time of release
- No resistance detected for SDHI and Strobolurin fungicides
 - High frequency of fungicide resistance towards Flutriafol (28%) and Jockey (22%)
 - Previous screen in 2015 detected similar levels (up to 20%) of resistance towards Jockey
 - Suggests frequency of resistance is stable and not increasing????
 - Limitation: *in planta* screen doesn't allow us to determine frequency of resistant isolates within a population.
 - Need to identify genes involved and then molecular markers for assaying populations.
 - Only 7% of populations with high levels of resistance towards Prosono
 - Lower frequency of resistance than Jockey and Flutriafol. Perhaps reflects that it was more recently released (2011)
 - Screening of individual isolates suggests that there may be cross resistance and possibly different levels of resistance.

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Acknowledgements

- Steve Marcroft and team at Marcroft Grains Pathology
- Agronomists/growers for submitting stubble samples
- Fran Lopez, Centre for Crop Disease Management, Curtin University

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