Fungicide resistance in Australian *Leptosphaeria maculans* populations

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

- Fungicide options available
  - Seed dressings – DMI and soon to be SDHI
  - Fungicide amended fertilizer - DMI
  - Foliar fungicides – DMI, SDHI, QoI

Untreated plot in disease nursery

- SDHI and QoI chemistries only available in the last few years. DMIs have been used for 20+ years

Jockey-treated plot in disease nursery

What is the status of fungicide resistance in Australia?

Australian Government
Australian Research Council

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syngenta

marcroft
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288 stubble populations submitted for screening from across Australia

- Information collected includes location, cultivar use and fungicide use

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

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

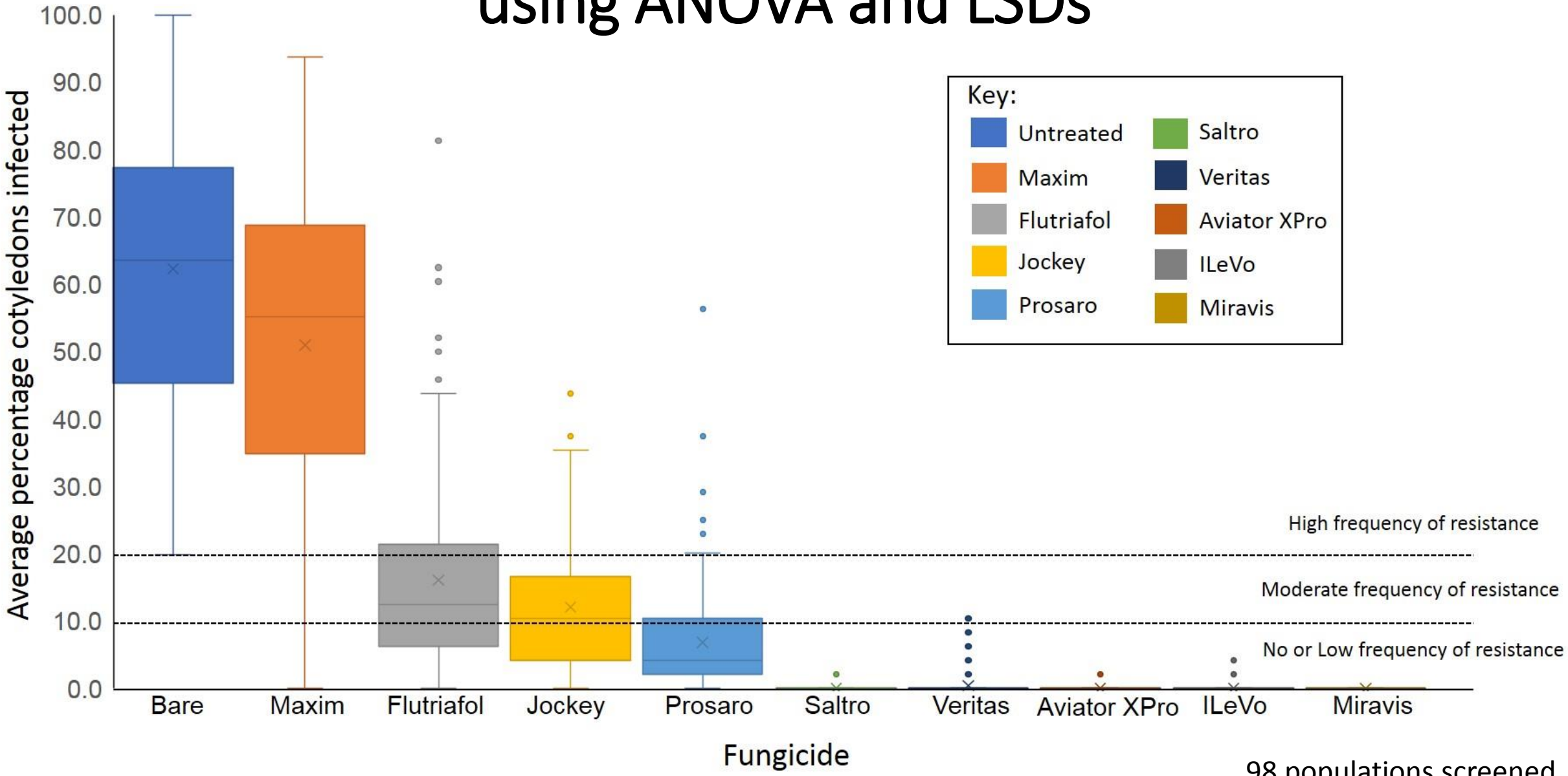
Untreated

Miravis (SDHI)

Flutriafol (DMI)

Jockey (DMI)

Cut offs for resistance classifications determined using ANOVA and LSDs



98 populations screened

No resistance detected towards new chemistries

		2018 results			2019 results		
Fungicide	Class	High	Mod.	Low	High	Mod.	Low
Saltro	SDHI	0%	0%	100%	0%	0%	100%
Veritas	Strobolurin + DMI	0%	1%	99%	0%	3.1%	96.9%
Aviator XPro	SDHI + DMI	0%	0%	100%	0%	0%	100%
ILeVo	SDHI	0%	0%	100%	0%	0%	100%
Miravis	SDHI	0%	0%	100%	0%	0%	100%

Untreated (UT)

Miravis

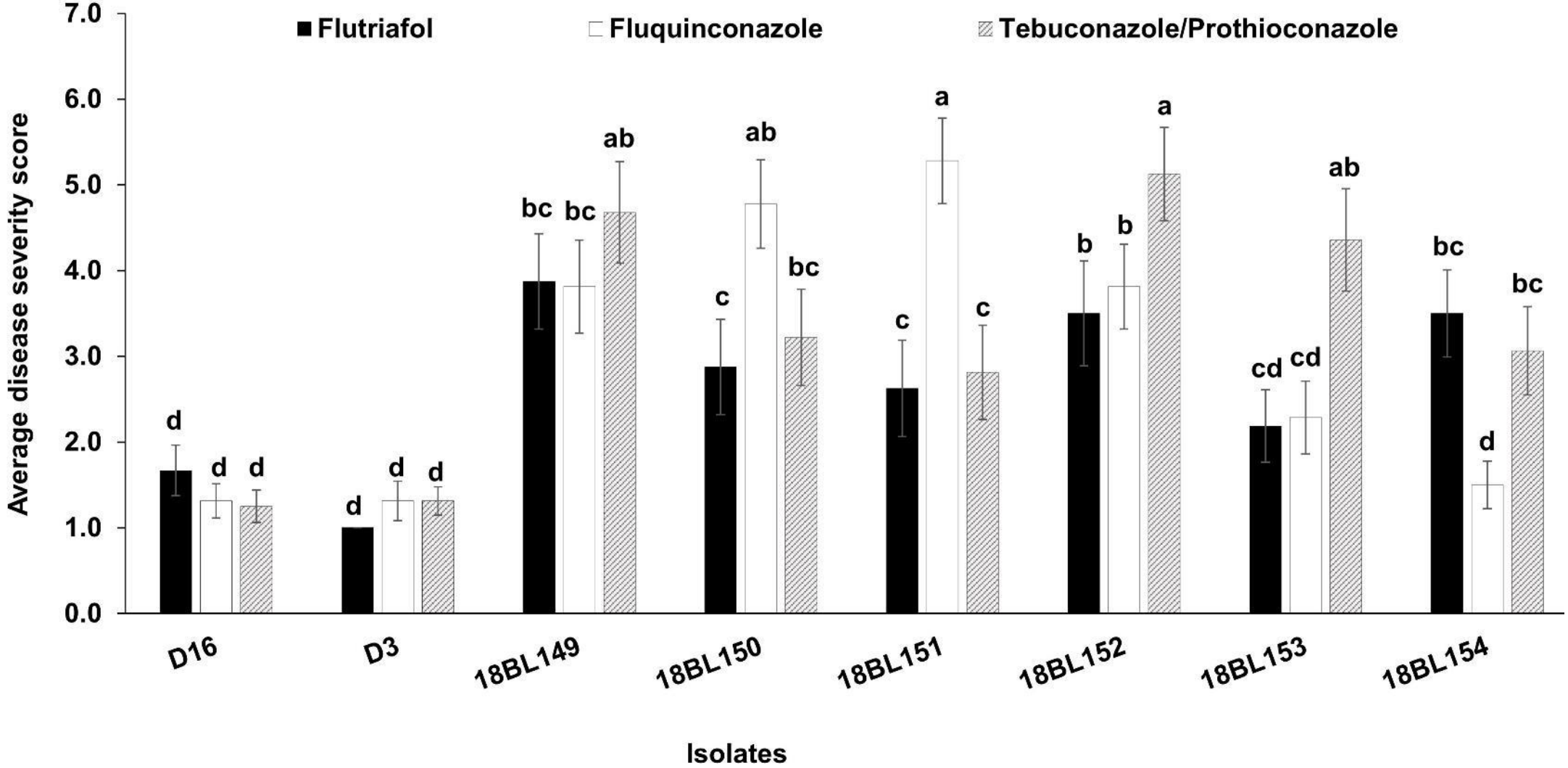
High levels of resistance are being detected for the DMI fungicides

		2018 results			2019 results		
Fungicide	Class	High	Mod.	Low	High	Mod.	Low
Flutriafol	DMI	28.6%	31.6%	39.8%	25.1%	22.0%	52.9%
Jockey	DMI	22.4%	31.6%	45.9%	20.4%	24.6%	55.0%
Prosaro	DMI	7.1%	17.3%	75.5%	7.3%	13.1%	79.6%

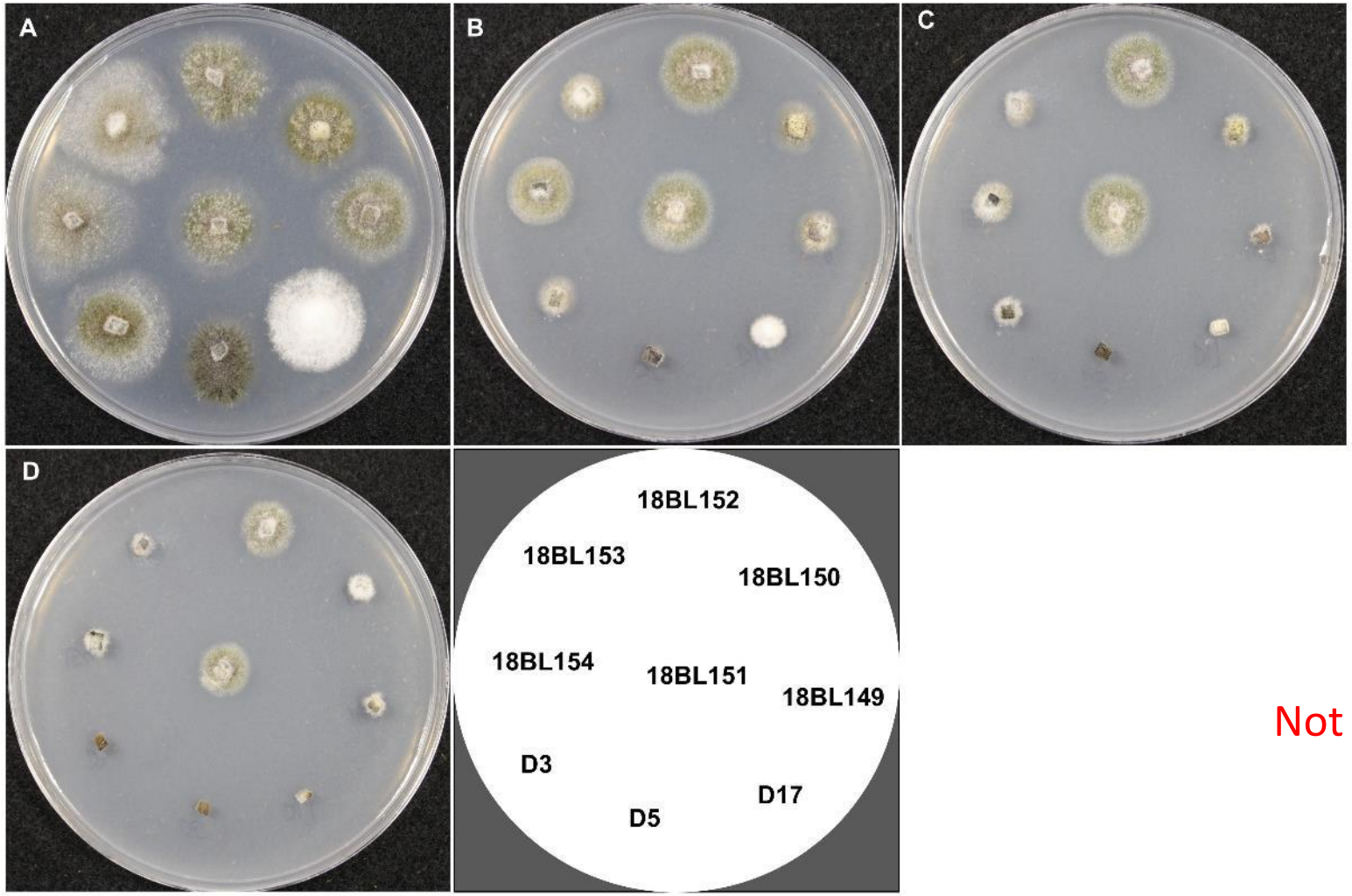
Untreated (UT)

Jockey

Fungicide resistant isolates were cultured to allow further characterisation of the mechanisms involved



Isolates were also screened for fungicide resistance *in vitro*

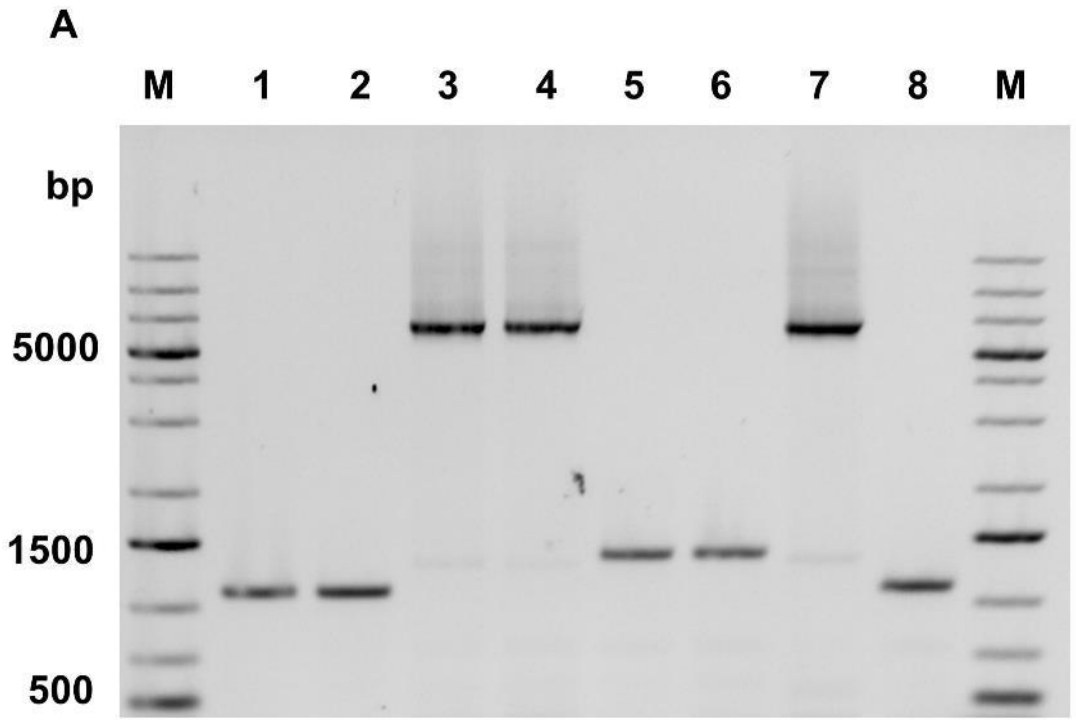


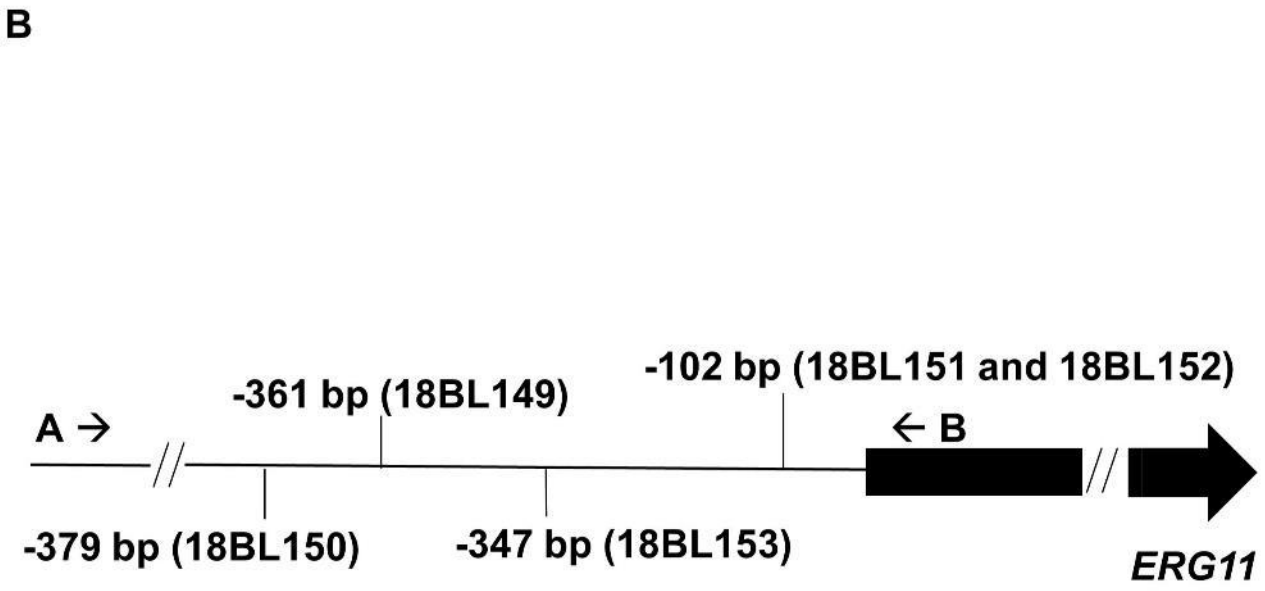
Resistance factor ranges:

Tebuconazole: 1.9 – 7.6
Fluquinconazole: 1.8 – 6.9
Flutriafol: 1.2 – 14.6
Prothioconazole: 1.1 – 4.4

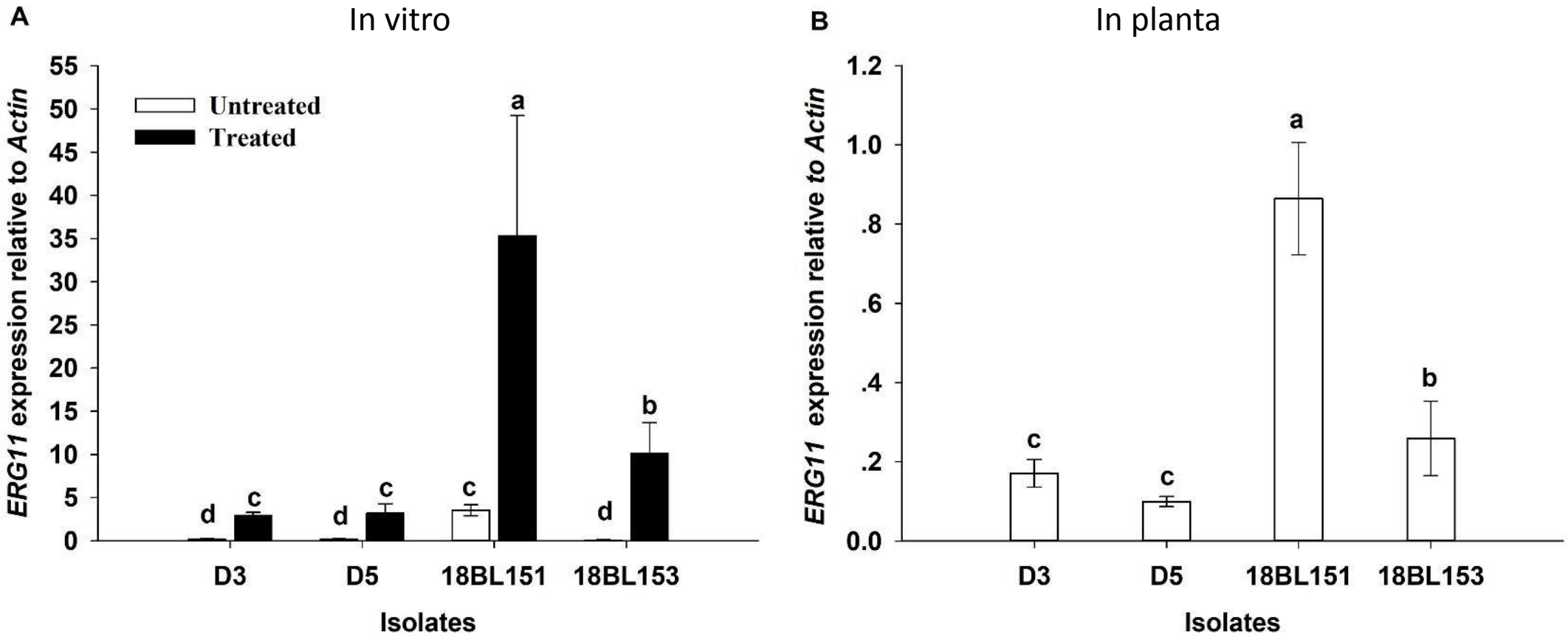
Not all isolates showed *in vitro* responses

Insertions in promoter region of ERG11 (Cyp51) responsible for resistance in some isolates





Insertion in promoter responsible for increased gene expression *in vitro* and *in planta*



Complementation and genetic mapping confirms promoter insertion responsible for resistance

Implications for industry

- No resistance detected for new SDHI and QoI fungicides
- Although 25-30% of populations have resistance to flutriafol and/or jockey, currently unknown what proportion of the isolates within these populations are resistance
  - Therefore impact on fungicide efficacy currently unknown
  - Will develop molecular marker for screening populations to determine frequency of resistance within a population
- Not all fungicide resistant isolates had insertion in promoter therefore other mechanisms of resistance yet to be identified
- Screens will be repeated in 2020, to submit samples please email angela@grainspathology.com.au

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