Durable Powdery mildew resistance in grapevines: myth or reality

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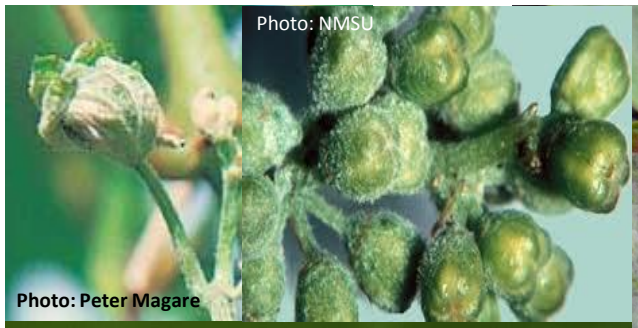
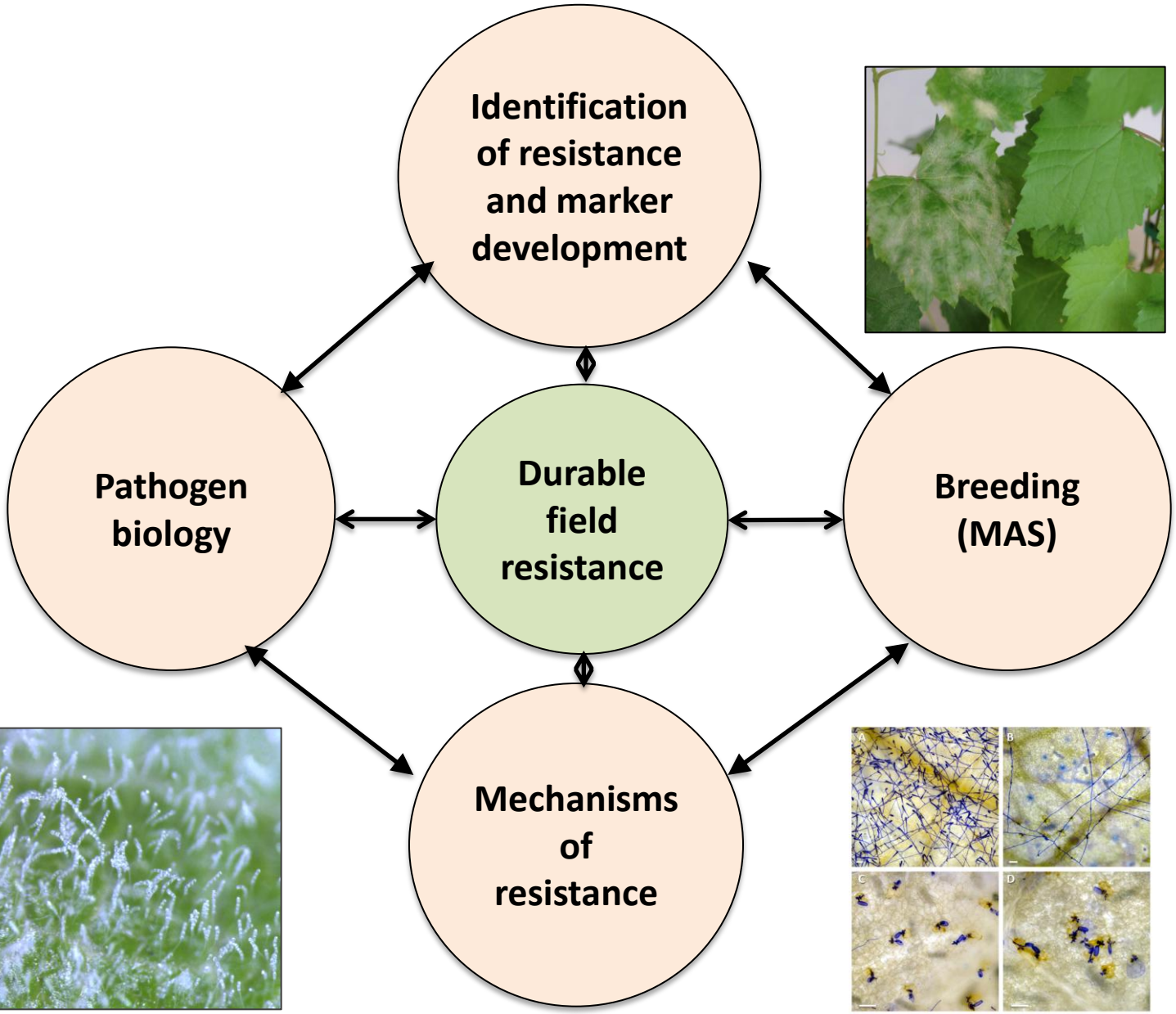


Integrative approach



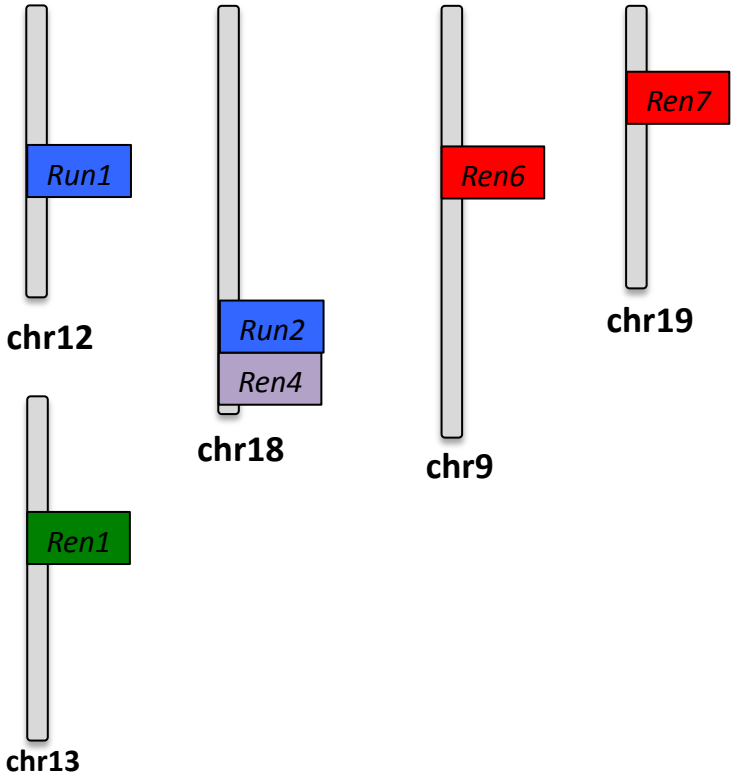
PM resistance loci in breeding program

- ***Run1, Run2***

  M. rotundifolia

- ***Ren1***

  V. sylvestris/vinifera



- ***Ren4***

  V. romanetii

- ***Ren6***
- ***Ren7***

  V. piasezkii

Other loci:

Ren2 (*V. cinerea* B9)

Ren3 and *Ren9* (American spp hybrid, Regent)

Ren8 (Villard blanc)

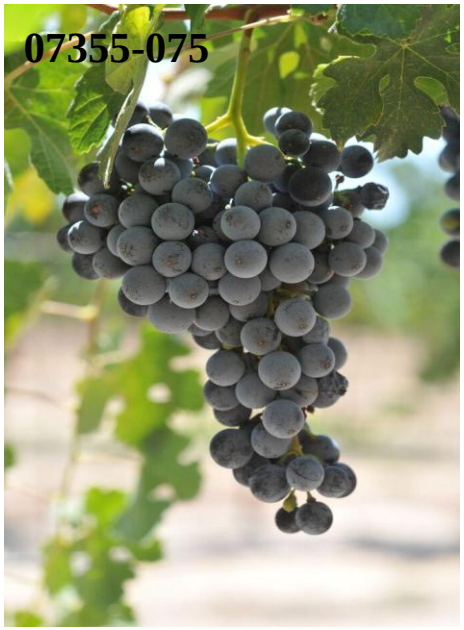
Ren10 (Seyval blanc)

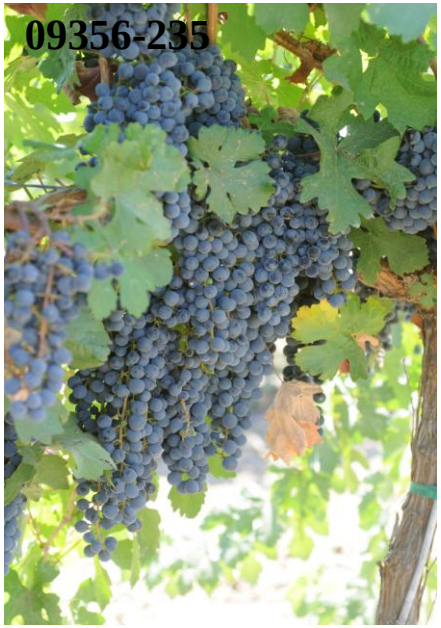
PM Breeding program at UC Davis

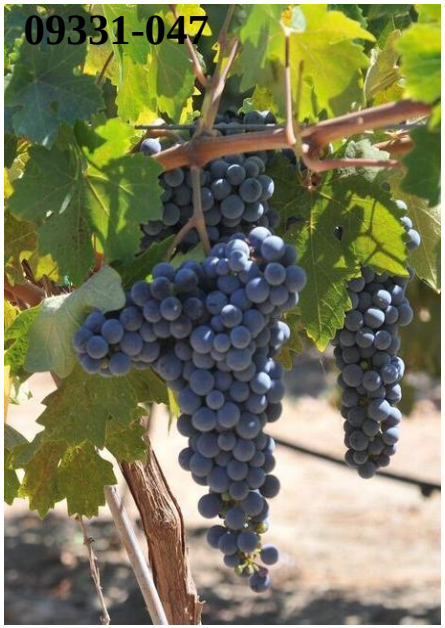
	% vinifera in the background											
	75%	81%	87%	88%	89%	91%	94%	95%	97%	98%	100%	No. of crosses
Ren1											2	2
Ren1xRen2					1							1
Ren1xRen4	5						6		4			15
Ren1xRen6xRen7							1					1
Ren1xRen4XRun1							12					12
Ren1xRun1						2						2
Ren1xRun1XRun2.1								6				6
Ren1xRun2.1	1		1	4			3		9			18
Ren4	10			11			19		31			71
Ren4xRen6		2				6						8
Ren6xRen7				10			15					25
Run1				9			51		7	10		77
Run2.1				5								5
No. of crosses	16	2	1	39	1	8	107	6	51	10	2	243

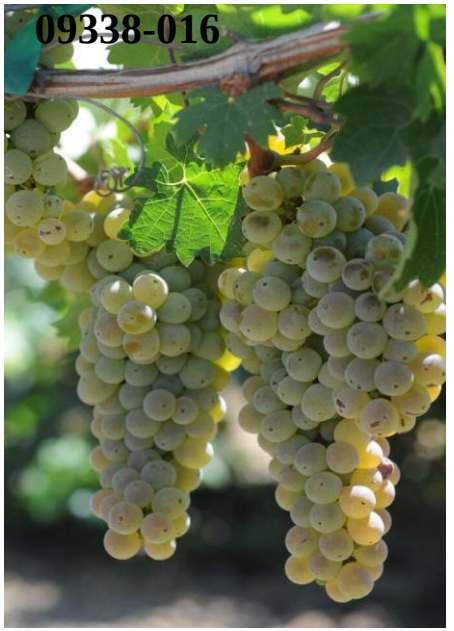
Summary

- *PdR1* locus from b43-17
- Chr14, MAS breeding
- Field trials and wine tasting
- Nursery release in 2017
- Public release in 2020







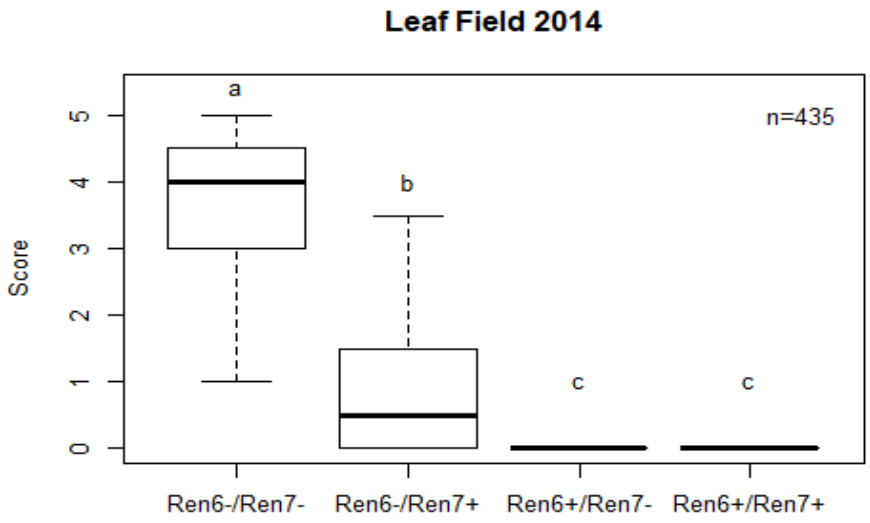


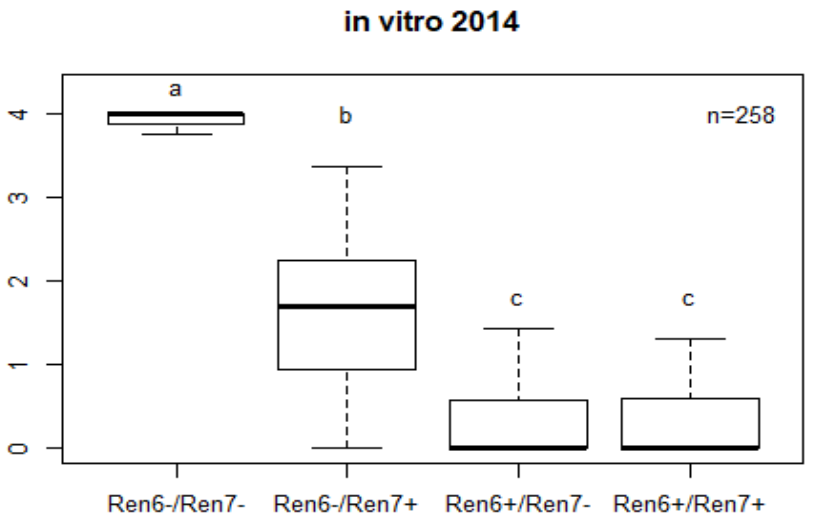
Constant field evaluations

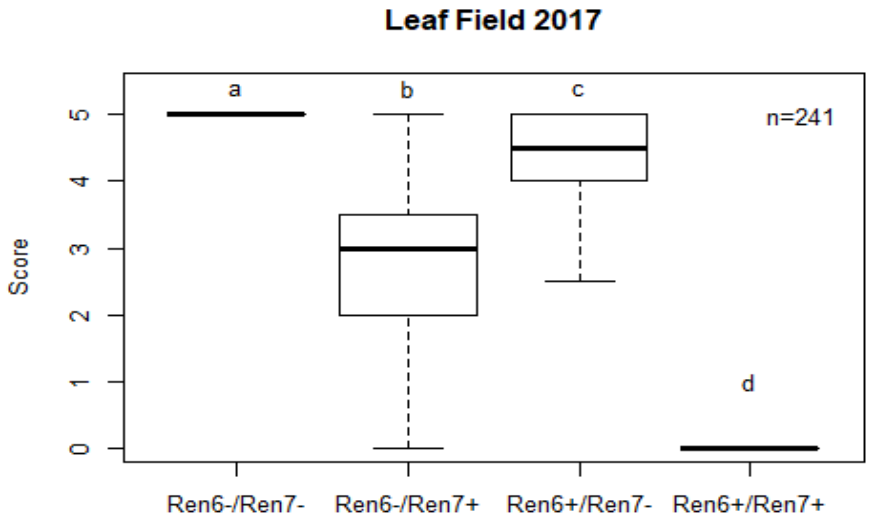
Isolate collection -- Summer 2016

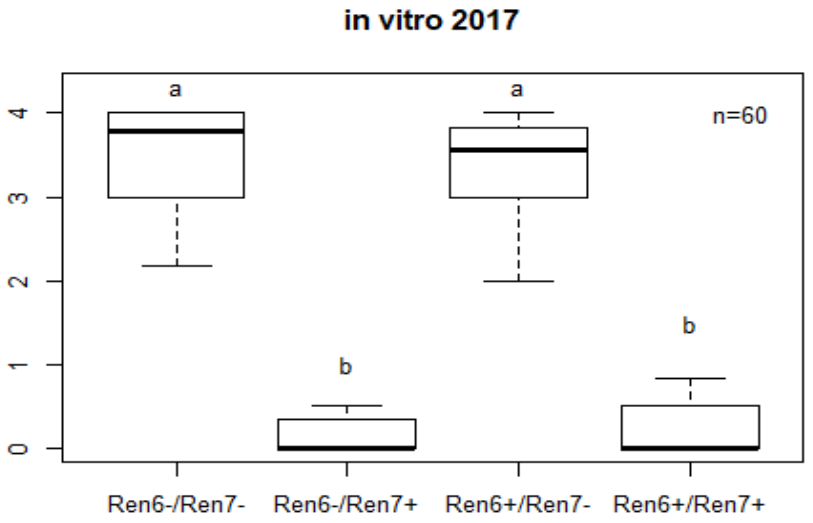
- **13352-57-A = BC1 population with Ren6 locus (infected leaves)**
- **14370-37-C = Pyramid cross with 3 loci (infected berries and rachis)**
- **Carignane= C- isolate (infected leaves)**
- **In vitro leaf assay**
- **Greenhouse grown plants**
- **Categorical scoring (1 – 5 scale)**

11373 population retesting



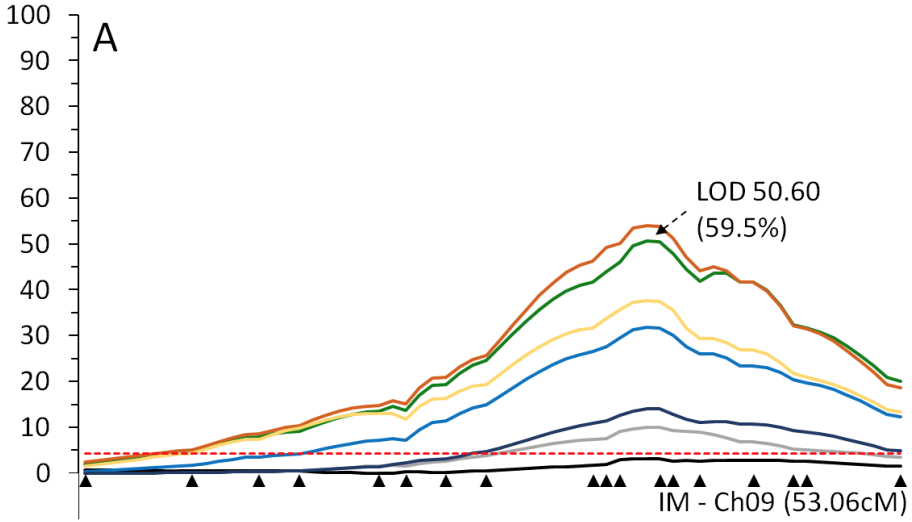


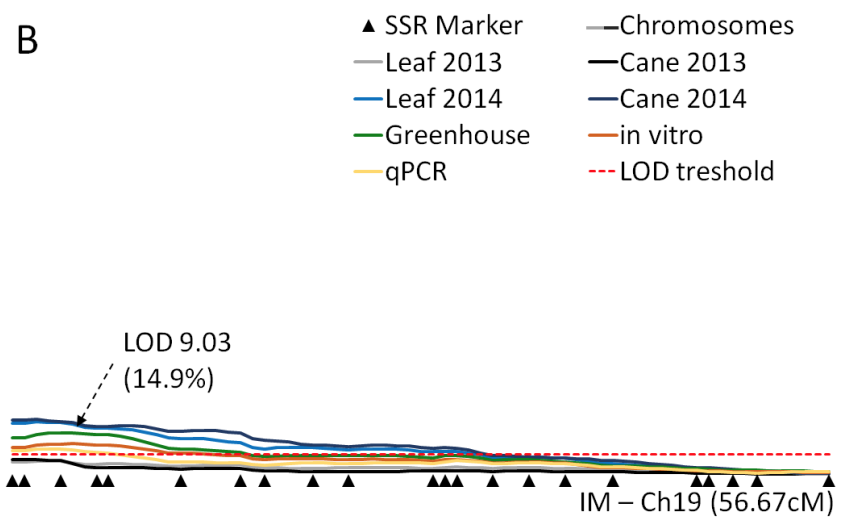




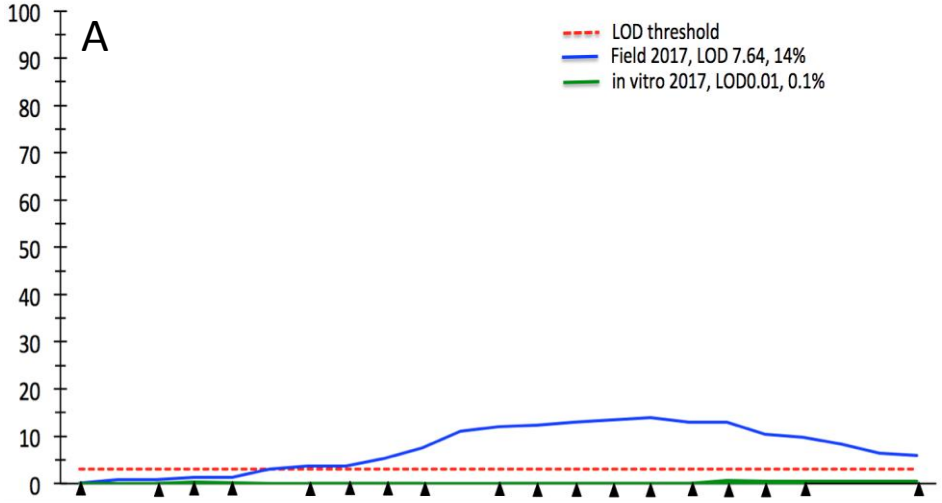
QTL analysis comparisons

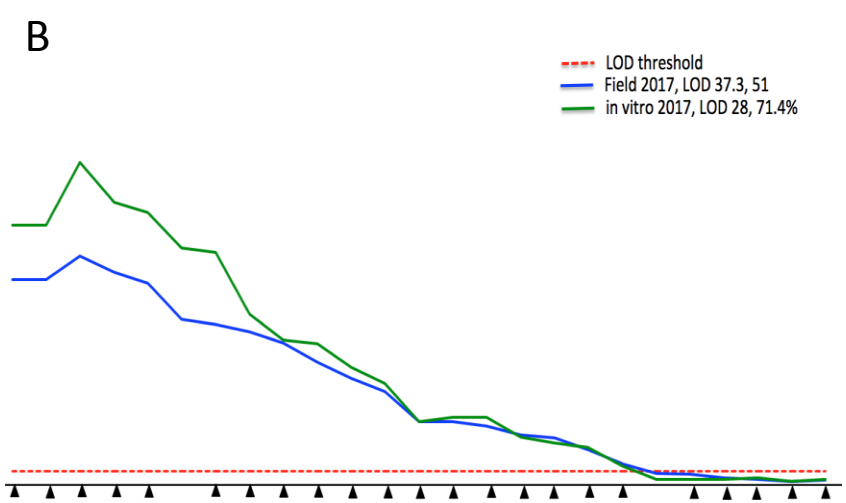
2014





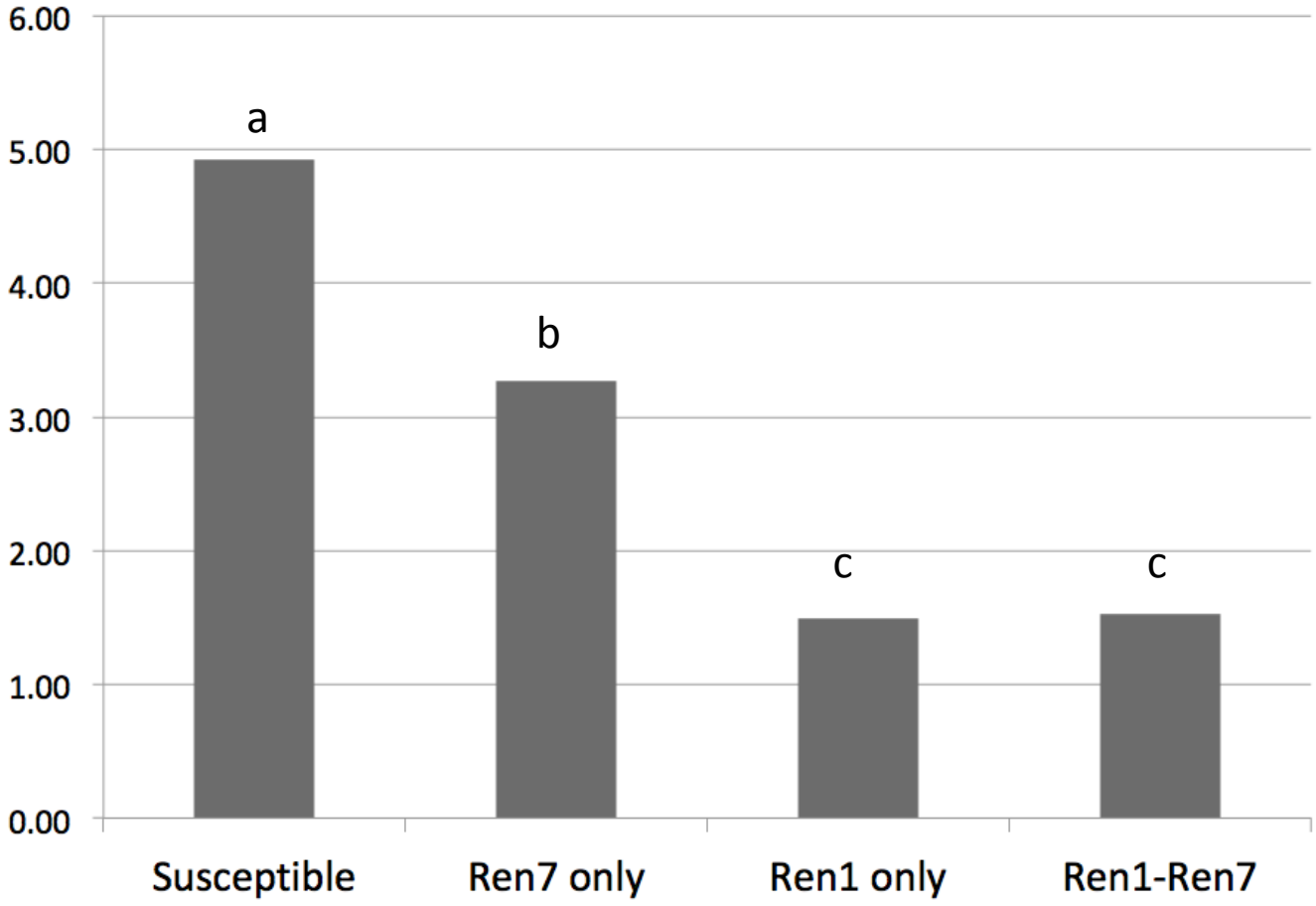
2017





		PM52-57-A	PM70-37-C	C-strain
Karadzhandal	*Ren1*	1.63	2.63	3.13
14339-043	*Ren1*	1.00	2.38	3.75
DVIT3351.27	*Ren1*	1.75	2.75	3.19
09321-146	*Ren4*	1.38	1.00	1.50
13353-09	*Ren4*	1.00	2.13	1.33
13353-15	*Ren4*	1.00	1.88	1.13
11373-005	*Ren6*	4.88	1.00	1.88
11373-009	*Ren6*	4.88	2.38	2.19
11373-029	*Ren7*	2.63	2.25	2.95
11373-017	*Ren7*	2.88	2.00	2.75
12366-20	*Run1*	1.00	1.75	1.00
12366-22	*Run1*	1.00	1.13	1.25
09705-45	*Run2.1*	2.50	3.00	2.38
e2-9	*Run2.2*	1.81	2.63	2.56
08391-125	*Run2.2*	2.63	2.88	2.94
14373-001	*Ren1Run1Ren4*	1.00	1.25	1.00
14370-009	*Ren1Run1Ren4*	1.56	1.50	1.63

Does combining loci with similar mechanisms of resistance improve overall resistance?



What we have learned, what we don't know?

- Multiple loci to breed
- Isolate specificity of different loci
- Understanding of pathogen biology
    - How quickly do virulent isolates originate or evolve?
    - Monitoring the spread of virulent isolates
- Resistant loci are not surety for complete eradication of PM

Conclusions

- Preventive sprays in the beginning and end of season
- Worth testing superior parental selections with wide range of isolates
- Understanding of mechanisms of resistance and how underlying genes function is important – core set of effectors

Team Powdery mildew

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