



# Fungal Diseases of Grapevine and Pear

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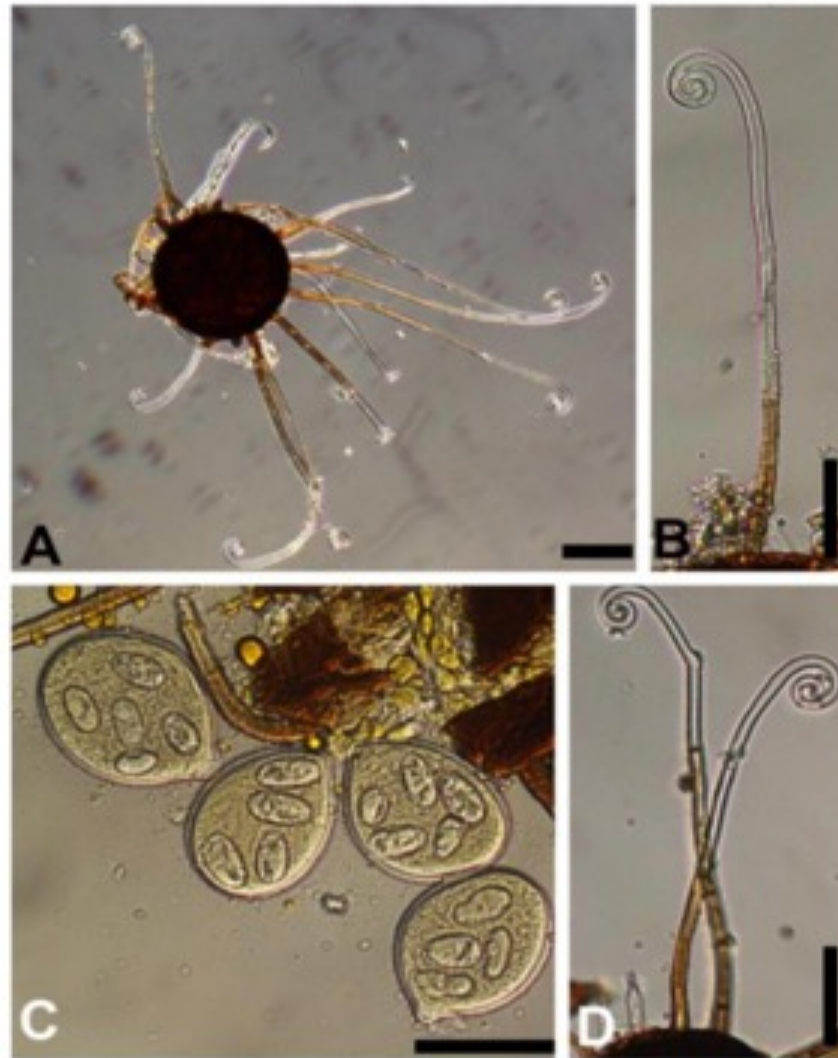
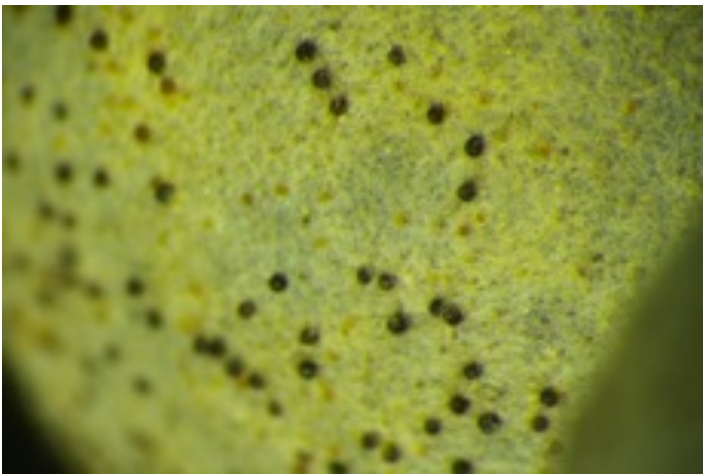
# Outcome

- Introduction, current project
- Powdery Mildew
- Botrytis Bunch Rot
- Fungal Diseases of Pear
- Conclusion

# Current project on grapevine

1. *In vitro* fungicide screening via spiral plater
2. Field fungicide trials to manage PM and Gray Mold
3. Screening of fungicide resistance
4. Grapevine trunk diseases
5. Biocontrol of Pierce's disease
6. Apple and Pear Diseases
7. Kiwi wilt disease

# Powdery Mildew (*Erysiphe necator*)



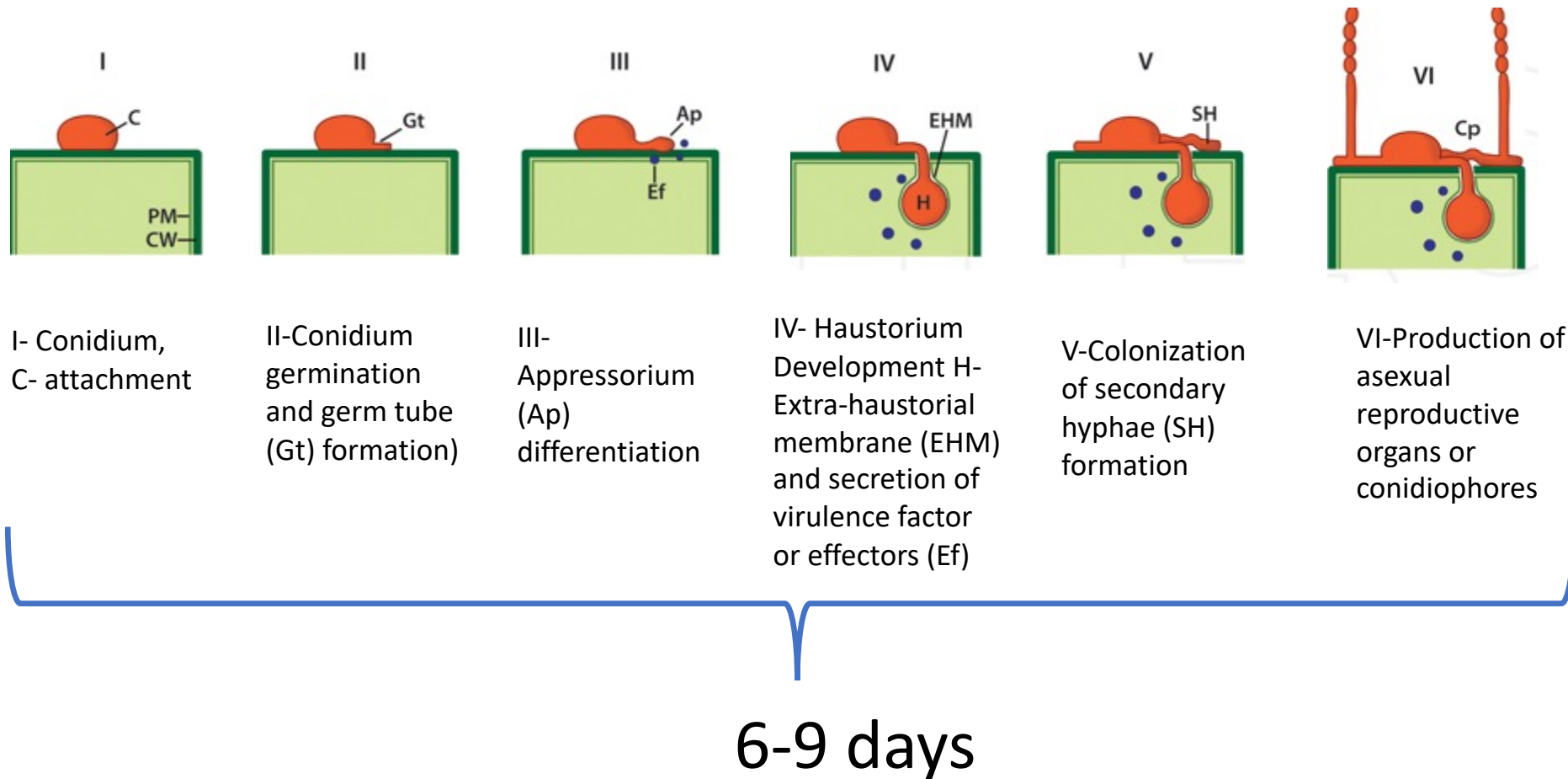
Ascospores from Chasmothecia (sexual reproduction)



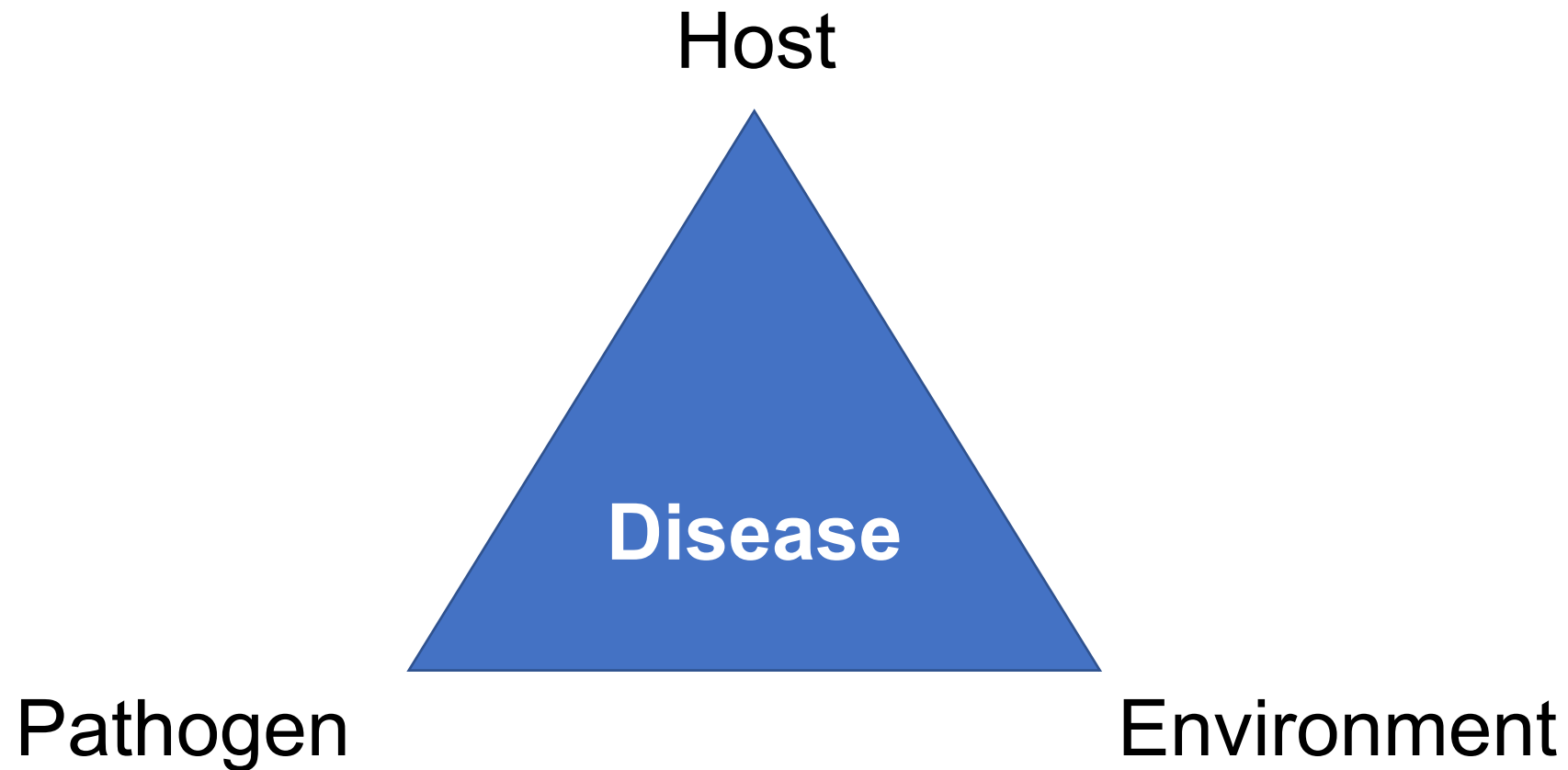
# Symptoms



# Infection by *Erysiphe necator*



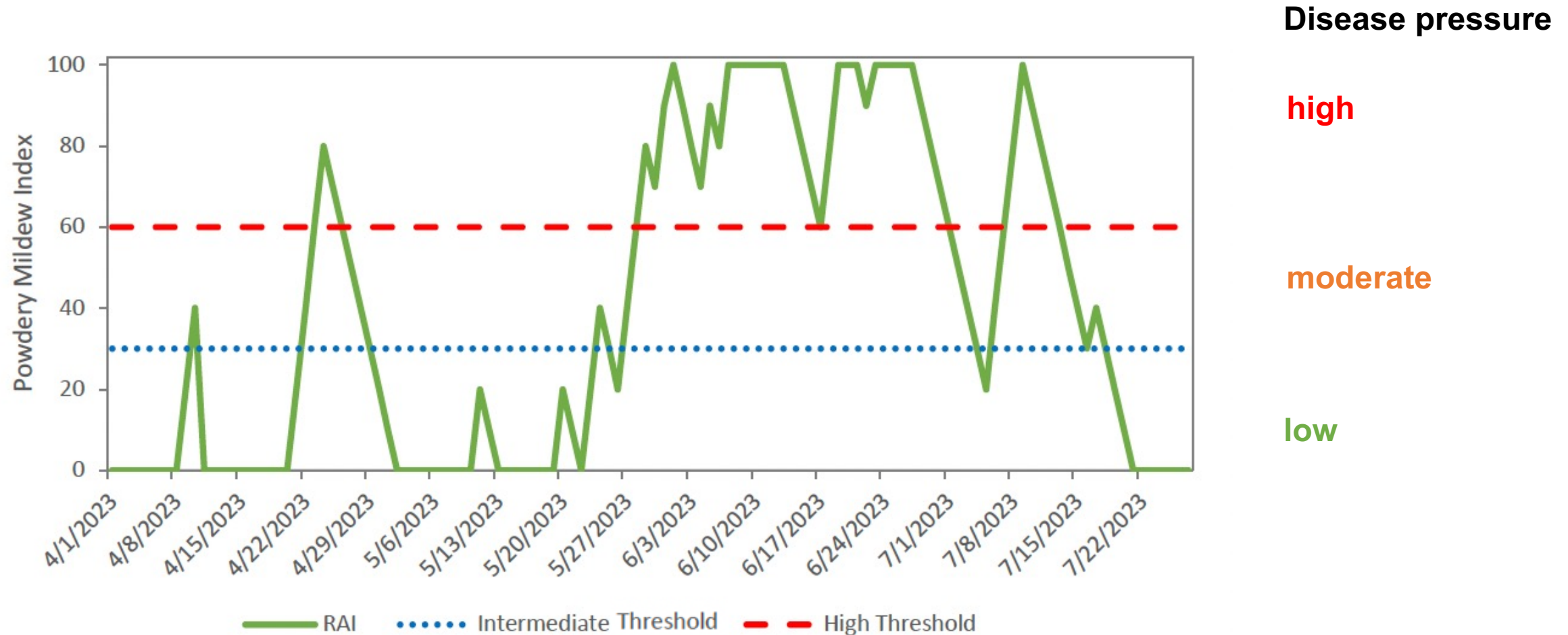
# What makes a “bad” disease year?





# Thomas-Gubler Risk assessment index (RAI)

- RAI is useful for determining disease pressure and how often you need to spray to protect the vines



<https://ipm.ucanr.edu/weather/grape-powdery-mildew-risk-assessment-index/>

# Field Trial to Evaluate Fungicides to control Powdery

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# 2023 Field fungicide efficacy trials

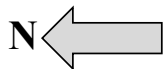
## Experimental design

Experimental design	Randomized complete block design with 5 replicates		
Experimental unit	2 adjacent vines = 1 plot		
Row and tree spacing	11 ft (row) and 7 ft (vine)	Plot unit area	154 ft <sup>2</sup>
Area/treatment	770 ft <sup>2</sup> or 0.0177 acre/treatment (5 replicates = 1 treatment)		
Volume water/Acre	50 gallons = 0.88 gal/5 reps		
	100 gallons (mid May,) = 1.77 gal/5 reps		
	150 gallons (early June ) = 2.65 gal/5 reps		
Equipment	Stihl SR 430 mist blower backpack sprayers		



# Trial Map

ROW	BLOCK 5					BLOCK 4					BLOCK 3					BLOCK 2					BLOCK 1					ROW		
VINE	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	VINE	
-31	X	X	X	X	13-YD	X	X	X	X	19-YRD	X	32-GKS	43-PWS	X	X	18-YKC	X	X	18-YKC	26-RKS	X	17-YKS	X	X	X	X	-31	
-30	36-BS	30-GS	X	X	X	X	47-PKC	X	26-RKS	19-YRD	37-BC	32-GKS	43-PWS	X	X	18-YKC	4-KS	1-W	18-YKC	26-RKS	X	17-YKS	X	X	X	19-YRD	-30	
-29			X	X	X	55-Pu+Y	P	X	44-PWC	19-YRD	37-BC	32-GKS	43-PWS	X	X	18-YKC	4-KS	1-W	18-YKC	26-RKS	X	17-YKS	X	X	X	19-YRD	-29	
-28	P	P	11-ONS	P	X	55-Pu+Y	P	X	44-PWC	19-YRD	37-BC	32-GKS	43-PWS	X	X	18-YKC	4-KS	1-W	18-YKC	26-RKS	X	17-YKS	X	X	X	19-YRD	-28	
-27					X	54-Pu+K	P	X	44-PWC	19-YRD	37-BC	32-GKS	43-PWS	X	X	18-YKC	4-KS	1-W	18-YKC	26-RKS	X	17-YKS	X	X	X	19-YRD	-27	
-26	38-BKD	58-Pu+R	50-B+G	X	34-B	53-B+W	X	X	28-G	25-RKD	54-Pu+K	27-RKC	8-OC+O	P	X	29-GD	16-YKD	54-Pu+K	32-GKS	57-Pu+O	P	10-OKS	26-RKS	16-YKD	46-PKS	4-KS	-26	
-25		X																										-25
-24	26-RKS	8-OC+O	46-PKS	PWD	34-B	53-B+W	X	X	28-G	25-RKD	54-Pu+K	27-RKC	8-OC+O	P	X	29-GD	16-YKD	54-Pu+K	32-GKS	57-Pu+O	P	10-OKS	26-RKS	16-YKD	46-PKS	4-KS	-24	
-23	X	3-KD	X	20-YRS	P	53-B+W	X	X	28-G	25-RKD	54-Pu+K	27-RKC	8-OC+O	P	X	29-GD	16-YKD	54-Pu+K	32-GKS	57-Pu+O	P	10-OKS	26-RKS	16-YKD	46-PKS	4-KS	-23	
-22	X	3-KD	X	20-YRS	P	53-B+W	X	X	28-G	25-RKD	54-Pu+K	27-RKC	8-OC+O	P	X	29-GD	16-YKD	54-Pu+K	32-GKS	57-Pu+O	P	10-OKS	26-RKS	16-YKD	46-PKS	4-KS	-22	
-21	X	3-KD	X	20-YRS	P	53-B+W	X	X	28-G	25-RKD	54-Pu+K	27-RKC	8-OC+O	P	X	29-GD	16-YKD	54-Pu+K	32-GKS	57-Pu+O	P	10-OKS	26-RKS	16-YKD	46-PKS	4-KS	-21	
-20	4-KS	X	29-GD	X	7-OS+O	2-K	56-Pu+G	X	P	23-RS+R	7-OS+O	10-OKS	55-Pu+Y	42-PWD	52-B+R	33-GKC	12-Y	50-B+G	10-OKS	P	11-ONS	57-Pu+O	12-Y	2-K	42-PWD	48-B+K	-20	
-19	X	44-PWC	47-PKC	9-OKD	X	X	X	X	12-Y	13-YD	24-RC+R	45-PKD	X	9-OKD	43-PWS	20-YRS	44-PWC	17-YKS	51-B+O	41-Pu	33-GKC	3-KD	44-PWC	45-PKD	56-Pu+G	35-BD	-19	
-18	X	44-PWC	28-G	X	41-Pu	51-B+O	58-Pu+R	43-PWS	9-OKD	33-GKC	6-O	46-PKS	22-RD+R	46-PKS	23-RS+R	54-Pu+K	3-KD	7-OS+O	X	2-K	53-B+W	36-BS	38-BKD	15-YC	51-B+O	32-GKS	-18	
-17	12-Y	37-BC	43-PWS	X	15-YC	19-YRD	X	X	45-PKD	15-YC	52-B+R	X	X	15-YC	40-BKC	50-B+G	3-KD	7-OS+O	X	2-K	53-B+W	36-BS	38-BKD	15-YC	51-B+O	32-GKS	-17	
-16	18-YKC	X	x	P	15-YC	19-YRD	X	X	45-PKD	15-YC	52-B+R	X	X	15-YC	40-BKC	50-B+G	3-KD	7-OS+O	X	2-K	53-B+W	36-BS	38-BKD	15-YC	51-B+O	32-GKS	-16	
-15	X	X	x	X	24-RC+R	5-KC	X	38-BKD	8-OC+O	53-B+W	P	X	31-GKD	28-G	X	P	35-BD	49-B+Y	33-GKC	15-YC	8-OC+O	9-OKD	47-PKC	40-BKC	28-G	X	-15	
-14	X	X	35-BD	X	39-BKS	32-GKS	X	41-Pu	8-OC+O	53-B+W	P	X	31-GKD	28-G	X	P	35-BD	49-B+Y	33-GKC	15-YC	8-OC+O	9-OKD	47-PKC	40-BKC	28-G	X	-14	
-13	X	X	X	57-Pu+O	39-BKS	X	20-YRS	X	X	17-YKS	29-GD	31-GKD	30-GS	47-PKC	5-KC	X	26-RKS	29-GD	5-KC	56-Pu+G	X	P	39-BKS	7-OS+O	6-O	30-GS	-13	
-12	14-YS	X	48-B+K	X	10-OKS	23-RS+R	X	50-B+G	14-YS	30-GS	P	6-O	4-KS	47-PKC	5-KC	17-YKS	3-KD	35-BD	58-Pu+R	30-GS	P	39-BKS	P	13-YD	P	X	-12	
-11	X	X	45-PKD	X	22-RD+R	X	42-PWD	X	P	16-YKD	2-K	P	24-RC+R	12-Y	20-YRS	34-B	24-RC+R	34-B	28-G	23-RS+R	52-B+R	8-OC+O	58-Pu+R	37-BC	X	X	-11	
-10	X	16-YKD	6-O	X	22-RD+R	X	42-PWD	X	P	16-YKD	2-K	P	24-RC+R	12-Y	20-YRS	34-B	24-RC+R	34-B	28-G	23-RS+R	52-B+R	8-OC+O	58-Pu+R	37-BC	X	X	-10	
-9	X	X	X	X	25-RKD	49-B+Y	42-PWD	11-ONS	X	57-Pu+O	48-B+K	44-PWC	10-OKS	48-B+K	41-Pu	38-BKD	56-Pu+G	38-BKD	6-O	25-RKD	X	23-RS+R	1-W	20-YRS	X	X	-9	
-8	X	X	X	X	1-W	40-BKC	56-Pu+G	51-B+O	18-YKC	35-BD	39-BKS	32-GKS	7-OS+O	X	X	X	11-ONS	19-YRD	46-PKS	42-PWD	13-YD	X	14-YS	54-Pu+K	25-RKD	X	-8	
-7	X	X	X	X	1-W	40-BKC	56-Pu+G	51-B+O	18-YKC	35-BD	39-BKS	32-GKS	7-OS+O	X	X	X	11-ONS	19-YRD	46-PKS	42-PWD	13-YD	X	14-YS	54-Pu+K	25-RKD	X	-7	
-6	X	X	X	X	1-W	40-BKC	56-Pu+G	51-B+O	18-YKC	35-BD	39-BKS	32-GKS	7-OS+O	X	X	X	11-ONS	19-YRD	46-PKS	42-PWD	13-YD	X	14-YS	54-Pu+K	25-RKD	X	-6	
-5	X	X	X	X	1-W	40-BKC	56-Pu+G	51-B+O	18-YKC	35-BD	39-BKS	32-GKS	7-OS+O	X	X	X	11-ONS	19-YRD	46-PKS	42-PWD	13-YD	X	14-YS	54-Pu+K	25-RKD	X	-5	
-4	X	X	X	X	1-W	40-BKC	56-Pu+G	51-B+O	18-YKC	35-BD	39-BKS	32-GKS	7-OS+O	X	X	X	11-ONS	19-YRD	46-PKS	42-PWD	13-YD	X	14-YS	54-Pu+K	25-RKD	X	-4	
-3	X	X	X	X	1-W	40-BKC	56-Pu+G	51-B+O	18-YKC	35-BD	39-BKS	32-GKS	7-OS+O	X	X	X	11-ONS	19-YRD	46-PKS	42-PWD	13-YD	X	14-YS	54-Pu+K	25-RKD	X	-3	
-2	X	X	X	X	1-W	40-BKC	56-Pu+G	51-B+O	18-YKC	35-BD	39-BKS	32-GKS	7-OS+O	X	X	X	11-ONS	19-YRD	46-PKS	42-PWD	13-YD	X	14-YS	54-Pu+K	25-RKD	X	-2	
-1	X	X	X	X	1-W	40-BKC	56-Pu+G	51-B+O	18-YKC	35-BD	39-BKS	32-GKS	7-OS+O	X	X	X	11-ONS	19-YRD	46-PKS	42-PWD	13-YD	X	14-YS	54-Pu+K	25-RKD	X	-1	

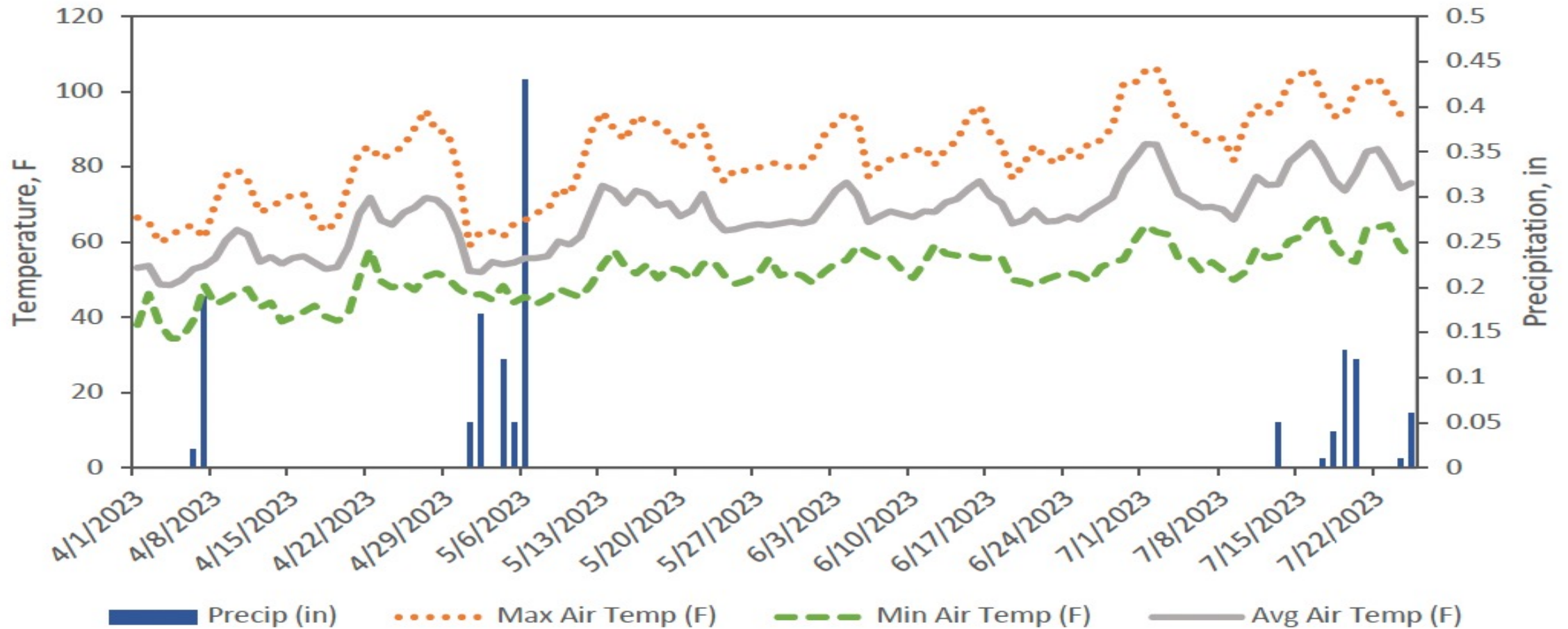


Color			
B	Blue	Pu	Purple
G	Green	R	Red
K	Black	Y	Yellow
O	Orange	W	White
P	Pink	N	Gray

Pattern	
C	Checker
D	Dot
S	Stripe



# 2023 Field climatic data



Average daily temperature (C) and precipitation (mm) from Apr 1 to July 25, 2022, from CIMIS station #226.

# 2023 Powdery Mildew Field Trial 1

Disease incidence and severity of synthetic fungicides and combinations of soft chemistry and synthetic products.

Treatment			Powdery mildew on the cluster <sup>x</sup>	
TRT	Rate/A <sup>y</sup>	Intervals	Incidence, %	Severity, %
1	Luna Experience 8.6 fl oz	14	4	0.1
	Pristine 23 oz			
	Endura 2.8 oz			
	Torjan 4 floz			
	Quintec 6 fl oz			
2	Cevya 4 floz + Syl-Coat 4 fl oz	14	5	0.2
	Gatten 6.4 floz+ Syl-Coat 4 fl oz			
	Luna sensation 5 floz + Syl-Coat 4 fl oz			
	Vivando 15.4 floz+ Syl-Coat 4 fl oz			
	Inspire super 16 floz+ Syl-Coat 4 fl oz			
	Prolivo 4 floz+ Syl-Coat 4 fl oz			
3	Sulfur Dry Flowable 5 lb	14	10	0.3
	V6M-5-7 27.4 fl oz + Dyne-Amic 0.125% v/v			
	Luna Experience 8.6 fl oz			
	Pristine 23 oz			
	Elevate 16oz			
4	Luna Experience 8.6 fl oz	14	13	0.5
	Pristine 23 oz			
	Endura 2 oz			
	Trojan 2.8 fl oz			
	Quintec 6 fl oz			
5	Luna Experience: 8.6 fl oz	14	11	0.5

Treatment		Powdery mildew on the cluster <sup>x</sup>		
TRT	Rate/A <sup>y</sup>	Intervals	Incidence, %	Severity, %
6	Luna Experience 8.6 fl oz	14	15	0.6
	Pristine 23 oz			
	Luna Experience 8.6 fl oz			
	Quintec 6 fl oz			
	Rhyme 5 fl oz			
	Torino 3.4 fl oz			
7	Luna Experience 8.6 fl oz	14	13	0.8
	Pristine 23 oz			
	Endura 1.6 oz			
	Trojan 2.3 fl oz			
	Quintec 6 fl oz			
8	Luna Experience 8.6 fl oz	14	20	0.9
	Pristine 23 oz			
	SA-0650004 28 fl oz			
	Quintec 6 fl oz			
	Rhyme 5 fl oz			
	Torino 3.4 fl oz			
9	Cevya 4fl oz + Syl-Coat 4 fl oz	14	24	1.1
	Serenade ASO 3 qts + Syl-Coat 4 fl oz			
	Luna sensation 5 fl oz + Syl-Coat 4 fl oz			
	Serifel 12 oz + Syl-Coat 4 fl oz			
	Inspire super 16 fl oz + Syl-Coat 4 fl oz			
	Sonata 3 qts + Syl-Coat 4 fl oz			

Treatment			Powdery mildew on the cluster <sup>x</sup>	
TRT	Rate/A <sup>y</sup>	Intervals	Incidence, %	Severity, %
10	Luna Experience 8.6 fl oz	14	34	1.6
	Pristine 23 oz			
	Mevalone 55 fl oz + Dyne-Amic 0.125% v/v			
	Quintec 6 fl oz			
	Rhyme 5 fl oz			
	Torino 3.4 fl oz			
11	Ninja 2% 8 oz	14	25	1.9
	Luna Experience 8.6 fl oz			
12	Luna Experience: 8.6 fl oz	14	25	2.5
	Pristine 23 oz			
	Elevate 16 oz			
	Berezi 5 lb			
13	Untreated Control-UTC		100	99.9

# 2023 Powdery Mildew Field Trial 2

Disease incidence and severity of soft chemistry products, including biologicals, sulfurs, nutrient applications, oils, and other materials.

Treatment		Powdery mildew on the cluster <sup>x</sup>	
TRT	Rate/A <sup>y</sup>	Incidence, %	Severity, %
41	Sulfur 5lb	24	1.4
	Saponel 0.5% + Sulphur 5lb		
	Saponel 1% + Kobber 30g/100L		
	HML32 1.25L/100L + Kobber 30g/100L + Sulphur 5lb		
15	Shielder (OR-536) 4 lbs/a + Oroboost (OR-097A) 32 fl. oz/100 gal	63	6.7
40	Sulfur 5lb	61	7.7
	Saponel 0.5% + Sulphur 5lb		
	Saponel 1% + Kobber 30g/100L		
	HML32 1.25L/100L + Kobber 30g/100L + Potum 300g/100L		
35	Sulfur dry	63	9.2
	Kaligreen 5lb		
12	Milagram Plus (OR-488) 40 fl oz/100 gal + Oroboost (OR-097A) 32 fl oz/100gal	67	11.1
47	Sulfur DF 5 lb	56	12.0
43	Sulfur 5lb	72	12.4
	NSA 1% + Kobber 33g/100L +HML Silco (225ml/100L or 100g/100L		
42	Sulfur 5lb	67	16.9
	Saponel 0.5% + Sulphur 5lb		
	Saponel 1% + Kobber 30g/100L		
	HML32 1.25L/100L + Kobber 30g/100L + HML Silco 225ml/100L		
	Saponel 1% + Kobber 30g/100L + HML Silco (225ml/100L or 100g/100L)		
25	Cinnaction (OR-489-E) 50 fl oz/100 gal + Attitude (OR-278F) 32 fl oz/100 gal	78	20.9
46	PureSpray Green 1 gal	78	21.7
	Sulfur Dry-Flowable 5 lb		
	Bio Project S10 68 fl oz + Bio Project ID 0.9 27 fl oz		

# 2023 Powdery Mildew Field Trial 2

Disease incidence and severity of soft chemistry products, including biologicals, sulfurs, nutrient applications, oils, and other materials.

Treatment		Powdery mildew on the cluster <sup>x</sup>	
TRT	Rate/A <sup>y</sup>	Incidence, %	Severity, %
46	PureSpray Green 1 gal	78	21.7
	Sulfur Dry-Flowable 5 lb		
11	Bio Project S10 68 fl oz + Bio Project ID 0.9 27 fl oz	60	28.6
	Bio Project S10 27 fl oz + Bio Project ID 0.9 27 fl oz		
	Bio Project ID 0.9 27 fl oz + Bio Project MT 0.9 27 fl oz		
	Bio Project S10 68 fl oz + Bio Project MT 0.9 27 fl oz		
	Bio Project S10 68 fl oz + Bio Project ID 0.9 34 fl oz + Bio Project MT 0.9 34 fl oz		
	Bio Project ID 0.9 34 fl oz + Bio Project MT 0.9 34 fl oz		
14	Thymic (OR-491) 50 fl oz/100 gal + Oroboost (OR-097A) 32 fl oz/100gal	93	32.3
13	Cinnaction (OR-489) 50 fl oz/100 gal + Attitude (OR-278F) 32 fl oz/100 gal	86	32.4
26	Thymic (OR-491-B) 50 fl oz/100 gal + Oroboost (OR-097A) 32 fl oz/100gal	85	35.4
2	Ninja 2% 8 oz	93	37.7
34	NSTKI-037 6 lb/A	91	38.6
33	NSTKI-037 4 lb/A	100	66.8
30	X7N68-R009	100	80.3
27	Sulfur 5lb	100	90.2
	Fun-Thyme 0.5% v/v		
52	30% Hydrogen peroxide + Fitor 20ml + Phosful 10 ml	100	95.1
1	Untreated Control- UTC	100	99.9

# Sulfur advantages

- Lime sulfur
- Dusting Sulfur
- Wettable sulfur
  - Micronized
  - Dry Flowable
- Is a natural product
- Inexpensive
- Effective
- Used hundreds of years
  - No Case of resistance



# Sulfur disadvantages

- Washes off easily with rain
- Less effective in cool weather
- May burn wines in hot weather

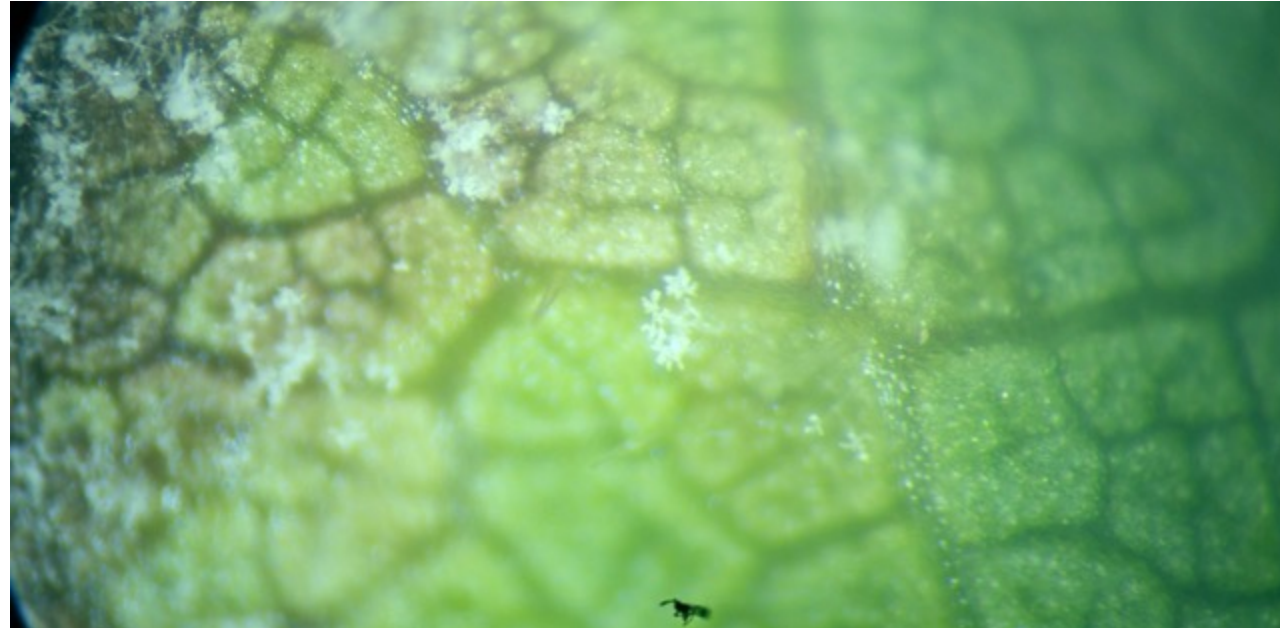


# Downy mildew *Plasmopara viticola* of grapevine





# Downy mildew *Plasmopara viticola* of grapevine

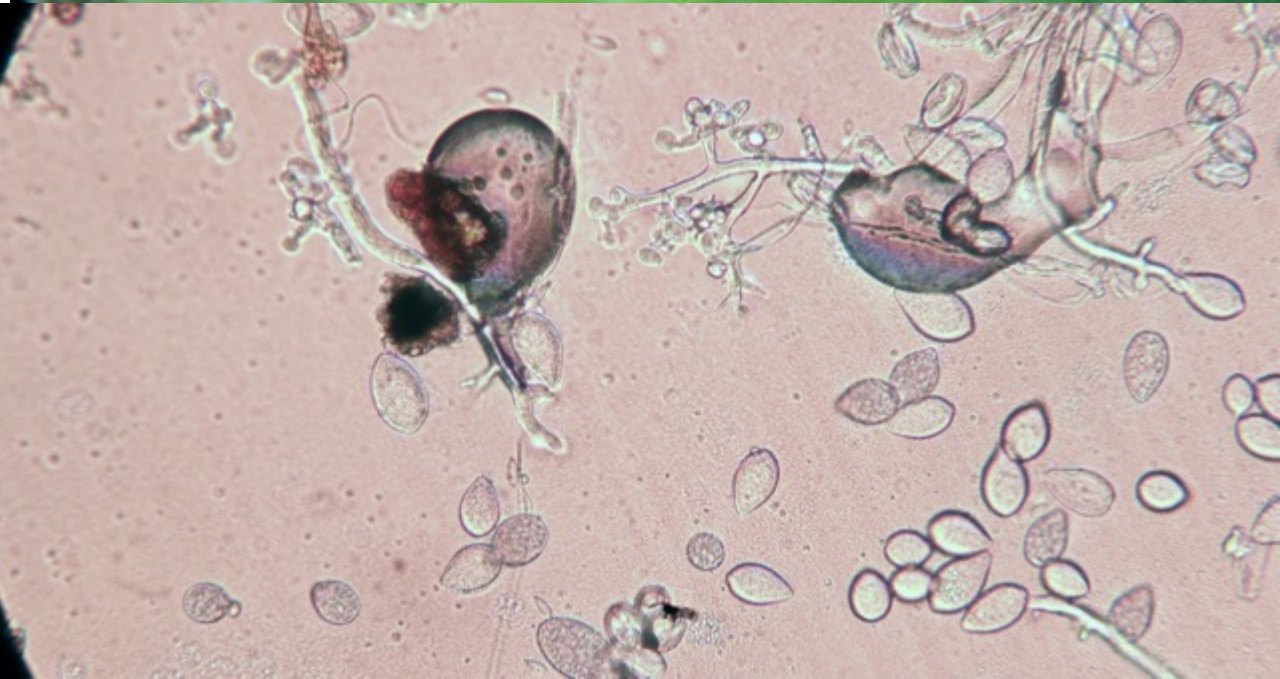


## Management:

Preventive management consists of effective soil drainage and reduction of sources of overwintering inoculum. In a vineyard that depends on sprinkler irrigation, extend the interval between irrigations as long as possible.

## Fungicides:

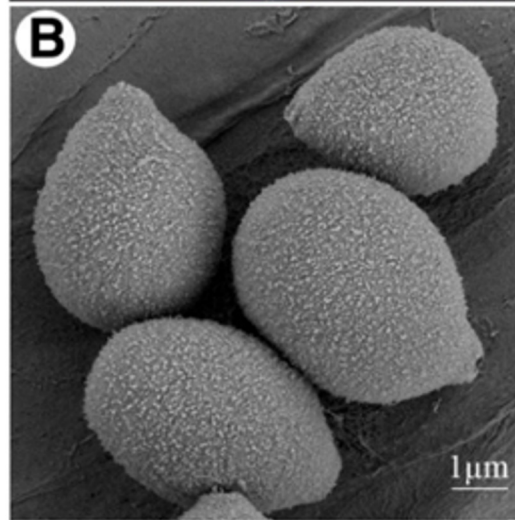
- Phosphonate (fosetyl-aluminum)
- Phenylamides (metalaxyl)
- **QoI (Azoxystrobin)**
- **Carboxylic acid amides (CAA; mandipropamid),**
- Copper Hydroxide



# Pathogens involved with Bunch Rot / Gray Mold



*Botrytis cinerea*



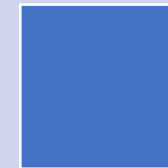
Zhou et al 2018, Plant Disease



Fungus is ubiquitous



Attacks juvenile tissue, ripe fruit Brix >8



After infection, the fungus can produce sclerotia (resting structure).



# Summer bunch rot (Sour rot)

- In California, sour rot has been attributed to a complex of microorganisms including *Botrytis cinera*, *Aspergillus niger*, *A. carbonarius*, and others (Latham et al 2008)





# Other common symptoms of sour rot



Acetobacter



Yeast



Secondary colonizers



Drosophila



# Pathogens involved with Summer Bunch rot (Sour Rot)



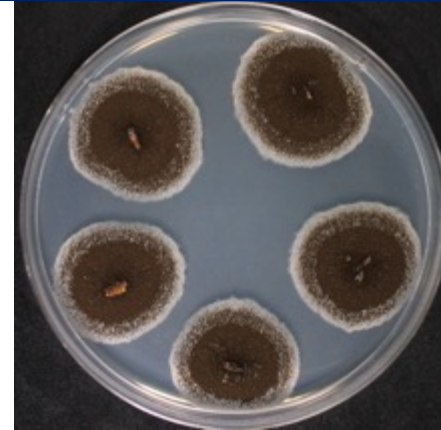
*Botrytis cinerea*



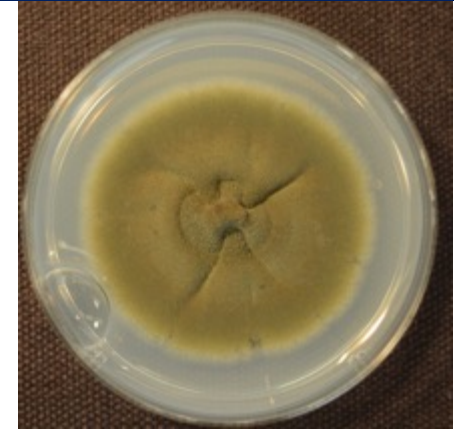
*Aspergillus carbonarius*



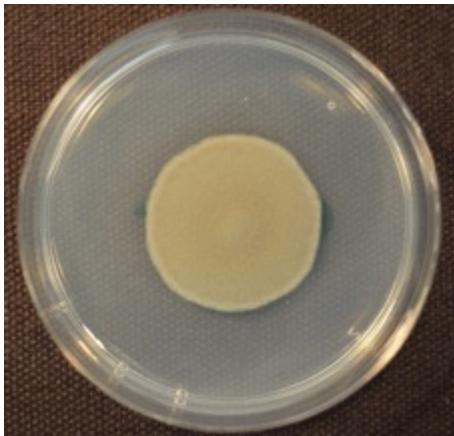
*Aspergillus niger*



*Aspergillus tubingensis*



*Cladosporium* sp.



*Penicillium* sp.



*Rhizopus* sp.



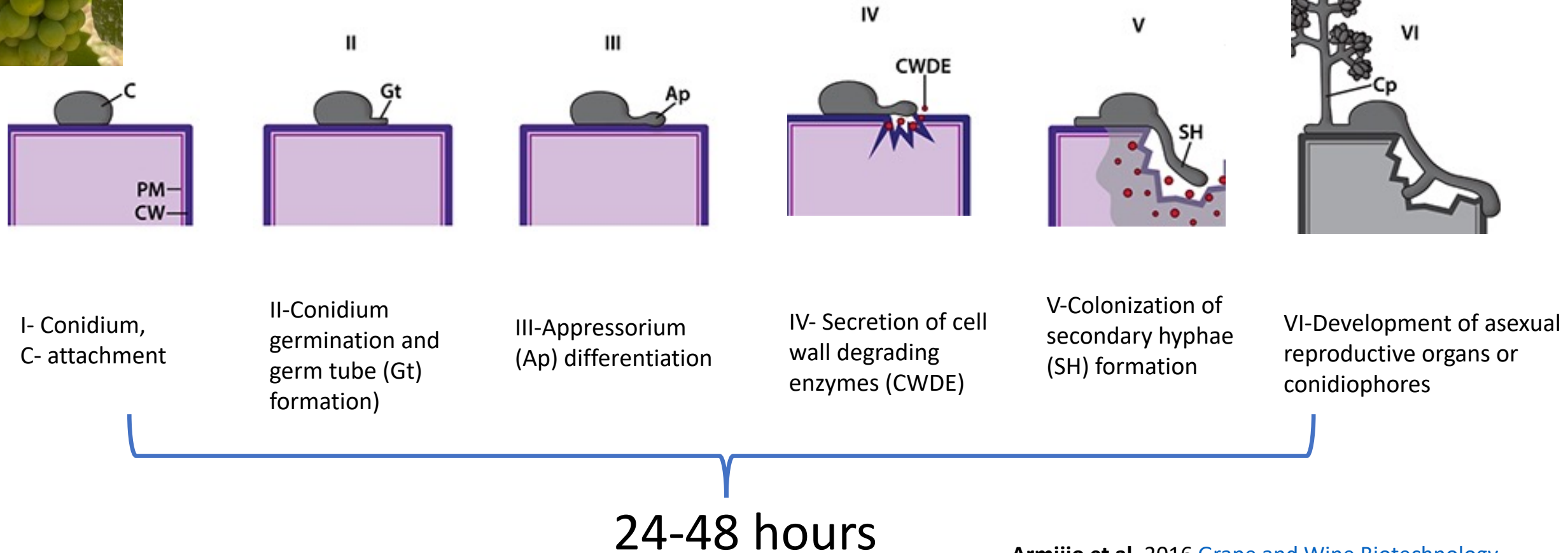
Yeast



Bacteria

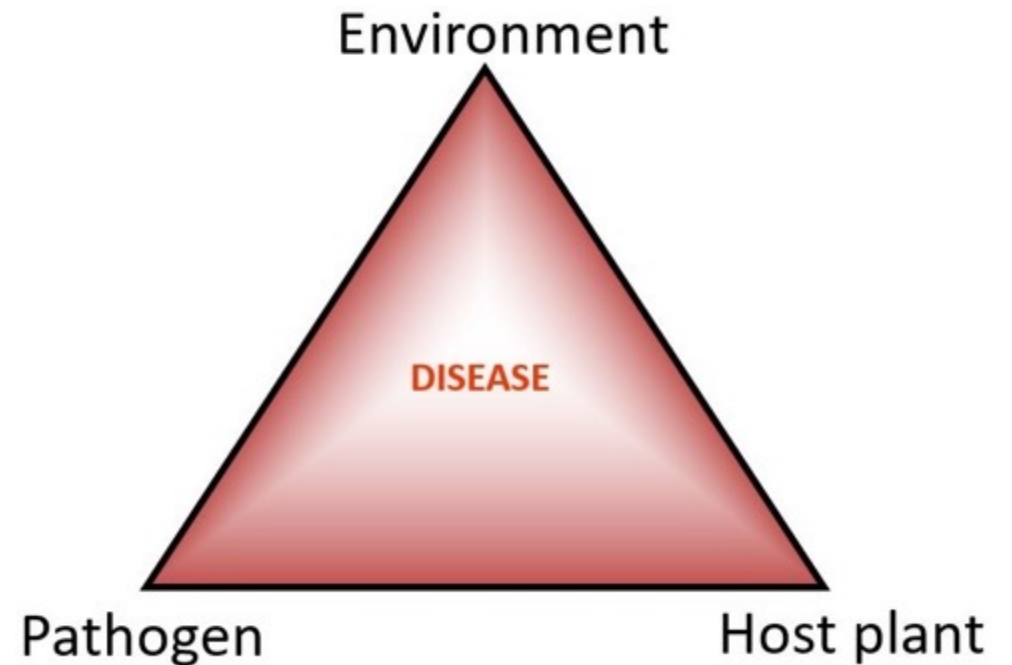


# Infection by *Botrytis cinerea*



# Cultural practices affect summer bunch rot

- Leaf removal
- Decreased fertilizer
- Cluster Architecture



# Fungicide efficacy

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- **Timing**

- Bloom, Preclose, **Veraison, Preharvest**

- **Application**

- Full coverage, Both sides of vine

- **Phenology**

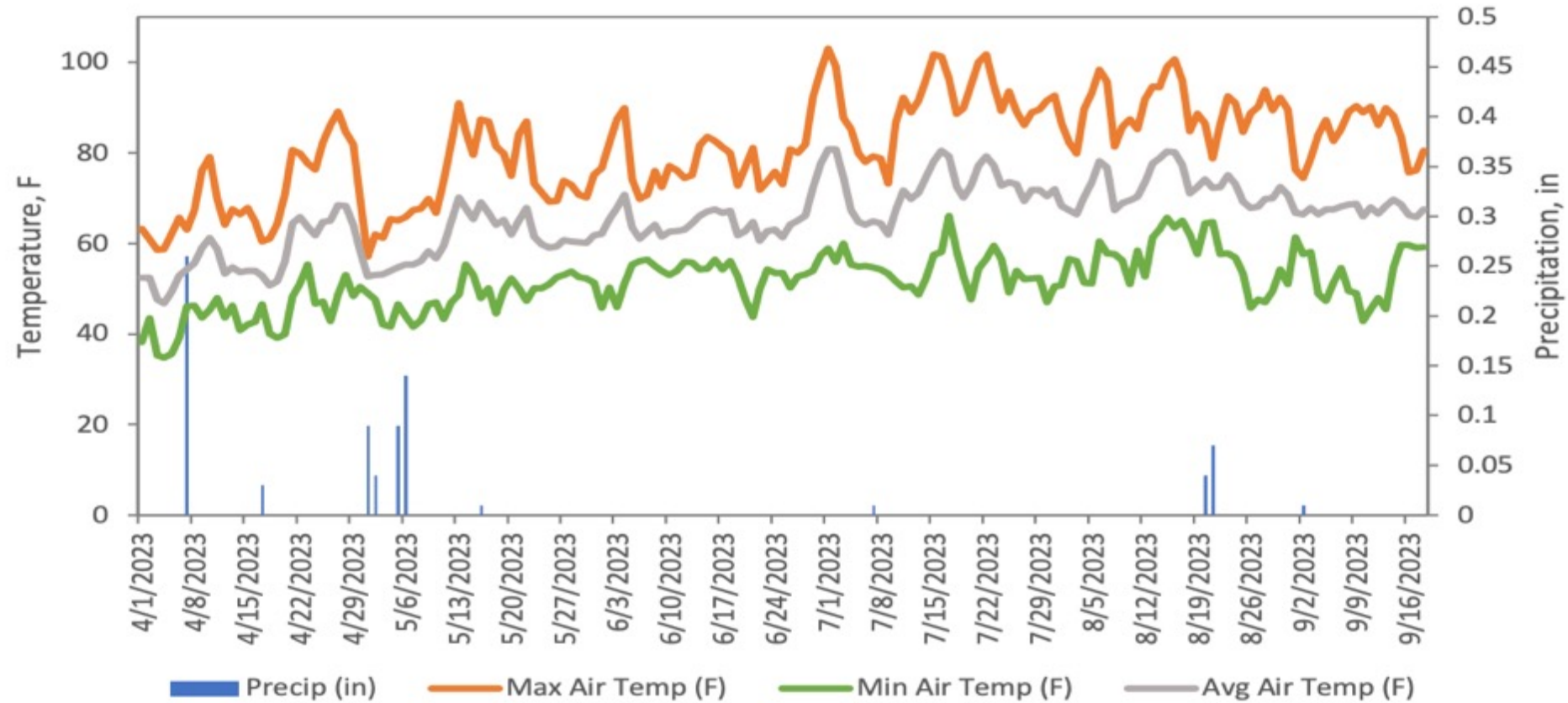
- Blossoms, young fruit, older fruit, leaves, shoots

# 2023 Field fungicide efficacy trials

## Experimental design

Experimental design	Completely randomized design with 5 replicates		
Experimental unit	3 adjacent vines = 1 plot		
Row and tree spacing	11 ft (row) and 5 ft (vine)	Plot unit area	165 ft <sup>2</sup>
Area/treatment	825 ft <sup>2</sup> or 0.01956 acre/treatment (5 replicates = 1 treatment)		
Fungicide	A bloom, May 25 <sup>th</sup> , 100 gallons = 1.5152 gal/5 reps		
Applications, Volume water/Acre	B pre-close, June 22 <sup>th</sup> , 150 gallons = 2.2727 gal/5 reps		
	C veraison, August 6 <sup>st</sup> , 150 gallons = 2.2727 gal/5 reps		
	D pre-harvest, August 23 <sup>rd</sup> , 150 gallons = 2.2727 gal/5 reps		
Equipment	Stihl SR 430 Backpack Sprayers		

# 2023 Field climatic data



Average daily temperature (C) and precipitation (mm) from Apr 1 to July 25, 2022, from CIMIS station #243.

# 2023 Summer Bunch Rot Field Trials

Treatment <sup>x</sup>		Bunch rot on the clusters <sup>z</sup>	
TRT	Rate/Acre	Incidence, %	Severity, %
40	Evoca 3 lb + Activator-90 16 fl oz/100 gal	8.0	1.0
	Pristine 23 oz		
	Elevate 16 oz		
50	SA-0650004 28 fl oz	14.4	0.9
	Vanguard WG 10 oz		
	SA-0650004 28 floz		
	Ph-D 6.2 oz + Syl-Coat 4 fl oz		
29	Miravis Prime 13.4 fl oz + Dyne-Amic 0.125% v/v	15.2	1.4
	Vanguard 10.0 oz + Dyne-Amic 0.125% v/v		
	Switch 14.0 oz + Dyne-Amic 0.125% v/v		
42	Mevalon 55 fl oz	16.0	1.0
	Vanguard WG 10 oz		
	Elevate 50WDG 1 lb		
	Ph-D 6.2 oz + Syl-Coat 4 fl oz		
6	V6M-5-7 27.4 fl oz + Dyne-Amic 0.125%v/v	17.6	1.8
30	Vanguard 10.0 oz+ Dyne-Amic 0.125% v/v	17.6	2.0
	Miravis Prime 13.4 fl oz + Dyne-Amic 0.125% v/v		
27	Kaligreen 5lb	20.0	2.6
41	Evoca 3 lb + Activator-90 16 fl oz	20.0	0.9
	Elevate 16 oz		

# 2023 Summer Bunch Rot Field Trials

Treatment <sup>x</sup>		Bunch rot on the clusters <sup>z</sup>	
TRT	Rate/Acre	Incidence, %	Severity, %
15	Stargus 2 qt	20.8	1.4
35	ApF23002 64 fl oz + Dyne-Amic 0.125% v/v	20.8	2.2
	Switch 14 oz Elevate 16 oz		
2	Switch 14 oz	23.2	2.4
	Pristine 23 oz		
	Elevate 16 oz		
5	Serenade 4 qts + Dyne-Amic 0.125% v/v	23.2	2.4
14	CX-10490 14 fl oz	23.2	4.1
18	Howler EVO 1.5 lb + Dyne-Amic 0.125% v/v	23.2	2.8
	Switch 62.5 WD 14 oz/A + Dyne-Amic 0.125% v/v		
	Howler EVO 1.25 lb + Dyne-Amic 0.125% v/v		
	Elevate 1 lb + Dyne-Amic 0.125% v/v		
32	ApF23002 64 fl oz + Kinetic 0.125% v/v	23.2	1.3
38	Evoca 3 lbs	23.2	3.5
	Pristine 23 oz		
	Elevate 16 oz		
48	Mevalone 55 fl oz	23.2	2.1
	Vanguard WG 10 oz		
	Elevate 50WDG 1 lb		
	Mevalone 55 fl oz + Syl-Coat 4 fl oz		



# 2023 Summer Bunch Rot Field Trials

Treatment <sup>x</sup>		Bunch rot on the clusters <sup>z</sup>	
TRT	Rate/Acre	Incidence, %	Severity, %
21	Fun-Thyme 0.5% v/v	24.0	2.7
39	Evoca 3 lbs	24.0	1.6
	Elevate 16 oz		
20	X7N68-R009 16 fl oz	24.8	5.7
22	B-Red 1% v/v	24.8	4.3
24	Cinnaction (OR-489-E) 50 fl. oz + Attitude (OR-278F) 32 fl oz	26.4	3.2
25	NSTKI-037 4 lb	27.2	4.1
33	ApF23002 64 fl oz + Kinetic 0.125% v/v	27.2	2.1
	Switch		
	Elevate		
34	ApF23002 64 fl oz + Kinetic 0.125% v/v	27.2	1.9
	ApF23002 64 fl oz + Dyne-Amic 0.125% v/v		
13	Milagrum Plus (OR-488) 60 fl. oz + Vintre (OR-009E)32 fl oz	28.0	2.0
36	Hydrogen peroxide 30% 12.8 fl oz/100 gal + Fitor 25.6 fl oz/100 gal + Phosful 12.8 fl oz/100 gal	28.0	5.9
47	ProBlad Verde 45 fl oz/a	28.0	2.8
17	Serenade ASO 4 qt + Dyne-Amic 0.125% v/v	28.8	2.8
	Switch 62.5 WD 14 oz + Dyne-Amic 0.125% v/v		
	Elevate 1 lb + Dyne-Amic 0.125% v/v		
43	Mevalone 55 fl oz	29.6	4.2
	Vanguard WG 10 oz		

# 2023 Summer Bunch Rot Field Trials

Treatment <sup>x</sup>		Bunch rot on the clusters <sup>z</sup>	
TRT	Rate/Acre	Incidence, %	Severity, %
43	Mevalone 55 fl oz	29.6	4.2
	Vangard WG 10 oz		
	Ph-D 6.2 oz + Syl-Coat 4 floz		
45	WE2097-1 0.5% V/V + Antero-EA 1pt	30.4	7.4
46	WE1891-1 2.5lb + WE2097-1 0.5% V/V + Antero-EA 1pt	30.4	7.6
49	SA-0650004 28 fl oz	30.4	3.1
	Vangard WG 10 oz		
	Elevate 50WDG 1 lb		
	Ph-D 6.2 oz + Syl-Coat4 fl oz		
12	Milagrum Plus (OR-488) 60 fl. oz + Oroboost (OR-097A) 32 fl oz	31.2	2.8
16	MBI-1P1 0.5 qt	32.0	4.2
	Mevalone 55 fl oz + Kinetic 0.125% v/v		
31	Switch 14 oz	32.0	5.1
	Elevate 16oz		
8	OSO 6.5 fl oz	32.8	4.1
11	Thymic (OR-491) 50 fl. oz + Attitude (OR-278F) at 32 fl oz	34.4	6.1
19	Howler EVO 1.25 lb + Rovral 1.5 lb + Dyne-Amic 0.125% v/v	34.4	3.1
	Switch 14 oz + Dyne-Amic 0.125% v/v		
	Elevate 1 lb + Dyne-Amic 0.125% v/v		
28	Luna Experience: 8.6 fl oz	34.4	5.4
	Pristine 23 oz		

# 2023 Summer Bunch Rot Field Trials

Treatment <sup>x</sup>		Bunch rot on the clusters <sup>z</sup>	
TRT	Rate/Acre	Incidence, %	Severity, %
28	Luna Experience: 8.6 fl oz	34.4	5.4
	Pristine 23 oz		
	Elevate 16 oz		
	Berezi 5 lb		
44	WE1891-1 2.5 lb + Infolium-EA 1pt	35.2	6.7
7	OSO 13 fl oz	36.0	2.5
10	Thymic (OR-491) 50 fl. oz + Oroboost (OR-097A) 32 fl oz	36.8	3.4
23	Thymic (OR-491-B) 50 fl. oz + Oroboost (OR-097A) 32 fl oz	36.8	4.1
1	Untreated control	38.4	7.8
3	NAI-9090 (BEC-60) 2 qt + Dyne-Amic 0.125% v/v	40.8	4.6
9	CX-10490 7 fl oz	41.6	5.1
26	NSTKI-037 6 lb	42.4	5.0

# Eskalen lab website

## Flag 18-YKC-2022- Powdery Mildew Trial

Jul 25 - 26, 2022 - Shared



## G. Results

### Trial I

**Table 1.** Disease incidence and severity of synthetic fungicides and combinations of soft chemistry and synthetic products. Product names are followed by rate (per acre). Treatment means followed by the same letter are not significantly different according to Fisher's LSD at  $\alpha=0.05$ ;

Pictures	Flag	Treatment Rate/A <sup>z</sup>	Application date (Julian day)	Powdery mildew on the cluster <sup>y</sup>	
				Incidence, %	Severity, %
18	YKC	Abound 15.5 fl oz + Syl-Coat 4 fl oz	105	0.0 a	0.00 a
		Prolivo 5 fl oz + Syl-Coat 4 fl oz	119		
		Kenja 22 fl oz + Rally 4 oz + Syl-Coat 4 fl oz	132		
		Quintec 4oz + Syl-Coat 4 fl oz	147		
		Torino 3.4 oz + Syl-Coat 4 fl oz	161		
		Merivon 4oz + Syl-Coat 4 fl oz	178		
		Vivando 15.4 oz + Syl-Coat 4 fl oz	193		
37	BC	PureSpray Green 1 gal	103, 110, 117	0.0 a	0.00 a
		Luna Experience 8.6 fl oz	124, 182		
		Pristine 23 oz	138		
		Elevate 16oz	152		
		Parade 3.1 fl oz	166		
41	Pu	Parade 3.1 fl oz + Dyne-Amic 0.25% v/v	108, 122, 136, 150, 165, 179, 194	0.0 a	0.00 a
62	Y+O	Aprovia Top 13.3 fl oz +Syl-Coat 0.125% v/v	122, 179	0.0 a	0.00 a
		Quintec 6.6 fl oz + Syl-Coat 0.125% v/v	136, 194		
		Miravis Prime 13.4 fl oz +Syl-Coat 0.125% v/v	165		
		Inspire Super 20.0 fl oz +Syl-Coat 0.125% v/v	150		
63	Y+W	Aprovia Top 13.3 fl oz + A9180B 0.5 oz +Syl-Coat 0.125% v/v	122, 179	0.0 a	0.00 a
		Quintec 6.6 fl oz + A9180B 0.5 oz + Syl-Coat 0.125% v/v	136, 194		



# Grapevine Trunk Diseases

- Young Vine Decline
- Esca
- Eutypa Dieback
- Bot Canker
- Phomopsis Dieback

## Vascular diseases

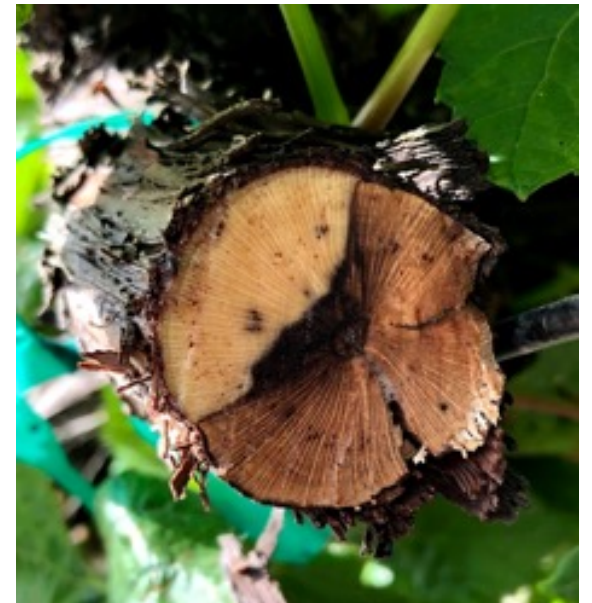


# Grapevine Trunk Diseases

- Young Vine Decline
- Esca
- Eutypa Dieback
- Bot Canker
- Phomopsis Dieback

Vascular diseases

**Canker diseases**





# Recent findings on other canker diseases



*Aspergillus* spp.



# Sour rot complex

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*Aspergillus tubingensis*

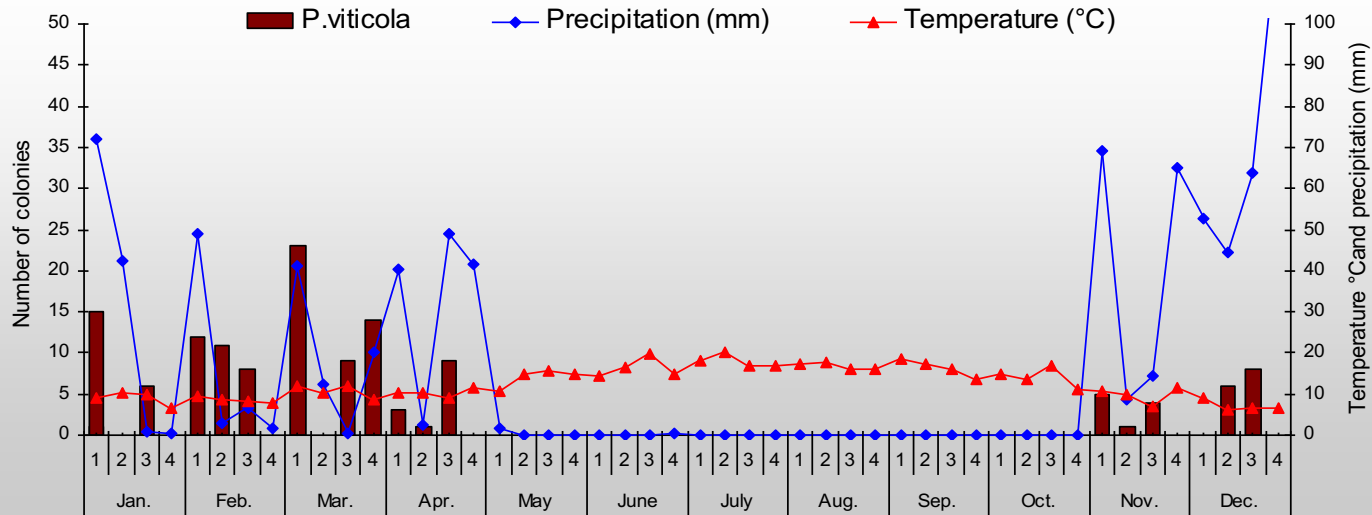
*Aspegillus niger*

*Aspegillus carbonarius*



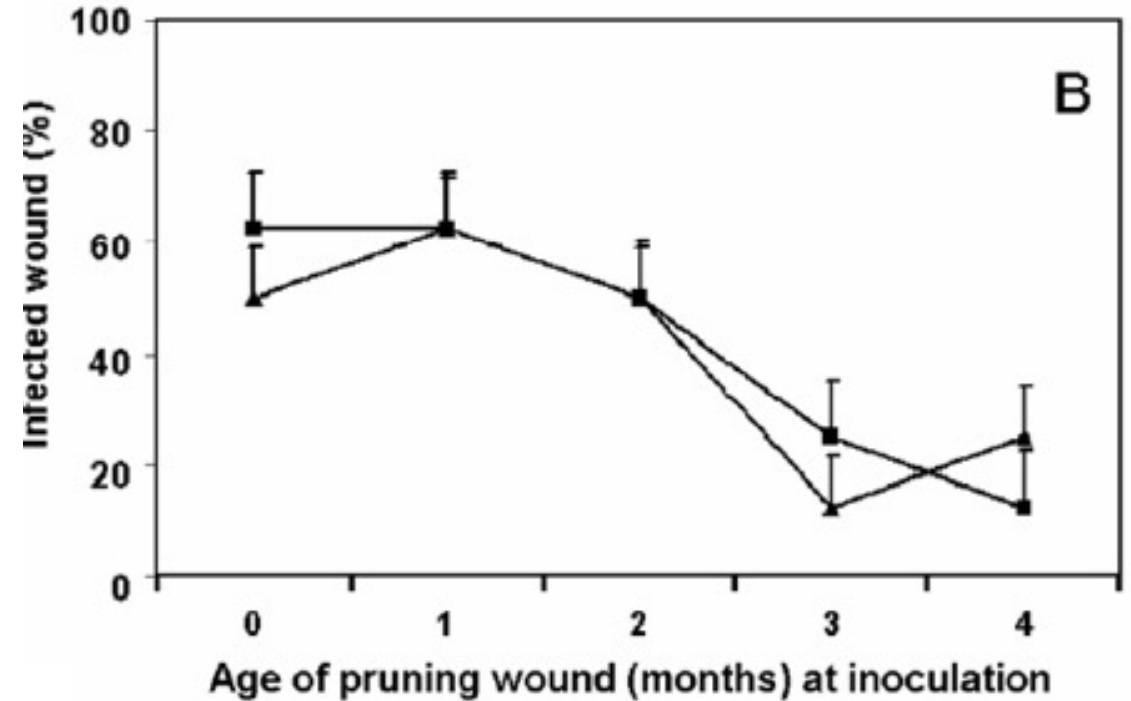
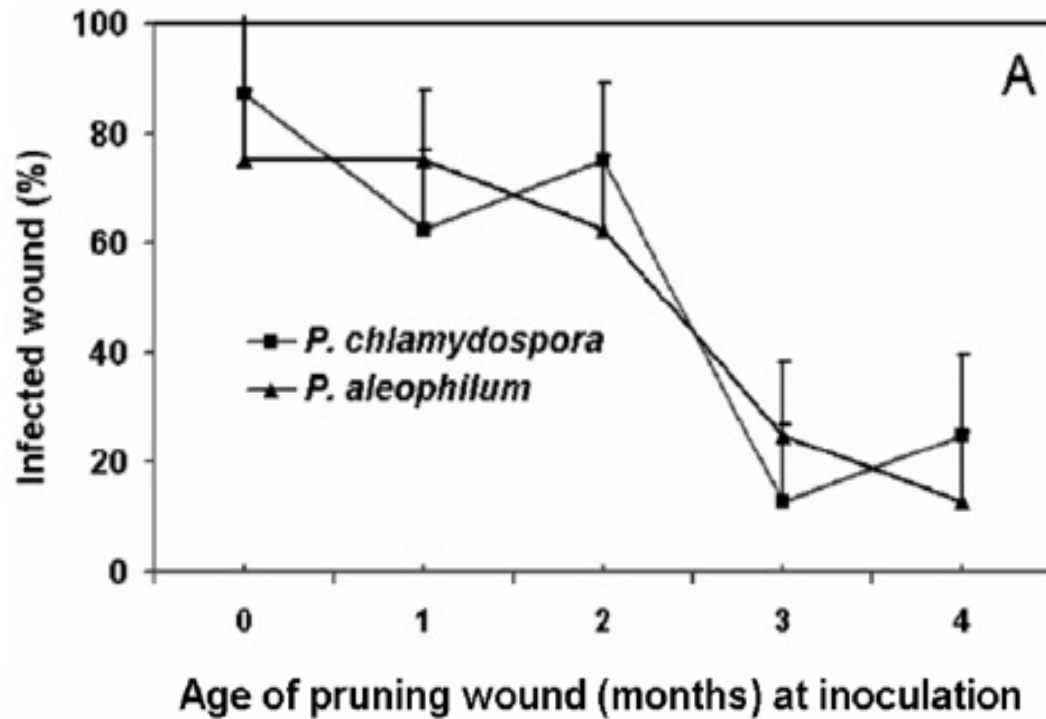
# Spore dispersal pattern of GTD pathogens

SONOMA 2003





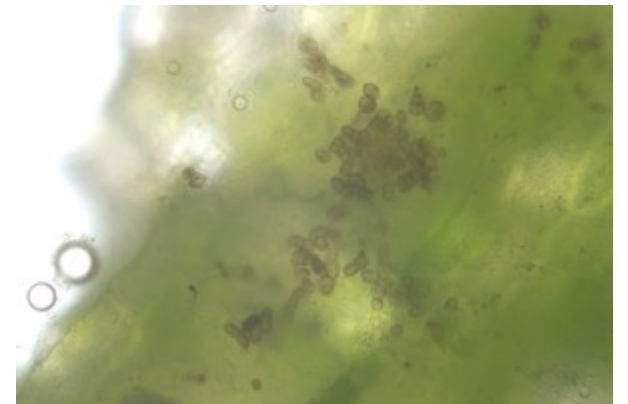
# Pruning wound susceptibility for Esca Pathogens



# How do they infect their hosts?

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- **Pruning wounds**
- **Latent and Endophyte**



# Infection of GTD on different parts of the vine



**Spurs**



**Cordon**



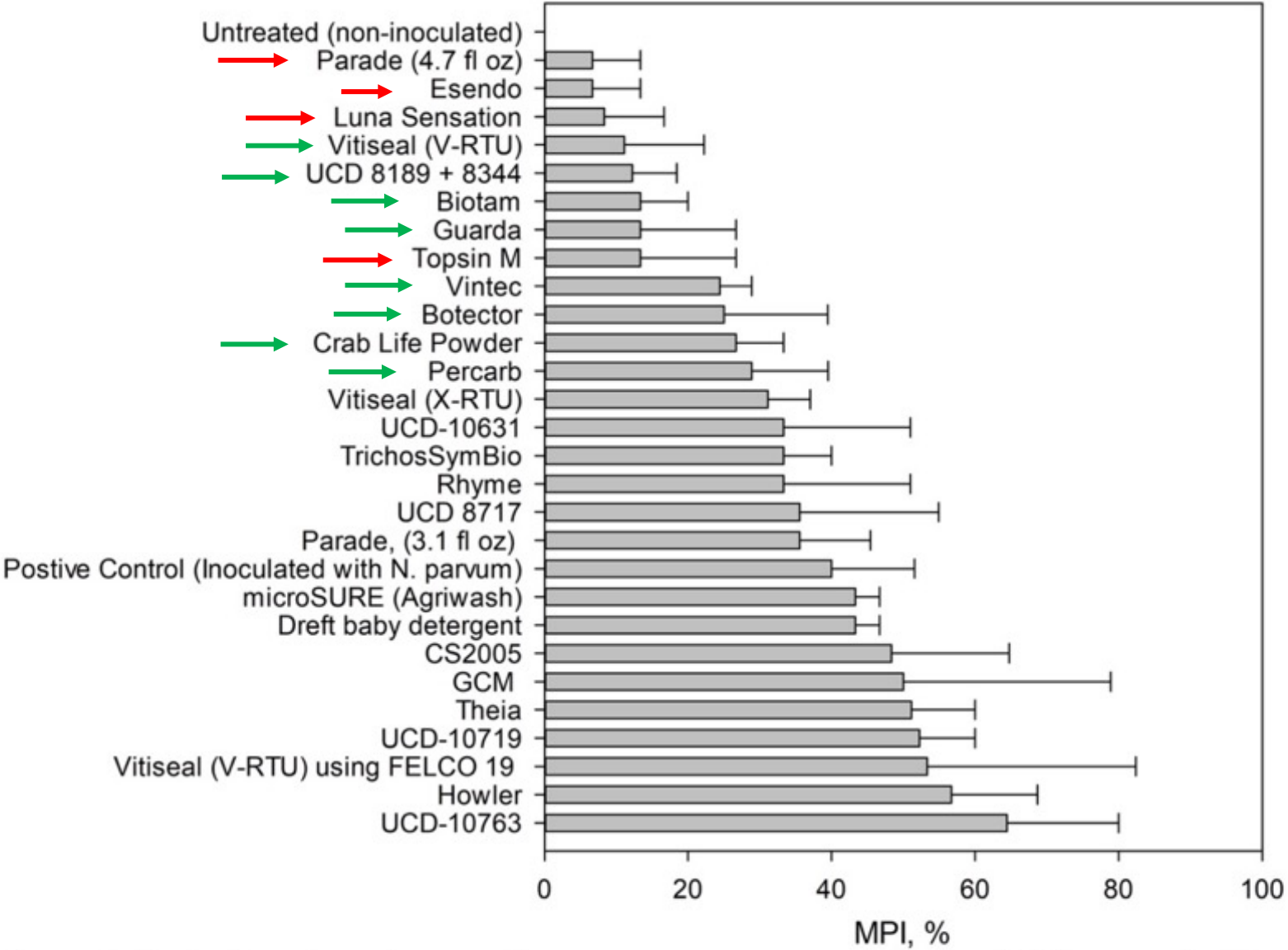
**Trunk**



**Rootstock**



# Results of pruning wound protection trial for *Neofusicoccum parvum* in 2022



**Figure 2.** Evaluation of pruning wound treatments mean percent infection (MPI) rates with *N. parvum* located at UC Davis Plant Pathology Field Station, 2022. Bars = standard errors.



# Protecting pruning wound is essential

	Commercial name	Active ingredient	Manufacturer
<b>Biocontrol</b>	Biotam (Frac BM2)	<i>Trichoderma asperellum</i> + <i>T. gamsii</i>	SepRo
	Vintec (Frac BM2)	<i>Trichoderma atroviride</i> SC1	BI-PA
	Botector (Frac BM2)	<i>Aerobasidium pullulans</i>	Westbridge
	GCM	<i>Bacillus velezensis</i> CE100	BSR
<b>Plant extract</b>	Guarda	Thyme oil	Biosafe System
<b>Synthetic fungicides</b>	Topsin-M (FRAC1)	Triophanate-methyl	United Phosphorous
	Luna sensation (FRAC-7)	Fluopyram/Trifloxystrobin	Bayer CropScience
	Esendo (FRAC 11)	Azoxystrobin + Pseudomonas chlororapsis	Agbiome
	Rhyme (FRAC 3)	Flutriafol	FMC
	Parade	Pyraziflumid	Nichino America
<b>Sealant</b>	Vitiseal	Acrylic Co-Polymer	Vitiseal International
<b>Disinfectant</b>	PerCarb	Sodium carbonate peroxyhydrate (85%)	Biosafe Systems



# Identification of Branch Dieback Disease Fungi and Detection of Fungicide Resistance in Populations of *V. pirina* in Pear Orchards

Celeste Gonzalez<sup>1</sup>, Karina Elfar<sup>1</sup>, Clebson Gonçalves<sup>2</sup>, Akif Eskalen<sup>1</sup>

<sup>1</sup>Department of Plant Pathology, UC Davis

<sup>2</sup>UCCE Lake County



# Pear branch dieback and wood canker

Observed branch canker diseases associated with pruning wounds in pear orchards





# Pear branch dieback and wood canker



## First Report of *Diplodia seriata* Causing Pear Branch Canker Dieback in California

R A Choudhury <sup>1</sup>, P Modi <sup>1</sup>, J Hanstad <sup>1</sup>, R Elkins <sup>2</sup>, W D Gubler <sup>1</sup>

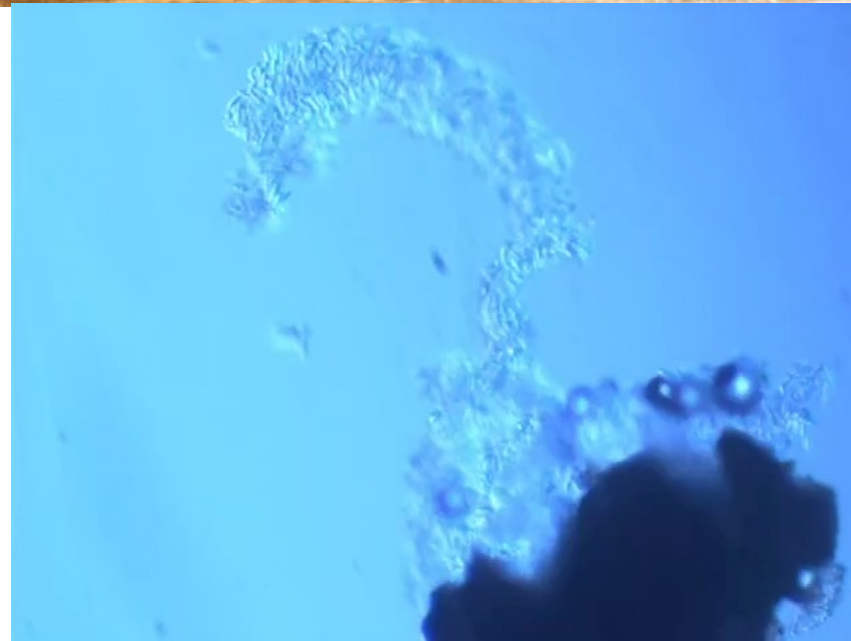
Affiliations + expand

PMID: 30708534 DOI: [10.1094/PDIS-07-13-0715-PDN](https://doi.org/10.1094/PDIS-07-13-0715-PDN)

 Sign in

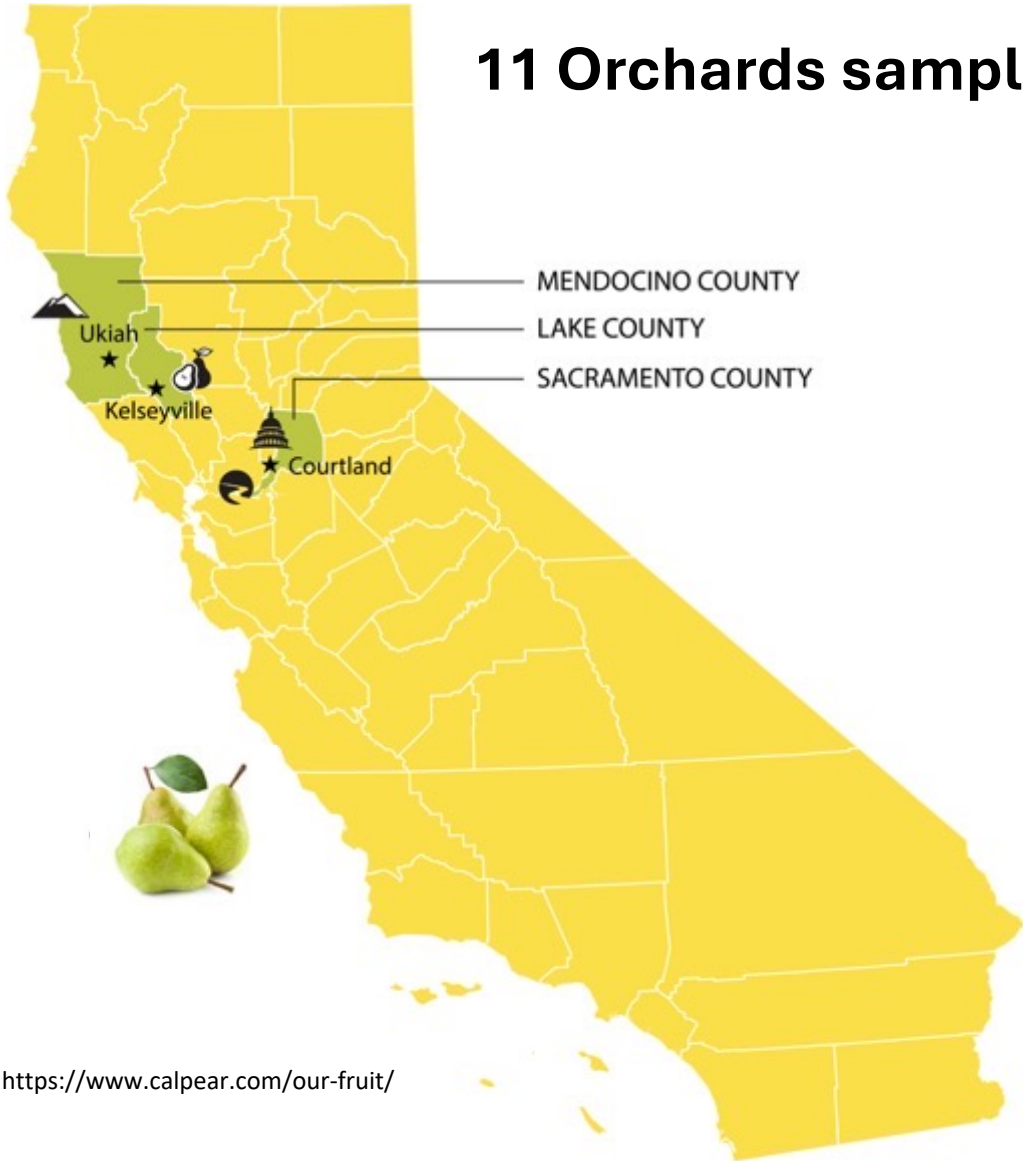


# Fungal Fruiting Body-Pycnidia of Botryosphaeria

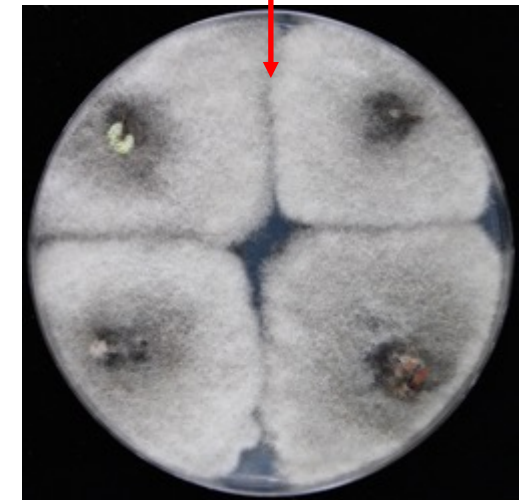
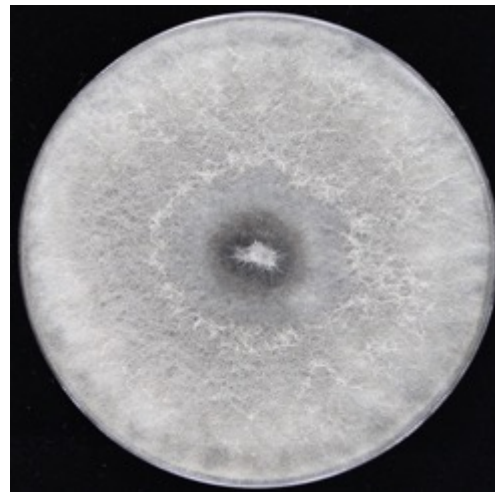
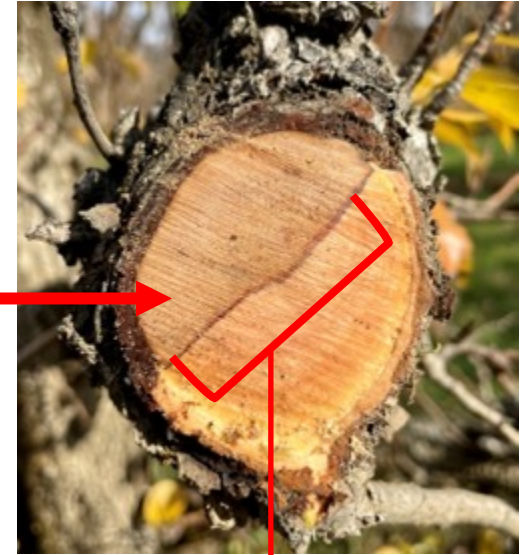


# Progress:

11 Orchards sampled

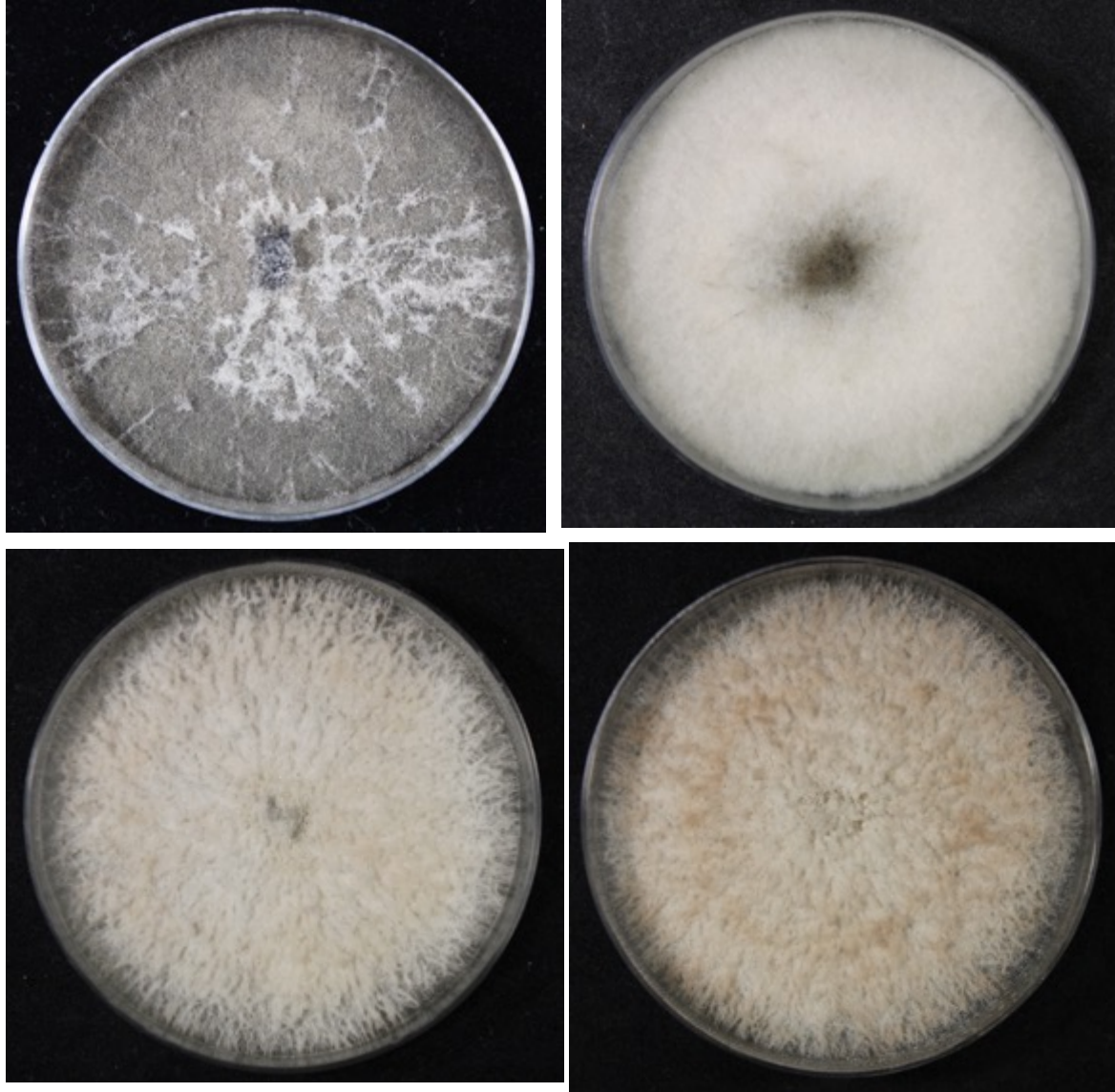


<https://www.calpear.com/our-fruit/>

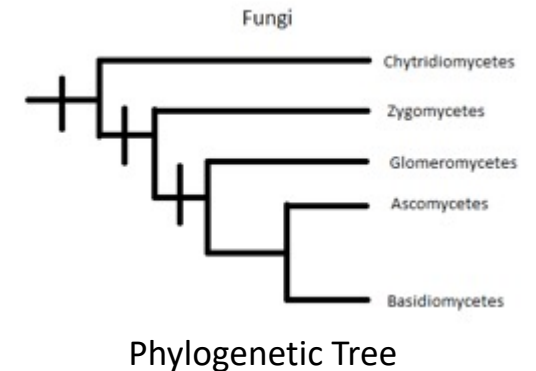




# OBJECTIVE 1. Preliminary Results



- *Botryosphaeria* spp.
- *Diaporthe* spp.
- *Eutypa lata*
- *Kalmusia* sp.
- *Pezicula* sp.
- *Stereum hirsutum*
- *Coprinellus micaceus*



# Acknowledgments



- Various donors
- Industry representatives

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<https://ucanr.edu/sites/eskalenlab/>

