Grapevine Trunk Diseases and Management Strategies

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Southern San Joaquin Valley Grape Symposium

Feb 8, 2024

Current project on grapevine

1. *In vitro* fungicide screening via spiral plater
2. Field fungicide trials to manage PM and Gray Mold
3. Grapevine Trunk Diseases

   -Dormant pruning wound protection

   -Biocontrol of GTD

   -Nursery practices for clean plant material

   -Aspergillus vine canker

   -Biocontrol of Pierce's diseases

Grapevine Trunk Diseases

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

Vascular diseases



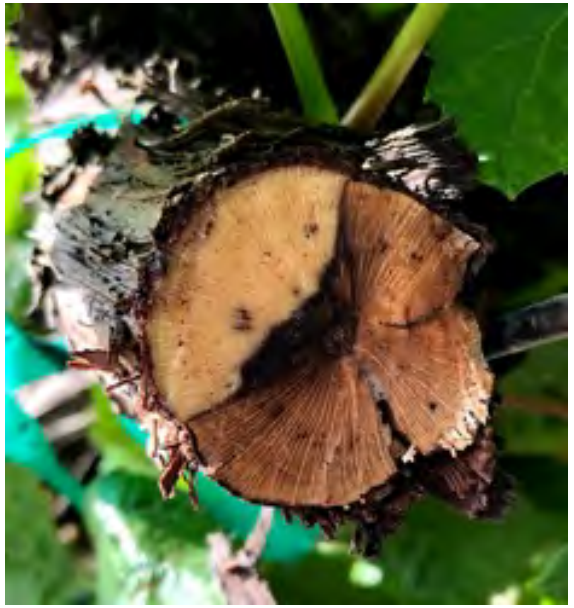

Grapevine Trunk Diseases

- Young Vine Decline
- Esca

Vascular diseases

- Eutypa Dieback
- Bot Canker
- Phomopsis Dieback

Canker diseases



Grapevine Trunk Diseases

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

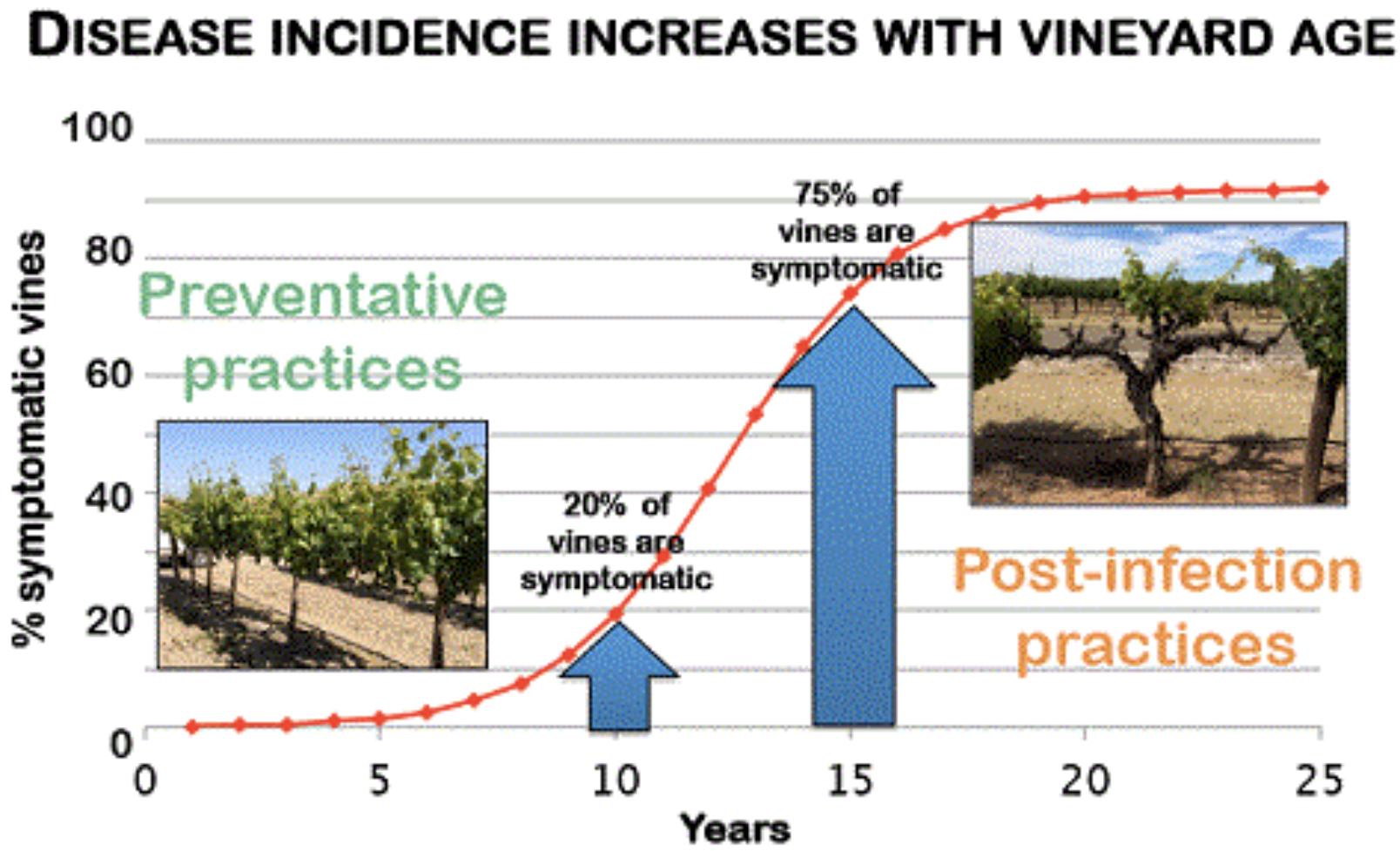
Vascular and Rot diseases

Canker diseases

Rot diseases




Economical Impact



From Duthie et al. 1991 (Colombard vineyards ranging from 5 to 34 years)

Asexual Fruiting body-Pycnidia

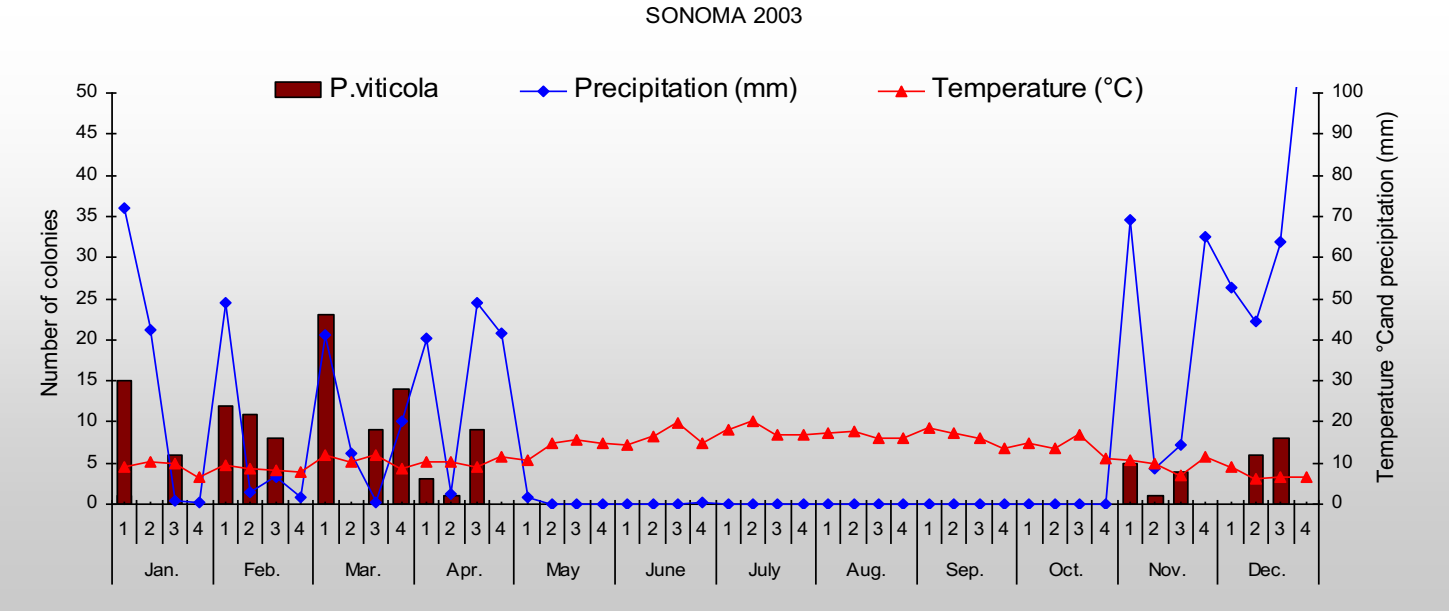
Source of inoculum

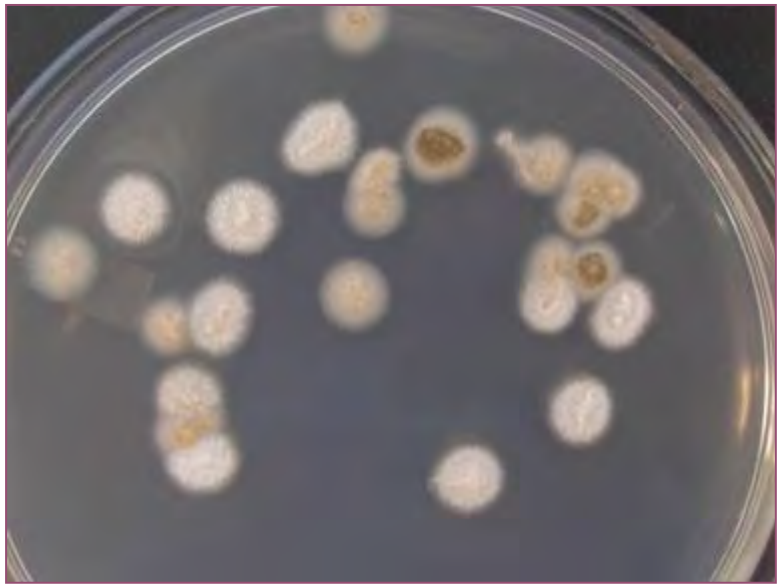
Sexual Fruiting body-Perithecia

Spore Release from Perithecia of Botryosphaeria

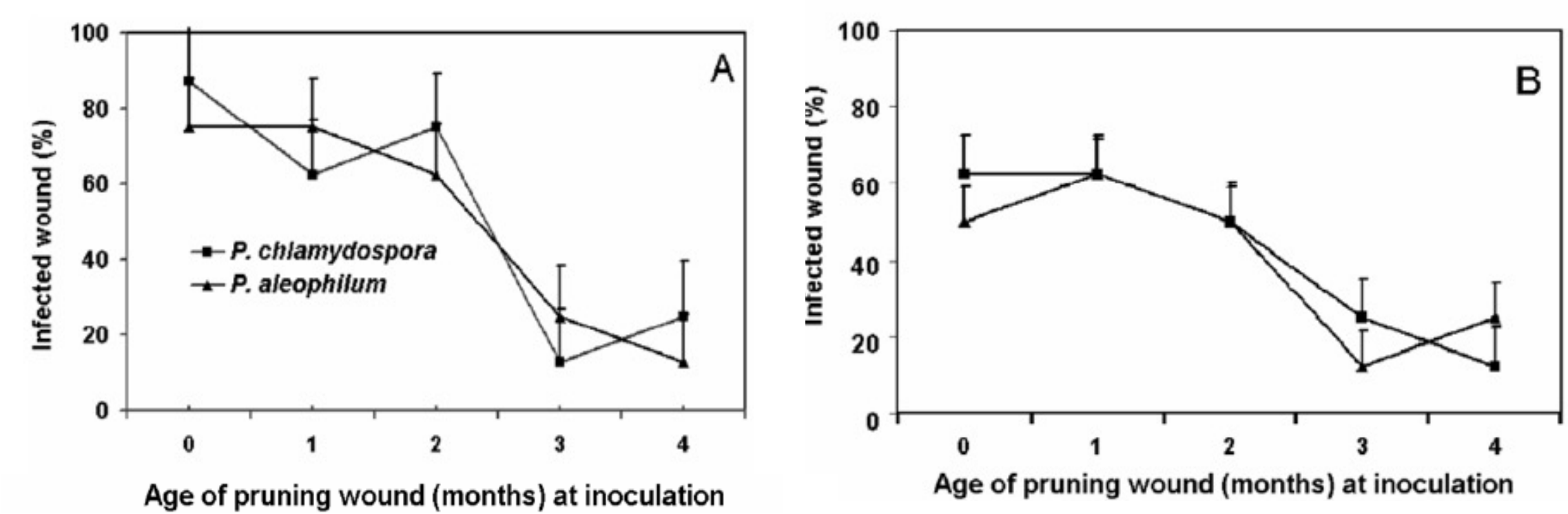
APS

Spore dispersal pattern of GTD pathogens





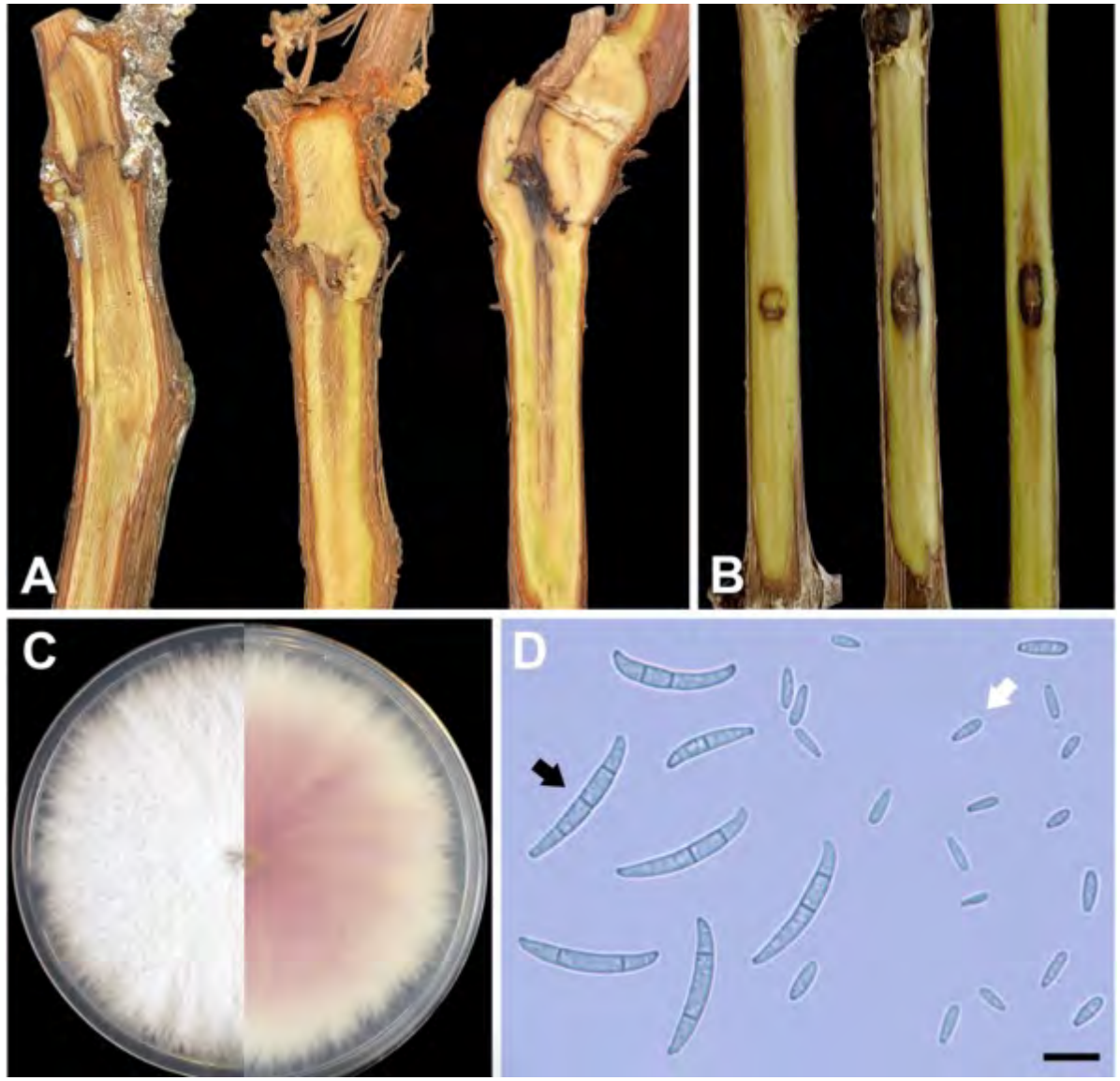
Pruning wound susceptibility for Esca Pathogens



Eskalen et al. Plant Disease, 2007, 91:9, 1100-1104.

Macrophomina Charcoal Rot *(Macrophomina phaseolina)*

Fusarium annulatum



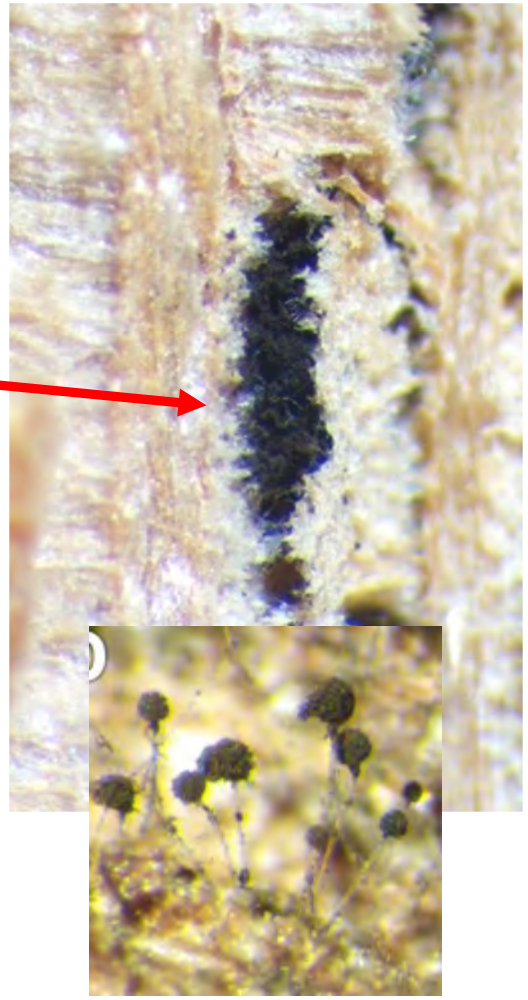
Graft Union

Bustamante et al. 2022 First Report of *Fusarium annulatum* Associated with Young Vine Decline in California. Plant Disease.

Unusual fall symptoms on virus free grapevines

Grenache cv./ Freedom

External Symptoms

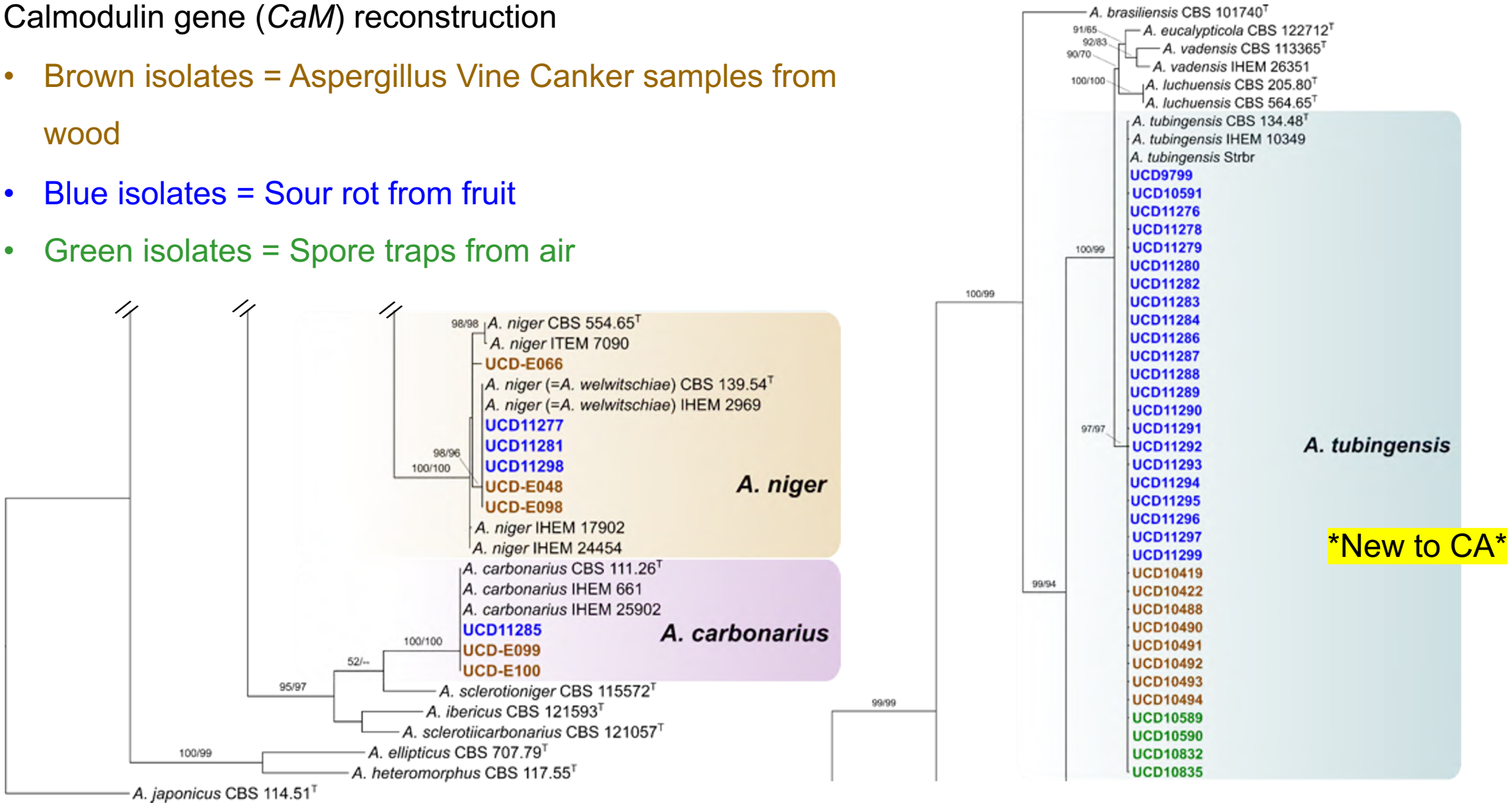


Internal symptoms:

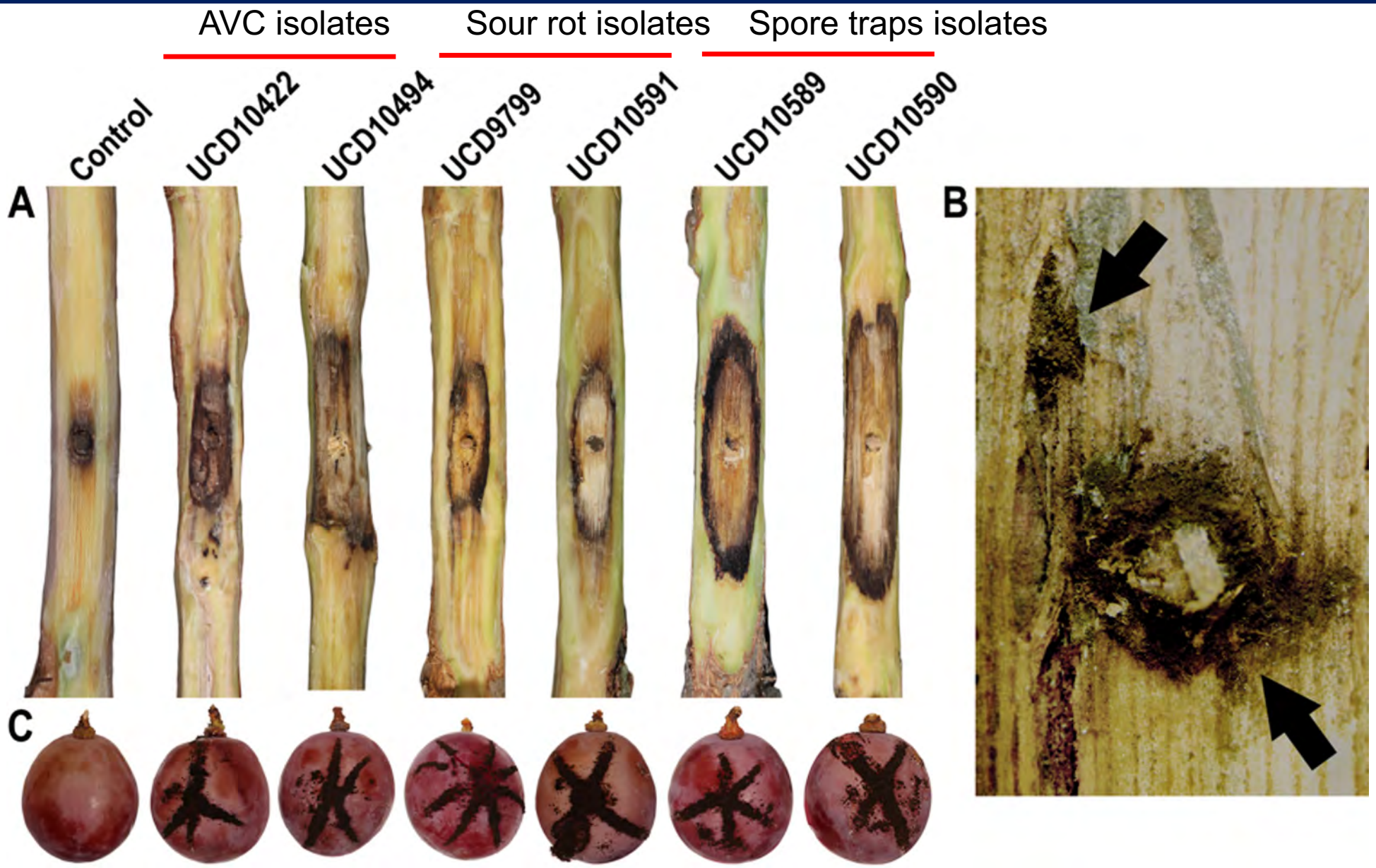
Identification of *Aspergillus* spp.

Calmodulin gene (*CaM*) reconstruction

- Brown isolates = Aspergillus Vine Canker samples from wood
- Blue isolates = Sour rot from fruit
- Green isolates = Spore traps from air



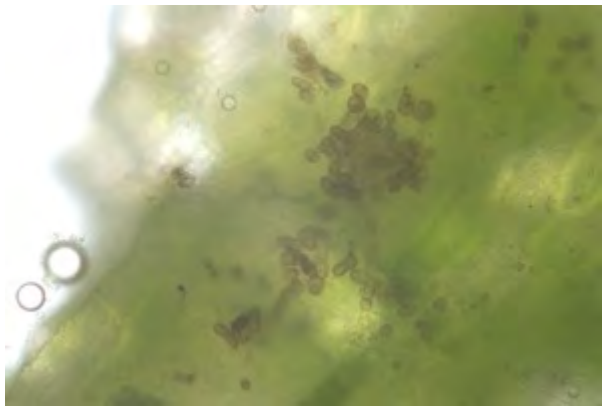
Pathogenicity of *Aspergillus tubingensis*



How do they infect their hosts?

- Pruning wounds

- Latent and Endophyte



Infection of GTD on different parts of the vine

Spurs

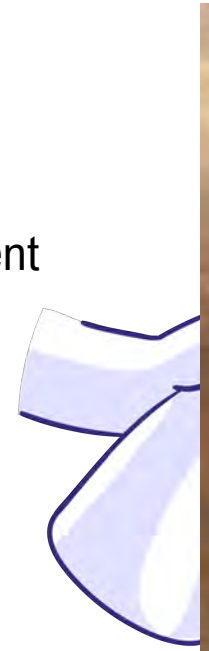
Cordon

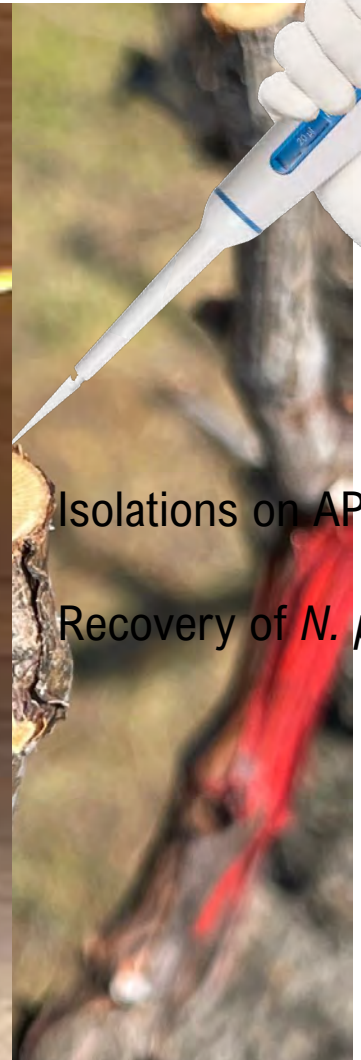
Trunk

Rootstock

Field pruning wound protection trials

1) Treatment





Isolations on APDA

Recovery of *N. parvum* (%)

2) Inoculation
N. parvum
(2,000 conidia)

3) Evaluation of infection

Product name	Active Ingredient	Manufacturer	MPI, %[z]	
Untreated (non-inoculated)	-	-	0.0	f
Esendo, 2.8 lbs	pre-mix of Howler and azoxystrobin	AgBiome Innovations	6.7	ef
Parade, 4.7 fl oz	pyraziflumid	Nichino America	6.7	ef
Luna Sensation, 7.6 oz	fluopyram (17.54%), tebuconazole (17.54%)	Bayer CropScience	8.3	ef
1 L Vitiseal ready-to-use (V-RTU). This is NOT to be diluted.	Acrylic Co-Polymer	VitiSeal International LLC	11.1	ef
UCD 8189 + 8344, $1x10^5$ cfu/ml	*Aureobasidium pullulans-8189+8344*	N/A	12.2	def
Topsin M 1.25 lbs	Triophanate-methyl	United Phosphorus Inc.	13.3	cdef
Guarda, 2.56 fl oz/ga	thyme oil	BioSafe Systems, LLC	13.3	cdef
Biotam, 2 lbs	*Trichoderma asperellum* (ICC 012) + *Trichoderma gamsii* (ICC 080)	Isagro USA	13.3	cdef
Vintec, 2.8 oz	*Trichoderma atroviride* strain SC1	Bi-PA	24.4	bcdef
Botector, 8 oz	*Aureobasidium pullulans* strain DSM14940/14941 1	Westbridge Agricultural Products	25.0	bcdef
Crab Life Powder, 0.5 lbs	Chitin	Conchazul de Mexico	26.7	bcdef
PerCarb, 4 lbs	sodium carbonate peroxyhydrate (85%)	BioSafe Systems, LLC	28.9	abcdef
2 X 0.5 L experimental new Vitiseal formulation, ready-to-use (X-RTU). This is NOT to be diluted.	Acrylic Co-Polymer	VitiSeal International LLC	31.1	abcdef
Rhyme, 5 fl oz (applied as pruning wound spray)	Flutriafol (22.7 %)	FMC	33.3	abcdef
TrichosSymBio, 25.6 fl oz	*Trichoderma harzianum* T78 (of 5 x 10^{11} cfu)	Symborg	33.3	abcdef

Treatments of pruning wound protection trial in 2022

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

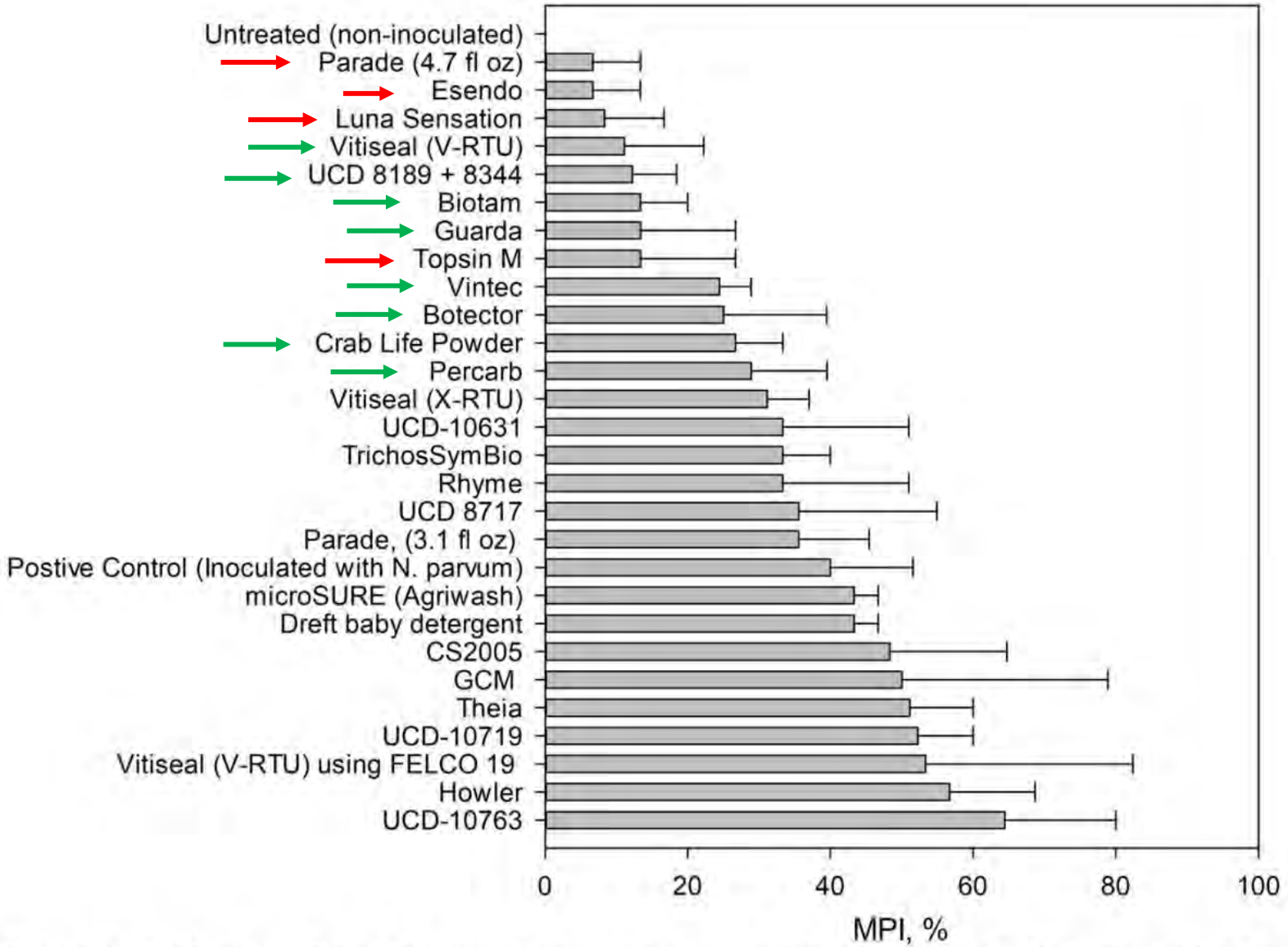
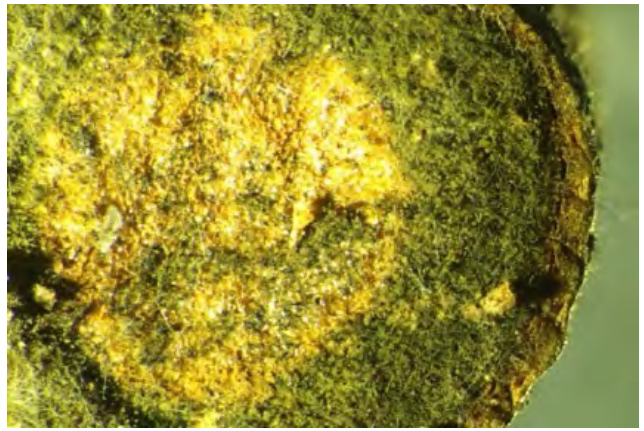


Figure 2. Evaluation of pruning wound treatments mean percent infection (MPI) rates with *N. parvum* located at UC Davis Plant Pathology Field Station, 2022. Bars = standard errors.

https://ucanr.edu/sites/eskalenlab/files/378928.pdf

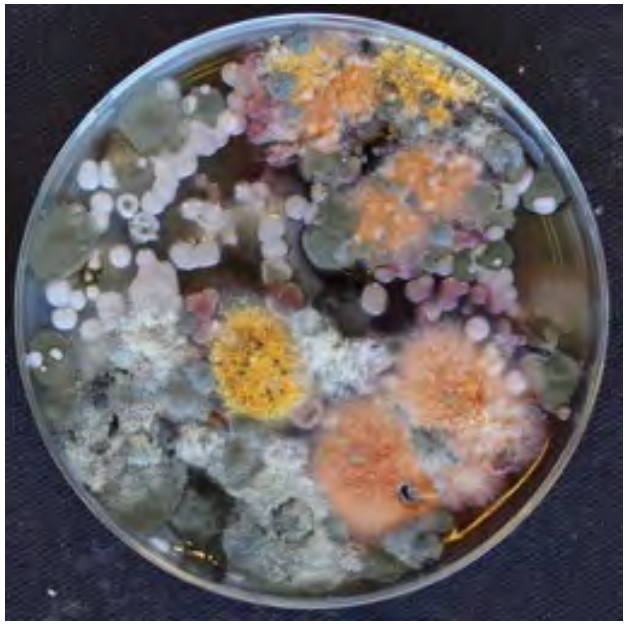
Recovery of biological treatments from inoculated canes

Treatment	Recovery %			
	Sacramento County		Kern County	
	E. lata	*N. parvum*	*E. lata*	*N. parvum*
Bacillus velezensis	0	25	25	5
Bacillus subtilis strain QST 713	0	5	0	0
Bacillus sp.	0	5	10	0
Trichoderma hamatum	0	20	20	15
Trichoderma asperellum and *Trichoderma gamsii* + a blend of crab and lonbster shell powder	35	10	30	30
Trichoderma asperellum and *Trichoderma gamsii*	60	45	20	30
Aureobasidum pullulans strain DSM14940/14941	65	100	25	30
Trichoderma atroviride	70	100	45	80
Aureobasidum pullulans	100	100	25	60



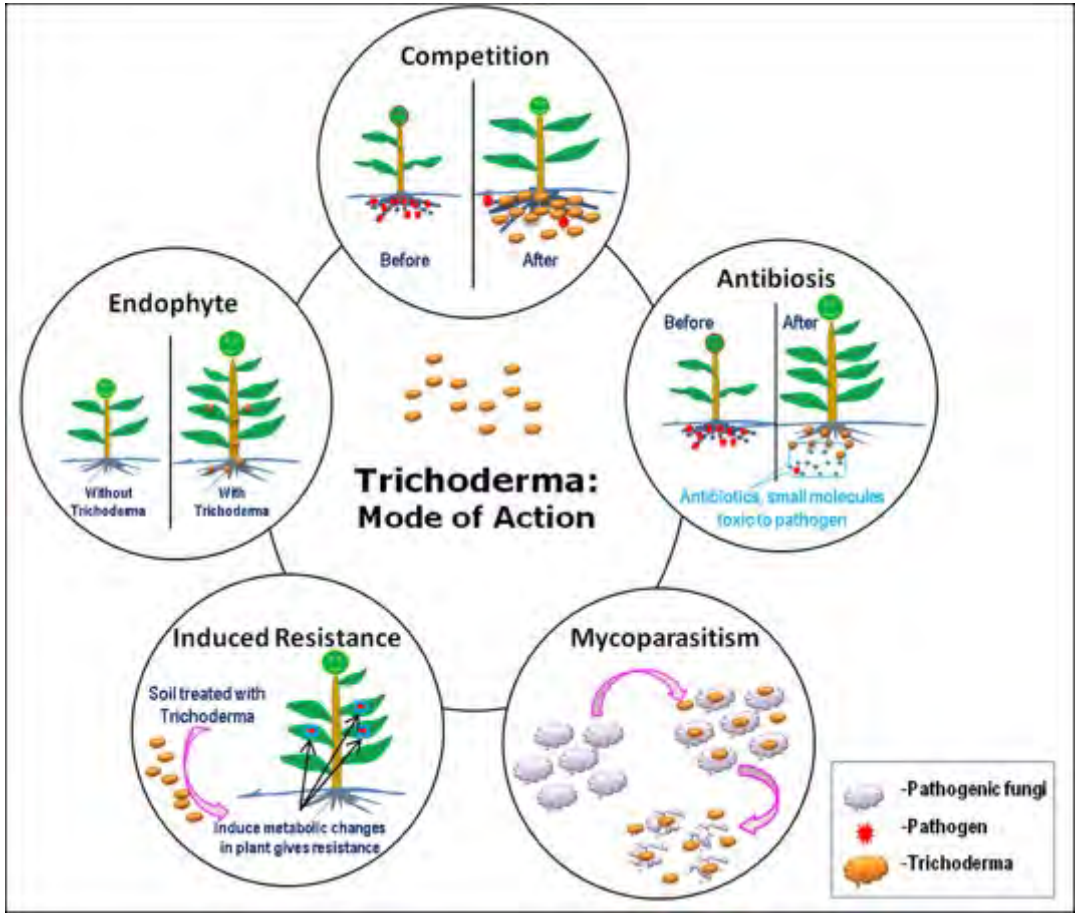
https://ucanr.edu/sites/eskalenlab/

Identification of Naturally Occurring Biological Control Agents in California Vineyards



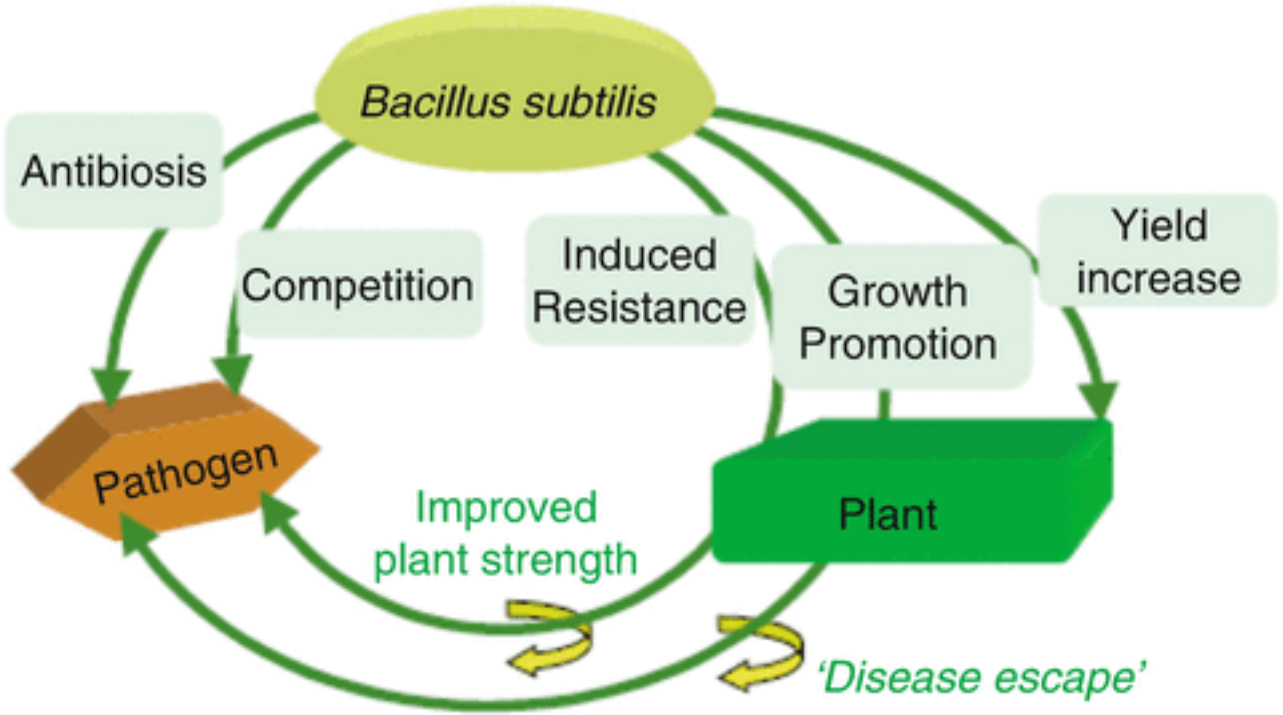
Mode of Action of Biologicals

Trichoderma spp.



[Rahul Mahadev Shelake, 2016]

Bacillus subtilis



Bohne and Helmut Junge, 2017

Preventative Management in Vineyards

- Protect pruning wounds
- Use disease free, clean plant materials when establish new vineyards
- Apply good cultural practices to minimize stress on young and mature vines
- Delay dormant pruning to avoid potential pathogen dissemination during winter precipitation and to reduce the susceptibility
- If applicable, consider doing double pruning to reduce fungal spore infection during winter moths

Double Pruning

- Pre pruning about 1-foot-long dormant season (December-February)
- Second prune is late pruning before budbreak

Summary

	Commercial name	Active ingredient	Manufacturer
Biocontrol	Biotam (Frac BM2)	(*Trichoderma asperellum* + *T. gamsii*	SepRo
	Vintec (Frac BM2)	*Trichoderma atroviride* SC1	BI-PA
	Botector (Frac BM2)	*Aerobasidium pullulans*	Westbridge
	GCM	*Bacillus velezensis CE100*	BSR
Plant extract	Guarda	Thyme oil	Biosafe System
Synthetic fungicides	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
Sealant	Vitiseal	Acrylic Co-Polymer	Vitiseal International
Disinfectant	PerCarb	Sodium carbonate peroxyhydrate (85%)	Biosafe Systems

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

Acknowledgements

Eskalen Lab Team – Department of Plant Pathology UC Davis

Cooperators and UCCE Farm Advisors
Mark Battany – UCCE San Luis Obispo, Santa Barbara
Larry Bettiga – UCCE Monterey
Monica Cooper – UCCE Napa
Carmen Gispert – UCCE Riverside
Glenn McGourty – UCCE Mendocino
Rhonda Smith – UCCE Sonoma
Gabriel Torres – UCCE Tulare
Jose Ramon Úrbez-Torres – Agriculture and Agri-Food Canada
Lynn Wunderlich – UCCE Central Sierra
George Zhuang – UCCE Fresno

Funding:

AMERICAN VINEYARD FOUNDATION

CALIFORNIA GRAPE ROOTSTOCK COMMISSION

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