

Wine Island Grape Growers: 12 March 2011

Grapevine Powdery Mildew: Biology and Control in Cool Climates

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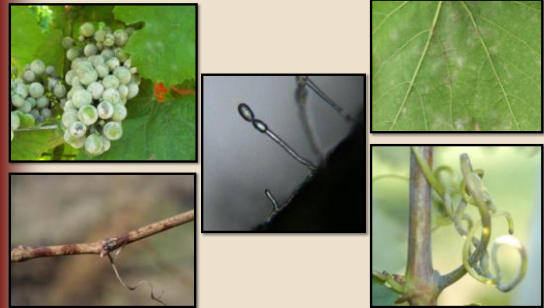
OVERVIEW

- Biology and history
- Implications in viticulture and enology
- Controlling outbreaks in cool, wet climates
 - What is disease management?
 - Cultural
 - Chemical
 - Decision support systems

HISTORY

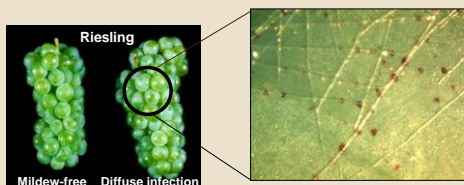
- Origin: Eastern USA (1836)
- European debut (England, 1845)
- Indirectly lead to phylloxera introduction
- Sulfur control (1854)
- Steady cycle of fungicide and resistance development since 1960's
- Worldwide disease distribution

NO TISSUE LEFT BEHIND...

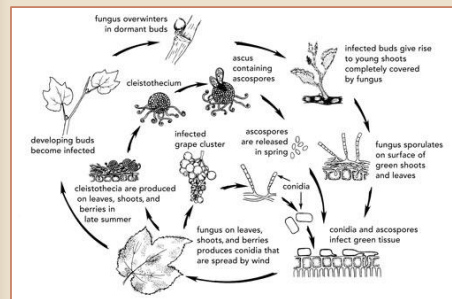


EFFECTS ON WINE

- Diffuse (light) infections can produce off flavors in wine



BIOLOGY




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BIOLOGY-OVERWINTERING

- Overwinters as cleistothecia/chasmothecia
 - Confirmed in 1980's
 - Sexual stage of fungus
 - Overwinters in bark crevices
 - Deposited there from fall rains

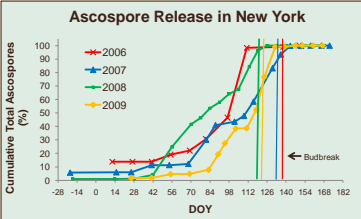


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BIOLOGY-OVERWINTERING

- Ascospores are released earlier than previously thought

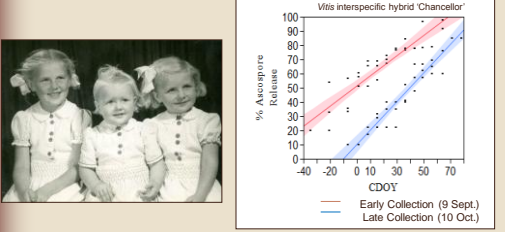


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BIOLOGY-OVERWINTERING

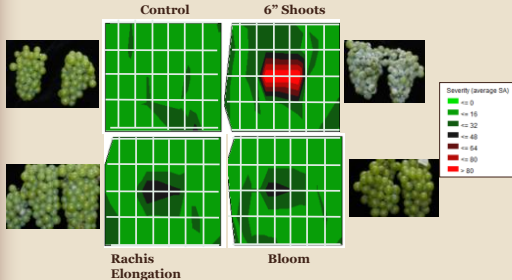
- Cohort Effect: Fall influences Spring



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BIOLOGY-OVERWINTERING



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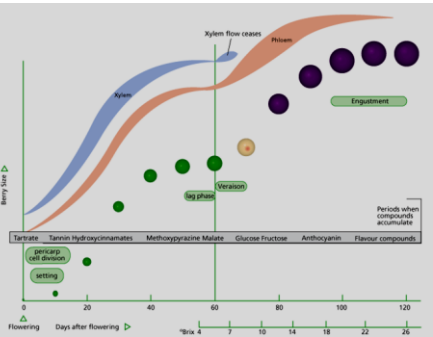
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BIOLOGY-SEASON DEVELOPMENT

- Ontogenic Resistance
 - Age-related resistance in grape tissues
 - Seen in powdery, downy, and black rot to various degrees

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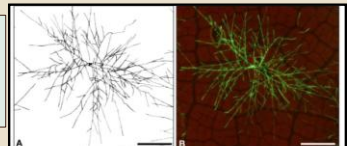
BIOLOGY-SEASON DEVELOPMENT (EARLY)

- Ontogenic Resistance
 - Age-related resistance in grape tissues
 - Seen in powdery, downy, and black rot to various degrees
- Influence of early-season cold temperatures
 - Induced resistance
 - Damaging to existing colonies

BIOLOGY- COLD KILLS

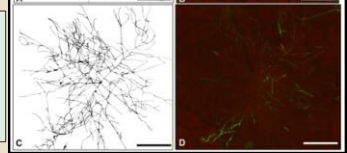
Four-day-old colony grown at 25° C::

- A) Line Sketch of colony footprint, and
- B) Same colony visualized with a vital stain



Four-day-old colony exposed to 2° C for 8h at 3dpi::

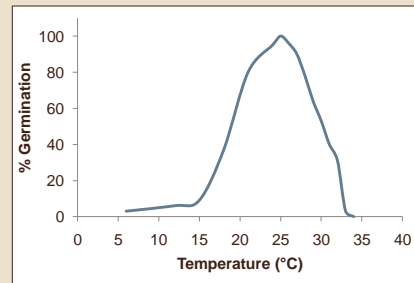
- C) Line Sketch of colony footprint, and
- D) Same colony visualized with a vital stain



BIOLOGY-SEASON DEVELOPMENT (MID)

- Influence of early-season cold temperatures
 - Induced resistance
 - Damaging to existing colonies
- Influence of mid-season temperatures and solar radiation
 - Temperature response well defined since 1950's

BIOLOGY-NORMAL TEMPERATURE RESPONSE



BIOLOGY-SEASON DEVELOPMENT (MID-LATE)

- Influence of early-season cold temperatures
 - Induced resistance
 - Damaging to existing colonies
- Influence of mid-season temperatures and solar radiation
 - Temperature response well defined since 1950's
 - Solar radiation and leaf surface temperature

BIOLOGY-SOLAR RADIATION


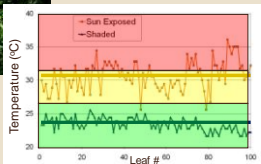


Photos courtesy of : Dr. Craig N. Austin, postdoctoral research associate, Cornell University

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BIOLOGY- SOLAR RADIATION AND "HEAT"

Photos and data courtesy of: Dr. Craig N. Austin

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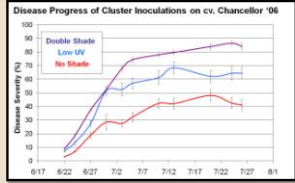
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BIOLOGY- SOLAR RADIATION AND "HEAT"

Heat, no UV

No heat, no UV

UV Radiation

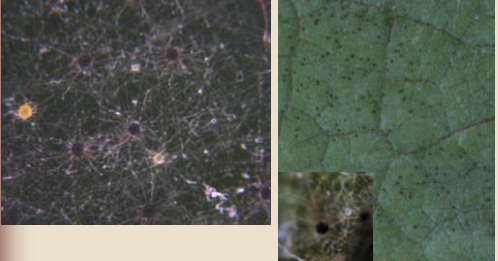


Photos and data courtesy of: Dr. Craig N. Austin.

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BIOLOGY-SEASONAL DEVELOPMENT (LATE)



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BIOLOGY- YEAR TO YEAR INFLUENCES

End of Last Season		Current Season				
Veraison	Harvest	Leaf Fall	Budbreak	Bloom	Veraison	Harvest
		↓	↓		↓	
		Build up of Inoculum (for next year)	Initial infections		Continuous repeat of infections	


Last year affects this year, which affects next year.

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Disease Management


Powdery Mildew



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DISEASE MANAGEMENT



"Chemical industry and plant breeders forge fine tactical weapons; but only epidemiology sets the strategy."

- van der Plank

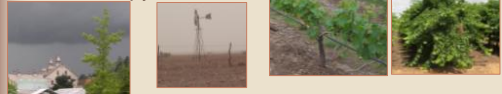
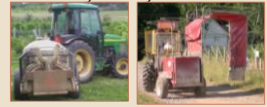
What does *MANAGEMENT* mean?

DISEASE MANAGEMENT- CULTURAL PRACTICES

- Canopy manipulation can help!
- Reduce humidity, increase solar radiation
- Ways to do this:
 - Managing canopy vigor
 - Shoot thinning
 - Leaf pulling
- Drip vs. mist vs. overhead irrigation

DISEASE MANAGEMENT- SPRAY COVERAGE

- Spray coverage influenced by many factors:
 - Nozzle size
 - Equipment used
 - Timing
 - Concentration (**NOT SAME AS RATE**)
 - Environmental conditions
 - Canopy size

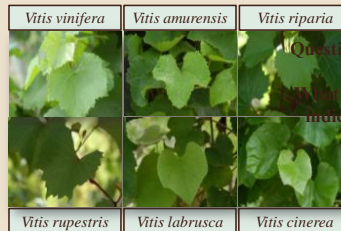


DISEASE MANAGEMENT- FUNGICIDE CHOICES

Class	Trade Name	Common Name	Resist. Risk	MOA	Type
DMI (triazole)	Rally	Myclobutanil	High	Membrane disrupter	postinfect/antisp.
DMI (triazole)	Elite or Folcur	Tebuconazole	High	Membrane disrupter	postinfect/antisp.
DMI (imidazole)	Procure	Triflumizole	High	Membrane disrupter	postinfect/antisp.
DMI (pyrimidine)	Rubigan	Fenarimol	High	Membrane disrupter	postinfect/antisp.
Strobilurin	Abound	Azoxystrobin	High	Qol	protectant
Strobilurin	Flint	Trifloxystrobin	High	Qol	protectant
Strobilurin/ carboxin	Pristine	Pyraclostrobin/ boscalid	High	Qol	protectant/antisp.
Strobilurin	Sovran	Kresoxim-methyl	High	Qol	protectant
Quinoline	Quintec	Quinoxifen	Low-Mod.	Disrupt appressorium	protectant
Petroleum oils	JMS Stylet Oil	Narrow range petroleum oil	Low	Broad" suffocation"	postinfect/ eradicant
Sulfur	Microthiol	Flowable sulfur	Low	Broad	protectant/ eradicant
Carbonates	Armicarb or Kalkgreen	Potassium bicarbonate	Low	Broad	postinfect/antisp.
Biologicals	Serenade Sonata	Bacillus subtilis Bacillus pumilis	Low ? Low ?	??	??

DISEASE MANAGEMENT- SUSCEPTIBILITY

- Susceptibility is species and variety dependent (**USE CAUTION**)



Question:
How does the value of indicator plants?

DISEASE MANAGEMENT- SUSCEPTIBILITY

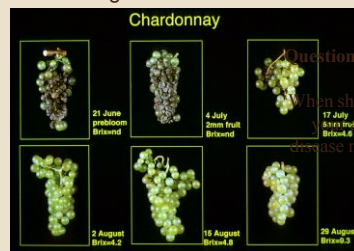
- Young tissue is susceptible, old tissue isn't (ontogenic resistance)



Question:
How does indeterminate growth influence this?

DISEASE MANAGEMENT-SUSCEPTIBILITY

- Clusters, in vinifera, are highly susceptible from emergence to fruit set



Question:
When should you focus attention for management of fruit?

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DISEASE MANAGEMENT- DECISION SUPPORT

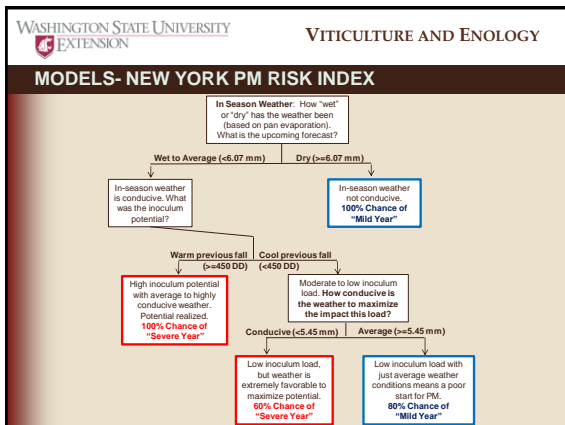
- Decision support systems either help you to time sprays or help provide information regarding pathogen biology.
- In some climates, they help reduce the total sprays
- In other climates, a DSS may actually INCREASE the number of sprays
- Take home: regardless of spray #, they should help control epidemics

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DISEASE MANAGEMENT- DECISION SUPPORT

- The current model of widespread use is the UC-Davis risk index
 - Follows the principle of slowed epidemics at high temperatures
 - Biggest crutch is when to start the risk index
 - Doesn't always perform well in cool climates
- A New York (i.e. cool, humid) model was recently developed to get around these issues



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**Generalized Spray Program:
Powdery Mildew**

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SPRAY PROGRAM CAUTIONS

- Before starting any spray program:
 - Calibrate sprayers and replace bad nozzles
 - Read fungicide labels (THEY ARE LEGAL DOCUMENTS)
 - Have a record book to record rates, concentrations, weather (before and during), dates, vine development, etc.
 - Review last year's spray records

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DISEASE MANAGEMENT- GENERAL SPRAY PROGRAM

- Initial establishment
 - Cooler time of year, epidemics are slow
 - Sulfur, stylet oil good here
 - Be careful about temperature!

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DISEASE MANAGEMENT- GENERAL SPRAY PROGRAM

- Period of peak susceptibility- **FOCUS HERE**
 - Alternate chemistries, use the best (DMI, Qols)
 - Tighten spray intervals
 - Watch weather
 - After 4wk, can return to softer chemistries

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DISEASE MANAGEMENT- GENERAL SPRAY PROGRAM

- Development of overwintering inoculum
 - Sprays will not influence fruit infection at this point
 - Simply controlling canopy mildew
 - High-risk fungicides not recommended (stick with sulfur, oils or bicarbonate)

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REVIEW and CONCLUSIONS

- Biology and history
- Implications in viticulture and enology
- Controlling outbreaks in cool, wet climates
 - What is disease management?
 - Cultural, Chemical, Decision support systems
- Spray programs should be focused from prebloom to fruit set.

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WEBSITES

- Washington State University
 - www.wine.wsu.edu/research-extension/
- Oregon State University
 - www.ipmnet.org
- Cornell University
 - www.nysaes.cornell.edu
- Ontario Ministry of Ag.
 - www.omafra.gov.on.ca/
- BC Ministry of Ag.*
 - www.agf.gov.bc.ca

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QUESTIONS?

http://www.agf.gov.bc.ca/cropprot/grapeipm/grape_pesticides.pdf