Fundamentals of Caneberry Management: Diseases

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Today's Goals

- Basic principals of plant disease diagnostics and management
- Explanations for plant decline and distinguishing virus symptoms in blackberry
- Identification of common fungal diseases of caneberries

Diagnosing Plant Diseases

1. Know your cultivar

   e.g. ‘Navaho’ highly susceptible to orange rust compared to ‘Traveler’ (tolerant)

‘Navaho’: Orange rust

‘Traveler’: Cane and leaf rust

Photo: NCSU, PDIC

Diagnosing Plant Diseases

2. Know what a healthy plant looks like

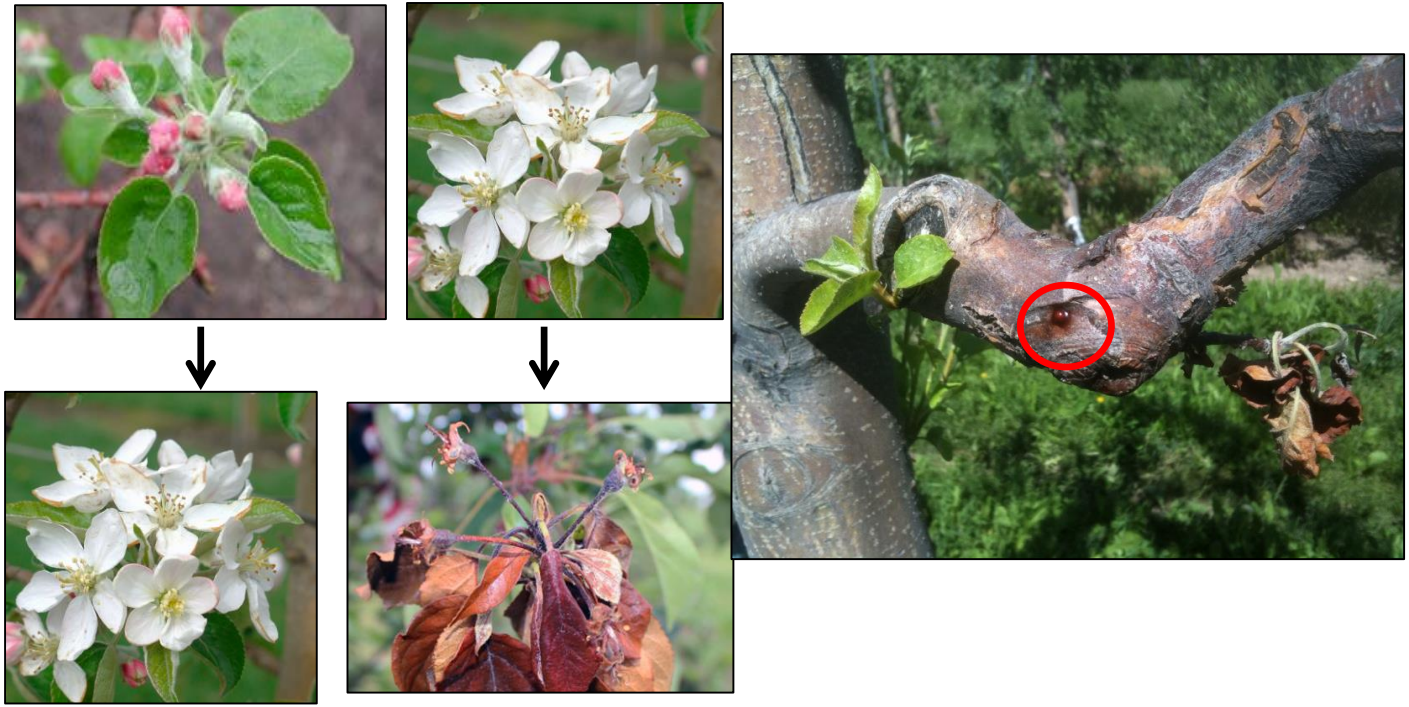
- Thorn load, leaf color, cane lesions, needle drop, fruit drop, etc.

Photos courtesy of NCSU PDIC

Diagnosing Plant Diseases

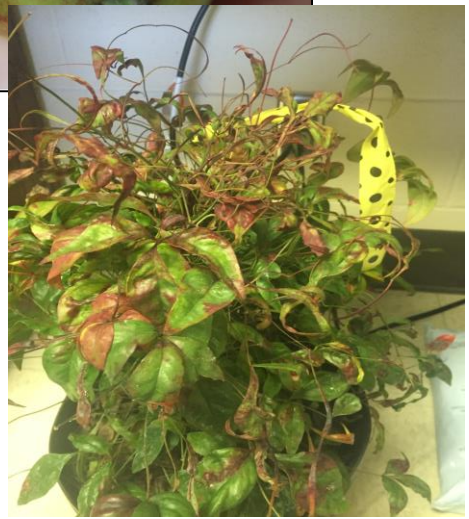
3. Consider the timing of symptom development

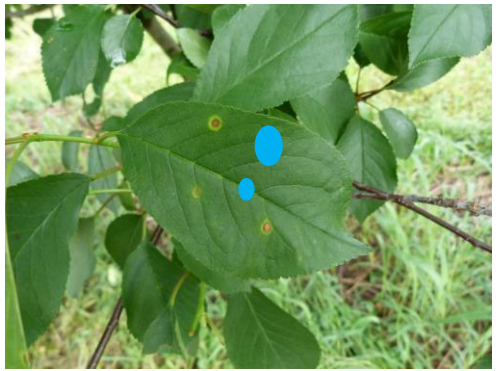
- Host phenology? Pathogen present? Vector present?



Diagnosing Plant Diseases

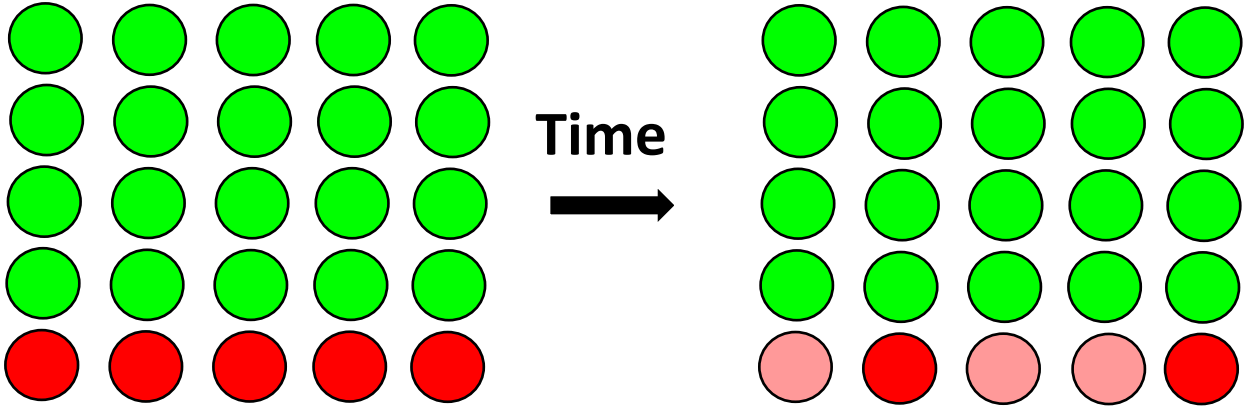
4. Consider distribution, environment, management history



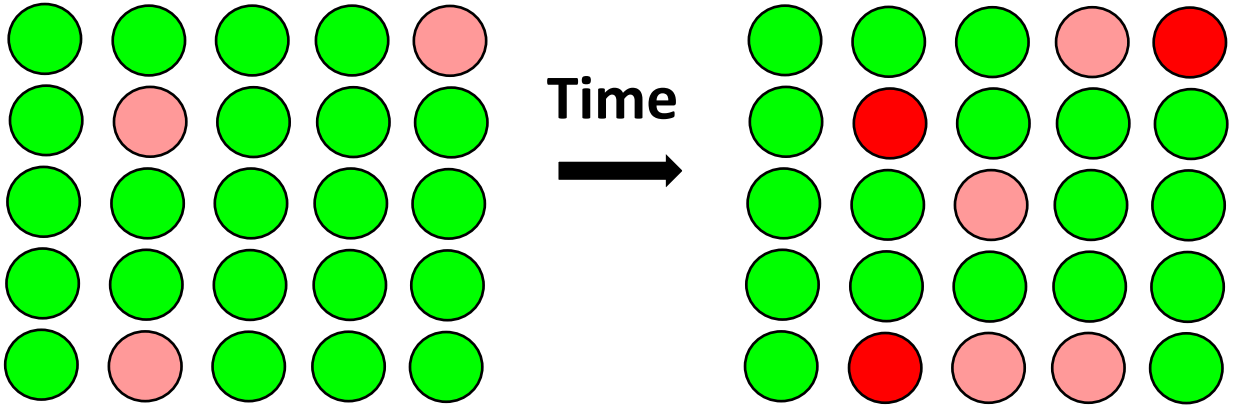


Diagnosing Plant Diseases: Distribution

Abiotic



Virus



Reasons for Blackberry Decline

Photos: Bill Cline; M. Lewis-Ivey, OSU

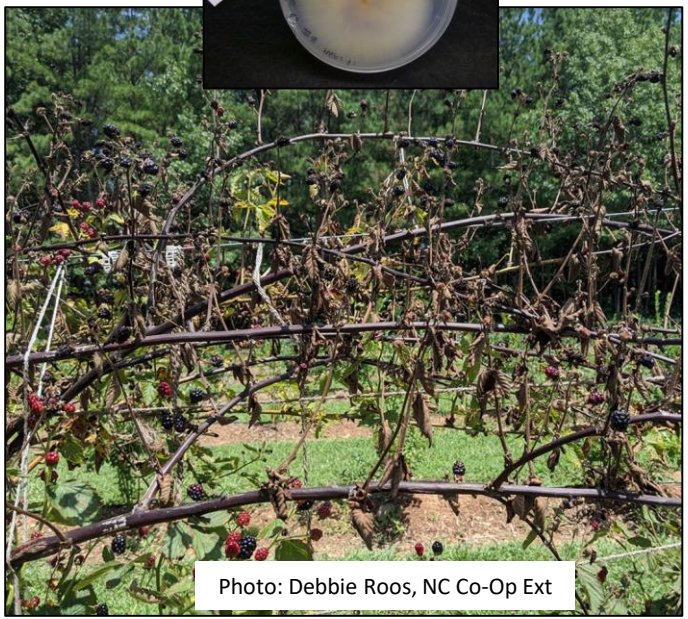


Photo: Debbie Roos, NC Co-Op Ext

Photo: Matt Lenhardt, NC Co-Op Ext

1. Fungal: Vascular colonization or Constriction Canker

Reasons for Blackberry Decline

Brian Olson, Oklahoma State University, Bugwood.org

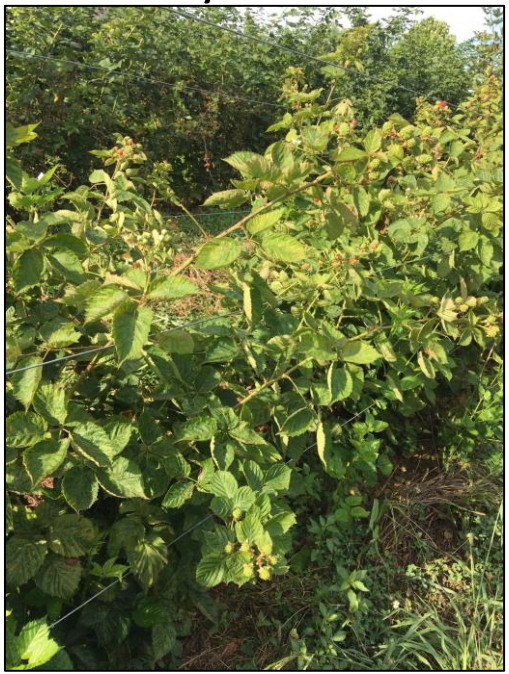
Photo: B. Bluhm and J. Stover, U. Arkansas

2. Bacterial: Vascular colonization
   - Possible but just not observed frequently

Reasons for Blackberry Decline

blackberry leaf mottle associated virus (BLMaV)

3. Viruses: Vascular
   - Over 40 known viruses in blackberry



blackberry yellow vein associated virus (BYVaV)
blackberry virus Y (BVY)

Reasons for Blackberry Decline

simazine injury

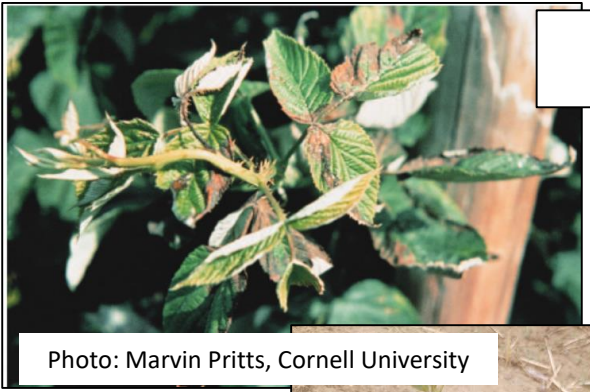


Photo: Marvin Pritts, Cornell University

4. Abiotic Disorders
   - Herbicide injury, nutrient deficiency/ excess, environmental stress

Photo: Karen Blaedow, NC Co-Op Ext

winter injury

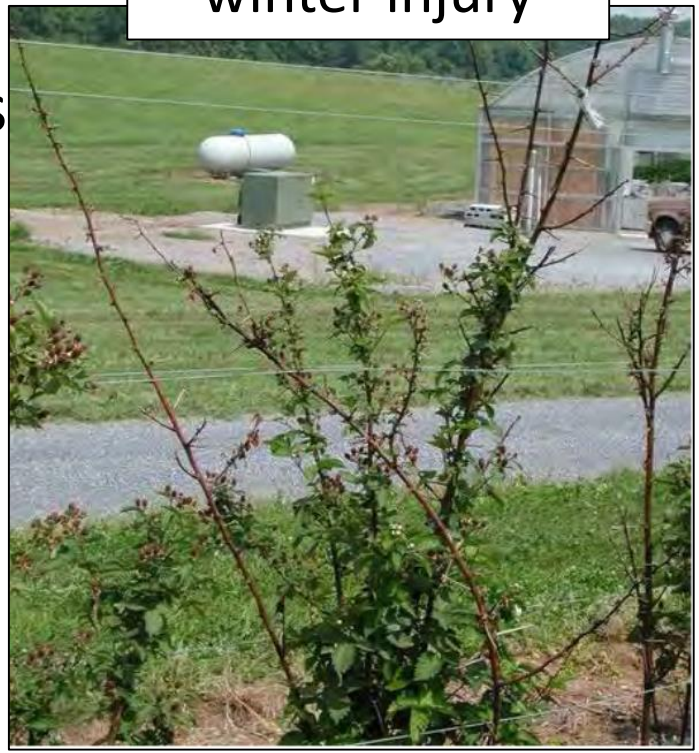


Photo: Gina Fernandez, NCSU

Quirks and Factoids about Blackberry Viruses

- > 40 viruses, 25 identified in North America
  - Viruses involved in **virus disease complexes** often vary by region (or even state)
- **Virus Disease Complex?**
  - Often plant must be infected with >1 virus (“co-infected”) in order for symptoms to be expressed
- All blackberry viruses can be transferred by either grafting or vegetative propagation
  - Insects also important vectors, but many likely not identified

Common Blackberry Viruses in the S.E.

	Rubus Pathogens
1	Apple Mosaic Virus (ApMV)
2	Arabis Mosaic Virus (ArMV)
3	Beet Pseudo-Yellow Virus (BPYV)
4	Black Raspberry Necrosis Virus
5	Blackberry Chlorotic Ring Spot Virus (BCRV)
6	Blackberry Virus Y (BVY) (BlVY)
7	Blackberry Yellow Vein-associated Virus (BYVaV)
8	Blackberry Vein Banding-associated Virus (BVBaV)
9	Blackberry Leaf Mottle-associated Virus (BLMaV)
10	Impatiens Necrotic Stop Virus (INSV)
11	Phytoplasma
12	Raspberry Bushy Dwarf Virus (RBDV)
13	Raspberry Latent Virus (RpLV)
14	Raspberry Leaf Mottle Virus (RLMV)
15	Rubus Yellow Net Virus (RYNV)
16	Strawberry Latent Ringspot (SLRSV)
17	Strawberry Necrotic Shock Virus (SNSV)
18	Tobacco Ring Spot Virus (TRSV)
19	Tomato Black Ring Virus (TBRV)
20	Tomato Ring Spot Virus (ToRSV)
21	Xylella fastidiosa
22	Blackberry Virus E (BVE)
23	Blackberry Chlorotic Ringspot Virus (BCRV)
24	Blackberry Virus F (BlVF)
25	Blackberry Virus S (BlVS)
26	Cherry Leaf Roll Virus (CLRV)
27	Cherry Raspberry Leaf Virus (CRLV)
28	Grapevine Syrah Virus 1 (GSyV-1)
29	Raspberry Leaf Blotch Virus (RLBV)
30	Raspberry leaf curl agent (RLCV)
31	Raspberry Ringspot Virus (RpRSV)
32	Raspberry Vein Chlorosis Virus (RVCV)
33	Sowbane Mosaic Virus (SoMV)
34	Tomato Black Ring Virus (TBRV)

Images: Christie Almeyda, NCSU MPRU

Viruses Detected			
Crop/Year	2017	2018	2019
Raspberries	None	None Tested	None Tested
Blueberries	BBLV, BRRV	BBLV, BRRV	BBLV, BRRV
Strawberries	SMoV	None	None Tested
Blackberries	BYVaV	BYVaV, BlVE, BVBaV, BlMaV	BYVaV, BlVY, BLMaV, TRSV, CCGaV-like

Symptoms of Blackberry Yellow Vein Disease

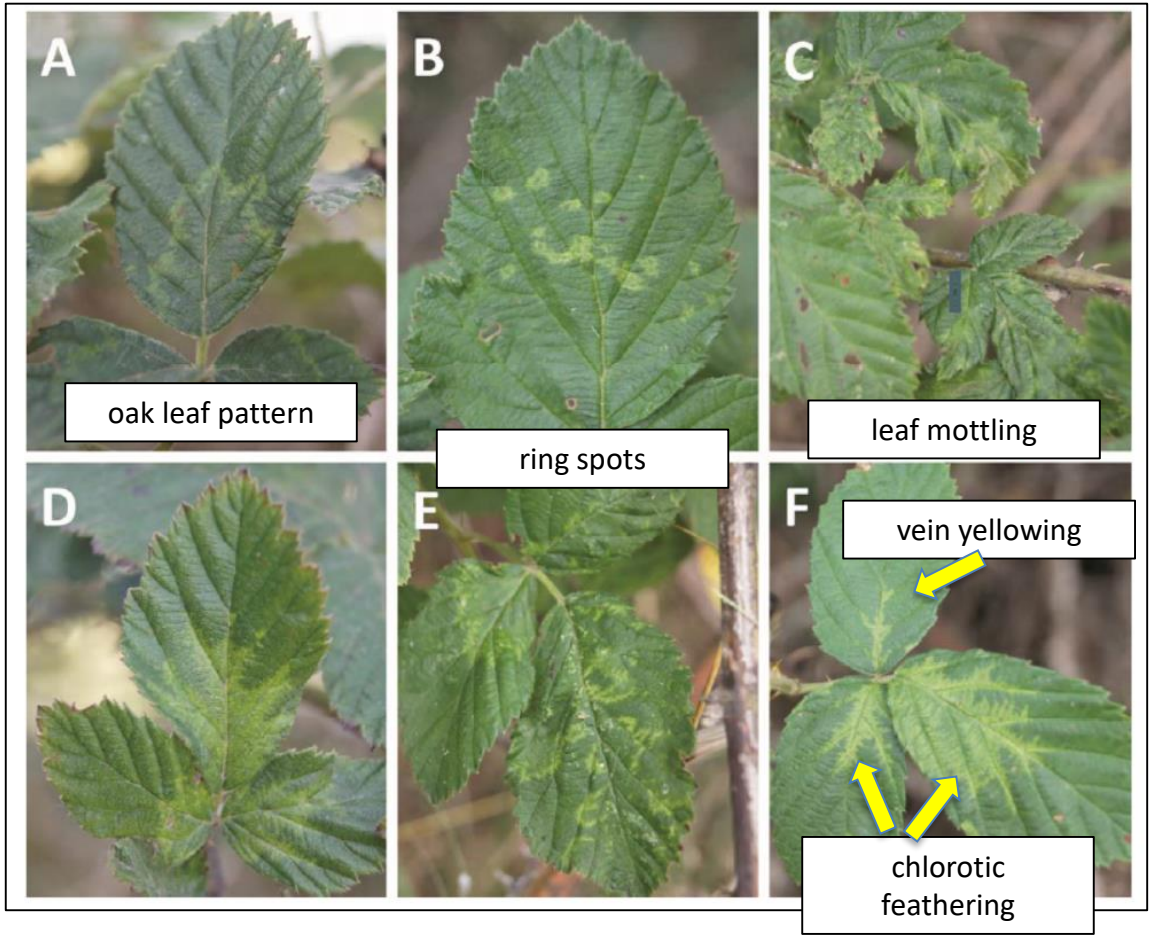


Photo Credit: Martin, R.R., MacFarlane, S., Sabanadzovic, S., Quito, D. Poudel, B., and Tzanetakis, I. 2013. Viruses and Virus Diseases of *Rubus*. Plant Dis. 97: 168-182

Symptoms of Blackberry Yellow Vein Disease

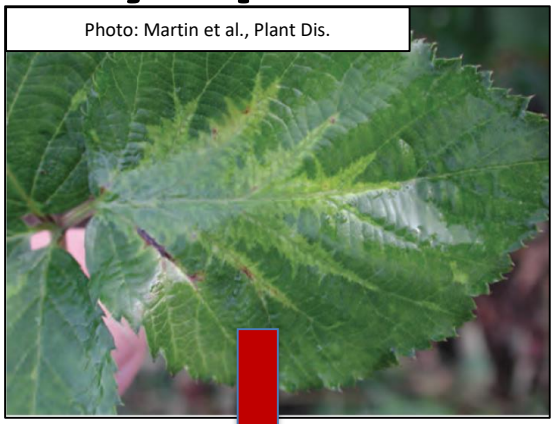


Photo: Martin et al., Plant Dis.

Photo: Compendium of Raspberry and Blackberry Pests and Diseases

- 10 viruses associated with BYVD
- Symptoms typically observed on mature leaves
  - Sporadic distribution in lower canopy
- Typically cuts production life 66-75%
  - Other general decline symptoms: e.g. stunting, aborted berry development
- Not necessary to control each virus detected in symptomatic plant

General Tips for Distinguishing Viral Infections

- Consider how many plants showed symptoms at similar timing and how symptoms are distributed in across field
- Check weeds/grasses in field-Do they present similar coloration/ symptoms?
  - Could signal herbicide or nutrient imbalance
- Consider if this is the first year you've noticed these symptoms at this timing in this field or have you noticed similar symptoms in previous seasons

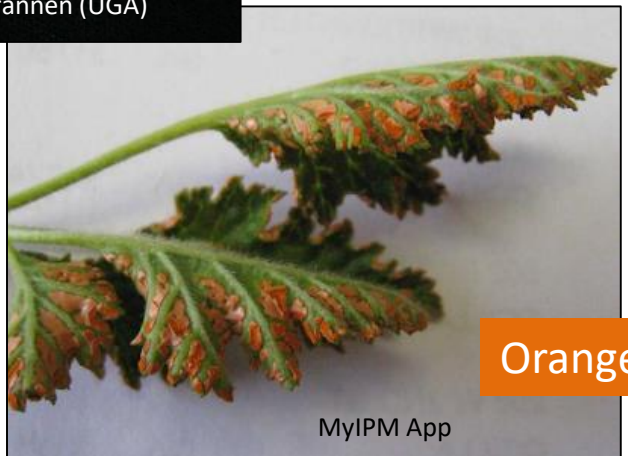
General Tips for Distinguishing Virus Infections

- Observe how the symptoms on the plant or throughout the field are progressing
- Double check to confirm plants were purchased from nursery with virus-tested stock
- Although not fool-proof, check woody tissue for symptoms
  - Viruses do but less frequently cause canker and dieback symptoms associated with other pathogens

Rust Diseases on Blackberry

Cane and Leaf Rust

May have similar symptoms, but disease management is quite different



Orange Rust

Cane and Leaf Rust: *Kuehneola uredinis*

Signs and Symptoms: Scout floricanes beginning in the late spring

Mid-Spring: Uredinia

Early Summer: Uredinia

July-Autumn: Premature defoliation + telia

Orange Rust (systemic): *Arthuriomyces peckianus* and *Gymnoconia nitens*

Early Spring: Spindly leaves emerging from floricanes

Late Spring: Waxy orange pustules (aecia) form on leaf bottom

Leaf drop + weak spindly shoots emerging from systemically infected root buds

Botrytis Fruit Rot: What does it take?

Susceptible Host

Biology and availability of pathogen

Conducive Environment

Botrytis Fruit Rot: What does it take?

Kohzar and Peeler, Phytopathology 2018

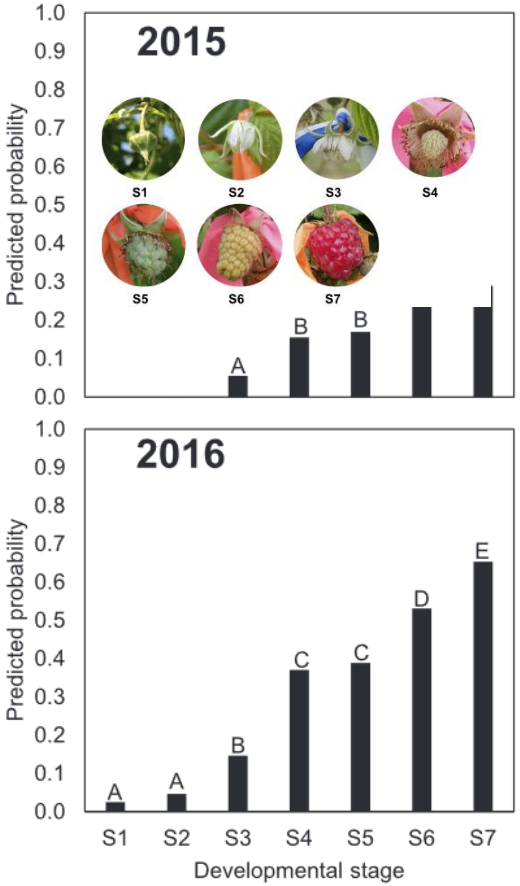


Photo: G. Fernandez

Botrytis Fruit Rot: What does it take?

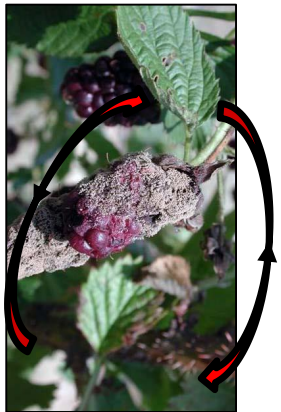
Susceptible Host

Biology and availability of pathogen

Conducive Environment

Botrytis Fruit Rot: *Botrytis cinerea*

Fruit Mummies



The New and Improved

MyIPM App

Information Provided by MyIPM App

- 9 fruit crops
- Diagnostics
  - Insect/Pathogen biology
  - Disease signs/symptoms
  - High quality, zoomable photo gallery
- Chemical, biological, cultural control
- Audio from specialists

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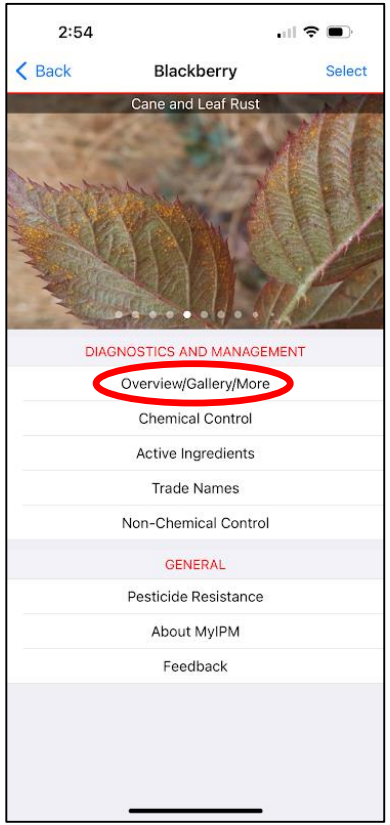
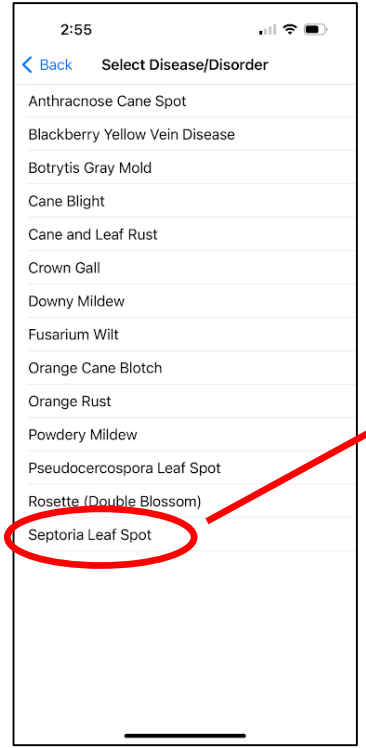
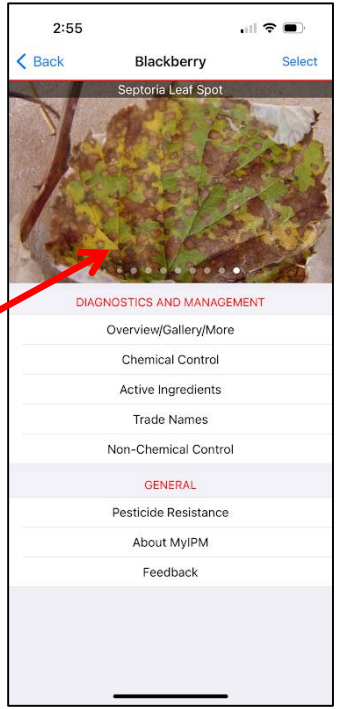
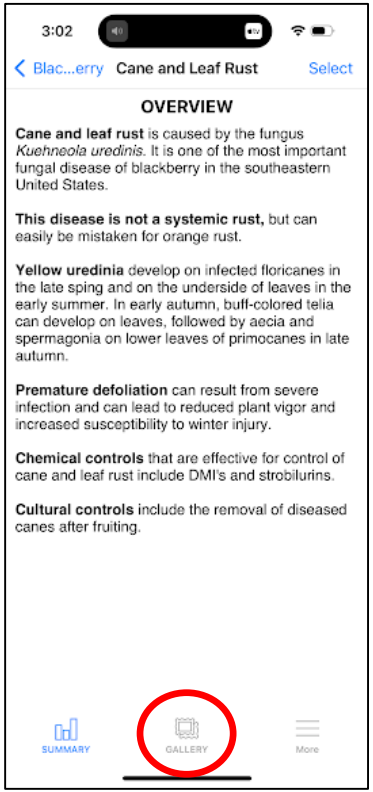
MyIPM App: Blackberries

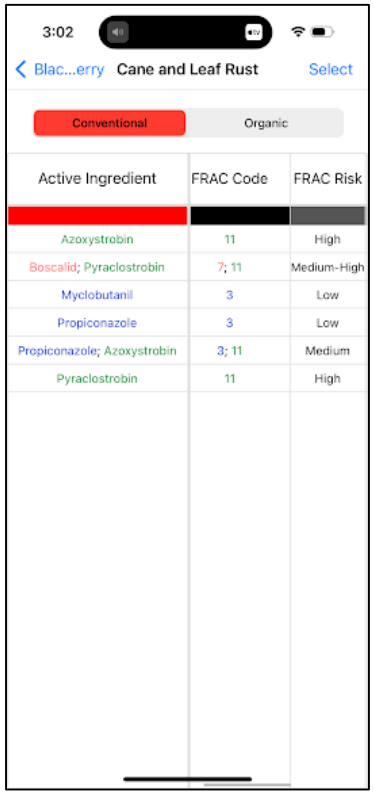






Scroll between diseases or click on “select” to help with identification and access more information





Basic biology, control, short audio clip

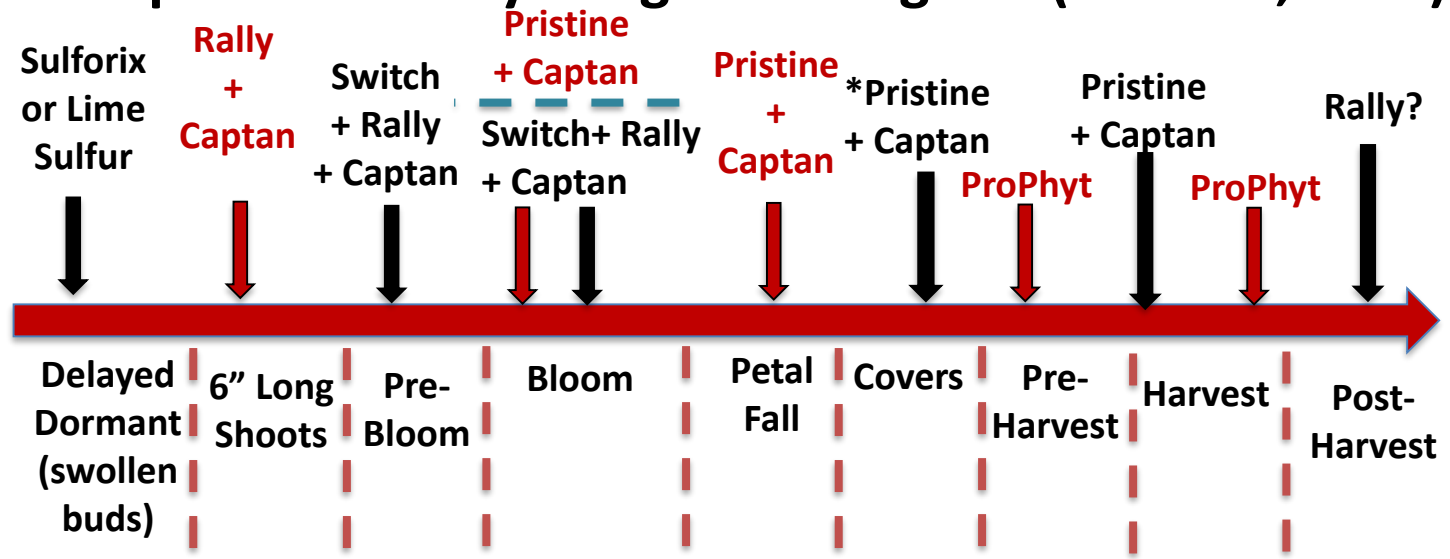
Additional photos of disease symptoms

Fungicide Management

Information Provided by MyIPM App

- Interactive Pesticide Tables
  - Active ingredients and trade names
  - REI, PHI, application rates
  - Product efficacy
  - Pesticide Risk
  - FRAC/IRAC codes
  - FRAC resistance risk

Example Blackberry Fungicide Program (J. Oliver, UGA)



Cane Blight

Leaf Spots

Rusts

Botrytis + Rosette(?)

Orange Blotch?

*Consider Rotation of Kenja + Rally

Thanks and Questions

- Christie Almeyda and Win Talton, NCSU MPRU
- Mike Munster and Chuck Hodges, NCSU PDIC
- Karen Blaedow, Debbie Roos, Matt Lenhardt, NCCE