



Linking *Colletotrichum* Diversity to Fungicide Sensitivity and Anthracnose Management

2026 FBGA Fall Meeting

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Overview

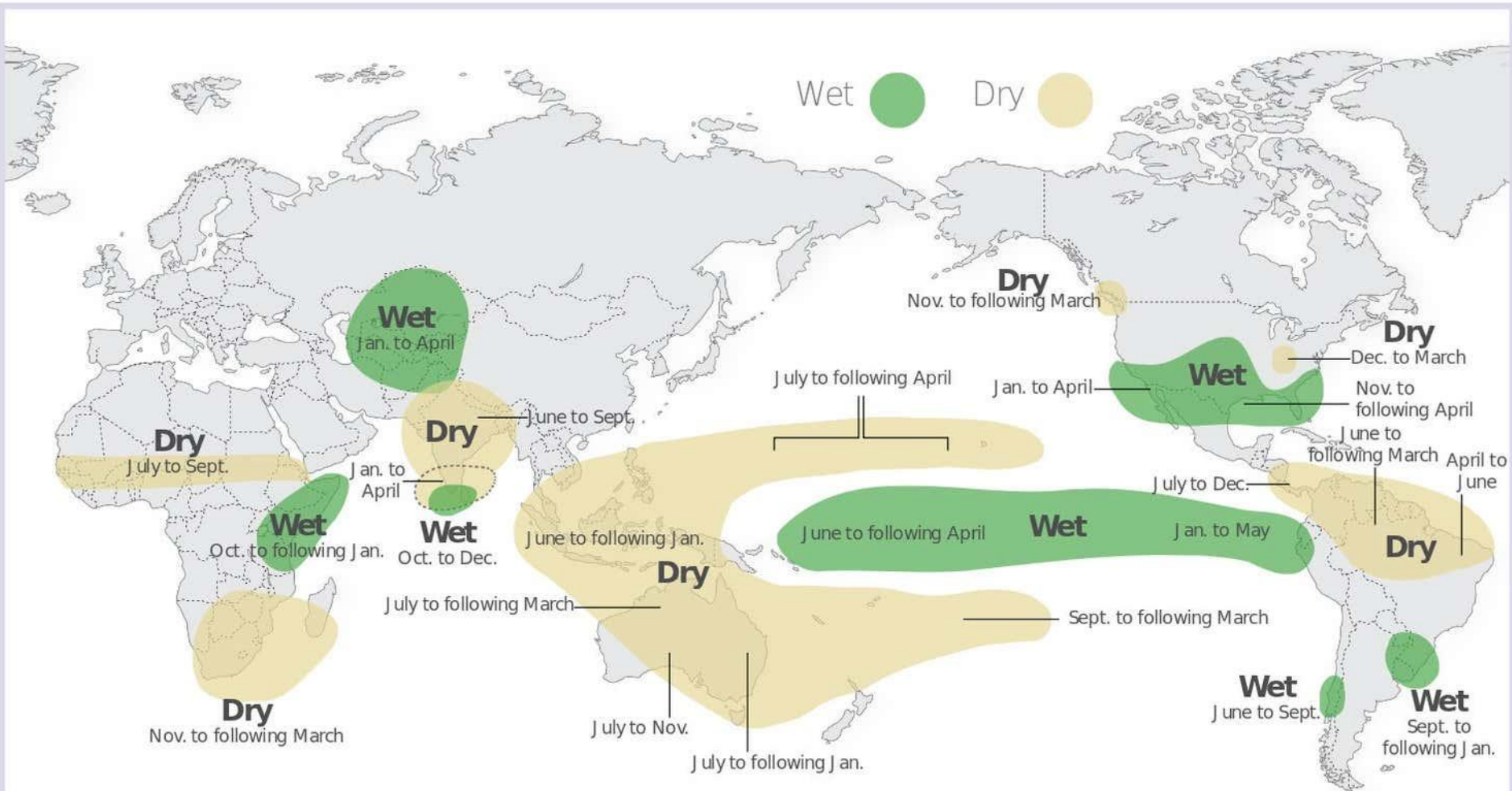
Today's topics to review

- Super El Nino, blueberry disease impacts
- Disease update since the spring freezes
 - Diagnostic lab summary
 - Doug's grower survey disease mentions
- Anthracnose research update
 - BEST grant, FBGA, Dean for Research, Foundation Seed, Breeding Program

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Global El Niño Effects

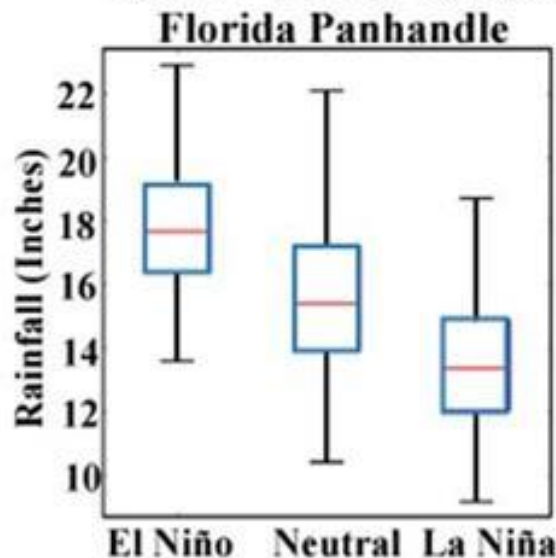
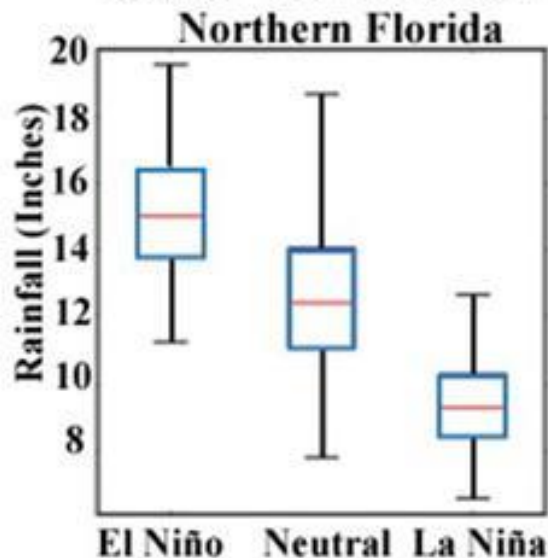
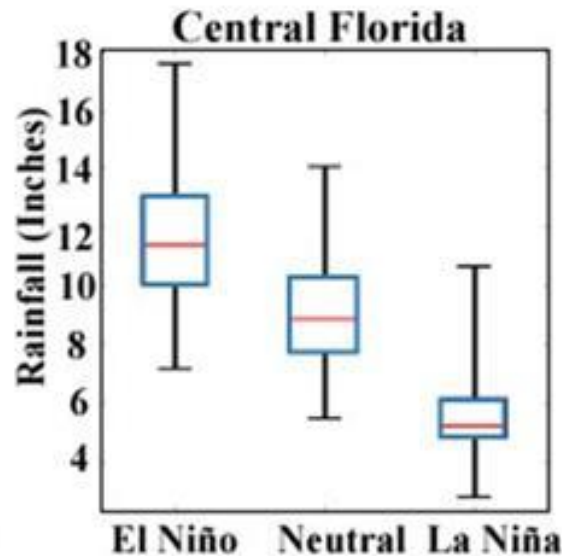
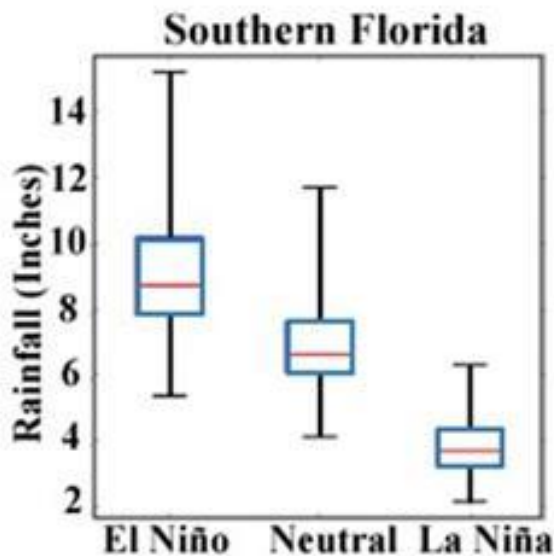
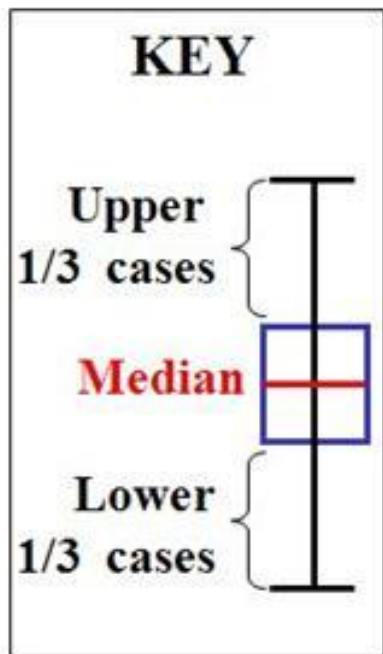


For more information on El Niño and La Niña, go to: <http://iri.columbia.edu/ENSO>

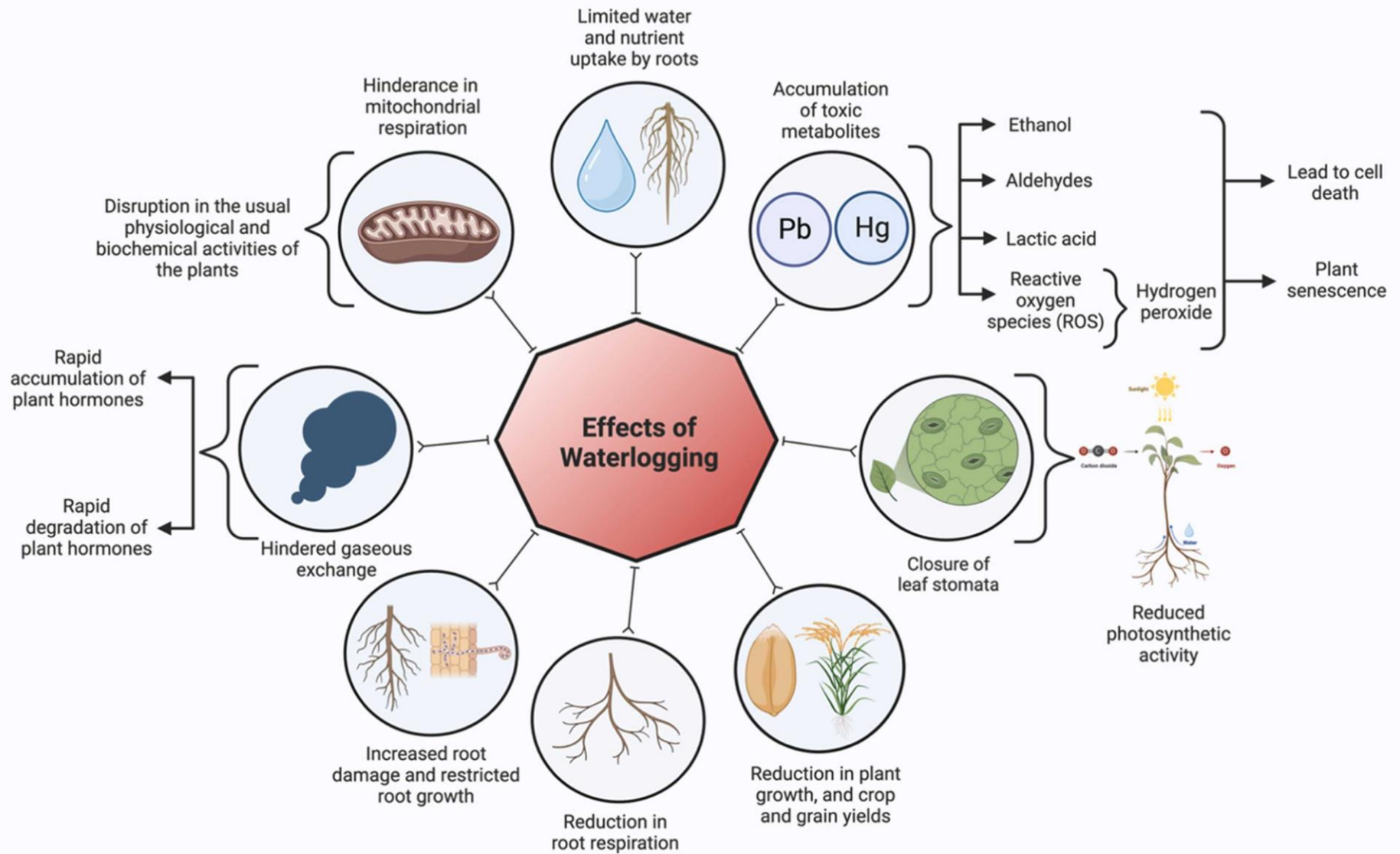
Sources: Ropelewski, C. F. and M. S. Halpert, 1989: Precipitation patterns associated with the high index phase of the Southern Oscillation. *J. Climate*, 2, 268-284.
Mason and Goddard, 2001: Probabilistic precipitation anomalies associated with ENSO. *Bull. Am. Meteorol. Soc.* 82, 619-638



Florida Winter Rainfall (Inches)



Throughout Florida, El Niño, Neutral, and La Niña wintertime rainfall differ dramatically



Environment—Water

- Moisture makes fungus/molds germinate and grow, spores swim through soil to find roots
- Fungal infection is encouraged by
 - Over-watering
 - Early evening watering
 - Shade or cloudy days
 - High humidity
 - Poor drainage
 - Fog or rain, etc.



Small Fruit 10-13-25 to 10-13-26

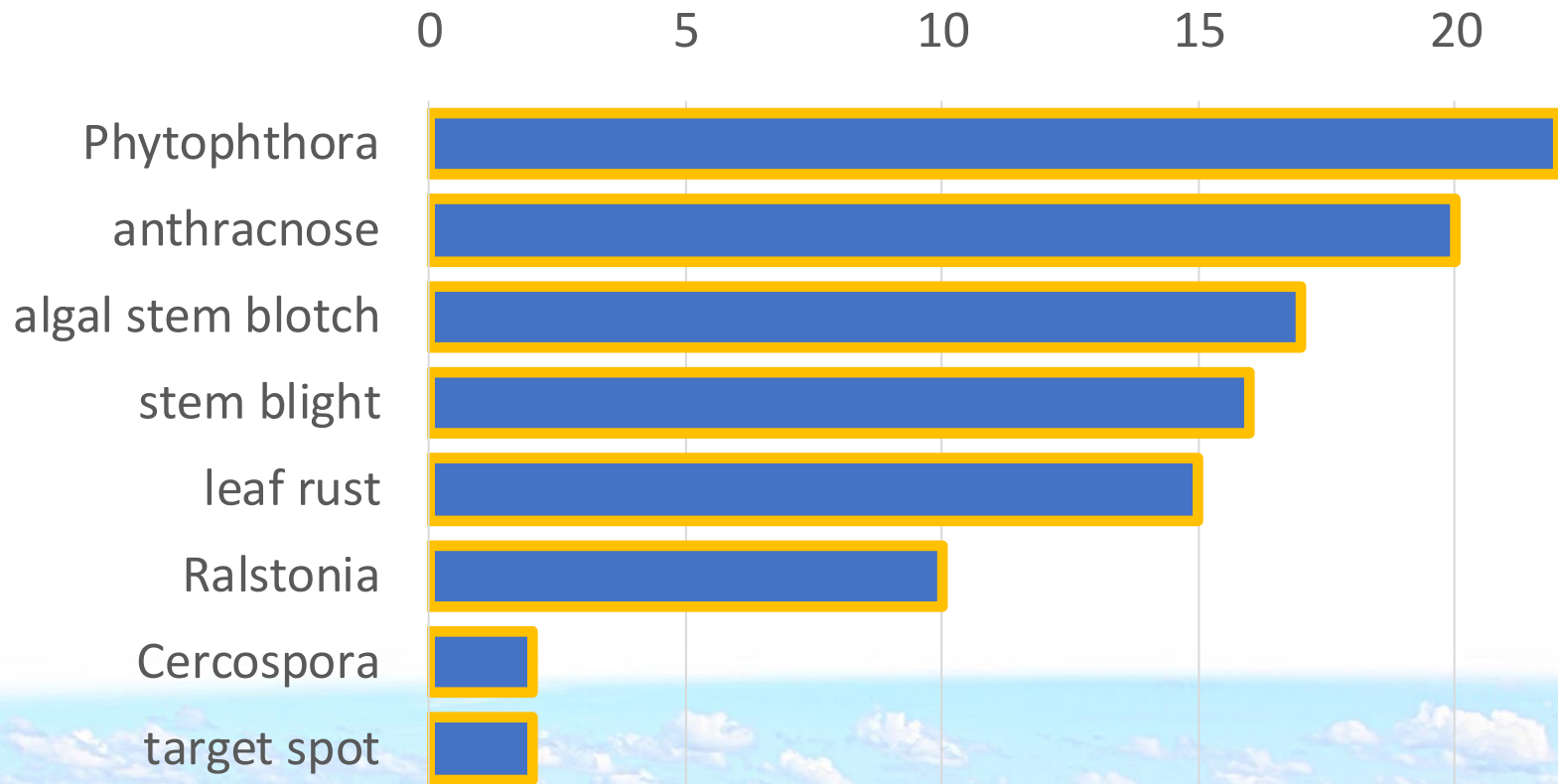
Southern highbush blueberry

35	Phytophthora crown and root rot	<i>Phytophthora sp./spp.</i>
29	Botryosphaeria Stem Blight	<i>Botryosphaeria sp./spp.</i>
15	Anthraxnose	<i>Colletotrichum gloeosporioides</i>
10	No Pathogen Found	
11	Target Spot	<i>Corynespora cassiicola</i>
8	Phyllosticta leaf spot	<i>Phyllosticta sp./spp.</i>
7	Bacterial Spot/Blight	<i>Xanthomonas sp./spp.</i>
7	pH/EC readings	
4	Bacterial wilt of blueberry	<i>Ralstonia solanacearum</i>
4	Crown Gall	<i>Rhizobium radiobacter</i>
3	Algal stem blotch	<i>Cephaleuros virescens</i>
3	Insect Damage	<i>Insects</i>
2	leaf rust	<i>Thekopsora minima</i>
1	Girdling	<i>Abiotic disorder</i>
1	Planting too deep	<i>Abiotic disorder</i>
1	Angular leaf spot	<i>Cercospora sp./spp.</i>
1	Abiotic Disorder: Oedema	<i>Oedema; Edema</i>
1	Pythium root rot	<i>Pythium sp./spp.</i>
1	Septoria leaf spot	<i>Septoria sp.</i>
1	Borers	



Grower Disease Issues Survey

Top 5 Disease Mentions 2026



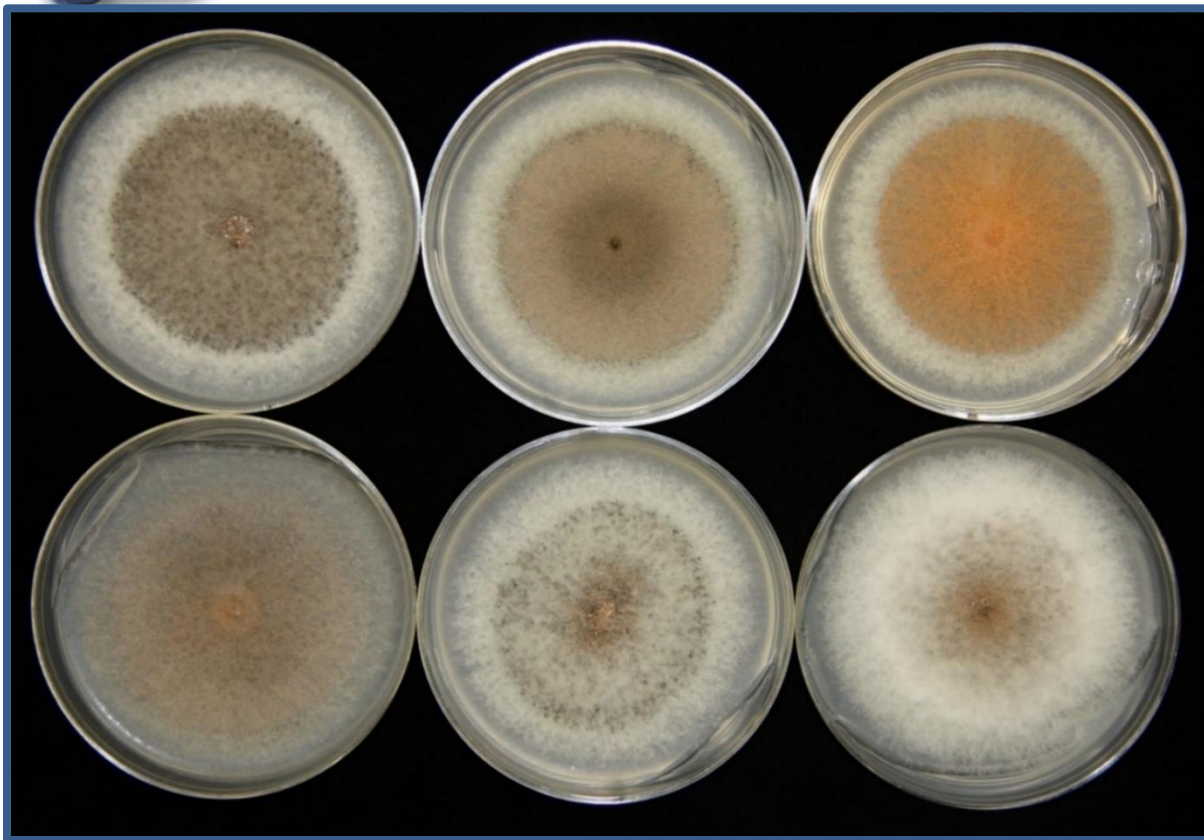
FBGA Research Priorities

Specific Priorities by Category			
Breeding	Yield	Machine Harvest	Pest and disease resistance
Entomology	Chili thrips	MOA rotations	Gall midge
Weeds	Plant safety/new a.i. eval	Sedge	Dollar weed Tank mix/rotations
Pathology	Anthracnose	Rust	Ralstonia Root rot
Horticulture	Harvest mechanization	Renovation pruning	Fertilizer optimization
Pollination	Cross pollination	AI bee visit yield prediction	

ai yield prediction anthracnose bacterial wilt biocontrol biological control
breeding chili thrips combinations of herbicides
cross pollination diseases dollar weed entomology
firmness fruit drop set gall midge horticulture irrigation and disease leaf rust
machine harvest mechanization moa rotation nitrogen nutrient
perennial grass pest and disease phosphorous nutrient plant safety
pollination quinstar renovation pruning and evergreen root girdling root rot
sanitation sedge stem blight variety density weeds yield



“Anthracnose”



Colletotrichum gloeosporioides
Overlapping colony morphology from
berry, stem, and leaf.
Fungicide resistance to our best products

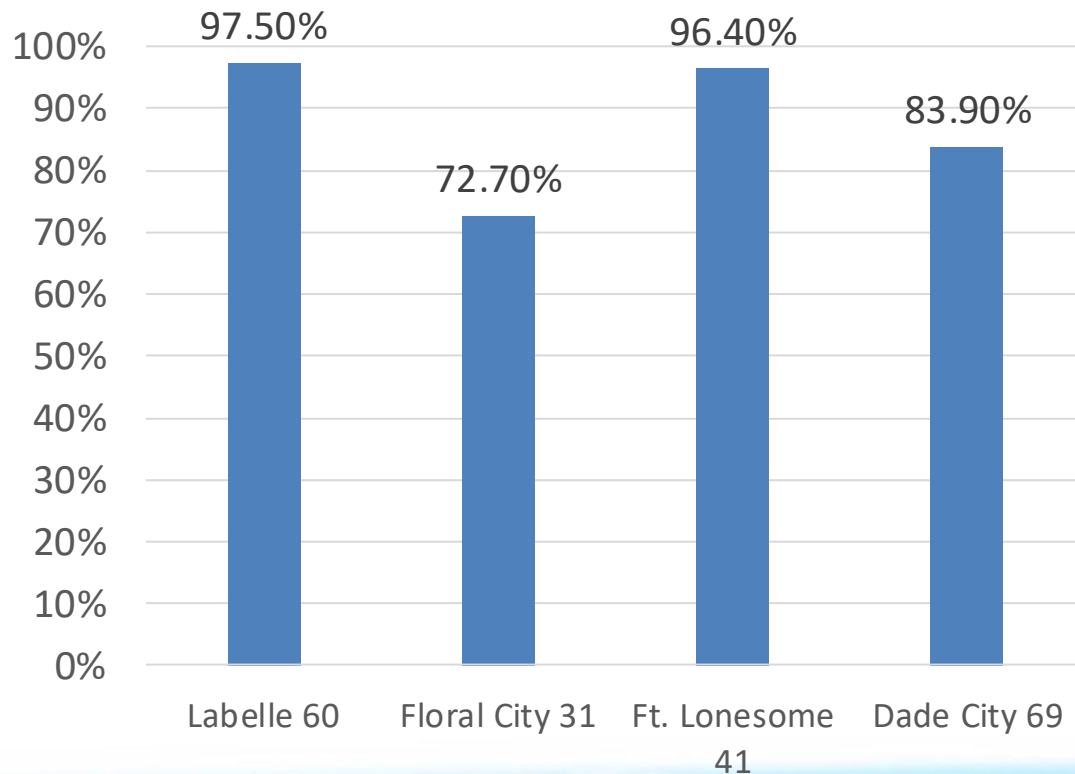
Anthracnose fruit rot

Ripe rot



Known Resistance

Azoxystrobin Resistance



- Resistance
 - Abound (azoxy)
 - Miravis (pydiflum)
 - Pristine (boscalid)
- Sensitive
 - Switch (fludioxonil)
 - Omega (fluazinam)
 - Fontelis (penthioy
 - Aprovia (benzovind
 - (lowbush only)

Gama et al 2021



Resistance to fludioxonil (Switch)?



Isolate *Colletotrichum*



PDA

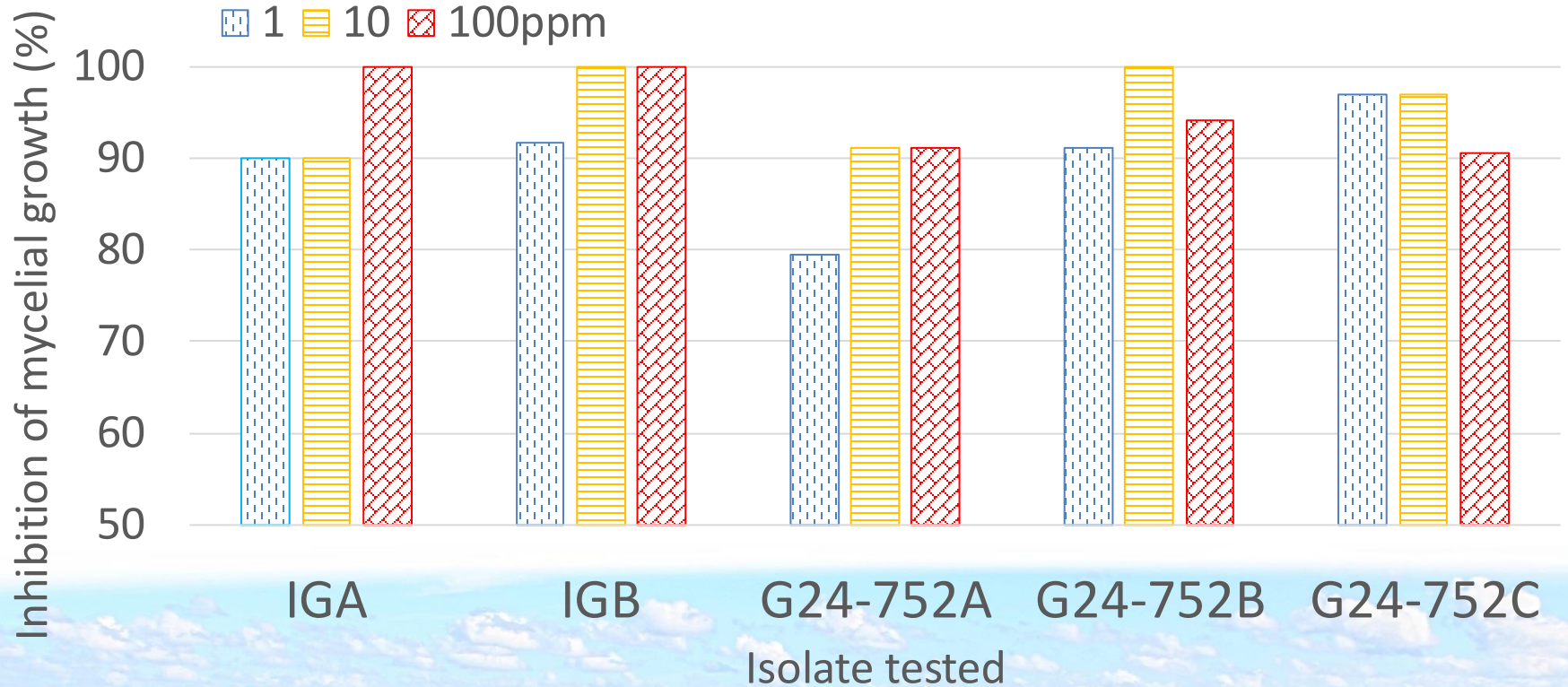
PDA
1ppm fludioxonil



Isolates were sensitive (>90% inhibition at 10ppm)

Fludioxonil sensitivity of ripe rot isolates

April 2024



BEST Funded Proposal

Linking *Colletotrichum* Diversity to Fungicide Sensitivity and Anthracnose Management

- Flavia Rogerio, Post Doc
- Brantlee Spakes Richter, PI
- Awarded in August, sampling started in Sept.,
- Continuing “Weeds and Wilds” work
- Manuscript submitted: The Enemy Is Nearby: Surrounding Weeds Harbor Blueberry-Pathogenic *Colletotrichum*



WEEDS

Amaranthus sp.



Portulaca
Pilosa ?



Cynanchum sp.



Smilax sp.



Sweet potato vine
(*Ipomoea batatas*)



Centella
asiatica



Blueberries





2025 Publication



G3, 2025, 15(11), jkaf187

<https://doi.org/10.1093/g3journal/jkaf187>

Advance Access Publication Date: 8 September 2025

Plant Genetics and Genomics

Genome-wide association study reveals candidate loci for resistance to anthracnose in blueberry

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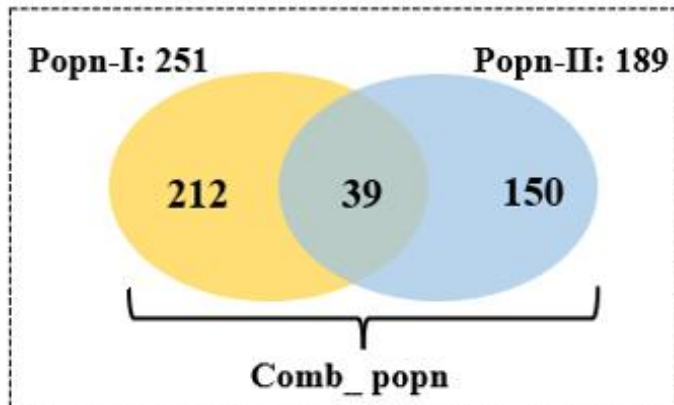
³Department of Statistics, Universidade Federal de Viçosa, Viçosa, MG 36570-000, Brazil

⁴Plant Breeding Graduate Program, University of Florida, Gainesville, FL 32611, United States

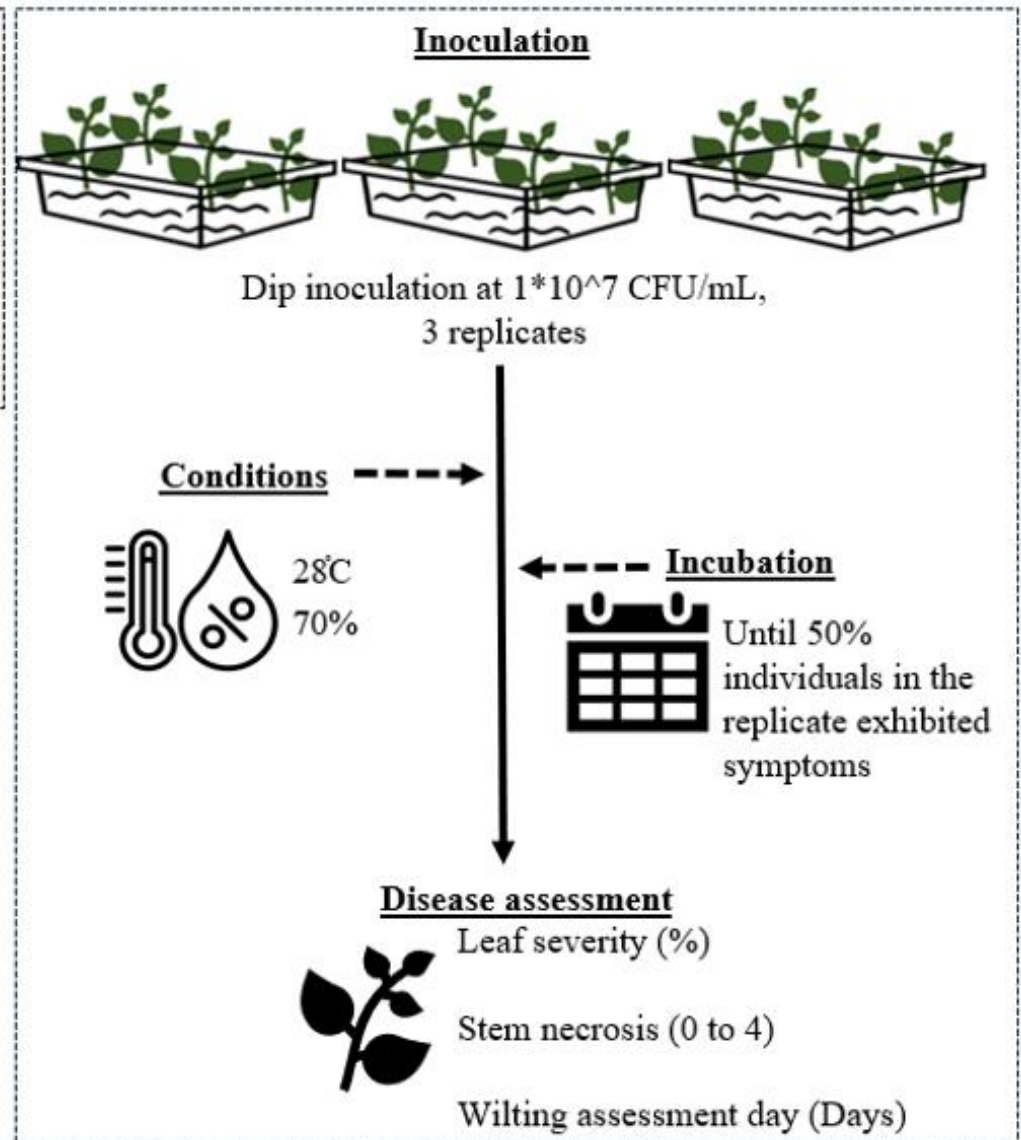
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Anthrachnose, caused by *Colletotrichum gloeosporioides*, poses a significant threat to blueberries, necessitating a deeper understanding of the genetic mechanisms underlying resistance to develop efficient breeding strategies. Here, we conducted a genome-wide association study on 355 advanced selections of southern highbush blueberry from the University of Florida Blueberry Breeding and Genomics Program. Visual scores and image analyses were used for assessing disease severity. The population was genotyped using Capture-Seq, detecting 38,379 single nucleotide polymorphisms. The study revealed a moderate narrow-sense heritability estimate (~0.5) for anthracnose resistance in blueberries. Minor additive loci contributing to anthracnose resistance were identified on chromosomes 2, 3, 5, 6, 9, 10, and 12, using 2 different phenotyping approaches. Visual and image-based phenotyping captured complementary aspects of anthracnose resistance, identifying distinct, non-overlapping SNP associations. Candidate gene mining flanking significant associations unveiled key defense-related proteins, such as serine/threonine protein kinases, pentatricopeptide repeat-containing proteins, E3 ubiquitin ligases that have been well-known for their roles in plant defense signaling pathways. Our findings highlight the complex and quantitative resistance mechanism for anthracnose in blueberry, providing insights for breeding strategies and sustainable disease management.

A)

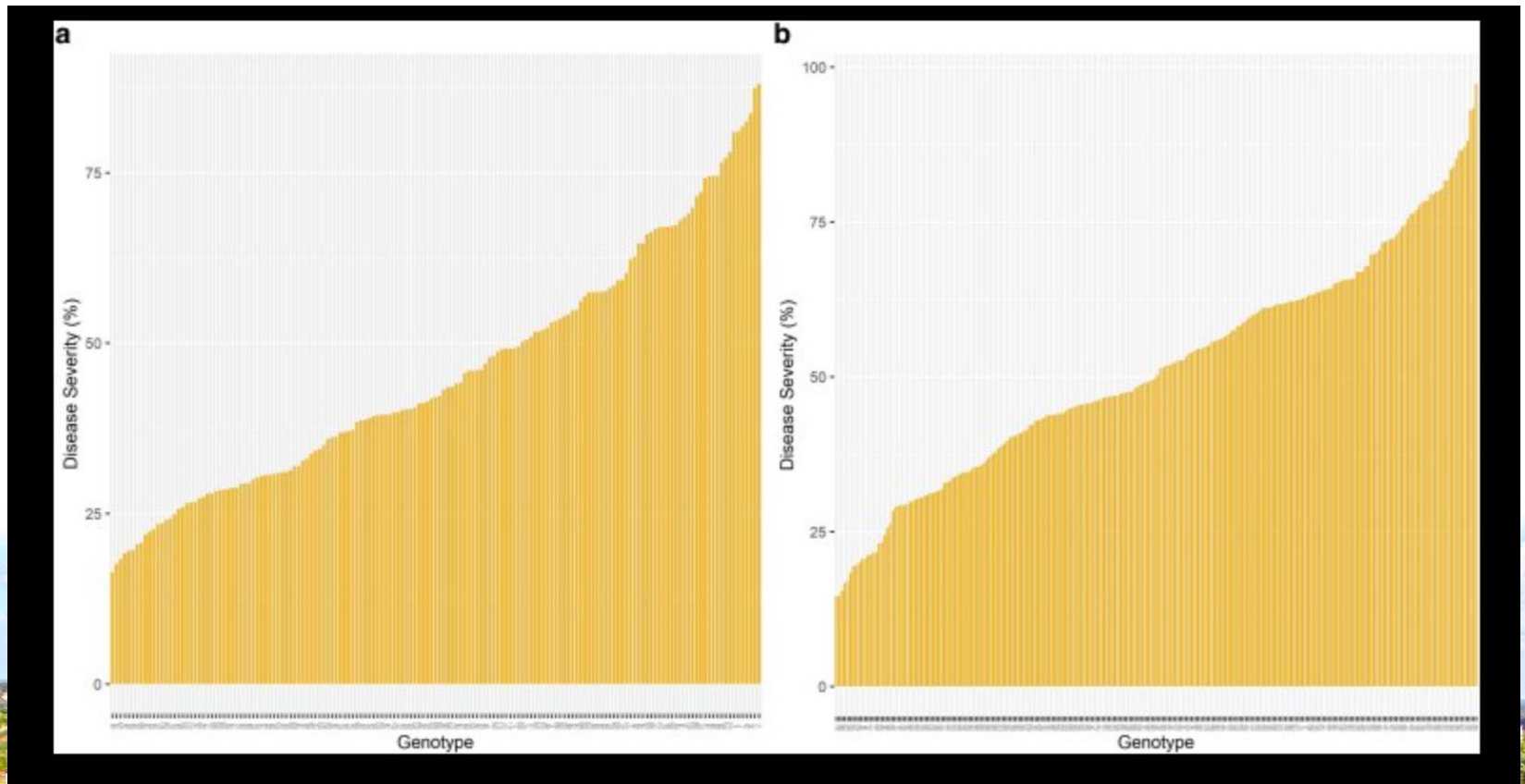


B)



Genome-wide Association Study

- Gene candidates tied to anthracnose resistance



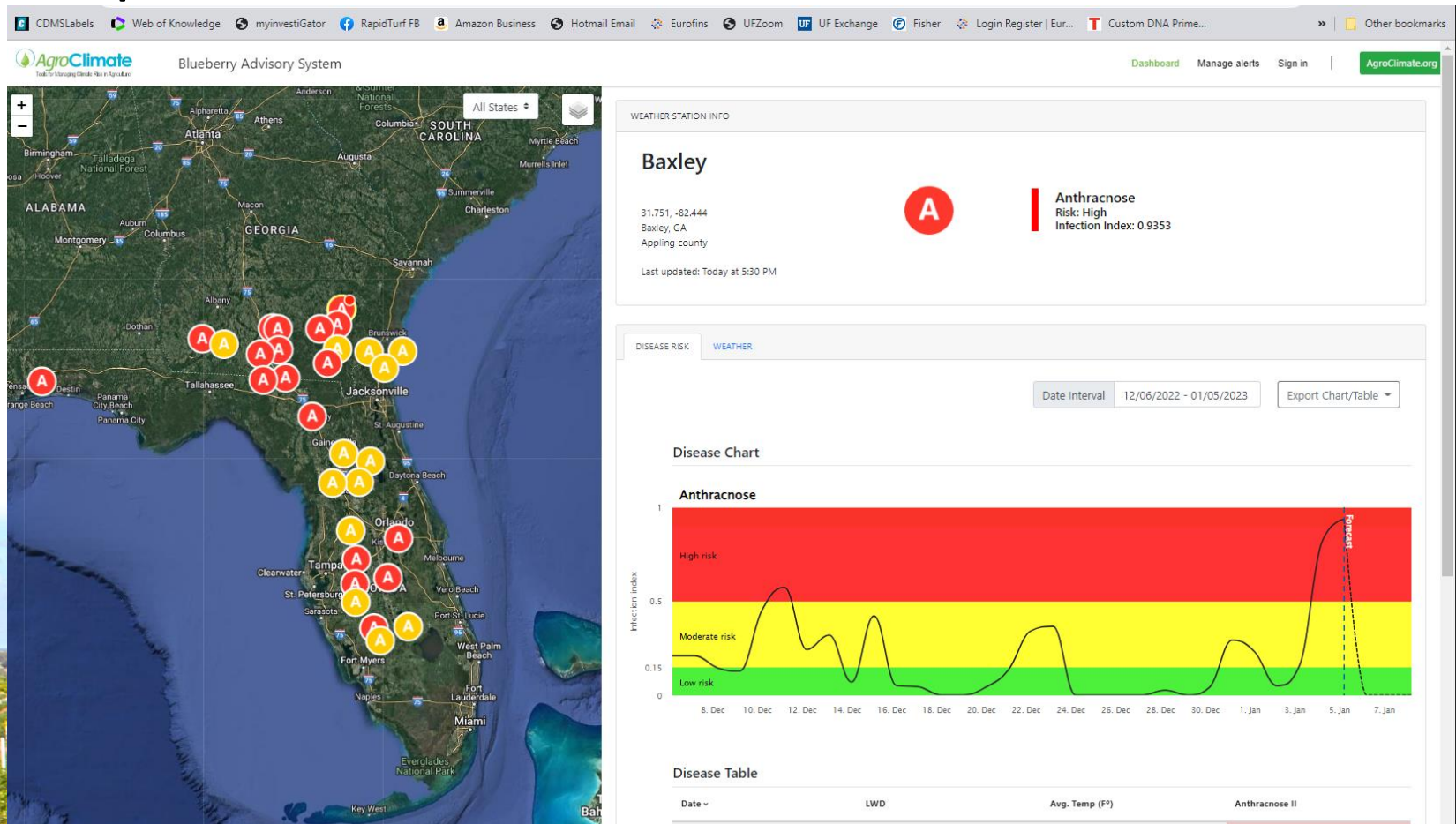
General Advice

- Avoid overhead irrigation
- Calibrate and keep sprayers “tuned up” to ensure good canopy penetration and spray coverage
- Use fungicide applications early in the disease progress, start at bloom
- Do not apply more than the labels allow for any one active ingredient for the season
- Rotate and tank mix products to cover all the bases



Blueberry Advisory System

- Reports how favorable the weather has been for anthracnose
- Infections from bloom—post harvest can result in ripe rot as fruit mature



Resources

Anthracnose on Southern Highbush Blueberry¹

Douglas A. Phillips, Maria C. Velez-Climent, Philip F. Harmon, and Patricio R. Munoz²

Information contained in this publication is intended for Florida blueberry growers to use as a guide in the identification and management of anthracnose on southern highbush blueberries (SHB). For more information, search the EDIS website (<http://edis.ifas.ufl.edu>) or contact your local UF/IFAS Extension office (<http://ifas.ufl.edu/extension-offices-rec-maps.shtml>).

Anthracnose Diseases and Symptoms

Anthracnose is a general name given to diseases caused by a group of fungal pathogens in the genus *Colletotrichum*. These pathogens affect a wide range of plants, including fruit crops, trees, turfgrass, and vegetable crops. Anthracnose diseases occur in both northern and southern US blueberry production regions, but are most problematic in tropical and subtropical regions of the eastern United States (Cannon et al. 2012). Symptoms of anthracnose on blueberry occur on leaves, twigs, canes, blossoms, and fruit.

Fruit Symptoms

Anthracnose fruit rot is also referred to as "ripe rot." Infection may occur as early as bloom, with symptoms appearing as the fruit begins to ripen, including shriveling, development of sunken lesions, soft, rotted fruit, and eruption of orange- or salmon-colored spore masses on the blossom end of the fruit (Figure 1). In some cases, symptoms do not appear until after the fruit is harvested and stored

(Polashock et al. 2017). Fungicide applications from bloom through harvest prevent significant ripe rot losses most years when coupled with frequent hand-harvesting and rapid-cooling practices that are standard for SHB growers in Florida. Pre-harvest fungicides are especially important in years where there is a high incidence of disease in the field coupled with warm, wet weather, which can promote disease development.



Figure 1. Anthracnose fruit rot. Credits: M. Velez-Climent

Leaf Symptoms

Leaf spot symptoms of anthracnose are common after harvest in Florida, and the severity differs by variety, with 'Jewel' considered to be one of the most susceptible.

- Fungicide Options
 - Switch or Miravis Prime (fludioxonil)
 - Save for high disease pressure periods 0 day PHI, 4 to 5 apps
 - Quash (fenbuconazole)
 - 7 day PHI, 3 apps allowed
 - Captan
 - Good for low pressure periods or as a tank mix partner
 - Omega (fluazinam)
 - Good efficacy reported from strawberry research, may be tough to find

Not for anthracnose:

- Pristine and Abound
- What about organic products?



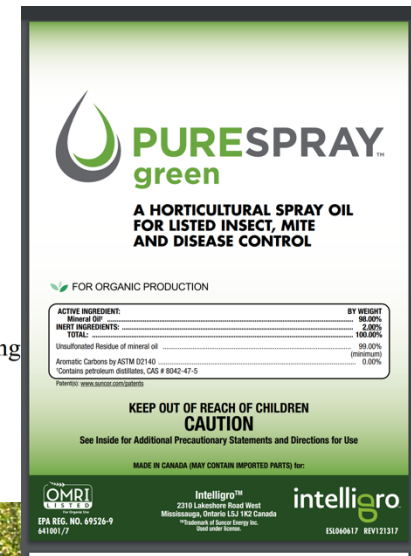
Organic Options

- Copper fungicides
 - Copper hydroxide
- Horticultural oil
 - Purespray Green

Treatment and amount/A	Application timing ^z	Blueberry leaf rust	
		Incidence (%) ^y	Severity (spots/leaf) ^y
Untreated control	----	95.9 a	7.7 ab
Double Nickel LC 2 qt	1-8	95.2 a	9.6 a
Serenade Opti 20 oz	1-8	93.6 a	7.4 ab
OSO 5% SC 6.5 fl oz	1-8	94.3 a	7.4 ab
LifeGard WG 3.4 oz	1-8	92.8 a	7.1 ab
EcoSwing 2 pt	1-8	95.8 a	6.9 b
TimorexACT 17 fl oz	1-8	92.8 a	6.7 bc
ThymeGuard 1.5 qt	1-8	91.3 a	6.4 bc
PureSprayGreen 1.5 gal	1-8	82.6 b	4.2 c

^zTreatments were applied on (1) 13 Mar, (2) 20 Mar, (3) 27 Mar, (4) 5 Apr, (5) 12 Apr, (6) 20 Apr, (7) 27 Apr, and (8) 4 May.

^yRecorded for ~50 leaves per plot on average. Means in each column followed by the same letter are not significantly different according to least significant difference test (LSD)($\alpha=0.05$).





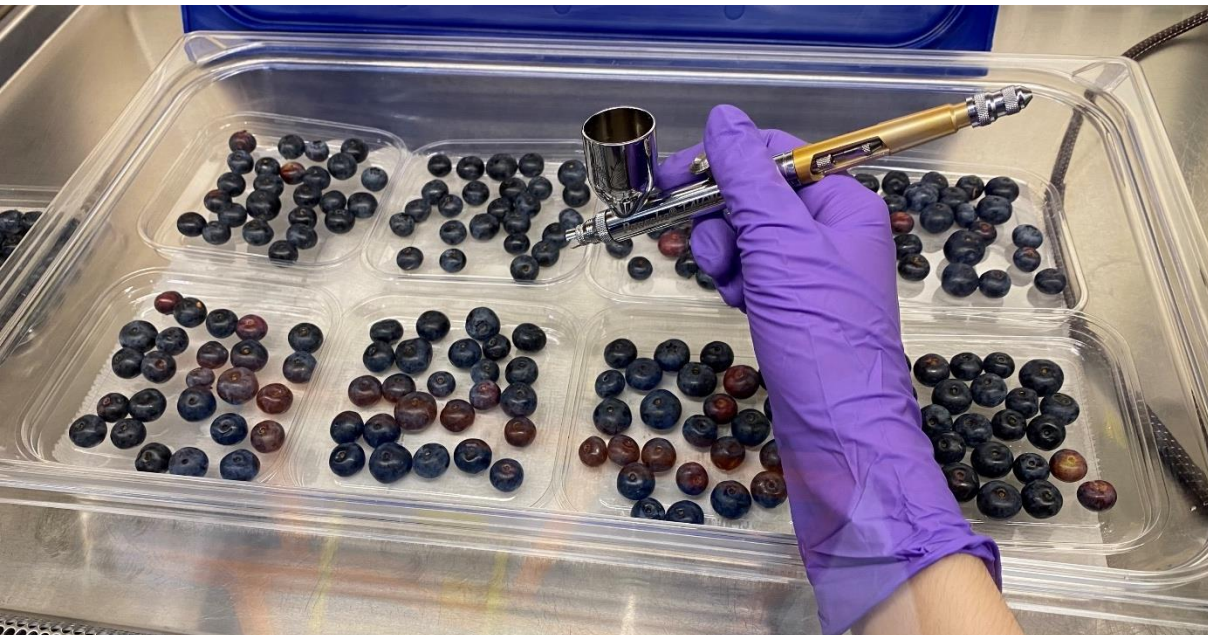
Evaluation of thyme oil vapor for control of postharvest anthracnose on blueberry

Yuru Chang*, Wardatou Boukari, Philip F. Harmon, Ali Sarkhosh, and Jeffrey K. Brecht
Horticultural Sciences Department, University of Florida
Jun 6th, 2022



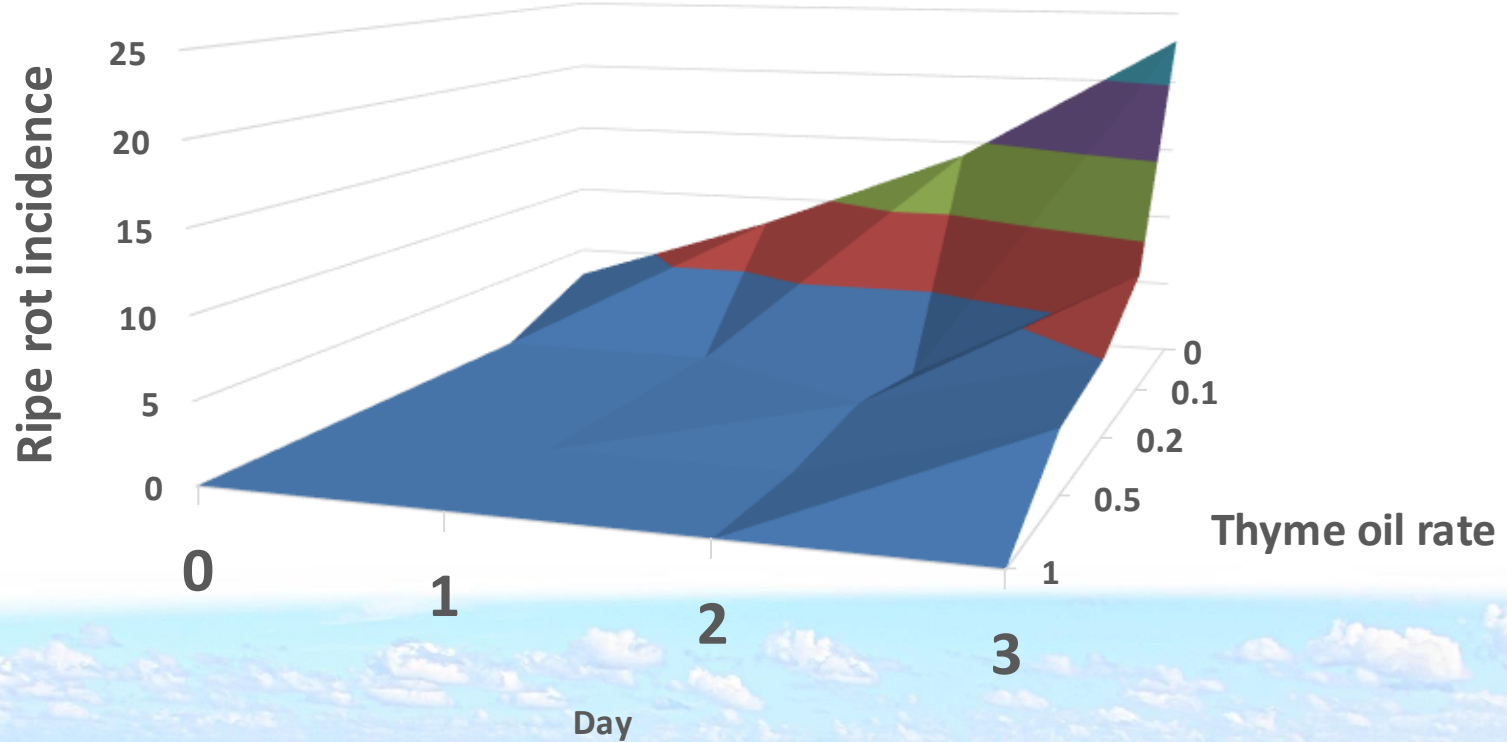
Thyme Oil Vapor

- 7 days at 41F, 4 concentrations plus a control
- Moved to room temp for 3 days
- Measured rot incidence, fruit color and firmness
- cv Suziblue



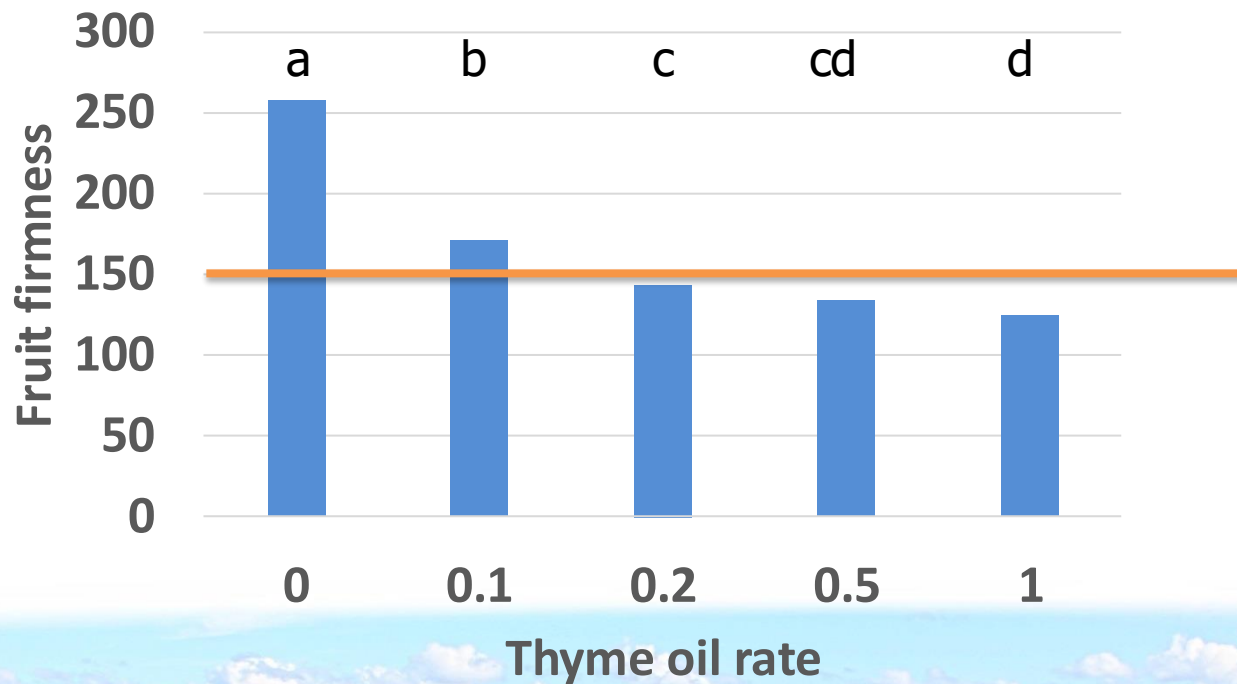
Thyme Oil Vapor

- Anthracnose ripe rot incidence was reduced
 - Rate of 1 is 1000 ppm



Thyme Oil Vapor

- Fruit firmness was reduced
- Color was affected



Essential Oil Products

- Not effective when applied in the field.
 - Blueberry, peach, mango, etc.
 - Products show good invitro toxicity
- Post harvest applications taking advantage of the volatile nature of these oils have shown the most promise so far.
 - Fruit quality limitations
 - More work needed before any commercial use



Any Questions?

Philip Harmon, University of Florida

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