Management of Crown Rot Diseases in Strawberry

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PLANT PATHOLOGY

Major crown rot diseases of FL strawberries

Phytophthora crown rot

Phytophthora cactorum

Colletotrichum crown rot

Colletotrichum gloeosporioides

Charcoal rot

Macrophomina phaseolina

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C. acutatum causes anthracnose fruit rot but also root and crown rot

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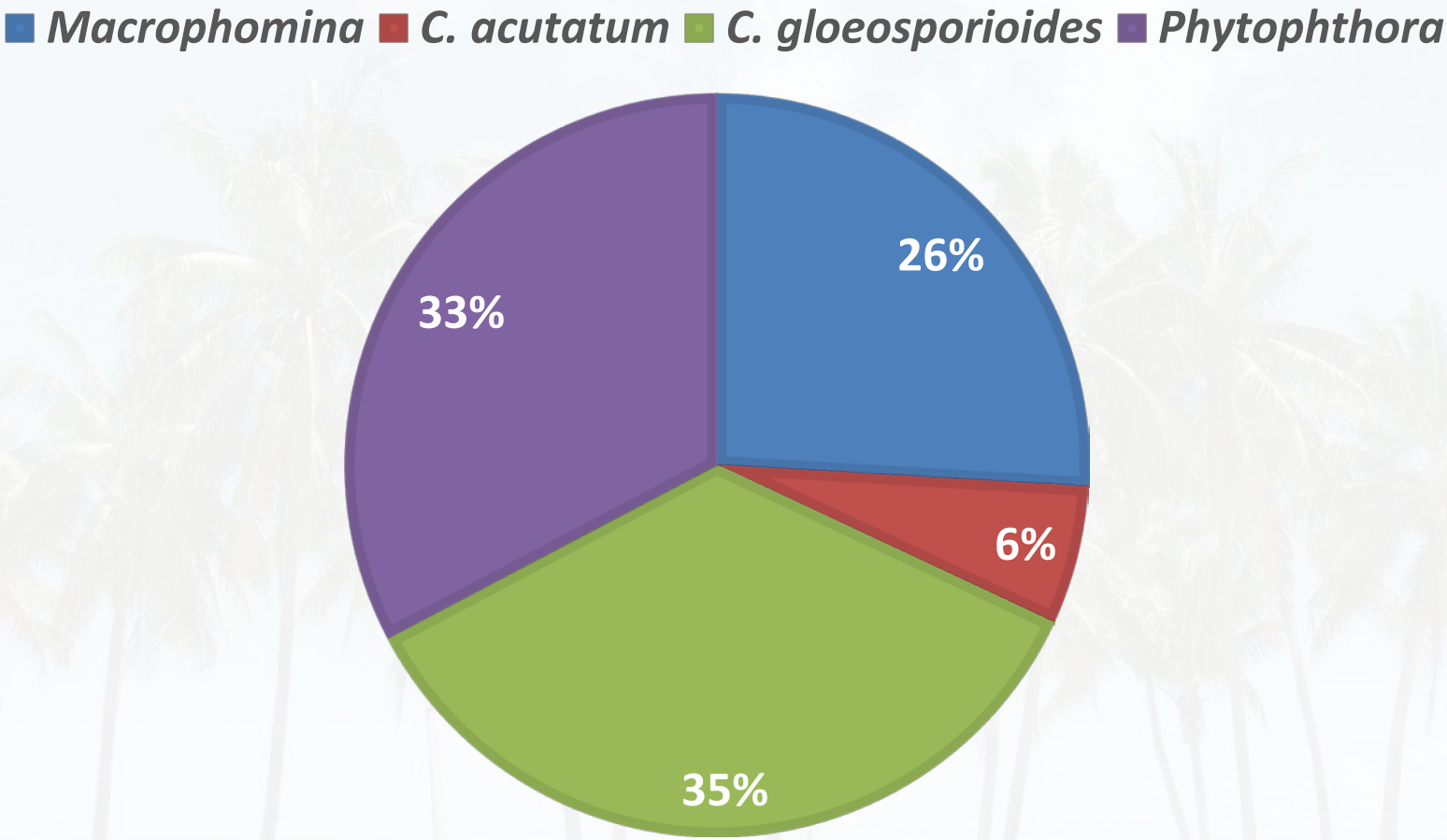
We get them all…



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Diagnosis!!

Phytophthora and Colletotrichum Crown Rots

Crown rot symptoms caused by *Colletotrichum gloeosporioides or Phytophthora cactorum* also similar to charcoal rot caused by *Macrophomina phaseolina*

Phytophthora crown rot

- ✓ **Caused mainly by *Phytophthora cactorum* in Florida but *P. nicotianae* also found**
- ✓ **Favored by similar (warm/humid) weather conditions**
- ✓ **Does not seem to survive over the summer in Florida (Apr to September)**
- ✓ **Inoculum introduced with nursery transplants**

Colletotrichum crown rot

- ✓ **Favored by warm & humid weather**
- ✓ ***Colletotrichum*: high incidence in local summer nurseries (in the past)**
  - ✓ **Production of transplants in northern states greatly reduced disease**
  - ✓ **Low incidence (1-5%) still observed: inoculum from other hosts (oak, wild grapes, etc..)**

Integrated approach for Phytophthora and Colletotrichum Crown Rot management

- ✓ **Correct diagnosis*****

- ✓ **Cultivar selection****

Disease	Festival	Radiance	Winterstar	FL-127	FL Beauty	Brillance
Colletotrichum crown rot	S (60%)	S (50%)	MS (30%)	MR (20%)	MS (30%)	MR
Phytophthora crown rot	R (5%)	HS (60%)	S (50%)	S (50%)	MR (20%)	S

- ✓ **Healthy transplants**
  - ✓ **Nurseries in cooler, non-favorable areas**
  - ✓ **Heat treatment (nurseries)**

- ✓ **Cultural practices (tunnel, drip)**

Integrated approach for Phytophthora and Colletotrichum Crown Rot management

Fungicides

- ✓ **Colletotrichum**
  - ✓ **Preventative captan applications (susceptible cv)**

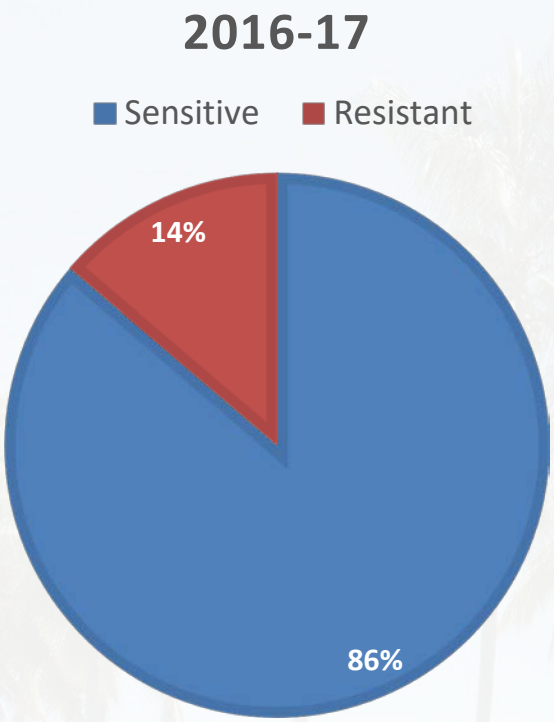
- ✓ **Phytophthora**
  - ✓ **applications of Ridomil (mefenoxam) after plant establishment (through drip)**
  - ✓ **regular applications of phosphorous acid or phosphite materials throughout the season (drip or foliar)**

Fungicide plant dipping is a good strategy *only* if problem is known

- ✓ In the case of *C. acutatum* infected plants…
- ✓ Abound: Resistance has limited the efficacy [might still work if R not present]
- ✓ Switch: has consistently worked in *most* of our trials but concern about phytotoxicity and overuse [4 app max]
- ✓ Actinovate and others: inconsistent results
- ✓ Zivion (natamycin): found effective in FL and CA trials [EPA just approved; OMRI application filed]
- ✓ Current recommendation: to dip ***IF*** cultivar or nursery is known to have a problem with *C. acutatum*

Current challenges with fungicide recommendations

Emergence of Phytophthora resistance to mefenoxam (FRAC 4)



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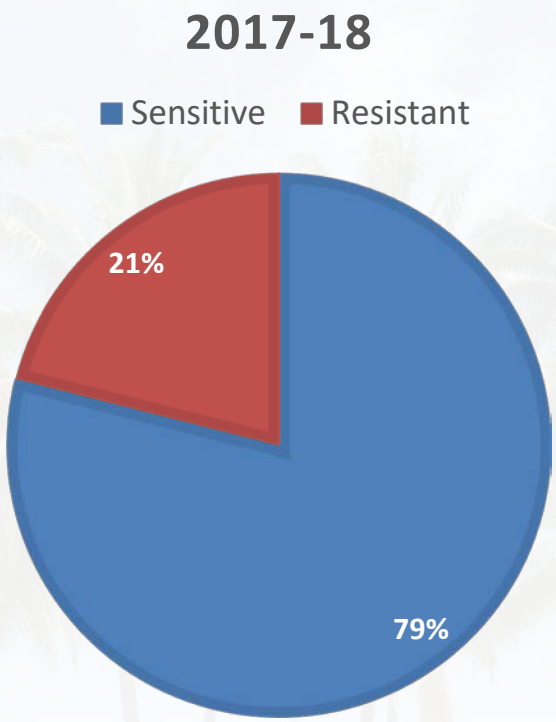

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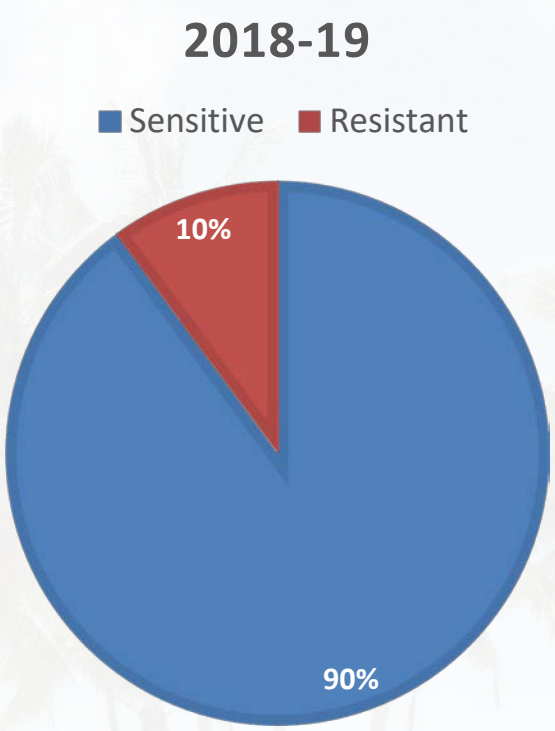

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… but it is limited to 2 nursery sources

→ Orondis (registration pending)

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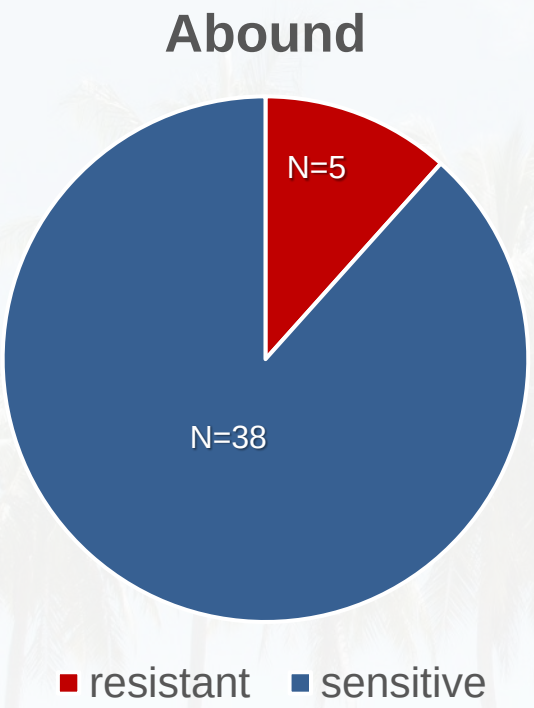
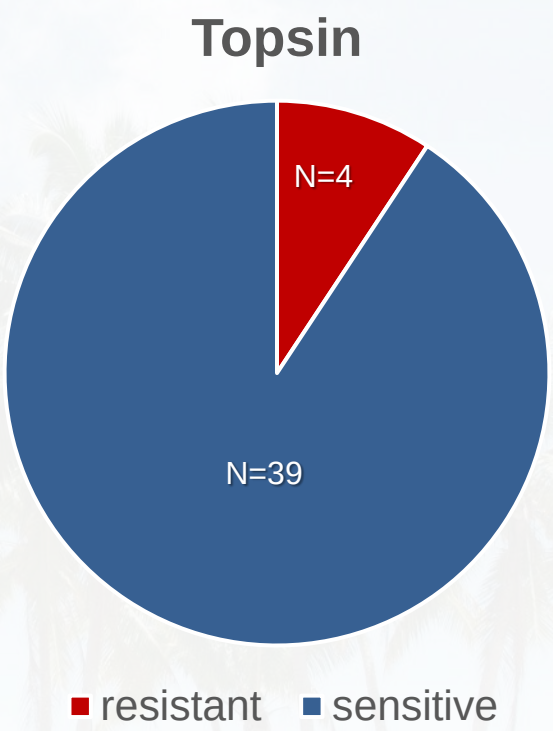
C. gloeosporioides resistance to Topsin and Abound



(+ Cabrio, Flint, Evito, etc)



***C. gloeosporioides* inoculum from other hosts**

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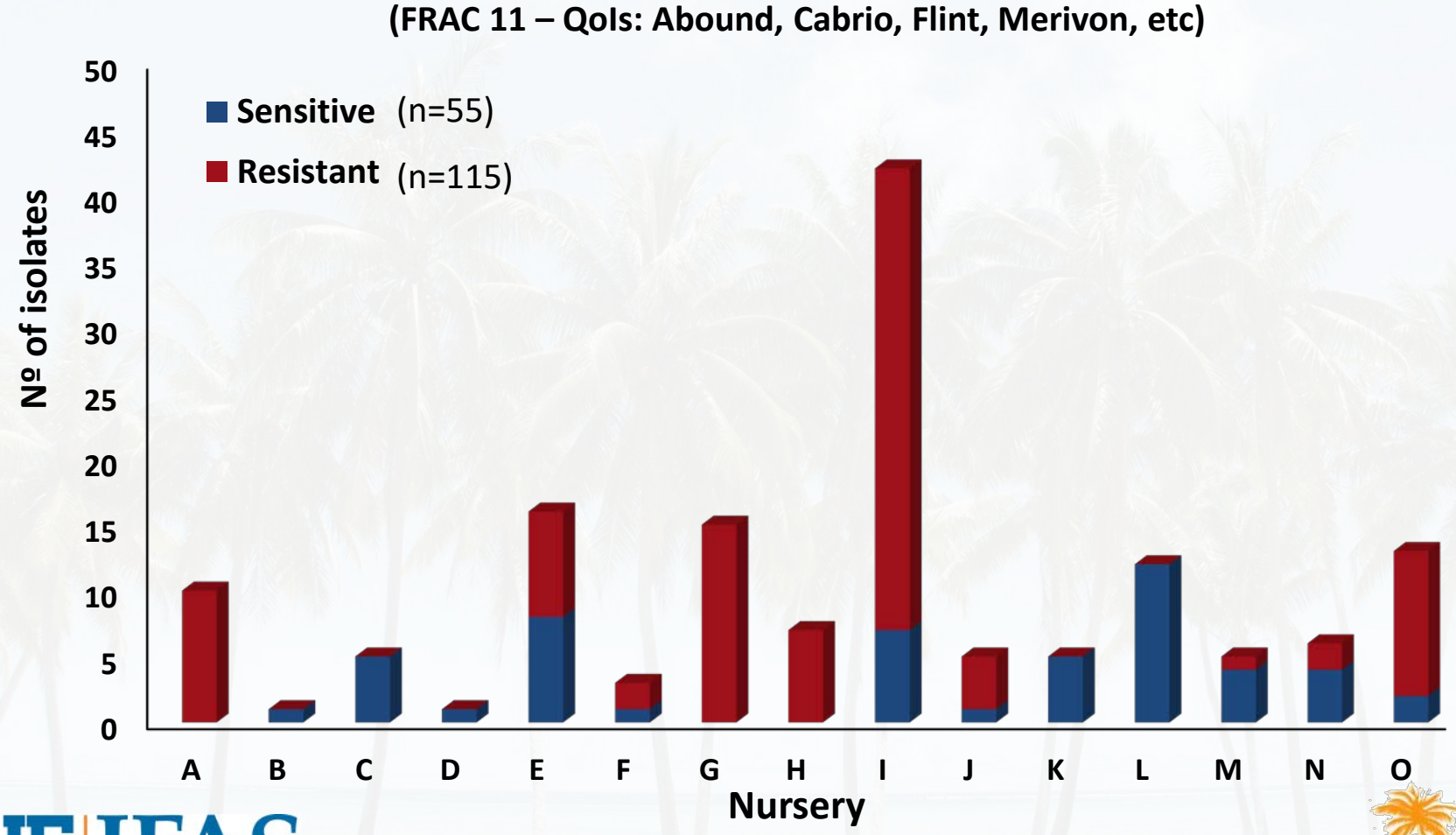
Emergence of *C. acutatum* resistance to QoI fungicides (FRAC 11)



→ Resistant strains found in 10 of 15 nurseries sampled!

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Develop non-chemical suppressive methods for strawberry diseases

- **Heat treatment**
  - Hot water treatment has been investigated and used to various degrees
    - Beginning with Buchner (1991) for cyclamen mite
  - Hot water treatment was commonly used in some nurseries (delayed growth makes it impractical for fruit production)
    - Also reduction in flowering!
  - Current protocols are generally not useful for disease management
    - 49°C for 7 min
  - Difficult to find a treatment that kills the bacteria (*Xanthomonas*) while minimizing plant damage

‘Aerated steam’ (plant sauna) field trials

Treatment
1. Non-treated control
2. Preheat (37°C, 1 h) + Steam (44°C, 2 h)
3. Preheat (37°C, 1 h) + Steam (44°C, 4 h)
4. Steam (44°C, 2 h)
5. Steam (44°C, 4 h)

99°F for 1 h
111°F for 2-4 h

Field trial: effect of heat treatment of transplants inoculated with *P. cactorum*

Inoculated + Heat-treat

37°C for 1 hour
44°C for 4 hours

Treatments	Plant mortality (%)
Inoculated control (non treated)	80.0 a
Inoculated + Heat treated (37°C for 1 hour f.b. 44°C 4 hours)	2.5 b
Non-inoculated (non treated)	0.0 b
Non-inoculated + Heat treated	0.0 b

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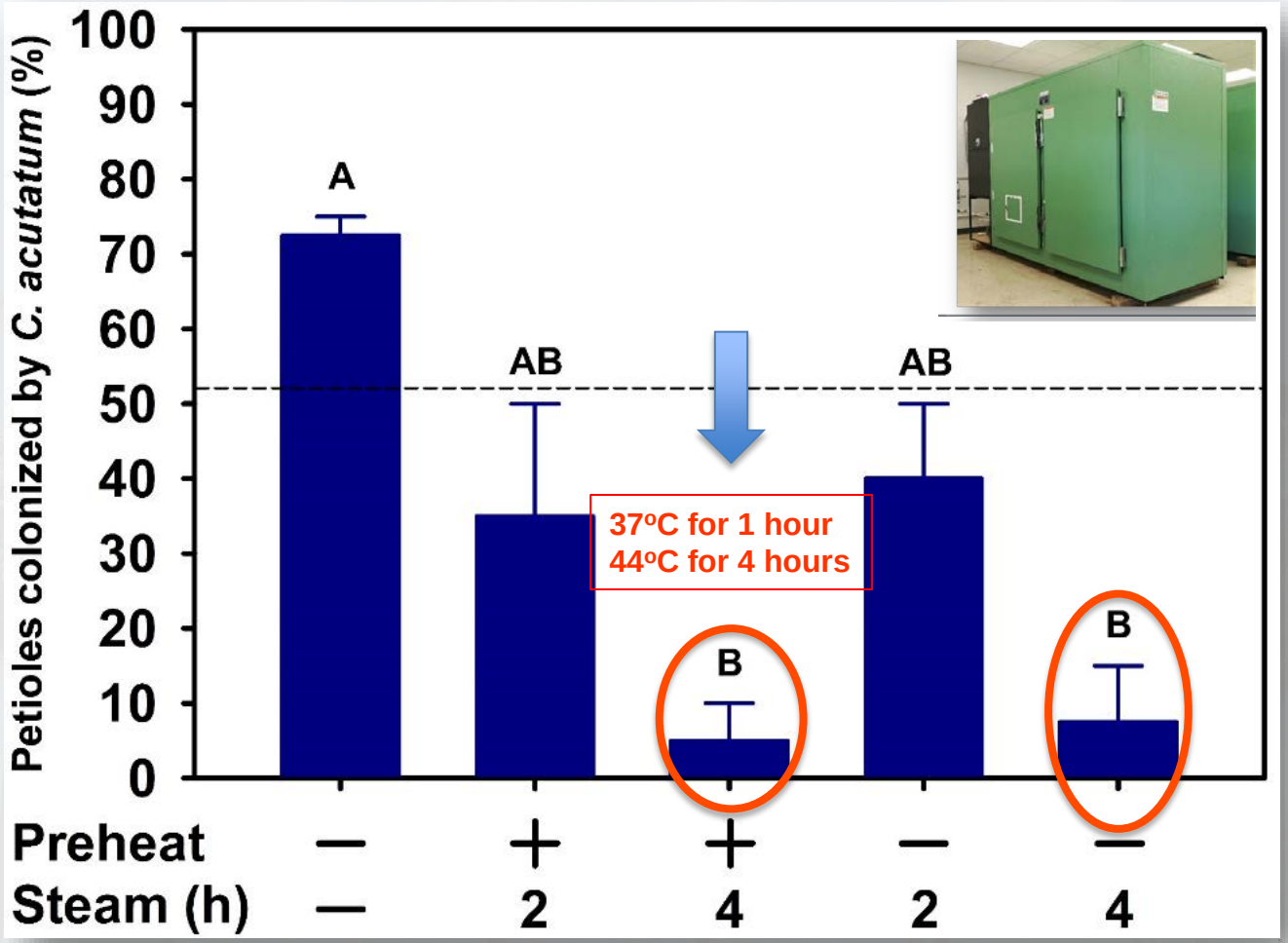
Effect of steam heat treatment on colonization of transplants by *C. acutatum*



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Heat treatment of transplants as cultural management for nurseries

- ✓ **Trial results show suppression of *Xanthomonas, Phytophthora, Colletotrichum, Botrytis,* Powdery mildew, *but not Macrophomina***

- ✓ **Trials in NC and Quebec nurseries**

99°F for 1 hour
111°F for 4 hours

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Charcoal Rot caused by *Macrophomina phaseolina*

*** Similar to symptoms caused by *Colletotrichum* and *Phytophthora***

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Inoculum survives in the soil and strawberry residue (mainly crowns) from previous seasons

- Optimum conditions: high temperatures (~ 85 F), sandy soils and low soil moisture

Survival: resistant structures: MICROSCLEROTIA

Soil

Strawberry crowns

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Inoculum from old crowns can infect new transplants

Double crop
(plastic re-used)

Integrated approach for Charcoal Rot management

- ✓ Crop destruction
- ✓ Crop residue removal
- ✓ Cultivar selection
- ✓ Pre-plant fumigation


Herndon, A.


Baggio, JS.


Herndon, A.

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Macrophomina infested field one year later…

2017-18

2018-19

Integrated approach for management of crown rot diseases

- ✓ Fumigation (*Macrophomina*) – Telone C35, PicClor80, KPam
- ✓ Healthy transplants (*Phytophthora*)
  - ✓ Heat treatment (nurseries)
- ✓ Fungicide injections/sprays (*Phytophthora* and *Colletotrichum*)
  - ✓ Important to monitor for fungicide resistance + identify/register new compounds
- ✓ Cultivar selection**

HS: Highly susceptible; **S**: Susceptible; **MS**: Moderate susceptible; **MR**: Moderate resistant; **R**: Resistant

Disease	Radiance	Winterstar	FL-127	FL Beauty	Brilliance
Colletotrichum crown rot	**S** (50%)	**MS** (30%)	**MR** (20%)	**MS** (30%)	**MR**
Phytophthora crown rot	**HS** (60%)	**S** (50%)	**S** (50%)	**MR** (20%)	**S**
Charcoal rot	**MS** (50%)	**MR** (10%)	**MR** (20%)	**MS** (40%)	**MR**

Emerging problem: *Pestalotiospis (Pestalotia)* leaf and fruit spot

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Pestalotiospis (*Pestalotia*) leaf and fruit spot

- **Symptoms on fruit, leaves, petiole, crown, and root**

Other leaf spots may be confused with *Pestalotiopsis*

Common leaf spot
(*Mycosphaerella fragariae*)

Tan center lesions
Darker outer zone

Leaf scorch
(*Marssonina fragariae*)

Small tan center lesions
Darker outer zone

***Phomopsis* leaf blight**
(*Phomopsis obscurans*)

Reddish-purple lesions
Darker outer zone

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Other leaf spots may be confused with *Pestalotiopsis*

Gnomonia leaf blotch
(*Gnomonia comari – Zythia fragariae*)

Cercospora leaf spot
(*Cercospora sp.*)

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Pestalotiopsis sp. is not new to strawberry

- ✓ **Reported for many years to cause fruit rot**
  - **1973: C.M. Howard**
    (*Pestalotia longisetula*)

- ✓ **More recently many reports worldwide of crown/root rot establishment difficulties (weak and stunted plants)**
  - **Spain, Netherlands, Belgium**
  - **Mexico, Brazil, Argentina**
  - **Bangladesh, Vietnam, India**
    (*Pestalotiopsis clavispora*)

- ✓ ***Aggressive leaf spot/blight: New!!!***

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J. Mertely

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The aggressiveness of current *Pestalotiopsis* outbreak is unprecedented

- ✓ **In general, *Pestalotiopsis* sp. is considered a weak pathogen; more likely to attack plants previously weakened by other stress factors (e.g. poor growing conditions, physical damage, pests, etc).**

- ✓ **Definitely not in this case!**

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We confirmed that isolates from recent outbreaks are more aggressive

Isolates	Tissue source	Fruit incidence (%)	Severity (%)	Root/Crown Incidence (%)
11-359R	root	0.0 c	0.0 b	35.0
11-360C	crown	5.5 c	0.6 b	75.0
13-460P	petiole	0.0 c	0.0 b	50.0
13-481R	root	25.0 b	3.8 b	55.0
14-691R	root	-	-	65.0
16-337C	crown	25.0 b	6.7 b	75.0
17-10F	fruit	97.2 a	78.4 a	90.0
17-40F	fruit	100.0 a	81.6 a	65.0
17-43L	leaf	88.9 a	73.2 a	70.0

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Acknowledgment

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Thank you!!
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