Citrus Black Spot (Guignardia citricarpa): Identification, Biology and Control

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Fungal Disease

- Causal agent: Guignardia citricarpa
- Asexual name: Phyllosticta citricarpa
- Hosts: Citrus species and hybrids
- Symptomatic: Sweet oranges, mandarins and tangerines, lemons
- Non-symptomatic: ‘Tahiti’ lime
- Produces spores

Black Spot

- Rind spots cause the economic damage
  - internal quality unaffected
- Reduces fruit value for the fresh market
- Restricts export of fresh fruit
  - mostly to European countries and U.S
- Causes premature fruit drop reducing yield
  - Especially on late harvested cultivars

Symptoms Occur on Maturing Fruit

- Unusual to see hard spot more than 2 months before maturity
- Exposure to sunlight increases lesion number
  - Warm temps (~ 81F, 27C) also increase disease
- Symptoms generally occur on the ‘sunny side of trees’

Hard Spot

- The most characteristic symptom
  - If hard spot is found then likely some of the other symptoms will be as well
  - If scouting for disease concentrate on this symptom
- Small round sunken lesions with brick red-chocolate brown margin and tan center
  - Fungal structures often seen as slightly raised pencil-point dots
  - Can have green halo around lesion

Hard Spot
False Melanose

- Looks like melanose from a distance
  - Melanose is rough and is quite red
- False melanose is a large number of small slightly raised lesions with a smooth texture
  - Usually occurs in heavily infested groves
  - Can occur on green fruit
  - No fungal structures present
  - Can become hard spot later in season

Cracked Spot

- Reported to be interaction with rust mite damage
- Large, flat, dark brown lesions with raised cracks in their surface
  - Can become hard spot later in season
  - Occurs on green and mature fruit

Virulent Spot

- Early symptoms small reddish irregularly shaped lesions.
  - Can develop into either virulent spot or hard spot
- Virulent spot is the expansion and/or fusion of many lesions covering most of fruit surface
  - Many fungal structures present
  - Occurs only on mature fruit as well as post harvest in storage
**Leaf and Stem Symptoms**

- Leaf symptoms are uncommon in groves with good control but present when little or no control under taken
  - Lesions most commonly found on highly susceptible lemons
  - Can be found on any cultivar
- Small reddish-brown lesions
  - Tan center forms as lesions age
  - Old lesions have dark brown margin sometimes with large yellow halo

**Black Spot Disease Cycle**

1. **Leaf drop**
2. **Under leafflaw**
3. **Early symptom development**
4. **PYCNIDIA**
5. **CONIDIA**
6. **SPORES**
7. **PYCNIDIA**

**Disease Cycle Highlights**

- Major source of inoculum: decomposing infected leaves on orchard floor (ascospores)
- Additional source of inoculum: lesions on infected fruits, leaves and branches (conidia)
- Means of spread: Wind (ascospores); Water splash (ascospores and conidia)

**Disease Cycle Highlights cont.**

- Optimal conditions for infection:
  - Temperatures 70-90 F (21 – 32 C)
  - Wetting period 24 - 48h
- Symptom expression: 1 – 12 months
- Survival of the fungus: leaves, leaf litter branches, fruits and peduncles

**Cultural Controls**

- Minimize trash when picking to avoid inadvertent movement of the fungus from one location to another
- Increase air flow in trees to reduce leaf wetness where possible
- Avoid cultivars with significant off-season bloom
- Purchase clean nursery trees
- Reduce leaf litter to reduce ascospore load
**Leaf Litter Reduction**

- Work done with Greasy spot fungus *Mycosphaerella citri*
- Primary disease causing spores also formed in leaf litter
- Need to determine effect on *G. citricarpa*
- Found that litter/spores were reduced by 70-90% with urea (1 application), lime, ammonium sulfate and frequent irrigation
- Source of nitrogen important
  - Nitrate little to no effect

**Black Spot Application Timing**

- Fruit is susceptible for 5-6 months post-petal fall
- Use strobilurins when concerned about copper phytotoxicity

**Conclusions of Study**

- Better field control consistently lead to fewer postharvest affected fruit
- Storing fruit at low temperatures consistently lead to fewer symptomatic fruit
  - Once fruit in warm temperatures symptoms could appear
- Benomyl drenches were ineffective
- Fungicides dips and waxes were ineffective

**Fungicides**

- Must work with fungicides registered for citrus in Florida
- Reported efficacy in other countries
- Copper – all formulations found to be equivalent
- Strobilurins (Abound, Gem and Headline)

**Postharvest Treatments**

- High temperatures and intense light promote symptoms (~ 81°F; 27°C)
- Lemons from Argentina have been exposed to these conditions before export to USA
- Cool temperatures (46°F; 8°C) reduce disease in storage

**Postharvest**

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* 0.08 to 0.04 mg L⁻¹ in Florida
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**Agostini et al., 2006**
Effects on Fungal Viability

- Tested humidity, fruit vs. peel, temperature and length of time in storage for effects on ability to isolate fungus

- Were able to isolate fungus after 40 days
- *G. citricarpa* was viable long after fruit not marketable
- No treatment had a significant effect

Agostini et al, 2006

Questions?