Citrus canker

Field Detection Guide

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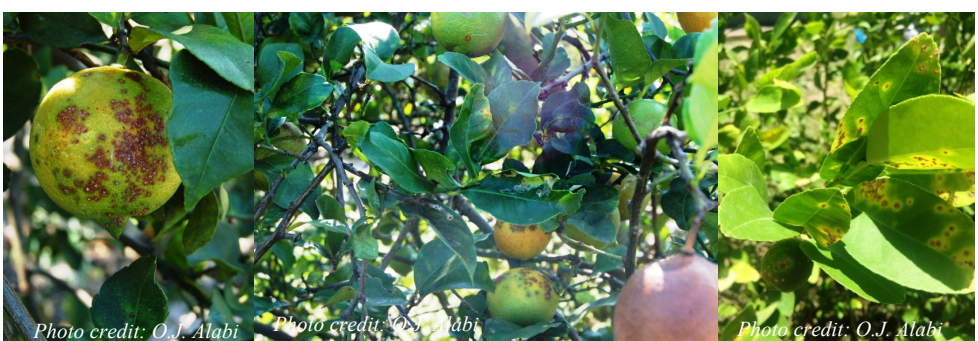
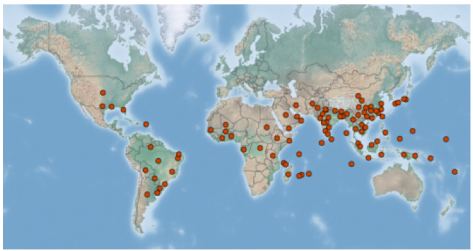


History & distribution of citrus canker

- Probably originated in Southeast Asia
  - symptoms on 1827 Indian herbarium specimens
- Affects all citrus and some citrus relatives
- Currently occurs in >30 countries; several continents



Credit: https://www.cabi.org/isc/datasheet/56921

Credit: http://idtools.org/news_10_17_2016.php

Global history of citrus canker

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  - symptoms on 1827 Indian herbarium specimens
- Affects all citrus and some citrus relatives
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Photo credit: O.J. Alabi

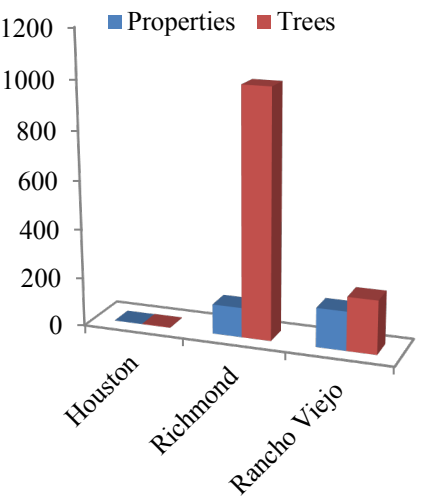
Citrus canker in the U.S.

- Discovered in the Gulf States in 1915
  - Introduced via infected trifoliate orange nursery stock from Japan
- Widespread across commercial citrus producing counties of FL
- Present in the southern citrus-producing states

Photo credit: O.J. Alabi

Disease status in TX

- Possibly introduced in the 1990's
- Appeared eradicated from Texas by 1947
- Recent detections
  - Rancho Viejo: A^W strain on limes & lemons
  - Gulf Coast: Canker A on different cultivars



Data source: TDA (April 30, 2018)

TX citrus canker quarantine map

Disease symptoms & signs

- Canker lesions are typically raised or pustular (blister-like)
  - may be circular or irregular
  - produced in all above ground parts (fruit, leaf, stem)
- Leaf lesions often surrounded by yellow halo with water-soaked margins

Credit: http://idtools.org/news_10_17_2016.php

- Mature lesions on older leaves may have a shot-hole appearance

Citrus canker: sweet orange

Blister-like lesions on leaves (left) and fruits (right).

Citrus canker: sweet orange

Canker lesions are produced in all plant parts.

Citrus canker: grapefruit

Photo credit: https://www.agric.wa.gov.au/citruscanker2018

Blister-like lesions on leaves, fruit and stem

Citrus canker: Lime

Canker induced lesions are both symptoms and signs of the disease.

Citrus canker: Lime

Young lesions with yellow halo (left) and old lesions displaying shot hole effect (right).

Citrus Canker, *Xanthomonas citri* subsp. *citri* (Syn. *Xanthomonas axonopodas* pv. *citri*)

Typical Symptoms on Grapefruit

Screening Aid for Citrus Canker Disease Symptoms by Dan Robl, Plant Pathologist, USDA, APHIS, PPQ, CHRP

Lesions go all the way through leaf…

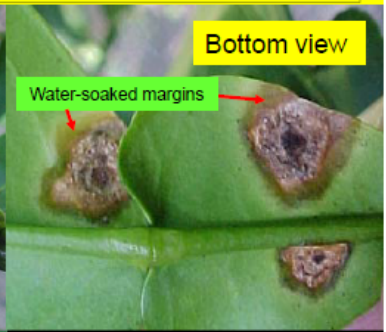
are rough & raised,

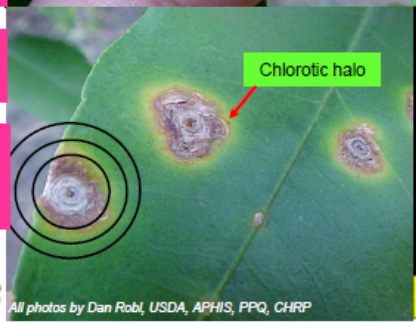
with chlorotic halos,

and water-soaked margins.

They are also spatially discrete,

usually round, and exhibit a pattern of concentric circles.





Fruit lesions

All photos by Dan Robl, USDA, APHIS, PPQ, CHRP

Causative agent

- Citrus canker is caused by rod-shaped Gram-negative bacterium
  - *Xanthomonas citri* subsp. *citri*
    - syn. *X. axonopodis* pv. *citri*
- The bacterium produces yellow ‘xanthomonadin’ pigment on semi-selective media

Photo credit: Gottwald, T.R. 2000. Citrus canker. The Plant Health Instructor. DOI: 10.1094/PHI-I-2000-1002-01

Bacterial diversity & distribution

- X. axonopodis exists in multiple forms based on:
  - biological, serological and molecular properties
- Canker A [Asiatic canker]:
  - wide host range; more widespread; greater severity; exists as variants
- Cancrosis B, C, & D:
  - narrow host range; local distribution

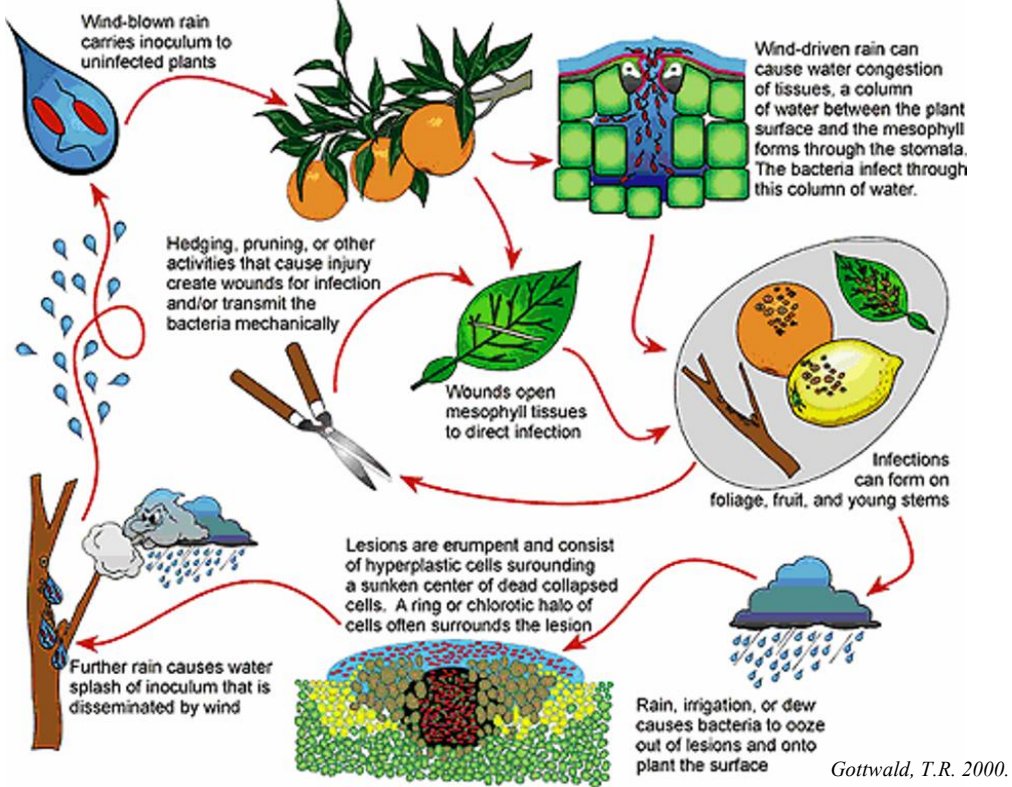
Credit: http://idtools.org/news_10_17_2016.php

- The different citrus canker forms and their variants are symptomatically indistinguishable

Disease epidemiology

- Spread over long and short distances occur via:
  - nursery trade, contaminated tools and equipment, wind-driven bacteria cells, lesions on plant debris
- Ports for bacterial entry into citrus:
  - natural openings, wounds,
- Disease is favored by:
  - periods of warm, moist conditions
  - disease development is optimal at 68ºF to 86˚F
- The Asian leafminer (*Phyllocnistis citrella*) implicated in bacterial cell dispersal

Photo credit: Gottwald, T.R. 2000. Citrus canker. The Plant Health Instructor. DOI: 10.1094/PHI-I-2000-1002-01



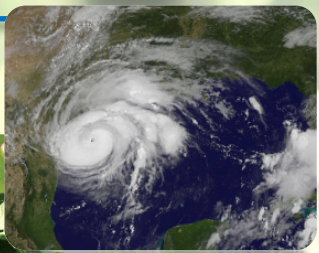
Gottwald, T.R. 2000.

Predicted Hurricane-mediated Long-distance dispersal analysis for: 1) CBS in Florida and 2) Citrus Canker in Texas

Tim Gottwald

Weiqi Luo, Drew Posny, Shuo Zhang

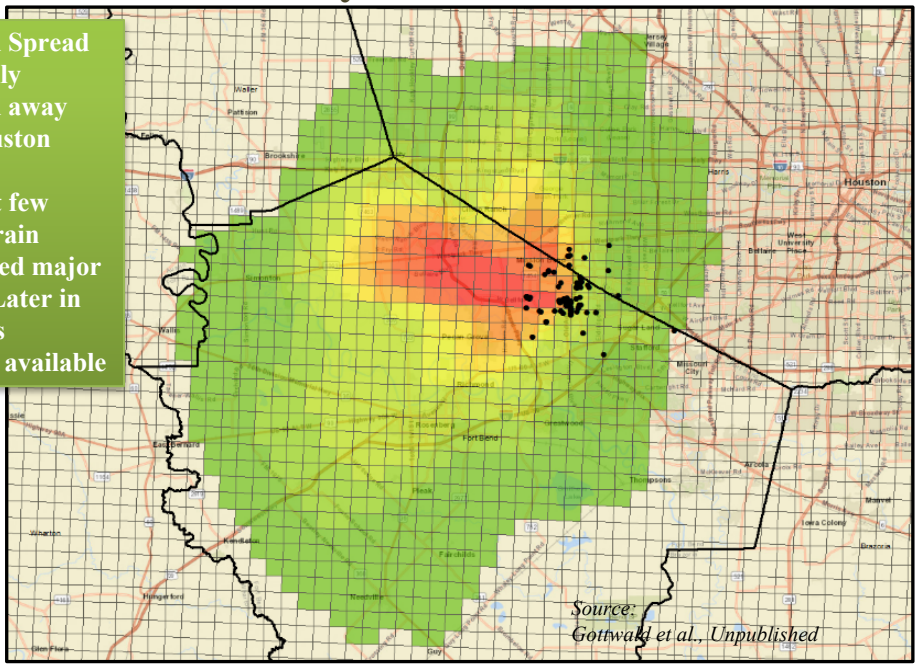
Tim Riley



Predicted high-risk citrus canker dispersal area associated with Harvey in Houston area

Predicted Spread is generally westward away from Houston

Only first few hours of rain contributed major spread. Later in storm less inoculum available



Risk

0.00
0.01 - 1.00
1.01 - 5.00
5.01 - 37.24
37.25 - 61.53
61.54 - 95.60
95.61 - 140.18
140.19 - 197.78
197.79 - 289.25
289.26 - 433.94

Source: Gottwald et al., Unpublished

Economic impact

- Growers:
  - loss of production
  - loss of acreage
  - spray costs (labor, chemical, equipment)
  - inspection and sanitation cost
- Regulatory agencies:
  - personnel cost
  - research expenditures
  - inspection and sanitation
  - cost of eradication programs
- Over $1.4 billion spent on eradication efforts by Federal and State agencies in FL
- $134-$350/ac. increase in grove care

Disease management

- Disease exclusion
  - clean plants
- Quarantine regulations
  - federal and state
- Good sanitation
  - equipment
  - plant debris
- Eradication
  - effective in early stage of epidemic
  - areawide implementation
- Chemical control
  - bactericides as protectants
  - leafminer control

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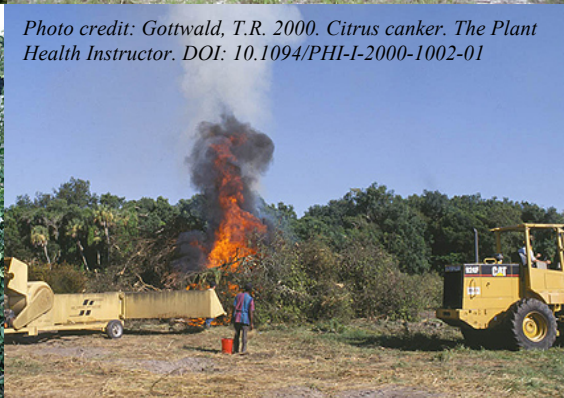
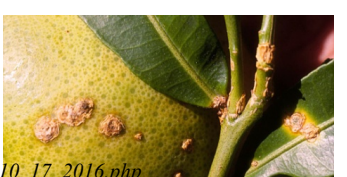


Take-home message

- Citrus canker is a devastating disease
  - fresh fruit industry of TX is at greater risk
- Symptoms recognition enhances accurate sampling and correct diagnosis
- Long distance spread facilitated by:
  - human activity
  - natural events e.g. hurricanes
- Awareness and compliance with Federal and State regulations key to prosperity of TX citrus industry
  - outreach & education critical



Credit: http://idtools.org/news_10_17_2016.php

Useful resources

- http://www.texasagriculture.gov/RegulatoryPrograms/PlantQuality/PestandDiseaseAlerts/CitrusCanker.aspx
- https://www.aphis.usda.gov/aphis/ourfocus/planthealth/plant-pest-and-disease-programs/pests-and-diseases/citrus-health-response-program
- http://www.citrusalert.com/

Credit: Gottwald, T.R. 2000.