

# The 'other' soilborne diseases

## Postharvest fruit diseases

### Grow Help Australia diagnostic service



## The 'other' soilborne diseases

- Verticillium wilt
- Cylindrocladium, Cylindrocladiella, Cylindrocarpon
- Basidiomycete diseases
  - brown root rot – *Phellinus noxius*
  - *Trametes* (?)

# Verticillium wilt

see Talking Avocados  
Summer 2009/10





# Verticillium wilt



# Verticillium wilt

- Caused by the fungus *Verticillium dahliae*
  - wide host range – potato, tomato, cotton, strawberry, peanut, weeds
- Sudden wilting of leaves on a branch, one side or whole tree. Leaves die but remain on tree
- Dark brown streaks “vascular discolouration” in xylem tissue
- Serious outbreaks where scion overgrowth or radical pruning/limb removal in winter stresses roots

# Verticillium wilt

- Infects healthy or injured feeder roots, colonises xylem in spring, tree produces gums that plug vessels – wilt
- Survives in soil as hardened microsclerotia
  - stimulated to germinate by root exudates
- Fungus prefers cool (<25°C) acidic, wet soil conditions – favour water flow and movement of spores in tree
- High summer temps arrest infection, trees recover, but may recur – remove trees repeatedly infected
- Mexican rootstocks more resistant



# Management of Verticillium wilt

- Foliar protectant fungicides are not effective
- Prevent planting where susceptible crops previously grown esp. solanaceous crops
- Prune out dead wood when vigorous shoots have appeared (will not eliminate fungus, but slow spread)
- Do not chip and use infected prunings as mulch
- Delay canopy management till temps warmer and unfavourable to the fungus
- Fumigation of replant sites with metham sodium or chlorpicrin



# Cylindrocladium, Cylindrocladiella, Cylindrocarpon

- Considered a complex of 'nursery' fungal pathogens
  - *Cylindrocladium parasiticum*
  - *Cylindrocladiella parva*
  - *Cylindrocarpon destructans*
- Large losses in young avo plantings
- *C. parasiticum* - aggressive pathogen of young seedlings in a pathogenicity test
- Path tests not yet done for other 2, but isolated from diseased roots







# Cylindrocladium & Cylindrocladiella in Eucalypts

- *Cylindrocladium* & *Cylindrocladiella* (many species) known as “damping off” and “seedling blight” pathogens, also cause stem canker, leaf and shoot blights, root rot, wilt and dieback in young trees
- Disease enhanced by overhead irrigation, excessive soil moisture, heavy shade, high temps & humidity, dense plantings
  - ie. nursery cloning rooms perfect incubators
- Evidence for resistance



## “Cylindro” complex in avocado

- Transplant stress, over-irrigation + other cultural or environmental factors + contamination of nursery stock may exacerbate decline and death of newly planted trees
- *Cylindrocarpon* consistently isolated from necrotic feeder roots (a root ‘nibbler’) – could predispose trees to other pathogens or disrupt nutrient & water uptake etc.
- Israeli research shows that drenching sick trees (*Cylindrocarpon*) with prochloraz may help

## BAITING FOR CYLINDROCLADIUM

two week old lucerne seedlings



**Positive - Cylindrocladium present**

**Control**



## BAITING FOR CYLINDROCLADIELLA



Positive



Control

Two week old *Cylindrocladiella* positive lucerne seedling baits



# Cylindrocladium



# Brown root rot

- Caused by basidiomycete fungus *Phellinus noxius*
  - confirmed on 25 properties in Atherton Tablelands, Bundaberg/Childers, Sunshine Coast, ntnh NSW
- Wide host range in tropics, sub tropics
  - avocado, mango, hoop pine, Ficus sp., jacaranda
- Replanting fails – fungal hyphae can survive in woody debris in soil
- No chemical control – remove and isolate infected trees, install root barriers



# Sudden leaf wilt and tree death





## Infection “stocking”





# Spreads by root-to-root contact along rows





## *Trametes* sp.

- (syn. *Coriolus*, *Polyporus*, *Polystictus* spp.)
- Many species, widespread
- Observed on dead wood in rainforests, also hoop and exotic pine plantations
- May invade via wounds rotting inner heartwood of living tree
- Limited reference to *T. versicolor* being a pathogen of fruit trees
- ***Identity to be confirmed!***





*Trametes versicolor*





# Postharvest fruit diseases

- Overview of anthracnose and stem-end rot
- Experimental results
  - Rootstocks, including nutrition
- Integrated control
  - Field fungicides, including strobilurin group
  - Postharvest care & fungicides



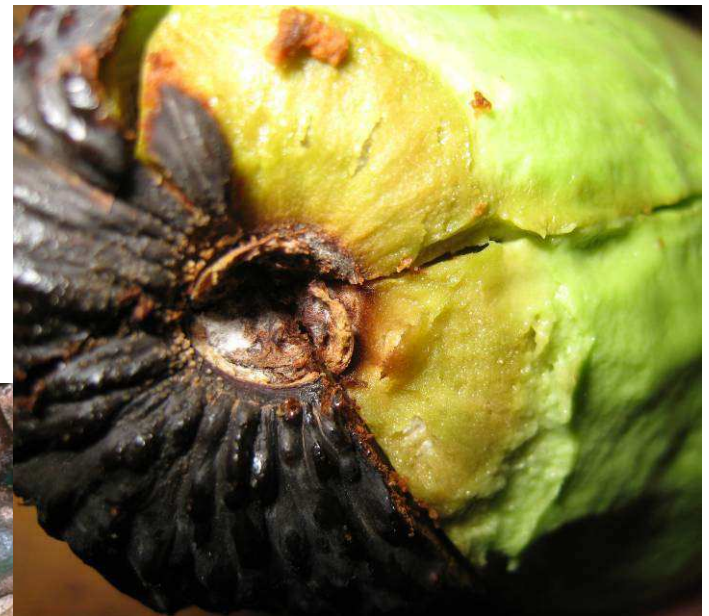
# Postharvest diseases



anthracnose



stem-end rot

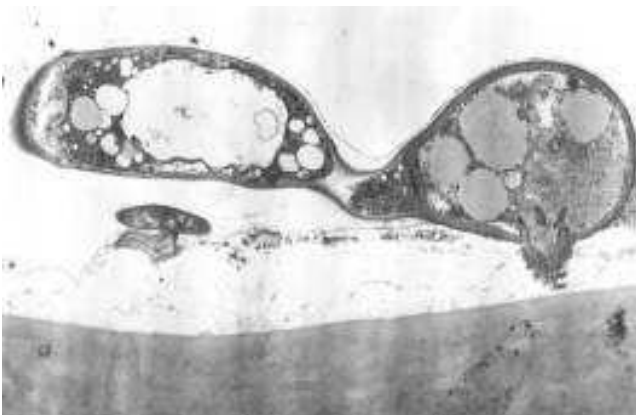


# Anthracnose (*Colletotrichum gloeosporioides*)

Infection occurs in field from fruit set to harvest

**dormant**  
→  
**period**

Symptoms develop during fruit ripening

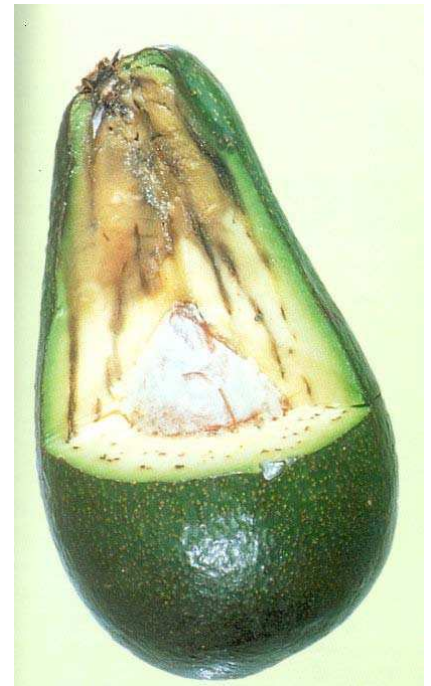


# Stem-end rot (many fungi)

- *Botryosphaeria* spp
- *Lasiodiplodia theobromae*
- *Colletotrichum gloeosporioides*
- *Phomopsis perseae*
- *Thyronectria pseudotrichia*

Stem-end rot (SER) fungi colonise the stem tissue of avocado trees without causing disease

Symptoms develop during fruit ripening

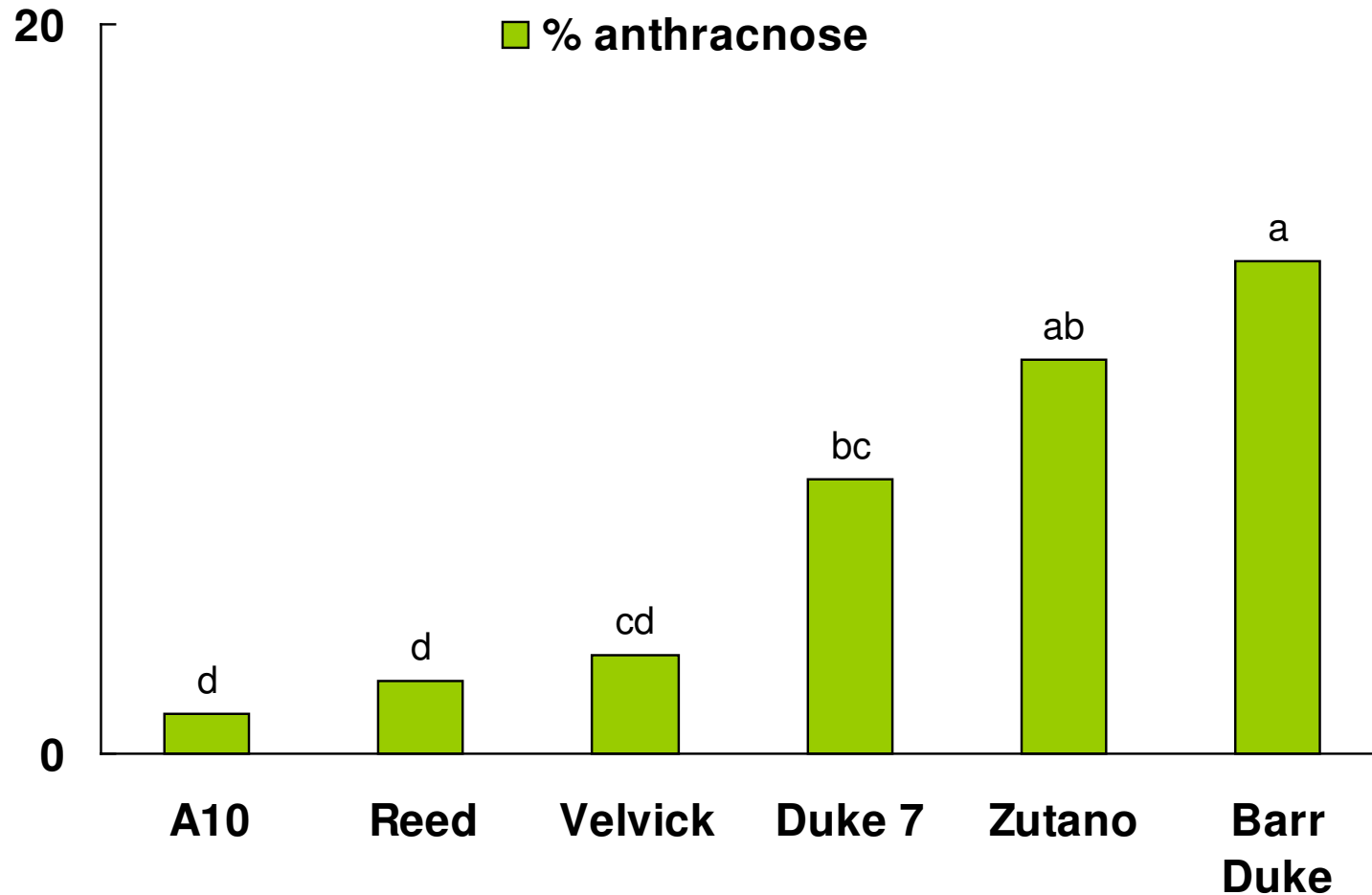


# Rootstock affects postharvest disease

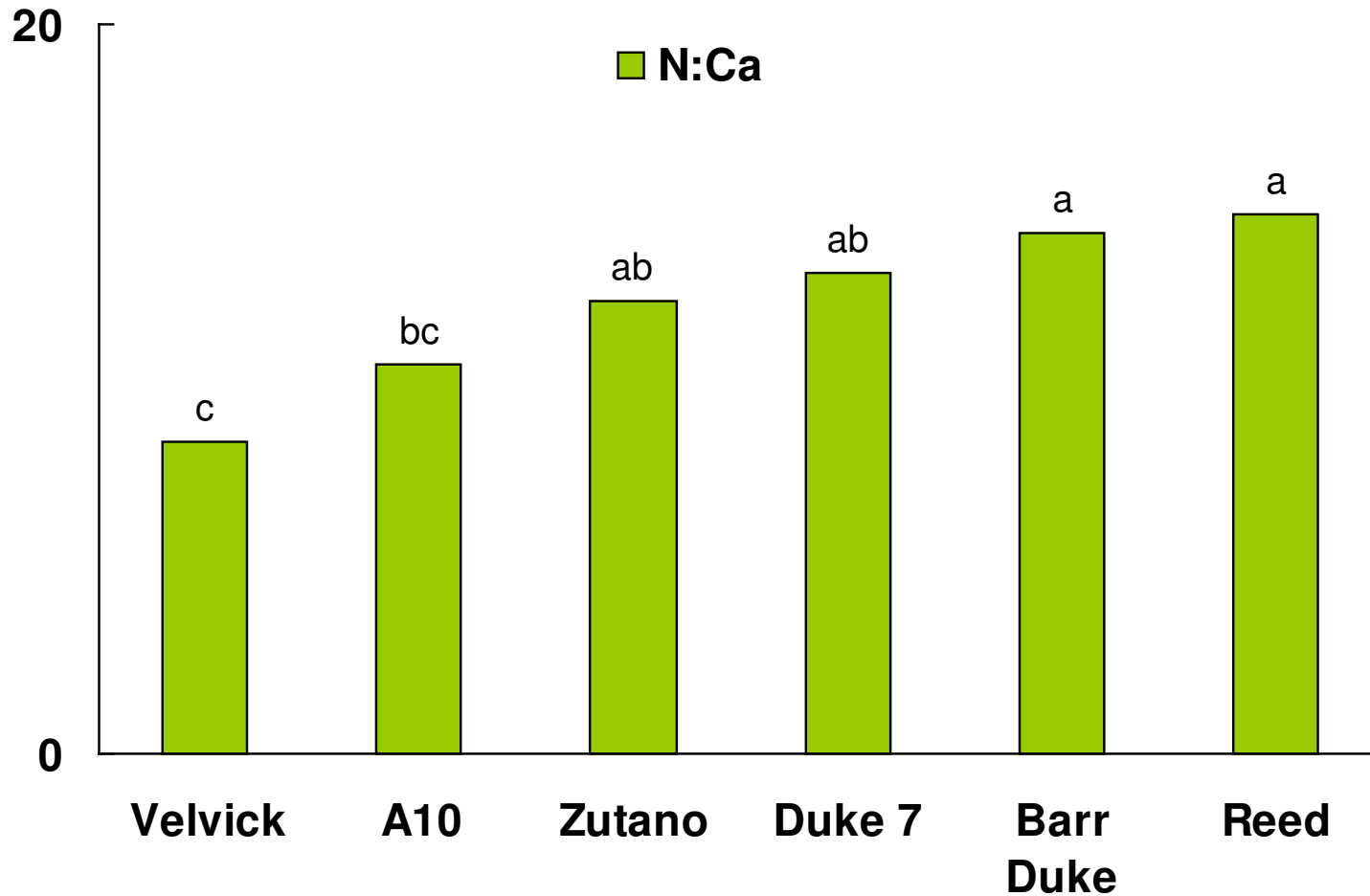
- Fruit harvested from T. Whiley's rootstock trials at
  - Childers, QLD ('Hass' in 2008-2010)
  - Walkamin, QLD ('Shepard' in 2009-10, 'Hass' 2010)
  - Pemberton, WA ('Hass' in 2008)
  - Hampton, QLD ('Hass' in 2007- 2009)
- Ripened at 23°C & 65% RH (Indooroopilly)
- Stored 5 weeks at 5.5°C, then ripened 20°C (Maroochy)
- Assessed for postharvest disease



# Effect of rootstock on anthracnose, Pemberton 2008



# Effect of rootstock on fruit skin N:Ca ratio, Pemberton 2008



## Significant trends

- Rootstock affects fruit quality
  - All locations
- Yield ↓ as anthracnose severity ↑
  - Childers and Hampton 2008
- Anthracnose severity ↑ as N and/or N:Ca ↑
  - All locations





# Management of fruit diseases

- Field activities
  - Registered fungicides eg. Copper, Amistar
  - Crop nutrition, especially Ca and N
  - Optimal irrigation
  - Variety/rootstock selection
  - Canopy management
  - Management of insect pests
  - Careful harvesting, avoiding skin damage, bruising

# Management of fruit diseases

- Postharvest activities
    - Keep fruit covered (out of sun) to prevent overheating
    - Remove field heat ASAP (pre-cool)
    - Handle fruit carefully, avoid bruising etc.
    - Registered fungicide (Sportak) before packing
    - Storage temperatures
      - green mature Hass, 4-5°C
      - ripening fruit >12°C
      - Near ripe 2-5°C
- Lower storage temps may cause chilling injury***
- Controlled ripening (ethylene)

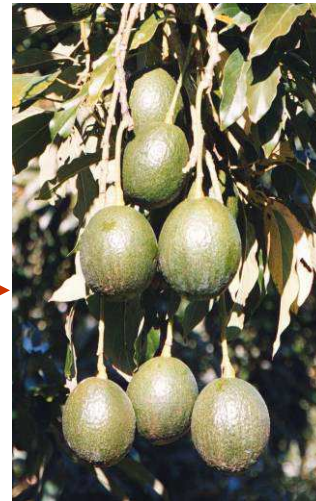


# Non-traditional approaches to disease management

- New products being tested – natural green® (calcium-based), Aminogro ® (chitosan from prawn shells), EcoCarb (potassium bicarb.), Serenade Max (BCA), plant defence activators
  - “soft”, not fungicides, OK for organic etc.
- Protectant fungicides being tested – mancozeb, metiram, fludioxinil (as postharvest)



# Integrated control – the complete picture



Tree husbandry

Strategic fungicides

Careful harvest

Postharvest care

- nutrition (N, Ca)
- canopy mgt
- mulching
- root health

- protectants and post-infection
- phosphorus acid
- postharvest

- maturity %DM
- wet weather

- cool chain
- pre-condition
- CA, ethylene

# Grow Help Australia diagnostic service

- [http://www.dpi.qld.gov.au/4790\\_12360.htm](http://www.dpi.qld.gov.au/4790_12360.htm)
  - Grow Help's schedule of fees
  - How to collect and prepare samples for analyses
  - Sample submission form (PDF, 65kb)
- **Grow Help Australia Client Services Officer**  
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Email: [growhelp@dpi.qld.gov.au](mailto:growhelp@dpi.qld.gov.au)

## Biosecurity

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- Identifying, moving & selling livestock
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- Agvet chemicals & residues
- Animal welfare & ethics
- Animal health & diseases
- Plant health, pests & diseases

[A-Z list](#)

[Eradication & surveillance](#)

- Weeds, pest animals

[Home](#) > [Plants](#) > [Plant health, pests & diseases](#) > **Grow Help**

## Grow Help Australia

Grow Help Australia provides a comprehensive disease and pest diagnostic service for all horticultural crops, including:

- nursery
- flower and ornamental plants
- turf grass
- fruit and vegetables.

### Features of our service

- rapid and accurate diagnosis and analysis
- experienced and dedicated staff
- confidentiality
- extensive experience in all nursery crops, traditional and native cut flower crops, and fruit and vegetable crops
- many new and unusual crops serviced.



# How to collect and prepare samples

- Rapid delivery of specimens and detailed information on the problem essential
- *Plants wilting, yellowing or dying back* - Dig up and submit whole plants (if practical), together with soil around roots
- *Fruit, leaves, flowers, twigs and branches* - Select specimens on which there are both diseased and adjacent healthy areas
- *Root diseases (including nematodes and Phytophthora)* - Collect a number of sub-samples of soil and roots (to a depth of 15 cm) from beneath each plant and bulk together to make a representative sample (approx. 500 g) for each plant or location. Include several plant samples if practical, from plants with early symptoms of the problem to plants with advanced symptoms

# How to package and send samples

- Wrap leaves, flowers or small plants in paper towelling, place sample in a sealed plastic bag and then into a padded envelope.
- Place soil sample and bulky plant material, such as stems and twigs in plastic bags, and pack bags into sturdy containers (not glass) to prevent crushing.
- Place pests and host material in an unbreakable container or tube.
- Label each sample clearly with a waterproof marker
- Provide useful information on submission form
- Directly deliver, courier or post (eg. 24h express) specimens and forms
- Protect samples from drying out and extremes of temperature
- Telephone first if unsure about collection, packaging etc.

# Acknowledgements



*Know-how for Horticulture™*



*Thanks to all our grower collaborators!*



# Fruit Pathology Team at Indooroopilly

