Common and Invasive Pests of Stonefruits:

Peaches and Nectarines – Fungal Diseases

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Background

Tree in leaf

Tree in bloom

Flower

Nectarine fruit

Peach fruit

Young fruit

Image citations: peach tree in leaf - Howard F. Schwartz, Colorado State University, www.bugwood.org, #5359260; tree in bloom - Charles Drake, Virginia Polytechnic Institute and State University, www.bugwood.org, #5335075; flower - H.J. Larsen, ww.bugwood.org, #5365442; nectarine fruit - Howard F. Schwartz, Colorado State University, www.bugwood.org, #5359261; peach fruit - Carroll E. Younce, USDA Agricultural Research Service, www.bugwood.org, #1304024; young fruit - University of Georgia Plant Pathology Archive, University of Georgia, www.bugwood.org, 1492186

Fungal Diseases

- Brown rot
- Scab
- Powdery mildew
- Green fruit rot
- Rust
- Shot hole
- Leaf curl
- Silver leaf
- *Leucostoma* canker
- *Armillaria* root rot

Fungal Diseases

- Brown Rot is caused by:
  - *Monilinia fructicola*
    - Widespread in US, not detected in Europe
    - Mostly found on peaches and nectarines, but can be found on all *Prunus* spp.
  - *Monilinia laxa*
    - Widespread in most countries, including the US, but not found in the southeastern part of the US
    - Mostly found on apricots and almonds, but can also be found on all *Prunus* spp., including peaches and nectarines
  - *Monilinia fructigena*
    - Eliminated from North America, found in Europe

Image citations:
Gerald Holmes, Valent USA Corporation, www.bugwood.org, #1570293

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Fungal Diseases

- Brown rot symptoms on flowers and stems

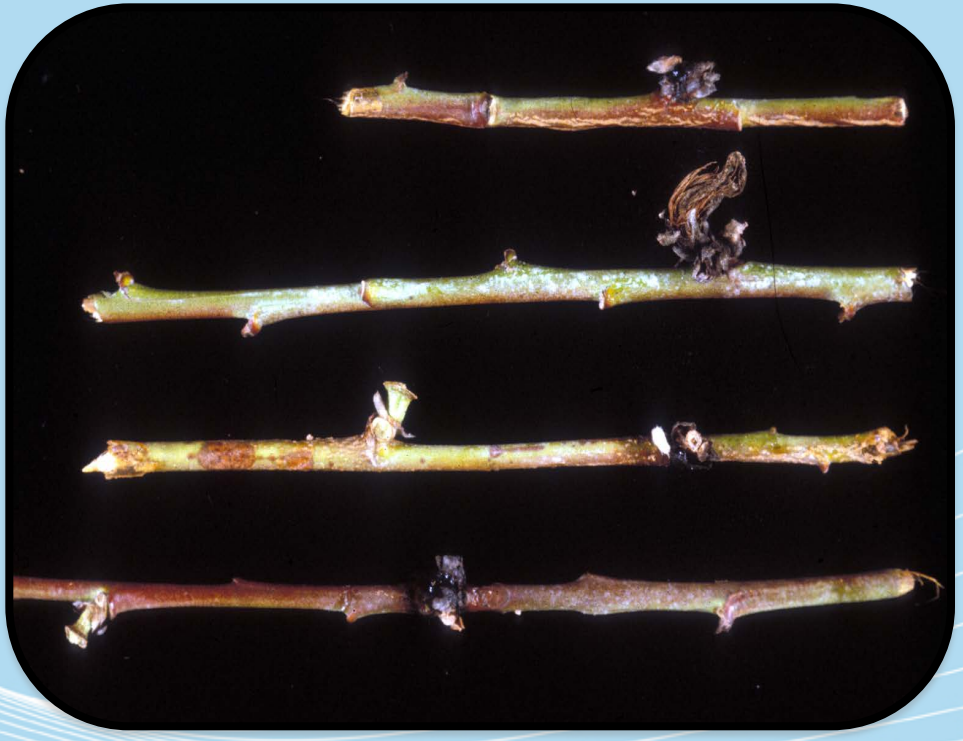

Image citations:
top and bottom left - Clemson University - USDA Cooperative Extension Slide Series, www.bugwood.org, #1233230 and #1436084;
right - University of Georgia Plant Pathology Archive, University of Georgia, www.bugwood.org, #1492003

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Fungal Diseases

- Brown rot symptoms on fruit

Image citations:
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right - University of Georgia Plant Pathology Archive, University of Georgia, www.bugwood.org, #1492003

Fungal Diseases

- Managing brown rot: Cultural control
  - Removal of infected plant parts and mummies (especially)
  - Removal of ornamental and wild species of *Prunus*
  - Plant resistant cultivars

Fruit “mummy”

Fruiting bodies of fungus

Image citations: I
Fruiting bodies - University of Georgia Plant Pathology Archive, University of Georgia, www.bugwood.org, #1492009;
mummy - Clemson University - USDA Cooperative Extension Slide Series, www.bugwood.org, #1235046

Fungal Diseases

- Managing brown rot: some chemical control recommendations *
  - Tebuconazole
  - Fenbuconazole
  - Propiconazole
  - Metconazole
  - Iprodione
  - Vinclozolin
  - Benomyl
  - Ziram
  - Triforine
  - Cyprodinil
  - Pyrimethanil
  - Fenhexamid
  - Boscalid/pyraclostrobin
  - Myclobutanil
  - Thiophanate-methyl
  - Captan

*Be sure to check with your local county agent to find out which chemicals are certified for use in your state, on what crop it is allowed to be used, if it is allowed to be used post-harvest or pre-harvest, and if it should be applied by a licensed applicator.

Fungal Diseases

- Scab is caused by *Venturia carpophilum*
- Occurs in warm areas with high rainfall and in orchards with overhead sprinklers

Fungal Diseases

- Scab symptoms on stems

Image citations:
Clemson University - USDA Cooperative Extension Slide Series, www.bugwood.org, #1436082

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Fungal Diseases

- Scab symptoms on leaves and fruit

Image citations:
right - Clemson University - USDA Cooperative Extension Slide Series, www.bugwood.org, #1436082

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Fungal Diseases

- Managing scab: Cultural control
  - Pruning
  - Reducing overhead sprinkler use

Image citations:
University of Georgia Plant Pathology Archive, University of Georgia, www.bugwood.org, #1492165

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Fungal Diseases

- Managing scab: Chemical control*
  - Sulfur (wettable)
  - Captan
  - Benzimidazoles
  - Chlorothalonil
  - Thiophanate methyl (mixed with captan)
  - Azoxystroblin
  - Trifloxystrobin

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Fungal Diseases

- Powdery mildew is caused by:
  - *Podosphaera tridactyla*
    - Affect s older leaves
  - *P. clandestina*
    - Affects older leaves
  - *P. pannosa*
    - (formally *Sphaerotheca pannosa*)
    - Affects younger leaves
- Does most damage in semi-arid areas

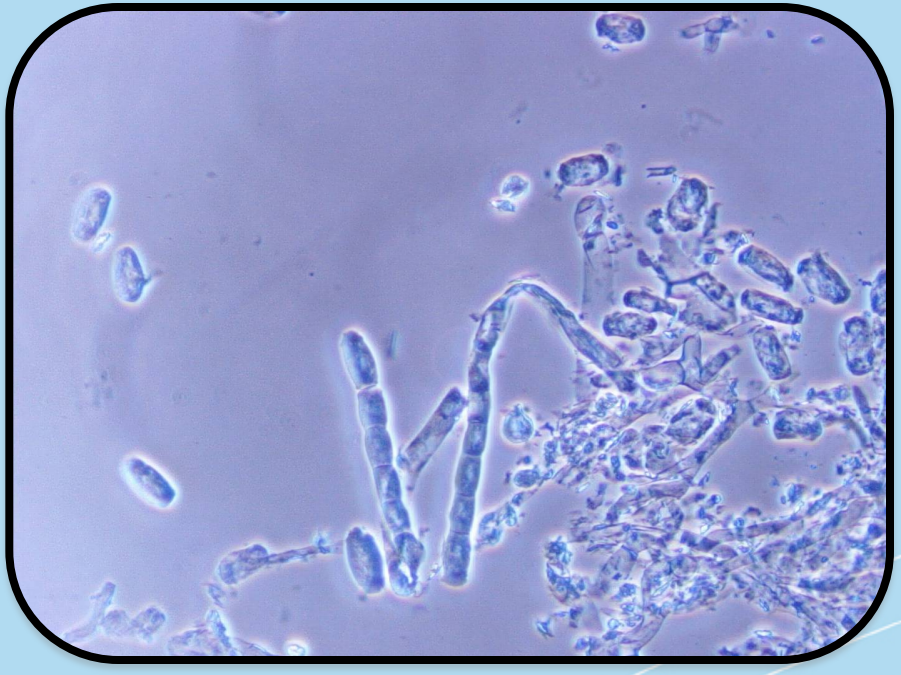

Image citations:
Cesar Calderon, USDA APHIS PPQ, www.bugwood.org, #2176099

Fungal Diseases

- Powdery mildew symptoms on fruit

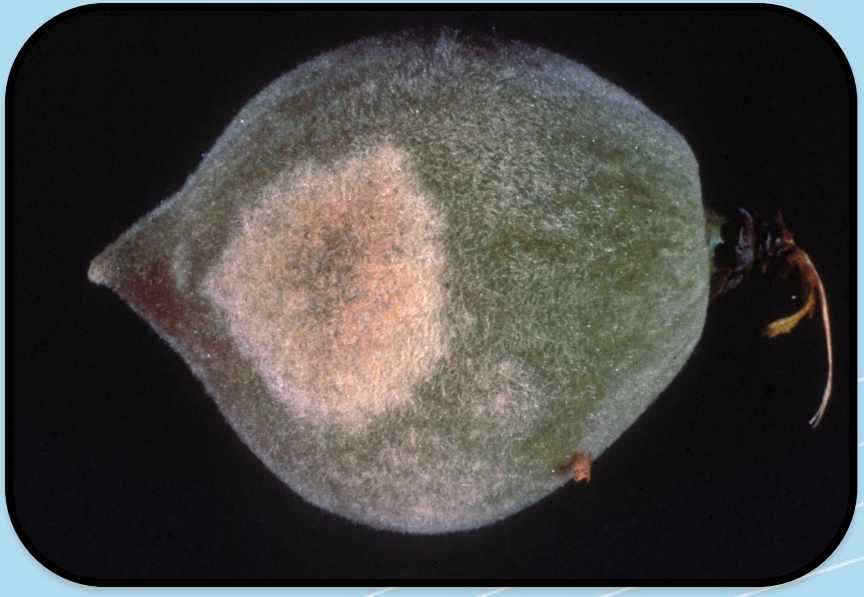

Image citations:
left - William M. Brown Jr., www.bugwood.org, #5359750
right - University of Georgia Plant Pathology Archive, University of Georgia, www.bugwood.org, #1492050

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Fungal Diseases

- Managing powdery mildew: Cultural control
  - Remove roses from area
  - Remove infected shoots in winter and fruitlets when thinning
  - Promote air movement and low humidity
  - Use resistant cultivars

Image citations:
left - Clemson University - USDA Cooperative Extension Slide Series, www.bugwood.org, #1234132;
right - Cesar Calderon, USDA APHIS PPQ, www.bugwood.org, #2176094

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Fungal Diseases

- Managing powdery mildew: Chemical control*
  - Sulfur (wettable, flowable, or liquid lime)
  - Myclobutanil
  - Horticultural oils
    - such as neem oil or jojoba oil
  - Potassium bicarbonate fungicides
  - Biological fungicides

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Fungal Diseases

- Green fruit rot is caused by *Botrytis cinerea* and *Sclerotinia sclerotiorum*
  - *B. cinerea* is associated with peaches and nectarines
- Can be a big problem in areas that are foggy with prolonged wet periods during bloom time, and in years that are particularly wet

Image citations:
Paul Bachi, University of Kentucky Research and Education Center, www.bugwood.org, #5405264

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Fungal Diseases

- Green fruit rot symptoms on fruit

Image citations:
left - University of Georgia Plant Pathology Archive, University of Georgia, www.bugwood.org , #1492022;
right - University of Georgia Plant Pathology Archive, University of Georgia, www.bugwood.org, #1492024

Fungal Diseases

- Managing green fruit rot: Cultural control
  - Removal of mummified fruit, fallen blossoms, and plant refuse on the ground
  - Remove infected fruit from tree
  - Limit watering from overhead sprinklers
  - Spacing the plants to aid in air circulation

Fungal Diseases

- Managing green fruit rot: Chemical control*
  - Benzimidazole fungicides
  - Captan
  - Iprodione
  - Chlorothalinil

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Fungal Diseases

- Rust is caused by *Tranzschelia pruni-spinosae* and *T. discolor*
  - *T. discolor* separated into special forms, *T. discolor* f. sp. *percicae* is found on peach
- Can be highly variable in occurrence
- Usually occurs in very wet years

Fungal Diseases

- Rust symptoms on leaves

Image citations:
Top and bottom right - Yuan-Min Shen, Taichung District Agricultural Research and Extension Station, www.bugwood.org, #5393177 and #5393178

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Fungal Diseases

- Managing rust: Cultural control
  - Removal of infected twigs and non-abscissed leaves
  - Overhead sprinklers can transfer the spore
  - Wind can also transfer the spore
  - Use cultivars that are resistant to rust

Fungal Diseases

- Managing rust: Chemical control*
  - Myclobutanil
  - Tebuconazole
  - Propiconazole
  - Azoxystrobin
  - Sulfur (wettable)
  - Benomyl
  - Thiophanate-methyl
  - Strobilurin

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Fungal Diseases

- Shot hole is caused by *Wilsonomyces carpophilus*
  - Also known as coryneum blight
- Occurs worldwide
  - Particularly problematic in the western U.S.

Fungal Diseases

- Shot hole symptoms on leaves and fruit

Image citations:
left - Whitney Cranshaw, Colorado State University, www.bugwood.org , #5366443;
right - William M. Brown Jr., www.bugwood.org, #5356776

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Fungal Diseases

- Managing shot hole: Cultural control
  - Pruning infected wood is probably impractical
  - The use of overhead sprinklers also increases the risk of shot hole disease development
  - No resistant cultivars are available at this time

Fungal Diseases

- Managing shot hole: Chemical control*
  - Bordeaux mixture or a fixed copper formulation
    - To provide protection during winter
  - Captan
  - Ziram
  - Iprodione
  - Chlorothalonil

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Fungal Diseases

- Leaf curl is caused by *Taphrina deformans*
- Distributed worldwide
- In U.S., mainly affects Pacific Northwest and the milder climates of California

Fungal Diseases

- Leaf curl symptoms on leaves and fruit

Image citations:
top and bottom left - Paul Bachi, University of Kentucky Research and Education Center, www.bugwood.org, #5405338 and #5430057;
right - Mary Ann Hansen, Virginia Polytechnic Institute and State University, www.bugwood.org, #5335080

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Fungal Diseases

- Managing leaf curl: Cultural control
  - Alleviate stress on the tree
    - Provide good irrigation during the dry season
    - Add appropriate levels of N at appropriate times
    - Thin the cropload
  - Use cultivars resistant to leaf curl

Fungal Diseases

- Managing leaf curl: Chemical control*
  - Copper ammonium complex products
    - mixed with 1% horticultural spray oil
  - Bordeaux mixture
    - copper sulfate and hydrated lime
  - Chlorothalonil

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Fungal Diseases

- Silver leaf disease is caused by *Chondrostereum purpureum*
- Occurs in temperate zones
  - Has also been found in nurseries
- Affects many other species including cultivated and non-cultivated hardwood trees

Fungal Diseases

- Silver Leaf Disease symptoms on stems

Image citations:
left - Joseph O'Brien, USDA Forest Service, www.bugwood.org, #5049074;
right – WikiMedia Commons.

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Fungal Diseases

- Managing silver leaf disease: Cultural control
  - Dispersal can be from wind and rain
  - Multiple hosts can serve as reservoirs for this disease
    - Removal of dead wood, stumps, trimmings, logs, etc. from these hosts can help control the disease
  - Proper pruning practices and treatment of tree wounds minimizes the risk of infection from this wood decay fungi

Fungal Diseases

- Managing silver leaf disease: Biological control
  - Biofungicides are being looked at
    - *Trichoderma viride*
    - *Truncatella* spp.
    - *Gliocladium* spp.
  - Currently, there are no chemical control measures recommended for the treatment of this disease

Fungal Diseases

- *Leucostoma* canker is caused by *Leucostoma cincta* and *L. persoonii*
  - Also called perennial canker, peach canker, Valsa canker, and Cytospora canker
- Occurs in the southeastern U.S. (where it is associated with peach short life syndrome) and the Pacific Northwest

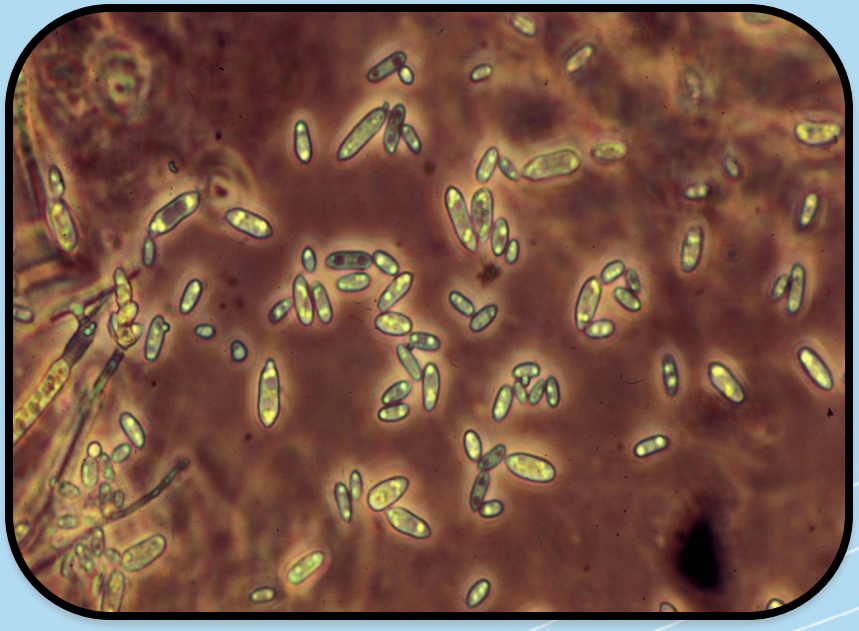

Image citations:
University of Georgia Plant Pathology Archive, University of Georgia, www.bugwood.org, #1492148

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Fungal Diseases

- *Leucostoma* canker symptoms on stems

Image citations:
left - Florida Division of Plant Industry Archive, Florida Department of Agriculture and Consumer Services, www.bugwood.org, #5371925;
right - William M. Brown Jr., www.bugwood.org, #5356714

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Fungal Diseases

- Managing *Leucostoma* canker: cultural control
  - Young healthy trees are less susceptible
  - Infection follows:
    - Injuries to wood from sunburn, pruning, insects, and even rodents
    - Stress caused by freezing, nutrient deficiency, nematode infections, and bacterial cankers
  - Alleviating stress and preventing injuries to the wood helps to control this pathogen

Fungal Diseases

- *Armillaria* root rot is caused by many *Armillaria* species
  - The species associated with peaches and nectarines include *Armillaria mellea*, *A. ostoyae*, and *A. tabescens*
- Also known as shoestring root rot and oak root rot
- World wide distribution

Fungal Diseases

- *Armillaria* root rot symptoms on stems

Image citations:
Rebekah D. Wallace, University of Georgia, www.bugwood.org, #5392883 and #5392884

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Fungal Diseases

- *Armillaria* root rot symptoms on leaves

Image citations:
Florida Division of Plant Industry Archive, Florida Department of Agriculture and Consumer Services, www.bugwood.org, #5371644

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Fungal Diseases

Armillaria mallea

- The fruiting bodies of all three *Armillaria* species associated with peaches and nectarines

Armillaria tabescens

Armillaria ostoyae

Image citations:
all are from WikiMedia Commons.

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Fungal Diseases

- Managing *Armillaria* root rot: Cultural control
  - Don't establish stone fruits on land previously known to have been infected with this disease
  - Have the tree rows separated by a sod-middle
  - Monitor for the symptoms, especially the fruiting bodies
  - There is no good chemical control of this fungal disease

Questions?

- For more information, check out www.protectingusnow.org

- You can also contact:
  - Amanda Hodges, University of Florida, achodges@ufl.edu
  - Stephanie D. Stocks, University of Florida, sstocks@ufl.edu

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National Plant Board (NPB) and State Departments of Agriculture

National Plant Diagnostic Network (NPDN)

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References

- Adaskaveg, J.E., H. Forster, W. D. Gubler, B.L. Teviotdale, D.F. Thompson. 2005. Reduced-risk fungicides help manage brown rot and other fungal diseases of stonefruit. California Agriculture, volume 59, number 2. accessed 12/14/2011 –
  - http://ucce.ucdavis.edu/files/datastore/391-427.pdf
- Adaskaveg, J.E., R. A. Duncan, J. K. Hasey, and K. R. Day. 2010. Brown Rot Blossom and Twig Blight. accessed 12/30/2011 –
  - http://www.ipm.ucdavis.edu/PMG/r602100111.html#MANAGEMENT
- Anonymous. 2010. 2011 North Carolina Agricultural Chemicals Manual. North Carolina Cooperative Extension Service. accessed 12/15/2011 –
  - http://ipm.ncsu.edu/agchem/agchem.html
- Broome, J.C., and C.A. Ingels. 2011. Peach Leaf Curl. University of California Agriculture and Natural Resources. accessed 12/16/2011 –
  - http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7426.html
- Bush, E.A., K.S. Yoder, and A.H. Smith, Jr. Brown rot on peach and other stone fruits. 2009. Virginia Cooperative Extension. accessed 12/15/2011 –
  - http://pubs.ext.vt.edu/450/450-721/450-721.html
- Doubrava, N. and J.H. Blake. 1999. Gray Mold (Botrytis Blight). Clemson Cooperative Extension. accessed 12/15/2011
  - http://www.clemson.edu/extension/hgic/pests/plant_pests/flowers/hgic2100.html

References

- Hartman, J.R. 2007. Peach Fruit Diseases. UK Cooperative Extension Service. accessed 12/14/2011
  - http://www.ca.uky.edu/agcollege/plantpathology/ext_files/PPFShtml/PPFS-FR-T-9.pdf
- Horton, D. and D. Johnson, editors. 2011. Southeastern Peach Growers' Handbook. University of Georgia Extension and Outreach. accessed 12/15/2011 –
  - http://www.ent.uga.edu/peach/peachhbk/toc.htm
- Layne, D.R., and D. Bassi, editors. 2008. The Peach: Botany, Production, and Uses. CABI, Cambridge, Massachusetts.
- Ogawa, J.M., editor. 1995. Compendium of Stone Fruit Diseases. American Phytopathological Society Press, St. Paul, Minnesota.
- Ritchie, D.F., M. Parker, K.A. Sorensen, J.R. Meyer, W. E. Mitchem, S. J. Toth, Jr. 2005. Crop Profile for Peaches in North Carolina. accessed 12/14/2011 –
  - http://www.ipmcenters.org/cropprofiles/docs/ncpeaches.pdf
- Soto-Estrada, A., H. Forester, J. Hasey, and J.E. Adaskaveg. 2003. "New fungicides and application strategies based on inoculum and precipitation for managing stone fruit rust on peach in California". Plant Disease, vol. 87, no. 9, pp. 1094-1101. accessed 12/15/2011 –
  - http://apsjournals.apsnet.org/doi/pdf/10.1094/PDIS.2003.87.9.1094

References

- Teviotdale, B.L., W.D. Gubler, and S.T. Koike. 2001. Powdery mildew on fruits and berries. University of California Cooperative Extension publication. accessed 12/14/2011 –
  - http://www.ardentermite.com/2003/pestnotes/plants/pnpowderymildewfruits.pdf
- Turechek, B., C. Heidenreich, and T. Burr. 2001. Brown Rot. NYS IPM Tree Fruit Crops Fact Sheet Series. accessed 12/14/2011 –
  - http://ccesuffolk.org/assets/Horticulture-Leaflets/Brown-Rot.pdf
- USDA-ERS. Spreadsheet A-5, A-8, and A-18. accessed 12/30/2011 –
  - http://usda.mannlib.cornell.edu/MannUsda/viewDocumentInfo.do?documentID=1377