

NPDN News

Volume 12 Issue 6, June 2017

GANODERMA ROOT AND BUTT ROT: AN EMERGING THREAT TO CALIFORNIA ALMONDS

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Wood decay fungi reduce the structural integrity of trees, leading to major limb breakage and wind-driven collapses (windfalls). Basidiomycetes associated with wood-decay colonize and digest the heartwood of trees. This group of fungi produce enzymes that degrade the cellulose and lignin that comprise the heartwood, reducing the structural integrity of the trees. Basidiomycetes that cause root and butt-rot have a distinct biology and etiology from those that cause heart rot. "Butt rot" is a forestry term. The "butt" log of a tree is the bottom most portion of the trunk and the most valuable. It is a type of heart rot found in the butt of the tree.

Heart rot is generally limited to above-ground portions of the tree. In almonds, *Phellinus* spp. are the most common type of heart rot fungi, but there are several other species that cause similar symptoms. Infection is generally initiated by spores at pruning or other types of wounds. Wood decay is often accompanied by a spore-producing fruiting structure (conk) in the scaffold or on the trunk. Extensive decay eventually results in limb breakage. This can be especially problematic when decay occurs at a primary scaffold or near the crotch of the tree. Because of limited pruning in almonds, heart rot-associated limb breakage is less prevalent than in other stone fruits.

Butt rot is the most poorly understood of the wood decay types associated with almond and perhaps the most important. Butt rot fungi affect the below ground portion of the trunk from which the roots diverge. These fungi decay the tree from the bottom up and from the inside out, rarely extending more than 12–18" above the soil line. There may be no obvious symptoms and the tree will still flower and set a crop. However, some trees with extensive decay may show a general loss of vigor. Fruiting structures (see photo) may occur at or near the soil line. Eventually infection leads to wind-driven collapse (windfall) with the tree



Active *Ganoderma adspersum* conk, notice bright white edge and reddish spores covering top surface.

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Issue Highlights

- Diagnostic workshop held in Puerto Rico
- First Detector significant pests/pathogens survey

snapping off at the soil line and little or none of the root ball remaining intact. Attrition from windfall related to butt rot is one of the factors limiting orchard age to 20–25 years. *Ganoderma* spp. and other butt rot fungi are long known in California orchards and usually considered a problem of older orchards often associated with weak or already diseased trees. Recent findings are challenging these notions. In 2016, a 9 to 10 year-old orchard in Kings County was diagnosed with *Ganoderma* butt rot caused by *Ganoderma adspersum*. In a two-year span, each block experienced

to determining the potential impacts to the industry and developing management strategies. With support from the Almond Board of California and California Dried Plum Board, the Rizzo Lab at UC Davis has been working to better understand *Ganoderma* and other wood decay diseases in California orchards. Our findings to date include:

- Airborne spores are most likely the source of inoculum for *Ganoderma* infections. A hand sized *Ganoderma* spp. conk may be capable of producing billions, if not trillions, of spores a year.
- Infections do not appear to be moving through root to root contact between trees, although this could still be happening, and has not been completely ruled out.
- Confirmed reports of *G. adspersum* to date were planted on peach rootstock and tended to be in sandier soils.
- *G. adspersum* has only been identified from orchards in the middle to southern San Joaquin Valley.

What we don't know, but are currently researching:

- Following tree loss from *Ganoderma* spp., is it safe to replant with almond?
- Where is the specific point of infection? When do infections occur?
- How long after initial infection before windfall is inevitable?
- Is *G. adspersum* found in wild lands and riparian areas as well?
- Are some almond rootstocks tolerant or resistant to infection?

If you have experienced decay-related windfall or have seen *Ganoderma* conks, please consider contacting us to come take a look and get a sample. Understanding the distribution and incidence of *Ganoderma* infections throughout the state in both orchards and other settings will help us to develop management strategies to limit the impact of this potentially damaging disease.

Please contact the Rizzo lab at 530.754.9894 or email bobjohnson@ucdavis.edu if you are interested. 🍃

This article first appeared in the spring 2017 issue of the Western Plant Diagnostic Network First Detector News, volume 10, issue 2. Read more First Detector articles like this at www.npdn.org/wpdn/newsletters.



Windfall caused by *Ganoderma* butt rot.

between 8 and 13% tree loss. A conservative estimate, after destructive sampling, put the infection level of remaining trees above 50%. This orchard has since been removed. Similar aged orchards with extensive *Ganoderma* butt rot infections and tree loss associated with *G. adspersum* have also been identified in Madera, Fresno, Kern, and Tulare Counties. Most of these have been slated for removal.

G. adspersum is previously unreported in California and appears to be more aggressive than the other *Ganoderma* spp. found in orchards. Understanding the biology, epidemiology and current extent is vital

DIAGNOSTICS

Diagnostic workshop held in Puerto Rico

*Consuelo Estevez de Jensen, Plant Disease Clinic,
Department of Crops and Agro-Environmental Sciences,
University of Puerto Rico*

The Plant Diagnostic Clinic in Puerto Rico organized a workshop entitled "Diseases of Corn and Soybeans in Puerto Rico: an update." This workshop was directed to personnel of APHIS/PPQ Ponce and Aguadilla. The workshop focused on new and emergent bacterial and viral diseases of corn and soybeans in Puerto Rico. The participants were able to use rapid detection methods to differentiate between viral, fungal and bacterial diseases based on symptom description and the use of commercial immunostrips. Drs. Consuelo Estevez de Jensen and Diego Viteri Dillon of Agro-Environmental Sciences gave the presentations. 🌿



YOUR INPUT IS NEEDED!

First Detector significant pests/pathogens survey

The NPDN First Detector training site is undergoing some updates. In addition to the great training resources and tools you already love, the new site will be mobile friendly and include information on specific pests and pathogens of national and regional concern. Click here to take a short survey to weigh in on which pests/pathogens should be included: <https://goo.gl/forms/hocu0fBQnhTVO0Gs1>

Diagnostics Committee

Clarissa Balbalian, Committee Chair,
Mississippi State University

The Diagnostics Committee had a conference call on June 22, 2017. The following agenda items were discussed:

The results of a Qualtrics survey, which was a cooperative effort between Diagnostics and Training and Education Subcommittees (Sladana and Lina), have been posted at www.npdn.org/training_education). You will be required to login to view the results.

- The NPDN-Dictionary/validation working group provided the consensus from the survey responses:
 - Change Polymerase Chain Reaction for the following three terms: Conventional PCR, Real-time PCR (qPCR), Isothermal amplification
 - Change Sequencing to Sequence Analysis (a broader term)
 - Change Molecular Analysis for Molecular (other)

Final list of terms and definitions/examples-to add to dictionary

Conventional PCR: to capture detection protocols with species-specific primers, single, nested and multiplex PCR reactions

Real-time PCR (qPCR): including SYBR green and TaqMan assays

Isothermal amplification: including LAMP and others (Recombinase Polymerase Amplification (RPA)- TwistDx, AmplifyRP (Avidia))

Sequence analysis: including single locus, multi-loci, and various regions/ targets (i.e. ITS1-4, ITS5-6... etc.)

Molecular (other): other molecular assays not included in dictionary, emerging or new techniques

- The Qualtrics survey also included questions on diagnostic resource awareness and training for detection and morphological ID of pathogens. A subcommittee will be working to submit a proposal for Farm Bill funding for developing training resources. There is a goal to create a separate tab on the NPDN website called the 'Diagnostician's Toolbox' where existing and proposed training resources will be posted.
- Farm Bill funding has been secured for the 2018 Beltsville Training workshops.

The full minutes for the meeting can be found on the NPDN Diagnostics webpage. The next meeting will be August 24, 2017 at 1PM-2PM ET. ☺

Training and Education

Joan Allen, Committee Chair, University of Connecticut

The Training and Education Committee had a conference call on June 5, 2017. The following agenda items were discussed:

- **First Detector website update—** Demo of new site (working, not live). Template based on the NPDN site, mobile responsive, image slide show coming up. Right now the site is protected behind a firewall. In the future CERIS can give access to some committee members to edit page content. Registration/workshop tools ready and set up to get hooked into the database. Keep reporting tools and registration, as these can help for reporting and funding requests. First Detector page changes

is available in Training and Education Google Drive

- **Committee officers for next term—**end of terms, Lina and Joan would like to serve another term. Any opposed to keeping the current chair and secretary? Term is 2 years. An email will be sent to the whole committee for input.
- **Diagnostics/T&E/methods survey results and discussion—** add list of resources in Training and Education with link to it on the Diagnostics committee. Potential to add link <http://wiki.bugwood.org/NPDN-MG-Training> to login site of FD and NPDN/ T&E tab within NPDN First Detector pests: quarantine significance and specific pests significant to a state. Segregate wiki by pathogens of concern. Align pests/pathogens of concern with APHIS lists.
- **Pest alerts for First Detectors—** currently working on template and graphics. Final template will be in PowerPoint. Info from bugwood wiki will be used to create scouting guide in ppt. Ideas to include: How to submit sample to local diagnostic clinic, information on local lab, host, what to look for, where to look for it, NPDN logo, and space for individual universities to add their logo if so desired.
- Update list of T&E committee members on NPDN website ☺

Visit the NPDN homepage at www.npdn.org for more information on Program Area Committees. Login and password required.

UPCOMING EVENTS

Meetings

August 5–9, 2017
2017 APS Annual Meeting
San Antonio, Texas

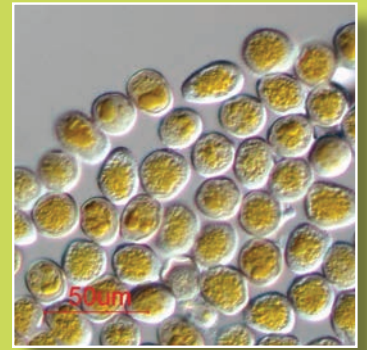
August 12–17, 2017
National Plant Board 2017 Annual Meeting
Savannah, Georgia

November 5–8, 2017
Entomology 2017
Denver, Colorado

March 19–22, 2018
Ninth International Integrated Pest
Management (IPM) Symposium
Baltimore, Maryland

PHOTO OF THE MONTH

onion rust spores
(*Puccinia allii*)



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