

**SUBMITTAL TO THE BOARD OF SUPERVISORS  
COUNTY OF RIVERSIDE, STATE OF CALIFORNIA**



**FROM:** Supervisor Ashley

**SUBMITTAL DATE:**  
January 27, 2015

**SUBJECT:** Non-Composted Green Waste Pest Transmission

**RECOMMENDED MOTION:** That the Board of Supervisors:

1. Approve sending a letter to the Secretary of the California Department of Food and Agriculture, expressing concerns regarding the transmission of the Polyphagous Shot Hole Borer.

**BACKGROUND:**

**Summary**

On January 15, 2015, representatives from the California Avocado Commission, Agriculture and the University of California, Riverside shared their concerns regarding the potential for pest transmission (resulting from the land-application of non-composted green waste) with the Riverside County Solid Waste Management Advisory Council/Local Task Force (SWMAC/LTF).

Specifically, non-composted green waste can harbor the Polyphagous Shot Hole Borer that causes a disease called Fursarium Dieback, which interrupts the transport of water and nutrients in over 110 tree species. (continued)

Departmental Concurrence

*Marion Ashley*  
Marion Ashley, Chairman

<b>FINANCIAL DATA</b>	<b>Current Fiscal Year:</b>	<b>Next Fiscal Year:</b>	<b>Total Cost:</b>	<b>Ongoing Cost:</b>	<b>POLICY/CONSENT (per Exec. Office)</b>
<b>COST</b>	\$	\$	\$	\$	Consent <input type="checkbox"/> Policy <input type="checkbox"/>
<b>NET COUNTY COST</b>	\$	\$	\$	\$	

**SOURCE OF FUNDS:**

**Budget Adjustment:**

**For Fiscal Year:**

**C.E.O. RECOMMENDATION:**

**County Executive Office Signature**

**MINUTES OF THE BOARD OF SUPERVISORS**

- A-30
- Positions Added
- 4/5 Vote
- Change Order

**Prev. Agn. Ref.:**

**District:**

**Agenda Number:**

**3-26**

**SUBMITTAL TO THE BOARD OF SUPERVISORS, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA  
FORM 11: Non-Composted Green Waste Pest Transmission**

**DATE: January 27, 2015**

**PAGE: 2 of 2**

**BACKGROUND:**

**Summary (continued)**

Attached is a proposed letter to Karen Ross, California's Secretary of Agriculture, expressing the Board's concern regarding the possibility of transmission of the Shot Hole Borer and potential impact to crops and ornamental trees in Riverside County. The letter requests assistance and guidance on this issue from the California Department of Food and Agriculture (CDFA).

Also attached is a letter to the Secretary from the SWMAC/LTF expressing similar concerns and requesting assistance from CDFA and a letter/fact sheet from Dr. Timothy Spann, Research Program Director at the University of California, Riverside.

The next SWMAC/LTF meeting on February 19, 2015 will focus on developing recommendations to the Board of Supervisors regarding actions the County can take to prevent the proliferation of the Polyphagous Shot Hole Borer in Riverside County.



# Polyphagous Shot Hole Borer + Fusarium Dieback A Pest Disease Complex on Avocado in CA

## BACKGROUND



The Polyphagous Shot Hole Borer (PSHB), *Euwallacea* sp. #1, is an invasive beetle that carries three fungi: *Fusarium euwallaceae*, *Graphium* sp., and *Acremonium* sp. The adult female (1.8-2.5 mm long) tunnels galleries into a wide variety of host trees, where it lays its eggs and grows the fungi. The fungi cause the Fusarium Dieback (FD) disease, which interrupts the transport of water and nutrients in over 35 tree species that are suitable for beetle reproduction.

A separate invasion was recently detected in commercial avocado groves and landscape trees in San Diego county. It has been determined that the damage has been caused by another closely

related species of PSHB (*Euwallacea* sp. #2), carrying a new species of *Fusarium*. The beetle in LA, Orange, Riverside, and San Bernardino Counties are morphologically indistinguishable, but genetically distinct from the beetle found in San Diego County. Photo (adult female) credit: Gevork Arakelian/LA County Dept of Agriculture.

## HOSTS

PSHB has been observed attacking hundreds of tree species, but it can only successfully lay its eggs and/or grow the fungi in certain hosts. These trees, called reproductive hosts, include: Avocado, Box elder, California sycamore, Coast live oak, White alder, Japanese maple, and Red willow.

Visit [eskalenlab.ucr.edu](http://eskalenlab.ucr.edu) for the full list.

## SIGNS + SYMPTOMS

Attack symptoms (e.g. gumming, staining, frass, sugary exudate) are a host tree's visible response to stress and vary among host species. On avocado, sugary exudate on trunks or branches may indicate PSHB attack (fig. A-C). Note that exudate may be washed off by rain events and therefore is not always present on heavily infested branches.

*Fusarium* dieback pathogens cause brown to black discoloration in infected wood. Scraping away bark over the entry/exit hole reveals dark, discolored tissue (fig E, F). Advanced infections eventually lead to branch dieback and death of the tree.



PSHB entry/exit-holes are ~0.85 mm in diameter, about the size of the tip of a ballpoint pen (fig. D). The female beetle's abdomen is sometimes seen sticking out of the hole.



Dark staining in PSHB galleries shows the extent of infection (fig. G, H).



## LOOK-ALIKE SYMPTOMS ON AVOCADO

Many other pests can cause staining, sugary exudate, or bark damage on avocado. Look out for signs and symptoms that look similar to those of PSHB/FD.

**Avocado trunk canker,**  
*Phytophthora menzei*  
Fig. I, J



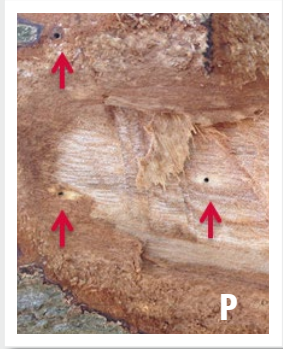
**Black streak disease**  
*Botryosphaeria* spp.  
Fig. K, L



**Bacterial canker,**  
*Xanthomonas campestris*  
Fig. M, N



**Ambrosia beetle,**  
*Xyleborus saxeseni*  
Fig. O, P  
Secondary beetle  
2-2.4 mm long,  
smaller entry holes  
than those of PSHB;  
attacks stressed and  
dying trees  
Photo credit: (O) Christoph  
Benisch <kerbtier.de>



**Avocado branch  
canker and  
dieback,** caused by  
*Botryosphaeriaceae*  
(*Neofusicoccum* spp.  
including *N. australe*,  
*N. luteum*, *N. parvum*;  
*Fusicoccum aesculi*;  
*Dothiorella iberica*;  
*Diplodia mutila*;  
*Phomopsis* sp.  
Fig. Q, R



## HOW TO REPORT A SUSPECT TREE

Please report suspected tree infestations to UC Riverside (eskalenlab@gmail.com). Submit the following information:

- Contact information (name, city, phone number, email)
- Suspect tree species
- Description of suspect tree's location (and/or GPS coordinates)
- Description of suspect tree's symptoms
- Photos of suspect tree and close-up photos of symptoms (see examples)

Take photos of suspect trees from several distances. Include photos of:

1. the trunk or symptomatic branches;
2. the symptoms (close-up); and
3. the entry/exit hole, if visible, with a ballpoint pen for scale (remove exudate if necessary). If dieback is observed, take a picture of the entire tree.



## PSHB ONLINE

**Stay up-to-date on the latest PSHB research at** Eskalen Lab website (<http://eskalenlab.ucr.edu>) or the website for the UC Riverside Center for Invasive Species Research (<http://cizr.ucr.edu>).

**Authors:** Akif Eskalen, Ph.D (UC Riverside), Monica Dimson (UCCE Orange); John Kabashima, Ph.D (UCCE Orange). Images provided by Eskalen and Dimson unless cited otherwise.

January 22, 2015

Karen Ross, Secretary  
California Department of Food and Agriculture  
1220 N Street  
Sacramento, CA 95814

**Re: Non-Composted Green Waste Pest Transmission**

Dear Secretary Ross:

On January 15, 2015, representatives from the California Avocado Commission, Agriculture and the University of California, Riverside shared their concerns regarding the potential for pest transmission (resulting from the application of non-composted green waste) with the Riverside County Solid Waste Management Advisory Council/Local Task Force (SWMAC/LTF).

Specifically, and as you are aware, non-composted green waste can harbor the Polyphagous Shot Hole Borer that causes a disease called Fursarium Dieback, which interrupts the transport of water and nutrients in over 110 tree species.

Over the past year, the SWMAC/LTF has been working closely with stakeholders to address the impacts of land-application of non-composted, ground green waste on land in Riverside County. Due to the trash component of this material, the SWMAC/LTF is concerned that this practice leads to stormwater quality degradation, while often having very little, if any, agronomic benefit to the soil. The SWMAC/LTF is now aware that this practice is also likely to lead to the uncontrolled transmission of pests.

The SWMAC/LTF is a 22-member body whose diverse membership includes representatives of supervisorial districts, cities whose population exceeds 100,000, Western Riverside Council of Governments, Coachella Valley Council of Governments, the waste management industry, the environmental community, and the agriculture industry. The SWMAC/LTF considers a broad scope of waste management and recycling issues in its efforts to advise the County Waste Management Department and the Board of Supervisors in ensuring a coordinated, cost-effective, and environmentally sound solid waste management system in Riverside County.

Consistent with these responsibilities, the SWMAC/LTF is requesting your assistance and guidance on this issue, and would appreciate any efforts from your agency to ensure that the Shot Hole Borer does not impact Riverside County's crops and ornamental street trees.

Sincerely,

Simon Housman  
First Vice-Chairman  
Riverside County Solid Waste  
Management Advisory Council



20 January 2015

Supervisor Marion Ashley  
County Administrative Center  
4080 Lemon Street – 5<sup>th</sup> Floor  
Riverside, CA 92501

Dear Supervisor Ashley,

On behalf of the California Avocado Commission and the nearly 5,000 California avocado growers we represent, thank you for your support in fighting the Polyphagous Shot Hole Borer beetle. Below are key points about the beetle and fungal pathogens it vectors that you may find useful in constructing your letter to the Secretary of Agriculture.

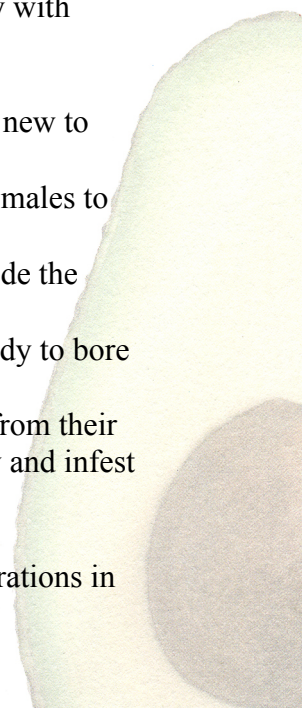
Please do not hesitate to contact me for any clarification or further information.

Best Regards,

Timothy M. Spann, Ph.D.  
Research Program Director

#### Polyphagous Shot Hole Borer and Fusarium Dieback Pest-Disease Complex

- The Polyphagous Shot Hole Borer (PSHB) beetle is a an ambrosia beetle, meaning that it feeds on fungi, which it inoculates into its host tree
- PSHB is new to science, appearing identical to and being closely related to the Tea Shot Hole Borer, *Euwallacea fornicatus*, but it is a genetically distinct species
- The beetle is tiny, about the size of Lincoln's nose on a penny
- Female beetles bore galleries into host trees, inoculating the walls of the gallery with spores of their fungal food source as they bore
  - The beetles feed only on the fungi, not on the wood of the host tree
  - PSHB carries with it the spores of four fungal species, all of which are also new to science
- Females lay eggs at the innermost ends of the galleries, and control the ratio of males to females, skewing the ratio to females
- When the eggs hatch, the larvae feed on the fungi in the gallery and mature inside the gallery
- The new females mate with their siblings, before emerging from the gallery ready to bore their own gallery and start the cycle anew
- Most beetles probably stay on the infested tree, crawling only a short distance from their birth gallery before boring their own new gallery; however, some beetles do fly and infest new trees
- It is believed that the male beetles never leave the gallery
- From egg to egg is about 40 days, meaning that there can be as many as 9 generations in one year



- Conservatively, if each female produces 10 new females, one beetle becomes 100,000,000 beetles in one year

### Host Range

- Currently, PSHB is known to attack >280 different tree species from 61 different plant families, representing every continent except Antarctica
- The host range includes at least 15 native California species and 11 agricultural commodities in addition to hundreds of common ornamental species (see attached table)

### Difficult to Control

- The beetle's lifecycle, spending nearly its entire life within the host tree, makes it very difficult to control since it has little exposure to any pesticide treatment
- Additionally, because of the sibling mating behavior, no sex or aggregation pheromones are known to exist for this species, making trapping for monitoring and attract-and-kill technology virtually impossible
- The fungal pathogens are equally difficult to control because they are inoculated in the tree as the beetle bores its gallery and they become systemic within the host tree

### Movement of Debris

- Dr. Timothy Paine, Professor of Entomology at UC Riverside, has conducted studies on how to manage debris from infested trees
  - He has found that chipping or grinding wood from infested trees is insufficient to control the beetle since it can survive in chips as small as 1-inch
  - Only further treatment by composting, heating or chemical fumigation can ensure that no beetles survive in chipped material to spread the infestation
- Furthermore, it is possible that the fungi infesting chipped material may be able to produce spores and spread, without the aid of the PSHB, to healthy trees by entering through pruning wounds or other injuries

### Not Just an Agriculture Problem

- The city of Long Beach has already lost hundreds of ornamental street trees to PSHB
- Orange County Parks and Recreation is battling PSHB in several of its parks, losing beautiful old specimen sycamore trees
- The collections at Huntington Botanical Gardens and the Los Angeles Arboretum have been devastated by this pest-disease complex
- As the beetle damages trees, limbs become weak and can break off, potentially causing property damage and personal injury, not to mention the costs associated with removing and replanting affected trees

**Table 1. Known reproductive hosts, agricultural crop hosts and native species hosts of the polyphagous shot hole borer/fusarium dieback disease complex as of February 2014<sup>a</sup>.**

	<b>Reproductive Hosts</b>	<b>Agricultural Crop Hosts</b>	<b>Native Species Hosts</b>
1.	Box elder ( <i>Acer negundo</i> )	Avocado ( <i>Persea americana</i> )	California box elder ( <i>Acer negundo</i> var. <i>californicum</i> )
2.	Castor bean ( <i>Ricinus communis</i> )	Japanese persimmon ( <i>Diospyros kaki</i> )	Coast live oak ( <i>Quercus agrifolia</i> )
3.	Avocado ( <i>Persea americana</i> )	Olive ( <i>Olea europaea</i> )	California sycamore ( <i>Platanus racemosa</i> )
4.	English oak ( <i>Quercus robur</i> )	Macadamia ( <i>Macadamia integrifolia</i> )	Big leaf maple ( <i>Acer macrophyllum</i> )
5.	Coast live oak ( <i>Q. agrifolia</i> )	Mulberry ( <i>Morus</i> spp.)	Red willow ( <i>Salix laevigata</i> )
6.	California sycamore ( <i>Platanus racemosa</i> )	Hazelnut ( <i>Corylus colurna</i> )	Valley oak ( <i>Q. lobata</i> )
7.	Big leaf maple ( <i>A. macrophyllum</i> )	Loquat ( <i>Eriobotrya japonica</i> )	Blue palo verde ( <i>Parkinsonia florida</i> )
8.	Mimosa ( <i>Albizia julibrissin</i> )	Peach ( <i>Prunus persica</i> )	Engelmann oak ( <i>Q. engelmannii</i> )
9.	Coral tree ( <i>Erythrina corallodendron</i> )	Grape ( <i>Vitis vinifera</i> )	White alder ( <i>Alnus rhombifolia</i> )
10.	Titoki ( <i>Alectryon excelsus</i> )	Sweet orange ( <i>Citrus sinensis</i> )	Canyon live oak ( <i>Q. chrysolepis</i> )
11.	Blue palo verde ( <i>Parkinsonia florida</i> )	Cassava ( <i>Manihot esculenta</i> )	California bay laurel ( <i>Umbellularia californica</i> )
12.	Tortuosa ( <i>Salix matsudana</i> )		Desert fan palm ( <i>Washingtonia filifera</i> )
13.	Weeping willow ( <i>S. babylonica</i> )		California buckeye ( <i>Aesculus californica</i> )
14.	Red willow ( <i>S. laevigata</i> )		Velvet ash ( <i>Fraxinus velutina</i> )
15.	Trident maple ( <i>A. buergerianum</i> )		Coffee berry ( <i>Rhamnus californica</i> )
16.	Japanese maple ( <i>A. palmatum</i> )		
17.	Evergreen maple ( <i>A. paxii</i> )		
18.	Chinese holly ( <i>Ilex cornuta</i> )		
19.	Brea ( <i>Cercidium sonora</i> )		
20.	Black bean ( <i>Castanospermum australe</i> )		
21.	Camellia ( <i>Camellia semiserrata</i> )		
22.	Cork oak ( <i>Q. suber</i> )		
23.	Red flowering gum ( <i>Eucalyptus ficifolia</i> )		
24.	Engelmann oak ( <i>Q. engelmannii</i> )		
25.	Palo verde ( <i>P. aculeata</i> )		
26.	Sweetgum ( <i>Liquidambar styraciflua</i> )		

<sup>a</sup>For a complete list of all host species see: Eskalen et al. 2013. Plant Disease 97(7):938-951.



January 27, 2015

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California Department of Food and Agriculture  
1220 N Street  
Sacramento, CA 95814

**Re: Non-Composted Green Waste Pest Transmission**

Dear Secretary Ross:

On January 27, 2015, the Riverside Board of Supervisors heard testimony from representatives of the (*California Avocado Commission, Agriculture and the University of California, Riverside*) regarding the potential for pest transmission resulting from the application of non-composted green waste.

Specifically, and as you are aware, non-composted green waste can harbor the Polyphagous Shot Hole Borer that causes a disease called Fursarium Dieback, which interrupts the transport of water and nutrients in over 110 tree species.

Over the past year, the Solid Waste Advisory Council and Local Task Force, an advisory body to the Board of Supervisors, has been working closely with stakeholders to address the impacts of land-application of non-composted, ground green waste on land in Riverside County. Due to the trash component of this material, the Board of Supervisors is concerned that this practice leads to stormwater quality degradation, while often having very little, if any, agronomic benefit to the soil. The Board of Supervisors is now aware that this practice is also likely to lead to the uncontrolled transmission of pests.

Based on the potential of Shot Hole Borer to significantly impact Riverside County's crops and ornamental trees, the Board of Supervisors is requesting your assistance and guidance on this issue, and would appreciate any efforts from your agency to prevent transmissions of this pest.

Sincerely,

Marion Ashley,  
Chairman, Board of Supervisors

January 22, 2015

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California Department of Food and Agriculture  
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First Vice-Chairman  
Riverside County Solid Waste  
Management Advisory Council