UNIVERSITY OF CALIFORNIA COOPERATIVE EXTENSION:
EL DORADO AND AMADOR COUNTIES

FOOTHILL FARM AND ORCHARD NEWS

Produced by your UC Cooperative Extension Farm Advisor,
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SPECIAL SPOTTED WING DROSOPHILA UPDATE!

Male SWD **July, 2010**

Dear Foothill Growers, **Spotted Wing Drosophila (*Drosophila suzukii*)** has been recently found infesting cherries in El Dorado County. This is a very serious new pest and all soft fruit growers need to be aware that their fruit production is likely to be at risk for infestation. Because Spotted Wing Drosophila is a new pest to California, we are still learning the best methods to trap and manage it. Below is a summary of the information I have gathered to date from my colleague Farm Advisors Janet Caprile (UCCE Contra Costa), Mark Bolda (UCCE Santa Cruz), Dave Haviland (UCCE Kern), UC Berkeley Specialist Bob Van Steenwyk, and information from the UCIPM website. Please keep in mind here is much to learn about this pest so recommendations are evolving.

What is Spotted Wing Drosophila (SWD)? Spotted Wing Drosophila, *Drosophila suzukii*, is a new type of vinegar fly that differs from other *Drosophila* vinegar flies because it attacks perfectly sound, ripening fruit. There are many other Drosophila and other fruit flies present here but they only attack fruit which is breaking down and compromised (as by hail damage, bird damage, brown rot, etc.)-SWD attacks perfectly good fruit. The fly is native to Asia (Japan, China, Korea, Thailand) and has been in Hawaii for about 15 years with no reports of crop damage there. SWD was first detected in California in August 2008 damaging berries in the Central Coast and by the end of cherry season in 2009 it had spread to all major cherry production areas in the Valley-infesting good cherry fruit. In 2009 it also spread to Oregon and Washington.

We had the first detections here in El Dorado County as of early July in cherries. The ability of this fly to spread so rapidly across the country means it is sure to spread to all of El Dorado County quite quickly-I would guess within a month.

Female SWD

Female serrated ovipositor-only visible under the microscope!

What does the SWD damage look like? What is the life cycle? Since this is a fly, the larvae are maggots (maggots do not have legs, to differ from moth larvae-caterpillars- like peach twig borer). The SWD females have an exceptional ovipositor that distinguishes her from other *Drosophila*-large, hard, and serrated, which allows her to oviposit her eggs into intact, ripening fruit. She lays one to several eggs per fruit, inside the fruit, and they hatch into the maggots. The maggots then consume the inside of the fruit, breaking it down and pre-disposing it to rot. The maggots then leave the fruit to pupate and emerge as adult flies to begin the cycle all over. Generation times are based on weather, they like moderate temperatures and the warmer the weather the more quickly the maggots mature into adults up to a point of about 90°F (after which the populations decline or are slower to develop). Much is not yet exactly known about the life cycle and development of this pest!

Look for tiny holes in otherwise undamaged parts of the fruit (see pictures above). If you find one, you can scrape into the fruit to look for the maggot. Remember that other *Drosophila* maggots can be present in damaged fruit so be sure you are looking at otherwise undamaged fruit.

What is the SWD host range? In California, SWD has infested **strawberries, cane berries (blackberries and raspberries), blueberries, and cherries.** There are some reports of SWD attacking tree ripened **nectarines, soft-skinned plums and pluots.** It has not appeared to be a pest of grape, apples or pear. The fly appears to prefer dark varieties of cherry (Bing over Rainer), although can attack both. We can not be sure exactly which crops will be affected here since it seems that there are a variety of influencing factors. I am very concerned about our tree-ripened fruit industry being at risk, however. **The abundance of cull piles and discarded fruit (peelings from pie shops and cider makings, etc.) may pose an additional threat to building populations.**

How can we monitor and trap for it? I am trying to work out which trap will work the best for our area. The key is to be able to trap male flies (the ones with the spots on the wings), since we do catch many other flies and Drosophila species and you can not tell the females without looking at the ovipositor under the microscope and this is very time consuming. The flies are quite small and not easy to identify.

A plastic cup or yogurt type of container, with the lid, with 3/16 inch holes drilled into the top is the trap we are working with. I have recruited a group of Master Gardener volunteers (thank you MGs!) to help me trap around the county. We first tried apple cider vinegar, based on work done by others last year, but did not trap any flies. I have since learned that you need to use REAL apple cider vinegar (not flavored-read the ingredients on the bottle to make sure it isn't white vinegar that is flavored). Also, it appears that REAL apple cider vinegar may trap more *females* than males earlier in the season, so if you are looking only for the males with the spots on the wings you will miss the SWD. As I said, there is much to learn about this pest.

We are currently trying the following trap mixtures to see if any work better:
1. ½ c. REAL apple cider vinegar
2. ½ c. REAL apple cider vinegar + 1 tablet tortula yeast (a non fermenting yeast)
3. ½ c. water + 1 tsp. sugar + ¼ tsp. baker's yeast

Putting a small drop of fragrance free soap will help break surface tension to trap flies.
Other researchers are also recommending cheap white wine as a trap attractant but I haven't tried it yet.

Traps should be hung in a shaded part of the tree and not in the direct sun. There are observations that flies prefer moist habitats (pond nearby, wet grass,etc.) and are less abundant in dry ground covered orchards. Earliest ripening varieties should be used as trap sites since this is where flies will attack first.

Management of SWD. There are many insecticides that can be used to knock down the adult flies if you find SWD on your farm. None of these materials are effective against the maggots once they are inside the fruit. The choice of insecticide depends on the host crop (the host crop must be listed on the label), the re-entry interval (REI) and pre-harvest interval (PHI). Environmental considerations (esp. water quality concerns as with the permethrins and organophosphates) may also influence choice of materials. Some are so broad spectrum they will likely knock out natural enemies and may flare other pests. There are organically-approved (OMRI) options as well. ROTATION of insecticides (insecticide class or mode of action) is important for all of these materials-since these are flies with a potential short generation time we need to rotate class of insecticides used so as not to introduce resistance into the population.

Data from Japanese literature on cherries, trials by Mark Bolda (UCCE Santa Cruz County) in coastal caneberries, laboratory trials by Denny Bruck (USDA-ARS, Corvallis OR) and work cited by Dave Haviland, (UCCE Kern County), all suggest that organophosphate (Malathion) and pyrethroid (Mustang) insecticides will be the most effective for blueberries. Both of these products are labeled for use in blueberries and have a one day pre-harvest interval. Other pyrethroids are also available but most have longer pre-harvest intervals.

Bob Van Steenwyk has noted that in the Japanese literature for cherries, 3-4 applications are required to control SWD and the organophosphate and pyrethroid insecticides are effective for one to possibly two weeks. Van Steenwyk has also reported good SWD control with spinetoram (Delegate). As with all SWD materials, Malathion and Mustang applications should be alternated (with a material in a different chemistry class such as Delegate) to reduce the risk of resistance to either chemistry.

Organic growers should contact their certifiers early in the year to make sure they will approve the use of spinosad (Entrust), pyrethrin (Pyganic 5.0) and/or azadirachtin (Aza-Direct) if spotted wing drosophila begins to cause damage. Pyganic 5.0 contains pyrethrins-a botanical insecticide derived from chrysanthemums. Entrust is the organic formulation of spinosad. Aza-Direct is azadirachtin which is a type of Neem product and used as a botanical antifeedant, repellant and insect growth regulator. Generally the organically approved products are not as effective as the other (non-organic) products previously mentioned, but can suppress fly populations and are important tools for organic producers. Recent studies in control of SWD in organic raspberries by Mark Bolda (UCCE Santa Cruz) showed differences in the number of SWD larvae in fruit treated with Pyganic 5.0 @ 18 oz. and Entrust @ 2 oz. compared to an untreated control. Bolda also looked at Pyganic 5.0 @ 18 oz. combined with Aza-Direct @ 2 pt. and this treatment provided similar control as that of the Pyganic 5.0 @ 18oz. alone. Pyganic 5.0 @ 9 oz. did not provide control in Bolda's study. Interestingly, in Bolda's work, treatment differences can not be seen when measuring adult fly populations (he uses a D-vac to vacuum up adult flies)-only when measuring maggots inside fruit. Other organic products such as GF-120 and a variety of oils are reportedly not very effective. It is also just as important to remember that Entrust and other organic products, as with conventional materials, should not be overused in efforts to prevent resistance development. Entrust has a pre-harvest interval of three days in blueberries. Check the labels for PHI for other materials in other crops.

Always read labels before applying to make sure your host crop is on the label. Also check for PHI and REI, which can vary by crop. Remember to rotate!!

Chemical Class	Trade Name	Active Ingredient	Considerations
Organophosphates	Malathion Diazinon	Malathion Diazinon	• Broad spectrum so will harm natural enemies and may blow up other pests. • Water quality concerns, esp. with Diazinon. • Rated highly effective, 7-14 days, in tests on cherries (Van Steenwyk). • In caneberries, Malathion gives approx. 10-14 days control on the coast (Bolda pers. com.).
Pyrethroids	Warrior II Mustang Asana Ambush/Pounce Others…	Lamda-cyhalotrhin Zeta-cypermethrin Esfenvalerate Permethrin	• Large group of chemicals to choose from-vary in PHI (14 days to 3 days) so read the label! • Rated for 1-3 days of control in tests on cherries (Van Steenwyk). • Broad spectrum so will harm natural enemies and may blow up other pests. • Water quality concerns-highly toxic to water organisms and can not allow drift into waterways!!
Neonicotinoids	Assail Provado Actara	Acetamiprid Imidacloprid Thiomethoxam	• Considered softer than pyrethroids and OPs on beneficial insects and waterways. • Rated for 3-1 day of control in tests on cherries (Van Steenwyk). • PHI varies 14-7 days.
Spinosyns	GF-120 Success, Entrust Delegate	Spinosad plus bait Spinosad Spinetoram	• Control varied in tests on cherries (Van Steenwyk) to only 1 day with GF-120; to 3-7 days with Entrust and Success; to 7-14 days with Delegate. • Entrust is organically approved and provided good control in organic raspberry studies @ 2 oz.(Bolda). • PHI varies 0 to 7 days.
Pyrethrin	Pyganic 5.0	Pyrethrin derived from chrysanthemums	• Organically approved • Provided control in organic raspberry studies @ 18 oz. (Bolda).

Cultural management of SWD-Region wide sanitation. Chemical controls are not the only consideration when managing Spotted Wing Drosophila. My colleagues with SWD experience, Mark Bolda (UCCE Santa Cruz) and Janet Caprile (UCCE Contra Costa), have both noted the high importance of removing unharvested, unused, rotting fruit from the field and properly composting or burying it to remove it as a food and resource for SWD. This means that ALL fruit needs to be removed from the field, AWAY from the growing crop, in order to help reduce SWD populations. Cull piles of fruit should be covered with plastic or buried with soil to help them heat up and compost rapidly. It may become extremely important for the Apple Hill region to adopt a neighborly sanitation program to help reduce SWD populations should they become high.

- I will try to keep everyone informed as we continue our trapping studies in the area. In the meantime, all soft fruit growers should be on alert, inspect ripening fruit (and train your sorters on what to look for), and have a plan for how to deal with Spotted Wing Drosophila.

Resources for more information:

UCIPM website for exotic pests (scroll down to Spotted Wing Drosophila):
http://www.ipm.ucdavis.edu/EXOTIC/exoticpestsmenu.html

Includes the following:

- Fact sheet: 2010 recommendations for sweet cherry (76 KB, PDF) Updated
- Fact sheet: Provisionary guidelines: Management of SWD on cherries in home garden situations New
- Pest Management Guidelines: Caneberries, Cherry, and Strawberry
- Dichotomous key: Identifying SWD from other *Drosophila* species (1.1 MB, PDF)

UCCE Santa Cruz Farm Advisor Mark Bolda's Blog (Caneberries and Strawberries):

http://ucanr.org/blogs/strawberries_caneberries/

UCCE El Dorado-this document and other information will be posted on my website at:
http://ceeldorado.ucdavis.edu