

First Detection and Response to the Arrival of Spotted Wing *Drosophila* in Michigan

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Michigan is a leading producer of fruits and vegetables, with one of the most diverse specialty crop sectors in the nation. As the top region for growing highbush blueberries, tart cherries, and Niagara grapes (among other food crops), it is important that Michigan maintains the economic vitality of these agricultural industries when threatened by invasive insects. This is particularly important at a time when agriculture is one of the few bright spots in the Michigan economy, and MSU Extension specialists have been keeping their eyes on the horizon for potential insect threats.

New potential invasive insects of fruit crops. Over the past few years, we have become increasingly concerned about four insect species that might affect fruit crops in the Great Lakes region. This list includes Light Brown Apple Moth (*Epiphyas postvittana*), European Grapevine Moth (*Lobesia botrana*), Brown Marmorated Stink Bug (*Halyomorpha halys*), and Spotted Wing *Drosophila* (*Drosophila suzukii*) or SWD. All of these species infest various fruit crops and the climate in the Great Lakes region would be highly suitable for their invasion and subsequent establishment. The two moth species have been detected in recent years in California in multiple counties, and are the subject of eradication/management programs with quarantine protocols in place to prevent further movement of these species between states. These exotic moth species were not found in Michigan during a widespread monitoring program conducted in 2010 by the Michigan Department of Agriculture. Establishment of the brown marmorated stink bug in Michigan was first reported in 2011 based on specimens first collected in two Michigan counties

in 2010. This species is of high concern because it has recently become a major pest across the Mid-Atlantic States with damage to fruits, vegetables, field crops, and ornamentals, as well as a nuisance pest because it invades homes in large numbers to overwinter.

This article focuses on the fourth of these exotic species, *Drosophila suzukii* (Matsumura) (Diptera: Drosophilidae). A native of Asia, this vinegar fly has been reported since the 1930s in the literature as a pest of fruit crops. The adult male of this species has a distinctive spot on each of the wings (Fig. 1), but it is the female morphology that makes it an agricultural threat. This species is one of only two *Drosophila* species that have serrated ovipositors that allow them to cut into intact fruit to lay their eggs (Fig. 2). This morphological feature has significant implications for susceptible crops, because it means that SWD larvae can be present at harvest-time, rather than the typical *Drosophila* that need weakened or split flesh to allow oviposition. With the fresh and processed fruit market having zero tolerance for insect contamination, this new pest, which can reproduce rapidly (one

generation every 12 days at 65-70°F) and has high fecundity (up to 300 eggs laid per female), poses a significant threat.

During 2010, SWD flies were detected in monitoring traps only after susceptible crops were harvested (see below). As we approach the coming 2011 growing season, we will learn much more about the ecology and management of this insect under our local conditions.

Forming a SWD Response Team.

SWD was first detected in the continental US in 2008 in raspberry plantings in central coastal California. It quickly moved through many of California's main fruit production regions and during 2009 was detected in Oregon, Washington, and British Columbia with infestations in blueberry, raspberry, cherry, and other fruit. The crops most at risk from this pest include those with thin skin and soft flesh. At first the arrival of SWD in the US seemed like a west coast issue and that The Rockies might keep the fly out of eastern states. However, modern interstate trade seems to have made that unlikely, and in late 2009 SWD was found in Florida. At that point, MSU entomologists took much more notice and invited interested organizations to form a SWD Response Team. The SWD Response Team is comprised of fruit commodity leaders, Michigan Department of Agriculture (MDA), MSU Extension educators and members of the MSU Entomology and Horticulture Departments who have been meeting since early 2010 to develop monitoring plans and to coordinate efforts within Michigan. This group developed an Early Detection-Rapid Response (EDRR) plan, both to monitor for this insect and to develop some response scenarios depending on when and where the pest was detected.

Monitoring and teamwork lead to 2010 detection in Michigan. Over 300 monitoring traps were deployed in early summer 2010, mostly in fruit farms but also at some processing sheds, rest stops, and urban gardens, and also around the MSU campus. For many weeks there were no captures of SWD in these traps but on Thursday, 23 September 2010, the first suspect flies (a few males and one female) were found in Allegan County by MSU Entomology technician Steve Van Timmeren. These flies were driven to MSU campus that same afternoon by John Wise, and the identification was



Figure 1. Male *Drosophila suzukii* clearly showing the two spots on the wings. The two dark bands on the foreleg are also partially diagnostic for this species. Note that other *Drosophila* trapped in Michigan during 2010 also had dots on the wings but they were either located elsewhere on the wing or were a different shape. Photo by Gevork Arakelian.

verified through the online key developed by Oregon Department of Agriculture by MSU Entomology graduate student Noel Hahn that same evening. The next day I took the samples to Gary Parsons, collection manager at the MSU Albert J. Cook Arthropod Research Collection who also confirmed their identity using the key. Robin Rosenbaum at MDA explained the process for getting samples officially submitted to USDA-APHIS Plant Protection and Quarantine's division for insect identification, and so at 1pm that Friday, 24 September 2010, Laurel Lindemann drove the flies to Jim Zablonty at the APHIS-PPQ office near the Detroit airport. Dr. Zablonty provided tentative official confirmation of SWD male and female flies that Friday afternoon, and early the next week the USDA Systematic Entomology Lab in Beltsville, MD, sent official confirmation. Such a rapid determination of the species identity of these samples by the USDA taxonomists was very helpful at the start of our response to this pest's arrival in Michigan.

During the long warm fall of 2010, additional detections were made at many more sites including farms, rest stops, urban gardens, and at the MSU campus. In total, 13 of the 28 counties monitored were found to be positive for this pest (Fig. 3). Our 2010 sampling efforts and the eventual trap distribution were somewhat haphazard and responsive to the hotspots that were first identified in September, but we have been able to highlight some of the major areas of distribution. The cold weather in early December finally brought the catches of flies down to zero. However, during fall 2010 we were able to determine that SWD flies are able to withstand cold nights in the 20's and remain active the following day and that they can infest some of our wild berry-producing plants such as dogwood and poke-weed. Further monitoring in 2011 with support from the Specialty Crop Block Grant through MDA will help further delineate SWD distribution in Michigan.

Monitoring for SWD. One of the most important functions of the SWD Response Team is to coordinate our monitoring program for understanding where SWD are present in Michigan. We are using a simple trap design based on a plastic 32-oz cup with ten 3/16 inch holes around the sides of the cup, leaving a 3-4 inch



Figure 2. Distinctive ovipositor morphology of *Drosophila suzukii*. Photo by Martin Hauser.

section without holes to facilitate pouring out of the liquid (Fig. 4). The holes can be drilled in sturdy containers or melted with a hot wire or wood burner in the cups with thinner plastic. Pour 1-2 inches of apple cider vinegar into the trap as bait. To help attract flies and to ensure that trapped flies do not escape, a small yellow sticky trap can be placed inside the trap. This is optional, because the trap can still work well if the sticky trap is omitted, but then a small drop of soap should be added to the vinegar to prevent fly escape. Traps must be hung in the shade in the fruit zone to optimize catch. Attach a wire to the sides of the trap and then fasten the trap to a branch or trellis. A commercially-available trap (Contech Co.) is now being marketed and it performed well in some 2010 trials on the west coast.

We recommend that traps are checked weekly for SWD flies and that the vinegar is changed weekly to retain its activity. During 2011, we will be running a study to compare different durations of vinegar deployment. Pour the old vinegar into a bottle or away from the trap location, and then place the traps back near the crop with fresh vinegar. Continue monitoring through harvest and post-harvest to determine whether the fruit need protecting.

Online SWD monitoring database. For the 2011 season, MSU will be establishing an online database for recording SWD capture information from monitoring traps. This will provide a central site for data collection and the weekly county-level reports will be used by MSU extension staff. We also hope to engage the Master Gardener network to provide further outreach into counties where fruit agriculture is sparse. We welcome MES entomologists joining this network of monitoring sites so that we can further in-

crease our geographic spread. This system will be online by June, and information on registering as a member of the SWD Monitoring Team will be posted later through our SWD website (see below).

Getting the word out – rapid extension education response. When new invasive insect pests arrive there is a rapid learning curve for everyone affected. In this case, large amounts of extension information in English have been developed by west coast research and extension colleagues, and they have made available their translations of the early Japanese literature. This has helped our Michigan team get up to speed quickly on this pest, and to develop some useful extension materials. With assistance from the MSU IPM Program's Joy Landis we have launched a SWD website (www.ipm.msu.edu/SWD.htm) that will serve as the central clearing house for all information on this pest in Michigan. At this site you can find an MSUE fact sheet in English and in Spanish, guides to monitoring for SWD, management information, a video about trap construction and placement, and regional contacts.

In addition to the printed and electronic information, MSU Extension specialists and educators have spent the winter giving talks at grower meetings to increase awareness about SWD. This has been challenging given that we have little experience with this pest in the Upper Midwest, but members of the SWD Response Team have provided numerous talks to fruit growers around the main fruit producing regions of the state, from Benton Harbor to Traverse City. These talks have focused on awareness, monitoring, identification, and management and we plan to generate much more information for Michigan by the end of this year.

As spring 2011 approaches, our education efforts have transitioned to focus on hands-on training events. These workshops provide extension educators, growers, scouts, and consultants with a chance to see SWD eggs, maggots, pupae, and adult flies. We demonstrate trap construction, placement, checking, and how to sample fruit for the SWD maggots. We hope that this early effort in training will enable better management decisions to be made during the summer if this pest is found again.

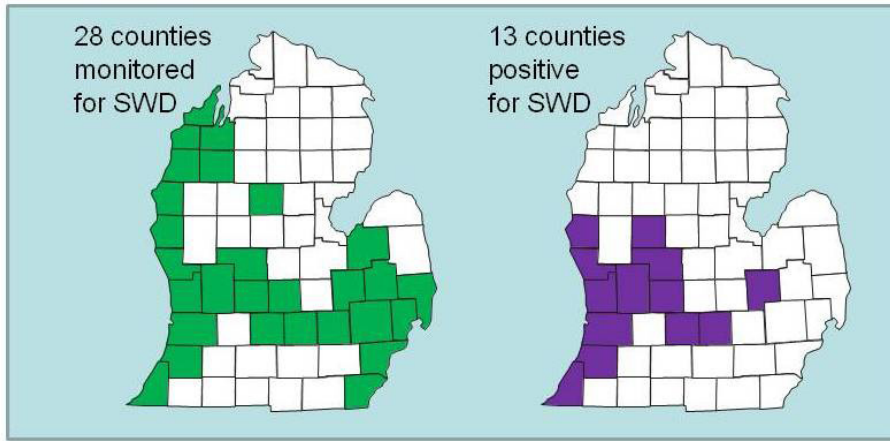


Figure 3. The 28 counties in Lower Michigan monitored for *Drosophila suzukii* during 2010 (left), and the 13 counties in which positive detections were made (right). Sampling effort and average trap counts varied widely across the sampled counties. Image: Rufus Isaacs.

Next steps. This coming summer the SWD Response Team will learn much more about how this pest behaves under Michigan conditions. We are continuing with a widespread monitoring effort that will provide important insights into distribution, phenology, and sex ratios

of this insect. Our newly-established research projects will address sampling methods, optimal monitoring techniques, and methods for control in conventional and organic farms.

If you are interested in learning more about the ongoing response to SWD detec-

Figure 4. The monitoring trap used for SWD. A plastic container with holes, containing apple cider vinegar as bait, and a sticky trap to catch flies. Traps may also be used without the yellow sticky trap if a drop of unscented soap is added to the apple cider vinegar. Photo: Rufus Isaacs.



tion in Michigan, keep in touch with our activities at <www.ipm.msu.edu/SWD.htm>.

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Photos from Breaking Diapause that was held at the Natural Science Building at Michigan State University on 19 March 2011.



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