

# Monitoring the abundance of Spotted Wing Drosophila in 'Bluecrop' and 'Blueray' blueberry varieties in Northwest Indiana

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**Abstract.** The Spotted Wing Drosophila (*Drosophila suzukii*)(SWD) is a major pest of soft skinned fruits and berries. Fruit and berry farmers have been battling this vinegar fruit fly for over a decade now in The United States. The SWD has negatively affected the crop production of many fruits and berries by laying eggs in developing fruit, leading to damaged and decaying fruit. The purpose of this study was to monitor the abundance of SWD throughout the blueberry season in La Crosse, Indiana in two highbush blueberry varieties: 'Bluecrop' (*Vaccinium corymbosum*) and 'Blueray' (*Vaccinium corymbosum*). The goal was to evaluate if either variety had a higher abundance of SWD during the ripening stage of blueberries. Baited traps were placed in one field of each variety and checked weekly for a 7-week period. Overall, I collected 671 of SWD flies in baited traps during the monitoring period, with 127 males and 544 females. I found that the variety that began ripening first ('Blueray') exhibited the first spike in SWD abundance, and this pattern was repeated when the other variety ('Bluecrop') ripened 2 weeks later. This suggests that SWD monitoring traps are effective tools for detecting SWD and that timing of berry ripening is an important factor that influences SWD abundance in blueberry fields.

## Introduction

The Spotted Wing Drosophila (SWD) is an invasive vinegar fruit fly, originating from East Asia. In 1980, the SWD was spotted in Hawaii, then in 2008, it was spotted in California [1]. By 2013 the SWD invaded the majority of the United States and could be found from the west coast to the east coast. The SWD favors ripening fruits and berries with thin skin, as well as wild berries. Fruits and berries can also be affected before the ripening stage. The following crops are at risk of attack by

the SWD: blueberries, blackberries, raspberries, cherries, strawberries, peaches, and grapes [2]. Having a large range of host crops offers the SWD an advantage of producing up to 15 generations a year within different crops. Females can lay up to 300 eggs- about 1 to 3 eggs per fruit. Crops that are infested with SWD larvae can be completely rejected by the buyer. Late season berry crops can experience up to 80% crop loss [3].

The varieties 'Bluecrop' and 'Blueray' are considered to be highbush blueberry plants, which are cultivated. Highbush blueberry plants are diverse and have different ripening periods and produce different fruit sizes, colors, and flavors. 'Blueray' is an early-season crop that spreads outwards when it grows and produces large berries [4]. On the other hand, 'Bluecrop' is a mid-season crop that grows upwards and also produces large berries [4]. Cross-pollination between blueberry varieties can help increase the yield of berries in a season.

## **Methods & Materials**

### ***Sampling***

Commercial traps from Scentry Biologicals Inc. were used to monitor SWD. The trap consisted of a plastic container wrapped in red paper, small holes on three sides, a lid holding a specific SWD lure, and 200mL of drowning solution at the bottom (Figure 1). The drowning solution was a 1:4 ratio mixture of water (150mL) and apple cider vinegar (50mL), with a drop of dish soap. This prevented flies from escaping the solution and preserved them until collection. Traps were placed in the field and were zip tied to a sheppard's hook to prevent them from falling off. One SWD monitoring trap was placed per field variety, for a total of two traps in this monitoring study. The total area of the 'Blueray' field is 11,138m<sup>2</sup> and the total area of the 'Bluecrop' field is 33,721m<sup>2</sup>. The baited traps were 310 meters apart. Traps were placed diagonally across the field from each other to ensure there was no competition between the traps in

attracting SWD from each blueberry variety (Figure 2).

Traps were placed in the field starting June 3<sup>rd</sup>, 2020 and collected every 7-10 days, for 7 weeks- until July 31<sup>st</sup>, 2020 (Table 1). It is recommended to place the traps at least one month before fruit ripens. When collecting the specimens each week, it was also vital to discard any excess drowning solution off site and away from the traps. Discarding any used or excess drowning solution on the ground around the traps could increase the attraction of SWD into the area around the traps and bias the monitoring results

### ***Identification***

After 7 weeks of monitoring, a microscope was used to identify male and female SWD. Males are easily identified by the signature spot towards the tip of their wings (Figure 3). In addition to the wing spot, the presence of two hairs on the first segment of the front legs is useful for identification. Unlike males, females do not have any spots on the wings. To identify a female SWD, you must use a microscope and look for an enlarged and jagged ovipositor at the end of the abdomen (Figure 3). This spikey ovipositor helps pierce soft-skinned fruits and berries to deposit eggs.

## **Results**

In total, I detected 671 of SWD in monitoring traps over the 7-week period. I found 127 males and 544 females in

total, with the highest abundance of SWD in 'Blueray'. The first SWD detection occurred on Jun 10<sup>th</sup>, 2020 in both varieties 'Bluecrop' and 'Blueray'.

I observed an obvious trend between the ripening periods of each blueberry variety and SWD abundance. The 'Bluecrop' had a very slow increase in abundance and even decreased in week 3 (Figure 4). The ripening stage peaked for 'Bluecrop' in week 6, which showed a small peak in SWD abundance. In week 7, the SWD abundance decreased dramatically.

'Blueray' crops began to ripen first around week 3. During week 5 the 'Blueray' ripening stage was at its peak, (Figure. 5). This was also when the abundance of males tripled and the abundance of females doubled. After July 15<sup>th</sup>, 2020, the SWD abundance in 'Blueray' gradually decreased.

## **Discussion**

The goal of this study was to monitor the abundance of the Spotted Wing *Drosophila* in two highbush blueberry varieties during the 2020 growing season. The results show a relationship between the ripening period and the increases in SWD abundance. 'Blueray' is an early-season crop, while 'Bluecrop' is a mid-season crop. I speculate that 'Blueray' had the highest SWD abundance and the first SWD spoke during the season (Figures 6 and 7), because its fruits were available to SWD earlier than the 'Bluecrop' variety. I also observed that the spike was in both male and female abundance as

well. The 'Bluecrop' berries were only ripe for about a week and a half and then the berries were gone. Since 'Bluecrop' is a mid-season crop and the berries I speculate that this might explain why SWD numbers spike only a small amount at the end of the season.

Additionally, pesticides that target the SWD were sprayed weekly on all of the crops. Three different SWD pesticides were alternated throughout the season to reduce insect resistance. There is a possibility that the pesticides altered the abundance of SWD, but if so, it affected both fields equally so that a trend still appeared.

Finally, I had the opportunity to sit in on the Indiana blueberry growers meeting and learned about some of the specific worries' growers had for the 2020 growing season. A late frost and cold spring really did some damage on the early-season varieties. Some farmers said the late frost damaged the blooms and leaves, which can cause some problems for the pollination process. Others noted that the mid-season varieties were coming in just fine. The farmers then discussed new regulations that were being implemented because of COVID-19. There was a worry about contamination regarding pickers and the buckets they would use. They came up with the idea that people can just bring their own container to U-pick.

If I had the chance to do this study again, I think that I would like to

station traps on every corner of the field. I also would like to station a trap within the blackberry and raspberry bushes located on the farm. I would be very curious to see what the abundance of SWD would look like. I think it would be

interesting to identify the other fruit flies that were caught in the traps and observe the different species abundance throughout the season as well.



**Figure 1:** Picture of Scentry SWD trap located in the field. The reape odor and red color attract SWD.



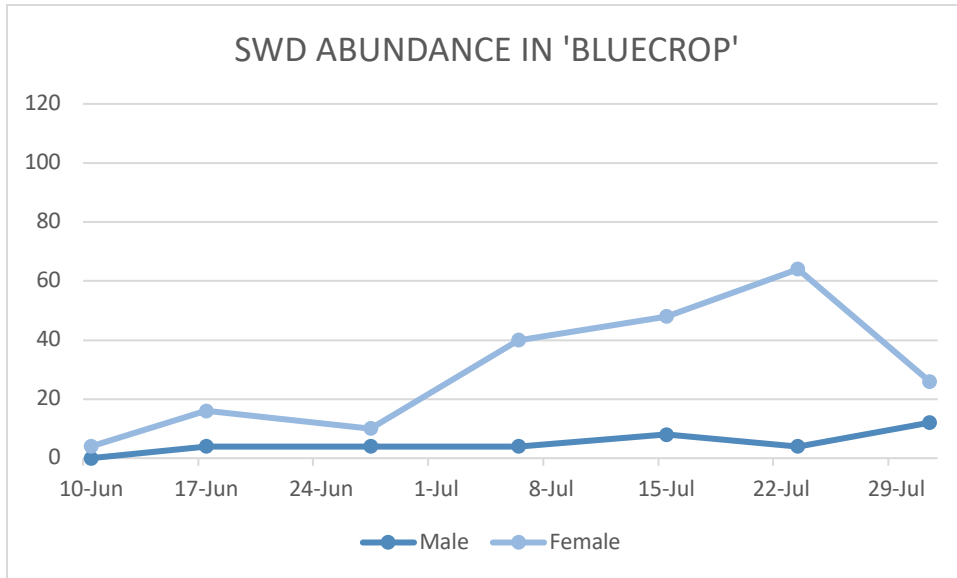
**Figure 2:** the location of SWD monitoring traps in one 'Bluecrop' and 'Blueray' highbush blueberry field

**Table 1:** The dates when SWD monitoring traps were set and collected in one 'Blueray' and one 'Bluecrop' highbush blueberry field.

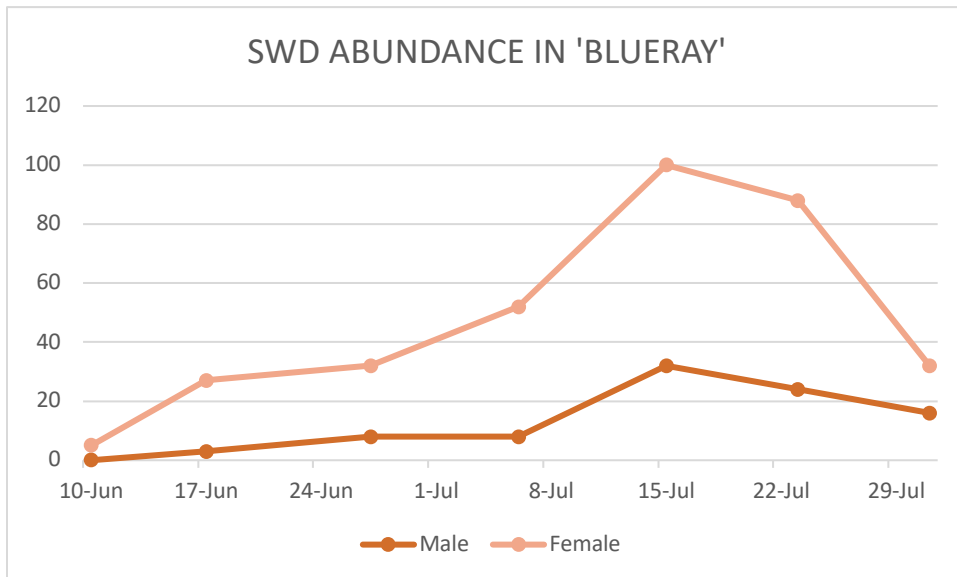
Date	Sampling point in season
June 3, 2020	Traps set
June 10, 2020	Week 1
June 17, 2020	Week 2
June 27, 2020	Week 3
July 6, 2020	Week 4
July 15, 2020	Week 5
July 23, 2020	Week 6
July 31, 2020	Week 7



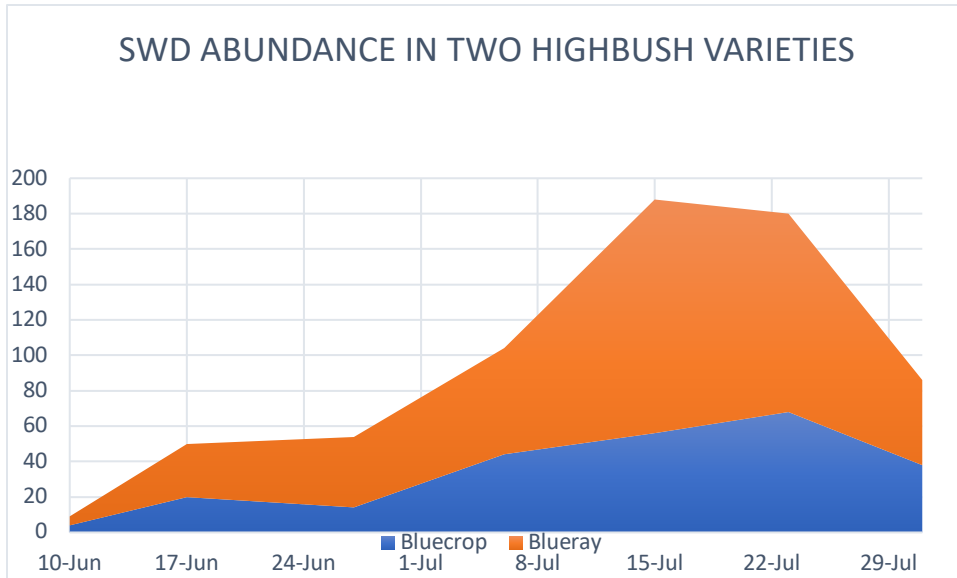
**Figure 3:** SWD specimens that were collected in monitoring traps during the study. (Left) Female SWD are identified by looking for a jagged ovipositor. (Right) Male SWD are identified by the signature spot towards the tip of each wing



**Figure 4:** the seasonal abundance of SWD flies in monitoring traps placed in the 'Bluecrop' highbush blueberry field. There was a slight increase in SWD abundance throughout the season, with more females than males detected. The highest spike occurred during week 6, followed by a decline in week 7.



**Figure 5:** The seasonal abundance of SWD flies in monitoring traps placed in the 'Blueray' highbush blueberry field. There was a steady increase in SWD abundance throughout the season, with more females than males detected. The highest spike occurred during week 5, followed by a gradual decline in weeks 6 and 7.



**Figure 6:** The total number of SWD captured in monitoring traps in ‘Bluecrop’ (blue) and ‘Blueray’ (orange) highbush blueberry fields. The ‘Blueray’ field consistently had the highest abundance of SWD compared to the ‘Bluecrop’ field.



**Figure 7:** Picture of the specimens that were collected from June 10<sup>th</sup>-July 31<sup>st</sup>. Labeled by week and numbered from which trap they were collected out of. (T1=Bluecrop) (T2=Blueray). Note: not every specimen that was collected was SWD.

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