SWD Overwintering Biology and Alternative Hosts

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Summary

Spotted wing drosophila (SWD) *Drosophila suzukii* was first detected in New York (and throughout the Northeast) in the fall of 2011. In 2012, adult SWD were found in baited traps in late June/early July at low levels in New York. Over the 2012 field season SWD populations steadily increased, reaching extremely high numbers in baited traps by the late fall. Our research program has been investigating the population dynamics of SWD, the factors promoting these large population increases and what happens to SWD over the winter and early spring.

One key question is how well does SWD survive the winter in more northern latitudes? We monitored adult SWD in the spring of 2013 at fruit farms where high populations existed the previous fall. We hypothesized that adults would overwinter in wooded areas adjacent to farms. To test this we established a grid of baited traps (deli cup design using water, sugar, yeast, and whole wheat flour as bait with a drowning solution made of apple cider vinegar and alcohol) in raspberry, strawberry and blueberry crops and adjacent wooded habitats. We did not capture any adults until mid-June (1 female in woods next to blueberry, growing degree days since January 1 = 550 Degree Days using 50° F as a lower developmental threshold) and we did not consistently capture adults (still at low levels) in traps until early July (1200 Degree Days). In early July we did not observe significant differences between traps located in wood edges and berry crops and hence, our results do not support our hypothesis. Moreover, it does not appear that traps placed in wood edges can provide an early warning of future infestations in nearby crops, at least not with lures used in our study.

Not capturing adult SWD until mid-season raises a number of questions. First, can adult SWD survive winter conditions in central NY and if so, what habitats and substrates do they survive best? We are still in the process of answering these questions. Based on published literature from Japan (Mitsui et al. 2010) and our own monitoring results, it appears SWD females enter reproductive diapause in late fall. Published results also indicate that SWD adults not in reproductive diapause can tolerate temperatures slightly below freezing, with females being slightly more tolerant than males (Kimura 2004). Our preliminary experiment comparing adults collected from the field in late fall under short day lengths with lab flies reared under long day length, suggests that females in reproductive diapause have increased cold tolerance relative to females not in reproductive diapause. Based on historical temperature records, we tentatively conclude that SWD females should be able to survive winters in sheltered habitats in central NY, although our monitoring

results do not support this conclusion. Clearly more research is necessary on diapause requirements of SWD, temperature tolerances, and adult behavior.

We propose several hypotheses that could explain our monitoring results in spring near sites with high populations in the fall. The Alternative Hosts Hypothesis proposes that SWD successfully survives the winter in our area, but utilizes alternative hosts and host cues until mid-season and therefore are not detected in our traps. The Prolonged Diapause Hypothesis predicts that SWD successfully overwinters but stays in diapause until mid-season when ripe fruit is available and therefore is not attracted to conventional lures. Finally, the Recolonization Hypothesis suggests that SWD does not survive winter at higher latitudes and either a) dies out in the area and recolonizes through passive mechanisms from southern locations in mid-summer or b) actively migrates south in the fall and north the following field season.

Although our monitoring results did not show that wood habitats are important refuges for SWD in the winter and spring, there is considerable evidence that some plant species growing in wood habitats serve as alternative hosts for SWD reproduction. The relative role different host species play in the population dynamics of SWD is not fully understood, however. To better quantify the seasonal contribution of non-crop hosts to SWD populations we reared fruit flies from ripe fruit from multiple host species at 7 study sites in central NY during the 2013 collected field season. Our goal is to combine rearing data from different host species with their abundance adjacent to small fruit farms to estimate their contribution to SWD population dynamics. Data are still being collected as of the end October. At our study sites bush honeysuckle (*Lonicera* species) appears to be an important host, with ripe fruit present for an extended period from late June to early September. Black cap raspberry (*Rubus occidentalis*) also is a mid-season host for SWD at our study sites, although it is mostly done fruiting before SWD becomes abundant. Wild species of blackberry (*Rubus* species), several species of dogwood (*Cornus* species) and possibly black cherry (*Prunus serotina*) were good late-mid season hosts along with bush honeysuckle. Important late season hosts in our area include American pokeweed (*Phytolacca americana*), common buckthorn (*Rhamnus cathartica*) and dogwood.

Cited Literature

Kimura, M.T. 2004. Cold and heat tolerance of drosophilid flies with reference to their latitudinal distributions. Oecologia 140: 442-449.

Mitsui, H., Peppu, K., and Kimura, M.T. 2010. Seasonal life cycles and resource uses of flower- and fruit-feeding drosophilid flies (Diptera: Drosophilidae) in central japan. Entomological Science 13: 60-67,