Think Spring
Spotted wing drosophila (SWD), Drosophila suzukii, is a small invasive vinegar fly from Southeast Asia. SWD has four life stages (egg, larva, pupa, and adult) and the time required to complete each life stage depends on host crop and climatic factors, with warmer temperatures speeding up development. SWD is a challenging pest because females can oviposit on undamaged fruit at the initial stages of ripening and because immature stages develop inside the fruit and are therefore protected from the majority of management practices. SWD has been found on both cultivated and wild hosts and there are over 10 genera of soft-skinned fruiting plants that are susceptible to SWD in Wisconsin. The presence of SWD was confirmed in the US in 2008 and currently is present in 47 states. In order to gain a better understanding of the spread of SWD infestation, we have been monitoring in Wisconsin since 2012. We are able to conduct statewide monitoring with the help of many collaborators for first detection and season long monitoring is conducted by UW staff and students. We are currently still trapping and catching small numbers of SWD as of December 2015. This multi-year data set has shed light on SWD phenology and biology such as first and last detection and population peaks, however there are many unanswered questions.

Figure 1. SWD male winter-morph (top left), female winter-morph (bottom left), male summer-morph (top right), and female summer-morph (bottom right)
regarding the biology of SWD. One pressing question is related to seasonal adaptations and overwintering success in Wisconsin’s long bouts of cold temperatures which can be below SWD’s cold tolerance threshold.

Drosophila is a well-studied genus and the recent spread of SWD has increased research interest regarding SWD survival in extreme winter conditions in temperate regions. It has been established that most drosophila overwinter as adults and environmental cues, both temperature and day light, trigger reproductive diapause. Therefore we have hypothesized that SWD populations adapt as they experience seasonal fluctuations, which occur in early spring and late fall as temperatures and photoperiods change, which results in the presence of seasonal morphs in Wisconsin. To better understand SWD populations in Wisconsin we are assessing the presence of a winter-morph and the reproductive output of the different seasonal morphs.

The data reported here are based on samples from a 2014 trapping study. Samples were processed and counted to obtain population numbers, sexed, sorted by seasonal morph over time, and dissected to assess their reproductive status. There is evidence of a winter-morph on the west coast and using the criteria from Oregon State University we have found the presence of a darker winter-morph in Wisconsin. The two morphs, the darker winter-morph and the lighter summer-morph, are differentiated by the melanization of the third abdominal segment for males and the fourth abdominal segment for females (Figure 1; black arrows). Our trapping study was conducted at 6 different farms in south central Wisconsin and each farm had yeast-sugar traps placed in both cultivated raspberry crops and nearby woodlots.

The first flies trapped were summer-morphs caught on July 2nd 2014. Darker winter morphs started appearing in late August and early September and represent more than half of the population by October (Figure 2). Previous findings suggest that SWD populations appear sooner in raspberry crops that are surrounded by woodlands suggesting that woodland habitats may provide alternative resources and overwintering sites. Based on these findings, we hypothesized that higher proportions of winter-morphs would be present in wooded areas. This hypothesis is based on the assumption that adult SWD are changing physiologically and behaviorally as they get ready to overwinter and therefore start to seek out overwintering sites in wooded areas. These wooded areas might provide more habitat, protection, and resources. However, the proportion of winter-morphs was not significantly different between the traps in the cultivated raspberry crops compared to woodlots (Figure 3). After sorting individual flies by seasonal morph, flies were dissected to assess reproductive output including the presence of immature eggs and mature eggs. The presence of immature eggs is different between seasonal morphs, where summer-morph females (3 ± 0.29) had more mature eggs than winter-morph females (0.08 ± 0.05).

These data suggest that SWD populations in Wisconsin respond to seasonal changes, that winter-morphs were present from September through November in 2014, and that there is a difference in reproductive output between the seasonal morphs. These assessments will be further developed and continued with data collected in 2015.

Figure 4. Mature eggs from female SWD dissections identified by the presence of breathing tubes.