

**AGRICULTURAL RESEARCH FOUNDATION
FINAL REPORT
FUNDING CYCLE 2015 – 2017**

TITLE: Assessing the Influence of Biological & Environmental Parameters on Dispersal Potential of *Drosophila suzukii*, an Economically Damaging Invasive Pest of Oregon Fruit Crops

RESEARCH LEADER: Jana Lee

COOPERATORS: Jessica Wong (M.S. student), Megan Woltz (former OSU postdoctorate scholar)

SUMMARY: *Drosophila suzukii*, spotted wing drosophila (SWD), is an economically damaging pest of small fruits. Current knowledge about SWD flight physiology and dispersal capabilities is limited. This project measures the flight capacities of SWD and the effect of diet with computerized flight mills. Another aim of this project is to measure the energy reserves used in flight by SWD. Results from this study provide estimates for SWD dispersal potential, which may support further research on management strategies and population modeling, and provide insight on the mechanism of this pest's rapid spread.

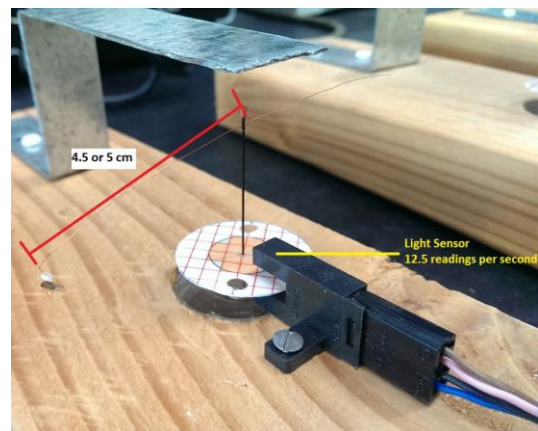
OBJECTIVES:

- 1) Measure flight distance, duration, and velocity of female SWD fed different diets that would be available in the landscape at varying times of the year.
- 2) Determine the type and amount of energy used during SWD flight.

PROCEDURES:

The flight mill design.

The flight mill's main components are the fly tether and the light sensor (photo). The fly tether is a number 2 insect pin with 4.5 cm or 5 cm copper thread mill arms and a laminated paper disc with two circular openings on opposite edges. The fly tether is suspended between two magnets, which allows near frictionless rotation of the pin as the SWD flies. The light sensor is controlled by an Arduino board and Parallax Data Acquisition tool for Microsoft Excel. The light sensor is programmed to take 12.5 readings per second, where light (circular openings on the fly tether disc) gives an output of 1 and darkness gives an output of 0.



1) Effect of diet on SWD flight.

Two to three day old adult SWD were placed in cages with water dispensed via sponge and one type of diet. The different diets included cherry blossoms, blueberry blossoms, blackberry

blossoms, cherry fruit, blueberry fruit, blackberry fruit, and raspberry fruit. SWD in cages with only water and no diet were the negative control group. The positive control group of flies were kept in cages with water and either a 20% sucrose solution or a standard diet comprised mostly of cornmeal, nutritional yeast, and sugar. The SWD were held in the cages for one to three days before the flight assay. Female SWD were attached at the pronotum with super glue to the end of a mill arm on the fly tether. The flight data was collected on a spread sheet and the output was converted to distance, duration, and velocity using code written in the statistical program R version 3.2.4.

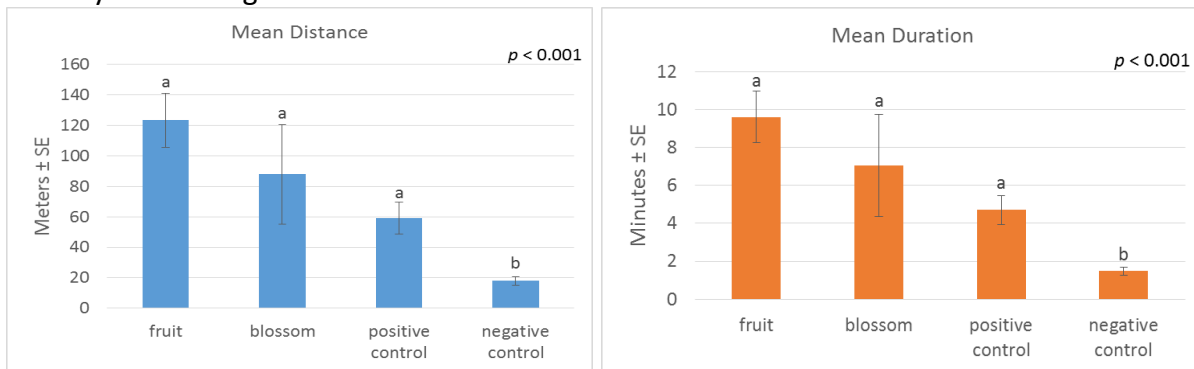
1) *Energy used in flight.*

The same individuals could not be used to determine the energy reserves before and after flight due to the destructive nature of the biochemical assays used to measure lipid, sugar, and glycogen levels. SWD kept in cages with different diets used in the flight assays were also used in this study. The female SWD that were flown for the flight assay were collected into microcentrifuge tubes. This group of flies was the “post-flight” group. Female SWD collected from the cages and put directly into microcentrifuge tubes without flying on the flight mill were the “pre-flight” group. Approximately the same number of post-flight and pre-flight SWD were sampled. Lipid levels were quantified with a vanillin-phosphoric acid reaction. Sugar and glycogen levels were quantified with a hot anthrone reaction.

SIGNIFICANT ACCOMPLISHMENTS: Experiments for the objectives have been completed.

1) *Effect of diet on SWD flight.*

Fed female SWD flew further distances and for longer durations than starved flies. Of the fed SWD, the mean distance and duration of flight was greatest in SWD fed fruit diets and the lowest mean flight distance and duration was observed in flies fed the standard diet or the sucrose solution, although these differences are not statistically significant. Diet did not affect velocity of SWD flight.



2) *Energy used in flight.*

Preliminary data analysis showed that there was no significant difference in lipid, glycogen, or sugar levels between groups of SWD before and after flight, however there were slight positive correlations between the sugar content in flies and distance flown, and between sugar content in flies and duration flown. Further examination of the data and literature will be conducted in the future.

BENEFITS & IMPACT: The results of this project provide estimates of the flight capacities of female SWD. They rarely fly more than a few hundred meters in a single flight session. This may suggest that their extensive geographical spread is due in part by wind and air currents amplifying flight distances. In addition, the high availability of floral and fruit resources may limit the distances needed to travel between feeding, mating, or oviposition. The quantification of SWD flight parameters can improve future research and management strategies. Researchers and growers may use the flight capacity estimates to determine the spacing of traps. Another application of this project's results may be to monitor the potential migration of SWD into fruit crops from mountainous regions, non-crop habitat, or overwintering sites. The presence of post-harvest fruit in fields may increase population growth of SWD, which may enable further geographic spread of this pest.

ADDITIONAL FUNDING RECEIVED DURING PROJECT TERM: None

FUTURE FUNDING POSSIBILITIES: Results will be included in grant proposals refining SWD management.