AGRICULTURAL RESEARCH FOUNDATION
FINAL REPORT
FUNDING CYCLE 2020 – 2022

TITLE: Testing the long-distance dispersal capacity of spotted-wing *Drosophila*

RESEARCH LEADER: Timothy L. Warren

SUMMARY/ABSTRACT: Spotted-wing Drosophila is a potent agricultural pest whose dispersal capacity is not well understood. We used computerized camera traps to discern the flight trajectories of thousands of flies released at a central location. Our findings provide a generalizable framework to study animal movement and its agricultural consequences.

OBJECTIVES: To test the dispersal capacity of Drosophila suzukii using a quantitative camera-trap based approach.

PROCEDURES: In each experiment, we released thousands of flies to determine the dispersal trajectories across the population using a network of computerized camera traps that are synced to environmental data.

SIGNIFICANT ACCOMPLISHMENTS:
- We developed a computerized camera trap system that automates the detection of arrival time of fruit flies at traps. The system is controlled by a Raspberry Pi computer that can connect to multiple sensors (including camera, GPS, etc.) and syncs to other environmental data (e.g. anemometer to measure wind direction and speed).

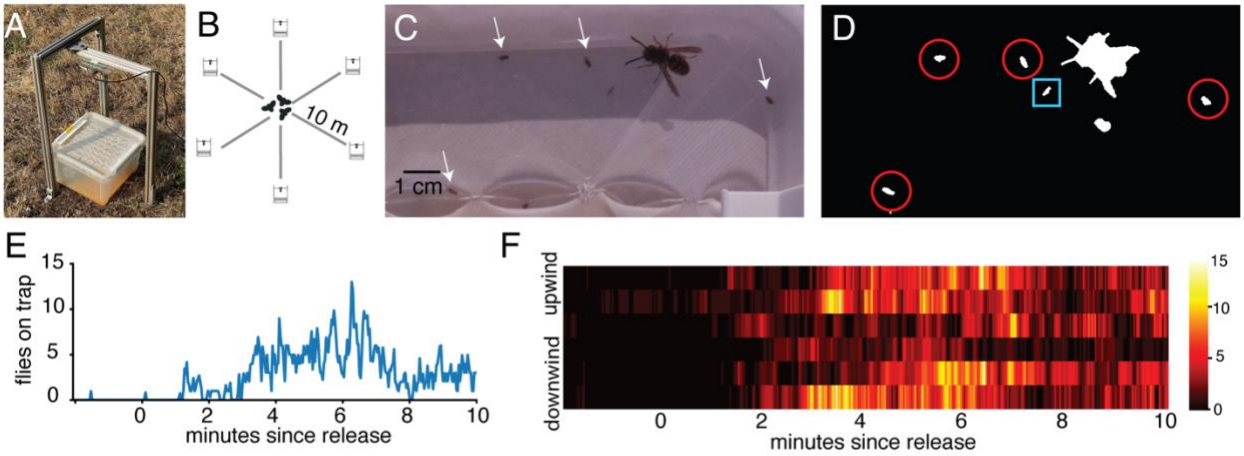

Figure 1. Automated measurement of fly arrival times at computerized camera traps. (A) Baited camera trap. Raspberry Pi camera images funnel trap attracting released fruit flies. **(B)** Thousands of flies are released at a central location and camera traps are set out at a grid (e.g. for example shown, six traps positioned a 10m distance from release point). **(C)** Example image frame of subset of trap minutes after release. Arrows point to individual fruit flies on trap. **(D)** Automated computer vision methods isolated candidate image contours (white) and identified flies on trap (red circles) and flies in trap (blue square). **(E)** Flies on single upwind trap over time. **(F)** Flies detected on all six traps for 10 minutes following release. Flies distribute radially- arriving 1.5 min. after release.

- We field-tested the use of the trap system in a series of small scale release-and-recapture experiments. These pilot experiments indicate that flies can fly 10m in less 2 min, much faster than previous studies in conventional traps.

- We further deployed traps in a wind tunnel (in lab of Jana Lee, USDA-ARS) to study *D. suzukii* dispersal and test new, high-resolution camera prototype traps.

- We developed a custom-built laboratory flight arena to study dispersal behavior of tethered *D. suzukii* under controlled environmental conditions. This will allow further studies toward objective 2, as well as future studies explaining how other factors (e.g. nutritional state) modulate dispersal behavior.

BENEFITS & IMPACT:

- Research funding from this ARF award has directly supported the training and development of three undergraduate researchers. Furthermore, research expenses incurred by a postdoctoral trainee havee been supported by the ARF funding.

- During the ARF support period, I obtained four years of federal funding (USDA/NIFA AFRI program) to expand and continue research aims of the ARF proposal.

- I have discussed project goals and preliminary data in numerous scientific talks on and off campus, including a university-wide Ignite Symposium hosted by the Vice President for Research Administration.

- The approaches described in this proposal have significant potential to translate to other insects, including pollinators. This connection to other insects is the basis of an accepted CAS Strategic Advantage preproposal that focuses on automated monitoring of insects pests and pollinators.

- An article about this work was published in the Summer 2021 issue of *The Source*.

ADDITIONAL FUNDING RECEIVED DURING PROJECT TERM:

USDA/NIFA AFRI grant, Pests and Beneficial Species Program. Four years of research funding.

FUTURE FUNDING POSSIBILITIES:

- CAS Strategic Advantage Award. A research preproposal on plant-insect interactions was one of three chosen for upcoming April 2022 symposium. The preproposal highlighted technology developed initially with ARF funding.

- We plan to pursue further grants from NSF, USDA on abiotic and biotic factors that mediate SWD dispersal.