SPOTTED WING DROSOPHILA: TIMING EARLY SEASON TREATMENTS

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Introduction

Sound and effective management practices for *Drosophila suzukii* , spotted wing Drosophila (SWD), rely upon predicting the initial timing of female oviposition in a susceptible host crop. A thorough understanding of SWD developmental events and activity, such as overwintering survival, occurrence of first damage, and when female ovaries are mature help schedule early treatment to knock down SWD before 1st generation egg-laying. A degree-day model was developed that is part descriptive, in that it reflects our current understanding of lab and field behaviors, and part predictive, in that it intends to provide management decision support by forecasting first feeding activity and reproduction, and number of generations. Degree-day models depend on a linear response to temperature (at least between thresholds). Over time, errors due to non-linear responses are expected to cancel out. Validation of degree-day models can be readily expressed as +/- days error for a given prediction.

Methods

In an effort to correlate crop damage with SWD trap counts to determine when to treat for SWD, trap counts during the pre-harvest and early harvest periods over a four-year period were used to help predict SWD oviposition. A trap study was carried out in no-spray non-crops, cherries, and blueberries between June 2011 - June 2014, using red and clear traps baited with a yeast/sugar or apple cider vinegar/soap mixture. Traps were serviced and the contents counted weekly, though counts of trap contents were carried out once every two weeks during the late fall-winter period. To determine SWD infestation rates, marketable fruits from plants nearby trapped plants were collected 3 to 4 times during the harvest period and reared in individual cups in the lab. Degree-days were calculated using the online model for SWD for the Corvallis, OR Hyslop Farm (CRVO) weather station, available at http://uspest.org/cgi-bin/ddmodel.us?spp=swd. Data was analyzed by looking at 5 parameters including: 1) substantial increases in trap counts, 2) first detection of fruit infestation; 3) sex shift in traps from predominately females to adult males, 4) initial oviposition by backtracking degree-days, and with 5) supporting data of ovary maturity ratings and crop phenology.

Results

Fly captures alone in individual traps were not reliable predictors of damage. Limitations of using adult counts only include: dependency on trap placement and number of traps placed, bait and trap design, crop type, ability to identify SWD correctly, and misrepresentation of population levels. By looking closely at the 5 parameters listed above, we were able to predict timing of oviposition by backtracking developmental degree-days in cherries (Fig. 1) and in the blueberry crop. The use of this degree day model (lower and upper thresholds, 10C and 30C, with a biofix of Jan. 1) does not provide precision regarding timing or need for treatments beyond initial implementation, nor does it predict the beginning of overwintering behaviors, which we are currently pursuing. Thus the degree-day model may be more effective in forecasting rapid rises in infested fruit than traps, which are competing with ripe fruit and thus not always a sufficient indicator or warning system.

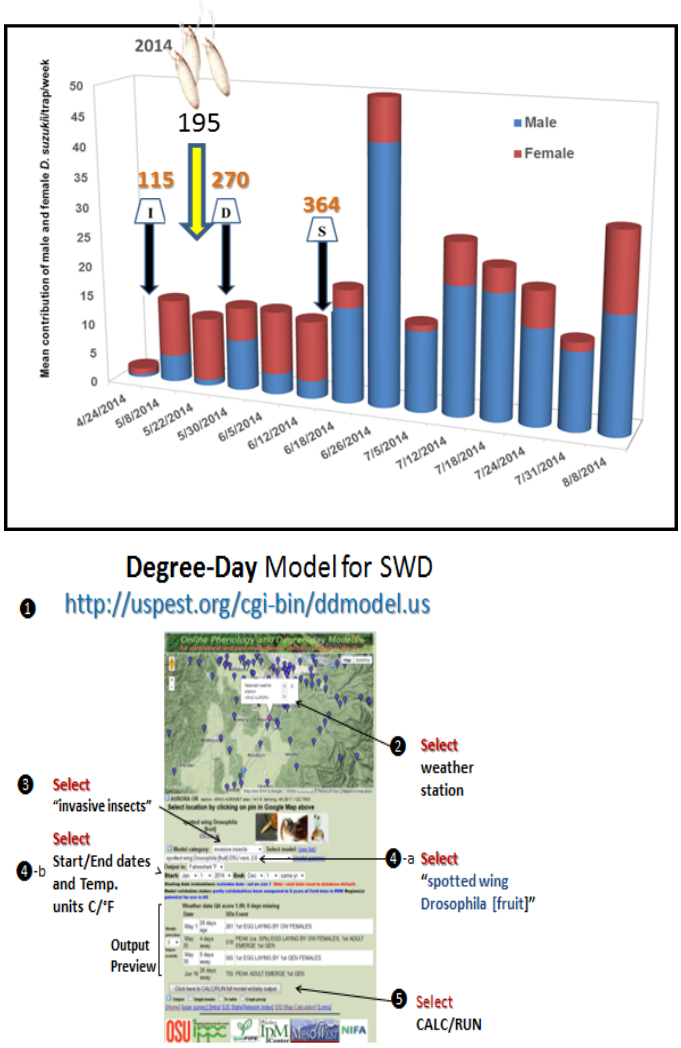

Fig. 1. Mean number of male (blue) and female (red) flies caught in monitoring traps (n=3) placed in cherry in the mid-Willamette Valley in 2014. Note: degree-days computed for events/activity: I= time when substatial increase in trap activity in spring; D= first detection of infestation (fruit damage); and S= when count shifts to males (reflecting next generation).

Initial SWD infestation levels were observed for trap counts varying from 0.6 SWD/trap/week in 2011 to 5.2 SWD/trap/week in 2013. The wide variation in these trap counts indicates that traps are not currently reliable, timely, or sensitive enough to predict damage, and underscores the necessity of investigating alternative prediction and verification methods. The cold winter of below freezing temperatures in 2014, decreased SWD survival and delayed spring activity by several weeks. In these studies, we found that using degree-day accumulations helped establish the timing of first treatments, in place of, or in addition to using trap counts. This tool will aid in predicting early SWD fly activity events, lead to appropriate timing of treatments and reduced use of unnecessary treatments; when used in combination with other methods such as regular larval extractions of fruit to determine whether fruit is infested.