Effects of Lure Volatilization Rates on Walnut Husk Fly Trap Captures in Orchards

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Abstract

Walnut husk fly (WHF) is a significant pest in walnuts in California. The California Department of Pesticide Regulation partially attributes the 135% increase in pesticide application in walnuts from 2010 to 2015 to an increase in pressure from WHF (CDPR, 2015). Better understanding WHF phenology and distribution in orchards may allow farmers to reduce the amount of insecticide applied each year. Current management strategies include the use of insect traps with a sticky surface with ammonium carbonate lures to monitor for the presence of WHF in orchards (UC IPM, 2017). Placement preference is given to "hot spots" where WHF has been observed or trapped in previous years (Northcut, 2014). This study looks at trap capture patterns and lure volatilization rates in orchards where high density trapping has been implemented to determine if "hot spots" exist, or if they are simply a product of trapping methodology and lure efficacy.

Figure 1 (a) Walnut husk fly on yellow sticky trap with ammonium carbonate lure. (b) Yellow sticky trap with ammonium carbonate lure.

Objectives

- Determine if volatilization rates observed in the field matched expected rates as supplied by the manufacturer
- Map lure volatilization rates and walnut husk fly trap captures
- Determine if there is a correlation between fly captures and lure volatilization rates

Data Collection Methods

- Data was collected June-October 2017
- Three sites were utilized in Dixon, Woodland, and Colusa California
- Each site had 200-250 sticky traps with lures
- Traps were checked and fly captures recorded each week
- Lures were weighed on the date of the final check and volatilization rates were estimated based on these final weights
- Manufacturer data found that the average final weight for lures after 42 days in the field was 2.5 grams.

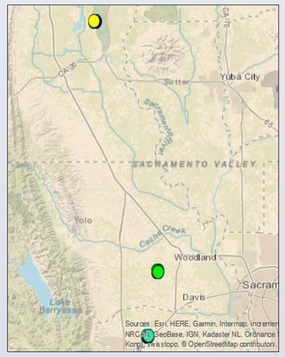

Figure 2. Field site locations in Central California. Sites located near Colusa, Woodland, and Dixon in the south.

Statistical Analysis Methods

- Lures that went missing or were replaced were recorded as missing volatilization rates.
- A correlation matrix was used to analyze any patterns between capture counts, volatilization rates, and final weight of lure traps.
- Several models were conducted to test if observed rates matched expected manufacturer rates:
  - T-test
  - ANOVA (per site)
  - Random Effect model (w/in site)
- A logistic model was conducted to assess if capture counts increased or decreased with volatilization rates.

Results

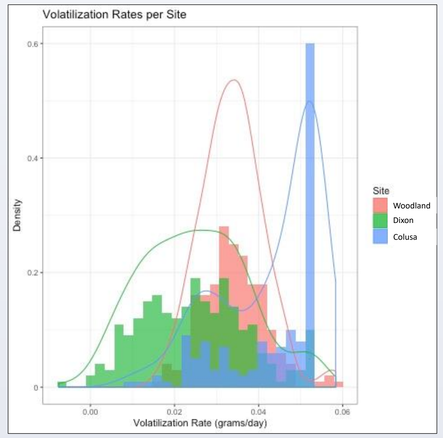

Figure 4. Observed average daily volatilization rates for Alphascents ammonium carbonate lures, organized by site. Woodland and Dixon had a normal distribution of means, while Colusa had a strong left-skew.

Model	Null Hypothesis	Results
T-test	True volatilization rates = Expected volatilization rates	Lures volatilized faster than expected
ANOVA	True vol. rates per site = Expected vol. rates	Lures in each site volatilized faster than expected (smaller st. error)
Random Effect Model	True vol. rates within sites = Expected vol. rates	Lures in each site volatilized faster than expected (larger st. error)
Logistic Model	$\beta_0 = \beta_1 = 0$	A logistic model does not provide significant information to test the odds of capture rates with vol. rates

Conclusions

- Woodland and Dixon sites had lure replacement rates <0.05%, while Colusa had a replacement rate of 26%
- Volatilization rates were higher than expected for all sites.
- Dixon had the highest number of trap captures and a low replacement rate for lures. Correlation between trap captures and volatilization rates was found using a Pearson test. The correlation coefficient was 0.05 with p-value of 0.46.
- There was not enough data to model trap capture odds based on volatilization rates

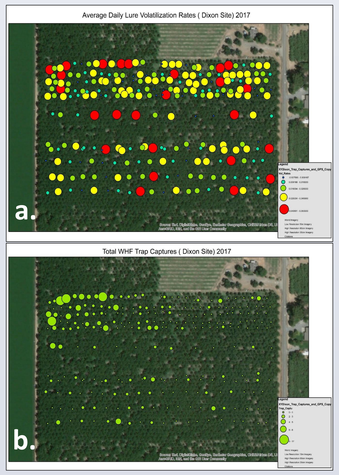

Figure 5. Visualization of volatilization rates (5a) and WHF trap captures (5b) at the Dixon field site June-October 2017 Correlation between trap captures and volatilization rates was insignificant at 0.05 with a Pearson correlation test and a p-value of 0.46.

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