

Purdue University  
Department of Entomology  
Undergraduate Capstone  
Project Summary

**Name of Student:**

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**Name of Mentor:**

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**Project Title:**

The effects of precipitation and temperature on *Psorophora columbiae* populations in New Jersey and Florida

**Project Summary:**

**Introduction**

*Psorophora columbiae* is a known mosquito vector of Venezuelan equine encephalitis and anaplasmosis in cattle. It is a significant floodwater mosquito that can occur at very high densities. Models for emergence enable vector control to accurately predict when they will emerge, allowing for more efficient control. There has been some laboratory research on the effect of temperature on *Psorophora columbiae* development. Most of the lab data is based on mosquitoes raised at constant temperatures, which may not result in an accurate prediction of real world development where temperatures fluctuate.

**Objective**

The objective of this study is to investigate whether lab-based models such as degree day models for mosquito emergence are accurate predictors when compared to real world data.

**Experimental Design**

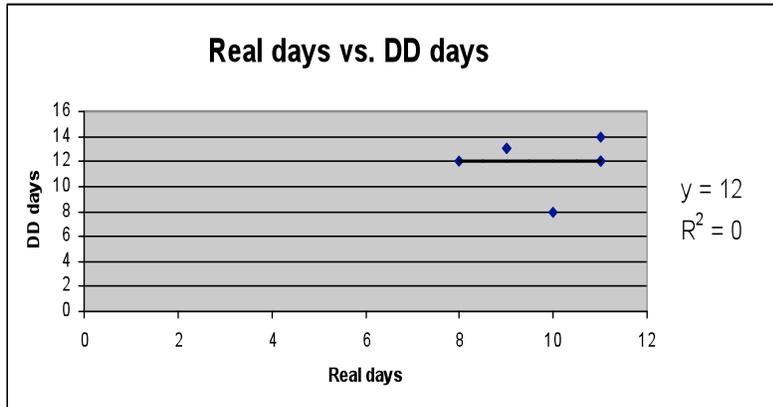
Lab-based developmental data from McHugh et al. 1982 was used to create a degree day model. The degree day model was determined to be

$$\text{Degree Days} = (\text{Temperature Maximum} / \text{Temperature Minimum}) - 12.9$$

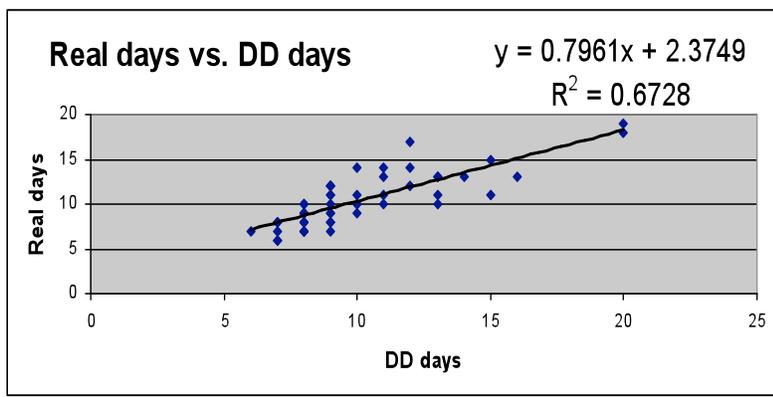
An accumulation of 92 degree days was determined to be the emergence point indicated by the model. Weather data was charted next to long-term vector control trap data on Microsoft Excel©. Using precipitation data as the beginning point, accumulation of degree days began until 92 was reached. The number of days the model predicted was compared against the time to a significantly increased *Psorophora columbiae* population was actually recorded.

**Results**

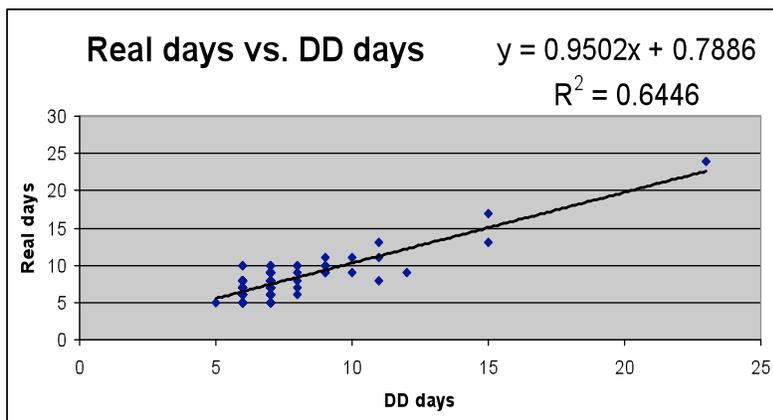
The graphs show the model predicted days compared to the actual days to mosquito emergence. Figure 1 shows data from Warren County, New Jersey. Figure 2 shows data from Ocean County, New Jersey. Figure 3 shows data from Pasco County, Florida.



(Figure 1)



(Figure 2)



(Figure 3)

**Data Analysis**

Depending on the temperature, mosquitoes began emerging as early as 5 days after a precipitation event, or as long as 24 days. Warren County was determined to have too small of a data sample to be a significant representative of the data comparison. Ocean County and Pasco County did have a very large data sample. Both were remarkably similar in their results. Both their  $R^2$  values indicated that the models explained about 65% of the models, which in considering a range of emergence from 5 to 24 days is acceptable.

### **Discussion**

Degree day models are easy for control officers to use, but they do not always hold up to real world conditions. It is known that other factors besides precipitation and temperature affect the rate of mosquito development, such as food availability and predation and disease rates. Models in the future may be able to take these factors into account, as well as utilize geographic information systems to predict where as well as when mosquitoes will emerge. Models such as these will help vector control districts efficiently control mosquitoes and the diseases they carry.

### **Sources**

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