CLIMATIC DATA-BASED ANALYSIS OF *LYGUS HESPERUS* PREFERENCE ON SELECTED HOST PLANTS

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Abstract

Based on data collected from a two-year Texas High Plains field survey of *Lygus* and their associated crop and weed hosts, three different kinds of regression models (simple linear regression, polynomial regression and Logistic Growth Curve regression) were constructed to quantify the *Lygus* preference caused by four selected host plants, plant growth stage and geographical location. Weather data were also regressed on *Lygus* counts. The results produced models with some significant trends, but very poor fits, indicating a much more complex dataset with more regressor variables will be required to produce good predictive models.

Introduction

Lygus bugs are serious economic pests of cotton in the southern growing region of the United States. The pest status of *Lygus* in the Texas High Plains (THP) is not yet well understood, but it is thought that the reduction in pesticide usage caused by boll weevil eradication and the widespread use of Bt cotton may elevate *Lygus* bugs to major pests. The dominant species of *Lygus* in the THP is *L. hesperus*. It is a highly polyphagous insect [Scott (1977) and Young (1986)] which has been documented on 385 documented host plant species within 55 plant families in Texas (Young 1986). The movement of *Lygus* between non-cotton hosts and cotton has been shown to be influenced by weather such as rainfall (Anderson and Schuster 1983) and wind direction and velocity (Butler 1972). Therefore, quantifying the effect of climatic data-based variables on *Lygus* movement among different hosts is meaningful. Often modeling insect population dynamics is complex and very difficult. Methods such as polynomial regression and logistic growth curves are often used in this type of modeling.

The objective of this study was to model *Lygus* populations using weather data, host plant, plant growth stage and geographical location.

Materials and Methods

Data for this effort was obtained from a *Lygus* survey conducted in three THP counties: Hale, Lubbock, and Dawson, representing northern, central and southern regions of the THP, respectively. The survey was conducted during the February to November periods of both 2004 and 2005. A 15-inch insect sweep net was used to sample weeds, cotton and alfalfa from between 3 and 10 sites weekly in each of the study areas. Sampled weeds were identified to species with the assistance of weed scientists located at the Texas AgriLife Research Center in Lubbock and using the book entitled, Weeds of the West (Whitson et al. 2001). Weather data were obtained from the Texas High Plains Evapotranspiration Network (TXHPET).

A principal components analysis (PROC PRINCOMP, SAS Institute 2003) revealed correlations in the weather data. Based on this analysis only minimum temperature was used in the modeling effort. Simple linear, polynomial, and logistic growth curve models were developed using the GLM, REG and NLIN procedures of SAS (SAS Institute 2003), respectively.

Results and Discussion

Across model type, P-values from tests for nonzero slopes ranged from 0.8262 to <0.0001, and indicated significant trends in 18 of 33 cases (as defined as combination of variable and model type). However partial R^2 values ranged from 0.0003 to 0.1810, indicating very poor fit in every case. Full model fits were also very poor. Not a single model, regardless of type, described enough variability in the *Lygus* populations to be of any real use.

It is obvious that *Lygus* numbers in the field are affected by many factors other than weather data recorded on the same day the *Lygus* sample was collected. As more *Lygus* are present in the warmer, summer months some correlation between *Lygus* numbers and temperature should be present. But this is due to seasonality rather than a day to day effect and is not meaningful. Temporal insect-host interactions are extremely complex. Other factors possibly affecting this are variation in cropping patterns and weather at a landscape level, delayed reactions to weather events such as poor plant health due to lack of rainfall, human interventions such as mowing of alfalfa (a preferred *Lygus* host) and the interactions of all of the above. Some of these factors are difficult if not impossible to quantify, but if possible they should be taken into account when any costly effort at modeling is undertaken. The *Lygus* data used in this study was collected using a sweep net, which has been shown in various studies to be relatively inefficient. A more effective sampling method should add to the production of a better model. This effort was made because the data was available, and little effort was required to complete the analysis. Though a strong model was not produced, the attempt is justified by even the small possibility that a meaningful pattern might have been identified.

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