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SPATIAL AND TEMPORAL VARIATION OF COTTON APHID AND LADY BEETLE DENSITIES IN A LOUISIANA COTTON FIELD

J.P. Lee, J.H. Temple, B.R. Leonard, and R.D. Bagwell
LSU AgCenter
Baton Rouge, LA

Abstract

Engineering and geospatial technologies are being modified for use in cotton integrated pest management. Global positioning systems (GPS) and geographic information systems (GIS) both are useful in monitoring and recording insect densities across a cotton field. This study was conducted in Tensas Parish, LA, to evaluate the temporal occurrence and intra-field variations of cotton aphid, *Aphis gossypii* (Glover), infestations and lady beetles, Coccinellidae. The field was divided into one acre sections (cells) using GIS and five sample sites within each grid cell. Insects were sampled between May 28 and June 24. Densities of both pests varied temporally and spatially. To accurately detect infestations of these insects, frequent samples at multiple locations are necessary, especially when low numbers occur.

Introduction

The cotton aphid, *Aphis gossypii* (Glover), has been a recognized as a cotton pest in the United States since 1854 (Slosser et al. 1989). Cotton aphids overwinter as adults on native vegetation. As numbers increase on alternate host plants during the spring months, winged adults migrate to fields soon after the emergence of cotton seedlings. Usually, cotton aphids are not detected until plants reach the second or third of true leaf (Fenton 1952). Significant yield reductions have been associated with high cotton aphid densities that persist for an extended period. End-of-season plant mapping has shown that high cotton aphid numbers can reduce plant height, number of main stem nodes, and boll density per plant. Weights of 1st and 2nd position bolls on sympodial branches also can be reduced (Bagwell et al. 1991). Lady beetles (Coccinellidae) are beneficial arthropods that can be associated with cotton aphids. Lady beetles prey on cotton aphids and other insect pests in cotton fields and provide an important component of biological control strategies of cotton pests.

Geospatial and precision technologies are currently available and are being used in several areas of agriculture that have an application in cotton production (Pierce and Nowak 1999). Precision technologies can help address production problems that vary spatially and temporally within a field (Leonard et al. 2003). The purpose of this project was to use global positioning systems and geographic information systems to monitor variations in cotton aphid and lady beetle densities within cotton fields. These tools have the potential to greatly improve sampling protocols for monitoring insect pests in cotton.

Materials and Methods

The study was conducted at Somerset Plantation near Newellton LA (Tensas Parish). The field (56 acres) was planted with Stoneville 5599BR (Stoneville Pedigreed Seed, Memphis, TN) cotton seed. All agronomic management practices followed standard recommendations from the Louisiana Cooperative Extension Service. No insecticides were applied to the field prior to or during sampling.

The position of the field boundary was mapped with a Trimble GPS backpack receiver (Trimble, Sunnyvale, CA). The field was arranged in a one acre grid pattern using ArcView GIS 3.3 (ESRI, Redlands, CA). Center points of each grid cell were located using Dell Axim handheld computers (Dell, Round Rock, TX) equipped with WAAS corrected Teletype GPS (Teletype, Boston, MA). Semi-permanent flags were placed at the center of each cell. Five random sites were sampled within each grid cell. Data were collected with Handspring Visor hand-held computers with a Magellan GPS unit (Thales, San Dimas, CA). Bayer Scoutlink software (Bayer Agricultural Division, Kansas City, MO) was used to record all data and automatically geo-reference each sample point. Excel (Microsoft, Bellevue, WA) files from Bayer Scoutlink were imported into ArcView GIS 3.3 on a desktop personal computer for geospatial analysis.

At each of the five sampling sites within a grid cell, the terminal and uppermost leaf of ten plants were inspected for cotton aphids. The cotton aphid density rating per plant (0, 1, 2, 3) was recorded using the following scoring system: 0 aphids (0), 1-10 aphids (1), 11-50 aphids (2), and 50+ aphids (3). In addition, lady beetle densities were estimated by taking a 10 sweeps sample with a 15 inch sweep net at each site. Sample dates were May 28, June 2, and June 10.

The cotton aphid density rating for each sample site within the one acre grid was transformed into an average density for the site on individual sample dates. Data collection points were summarized geospatially and use graduated symbols to represent cotton aphid and lady beetle densities.

Summary

Cotton aphid colonization was first observed on plants located near field edges on May 28 (Figure 1). On June 2, cotton aphid colonies were more common along the field border. Cotton aphid densities (Figure 2) had increased compared to that observed on May 28. High cotton aphid populations were observed across the entire field on June 10 (Figure 3).

Lady beetle location and densities on May 28, June 2, and June 10 did not correspond to the occurrence of cotton aphids. Their densities appeared to be random and dispersed across the field. On May 28, only 7 of 257 sample sites contained lady beetles with a range of 0-1 per site. On June 10, 57 of 232 sample sites contained lady beetles, with densities ranging from 0 to 9 with a mean of 0.5 per site (Figure 4).

GIS technologies and GPS tools are useful for monitoring insect population densities across cotton fields. This data can improve producer's base of knowledge on which to base IPM decisions. Ultimately, this information can be used as part of a system that drives variable rate pesticide application technology in order to reduce insecticide input costs. Private agricultural consultants can use these data to keep permanent records of insect densities and distribution across fields.

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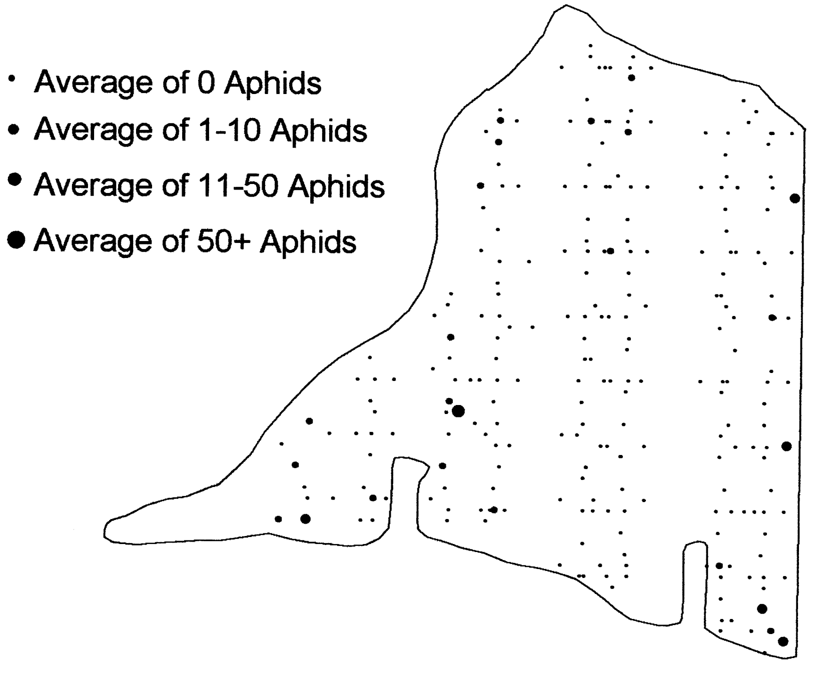

Figure 1: Aphids samples on May 28, 2003.

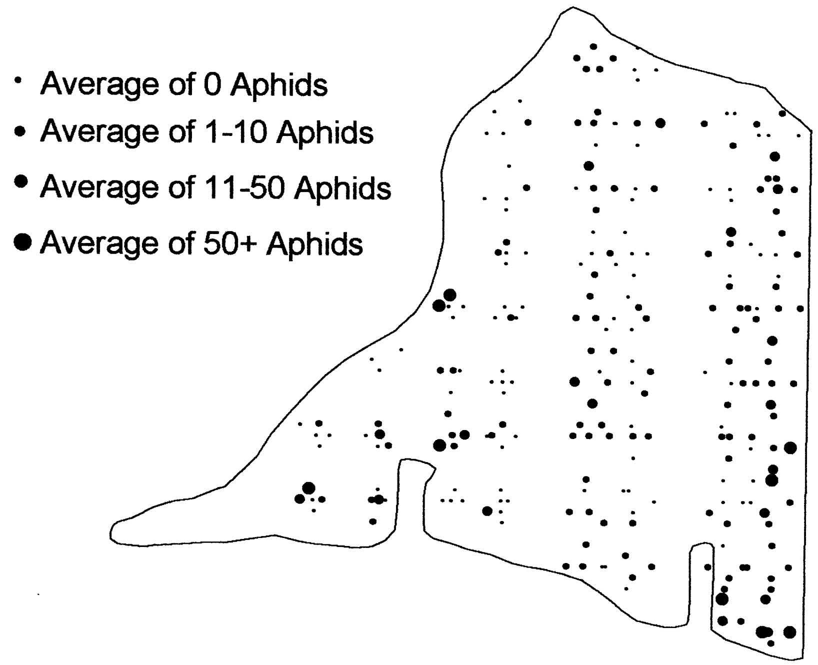

Figure 2: Aphid samples on June 2, 2003.

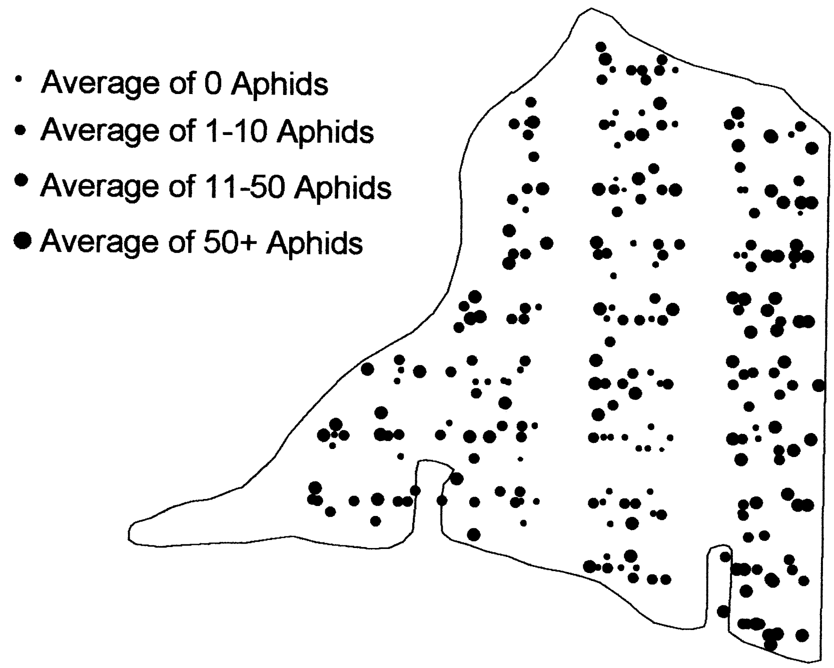

Figure 3: Aphid samples on June 10.

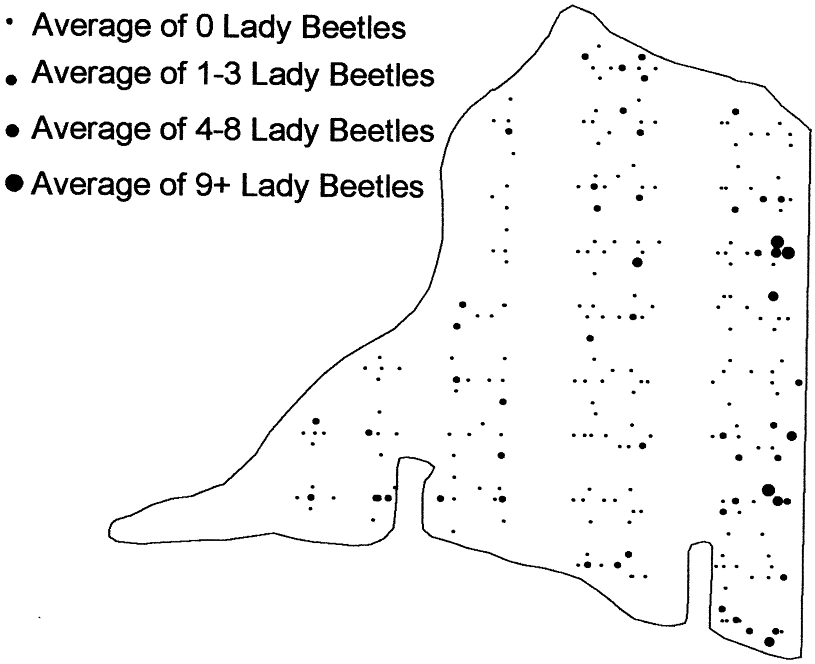

Figure 4: Lady Beetle samples on June 10.