Studies associated with *Lygus* and cotton aphid management

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Background and update on results of previous studies.

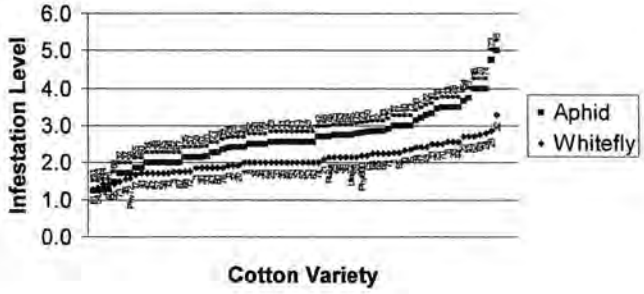
Lygus bugs play a pivotal role in cotton pest management. They cause direct damage to bolls, and their control with broad spectrum pesticides disrupts natural enemies and induces outbreaks of secondary pests. Cotton pests and their natural enemies move within cotton fields and migrate between the field and adjacent areas. Quantitative knowledge of the movement of *Lygus* bugs is lacking in the field. Understanding of the dispersal and host finding behavior of these pests and their natural enemies is needed for IPM. This will also be important for the selection and conservation of *Lygus* parasitoids. Previous mark-recapture studies measured the movement of *Lygus* bugs within cotton, alfalfa and bean fields and between alfalfa and cotton (Bancroft 2005). Most *Lygus* were predicted to have lifetime dispersal less than 1000 feet within fields, but they may fly much farther when host-plants are not available. Simulation models of dispersal have also been constructed that can quantify the effect of plant condition and weather on observed dispersal patterns. The experiments provide a valuable link between pest management practices and the migratory behavior of *Lygus*.

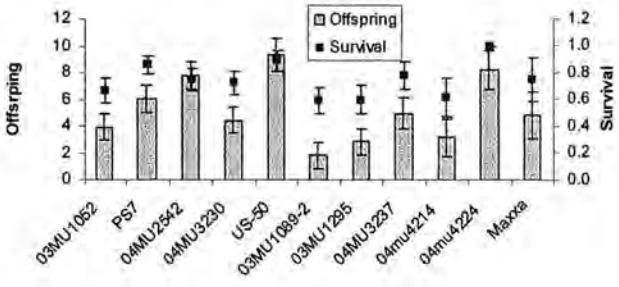
Last year several experiments examined sampling issues and cotton insect's response to water and fertilizer treatments. A sampling experiment showed the sweep net to be most effective for capturing *Lygus* adults, while DVac and sticky cards were not very efficient. Several species of the predator community were better monitored with simple pitfall traps.

The results show larger abundances of *Lygus* in the high water treatment. Further analysis showed a weaker but significant effect of nutrients available in the plant, and effects on abundance in the rest of the arthropod community.

Another experiment studied behavior of *Lygus* in response to bare ground nearby cotton and alfalfa. The flight behavior study showed an activity threshold in response to temperatures above 90F. There was an especially strong increase in activity in the morning as the field warmed up. We discovered a strong attraction to upwind alfalfa fields. W also showed *Lygus*' propensity to fly toward larger lush canopies and avoidance of flying over even small gaps of bare ground.

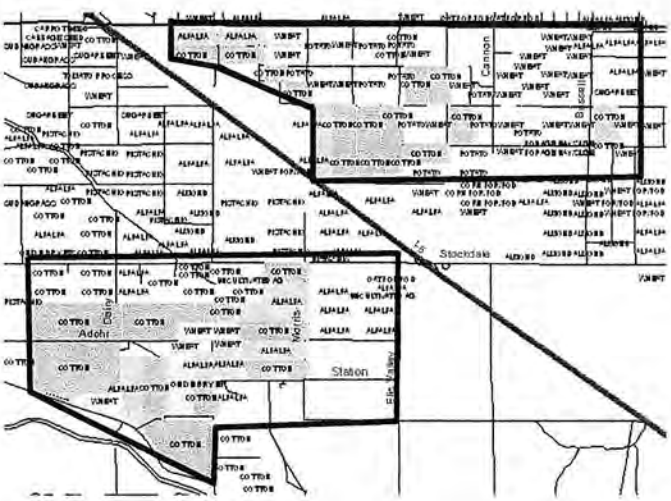
Resistance studies screened varieties for prevalence of aphid and whitefly (graphs at right). Controlled cage-experiments further characterized the suitability of varieties for aphids.

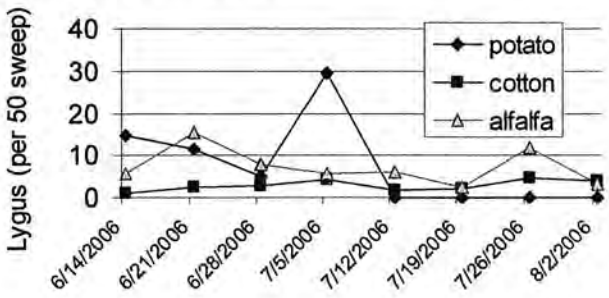




Current projects
Brief descriptions of current projects and preliminary results are provided.

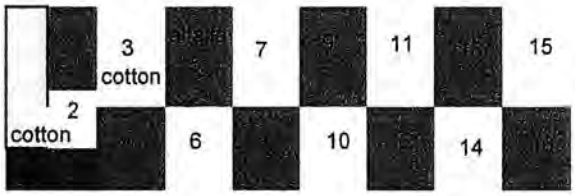
***Lygus* landscape dynamics**



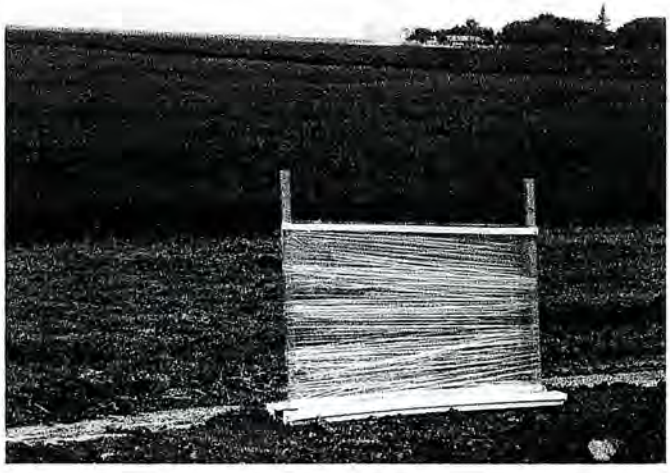


This is a cooperative effort with several growers, Dale Deshane (PCA) and Peter Goodell (UC Kearney) that is supported by a grant from Cotton Incorporated. *Lygus* populations were monitored at 2 large field sites in Kern county (see map). Each of 77 fields was sampled two times per week, unless agronomic activities prevented sampling. Samples were 25 sweeps in Alfalfa and 50 sweeps in cotton. Samples were frozen and *Lygus* and natural enemies are currently being counted. A database of all data is being used to record all the data. A time series of Lygus is shown at right. Variability among fields (for a given week and crop) was generally less than variability through time suggesting samples were at an appropriate scale to assess landscape population dynamics as a result of environmental conditions. Host-plant condition and pesticide application data are also being entered. Detailed cotton growth and development were collected on 36 fields at the same locations where Lygus population data are being collected. Two plants per inspection are mapped for fruit retention, phenological stage of plant and fruit, as well as height and number of nodes. These data will be used in an analysis to understand causes of local *Lygus* population densities, and they are going to be used to test a simulation model to forecast *Lygus* populations.

Flux



The figure shows the southwest corner of SREC field 44. Eight plots (60x150') of cotton and alfalfa are shown. The timing of irrigation and alfalfa cutting has been coordinated to maximize the measurement of *Lygus* emigration from alfalfa. The dispersal of *Lygus* between cotton and alfalfa is being measured around two alfalfa fields that are cut each week Interception traps (see picture) and sweep samples are used in the source alfalfa fields, precutting, and in surrounding cotton. This will provide a measure of the proportion of *Lygus* and their natural enemies that successfully emigrate from cut fields.



Temperature tolerance

Acquisition of reliable environmental chambers has enabled sophisticated studies of the effects of temperature, humidity, light, and host plant on insects.

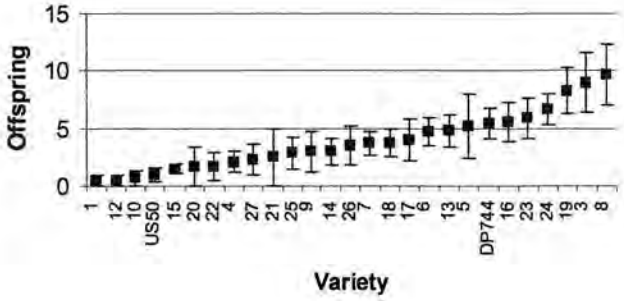
Cotton aphids frequently exceed treatment thresholds and are especially problematic in late season when sticky cotton lint is a concern. We have shown that they utilize many of our common weeds (Bancroft 2006). Biocontrol efforts with two parasitoid wasps showed overwintering success for both species, but these parasitoid's populations have not yet taken off. We are performing high temperature studies to determine their climate suitability in the southern SJV. These exotic (foreign) wasps compare favorably to native natural enemies in rapid aphid suppression.

Interception trap. 2 x 1 m

A study of *Lygus* temperature tolerance aims to measure the effect of high temperature on survival and reproduction. This ongoing study aims to resolve enigmatic reproductive observations of *Lygus* in the field during hot summer temperatures in the SJV.

Resistance

These studies expand upon screening studies preformed previously. Characteristics of the 27 selected varieties are being evaluated as indicators of resistance. The graph at right shows results from cage studies of aphids on SREC field 44 this year (yellow block above). Common varieties for controlled comparison are labeled on the x-axis.



Reference materials are available from -and questions about the research can be directed to Jay at 746-8003 or jsbancroft@pw.ars.usda.gov

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