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# MEASURING LOCALIZED MOVEMENT OF *LYGUS HESPERUS INTO SAN JOAQUIN VALLEY COTTON FIELDS*

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## Abstract

*Lygus hesperus* populations develop both externally and internally to the San Joaquin Valley in California. In certain years, weed hosts are favored by precipitation patterns and these can provide extended habitat on which *Lygus* population can build. In 2005, tarweed, *Hemizonia kelloggii*, was abundant and widely distributed. *Lygus* populations were sampled weekly from tarweed on uncultivated rangeland and in the adjoining cotton. Both Pima and Acala upland cottons were sampled. In addition to tarweed, almonds (bearing and non-bearing), pistachios, onions and highway frontage were bordering cotton. Tarweed allowed population development into July before soil moisture was depleted and plants senesced. Cotton bordering tarweed did not show a *Lygus* population increase until this time. Other bordering crops and situations acted as substantial sources for *Lygus* adults illustrating the annual problem of pest buildup on internal crops as opposed to the infrequent movement from rangeland areas.

## Introduction

The predominate *Lygus* species in the San Joaquin Valley (SJV) of California is *Lygus hesperus* (Mueller et al, 2005). This insect is a key pest on cotton but must move into the crop as adults in sufficient numbers to warrant economic treatment. The dry summer landscape of the SJV provides limited wild hosts for *Lygus. C*ultivated crops and their associated weeds act as major sources of *Lygus* (Stern, 1969). The degree of severity of this migration depends on the timing of harvest of the source and the stage of susceptibility of the cotton fruiting cycle. Movement during the earliest fruiting stages can cause widespread loss of fruit and delay earliness of the crop.

In most years, uncultivated rangeland does not provide substantial *Lygus* populations. However, in years when rainfall is abundant, especially during March through May, sufficient moisture remains in the soil to create opportunities for widespread development of tarweed. In 2005, weather patterns occurred that allowed large areas of tarweed to develop along the western hillside rim of Fresno County, adjacent to Interstate 5 ("I-5 Corridor").

We investigated the relationship between tarweed and cotton and the timing of the movement of *Lygus* from tarweed to cotton.

## Materials and Methods

A location in western Fresno County was identified that had both Pima and Acala upland cottons adjacent to a large assemblage of tarweed. In addition to cotton, other crops bordering the fields included onions, almonds (bearing and non-bearing) and pistachios. Frontage roads also bordered this site (Figure 1).

*Lygus* populations were sampled weekly during June and July from tarweed on uncultivated rangeland at eight georeferenced sites. A standard sweep net was used to take 50 sweeps. Adults and nymphs collected on tarweed were brought back to the lab, counted and nymphs were classified into instar stages. In the adjoining cotton, twenty-one sample sites were established and georeferenced. These sites were sampled weekly through June and July with both a vacuum sampler (commercial leaf blower with venturi attachment) and a standard insect sweep net. Because the development of cotton was delayed due to cool temperatures, the suction sampler was utilized on June 2 and 20, 2005. All other sampling dates utilized sweep nets. The suction sampler was brushed across the terminals of cotton plants over a distance of 35 paces, the equivalent distance of a 50 sweep count. In very small but fruiting cotton, this is method is less destructive. Adult and nymphs were counted and recorded in the field. All samples were taken near the edge of the field.

Data were examined by cotton type and by bordering crop or situation. Distance from tarweed was not considered due to the confounding influence of other sources of *Lygus* in the vicinity. Border classes included tarweed (n=4, sample sites 9-12), frontage road (n=5, sites 2-6), nonbearing almonds (n=6, sites 7, 8, 13, 14, 18 and 19), onions (n=3, sites 1, 20 and 21) and mid-cotton (n=3, sites 15-17). Mid-cotton was cotton in the interior of this 400 acre field and is more distant from the borders than other sampling sites (Figure 1).

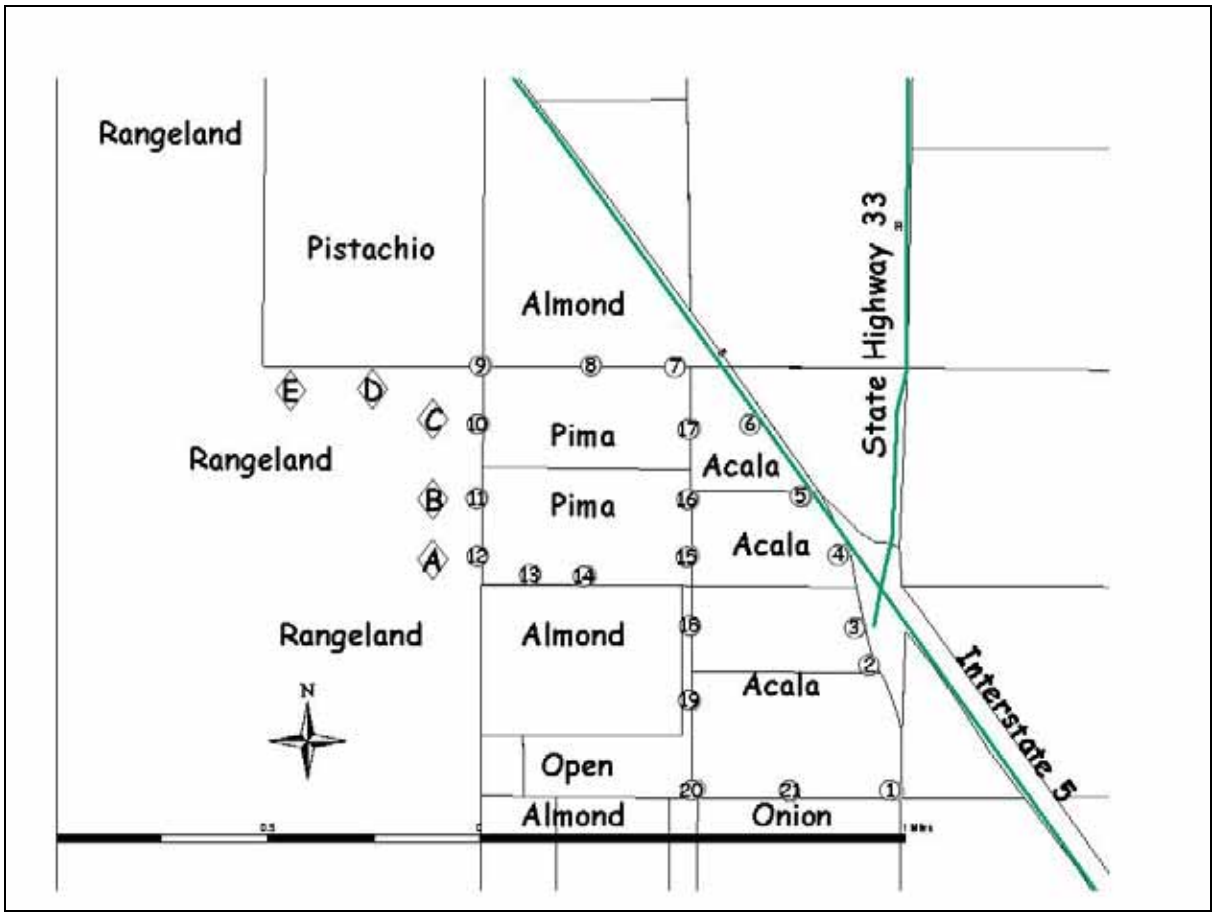


Figure 1. Schematic map of 2005 *Lygus* movement study area. Circles represent sample sites for cotton. Diamonds represent sample sites for rangeland. Not all rangeland sites shown.

## Results

*Lygus* populations built to high densities in tarweed and did not decline until mid-July (Figure 2). The decline noted between June 7 and June 13 was due to an insecticide treatment applied to the rangeland area. The overall population was reduced and the adult population did not increase until the nymphal population began to decrease. Adult and nymphal population declined sharply after July 1st due to emigration for the former and morphing into adults in the latter. Although, the population was extremely high in the tarweed with a weekly density of 30 *Lygus* per 50 sweeps, the population densities between Pima and Acala did not differ (Figure 3) and densities did not exceed 4 adults/50 sweeps or equivalent suctions in either field. Reproduction occurred in both fields near the end of June.

When the perimeter of the cotton is classified by what it borders, five classes emerged (Figure 1). The class with greatest border was frontage (1.25 miles) followed by non-bearing almonds (1.4 miles, discontinuous) and the remaining classes (onions, tarweed and mid-cotton) were 0.5 mile each. Three classes (onions, almonds and

frontage) had an increase of adults between June 20 and June 27 while cotton near tarweed did not increase until July 5th (Figure 4). Mid-cotton had a stable adult population around one adult/50 sweeps until July 19 when it increased to two adults per 50 sweeps.

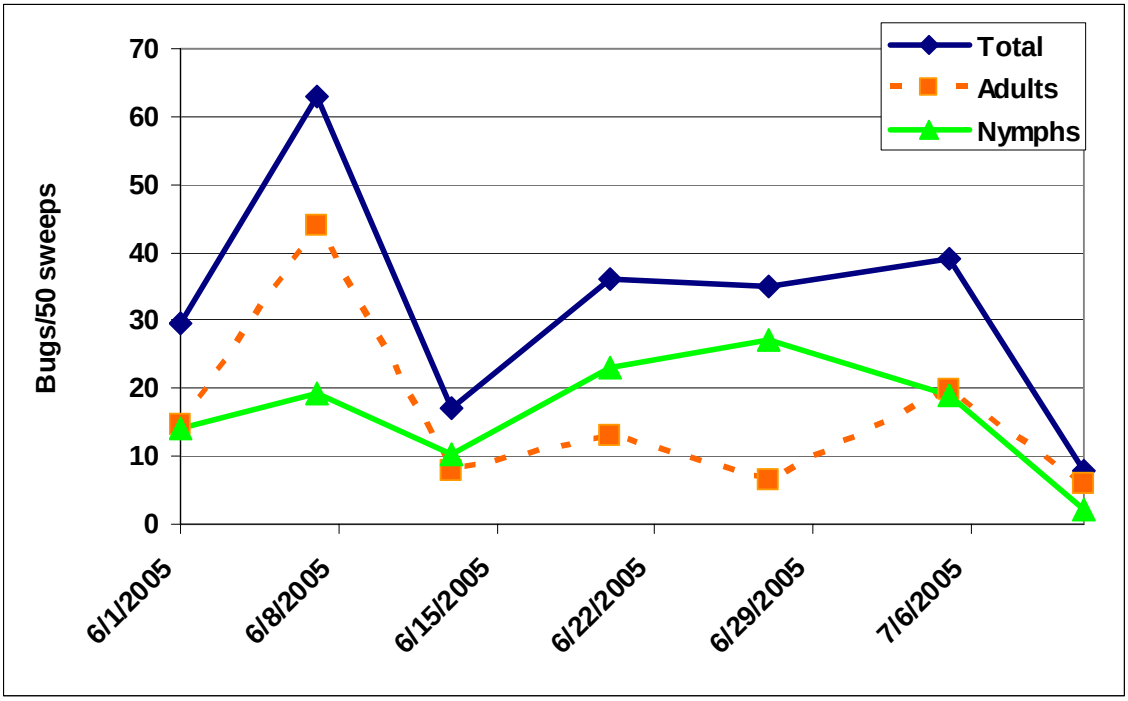


Figure 2. *Lygus* population density in tarweed in west Fresno County, 2005. Tarweed was treated on June 11, 2005 to reduce the *Lygus* population

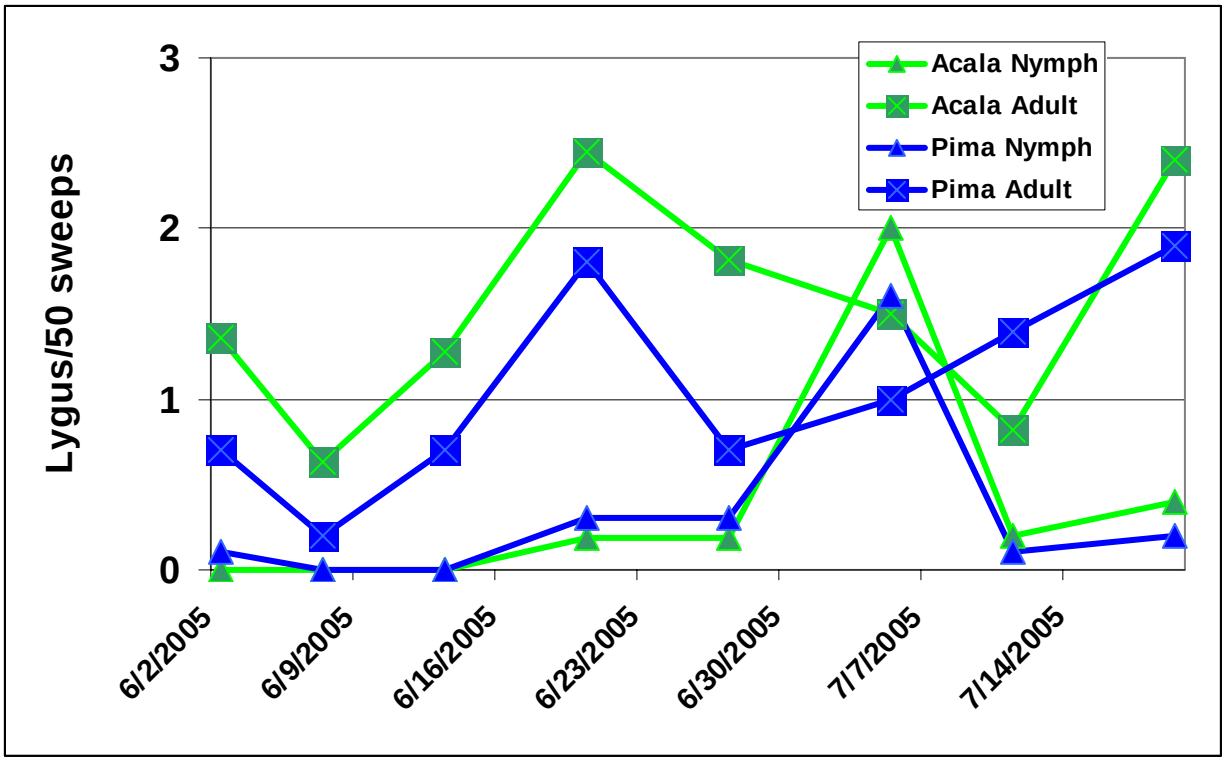


Figure 3. Population densities of *Lygus* in Pima and Acala cotton fields, Fresno County 2005.

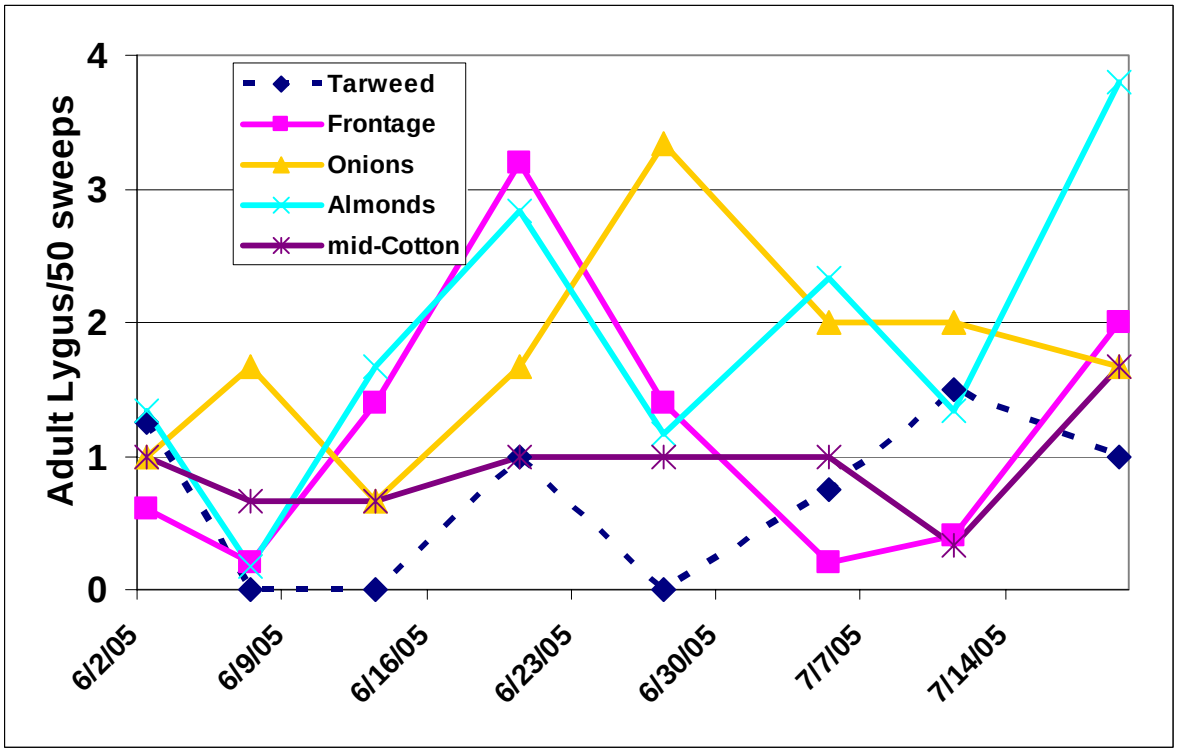


Figure 4. Population densities of *Lygus* adults in cotton that bordered different crops and situations.

## Discussion

In this 400 acre cotton field, multiple sources of *Lygus* were observed. Tarweed, *Hemizonia kelloggii*, is a key weed host on which populations can increase but it did not prove to be the only or even the primary source of *Lygus*. Onions and non-bearing almonds and their associated weeds were also substantial contributors of *Lygus.*

Tarweed supported *Lygus* through June and into July until the plants senesced after the soil moisture was depleted. The mortality inflicted by the insecticide application in early June effectively reduced the population of adults and may have limited migration. Very little population movement was noted in the adjacent cotton until mid-July. It appears that adults resided in the plant as long as possible, even though Pima cotton was available a short distance away. Irrigation may have played a role (Leigh, et al, 1974; Munk and Goodell, 2002) since this Pima cotton was irrigated using subsurface drip which may have minimized the amount of free moisture associated with sprinkler or furrow irrigation.

*Lygus* moved from onions beginning in mid June and peaked on June 27. As the onion field was prepared for harvest, irrigation ceased resulting in plants becoming stressed and unsuitable hosts. Movement from almonds was noted on several occasions (June 20 and July 14) due perhaps to different cultural operations on the various orchards (one to south and one to north, Figure 1). Mini-sprinklers in the orchard provided irrigation only to the tree row and not the orchard centers. In addition, weed cultivation occurred at different in each orchard. The movement of insects into the frontage border may have come from weedy shoulder between Interstate 5 and the farm property which was left to desiccate without mowing.

This study demonstrated no crop or site provided the single source of *Lygus.* Within the mosaic of crops and plants of the SJV, an understanding of the plants that provide context of insect movement through the spring and summer is essential in improving IPM. This localized example illustrates the vulnerability of cotton when it serves as the sink for *Lygus* populations abandoning unsuitable hosts. It also points out the annual problem of localized movement from neighboring crops as opposed to the infrequent movement from rangeland or other uncultivated areas. The development of area-wide, landscape approaches could provide benefit to the cotton farmer. Such approaches could incorporate more favored hosts (alfalfa, blackeye beans) as habitat or trap strips or introduce crops that are more favored sinks without being economically damaged (e.g. alfalfa forage).

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