SAMPLING LYGUS BUGS IN WEST TEXAS Megha N. Parajulee Texas Agricultural Experimental Station Lubbock, TX

Abstract

A two-year (2002-2003) survey of non-cotton hosts and cotton was conducted to examine the role of noncotton hosts in supporting Lygus bugs in cotton in the Texas High Plains. Survey of non-cotton hosts was conducted from January to November in three selected counties, while 25 counties were surveyed in April and July-August. Cotton was surveyed together with non-cotton hosts from July through September. A total of 208,715 sweeps taken from the survey resulted in 60,265 Lygus specimens. The species complex consisted of 96.8, 3.0, and 0.2% L. hesperus, L. elisus, and L. lineolaris, respectively, in non-cotton hosts and 92.1, 7.9, and 0.0% L. hesperus, L. elisus, and L. lineolaris, respectively, in cotton. Species composition did not greatly vary through the growing season, but L. elisus and L. lineolaris composition slightly increased through the season. The survey of non-cotton host plants showed that wild mustard (flixweed, London rocket, tumble mustard, black mustard) supported the most Lygus in winter and spring months. When mustard senesced and alfalfa began to bloom in late April, alfalfa was the most dominant host to support Lygus populations. Alfalfa remained an attractive host for Lygus throughout the year until the extremely dry fall conditions or frost killed most other non-cotton hosts in late November. From early June through November, Russian thistle was an abundantly available non-cotton host that was as supportive as alfalfa as a host for Lygus. In the northern region of the High Plains (Lubbock and Hale counties), Texas blueweed, silverleaf nightshade, pigweed, and yellow sweetclover all supported Lygus during the growing season, whereas these hosts were either did not occur in the southern region (Gaines County) or did not support Lygus. For the southern region of the High Plains, alfalfa and Russian thistle were the only non-cotton hosts that supported significant numbers of Lygus during the cotton growing season. Despite a large abundance of Lygus bugs in adjacent non-cotton hosts, cotton in the Texas High Plains in general had no apparent Lygus problems during the period of this survey, indicating a potential positive role of non-cotton hosts during the cotton growing season.

Introduction

The tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), and western tarnished plant bug, *L. hesperus* Knight, are dominant pests of cotton in several states in the Cotton Belt (Williams 2004). In addition to these two species, a third species, *Lygus elisus* Van Duzee, has been identified to occur in the Texas High Plains (Bommireddy et al. 2004). However, very little biological information on *Lygus* bugs is available for the Texas High Plains, hindering the management of this pest in cotton (Carroll et al. 2005). More recently, the *Lygus* bug complex has been considered as an emerging pest issue in High Plains cotton and the situation is expected to become more pronounced in coming years. Reasons for increased *Lygus* pressure to High Plains cotton include the release of early season *Lygus* populations due to reduction in insecticide usage for boll weevil control, and increased acreage of sunflower, alfalfa, peanuts, guar, and canola that are suitable or perhaps preferred hosts for *Lygus*. These factors are expected to bring about a shift in the pest complex in cotton and may elevate *Lygus* species from minor to economic pest status.

The potential factors influencing the population dynamics of *Lygus* species include diversity of cultivated and wild hosts which support *Lygus* populations when cotton is not available, variation in cotton cultivars, the geographic gradient, planting date, and irrigation management. Specific objectives of this study were to: 1) identify non-cotton host plant sequence prior to cotton planting, 2) determine *Lygus* species composition as affected by non-cotton host plants, and 3) establish relationship between non-cotton host plants and *Lygus* movement to adjacent cotton.

Materials and Methods

A two-year (2002-2003) survey of non-cotton hosts and cotton was conducted to examine the role of noncotton hosts in supporting *Lygus* in cotton in the Texas High Plains. A comprehensive survey of non-cotton hosts were conducted from January to November in three selected counties of the Texas High Plains, while an area-wide survey of non-cotton hosts was conducted in April in each of the 25 counties of the Texas High Plains that comprise what is called the Plains Cotton Growers (PCG) service area (Fig. 1). The comprehensive survey consisted of surveying in Hale, Lubbock, and Gaines counties at 1-2-week intervals throughout the survey duration. This type of survey was designed to establish a host plant sequence of *Lygus* movement from non-cotton habitats into cotton. These three counties represented the northern, central, and southern regions of the 25-county PCG service area. The standard sweep sampling method was used to survey prominent weed hosts along roadsides in each county (Fig. 2). Approximately 800 sweeps were taken per county, and approximately 200 sweeps were taken per host plant species. A total of four locations were surveyed per county and the survey locations were identified using a GPS unit. All 25 counties were again surveyed in late July to early August to coincide with cotton blooming/fruiting. Over a 2-year period, a total of 154,600 sweeps were taken from non-cotton hosts.

Cotton from all 25 counties was surveyed in late July-early August. Cotton survey sites were adjacent to the non-cotton survey sites in each county. Surveys were conducted in both non-cotton and adjacent cotton sites from late July to late October in Hale, Lubbock, and Gaines counties (Fig. 2). Approximately 500 sweeps were taken from cotton per county. A total of 54,115 sweeps were taken from cotton during the 2-year period.

Results and Discussion

Lygus bugs were collected from 22 non-cotton host plants surveyed during the survey season (Table 1). Among non-cotton host plants, wild mustard (flixweed, tumble mustard, black mustard, and London rocket) supported the highest number of Lygus bugs (Table 2), but these hosts senesced well before cotton was available as a suitable host for Lygus (Figs. 3-5). In northern region of the High Plains (Hale and Lubbock counties), London rocket was available as a Lygus host as early as in late January (Figs. 3-4), whereas no apparent host plant was available for Lygus in Gaines County until early March (Fig. 5). Therefore, it appears that London rocket is responsible for supporting early-emerging Lygus (emerging from overwintering quarters) in the northern region of the High Plains, whereas in the southern region, Lygus may not have suitable hosts to develop early spring populations (Figs. 3-5). In the northern region, five (Hale County) to 12 (Lubbock County) non-cotton host plants were observed to "bridge" the sequence between non-cotton host plants and cotton during cotton squaring stage. However, in the southern region, alfalfa and Russian thistle were the only non-cotton hosts that provided the host sequence with cotton during cotton fruiting season (Fig. 5). Alfalfa and Russian thistle were attractive non-cotton hosts for Lygus throughout the season in all counties surveyed (Figs. 3-5). Pigweed was a prevalent non-cotton host from June/July to October in all three counties. Nevertheless, Lygus did not move to pigweed in Gaines County in any of the sample weeks (Fig. 5), but it moved to pigweed in Hale County in late August (Fig. 3), while pigweed always had Lygus in Lubbock County (Fig. 4). In most years pigweed in the High Plains region would be an available host until the time of a plant-killing freeze but during 2003 most pigweed died much earlier due to unusually dry conditions. Overall, mustard, alfalfa, pigweed, and Russian thistle were the most supportive noncotton hosts for Lygus bugs in the Texas High Plains.

Averaged across all non-cotton host plants surveyed, the northern region of the High Plains had more *Lygus* numbers compared to the southern region. For example, Hale and Lubbock counties had higher *Lygus* abundance compared to that in Gaines County throughout the season (Fig. 6). During early part of the season (January through May), *Lygus* numbers were highest in Lubbock County, followed by Hale and Gaines counties. The average *Lygus* abundance was not significantly different between Hale and Gaines counties during winter/spring months. *Lygus* numbers in non-cotton hosts declined considerably throughout the High Plains during July/August (Fig. 6). Nevertheless, the northern counties had higher *Lygus* activity compared to that in Gaines County during these summer months. *Lygus* numbers increased considerably in non-cotton hosts as cotton began maturing (September-November), but the increase was not as dramatic in Gaines County as in the northern counties (late-season; Fig. 6). During late season, *Lygus* activity was similar between Hale and Lubbock counties. On average, *Lygus* activity was highest in Lubbock County, and the lowest in Gaines County.

Although observed numbers were fewer, *Lygus* abundance and seasonal activity patterns in cotton compared across the three counties were similar to that observed in non-cotton hosts. For example, Lubbock County had the highest *Lygus* abundance, followed by Hale County and the lowest abundance was observed in Gaines County throughout the season (Fig. 8). In Lubbock County, *Lygus* abundance increased significantly from peak cotton fruiting season (July/August) to late season (September/October) as squaring declined and bolls began to mature.

Lygus species composition in non-cotton hosts consisted of *L. hesperus* (96.8%), *L. elisus* (3.0%), and *L. lineolaris* (0.2%), whereas the species composition in cotton consisted of *L. hesperus* (92.1%), *L. elisus* (7.9%), and *L. lineolaris* (0.0%). Species composition did not greatly vary through the growing season, but *L. elisus* and *L. lineolaris* composition slightly increased through the season (Table 3). The trend of increased proportion of *L. elisus* and *L. lineolaris* during mid- and late seasons may be attributed to both the host plant type and seasonal temperature. Sex-ratio of adult Lygus bugs across all samples consisted of 52% males to 48% females; the ratio was not significantly different from 50:50.

Seasonal activity patterns showed that *Lygus* bugs were active in mid- to late January, with 200 bugs per 100 sweeps (Fig. 9). *Lygus* abundance declined in February, but numbers increased through the spring months as temperatures and non-cotton host diversity and abundance increased. *Lygus* numbers peaked during April/May (Fig. 9). *Lygus* activity in non-cotton hosts declined to its lowest level during July when cotton fruiting began. *Lygus* activity began to appear in cotton in July when their activity was at a minimum in non-cotton hosts. *Lygus* numbers increased in cotton during August and the rate of *Lygus* increase in cotton during August was higher than that in non-cotton hosts. The bug activity continued to increase in both cotton and non-cotton hosts during September and October. A significant number of *Lygus* was captured from non-cotton hosts in late November (Fig. 9). This study clearly shows that the non-cotton host diversity and prevalence significantly affect the *Lygus* activity in cotton. Also, there exists a relationship between non-cotton host seasonal phenology and *Lygus* severity in cotton.

References

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Common Name	Scientific Name
Alfalfa	Medicago sativa
Black mustard	Brassica nigra
Blue mustard	Chorisporia tenella
Curly dock	Rumex crispus
Cotton	Gossypium hirsutum
Flixweed	Descurainia sophia
Gumweed	Grindelia squarrosa
Huisache-daisy	Amblyyolepis setigera
Kochia	Kochia scoparia
London rocket	Sisymbrium irio
Pigweed	Amaranthus spp.
Prairie sunflower	Helianthus rigidus
Ragweed (common)	Ambrosia artemisiifolia
Redstem filaree	Erodium cicutarium
Russian thistle	Salsola iberica
Scarlet gaura	Gaura coccine
Silverleaf nightshade	Solanum elaeagnifolium
Texas blueweed	Helianthus ciliaris
Tumble mustard	Sisymbrium altissimum
Wavy gaura	Gaura villosa
Woolyleaf bursage	Ambrosia grayi
Wild sunflower	Helianthus annuus
Yellow sweetclover	Melilotus officinalis

Table 1. List of host plants surveyed for Lygus in the Texas High Plains in 2002-2003.

Host plant	Frequency	Adult	Nymph
Flixweed	144	170.19	50.60
Tumble mustard	13	105.08	51.62
Black mustard	15	102.20	20.60
London rocket	41	96.18	24.15
Yellow sweetclover	18	79.44	12.39
Curly dock	3	47.00	1.67
Alfalfa	222	45.76	10.29
Russian thistle	71	39.55	3.86
Pigweed	76	27.46	7.05
Redstem filaree	5	14.00	4.60
Prairie sunflower	4	10.00	1.75
Scarlet gaura	4	9.50	0.50
Woolyleaf bursage	36	9.39	0.53
Texas blueweed	49	7.63	1.31
Huisache daisy	3	7.33	0.00
Kochia	30	7.03	0.43
Ragweed	26	3.46	0.04
Gumweed	5	3.20	1.80
Silverleaf nightshade	45	2.84	0.31
Blue mustard	21	2.81	0.10
Cotton	143	2.51	0.32
Wavy gaura	3	1.67	0.00
Wild sunflower	20	0.45	0.05

Table 2. Number of 100-sweep samples and seasonal average abundance (number/100 sweeps) of *Lygus* bugs in cotton and 22 non-cotton hosts in the Texas High Plains (all 25 counties averaged), 2003.

Table 3. Within-season variation in species composition of *Lygus* bugs in non-cotton hosts (data combined over 22 hosts), Texas High Plains, 2002-2003.

Species	Feb-Mar	Apr-May	Jun-Jul	Aug-Sep	Oct-Nov
Lygus hesperus	99.9	97.4	88.2	84.2	91.8
Lygus elisus	0.0	2.1	10.6	8.7	0.9
Lygus lineolaris	0.1	0.5	1.2	7.1	7.3



Fig. 1. Survey site showing the 25-county Plains Cotton Growers service area in the Texas High Plains.



Fig. 2. The standard sweep sampling method was used to survey non-cotton hosts along the roadside. The noncotton host survey sites were adjacent to the cotton survey sites as shown in this figure.

Host	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	ОСТ	NOV
Flixweed											
Tumble					-						
mustard											
Black											
mustard											
London											
rocket	+ + + + + + + + + + + + + + + + + + +									+	+ + + + + + + + + + + + + + + + + + +
Yellow											
sweetclover											
Curly doals											
Curry dock										+	+ + + +
Alfalfa											
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Woolyleaf											┢┿┯┷
bursage											
Texas											┝┿┯┿╼║
blueweed											
Huisache											
daisy										+	┢┼╌┼╌┼
Voobio											
Kocilia										+	┢┼╌┼╌┤
Ragweed											
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Gumweed											
Silverleaf											
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Cotton											
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sunflower											

Fig. 3. Weekly survey of available host sequence (green line) and the presence of *Lygus* specimens on each survey (orange line) in Hale County, 2003.

Host	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	ОСТ	NOV
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Flixweed											
Tumble											
mustard											
Black											
mustard											
London											
rocket										+	
Yellow							<u>+</u>				
sweetclover									+	+	
Curly dock											
Alfalfa						+ + - + - +		+	+	++	
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thistle										+ +	
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Redstem											
Drainia	+ + + + + + + + + + + + + + + + + + +								+ + - + - + + + + + + + + + + - + + - + - + + - + + + + + + + +	+	
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Woolvleaf											
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blueweed											
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Kochia											
Ragweed											
Gumweed										=	
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Wild											
sunflower											

Fig. 4. Weekly survey of available host sequence (green line) and the presence of *Lygus* specimens on each survey (orange line) in Lubbock County, 2003.

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Fig. 5. Weekly survey of available host sequence (green line) and the presence of *Lygus* specimens on each survey (orange line) in Gaines County, 2003.



Fig. 6. *Lygus* species composition and abundance in non-cotton hosts in three selected Texas High Plains counties through the season, 2002-2003.



Fig. 7. Seasonal average *Lygus* species composition and abundance in non-cotton host plants in three selected counties, 2002-2003.



Fig. 8. Seasonal abundance of *Lygus* bugs in cotton in the Texas High Plains, 2002-2003.



Fig. 9. Seasonal abundance and host plant sequencing of *Lygus* bugs in four dominant noncotton hosts in the Texas High Plains, 2002-2003. Solid and dotted lines represent adult and nymphal densities, respectively.