

CULTURAL PRACTICES AFFECTING SEASONAL ABUNDANCE OF SELECTED COTTON ARTHROPOD PREDATORS

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Abstract

Cotton planting date and cultivar were tested in 2002 and 2003 for their effect on populations of arthropod predators in cotton in the Texas High Plains. Timely and late cotton plantings were made, and four of the most common adapted stripper cultivars were used. Predators were sampled using five methods which were also evaluated for effectiveness. Seasonally, timely planted cotton had more total predators per acre in 2003, while cultivar ST 2454R had more total predators (also in 2003). In both years, the beat bucket was the most effective of the sampling methods tested, while the sweep net and vacuum sampler were the poorest.

Introduction

Significant reduction in insecticide use is expected after the boll weevil is functionally eradicated from the Texas High Plains, allowing an increased role for natural enemies in cotton IPM. In the High Plains, there is a paucity of information on the role of natural enemies in cotton insect pest suppression, which limits the potential to use this natural control in pest management strategies.

Objectives were to evaluate the effect of planting date window and selected adapted crop cultivar on arthropod predator activity in the High Plains. Evaluation of various sampling methods was a secondary objective, added as the test was initiated.

Methods

The study was conducted at the Helms research farm at Halfway, Texas in 2002 and 2003. The experimental design of the test was RCB in a 2x4 factorial arrangement with planting date and cultivar as main effects. Each factorial combination was replicated four times. The planting date effect included timely (planted May 7, both years) and late planted (planted June 7, 2002 and June 11, 2003) treatments. The cultivar effect included four cultivars: Stoneville 2454R (smooth leaf), Paymaster 2326RR (semi-smooth leaf), Paymaster 2145RR (hairy leaf) and Paymaster 2167RR (semi-smooth leaf). Together with PM 2280, these represent the majority of the stripper cottons grown in the Texas High Plains area. Row spacing in the field was 30 inches, and irrigation was by LEPA system. To evaluate sampling method, plots planted to cultivar PM 2326RR were sampled weekly for predaceous arthropods using the beat bucket, visual on-plant sampling, the drop cloth, the sweep net and the vacuum sampler (Agricultural Backpack Two-cycle Aspirator, John W. Hock Co, Gainesville, FL). Sample sizes were: 8 plants (beat bucket), 10 plants (visual sampling), 18.4 row feet (drop cloth), 100 sweeps (sweep net) and 100 row feet (vacuum sampler). Predators counted were: convergent lady beetle adults and larvae (*Hippodamia convergens*), scymnus lady beetle adults (*Scymnus* spp.), hooded beetle adults (*Notoxus* spp.), soft-winged flower beetle adults (*Collops* spp.), big-eyed bug nymphs and adults combined (*Geocoris* spp.), minute pirate bug nymphs and adults combined (*Orius* spp.), damsel bug nymphs and adults combined (*Nabis* spp.), green lacewing larvae (*Chrysoperla* spp.) and spiders (not identified below order). To evaluate the planting date and cultivar effects, all other plots were sampled weekly using only the vacuum sampler. All samples were taken during the same session and vacuum sampling data from the PM 2326RR plots was used in the planting date and cultivar analysis.

Results and Discussion

Sampling Method

In considering total predators detected, the relative effectiveness of the five sampling methods was similar in both years. In both years, the beat bucket detected significantly more total predators than all other methods tested while the sweep net and vacuum sampler detected significantly fewer predators (with numerically large differences) than the other methods (Table 1). Visual sampling and the drop cloth were intermediate in effectiveness. For individual predators, the beat bucket or visual sampling detected significantly more predators than the other methods in most cases. In general the drop cloth was third in efficiency, in several cases detecting significantly more predators [scymnus (2002), hooded beetle (2002-03), big-eyed bug (2003), minute pirate bug (2003)] than the sweep net or vacuum sampler (Table 1). While sampling times were not recorded, it was noted that the beat bucket was by far the quickest of the methods tested. Visual sampling, while effective at detecting predators in most cases, was the most time consuming. Sweep net and vacuum sampler were the poorest methods. Considering time spent and overall effectiveness in detecting predators, the beat bucket appears to be the best method tested.

Cotton Planting Date

In 2002, significantly more spiders and damsel bugs were detected in timely planted cotton, while significantly more minute pirate bugs and green lacewing larvae were detected in late planted cotton. Total numbers of predators detected in timely and late planted cotton were not significantly different (Table 2). In 2003, more scymnus lady beetles, soft-winged flower beetles, minute pirate bugs and spiders were detected in the timely planted cotton. Significantly more total predators were detected in the timely planted cotton than in late planted cotton (Fig. 7). Notes on crop phenology of the timely and late planted cotton were recorded for both years and analysis is underway to attempt to relate this information to any differences in predator numbers.

Cotton Cultivar

In 2002, significantly more green lacewing larvae were detected in PM 2145RR than in the other cultivars. Significantly more convergent lady beetle adults and soft-winged flower beetles were detected in ST 2454R than in PM 2167RR. Other significant differences were observed between numbers of predators detected in the individual cultivars, but in most cases the differences were numerically small. There were no significant differences between numbers of total predators in 2002 (Table 3). In 2003, generally highest numbers of individual predators were detected in ST 2454R, but in most cases means did not separate statistically from those of the other cultivars. Significantly more total predators were detected in ST 2454R than in the other cultivars (Table 3). ST 2454 is a smooth leaf variety, which may be the factor explaining the significantly higher numbers of total predators found in that cultivar in 2003. A leaf with less pubescence may have been more attractive due to less interference with the movement of the arthropods.

Before beginning the test, the vacuum sampler was chosen as the standard sampling method for use on all plots. After completing the first year's research it was evident that the vacuum sampler was by far the least effective of the methods tested. It was decided, however, to complete the experiment in a uniform fashion and use the vacuum sampler as the standard in the second year. A better evaluation of the planting date and cultivar effects might have been obtained if one of the more effective sampling methods had been used.

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Table 1. Mean numbers of predaceous arthropods per acre detected in cotton using five sampling methods, at Halfway, Texas.

Year	Predator	Sampling method*				
		Beat bucket	Visual sampling	Drop cloth	Sweep net	Vacuum sampler
2002	Convergent lady beetle adult	3389.0 a	4241.0 a	1037.1 b	283.3 b	34.2 b
	Convergent lady beetle larva	96.8 a	154.9 a	33.5 a	12.9 a	6.2 a
	Scymnus lady beetle adult	1355.6 a	581.0 b	351.3 b	23.2 c	9.3 c
	Hooded beetle adult	4938.2 a	2440.0 b	1087.3 c	141.6 d	15.6 d
	Soft winged flower beetle adult	5035.0 a	3524.5 a	1355.0 b	224.0 b	49.8 b
	Big-eyed bug (nymph+adult)	1258.8 a	445.4 ab	100.4 b	33.5 b	12.5 b
	Minute pirate bug (nymph+adult)	3001.6 a	2478.8 a	719.3 b	69.5 b	230.3 b
	Damsel bug (nymph+adult)	387.3 ab	445.4 a	66.9 ab	25.8 b	18.7 b
	Green lacewing larva	2614.3 a	4279.8 b	317.8 c	177.7 c	105.8 c
	Spiders	24690.9 a	9237.3 b	4667.1 c	754.5 cd	441.8 d
	Total predators	46767.5 a	27828.1 b	9819.4 c	1745.8 d	924.1 d
	2003	Convergent lady beetle adult	237.5 bc	760.0 a	468.4 ab	198.3 bc
Convergent lady beetle larva		356.3 a	0.0 b	70.3 b	7.2 b	0.0 b
Scymnus lady beetle adult		1187.5 a	285.0 b	538.7 ab	21.6 b	4.4 b
Hooded beetle adult		8193.8 a	2280.0 bc	2833.7 b	411.0 cd	104.5 d
Soft winged flower beetle adult		831.3 a	475.0 ab	351.3 ab	119.0 b	4.4 b
Big-eyed bug (nymph+adult)		2018.8 a	1520.0 ab	1920.4 a	663.3 bc	135.0 c
Minute pirate bug (nymph+adult)		2137.5 a	665.0 b	608.9 b	61.3 c	91.5 c
Damsel bug (nymph+adult)		1187.5 a	950.0 ab	632.3 abc	237.9 bc	74.1 c
Green lacewing larva		1187.5 ab	1995.0 a	234.2 b	165.8 b	91.5 b
Spiders		3206.3 a	1805.0 b	1007.0 bc	169.4 c	61.0 c
Total predators		20543.8 a	10735.0 b	8665.2 b	2054.8 c	570.6 c

*Means within a row, followed by the same letter are not significantly different (P>0.05, LSD).

Table 2. Mean numbers of predaceous arthropods per acre detected using a vacuum sampler in cotton planted on timely and late dates, at Halfway, Texas.

Year	Predator	Cotton planting date*	
		Timely Planted	Late Planted
2002	Convergent lady beetle adult	24.2 a	25.4 a
	Convergent lady beetle larva	2.4 a	0.0 a
	Scymnus lady beetle adult	7.3 a	7.3 a
	Hooded beetle adult	12.1 a	13.3 a
	Soft winged flower beetle adult	41.1 a	31.5 a
	Big-eyed bug (nymph+adult)	12.1 a	13.3 a
	Minute pirate bug (nymph+adult)	186.3 b	240.8 a
	Damsel bug (nymph+adult)	30.3 a	14.5 b
	Green lacewing larva	191.2 b	359.4 a
	Spiders	497.3 a	290.4 b
	Total predators	1004.3 a	995.8 a
2003	Convergent lady beetle adult	8.7 a	6.5 a
	Convergent lady beetle larva	0.0 a	0.0 a
	Scymnus lady beetle adult	17.4 a	2.2 b
	Hooded beetle adult	111.1 a	71.9 a
	Soft winged flower beetle adult	26.1 a	8.7 b
	Big-eyed bug (nymph+adult)	108.9 a	117.6 a
	Minute pirate bug (nymph+adult)	102.4 a	56.6 b
	Damsel bug (nymph+adult)	84.9 a	54.5 a
	Green lacewing larva	100.2 a	98.0 a
	Spiders	95.8 a	41.4 b
	Total predators	655.6 a	457.4 b

*Means within a row, followed by the same letter are not significantly different (P>0.05, LSD).

Table 3. Mean numbers of predaceous arthropods per acre detected using a vacuum sampler in four cultivars of cotton, at Halfway, Texas.

Year	Predator	Cultivar*			
		ST 2454R	PM 2326RR	PM 2145RR	PM 2167RR
2002	Convergent lady beetle adult	38.7 a	26.6 ab	21.8 ab	12.1 b
	Convergent lady beetle larva	0.0 a	4.8 a	0.0 a	0.0 a
	Scymnus lady beetle adult	2.4 a	9.7 a	4.8 a	12.1 a
	Hooded beetle adult	21.8 a	12.1 ab	4.8 b	12.1 ab
	Soft winged flower beetle adult	50.8 a	38.7 ab	33.9 ab	21.8 b
	Big-eyed bug (nymph+adult)	14.5 a	12.1 a	9.7 a	14.5 a
	Minute pirate bug (nymph+adult)	169.4 a	210.5 a	234.7 a	239.6 a
	Damsel bug (nymph+adult)	29.0 a	14.5 a	21.8 a	24.2 a
	Green lacewing larva	263.8 b	222.6 b	355.7 a	258.9 b
	Spiders	452.5 a	370.3 a	428.3 a	324.3 a
	Total predators	1043.0 a	922.0 a	1115.6 a	919.6 a
2003	Convergent lady beetle adult	13.1 a	4.4 a	0.0 a	13.1 a
	Convergent lady beetle larva	0.0 a	0.0 a	0.0 a	0.0 a
	Scymnus lady beetle adult	17.4 a	4.4 a	0.0 a	17.4 a
	Hooded beetle adult	161.2 a	104.5 ab	43.6 bc	56.6 c
	Soft winged flower beetle adult	34.9 a	4.4 ab	21.8 ab	8.7 b
	Big-eyed bug (nymph+adult)	135.0 a	135.0 a	82.8 a	100.2 a
	Minute pirate bug (nymph+adult)	100.2 a	91.5 a	56.6 a	69.7 a
	Damsel bug (nymph+adult)	78.4 a	74.1 a	74.1 a	52.4 a
	Green lacewing larva	104.5 a	91.5 a	113.3 a	87.1 a
	Spiders	108.9 a	61.0 bc	78.4 ab	26.1 c
	Total predators	753.6 a	570.6 b	470.5 b	431.2 b

*Means within a row, followed by the same letter are not significantly different (P>0.05, LSD).