OCCURRENCE AND IMPACT OF *KURTOMATHRIPS MORRILLI*: A NEW PEST OF COTTON ON THE TEXAS HIGH PLAINS

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Abstract

Kurtomathrips morrilli is an unusual thrips that occasionally attacks and severely damages cotton in the southwestern United States, but there is very little information available regarding this pest. In 2011, the south plains region of Texas was severely impacted by a drought which may have been a key factor resulting in an outbreak of *K. morrilli*. This outbreak encompassed an estimated 330,000 acres of cotton, approximately 83,000 acres of which received insecticide applications. The outbreak resulted in the loss of about 24 million pounds of cotton lint, resulting in over $20 million in yield loss and control costs. Water-deficit stressed cotton appeared to be most severely affected by *K. morrilli*, while cool temperatures and precipitation appeared to naturally mediate the outbreak. Insecticide efficacy tests determined that the neonicotinoid insecticides, Intruder (acetamiprid), Trimax Pro (imidacloprid) and Centric (thiamethoxam), and the organophosphate Orthene (acephate) were highly effective in mediating *K. morrilli* infestations. The mostly commonly used insecticides in the 2011 outbreak were imidacloprid, primarily generic brands, and acephate. These were the insecticides of choice primarily because they were inexpensive, yet effective.

Introduction

Kurtomathrips morrilli Mouton, family Thripidae, was originally collected in Gila Bend, AZ from cotton, where it was recorded as causing severe damage (Moulton 1927). The second report of this species occurred in 1939 in California where it was reported damaging chrysanthemums, and was also collected from southern mules ear, *Wyethia ovata* (Bailey 1957). Additional reports indicate that *K. morrilli* have been collected from a number of cultivated hosts, including beans, lantana, locust, snapdragon and eggplant, and from wild hosts including *Datura stramonium* L., *Malva rotundifolia* L., *Wedelia* sp. and *Wisteria* sp. (Bibby 1958, Bailey 1961, McKinney 1939, Hoddle et al. 2008).

K. morrilli are considered native to the western United States including California, Nevada, Arizona, New Mexico and Texas, but have also been collected in Florida, Jamaica and India (Hoddle et al. 2008). *K. morrilli* and three other species of the same genera, are all reported as minute in size, usually wingless, sluggish in movement and seem to be associated with the plant genus *Parthenium*. In India, *K. morrilli* has been collected from *Parthennium hyterophorus*, which is also common along the U.S. Gulf Coast and central Texas (de Borbon 2004). Similar species of plants may serve as a reservoir for *K. morrilli* in the southwestern United States including *P. confertum* and *P. argentatum*. *P. argentatum*, guayule, is cultivated in the desert southwest for rubber. However, there are no documented collections of *K. morrilli* from either of these plant species. Thus, the natural reservoir for *K. morrilli* in west Texas is uncertain. *K. morrilli* have also been reported in Hawaii infesting the weed *Pluchea odorata*, where it was considered as a possible biological control organism since it often quickly killed the weed (Bianchi 1956, Sakimura 1956).

Little is known concerning the biology of *K. morrilli* outside of previously mentioned taxonomic records, collections and descriptions. However, it appears that most, if not all of these collections occurred where warm, dry conditions prevail (Bianchi 1965). *K. morrilli* was considered strictly apterous until alate forms were collected in Hawaii (Bianchi 1965).

In this paper we report observations and pest management tactics for *K. morrilli* in Texas cotton in 2011.

Materials and Methods

Three tests were conducted in a commercial cotton fields grown near Seminole, TX. The fields were on 36 or 40-inch rows, and were irrigated using pivot irrigation systems. All three tests were planted with the same variety, Phytogen 367WRF. All the tests were RCB designs with four replications. Plots were 4-rows wide × 50 ft in length.

At all locations, insecticides were applied with a CO_2 pressurized hand-boom sprayer calibrated to deliver 10 gpa through TX-6 hollow cone nozzles (2 per row) at 40 psi. Insecticides were applied to all four rows of each plot.

Insecticides evaluated at Test site 1 included: Trimax Pro (imidacloprid) at 1.8 fl-oz/ac, Intruder at 1.0 oz/ac, Othrene 97 (acephate) at 8 oz/ac, Radiant (spinetoram) at 6 fl-oz/ac and Tracer (spinosad) at 2.5 fl-oz/ac. Because we did not know how efficacious any of the insecticides would be, we used high use rates of all products.

The purpose of Test site 2 was to evaluate the efficacy of insecticides before the plants were severely damaged and to collect yield data. At Test site 2, we eliminated the insecticides that did not appear to offer highly effective control and included lower rates of the effective insecticides as well as an additional active ingredient. Treatments included: Trimax Pro at 1.2 and 1.8 fl-oz/ac, Intruder at 0.6 and 1.0 oz/ac, Othrene 97 at 4 oz and 8 oz/ac and Centric (thiamethoxam) at 1.8 and 2.5 oz/ac.

The purpose of Test site 3 was to evaluate the efficacy of Vydate C-LV (oxamyl). Vydate C-LV is commonly used in cotton near the pinhead size square stage for suppression of root knot nematode, *Meloidogyne incognita*, which commonly occurs where the infestations of *K. morrilli* were first noted and most severe. If infestations of *K. morrilli* occur in the near future in pre-bloom cotton, it is important to know if applications of Vydate C-LV will control or suppress the thrips. Vydate C-LV was evaluated at the common nematode rate of 8.5 and 17 fl-oz/ac.

Treatments were evaluated by collecting five leaves at Test site 1, and ten leaves at Test sites 2 and 3, into 1-pt jars containing a 30% isopropyl alcohol solution. The jars were returned to the laboratory where the thrips were vacuum filtered onto filter paper and then the adult and immature thrips were counted using a stereo dissecting scope. At Test site 1, pretreatments collections and counts were conducted on 25 July, and subsequent evaluations were made on 1 and 9 August. In addition to thrips, at Test site 1, eggs, immatures and adult carmine spider mites, *Tetranychus cinnabarinus,* were counted on 9 August to determine if any of the treatments increased the potential for flaring the mites.

At Test sites 2 and 3, the middle two rows of each plot were harvested on 7 November and 10 October respectively, using a mechanized cotton stripper with integrated scales. Approximately 3 lb grab samples were taken from each plot during harvest and ginned to determine lint turn out. During ginning, approximately 200 g of processed lint was collected from each plot for HVI analysis. All data were analyzed using ANOVA and means were separated using an F-protected LSD ($P \leq 0.05$). Yield correlation at Test site 3 was analyzed using simple linear regression where the combined immature and adult thrips on 8 August were the independent variable and yield in lbs-lint/acre was the dependent variable (Sigma Plot 2011).

Results and Discussion

Observations

In 2011, a severe outbreak of *K. morrilli* was experienced in cotton in the south plains region of Texas. This outbreak encompassed an estimated 330,000 acres of cotton, approximately 83,000 acres of which received insecticide applications (Williams In press) (Figure 1). Additionally, *K. morrilli* was estimated to have caused the loss of about 24 million pounds of cotton lint, resulting in over $20 million is losses and control costs (Williams In press). The first report of cotton infested with *K. morrilli* in 2011 occurred on 22 July in Gaines County near

Seminole, TX. At the time of the initial infestations, most of the cotton was near or had reached cutout (≤ 5 nodes above white flower). Thus most of the cotton crop was filling bolls and few new bolls were being produced. During this physiological time in the cotton plant's development, water demand is near its peak (Loka et al. 2011).

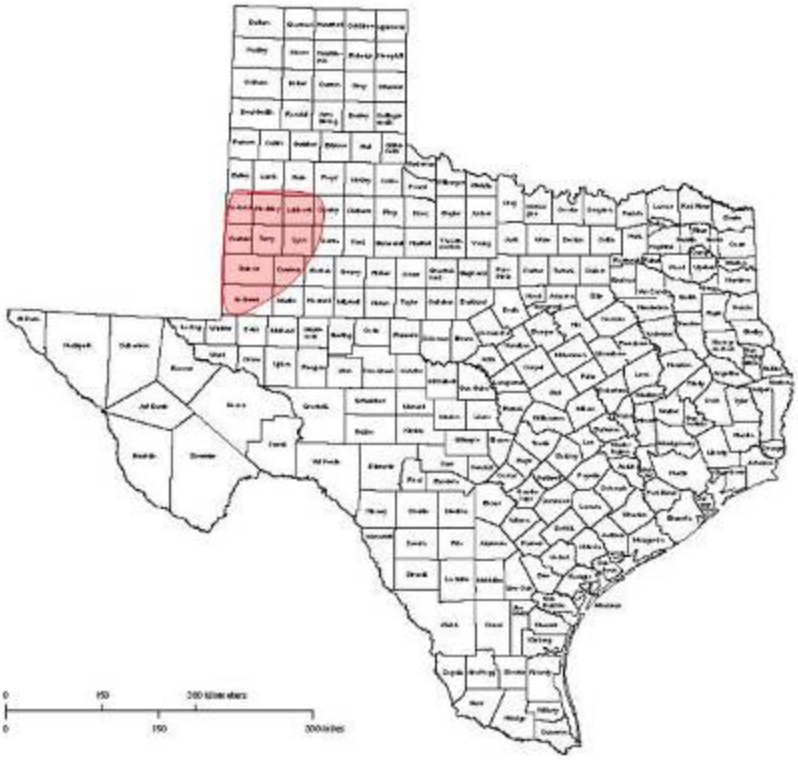

Figure 1. Approximate area of spread of *K. morrilli* outbreak in 2011.

Concurrently in 2011, much of Texas experienced the worst drought in the State's history (Nielson-Gammon, 2011). Infestations of *K. morrilli* appeared to be most severe in water-deficit stressed cotton in areas where irrigation was insufficient to completely meet the crops water demand. Infestation usually began on field edges, but circular patches of thrips damaged cotton could often be found away from the edge towards the field's centers. Collections of *K. morrilli* in 2011, suggested that approximately 2% of adult thrips collected were alate. Whether most infestations were the result of alate migration or wind-blown apertous forms is not certain. Unlike most species of thrips commonly associated with cotton in west Texas, primarily western flower thrips, *Franklinella occidentalis* and onion thrips, *Thrips tabaci*, *K. morrilli* is approximately 50% the size of these thrips and was less active and did not quickly move about when disturbed, but was rather lethargic in nature as described by de Borbon (2004). Additionally, unlike western flower thrips, adult and immature *K. morrilli* did not appear to prefer blooms or the plant terminal, but was most common on the abaxial leaf surface of fully expanded leaves feeding along the veins. However, when populations were high the entire leaf would commonly be infested resulting in as much as 100% of individual leaves being damaged.

Damaged leaves appeared grayish-silver in appearance, often with a dark speckling due to accumulated thrips feces. Where water-deficit stress was most severe, easily notable damage from an infestation of *K. morrilli* on a field's edge could spread across as much as 100 acres in less than 7 days. Damage from *K. morrilli* often occurred so quickly, defoliation and death of plants was mistaken for drought stress alone, or was too late to take curative actions.

After the initial discover of *K. morrilli* infesting cotton in Gaines County, within a few days infestations were discovered in Terry and Hockley counties. By mid-August, the infestation had spread through much of the south plains region. The infestation continued to spread north and eastward until cooler temperatures prevailed in mid-September (Figure 1). After which infestations of *K. morrilli* ceased to be a problem.

Management

Insecticide evaluations

Before the thrips was known to be *K. morrilli*, it was thought that the infestation may be bean thrips, *Caliothrips fasciatus* (Pergande) which sometimes infests mid to late-season cotton in south Texas. Thus, insecticides that are known to be effective towards bean thrips were selected for evaluation.

Test site 1 occurred in the cotton field where the initial infestation of *K. morrilli* was discovered. The thrips population at this location was very high, averaging 136 thrips per leaf prior to spraying on 25 July (Table 1). At 3 days after treatment (DAT), the thrips numbers were highly variable among treatments and there were no significant differences. However, for immature and total thrips at 7 DAT, Intruder had the fewest thrips, but did not differ from Orthene or Trimax Pro. Neither of the spinosyns, Radiant and Tracer differed from the untreated. By 9 August the thrips population had declined across the entire test and all the insecticide treatments had fewer thrips than the untreated. This decline in thrips was due primarily to the severe deterioration of the plants. The producer of this field ultimately abandoned one-half of the field where the infestation began, but treated the remaining cotton with insecticide and finished the crop.

Table 1. Mean number of *K. morrilli* thrips prior to insecticide treatment and three days after treatment at Test site 1.

Treatment/ formulation	Rate amt product/acre	Thrips per 5 leaves					
		25 July (pre-treatment)			28 July (3 DAT)		
		immatures	adults	total	immatures	adults	total
Untreated	--	377.75 a	167.50 a	545.25 a	293.75 a	51.25 a	345.00 a
Trimax Pro	1.8 fl-oz	665.00 a	110.50 a	775.50 a	90.00 a	5.25 a	95.25 a
Orthene 97	8.0 oz	424.50 a	61.00 a	485.50 a	145.25 a	13.00 a	158.25 a
Intruder 70WP	1.0 oz	716.00 a	136.50 a	852.50 a	77.75 a	10.50 a	88.25 a
Radiant 1SC	6.0 fl-oz	545.00 a	113.75 a	658.75 a	154.75 a	14.50 a	169.25 a
Tracer 4SC	2.5 fl-oz	509.25 a	242.25 a	751.50 a	227.25 a	17.75 a	245.00 a

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \leq 0.05$).

Table 2. Mean number of *K. morrilli* thrips at 7 and 15 days after insecticide treatment at Test site 1.

Treatment/ formulation	Rate amt product/acre	Thrips per 5 leaves					
		1 August (7 DAT)			9 August (15 DAT)		
		immatures	adults	total	immatures	adults	total
Untreated	--	334.00 a	61.25 a	395.25 a	139.00 a	56.00 a	195.00 a
Trimax Pro	1.8 fl-oz	55.50 cd	5.75 a	61.25 bc	21.25 b	22.00 b	43.25 b
Orthene 97	8.0 oz	45.50 cd	9.00 a	54.50 c	10.75 b	13.75 b	24.50 b
Intruder 70WP	1.0 oz	23.00 d	1.75 a	24.75 c	0.50 b	1.75 b	2.25 b
Radiant 1SC	6.0 fl-oz	177.50 bc	14.50 a	192.00 bc	2.25 b	4.00 b	6.25 b
Tracer 4SC	2.5 fl-oz	230.00 ab	18.75 a	248.75 ab	15.50 b	18.50 b	34.00 b

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \leq 0.05$).

At Test site 1 spider mites were evident in low numbers prior to the insecticide applications. At 15 DAT, carmine spider mites were counted along with the thrips, and treating with Intruder appeared to more likely result in a mite outbreak than any of the other treatments (Table 3).

Table 3. Incidence of carmine spider mite following insecticide treatments targeting *K. morrilli* at Test site 1, on 9 August (15 DAT).

Treatment/ formulation	Rate amt product/acre	Spider mites per 5 leaves			
		eggs	immatures	adults	motiles
Untreated	--	1.50 a	2.50 a	9.50 b	12.00 a
Trimax Pro	1.8 fl-oz	0.00 a	0.00 a	0.00 b	0.00 a
Orthene 97	8.0 oz	0.00 a	0.00 a	0.00 b	0.00 a
Intruder 70WP	1.0 oz	3.75 a	19.25 a	53.25 a	72.50 a
Radiant 1SC	6.0 fl-oz	0.00 a	0.00 a	0.00 b	0.00 a
Tracer 4SC	2.5 fl-oz	0.75 a	0.00 a	1.50 b	1.50 a

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \leq 0.05$).

At Test site 2, the thrips population was averaging about 23 thrips per leaf when the test was initiated on 17 August (Table 4). At 7, 12, and 21 DAT, all of the products and rates evaluated had fewer thrips than the untreated, but there were no differences among the insecticides (Tables 4 and 5). Significant differences in yield were detected in this test (Table 5). Centric at 1.8 oz had the highest yield but was not statistically better than either rate of Intruder, the low rate of Centric or the high rates of Orthene or Trimax Pro. Both rates of Centric and Intruder were the only insecticide treatments that yielded significantly more than the untreated.

Table 4. Mean number of *K. morrilli* thrips prior to insecticide treatment and seven days after treatment at Test site 2.

Treatment/ formulation	Rate amt product/acre	Thrips per 10 leaves					
		17 August (pre-treatment)			24 August (7 DAT)		
		immatures	adults	total	immatures	adults	total
Untreated	--	172.00 a	51.25 a	223.25 a	217.00 a	57.75 a	274.75 a
Trimax Pro	1.2 fl-oz	154.88 a	225.71 a	380.60 a	42.25 b	10.00 b	52.25 b
Trimax Pro	1.8 fl-oz	158.25 a	29.75 a	188.00 a	22.75 b	6.75 b	29.50 b
Orthene 97	4.0 oz	54.25 a	38.25 a	92.50 a	13.50 b	6.50 b	20.00 b
Orthene 97	8.0 oz	168.88 a	51.05 a	219.93 a	13.00 b	13.00 b	26.00 b
Intruder 70WP	0.6 oz	204.50 a	57.25 a	261.75 a	13.00 b	12.50 b	25.50 b
Intruder 70WP	1.0 oz	154.50 a	41.75 a	196.25 a	15.75 b	14.75 b	30.50 b
Centric 40WG	1.8 oz	171.00 a	41.75 a	212.75 a	30.50 b	24.00 b	54.50 b
Centric 40WG	2.5 oz	175.00 a	66.00 a	241.00 a	12.50 b	10.00 b	22.50 b

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \leq 0.05$).

Table 5. Mean number of *K. morrilli* thrips at 12 and 21 days after treatment, and yield at Test site 2.

Treatment/ formulation	Rate amt product/acre	Thrips per 10 leaves						Yield (lint-lbs/ac)
		30 August (12 DAT)			8 September (21 DAT)			
		immatures	adults	total	immatures	adults	total	
Untreated	--	227.00 a	52.25 a	279.00 a	53.00 a	30.00 a	83.00 a	431.35 d
Trimax Pro	1.2 fl-oz	13.00 b	15.75 b	29.00 b	2.00 b	2.25 b	4.25 b	454.27 cd
Trimax Pro	1.8 fl-oz	1.00 b	3.00 b	4.00 b	0.50 b	2.50 b	3.00 b	675.92 a-d
Orthene 97	4.0 oz	0.75 b	3.50 b	4.00 b	1.00 b	0.50 b	1.50 b	570.42 bcd
Orthene 97	8.0 oz	4.75 b	15.50 b	20.00 b	1.00 b	2.25 b	3.25 b	727.05 ab
Intruder 70WP	0.6 oz	0.00 b	0.50 b	1.00 b	0.75 b	0.75 b	1.50 b	712.88 ab
Intruder 70WP	1.0 oz	0.75 b	7.00 b	8.00 b	1.25 b	0.25 b	1.50 b	766.93 ab
Centric 40WG	1.8 oz	0.75 b	6.50 b	7.00 b	1.00 b	3.25 b	4.25 b	859.01 a
Centric 40WG	2.5 oz	0.75 b	4.25 b	5.00 b	1.00 b	0.25 b	1.25 b	687.62 abc

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \leq 0.05$).

At Test site 3, the thrips population was averaging 16.75 thrips per leaf on 26 August prior to the insecticide applications, and there were no statistical differences among treatments at this time (Table 6). At 7 DAT, Vydate at 17 fl-oz had fewer immatures and total thrips than the untreated but did not differ from Vydate at 8.5 fl-oz. By 14 DAT, the thrips population had increased in the untreated and both rates of Vydate had fewer immature and total thrips than the untreated (Table 7). Vydate does have some activity on these thrips, but the level of activity does not appear to be as good as what was observed from some of the other insecticides in the other tests. It is probable that Vydate will suppress *K. morrilli* populations if they occur in pre-bloom cotton at the time it is treated for nematodes. No differences in yield were detected among treatments in test 3, but yields did correlate with thrips numbers (Table 7 and Figure 2). Based on the regression model, it appears that there was an approximate 55 lbs/acre reduction in lint for every 20 thrips per leaf based on thrips densities 14 DAT.

Table 6. Mean number of *K. morrilli* thrips prior to insecticide treatment and seven days after treatment at Test site 3.

		Thrips per 10 leaves					
Treatment/	Rate amt	26 Aug (pre-treatment)			1 Sep (7 DAT)		
formulation	product/acre	immatures	adults	total	immatures	adults	total
Untreated	--	290.50 a	381.25 a	381.25 a	295.00 a	102.00 a	397.00 a
Vydate C-LV	8.5 fl-oz	214.50 a	293.50 a	293.50 a	159.25 ab	27.25 a	186.50 ab
Vydate C-LV	17 fl-oz	194.25 a	314.25 a	314.25 a	48.25 a	11.25 a	59.50 b

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \leq 0.05$).

Table 7. Mean number of *K. morrilli* thrips at 14 days after treatment, and yield at Test site 3.

		Thrips per 10 leaves			
Treatment/	Rate amt	8 Sep (14 DAT)			Yield
formulation	product/acre	immatures	adults	total	(lint-lbs/ac)
Untreated	--	409.00 a	173.50 a	582.50 a	639.25 a
Vydate C-LV	8.5 fl-oz	141.50 b	23.75 a	165.25 b	713.76 a
Vydate C-LV	17 fl-oz	63.75 b	20.50 a	84.25 b	688.09 a

Values in a column followed by the same letter are not significantly different based on an F-protected LSD ($P \leq 0.05$).

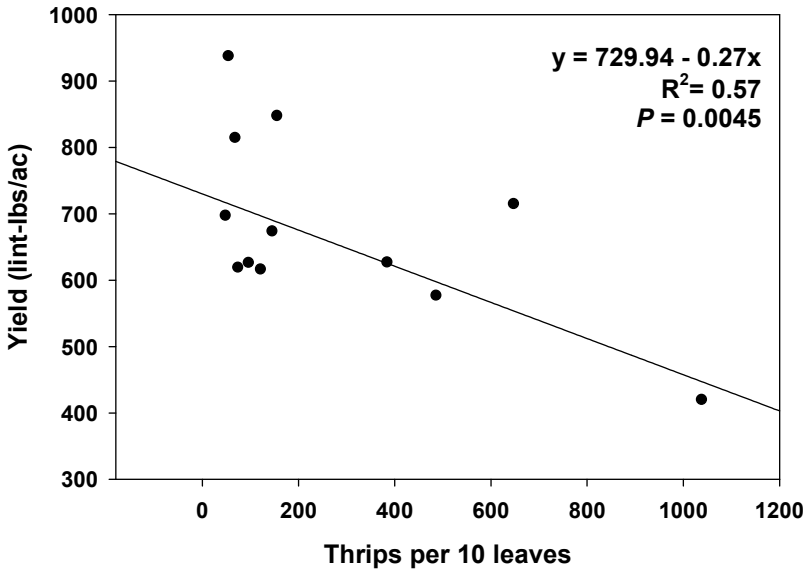

Figure 2. Correlation between *K. morrilli* thrips and yield.

Decision making

K. morrilli is an unusual pest of cotton that appears to occur under hot, dry conditions affecting primarily water-deficit stressed cotton. Although this is the first report of this pest damaging cotton in Texas, it is highly probable that this in an endemic species that has simply remained undetected. It is likely that dryland cotton grown in the south plains region of Texas has been affected by this pest in the past, but has gone unnoticed because most dryland cotton is not regularly scouted and since this pest impacts primarily water-deficit plants, damage, defoliation and death is often attributed solely to the lack of water. Additionally, most dryland cotton suffering water-deficit conditions is probably not worth protecting from *K. morrilli.* However, under conditions similar to those experienced in 2011, irrigated cotton grown under water-deficit conditions may be worth protecting. When making the decision to treat or not to treat consider the following:

1. **What stage of growth is the cotton?**
   Check boll maturity. If the bolls are mature (cutting the boll open and seeds have well defined cotyledons and seed coat versus those which are watery seeds) they may not be significantly damaged by the defoliation. If there are numerous bolls to mature, treatment may be justified. These immature bolls should yield enough to cover treatment costs including cost of the insecticide and the application.

2. **Choose the right insecticide**
   K. morrilli do not appear difficult to control with a number of insecticides including acephate, acetamaprid, imidacloprid and thiamethoxam. The most commonly used insecticides in the 2011 *K. morrilli* outbreak were imidacloprid, primarily generic brands, and acephate. These were the insecticides of choice primarily because they were inexpensive, yet effective.

3. **Consider cost saving methods.**
   Consider piggy backing applications to save costs. If *K. morrilli* is present and an over the top herbicide application is scheduled, the addition of a relatively inexpensive, yet effective insecticide may save a trip though the field solely for thrips control. Spray field edges where *K. morrilli* is abundant and does not appear to be spreading into the field.

4. **What is the weather forecast?**
   K. morrilli appears adversely sensitive to cool temperatures and precipitation. If these conditions are predicted in the immediate future and you have field edges infested, then an insecticide application may not be necessary.

Summary

Kurtomathrips morrilli is an unusual thrips that occasionally attacks and severely damages cotton in the southwestern United States. In 2011, the south plains region of Texas was severely impacted by a drought which may have been a key factor resulting in an outbreak of *K. morrilli*. Water-deficit stressed cotton appeared to be most severely affected by *K. morrilli*, while cool temperatures and precipitation appeared to naturally mediate the outbreak. Insecticide tests determined that the neonicotinoid insecticides, Intruder (acetamiprid), Trimax Pro (imidacloprid) and Centric (thiamethoxam), and the organophosphate Orthene (acephate) were highly effective in mediating *K. morrilli* infestations.

Acknowledgements

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