MONITORING POPULATIONS OF ADULT FALL ARMYWORM, *SPODOPTERA FRUIGIPERDA* SMITH (LEPIDOPTERA: NOCTUIDAE), IN FLORIDA SUGARCANE USING PHEROMONE TRAPS, WITH SPECIAL REFERENCE TO GENETIC STRAINS OF THE PEST

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Abstract

FALL ARMYWORM (FAW) is a pest of occasional importance in Florida sugarcane and sporadic outbreaks of FAW often develop rapidly in young cane and can result in severe defoliation. Traps baited with pheromones hold potential for predicting where and when infestations develop. Two genetic strains of FAW occur in Florida, the 'corn' and 'rice' strains, but whether both strains are associated with sugarcane was not known. Commercial pheromone lures for monitoring FAW in sugarcane were compared by obtaining data on numbers of FAW collected at pheromone traps, and investigating the genetic strain(s) of FAW associated with sugarcane. Five synthetic FAW pheromones available for purchase (Hercon, Trece, Scentry 2-component, Scentry 4-component, and Scenturion) were evaluated using universal moth traps (yellow, white and green combination) at multiple locations in Florida during 2003 and 2004. Polymerase chain reaction (PCR) analyses were used to identify FAW strains. The Scenturion lure attracted significantly more FAW than the other lures. The Trece and Scentry 2 lures ranked second in numbers of moths captured. For traps baited with Scenturion lures, numbers of moths collected at traps peaked during 2003 and 2004 at maximums of 125 and 356 moths per trap per night, respectively. PCR analyses indicated 99% FAW collected during 2003 were 'rice strain' individuals. In 2004, 96% moths collected in areas where no corn was grown were 'rice strain' individuals and 85% were 'rice strain' over all trapping locations. Only a few FAW larvae were found in cane, and these were 'rice' strain. Larvae of each strain were found in corn. The study provided base information on pheromone trapping for FAW and indicated that FAW infestations in Florida sugarcane may be predominantly by 'rice strain' individuals.

Introduction

Fall armyworm (FAW; *Spodoptera fruigiperda* Smith) is a pest of occasional importance in Florida sugarcane (Hall, 1988; Hall and Bennett, 1994). Sporadic outbreaks of FAW occur and can result in severe defoliation, particularly in young sugarcane to which FAW is apparently attracted. Infestations often develop rapidly, and substantial defoliation can occur before infested fields are identified and control tactics applied.

Weekly scouting in young cane is generally adequate for catching infestations in time to prevent severe defoliation, but the cost of monitoring can be difficult to justify during years in which no outbreaks occur.

Pheromone traps may hold potential for predicting ahead of time where and when infestations of FAW might develop. Meagher and Mitchell (2000) reviewed research on FAW sex pheromone and trapping male moths. A number of different pheromones are available commercially for FAW, and some of these have been recognised as effective for catching FAW in traps such as the universal moth trap.

Two genetic strains of FAW have been identified and both occur in Florida (Nagoshi and Meagher, 2003). These are referred to as the 'corn' and 'rice' strains. Whether both strains are associated with sugarcane has not been known.

The purpose of research presented here was to compare commercial pheromone lures for monitoring FAW in sugarcane; to obtain data on numbers of FAW collected at pheromone traps; and to investigate the genetic strain(s) of FAW associated with sugarcane in Florida.

Methods and materials

Universal moth traps (yellow, white and green combination) (Great Lakes IPM, Vestaburg, MI) baited with commercial pheromone lures were operated in April–October 2003 in the sugarcane-growing region of Florida.

During April–June at four locations, two sets of five traps were placed along the edge of a sugarcane field at 15 m intervals. For each set of traps, five lures were randomly assigned to a trap location: Hercon (Hercon Environmental, Emigsville, PA); Trece (Trece Inc., Adair, OK); Scentry 4-component; Scentry 2-component (Scentry Biologicals, Billings, MT); and Scenturion (Suterra LLC, Bend, OR).

During July–October, one set of five traps was operated at each location with each lure randomly assigned to one trap (15 m between traps). The traps were suspended from a 1.5 m pole (PVC 1.27 cm internal diameter) along ditchbanks adjacent to cane fields.

Hercon Vaportape strips (Hercon Environmental, Emigsville, PA) (2.5 x 1.3 cm piece of PVC tape treated with 10% 2,2-dichlorovinyl-dimethyl-phosphate toxicant) were placed in each trap (1 per trap) to kill moths after they entered the traps. New lures were placed into traps every 3 weeks. The traps were checked weekly to record the number of moths per trap. Moth numbers per trap per night were compared among lures using simple one-way ANOVA on $\log_{10}(x+1)$ transformed counts, and means were separated using Duncan's multiple range test.

Traps baited with Scenturion lures were operated at five additional farms during July–October 2003 and at 12 farms during April–June 2004. Samples of moths from traps were periodically screened using polymerase chain reaction analyses (Nagoshi and Meagher, 2003) to determine if they were 'corn' or 'rice' strain individuals.

Results and discussion

Significantly more moths were collected in traps baited with Scenturion lures than at any other lure (Table 1); the Trece and Scentry 2 lures ranked second in numbers of moths captured. Traps baited with the Hercon lure captured the fewest number of moths.

Although there were significant differences among the lures in numbers of FAW moths trapped, each lure had value as a FAW attractant. A lure of moderate attractiveness might attract fewer moths yet be useful for identifying peaks of FAW activity with less labour in counting moths.

Table 1—Numbers of fall armyworm males collected at traps baited with different pheromone lures in Florida (2003).

Lure	Mean moths/trap/night[a]	Maximum moths/trap/night	Percent 'rice' strain
Hercon	0.7 d	16	98.2
Scenturion	6.4 a	125	99.1
Scentry 2 component	3.3 b	60	97.2
Scentry 4 component	1.8 c	40	100.0
Trece	4.5 b	121	98.8

[a]Means followed by the same letter are not significantly different (P = 0.05), Duncan's multiple range test (analyses on $\log_{10}$-transformed counts, non-transformed means shown).

Over the entire 2003 study period, the largest numbers of FAW were collected at traps during late April and May. Maximum numbers of moths collected during this peak period of moth activity reached 125 per trap per night in a trap baited with a Scenturion lure.

During 2004, numbers of moths collected at traps baited with Scenturion lures peaked at an average of 157 moths per trap per night over all locations with a maximum of 356 per trap per night at one location.

Of 386 male FAW trapped and analysed during 2003, 381 (98.7%) were 'rice' strain individuals, and of 327 moths trapped and analysed during 2004, 84.7% were 'rice' strain. Corn was grown in the vicinity of six trapping locations during 2004, and 27.6% FAW from these locations were 'corn' strain individuals.

Among moths from the traps not in the vicinity of corn, 96% were of the 'rice' strain. Nineteen FAW larvae collected from a sugarcane field during 2003 were the 'rice' strain individuals. Both strains were found infesting corn during spring 2004.

The research indicated that FAW populations associated with cane were predominantly 'rice' strain. The ramifications of FAW infestations in cane being of only one strain are not currently clear, but could include potential differences in insecticide susceptibility, biological control and other factors.

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SUIVI DES POPULATIONS DE L'ADULTE DU LEGIONNAIRE D'AUTOMNE *Spodoptera fruigiperda* Smith (Lepidoptera: Noctuidae) DANS LA CANNE À SUCRE EN FLORIDE À L'AIDE DE PIÈGES À PHÉROMONES, AVEC UNE ATTENTION PARTICULIÈRE AUX SOUCHES GÉNÉTIQUES DU RAVAGEUR

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MOTS CLÉS: Échantillonnage, Prospections.

Résumé

LE LÉGIONNAIRE d'automne est un ravageur occasionnel important de la canne à sucre en Floride et des infestations sporadiques se développent rapidement dans les jeunes cannes, pouvant provoquer des défoliations sévères. Les pièges à phéromones peuvent être utilisés pour prédire où et quand les infestations se développent. Deux souches génétiques de la chenille ont été répertoriées en Floride – la souche 'riz' et la souche 'maïs' – mais il n'a jamais été établi si ces deux souches sont associées à la canne à sucre. Les leurres à base de phéromones disponibles commercialement ont été comparés à travers les captures de l'insecte dans les pièges et ainsi, l'association des souches génétiques du légionnaire d'automne avec la canne à sucre a été étudiée. Cinq phéromones synthétiques du légionnaire d'automne, disponibles sur le marché, (*Hercon, Trece, Scentry 2-component, Scentry 4-component*, et *Scenturion*), ont été évalués à l'aide des pièges universels à phalènes (une combinaison du jaune, blanc et vert) dans plusieurs localités en Floride, en 2003 et 2004. La technique PCR (l'amplification en chaîne par polymérase) a été utilisée pour identifier les souches de la chenille. Les captures étaient significativement plus élevées avec le leurre *Scenturion*, alors que les leurres *Trece* et *Scentry 2* venaient en deuxième position. Pour les pièges avec le

leurre *Scenturion*, le nombre maximum de captures en 2003 et en 2004 était respectivement de 125 et 356 phalènes/piège/nuit. Les analyses PCR ont indiqué que 99% des légionnaires d'automne capturés en 2003 appartenaient à la souche 'riz'. De ceux capturés en 2004, dans les localités où le maïs n'était pas cultivé, 96% étaient aussi de la souche 'riz', alors que sur l'ensemble des localités, 85% appartenaient toujours à la même souche. Très peu de larves de légionnaires d'automne ont été observées dans les champs de canne et elles étaient toutes de la souche 'riz', alors que dans les plantations de maïs, des larves des deux souches ont été observées. Cette étude a fourni les informations de base sur le piégeage à l'aide de phéromones et a démontré que les infestations du légionnaire d'automne dans la canne à sucre en Floride pourraient être attribuées principalement aux individus de la souche 'riz'.

SEGUIMIENTO DE LAS POBLACIONES ADULTAS DEL GUSANO EJERCITO S*PODOPTERA FRUGIPERDA* SMITH (LEPIDOPTERA: NOCTUIDAE), EN LA CAÑA DE AZÚCAR DE LA FLORIDA, EMPLEANDO TRAMPAS CON FEROMONA Y CON ESPECIAL REFERENCIA EN LAS VARIANTES GENÉTICAS DE LA PLAGA

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PALABRAS CLAVES: Muestreo, Evaluaciones

Resumen

EL GUSANO ejercito (FAW) es una plaga de importancia esporádica para la caña de azúcar de la Florida donde ocurren brotes esporádicos de FAW que se convierten a menudo de manera rápida en epidemias que afectan caña joven ocasionando severos deshoje de las plantas. Las trampas impregnadas con feromonas tienen un gran potencial para predecir donde y cuando están ocurriendo las infestaciones. Dos variantes genéticas de FAW se encuentran en la Florida, las variantes 'maíz' y 'arroz', sin embargo su asociación con caña de azúcar es desconocida. Los señuelos comerciales de feromonas para el seguimiento de FAW en caña de azúcar se comparó con los datos obtenidos en el número de FAW colectados en las trampas de feromona e investigando la variante genética de FAW asociado con la caña de azúcar. Cinco feromonas sintéticas de FAW comerciales y disponibles fueron evaluadas (Hercon, Trece, componente Scentry 2, componente Scentry 4, y Scenturion) empleando la las trampas universales de la polilla (las combinaciones amarillo, blanco y verde) en muchas localidades de la Florida durante 2003 y 2004. El análisis de la reacción en cadena de la polimerasa (PCR) se utilizó para identificar las variantes genéticas de FAW. El señuelo de Scenturion atrajo considerablemente mayor número de FAW que el otro atrayente. El Trece y el Scentry 2 estuvieron en segundo lugar en el número de las polillas capturadas. Para las trampas impregnadas con el atrayente Scenturion, el número máximo de polillas recolectadas en las trampas impregnadas durante 2003 y 2004 fue de 125 y 356 polillas por trampa por noche, respectivamente. Los análisis de PCR indicaron que el 99% de los FAW recogidos durante 2003 fueron individuos de la variante 'arroz'. En 2004, el 96% de las polillas colectadas en las áreas donde no se cultivó ningún maíz pertenecían a la variante 'arroz' y el 85% en general eran de la variante 'arroz' en todas las localidades. Solamente unas pocas larvas de FAW se encontraron en caña, y éstas correspondían a la variante 'arroz'. Larvas de cada variante se encontraron en maíz. El estudio proporcionó una buena información sobre el uso de trampas impregnadas con feromonas en la captura de FAW e indicó que las infestaciones con FAW en la caña de azúcar de la Florida FAW corresponden predominantemente a individuos de la variante 'arroz'.