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Combating Melon Thrips, *Thrips palmi* Karny (Thysanoptera: Thripidae) in South Florida

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Melon thrips, *Thrips palmi* Karny, is an economic pest of various vegetable crops in Florida. In a survey study, vegetable growers rated the importance of this pest as high on squash (*Cucurbita pepo*), bean (*Phaseolus vulgaris* L.), eggplant (*Solanum melongena*) and pepper (*Capsicum annuum* L.). Spinetoram, methomyl–azinphosmethyl, and abamectin provided a reduced level of control to melon thrips in 2012 when compared with a study conducted in 2008. A premix insecticide, Voliam Xpress, consisting of lambda cyhalothrin and chlorantraniliprol, significantly reduced melon thrips on bean when compared with the nontreated control and other insecticide treatments. Cyazypyr at 13.5 and 20.5 oz/acre provided significant reduction of melon thrips followed by a rotation program of spinetoram–dinotefuran.

The melon thrips, *Thrips palmi* Karny, is a key pest of various vegetable crops in south Florida. From the time of its arrival until the present crop season, melon thrips have caused significant yield loss to various vegetable crops (Seal, 2011). In severe instances of population abundance in a host crop, thrips can cause total loss of marketable yield (Seal and Baranowski, 1993). Every year this situation occurs in some host crop fields in the Miami–Dade County area when growers abandon the crop field (Personal observation, C.M.S). Seal et al. (1993) conducted several insecticide evaluation studies. In these studies, none of the labeled insecticides provided satisfactory control of this pest.

Thrips palmi is a native to Sumatra (Waterhouse and Norris, 1987) and other parts of Indian subcontinent. Later, it moved to Sudan, Pakistan, India, Bangladesh, Thailand, Malaysia, Singapore, Indonesia, the Philippines, Hong Kong, China, Taiwan, Japan, and Guam (Sakimura et al., 1986). It was discovered in Hawaii in 1984 and Puerto Rico in 1986 (Johnson, 1986). *Thrips palmi* is widely established in Africa. It invaded Florida in 1990. Its infestation on ornamental and vegetable plants in the Netherlands was reported in 1995 (Seal and Klassen, 1995).

Thrips palmi has a wide host range consisting of onion, cotton, avocado, citrus, peach, plum, muskmelon, carnation, and chrysanthemum in different countries (Bournier, 1983; Gutierrez, 1981; Ruhendi and Litsinger., 1979; Wangboonkong, 1981; Yoshihara, 1982). It also attacks various legumes, as well as fruiting and leafy vegetables in many countries in tropical and subtropical regions (Bhatti, 1980; Johnson, 1986; Negai et al, 1981). In southern Florida, *T. palmi* has devastated bean, potato, pepper, squash, cucumber, and eggplant (Seal, 1994; Seal and Baranowski, 1992). It has been considered as an economic pest of vegetable crops in Japan since 1978.

With the advent of Spinosad and spinetoram in the agro pest management business, *T. palmi* populations on various vegetable crops were significantly controlled with insignificant loss of marketable yield. Besides *T. palmi*, spinosad and spinetoram were used to control worms and leafminers. Due to the frequent use of this chemistry on various vegetable crops for controlling multiple insect pests, susceptibility of *T. palmi* to these insecticides has decreased to a greater extent (Seal, 2011).

In the light of the current situation, the objectives of this study were to understand growers' evaluation about the status of *T. palmi* on squash, bean, eggplant, and pepper. Attempts were also made to compare the effectiveness of some specific chemicals in controlling *T. palmi* between the 2008 and 2012 growing seasons. Finally, efficacy of premixed insecticides and a new insecticide was evaluated in controlling *T. palmi* on bean and squash.

Materials and Methods

Growers concern about *T. palmi* current situation. Squash (*Cucurbita pepo*), bean (*Phaseolus vulgaris* L.), eggplant (*Solanum melongena*) and pepper (*Capsicum annuum* L.) are common vegetable crops grown in Miami–Dade County. Common insect pests of squash include melon thrips (*Thrips palmi* Karny), Silverleaf whitefly (SLW; *Bemisia argentifolii* Bellows & Perring), cucumber beetle (*Diabrotica* spp.), melonworm (*Diaphania hyalinata* L.), pickleworm (*Diaphania nitidalis* Stoll), and mites. Common insect pests of bean include melon thrips, SLW, leafminer [*Liriomyza trifolii* (Burgess)], broad mites [*Polyhagotarsonemus latus* (Banks)], and cucumber beetle. For eggplants, common insect pests include melon thrips, SLW, cucumber beetle, and broad mite. And for pepper, the common insect pests are melon thrips, beet armyworm [*Spodoptera exigua* (Hübner)], pepper weevil [*Anthonomus eugenii* (Cano)], and broad mites.

Five growers of each crop were interviewed to obtain their perspective about melon thrips on each crop. Each grower was given a form covering various common pests on a specific crop. They were asked to rate each insect on a scale ranging from 1 to 10 based on their judgment of the relative importance on that crop. The same growers were also asked to rank the level of effort they will invest to manage various pests on a crop.

Comparative effectiveness of insecticides in two seasons. The study was conducted to determine the effect of the same insecticides in two growing seasons (2008 and 2012) on the control of melon thrips. 'Dixie' squash was planted on 12 Jan. in

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Table 1.

Treatments	Rate (oz/acre)	Active ingredients	Method of application	IRAC Group	Toxity to predators/parasitoids
Check					
Radiant (Dow AgroSciences)	8.0	Spinetoram	Foliar	5	Low–medium
Lannate (DuPont)	16.0	Methomyl	Foliar	1A	Medium–high
Guthion (Micro Flo)	16.0	Azinphosmethyl		1B	Medium–high
Agrimek (Syngenta)	12.0	Abamectin	Foliar	6	Low–high

2008 and 2012. The same standard cultural practices were used to manage each crop. Treatments evaluated in both studies are shown in Table 1.

The plants were spaced 6 inches within the rows and 36 inches between the rows. Treatment plots were arranged in a randomized complete-block design with four replications.

Application of treatments was made on four dates at weekly intervals by using a backpack sprayer with two nozzles delivering 70 gal/acre. Treatments were evaluated 48 h after each application by collecting five leaves, one leaf/plant, from each treatment plot. The leaves were then transported to the laboratory and washed with 70% ethanol to separate thrips. Alcohol containing thrips were checked using a binocular microscope to record *T. palmi* larvae and adults.

Evaluation of premixed insecticides. In a separate study, the effectiveness of various premixed insecticides was evaluated to control melon thrips on 'Pod Squad' beans. 'Pod Squad' bean was directly seeded into a Rockdale soil at Tropical Research and Education Center (TREC). Seeds were spaced 6 inches within the row and 36 inches between the rows. Bean plants were irrigated once daily using a drip system. Fertilizer (N–P–K mix) was applied at 200–50–240 lb per acre. To control weeds, trifluralin (Treflan EC product at 24 lb/acre) was used once, 10 d before planting, and was supplemented during the middle of the season with mechanical cultivation. The treatments included in this study are shown in Table 2.

Evaluation of new insecticide (Cyazypyr). In this study, 'Pod Squad' bean was planted in an experimental plot at TREC on 10 Apr. 2012. All methods for growing plants, designing treatment plots, and collecting and preparing samples were as discussed in the previous study. Treatments included in this study are shown in Table 3.

Statistical analysis. Data from evaluation of Cyazypyr were subjected to square root (x + 0.25) transformation. Transformed data were analyzed using SAS statistical package (SAS Institute, 1989). The Duncan Muliple K ratio *t* test was used to separate treatment means where significant ($P < 0.05$) differences occurred (Waller and Duncan, 1969).

Results and Discussion

Growers' concern about *T. palmi* current situation. All growers considered melon thrips as the most serious threat to squash production (Fig. 1). Larval feeding of melon thrips on squash causes scars rendering fruit unmarketable. Melon thrips feeding on squash leaves debilitate plant growth. In the present survey, leafminer and broad mite infestations on squash were scored as less serious threats than other insect pests. Among bean pests, melon thrips and SLW were considered more serious than others (Fig. 2). Melon thrips damage on bean was due to larval feeding. On the other hand, SLW damage was due to transmission of *Bean golden mosaic virus* to bean plants. Bean

Table 2.

Treatments	Rate (oz/acre)	Active ingredients	Method of application	IRAC Group	Toxity to predators/parasitoids
Check					
Endigo 2.06 ZC (Syngenta)	4.5	Lambda-cyhalothrin	Foliar	3	High
		Thiamethoxam		4A	Low–moderate
Endigo 2.71 ZC (Syngenta)	4.4	Lambda-cyhalothrin	Foliar	3	High
		Thiamethoxam		4A	Low–moderate
Actara 25 WG (Syngenta)	5.5	Thiamethoxam	Foliar	4A	Low–moderate
Voliam Xpress 1.25 (Syngenta)	9.0	Lambda-cyhalothrin	Foliar	3	High
		Chlorantraniliprol		28	Low–moderate
Brigade (FMC)	5.13	Bifenthrin	Foliar	3	High

Table 3.

Treatments	Rate (oz/acre)	Active ingredients	Method of application	IRAC Group	Toxity to predators/parasitoids
Check					
Cyantraniliprole *DPX*-HGW86	6.75, 13.5 & 20.5	Cyazypyr™	Foliar	28	0–low
Radiant ® (Dow AgroSciences) in rotation with	8.0	Spinetoram	Foliar	5	Low–medium
Venom™ (Valent USA)	5.0	Dinotefuran	Foliar	4A	Low

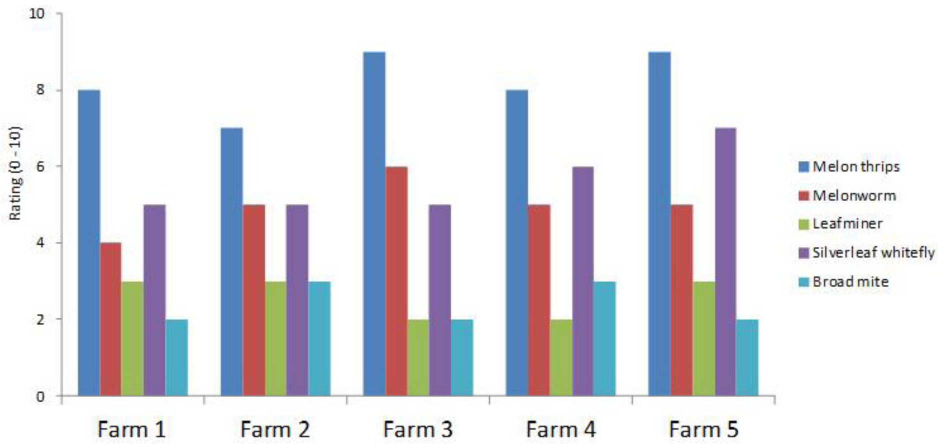

Fig. 1. Major insect pests of squash and ratings of economic importance by growers using a scale ranging from 0 to 10, where 0 = no concern about an insect and 10 = serious concern of crop loss due to a pest infestation.

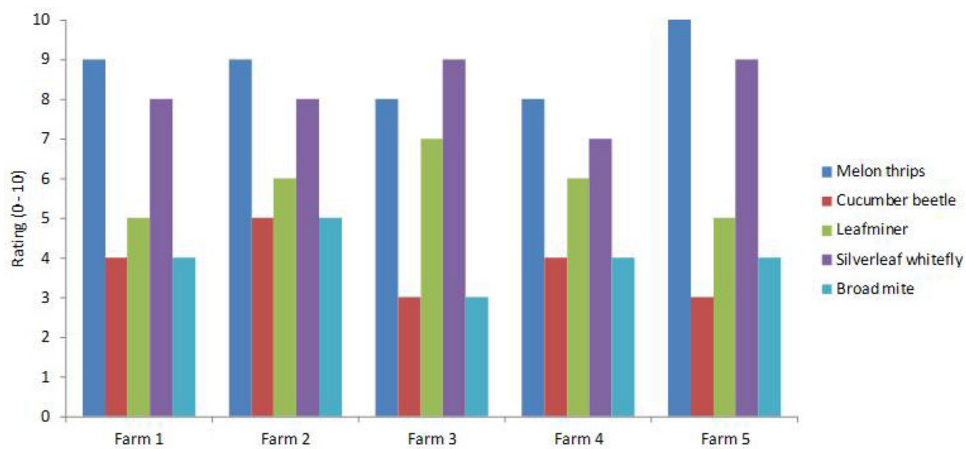

Fig. 2. Major insect pests of bean and ratings of economic importance by growers using a scale ranging from 0 to 10, where 0 = no concern about an insect and 10 = serious concern of crop loss due to a pest infestation.

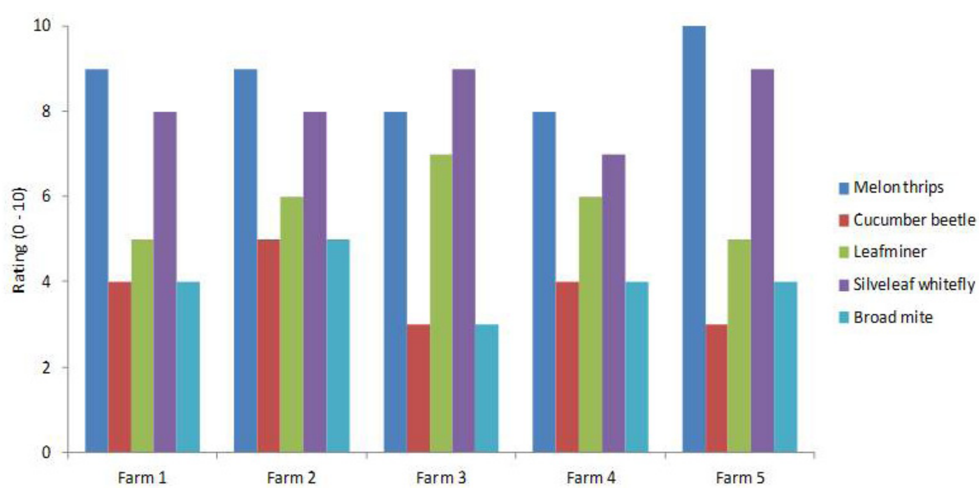

Fig. 3. Major insect pests of eggplants and ratings of economic importance by growers using a scale ranging from 0 to 10, where 0 = no concern about an insect and 10 = serious concern of crop loss due to a pest infestation.

growers rated melon thrips and SLW damage between 8 and 10; where 10 is the worst damage, leaving unmarketable fruit on the infested plants. On eggplants, melon thrips and SLW were also considered as the most serious among all insect pests (Fig. 3). Eggplant growers expressed the seriousness of melon thrips and SLW damage by scoring their importance from 8 to 10. On pepper, pepper weevil and melon thrips are the most damaging pests (Fig. 4). Growers expressed the importance of these two

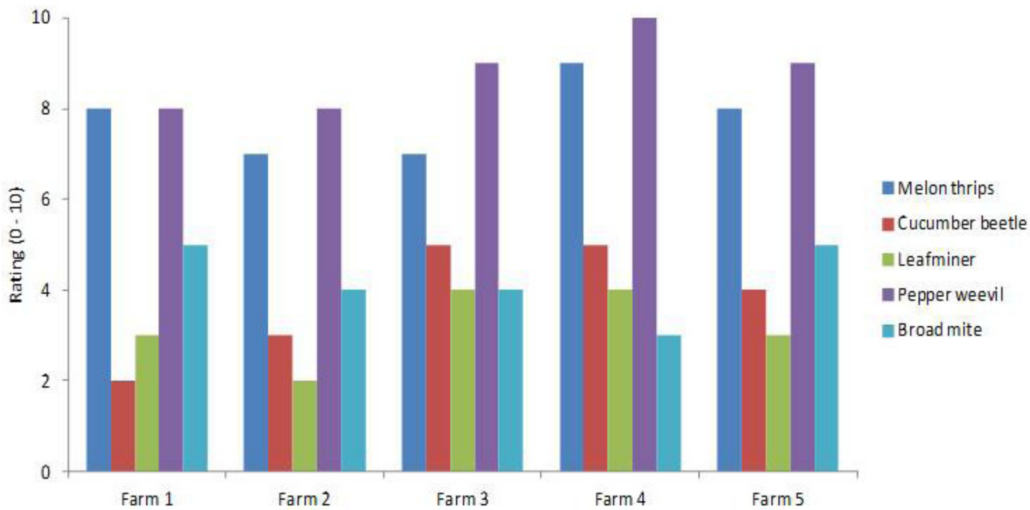

Fig. 4. Major insect pests of pepper and ratings of economic importance by growers using a scale ranging from 0 to 10, where 0 = no concern about an insect and 10 = serious concern of crop loss due to a pest infestation.

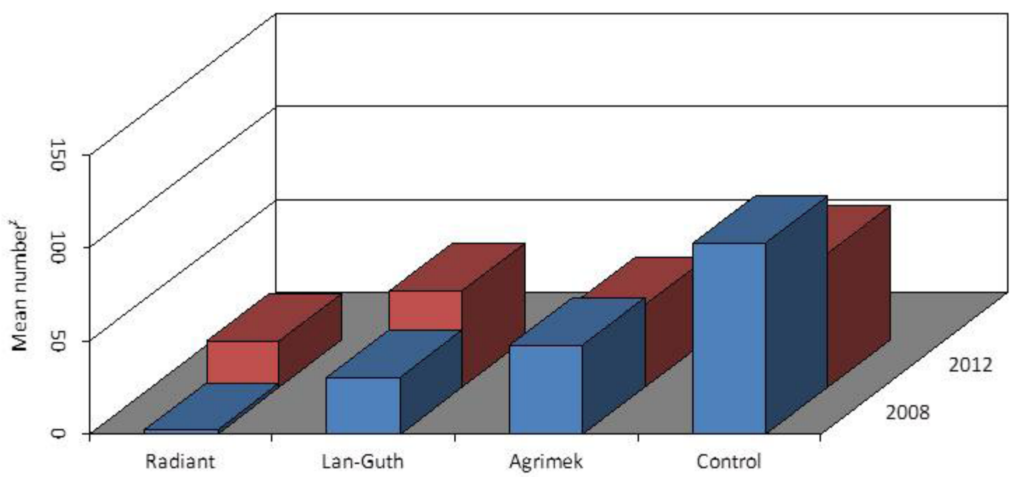

Fig. 5. Comparative effectiveness of various insecticides in controlling *Thrips palmi* in squash in 2008.

pests by scoring their importance from 7 to 10.

Comparative effectiveness of insecticides in two seasons. In 2008, spinetoram provided significant reduction of melon thrips on squash with 2.5 thrips per five-leaf sample or about 2.5% of the nontreated control (103 thrips per five-leaf sample) (Fig. 5). In the 2012 study, the mean number of melon thrips/per five-leaf sample of squash treated with spinetoram was 25, which is one-third of the number recorded on the nontreated control plants (75 thrips per five-leaf sample). The methomyl–azinphosmethyl weekly rotation program significantly reduced melon thrips in 2008 when compared with the nontreated control. In 2012, the methomyl–azinphosmethyl program did not differ from nontreated control in mean number of thrips/leaf sample.

Evaluation of premixed insecticides. Population abundance of melon thrips was low during this study. All treatments reduced melon thrips populations when compared with the nontreated control (Fig. 6). Voliam Xpress, consisting of lambda-cyhalothrin and chlorantraniliprole, provided superior control of melon thrips populations when compared with other treatments and the nontreated control. All premix insecticides in the present study contain lambda-cyhalothrin, which is considered incompatible with natural biocontrol agents (Sadof and Raupp 1999).

Evaluation of new insecticide (Cyazypyr). Cyazypyr at all experimental rates used in the present study in combination with MSO significantly reduced melon thrips adults when compared with the nontreated control (Fig. 7). However, Cyazypyr alone (without MSO) at 6.75 oz/acre did not reduce melon thrips adults when compared with the nontreated control. However, none of the treatments provided significant reduction of melon thrips larvae when compared with the nontreated control. Spinetoram – Venom rotation program did not reduce either melon thrips adults or larvae when compared with the nontreated control.

Cyazypyr is compatible with biocontrol and can be used in an integrated pest management program to control melon thrips. The use of spinetoram for controlling insect pests on vegetables should be managed intelligently to avoid resistance development in target pests. Premix products containing pyrethroids should be used in a timely manner in integrated pest management programs to avoid harming biocontrol agents.

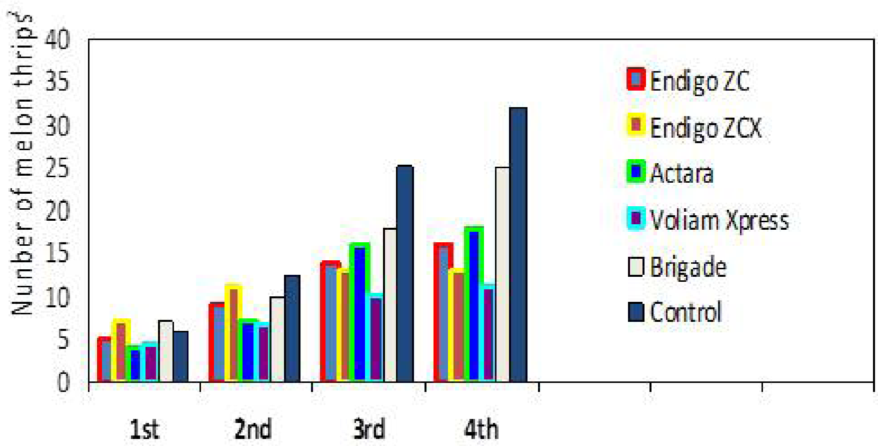

Fig. 6. Effectiveness of various premixed insecticides in controlling *Thrips palmi* in bean.

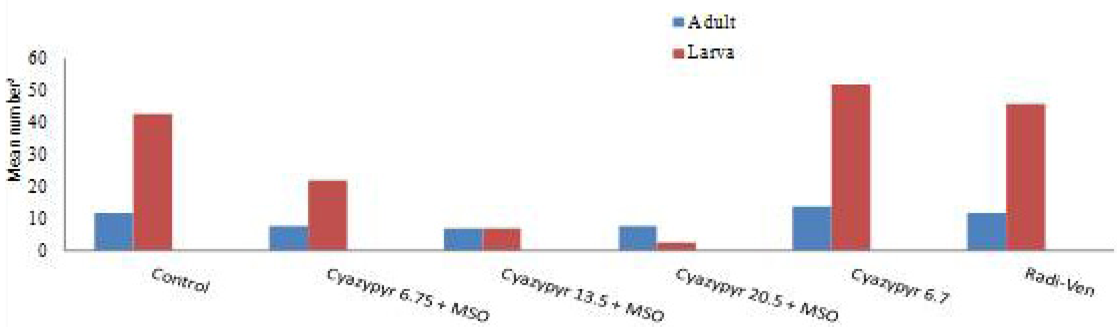

Fig. 7. Effectiveness of Cyazypyr, an anthranilic diamide insecticide, in controlling *Thrips palmi* in bean .

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