Effectiveness of Three Insecticides to Control Bactrocera cucurbitae (Diptera: Tephritidae) on the Cucumber Crop at Praslin, Seychelles

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EFFECTIVENESS OF THREE INSECTICIDES TO CONTROL *BACTROCERA CUCURBITAE* (DIPTERA: TEPHRITIDAE) ON THE CUCUMBER CROP AT PRASLIN, SEYCHELLES

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Abstract

A field experiment was conducted from Oct to Dec in the 2009 and 2010 planting seasons at the Vegetable Evaluation and Research Sub-Station farm located at Praslin, Seychelles to evaluate the effectiveness of 3 insecticides namely lambda-cyhalothrin, deltamethrin and mercaptothion, to control the melon fruit fly (*Bactrocera cucurbitae*) in the cucumber crop. The 3 insecticides constituted the treatments, replicated 4 times in a randomized complete block design. The results obtained showed that the use of deltamethrin insecticide recorded the lowest number of ovipositor marks, number of pupae and number of emerged melon fruit flies. The number of melon fruit flies that emerged with the use of deltamethrin insecticide was significantly ($P \leq 0.05$) decreased by 19.0% and 38.1%, respectively, in 2009 and by 10.0% and 44.4%, respectively, in 2010 compared to that recorded with the use of lambda-cyhalothrin and mercaptothion. The highest number of marketable cucumbers was produced from plots sprayed with deltamethrin; and which was significantly ($P \leq 0.05$) increased by 50.5% and 62.9%, respectively, in 2009 and by 29.0% and 50.7%, respectively, in 2010 compared to those obtained when lambda-cyhalothrin and mercaptothion were used. This study showed that deltamethrin insecticide was the most effective, and could be recommended for the control of melon fruit fly in cucumber under field conditions.

Key Words: lambda-cyhalothrin deltamethrin, mercaptothion, insecticide and cucumber

Resume

Se realizó un experimento de campo durante las estaciones de siembra desde octubre hasta diciembre del 2009 y 2010 en la sub-estación de la finca de Evaluación e Investigación de Vegetales ubicada en Praslin, Seychelles para evaluar la eficacia de 3 insecticidas: lambdacialotrina, deltametrina y mercaptothion para controlar la mosca de la fruta del melón, *Bactrocera cucurbitae* Coquillett, en un cultivo del pepino (*Cucumis sativus* L.). Los 3 insecticidas constituyeron los tratamientos, que se replicaron 4 veces en un diseño de bloques completamente aleatorizados. Los resultados mostraron que el uso del insecticida deltametrina causó el menor número de marcas de oviposición y número de pupas y adultos emergidos de la mosca de la fruta del melón. En comparación con los tratamientos del lambdacialotrina y mercaptothion, el número de moscas de la fruta del melón que emergieron con el uso del insecticida deltametrina se diminuyó significativamente ($P \leq 0.05$) un 19.0% y 38.1%, respectivamente, en el 2009 y un 10.0% y el 44.4% en el 2010, respectivamente. También en comparación con los tratamientos de lambdacialotrina y mercaptothion, el número de frutos de pepino que se puede vender del tratamiento deltametrina fueron mayores ($P \leq 0.05$) de 50.5% y 62.9% en el 2009, respectivamente, y 29.0% y 50.7% en el 2010, respectivamente. Se concluye que el tratamiento con deltametrina fue el más efectivo y puede ser recomendado para el control de la mosca de la fruta de melón en cultivos de pepino bajo condiciones de campo.

Palabras clave: lambda-cihalotrina, deltametrina, mercaptothion, pepino

The melon fruit fly (*Bactrocera cucurbitae* Coquillett; Diptera: Tephritidae) is one of about 250 economically important tephritids worldwide in this family of around 4,000 species (Vayssieres 1998). The melon fruit fly is native to tropical Asia and has spread to many countries outside of Asia including Indian Ocean countries like Mauritius, Reunion, Madagascar and Comoros (Ronald & Kessing 1991). It is believed to have established itself in Seychelles towards the end of 1999, where it contributes to about 50% yield loss in the cucumber crop, popularly grown and a widely consumed in the diet of the Seychelles people (Stonehouse 2003).

Currently, mercaptothion (malathion) is widely applied as a foliar spray by vegetable farmers in Seychelles to control the melon fruit fly. Investigations have shown a high level of melon fruit fly resistance to this chemical resulting in this pest's gradual buildup in population density and considerable loss in cucumber production (Klunginess et al. 2000).

This study, therefore, aimed at evaluating the effectiveness of 2 newly introduced chemical insecticides, lambda-cyhalothrin, deltamethrin, in comparison with the commonly used mercaptothion (malathion) to control melon fruit fly in cucumber under field conditions.

Materials and Methods

The experiment was conducted from Oct to Dec in the 2009 and 2010 planting seasons, under field conditions at the Vegetable Evaluation and Research, Sub-station Farm at Praslin, Seychelles. The crop used was cucumber, variety, 'Slicer 5'. This variety is popularly grown by Seychelles farmers and shows good adaptation to the Seychelles environment to evaluate the effectiveness of 2 newly introduced insecticides namely lambda-cyhalothrin and deltamethrin alongside the popular insecticide mercaptothion (malathion) in the control of melon fruit fly, *B. cucurbitae*.

The cucumber seeds were sown at the rate of one seed per polypot, so that the seedlings developed in the nursery in early Oct. Nursery care such as handpicking of weeds and watering was carried out. The seedlings were transplanted to the field experimental site 2 wk after the seeds had been sown.

The experimental area (249.3 m^2), which consisted of sandy-loamy soil, was cleared, renovated and divided into 12 plots. Each plot had an area of 30.2 m^2 and consisted of 6 rows in which 8 seedlings per row were transplanted at a spacing of 90 × 60 cm giving a total plant population of 48 plants per plot (15,894 plants/ha). All cucumber plants were individually staked at 1 wk after transplanting. The 3 foliar spray insecticides constituted the treatments, which were replicated 4 times in a randomized complete block design. The foliar applied insecticide sprays constituted the treatments, replicated 4 times in a randomized complete block design.

Well-decomposed poultry manure was initially applied in each row at the rate of 450 g per plot, following the recommendation of Sunassee (2001). The manure was incorporated into the soil and watered immediately by drip irrigation at 35 L of water/d in accordance with the formula of Estico (2000).

Two side dressings with mixed fertilizer 12:12:17 NPK at 250:200:250 kg/ha was applied following the recommendation of Ripjma (1991) at 3 wk after the seedlings had been transplanted and repeated 4 wk later. This translated into 15.3 g equivalent of the fertilizer applied to each plant. The fertilizer, placed about 7.5 cm away from the plant at a depth of about 10 cm, was covered with soil and watered immediately after each application. Weeding was done manually as the need arose.

The foliar spray insecticide applications commenced as soon as an ovipositor mark was noticed on the cucumber fruit. The volume of water mixed with insecticide varied in relation to the crop growth stage. As the cucumber plants advanced in growth stage, the quantity of spray applied was increased. A total of 3 foliar spray applications were carried out in each plot. The first application involved a mixture 7.5 L of water with either 3 mL of lambda-cyhalothrin (Karate Zeon®), 13 mL of mercaptothion (malathion) or 4 mL of deltamethrin (Decis®). The second application involved a mixture of 15 mL of water with either 3 mL of lambda-cyhalothrin, 26.3 mL of mercaptothion or 7.5 mL of deltamethrin, while the last foliar spray application involved a mixture of 18 L of water with either 4 mL of lambda-cyhalothrin, 31.5 mL of mercaptothion or 9 mL of 'deltamethrin' respectively. The sprayers were thoroughly washed and calibrated before and after each treatment application. Harvesting was done in mid Dec. The harvested fruits were kept for about 20 d in plastic bags containing some sand. The plastic bags were pierced to have holes for aeration of the pupae and adults.

Data taken included number of ovipositor marks per fruit, number of pupae, number of emerged adult melon fruit flies, and number of marketable and non-marketable fruits. The data were subjected to analysis of variance (ANOVA) while the least significant difference (LSD) was used to separate treatment means (Steel & Torrie 1980).

Results and Discussion

Effectiveness of the 3 Insecticides

Table 1 gives the effects of each of the 3 insecticides on the number of ovipositor marks, the number of pupae, the number of emerged adult melon fruit flies, and the number of marketable and non-marketable cucumber fruits during the 2009 and 2010 planting seasons. The number of ovipositor marks on cucumber fruits and the number of pupae that emerged were lowest in the deltamethrin treatment. Deltamethrin significantly ($P \leq 0.05$) decreased the number of ovipositor marks on cucumber fruits and the number of pupae by 85.0% and 32.0%, respectively, compared to the lambda-cyhalothrin treatment, and by 92.3% and 64.0%, respectively, compared to the mercaptothion treatment in 2009. Similarly, in the year 2010, the deltamethrin treatment significantly (P

TABLE 1. EFFECTIVENESS OF 3 INSECTICIDES SPRAYS APPLIED TO CUCUMBER TO CONTROL THE MELON FRUIT FLY, *BACTROCERA CUCURBITAE* DURING THE 2009 AND 2010 PLANTING SEASON AT PRASLIN, SEYCHELLES.

Treatments	Number of ovipositor marks per fruit		Number of pupae		Number of emerged adult melon fruit flies		Number of marketable fruits		Number of non-marketable fruits	
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
Lambda-cyhalothrin	2.0	2.3	14.7	14.0	23.7	20.0	40.8	60.5	7.4	17.6
Deltamethrin	0.3	1.0	10.0	10.1	19.2	18.0	82.4	85.2	3.3	8.2
Mercaptothion	3.9	3.6	27.8	18.7	31.0	32.4	30.6	42.0	15.6	25.3
Means	2.1	2.3	17.5	14.3	24.6	23.5	51.3	62.6	8.8	17.0
LSD (P = 0.05)	1.6	1.2	4.3	3.1	1.7	1.5	10.1	12.2	3.1	6.0
CV (%)	18.9	14.0	12.2	16.4	18.2	15.7	18.5	15.4	10.4	12.4

≤ 0.05) reduced the number of ovipositor marks and the number of pupae by 56.5% and 27.9%, respectively, compared to the mercaptothion treatment. Keng-Hong (2000) reported that malathion applied at 3 different concentrations to either whole or smashed cucumber fruits in Malaysia failed to reliably control melon fly larvae.

The number of emerged adult melon fruit fly significantly ($P \leq 0.05$) decreased in the deltamethrin treatment compared to the number that emerged in the lambda-cyhalothrin and mercaptothion treatments. Likewise Klunginess et al. (2000) in their evaluation of malathion against tephritid fruit flies in smashed fruits in Hawaii, reported that inspite of 3 three treatments of malathion high numbers of live adults emerged.

The deltamethrin treatment – compared to the lambda-cyhalothrin and mercaptothion treatments – significantly ($P \leq 0.05$) decreased number of melon fruit flies by 19.0% and 38.1%, respectively, in 2009, and by 10.0% and 44.4%, respectively, in 2010.

The cucumber plots sprayed with deltamethrin' produced the highest number of marketable fruits compared to the lambda-cyhalothrin and mercaptothion treated plots, while the highest number of non-marketable cucumber fruits was obtained from mercaptothion treated plots. Clearly continued use of mercaptothion would result in increasing the level of resistance to it in this population of melon fruit flies. Mercaptothion has consistently been used by Seychelles farmers over many years. The numbers of marketable cucumber fruits produced from deltamethrin treated plots were significantly ($P \leq 0.5$) increased by 50.5% and 62.9% , respectively, in 2009 and by 29.0% and 50.7%, respectively, in 2010 compared to the corresponding lambda-cyalothrin and mercaptothion.

CONCLUSIONS

Deltamethrin, insecticide proved far more effective than lambda-cyhalothrin and mercaptothion in controlling B. cucurbitae, the melon fruit fly because in deltamethrin treatment there occurred the lowest number of ovipositor marks, the lowest number of pupae, the lowest number of adult melon fruit flies emerged, and the highest number of marketable fruit. The continued use of mercaptothion can be expected to result in a further build-up of resistance to this insecticide. The efficacy of deltamenthrin across different locations with varied ecology in the Seychelles should be evaluated.

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