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Application of three insecticides to control thrips (Thysanoptera) in avocado (var. Hass) in Caltzontzín, Michoacán

Cristofer Elías García Pérez[1*], Julio Cesar Tovar Rocha[2]
[1,2] Facultad de Agrobiología "Presidente Juárez", Universidad Michoacana de San Nicolás de Hidalgo. Paseo Lázaro Cárdenas esq. Berlín s/n, Col. Viveros, 60170. Uruapan, Michoacán., México.

ABSTRACT

Mexico is the world's leading producer and exporter of avocados. Its commercialization requires quality fruit that meets phytosanitary standards, as well as sound integrated pest and disease management. This study was conducted in Caltzontzin, Uruapan municipality, Michoacán. It is located at an altitude of 1,640 meters above sea level between the coordinates (19°25'35.2" N 101°59'19.3") W. The effectiveness of three insecticides was evaluated, where the absolute control (treatment 1) is Spinetoram and the (treatments 2 to 6 are based on pyrethrin extract from chrysanthemum flowers). The insecticides evaluated were: Palgus ® (Spinetoram) at a dose of 0.325 ml, Santem ® (natural pyrethrin extract based on chrysanthemum flowers 2.5%) at doses of 0.8, 1 ml, 1.5 ml / L of water and Tec fort (natural pyrethrin extract based on chrysanthemum flowers 4%) at doses of 1 ml and 1.5 ml / L of water. Evaluations were carried out at 24, 48 and 72 hours after application to determine its efficiency. The results indicate Santem and Tec fort products at concentrations of 2.5 and 4% showed intermediate behavior, with thrips numbers ranging from 5.8 to 13.5 per treatment compared to the initial populations (33-36 thrips per flower panicle). After the first application and based on the results obtained, this experiment demonstrated that adequate thrips control can be achieved by using products based on natural pyrethrins.

KEYWORDS: Pyrethrins, *Chrysanthemum*, Thrips.

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Corresponding Author: Cristofer Elías García Pérez

INTRODUCTION

Avocado cultivation (*Persea Americana* Mill.) variety "Hass" is an important crop in Mexico due to its demand and commercial value, whose boom has generated an increase in its cultivation at national and international level (González *et al.,* The importance of the economy that originates with avocado production is due to its import to the United States, increasing to a total of $5.5 billion dollars; another important benefit is the generation of 28,251 jobs, which is explained as $1.9 billion dollars of workers' income, which are granted by producers, packers and marketers, among others (APEAM, 2018). Mexico is the world's leading producer with a production of 2,442,944.64 tons whose planted area is 226,534 Ha-1 with a yield of 107,840 kg Ha-1 (FAOSTAT, 2021). For its part, the state of Michoacán is the main producer in the country with a production of 1,826,415.75 tons obtained from a planted area of 174,442.35 Ha and an approximate yield of 10.95 tons Ha-1 (SIAP, 2021). Production is affected by a series of biotic and abiotic factors that affect the quality of the fruit. Among the biotic factors that affect the crop (Tamayo, 2007). As well as a series of arthropods of agricultural importance such as (*Olygonychus punica Hirst*), (*Oligonychus persea)*, (*Amorbia emigratella Busk),* (*Frankinia* spp.) Some species of *(Abgrallaspis aguacatae, (Trioza anceps tuthill*), *Bemisia tabaci)*(Varón-Devia, 2016; Teliz and Mora 2007). In the case of regulated pests of quarantine interest that affect the production and marketing of the fruit are: (*Conotrachelus persea* Barber, *C. avocado* Barber, *Macrocopturus avocado* Barber, *Heilipus lauri* Bohemian, *Stenoma catenifer* Walsingham) and some of them are considered to cause damage of up to 90% (SENASICA, 2016).

Thrips (Thysanoptera) are economically important pests of crops. They primarily cause damage by feeding on fruit in its skeletal state (Teliz, 2015). According to Marroquín (1999), high temperatures favor the threshold of ripening, which leads to the appearance of lesions or damage to the fruit. which become the main access for the entry and subsequent development of the fungus (*Sphaceloma perseae)*. (Tamayo, 2007).

METHODS

The experiment was carried out in the "La joyita 2" orchard, the property is located in the community of Caltzontzin, municipality of Uruapan, Michoacán and is located at an altitude of 1,640 meters above sea level, between the coordinates 19 ° 25'35.2 "N 101 ° 59'19.3" W. The treatments were evaluated in a 6 Ha orchard of Hass variety avocado with 15-year-old trees, under organic management and established at a distance of eight by eight meters. The experiment was carried out during the months of March and April 2021. The trees were marked with blue ribbons, numbering them from 1 to 6 for the identification of the treatments, a randomized block experimental design was used with six treatments and six replications (Table 1).

Table 1. Sketch of the experimental design used

Treatments					
R1	**R2**	**R3**	**R4**	**R5**	**R6**
T3	T1	T5	T6	T4	T2
T2	T5	T2	T1	T2	T6
T5	T3	T1	T4	T1	T1
T6	T6	T4	T5	T3	T4
T1	T4	T3	T2	T5	T3
T4	T2	T6	T3	T6	T5

Two applications were made with a stretcher at 15-day intervals. The variables evaluated were: number of thrips (adults) per flower panicle. Sampling was carried out by taking two panicles from each cardinal point, a total of eight panicles per tree were counted, considering the lower and middle parts of the tree. The sampling method was implemented according to the proposal of Ascensión-Betanzos et al. (1999). Once the panicle was taken, it was sprayed with water using a spray bottle. After that, the inflorescence thrips knockdown methodology was implemented (Urías López et al., 2007). Subsequently, the panicle was hit on a black board to count the number of thrips per panicle. Sampling data were recorded in a logbook. Treatments were evaluated with different doses: Santem: 0.8, 1.0 and 1.5 mL L-1; Tec Fort: 1.0 and 1.5 mL L-1 and Palgus: 0.325 mL L-1, with a total of six treatments and six replicates. In each product preparation, the pH was measured to confirm that it was within the optimal range, which would favor the effectiveness of the treatments (Table 2). In addition, 100 mL of acidifier was added to 1000 liters of water, to lower the water pH to a range of 9.1 to 6.5; in addition, an adjuvant (Break thru) was added to act as a surfactant, wetting agent and dispersant.

Table 2. Treatments used during the study.

Treatment	Active ingredient	pH /dose	Dose in 76 L of wáter
1 Palgus ® 0.325 ml	Spinetoram	6.8	26.6 mL
2 Santem ®0.8 ml	natural pyrethrin 2.5 %	6.7	60.80 mL
3 Santem ®1 ml	natural pyrethrin 2.5 %	6.8	76 mL
4 Santem ®1.5 ml	natural pyrethrin 2.5 %	6.8	114 mL
5 Tec Fort ®1 ml	natural pyrethrin extract 4.0%	6.7	76 mL
6 Tec Fort ®1.5 ml.	natural pyrethrin extract 4.0%	6.7	114 mL

To analyse the formation of each of the eight variables measured in the experiment, the Pr>F value obtained in the analysis of variance was used as a test statistic, considering the magnitude of the value (probability) of this: Pr>F values less than 0.05 are considered significant differences between treatments (*), less than 0.01 highly significant differences (**) and values greater than 0.05 as non-significant differences (NS). The results of the analysis of variance performed for each of the eight variables evaluated and the results obtained can be seen in (Table 3).

Table 3. Significance for the number of thrips measured in eight samples with two applications of the treatments in the Hass avocado experiment.

Variable	Pr > F	Significance
Number of thrips previous to first application	0.8246	NS
Number of thrips in second sampling	0.228	NS
Number of thrips in third sampling	0.0621	NS
Number of thrips in forth sampling	0.4815	NS
Number of thrips previous to second application	0.7843	NS
Number of de thrips in sext sampling	0.458	NS
Number of thrips in seventh sampling	0.603	NS
Number of thrips in eight octavo sampling	0.5846	NS

NS = Differences between treatment means were not significant.

Experimental design and statistical analysis. A randomized block design with six treatments and six replicates was used, resulting in a total of 36 experimental units. The experimental unit consisted of a Hass avocado tree, with two panicles taken from each cardinal point, yielding a total of eight samples per tree. The number of thrips per flower panicle was recorded in the field, and each sample taken during the experiment was subjected to analysis of variance. Analyses were performed using PROC ANOVA in the SAS statistical software version 9.0 (SAS, 2003).

Treatment efficiency. With the data obtained, it was possible to determine an average mortality of thrips, it can be observed that there is no significant statistical difference between them, which shows that the thrips population was distributed evenly in the trees selected for the test (Table 3); the population of thrips per floral panicle before starting the experiment showed averages between 33.7 and 46.5 thrips per panicle, which decreased from the first applications of (natural pyrethrins) with averages between 5.8 and 13.5 thrips per panicle, indicating that the application of the treatments considerably reduced the thrips populations, (Table 4).

Table 4. Results obtained from the Treatments used for thrips control after 12, 24 and 72 hours of the first application.

Active ingredient	Thrips sampling prior to application	1st Thrips sampling after 12 hours of application	Mortality rate	2nd sampling after 24 hours of application	Mortality rate	3rd sampling after 72 hours of application	Mortality rate
Santem 0.8 ml /L	34.17	13.5	4.6 %	17.6	6 %	26.6	9 %
Santem 1 ml /L	36.16	9.1	3.3 %	20.3	7.3 %	27.8	9.3 %
1.5 ml/L	35.67	11.8	4.2 %	11.8	4.2 %	22.1	7.8 %
Tec fort 1.5 ml /L	33.67	10.5	3.5 %	15.6	5.2 %	18.5	6.2 %
Tec fort 1 ml /L	46.5	13	6.0 %	18.3	8.5 %	25.8	9.8 %
Volume 0.325 ml/L	36.83	5.8	2.1 %	8	2.9 %	20	7.3 %

In addition, the mortality rate for each product treatment (Santem and Tec Fort) was similar to that of the product used regionally (Palgus) by avocado producers. Therefore, natural pyrethrins can be used to manage thrips and may also contribute to reducing genetic resistance of thrips to conventional products used by producers. The effectiveness of treatments with organic insecticides (Santem and Tec Fort) indicates that they can be used at doses of 1 mL L-1 of water as well as 1.5 mL L-1 of water.

It was possible to verify that by using these doses in a second application (15 days after the first application) better control of thrips was obtained (Table 5).

Table 5. Results obtained from the treatments used for thrips control after 12, 24 and 72 hours of the second application.

Active ingredient	Thrips sampling prior to the 2nd application	1st Thrips sampling after 12 hours of application	Mortality rate	2nd sampling after 24 hours of application	Mortality rate	3rd sampling after 72 hours of application	Mortality rate
Santem 0.8 ml /L	13.83	4.5	0.62 %	4.3	0.62 %	5	0.69 %
Santem 1 ml /L	27.1	3.5	0.95 %	6.3	1.71 %	12	3.25 %
1.5 ml/L	23.6	7	1.65%	7.6	1.79 %	19.5	4.60 %
Tec fort 1.5 ml /L	27	5.1	1.38 %	4.5	1.22 %	9.1	2.46 %
Tec fort 1 ml /L	22.8	6.1	1.39 %	6.1	1.39%	12.8	2.92 %
Volume 0.325 ml/L	18.5	3.3	0.61 %	3.6	0.67 %	8.1	1.50 %

CONCLUSION

The incidence of thrips populations decreased considerably with the treatments applied, so we can consider the use of 2.5% natural pyrethrins to be an effective tool for thrips control. The most effective pyrethrin doses for thrips control in avocado crops, according to our study, are: Santem 1.5 ml / Santem 1 ml and Tec Fort 1 ml, with an effectiveness of 46%, 32%, and 29% control, respectively.

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