



Evaluation of Ethiodemethrin 2.5% EC and Karate 5% against Citrus Leafminer at Metahara Citrus Orchard

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JEAI/2019/v34i330174

Editor(s):

(1) Dr. Wafaa Haggag, Professor, Plant Pathology Department, Agriculture and Biology Research Division, Egypt.

Reviewers:

(1) Faiza Ilias, University of Abou Bekr Belkaid, Algeria.

(2) Clement N. Mweya, National Institute for Medical Research (NIMR), Tanzania.

(3) Dr. Anderson Ricardo Trevizam, University Federal of Lavras, Brazil.

Complete Peer review History: <http://www.sdiarticle3.com/review-history/15824>

Original Research Article

Received 02 December 2014

Accepted 07 February 2015

Published 15 April 2019

ABSTRACT

The study was conducted at Metahara Sugar Factory Citrus orchard fields in 2010/11 cropping season with the objective of evaluating the efficacy of Ethiodemethrin 2.5% EC and Karate 5% for the control of citrus leafminer. In this study, seven treatments were used i.e. Ethiodemethrin 2.5% EC at 20, 30 and 50 ml per tree and Karate 5% EC at 0.72 and 1.10 ml per tree including free checks. Treatments were given at once and twice application frequencies; the second application was applied after fifteen days of the first application. The experiment was laid out in randomized complete block design with four replications. The study indicated that Ethiodemethrin 2.5% EC at 20, 30 and 50 ml tree⁻¹ and Karate 5% EC at 0.72 and 1.10 ml tree⁻¹ had satisfactory control potential of citrus leafminer (CLM) for a maximum of two weeks period as compared to the untreated check. Therefore, the orchard could use Ethiodemethrin 2.5% EC at 20 ml tree⁻¹ and Karate 5% EC at 0.72 ml tree⁻¹ for the control of leafminer. Moreover, using single control tactics does not provide utmost control of CLM in the orchard.

Keywords: Citrus; leafminer; insecticide.

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1. INTRODUCTION

Insect pests are among the major citrus production constraints in most citrus growing countries of the world (Talhok, 1975). Metahara Sugar Factory has an orchard of over 100 hectares besides its main crop sugarcane. Some of the insect pests that attack the citrus orchard at Metahara include leaf miner, thrips, fruit fly, scales, aphids and termites (Leul, 2008, Personal observation). Among them citrus leafminer has causing damage on seedling, young citrus tree and old trees during new flushing period at Metahara citrus orchards (Leul, 2009; Personal observation).

Economic losses due to the citrus leaf miner include increased costs for protecting nursery trees and young non-bearing citrus and increased orchard production costs, either directly, through the use of pesticides, or indirectly, through treatments that disrupt biological control and Integrated Pest Management programs. Several studies have been conducted to correlate CLM damage with economic loss. Knapp et al. [1] reported that a 10% leaf area loss did not affect citrus yield. In Florida, control of CLM increased yield of 3- to 5-year-old grapefruit or orange trees by 13.1% to 16.9% [2]. In another Florida study, a 16% to 23% leaf area loss caused significant yield reduction of 15-year old Tahiti lime trees, and 18% to 85% leaf area loss caused significant yield reduction of 5-year-old lime trees [3]. Sometimes much more important for the crop is the indirect damage of the pest, in this particular case, CLM help spread citrus canker *Xanthomonas axenopodis* pv. citri [4,5] (Cook, 1988).

The goal of cultural, chemical and other control tactics is to protect the main growth flushes. Effective chemical control of citrus leaf miner is difficult because its larva and pupae are protected from insecticides by leaf cuticle and rolled leaf margins. Moreover, citrus flushing is dependent on environmental conditions with soil moisture (rainfall or irrigation) being a major factor in determining flush production in the production season. Soil applied imidacloprid, systemic neonicotinoid provides much longer residual activity than foliar products and significantly delays pest population resurgence [6]. On the other hand, truck application provided effective and longer control for at least three months. Broad spectrum insecticides (pyrethroides, carbamates and organo-

phosphates) are generally used against *P. citrella* [7]. Satisfactory efficacy of imidachloprid against *P. citrella* has already been reported in Greece [8]. According to several authors, the application of abamectin + petroleum oil provides the most effective control of leafminer [9,10]. Several different insecticides, such as Avant, Buprofezin and Pyriproxifen was used [11], but these may involve interference in control of the pest by natural enemies [12].

Metahara sugar factory has been using few insecticides for the control of citrus insect pest problems like Ethiozinon 60% EC and Pyninex 50% EC. On the other hand, the severity of the pest increased over years even if repeated insecticide application was made during main flushing period (Personal communication). Adami Tulu Pesticide Company applied to the then Ethiopian Sugar Development Agency Research Directorate for evaluation of Ethiodemethrin 2.5% EC for the control of citrus leaf miner. Moreover, in order to provide supplementary and alternative insecticide for the plantation/ orchard karate 5% EC was also included. Therefore, the purpose of this study was to evaluate Ethiodemethrin 2.5 % EC and Karate 5% EC for the control of citrus leafminer (*P. citrella*) at Metahara Citrus Orchard.

2. MATERIALS AND METHODS

2.1 Site Description

Metahara Sugar Factory is situated in the central part the East African Rift Valley system at 8°N latitude and 39°52' E longitude and at an altitude of 950 meter above sea level. The estate is located at about 200 km south east of Addis Ababa. The total area under cultivation is about 10,000 ha with an average cane yield of 174 tons/ha. It receives an average of 554 mm annual rainfall with a bimodal distribution (between February to April and June to September). The mean minimum and maximum temperatures are 17.4°C and 32.6°C, respectively. The estate sugarcane production is undertaken under irrigation.

2.2 Study Approach

The study was conducted at Metahara Sugar Factory citrus orchard in 2010/11 for one crop season. Uniformly sized forty four citrus trees were selected for this experiment and single tree was considered as a plot. Treatments were Ethiodemethrin 2.5% EC at 20, 30 and 50 ml per

Table 1. Treatments of the experiment

S/N	Insecticides	Active ingredient	Rate	Frequency
1	Ethiodemethrin 2.5% EC		20 ml/tree	Once
2	Ethiodemethrin 2.5% EC		30 ml/tree	Once
3	Ethiodemethrin 2.5% EC		50 ml/tree	Once
4	Ethiodemethrin 2.5% EC	Deltamethrin	20 ml/tree	Twice
5	Ethiodemethrin 2.5% EC		30 ml/tree	Twice
6	Ethiodemethrin 2.5% EC		50 ml/tree	Twice
7	Karate 5% EC		0.72 ml /tree	Once
8	Karate 5% EC		1.10 ml/tree	Once
9	Karate 5% EC	Lambda-cyhalothrin	0.72 ml /tree	Twice
10	Karate 5% EC		1.10 ml/tree	Twice
11	Free Check		-	-

tree and Karate 5% EC at 0.72 and 1.10 ml per tree including free checks (Table 1). The levels of the test insecticides were determined using the manufacturer's ranges of recommendations for orchard pest. Treatments were given at once and twice application frequencies; the second application was applied after fifteen days of the first application [13].

The experiment was laid out in randomized complete block design with four replications. Insecticides application was made using knapsack sprayer with sufficient water to cover the entire canopy of the citrus tree. Ten immature growth flushes were examined from each plot before treatment application and also at seven days interval after treatment application for six successive weeks. Variable measured per flush was the average number of surviving and dead larvae at seven days interval. Percent decrease data was transformed using square root ($x + 1$) and were analyzed using ANOVA procedure, and treatments means comparisons were conducted using Duncan Multiple Range Test (DMRT). The original means were shown on the tables. Percent decrease over control for citrus leaf miner was calculated by the following formula [14].

$$C = (A / B) * 100$$

Where,

A= Population infestation in treated plants;

B= Population infestation in control

C= Decrease over control; Percent decrease=
100 – C

3. RESULT AND DISCUSSION

The study showed that plots received both Ethiodemethrin 2.5% EC at 20, 30 & 50 ml tree-

1 and Karate 5% EC at 0.72 & 1.10 ml tree-1 had resulted significantly superior control of CLM larval population as compared to the unsprayed check for two weeks period after treatment application (Table 2). Likewise, plots received twice application of Ethiodemethrin 2.5% EC at 20, 30 & 50 ml tree-1 and Karate 5% EC at 0.72 & 1.10 ml tree-1 showed significantly superior control of the pest as compared to plots received the same insecticides at once in the 3rd and 4th weeks after treatment application. In support of this, study in Mauritius indicated that Deltamethrin (Decis 2.5 EC) were used against citrus leaf miner and in a regular spraying of each successive flush provided effective control (Mungroo and Abeeluck, 1998). The study indicated that both Ethiodemethrin 2.5% EC at 20, 30 & 50 ml tree-1 and Karate 5% EC at 0.72 & 1.10 ml tree-1 showed a maximum control of the pest not more than two weeks period. In support of this fact, several authors indicated that foliar application of insecticides provides control for of CLM only for two weeks period [15,13,10]. In Reunion, Deltamethrin (Decis 2.5 EC) with 0.5% oil (Citrole or Ovipron) had showed better efficacy (Anonymous, 1997 as in Mungroo and Abeeluck, [16]). According to Latif et al. [17] report indicated that application of Betacyhalothrin 2.5% EC and Thiamethoxam 25% WG were resulted significant control of citrus leafminer (*Phyllocnistis citrella*). In line with this, several authors also reported that integration of all possible control options like improving the cultural practices, timely irrigating, applying fertilizers, proper field sanitation and biological control and other resulted better control of CLM in some citrus producing countries of the world.

The overall larval population density in plots received insecticides once showed about 50% mean reduction as compared to the untreated

Table 2. Impact of insecticides on citrus leafminer population density at Metahara Citrus Orchard in 2010/11

Treatment	Average citrus leafminer larval count per shoot						
	BAP	1WAAP	2WAAP	3WAAP	4WAAP	5WAAP	6WAAP
Ethiodemethrin 2.5% EC at 20 ml tree ⁻¹ once	3.75	2.10b	2.70b	3.60a	3.68a	3.78a	3.98a
Ethiodemethrin 2.5% EC at 30 ml tree ⁻¹ once	4.70	2.10b	2.70b	3.58a	3.55a	3.73a	3.85a
Ethiodemethrin 2.5% EC at 50 ml tree ⁻¹ once	3.68	2.03b	2.61b	3.60a	3.60a	3.73a	3.88a
Ethiodemethrin 2.5% EC at 20 ml tree ⁻¹ twice	4.40	2.00b	2.73b	2.23b	2.18b	3.68a	3.95a
Ethiodemethrin 2.5% EC at 20 ml tree ⁻¹ twice	4.50	2.03b	2.68b	2.18b	2.15b	3.68a	3.80a
Ethiodemethrin 2.5% EC at 20 ml tree ⁻¹ twice	3.83	2.11b	2.63b	2.13b	2.03b	3.73a	3.83a
Karate 5% EC at 0.72 ml tree ⁻¹ once	4.53	2.10b	2.75b	3.58a	3.78a	3.85a	3.90a
Karate 5% EC at 1.10 ml tree ⁻¹ once	4.50	2.08b	2.64b	3.60a	3.73a	3.78a	3.78a
Karate 5% EC at 0.72 ml tree ⁻¹ twice	4.45	2.10b	2.70b	2.25b	2.13b	3.70a	3.73a
Karate 5% EC at 1.10 ml tree ⁻¹ twice	4.50	2.00b	2.62b	2.15b	2.08b	3.68a	3.80a
Free Check	4.50	4.15a	4.20a	4.28a	4.28a	4.45a	4.30a
CV (%)	9.71	6.29	6.78	6.36	7.30	5.48	4.40

NB: shoot refers on average about five most top leaves (the new flush leaves) ; WAAP: weeks after insecticide application; BAP= Before application.

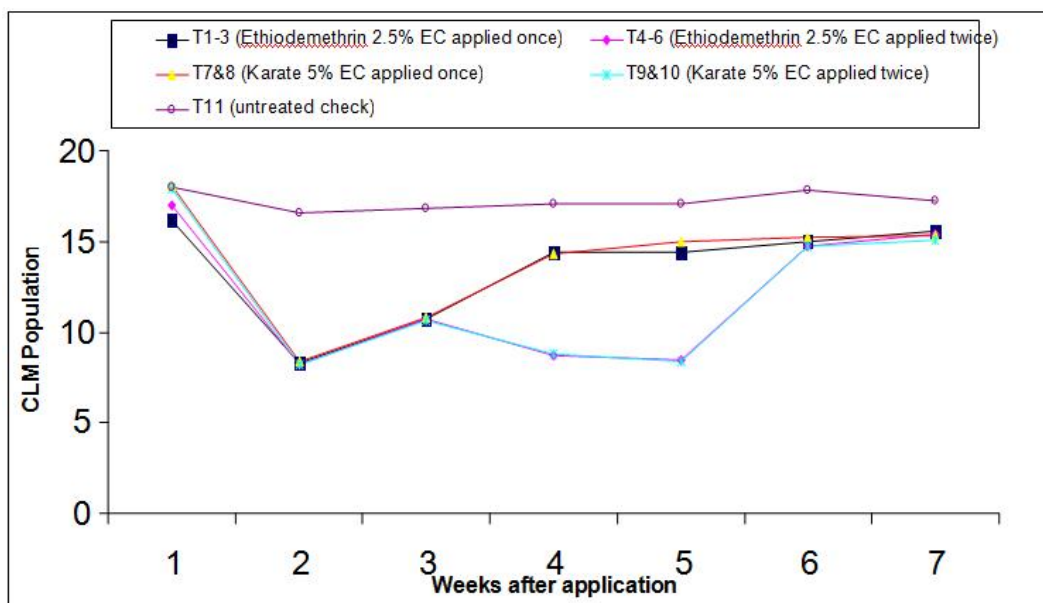


Fig. 1. Citrus leaf miner total larval population trend over six successive weeks after treatment application Conclusion and Recommendation

check during the first two weeks period after treatment application. Likewise, plots received insecticide twice showed about 30 and 69% mean larval population reduction as compared to plots received once and also to the untreated checks, respectively. Study in Pakistan indicated that application of Betacyhalothrin has showed 55.43 percent larval mortalities [17]. According to Rae et al. [18] report 94-100 larva mortality was recorded when Abamectin was mixed with 1% oil for the control of citrus leafminer. On the other hand, the study showed that an overall increment trends of citrus leafminer population density in the untreated plots followed by plots treated once and twice (Fig. 1). In support of this, Mungroo and Abeeluck [16] reported that, average number of larvae per leaf in untreated plots progressively increased as compared to the citrus trees received insecticide treatment.

4. CONCLUSION

The study was conducted at Metahara Sugar Factory Citrus orchard fields for one cropping season with the objective of evaluating the efficacy of Ethiodemethrin 2.5% EC and Karate 5% for the control of citrus leafminer. The result indicated that Ethiodemethrin 2.5% EC at 20, 30 and 50 ml tree⁻¹ and Karate 5% EC at 0.72 and 1.10 ml tree⁻¹ had satisfactory control potential of CLM for a maximum of two weeks period as compared to the untreated check. Therefore, the

orchard could use Ethiodemethrin 2.5% EC at 20 ml tree⁻¹ and Karate 5% EC at 0.72 ml tree⁻¹ for the control of leafminer as an alternative of the existing insecticides that are in use. Moreover, using single control tactics does not provide utmost control of CLM in the orchard, therefore, strengthening and integrating of all possible improved cultural practices (such as fertilization, irrigation and field sanitation and pruning of attacked shoot etc) should be imperative so as to achieve better control.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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