
Evaluation of insecticides and botanicals against Onion thrips, *Thrips tabaci* (L.) (Thysanoptera: Thripidae)

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ABSTRACT

Onion thrips, *Thrips tabaci* (L.) is a key pest of onion and their control is vital to the production and profitability of this crop. If onion thrips are not controlled, damage can routinely reduce bulb yields by 23-85%. Most onion fields need protection against thrips for two to three months and multiple applications are required to control infestations, but there are few labeled insecticides that provide effective and consistent control. Therefore, the present study was conducted in two locations viz. Ambo and Guder, Western Shewa of Oromia Regional state, Ethiopia. A factorial experiment was laid out in randomized complete block design with three replications to evaluate the effect of insecticides (Cutter 112 E.CTM and Triger 5% E.CTM) and botanicals (*Azadirachta indica* L. and *Dodonaea angustifolia* L.) on onion thrips on farmers cultivated field. The results of the study revealed that the newly introduced both insecticides gave promising mortality rate and not significantly ($P < 0.001$) different compared with the standard check previously registered (Diazinon 60 E.CTM) and highly significant ($P < 0.001$) different from the untreated check. The botanicals, *A. indica* and *D. angustifolia*, fresh leaf extracts with foliar application gave promising mortality rate used as alternative control measures of onion thrips, while the combination of two botanicals were found less effective as compared with other treatments but significantly different from untreated check. From this study, we concluded that the newly introduced insecticides Cutter 112 E.CTM and Triger 5% E.CTM could be recommended to be registered as alternative insecticides. The two botanicals (*A. indica* and *D. angustifolia*) fresh leaf for making bio-pesticide, which are easily available in the surrounding areas, are better option and eco-friendly to adopt for controlling onion thrips in Ethiopia.

Key words: Botanicals, Onion thrips, Evaluation, Efficacy, Mortality, Insecticides.

INTRODUCTION

Onion is considered as one of the most important vegetable crops produced on small and large scale in Ethiopia. It also occupies an economically important place among vegetables in the country. A total of 30,478.35 hectares of land was under Onion in the country, taking up about 15.25% land area covered by all vegetable crops at country level and yielding about 328,157.42 tones of produce by the peasant holders, contributing about 19.64% to the total country level all vegetable crops Production [1]. Consumption of onions has been increasing significantly in the world partly because of the health benefits they possess [2, 3].

Onion (*Allium cepa* L.) is an important vegetable produced across a wide range of latitudes in the world. *Allium* crops are the most indispensable vegetable crops used as condiments in most Ethiopian cuisine. Among them, onion (*Allium cepa* L.) is one of the oldest known and an important bulbous vegetable crop grown in Ethiopia. It is used in preparation of different foods and in therapeutic medicine in the country. It has a great potential to produce every year for both local consumption and export with an average yield of 10.77 tons per hectare [1].

The area under onion is increasing from time to time mainly due to its high profitability per unit area and ease of production, and the increases in small scale irrigation areas. The crop is produced both under rain fed in the meher season and under irrigation in the off season. In many areas of the country, the off season crop (under irrigation) constitutes much of the area under onion production. Despite areas increase, the productivity of onion is much lower

than other African countries. The low productivity could be attributed to poor insect pest and disease management and other problems.

Ambo and Toke Kutaye 'Wereda', West Shawa Zone, Oromia Regional State, Ethiopia has high potential for onion cultivation due to availability of ample irrigated farmlands and the presence of relatively better market access as compared to other districts of West Showa Zone. Currently farmers in the study areas are growing the varieties of Adama red and Bombe red. However, both varieties are susceptible to onion thrips but high yielder.

Onion thrips (*Thrips tabaci*, Lindman; Thysanoptera: Thripidae) is a key insect pest of onion. In Ethiopia, it is an important insect pest that affect onion yield by direct feeding as well as reducing the quality and quantity by rasping the leaves and other tissues of onion crops to release the nutrients [4]. Onion fields can be destroyed by onion thrips, especially in dry seasons and are the major problem on onion crops in Ethiopia. Onion thrips (*Thrips tabaci*) which is considered to be the most economically important pest of onion worldwide [5] is responsible for causing considerable reduction in yield [6, 7, 5]

[4, 8, 9] reported that onion bulb yield losses of 36.44, 33 and 26-57%, respectively, due to onion thrips in Ethiopia. Similar studies at Upper Awash Agro Industry Enterprises revealed yield losses of 10 to 85% due to onion thrips in Ethiopia [10].

Thrips, *Thrips tabaci* is the only economically important insect pest of onion. It is the most common during dry months. Insecticides are commonly used to control thrips. Currently, effective insecticide in Ethiopia includes selegon and karate, even if resistance is being developed to the later. Besides the use of chemicals, cultural practices like plowing and crop rotation are useful tools to combat thrips. Better to plough fields immediately after harvesting to eliminate resting sites for the pest.

To control onion thrips at minimum cost, botanicals and new insecticides could easily be adopted. Keeping in view this study was designed to evaluate the newly introduced chemicals and botanicals were affects the population density of thrips in onion. Therefore, this study was undertaken to evaluate effectiveness of newly introduced insecticides and botanicals on the management of onion thrips.

MATERIALS AND METHODS

1.1 Description of the study areas

The experiment was conducted at Ambo and Toke kutaye districts, West Showa, Ethiopia, during the dry/off cropping season of 2013/14. The experiment site is located about 110 and 125 km West of Addis Ababa, respectively. Ambo was located at latitude 8°57'N, longitude 38°07'E, annual mean temperature of 18-24°C, mean annual rainfall of 1115mm. and Toke kutaye was located at an altitude of 1990 meter above sea level, latitude of 08° 59' 01.1' N. and longitude of 37° 46' 27.6' E. The average annual rainfall is 1028.7 mm and maximum and minimum temperatures of the area 29.6°C and 11.8°C, respectively.

2.2 Treatments and experimental design

A field study was under taken in two potential areas (Ambo and Guder) to evaluate onion, *Allium cepa* (L.) response and onion thrips, *Thrips tabaci* control with newly introduced insecticides and botanicals. The field was ploughed and disked to create a seedbed suitable for onion production. One meter wide and two meter length seed beds was made to facilitate furrow irrigation.

Treatments were CUTTER 112 E.CTM at rate of 250ml ha⁻¹, Triger 5% E.CTM at rate of 350ml ha⁻¹, *Azadirachta indica* leaf, *Dodonae angustifolia* fresh leaf, the combination of *Azadirachta indica* leaf and *Dodonae angustifolia* fresh leaf were at the rate of 10% (v/v), Diazinon 60% E.CTM (standard insecticide) at rate of 1000 ml ha⁻¹ and Control (untreated). The study was carried out a randomized complete block design (RCBD) with three replications of all treatments and individual plots were 2 meter wide (10 rows) by 3 meter long at farmers' field conditions. Factor "A" (treatments) were in the main plot, and Factor "B" (locations) were in the sub plot.

Onion seeds of variety 'Bomb red' was planted on October, 2013/14 each plot was consists of 2 X 3m with 1m alley between the plot and block to minimize interference. The onion was planted at a spacing of 20 X 10cm, between

rows and plant, respectively. Di ammonium Phosphate (DAP) and UREA fertilizers were applied at recommended rate and all agronomic practices were undertaken. Visual observation of onion

2.3 Data Collection

Pre-spray count and beneficial insects were recorded every week from five randomly selected plants from each plot until the thrips populations were reach economic threshold level (5-10 thrips/plant). After the population of onion thrips reached economic threshold level the insecticides were sprayed and post spray count was taken after 24 hours. Yields data was also weighed to determine plants response to the thrips infestation resulting from insecticides.

2.4 Data Analysis

The data was analyzed using Statical Analysis Software [11]. Analysis of variance (ANOVA) also constructed to test for significant differences between the variables. Efficacy percentages and yield losses were calculated by using the following formulas:

$$\text{Efficacy (\%)} = \frac{\text{Pre spray count} - \text{Post spray count}}{\text{Pre spray count}} \times 100$$

$$\text{Yield loss (\%)} = \frac{\text{Protected treatment} - \text{un treated treatment}}{\text{Protected treatment}} \times 100$$

RESULTS AND DISCUSSION

3.1 Effect of insecticides on onion thrips

The efficacy percent of treatments were observed after 24, 48, and 72 hours for their mortality and the results were presented in (table 1). All of the insecticides and botanicals were promised control of onion thrips at various degrees of significances over the untreated check. The newly introduced insecticides Cutter 112 E.CTM and Triger 5% E.CTM and Diazinon 60% E.C (standard check. provided the best efficacy percent of onion thrips among the tested treatments. Botanicals *Azadirachta indica* leaves extract and *Dodonae angustifolia* fresh leaf extract were the second best botanical insecticide over all.

The experiments were showed that not significantly ($P < 0.001$) different among insecticides and from the standard check (Diazinon 60 E.C) against onion thrips. However, they were highly significant ($P < 0.001$) different when compared with untreated check (table 1). The efficacy percent of Cutter 112 E.C (100, 100%), Triger 5% E.CTM (100, 98%) *Azadirachta indica* (76.07, 78%) and Diazinon 60 E.C (95.6, 92.37) at Ambo and Guder farmers cultivated field, respectively, after treatment application of 72 hours. The results were relatively increase from 24 hours until 72 hours but there was not significantly different after 24 hours and also not significantly different between the locations.

Neem seed powder at 6% gave less effective (Sujay *et al.*, 2013). This study was focused on neem leaves powder performance at 10% formulation (v/v) gave effective control on onion thrips. Therefore, increasing the concentration of neem extract it may gave in some extent effectiveness of botanicals on onion thrips mortality percent. Hazara *et al.* [12] reported about 40 and 60% control of onion thrips with two different botanical formulations, neem seed extract and neem oil. The potential of using plant extracts in controlling onion thrips has been shown by several authors [13, 14, 15, 9]. This study has shown that the leave extracts of *Azadirachta indica* and *Dodonaea viscosa* fresh leaves had promising insecticidal effects on onion thrips.

Neem seed powder at 6% gave less effective [16]. This study was focused on neem leaves powder performance at 10% concentration (v/v) gave effective control. Tadele *et al.* [9] stated that *Azadirachta indica* seed extract had good performance on controlling of onion thrips. Use of neem oil at 3.5 lt/ha was found to be most effective in managing onion thrips over farmers practice [17].

Dodonae angustifolia fresh leaves gave intermediate mortality percent (69.3) and (68.13) after 72 hours at Ambo and Guder, respectively. The combination of the two botanicals showed the lowest mortality percent (59.57) at Ambo and (41.77) at Guder locations compared with other treatments but significantly ($P < 0.001$) different when compared with the untreated check. *Dodonae angustifolia* fresh leaf has some bactericidal effect on disease but there is no any information in controlling insect pests.

3.2 Effect of insecticides on onion crops and natural enemies

During the study period one beneficial insect was observed namely Ladybird beetles, (*Adonia variegata*: Concinellidae). All tested insecticides and botanicals were no side effect on ladybird beetles. There was no any phototoxicity (abnormal coloring and scorching) of the leaves of onion crops not observed after application of insecticides and botanicals.

3.3 Effect of insecticides on yield

There was a significant different between treated and untreated check but no significances were scored among the yield obtained from Cutter 112 E.CTM, Triger 5% E.CTM, *Azadirachta indica* and Diazinon 60 E.CTM gave high yield percentage in all locations compared to untreated plot (table 2). The minimum (16486 kg ha⁻¹) yield bulb obtained from untreated check.

Edelson *et al.* [18] and Tadele *et al.* [9] reported a negative relationship between thrips population and onion bulb yield when the population densities of thrips above economic threshold level. Our findings agree with Mayer *et al.* [19]. They indicated that onion thrips do not reduce onion yield unless the pest infestation above economic threshold level. Our result suggests that thrips population in untreated check above economic threshold (35 thrips/plant). Therefore, yield of untreated check gave minimum results. The results agreed with Malik *et al.* [20] indicated thrips population densities have an indirect effect on yield. Yield losses due to onion thrips also calculated and resulted 41.07 and 33.6% at Ambo and Guder, respectively.

Table 1: Mean efficacy percentage of insecticides and botanicals against onion thrips in Ambo and Toke Kutaye districts, Western Shawa, Ethiopia

Treatments	Efficacy percentage (%) of insecticides and botanicals on different locations and hours					
	Ambo			Guder		
	24 hrs	48 hrs	72 hrs	24 hrs	48 hrs	72 hrs
Cutter 112 E.C	88.28b	99.4a	100a	91.57a	97.53a	100a
Triger 5% E.C TM	97.6a	99.4a	100a	95.17a	96.43a	98.43a
<i>Azadirachta indica</i> leaf	77.87b	78.67b	76.07b	71.13b	74.17b	78.0b
<i>Dodonae angustifolia</i> fresh leaf	69.73b	69.1b	69.83b	55.12c	66.27b	68.13b
<i>Azadirachta indica</i> leaf + <i>Dodonae angustifolia</i> fresh leaf	46.18c	39.58c	59.57bc	32.69d	39.41c	41.77c
Diazinon 60 E.C	98.0a	98.33a	95.6a	92.07a	93.84a	92.37a
Control	2.56d	0.00d	0.00d	0.00e	0.00d	0.00d
MSE	10.91	6.77	11.54	6.87	8.38	9.13
CV (%)	15.27	11.33	15.51	10.50	12.03	12.82

Table 2: Yield of onion at different localities of Western Shawa, Ethiopia

Treatments	Yield in kg/ha	
	Ambo	Guder
Cutter 112 E.C TM	27976a	27211a
Triger 5% E.C TM	27971a	27291a
<i>Azadirachta indica</i> leaf	25536a	25841a
<i>Dodonae angustifolia</i> fresh leaf	20765b	23050b
<i>Azadirachta indica</i> leaf + <i>Dodonae angustifolia</i> fresh leaf	20576b	21628b
Diazinon 60 E.C TM	27771a	27207a
Control/Untreated	16486c	18120c
MSE	1449.95	1565.82
CV (%)	5.96	6.56

CONCLUSION

The experiment results were indicated in all locations the mortality rate percentage of the two newly introduced insecticides (Cutter 112 E. C and Triger 5 E.C) were found to be comparable and effective to the standard check (Diazinon 60 E.C) in controlling onion thrips, *Thrips tabaci* (L.) population. The yield of all treatments except untreated check gave similar yield results compared with the standard check. Therefore, the newly introduced insecticides Cutter 112 E.CTM and Triger 5 E.CTM could be recommended to be registered for control of onion thrips and also both botanicals used as alternative insecticides for the control of onion thrips.

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