https://doi.org/10.46344/JBINO.2022.v11i05.20

EVALUATION OF EMABENDOX 90SC (*INDOXACARB 7.5% + EMAMECTIN BENZOATE 1.5%*) SC AGAINST TOMATO LEAF MINER, *TUTA ABSOLUTA* ON TOMATO

Feyisa Begna,

Oromia Agricultural Research Institute

* E-mail:: fbos2009@gmail.com, Batu/zway, Ethiopia

ABSTRACT

Tomato leaf minor , *Tuta absoluta* Meyrick (Lepidoptera: Gelechiidae) in the country that was detected following heavy infestation of tomato fields in February 2013 in the major tomato production belt of the central Rift Valley region. In its new regions, *T. absoluta* has spread extremely fast, becoming a potential threat to the world tomato production. These include organophosphates, such as profenofos and pyrethroids, such as Lambda cyhalothrin with no success or reduction of infestation resulting in huge financial loss with the objective. To evaluate the efficacy of Emabendox 90SC (Indoxacarb 7.5% + Emamectin benzoate 1.5%) SC to manage the tomato leaf miner (*Tuta absoluta*). The experiment was conducted at Adami Tulu Agricultural Research Center during off season (2020), to test the efficacy of an insecticide known as Emabendox 90 SC (Indoxacarb 7.5% + Emamectin benzoate 1.5%) SC for controlling (*Tuta absoluta*). Treatments were: the test chemical Emabendaox 90SC (Indoxacarb 7.5% + Emamectin benzoate 1.5%) SC at the rate of 0.5 liter/ha. In all weekly application, insecticide Amsac significantly reduced *Tuta absoluta* larval population; this was followed by Emabendaox 90SC. In Japan, Hama (1983) reported that chemicals proved more toxic to a susceptible strain of insect pest than dichlorvos, profenofos. There were significant differences (P< 0.05) among treatments in terms of marketable yield (Table 3). Marketable yield of tomato crop (Galila variety) ranged from 244 to 556 qu/ha. The highest level of marketable yield was obtained from plots sprayed with insecticide Amsac, followed by Emabendox 90SC treated tomato Galila variety. The untreated plot (control) had the lowest marketable yields. This indicates that controlling *Tuta absoluta* populations with synthetic chemicals can double the yield of tomato crops production.

INTRODUCTION

Tomato *(Lycopersicon esculentum* Mill.) is one of the most important edible and nutritious vegetable crops in the world. It belongs to the Solanaceae family. It ranks third next to potato and sweet potato with respect to the volume of world vegetable production (FAO, 2006). It is one of the most economically important vegetable crops and is widely cultivated in tropical, sub-tropical and temperate climates in the world. It is the most frequently consumed vegetable in many countries, becoming the main supplier of several plant nutrients and providing an important nutritional value to the human diet (Willcox *et al*., 2003).

Agricultural pests can reduce yield, increase production costs, and may lead to the use of pesticides which ultimately leads to the disruption of existing integrated pest management systems (Thomas, 1999). Tomato crops are normally attacked by a great variety of insect pests including the tomato leaf miner (*Tuta absoluta)* Meyrick (Lepidoptera: Gelechiidae), is one of the economically important insect pests of tomato (Medeiros *et al.*, 2006). Productivity of tomato in Ethiopia is lower nearly by half than the world average due to several biotic and abiotic stresses. With global agriculture and trade that enhance the exchange of plant materials, new pests are being introduced into the country frequently. A case- in -point is the occurrence of Tomato leaf minor , *Tuta absoluta* Meyrick (Lepidoptera: Gelechiidae) in the country that was detected following heavy infestation of tomato fields in February 2013 in the major tomato production belt of the central Rift Valley region (Gashawbeza and Abiy, 2013).

In its new regions, *T. absoluta* has spread extremely fast, becoming a potential threat to the world tomato production (Desneux *et al*., 2011). Unusually extensive leaf mining and fruit damage on tomato by a micro-lepidopteron moth was observed in some tomato growing areas of Ethiopia in January/February 2013. Heavy incidence of this moth was reported from Alamata area of Tigray and major tomato belt between Modjo and Zeway towns in the Central Rift Valley. Tomato growers in the affected areas of Ethiopia reacted to the pest damage by applying conventional insecticides locally available on the market. These include organophosphates, such as profenofos and pyrethroids, such as Lambda cyhalothrin with no success or reduction of infestation resulting in huge financial loss. Therefore, Adami Tulu Agricultural Research Center in collaboration with Lion International Trading has been undertaken the efficacy test of an insecticide known as Emabendox 90SC (Indoxacarb 7.5% + Emamectin benzoate 1.5%) SC with the following objective.

Objective

- To evaluate the efficacy of Emabendox 90SC (Indoxacarb 7.5% + Emamectin benzoate 1.5%) SC to manage the tomato leaf miner (*Tuta absoluta*)

Materials and Methods

The experiment was conducted at Adami Tulu Agricultural Research Center during off season (2020), to test the efficacy of an insecticide known as Emabendox 90 SC (Indoxacarb 7.5% + Emamectin benzoate 1.5%) SC for controlling (*Tuta absoluta*). Treatments were: the test chemical Emabendaox 90SC (Indoxacarb 7.5% + Emamectin benzoate 1.5%) SC at the rate of 0.5 liter/ha, standard check (Amsac) at the rate of 0.5 liter/ha and untreated check. Tomato (variety Galila) was planted on 10 m x10 m, with row and plant spacing of 1 m x 0.5 m, respectively. This experiment was designed as randomized complete block design in three replications.

Fungicides (Emabendox 90SC and Amsac) were foliar sprayed with knapsack sprayer in ten days interval from onset of the pest until the crop reached physiological maturity.

Data to be collected

The central four rows of each plot were considered for collecting data. Four plants per plot were randomly selected to count larval density. Samples of three leaves each were collected from the bottom, middle and upper layer of the canopy and placed separately in plastic bags for counting the number.

Leaf damage score was taken based on scale of 1 to 5 where 1= 1-10% no infestation; 2= 11- 25% slight infestation of; 3= 26-50% moderate infestation; 4= 51-75% of; 5= 76-100%, heavy infestation.

The total fruit yield was sorted into marketable and unmarketable. Then the marketable fruit yield was recorded by counting and weighing from plots and expressed in results marketable fruit number and yield per hectare.

Ten samples fruit was taken from damaging fruits due to *Tuta absoluta* counting the holes number and take the average of the hole per fruit.

Total fruit yield (qu/ha) was recorded by sum up the weight of marketable and unmarketable fruit yields from plots and expressing it in hectare base. Total marketable and unmarketable fruit per ha was recorded per plot.

Statistical Data Analysis

The data were analyzed using the General Linear Model (GLM) procedure of SAS statistical version 9.2 Software (SAS, 2009). Data were checked for satisfying ANOVA assumptions before subjecting them to ANOVA. To stabilize the variance the egg density count data were transformed to square root scale. Significance mean was separated using Student-Newmans-Keuls test

RESULTS AND DISCUSSION

Tuta absoluta larval population after treatment application

Across all the weeks' significant differences ($P < 0.05$) were observed on population of *Tuta absoluta* larvae per leaf among treatments following foliar applications of insecticides (Table 1). The highest numbers of *tuta absoluta* larvae per leaf were recorded from untreated plots, whereas the least numbers of *Tuta absoluta* larvae were recorded from plots treated with

Emabendaox 90 SC and Amsac insecticides.

In all weekly application, insecticide Amsac significantly reduced *Tuta absoluta* larval population; this was followed by Emabendaox 90SC. In Japan, Hama (1983) reported that chemicals proved more toxic to a susceptible strain of insect pest than dichlorvos, profenofos, acephate and chlorpyriphos. Magallona (1985) also reported that insecticides are generally considered the most effective means of protecting crops against insect damage as they provide rapid untreated of wide pest complex of major pests, and growers concerned about leaf damage, even of a few holes, tend to spray insecticides. Nakagome and Kato (1981) believed that repeated insecticide applications are required to control insect pests, especially during the peak population period. However, Motoyama *et al* (1990) warned that effective insecticidal control of *Tuta absoluta* might not be achieved for longer period as the insect can develop resistance to a new insecticide very quickly because of its unique feature of insecticide resistance.

Table1. Mean number of *Tuta absoluta* Larvae per leaf sprayed with chemicals across the week

Treatments	On station				On farm			
	Week1	Week2	Week 3	Week4	Week1	Week2	Week3	Week4
Emabendox 90SC	2.33a	1.33b	1.36b	3.33b	1.67b	2.86b	1.33b	2.00b
Amsac	1.03b	0.66b	0.33b	1.27b	1.33b	0.33b	2.03b	0.67b
Untreated check	3a	5.26a	5.33a	7.26a	3.56a	4.33a	7.42a	7.33a
CV	11	17	21	18	13	14	19	12

Total fruit yield

The results indicated in Table 2 show significant difference both in total fruit number and yield in response to Emabendox 90SC, Amsac and untreated check. The higher fruit number(556qu/ha) on tomato treated with Emabenda, while lower fruit number (244qu/ha) recorded on untreated check.

Marketable yield

Effect on Marketable Yield

There were significant differences ($P< 0.05$) among treatments in terms of marketable yield (Table 3). Marketable yield of tomato crop (Galila variety) ranged from 244 to 556 qu/ha. The highest level of marketable yield was obtained from plots sprayed with insecticide Amsac, followed by Emabendox 90SC treated tomato Galila variety. The untreated plot (control) had the lowest marketable yields. This indicates that controlling *Tuta absoluta* populations with synthetic chemicals can double the yield of tomato crops production.

Tuta absoluta larvae feeds on the marketable portions of the crop, therefore, synthetic insecticides will remain essential for the management of this pest (Hill & Foster, 2000).The plant extracts compared favorably with the synthetic insecticide in the control of *Tuta absoluta*. This could be due to the pungent smell given out by the soaked plant extract which deter animals from eating the plant Sivapragasam and Aziz (1990).

Table 2 the effects of frequency of synthetic chemicals on total fruit, marketable fruit yield (qu/ha), damaged fruit and fruit holes

Treatments	On station			On farm		
	Marketable qu/ha	Unmarketable qu/ha	Fruits holes number/ fruit	Marketable qu/ha	Unmarketable qu/ha	Fruits holes number
Emabendox 90SC	423b	18.6b	2.03b	448b	22b	1.62b
Amsac	556a	16b	0.63b	543a	18b	0.87b
Untreated check	260c	26a	5.87a	244c	26a	6.33a
CV	18	23	10	13	12	13

TFN ha^{-1}= Total fruit number per ha, TY=Total yield, MFN ha^{-1}= Marketable fruit number per ha, MY= Marketable yield

Fruits holes number due to *T. absoluta*

The highest fruit hole number 5.07 (table 2) was recorded on untreated check, while the lowest fruit hole number 0.63 were observed on plot treated with insecticide Amsac. The second lower fruit hole number 1.63 was recorded when Emabendox 90SC was applied on weekly. The caterpillars directly damage the leaves, the terminal buds, the flowers and the fruits (Moraes and Normanha, 1982; Haji *et al*., 1988; Souza and Reis, 1992), or decrease fruit quality indirectly by burning the skin of the fruit. The latter symptom has been frequently observed on fruits from caterpillar-defoliated plants. Also, potting *et al*. (2013) demonstrated that unacceptable levels of cosmetic fruit damage may occur in fresh market tomato production due to the mining habit of the organism. Without any control measure, the potential damage may be 100%, especially at high population densities at the end of the growing season because the presence of the organism in a greenhouse may lead to unacceptable levels of cosmetic fruit damage.

Conclusion and Recommendation

Results indicated that across all the weeks, there were significant differences (P< 0.05) among treatments in affecting population of *Tuta absoluta* larvae following foliar applications. The highest number of *Tuta absoluta* larvae were recorded from control (untreated) plots. The lowest number of *Tuta absoluta* larvae were recorded from plots treated with insecticides. This shows both chemical insecticides can significantly reduce the number of *Tuta absoluta* larvae and the subsequent damage to the crop, including quantity and quality of fruit yield.

On the yield data significant differences (P< 0.05) among treatments was observed in marketable yield of the tomato crops. The highest levels of tomato marketable yield per plot were obtained from plots sprayed with foliar application of insecticide Amsac which was followed by plot treated with foliar application of insecticide Emabendox 90SC . Untreated plot (control) had the lowest marketable yield. This indicates that controlling *Tuta absoluta* populations with insecticides, Emabendox 90SC and Amsac can significantly increase the yield of the tomato crop.

The result of this study indicated that the newly tested insecticide, Emabendox 90SC (Indoxacarb 7.5% + Emamectin benzoate 1.5%) SC, sprayed at the rate of 0.5L ha^{-1}can can control Tomato Leaf Miner *(Tuta absoluta)* as the comparison to standard check.

Therefore, based on the results of this study, Emabendox 90SC (Indoxacarb 7.5% + Emamectin benzoate 1.5%) SC can be recommended for management of *Tuta absoluta*on tomato sprayed at the rate of 0.5L ha^{-1} and at ten (10days) spray intervals.

I. REFERENCES

Desneux, N., M. Luna, T. Guillemaud and A. Urbaneja, 2011. The invasive South American tomato pinworm,*Tuta absoluta*, continues to spread in Afro-Eurasia and beyond: the new threat to tomato world production. *J. Pest Sci*. 84:403-408.

Food and Agriculture Organization (FAO), 2006. FAO production yearbook, Basic Data unit, Statistics Division, FAO, Rome, Italy, No.55,pp 125-127

Gashawbeza, A. and Abiy, F. 2013. Occurrence of a new leaf mining and fruit boring moth of tomato (*Tuta absoluta*) in Ethiopia. Field trip report to Ethiopia Institute of Agricultural Research, February 2013, pp 11.

Haji, F.N.P., C.A. Oliveira, M.S. Amorimneto and J.G.S. Batista, 1988. Flutuac Ë a Äo populaciona l da trac Ë a do tomateir o no subm e Â di o Sa Äo Francisco. *Pesquis a Agropecua Â ri a Brasileir a* 23: 7 – 17

Magallona ED (1985). Development in Diamondback Moth Management in the Philippines. P 3-15. Cited in: Lidet Sitotaw, 2006. Distribution and Management of Dimandback Moth of Pultella xylostella L. (Lepidoptera: Plutellidae) on Cabbage in the Central Rift Valley of Ethiopia, M.Sc. Thesis, Haramaya University.

Mediros, M.A., N.J. Vilela and F.H. Franca, 2006. Technical and economic efficiency of biological control of the South American tomato pinworm in protected environment. *Horticultura Brasileira*. 24 (2): 180- 184.

Moraes, G.J. and J.A. Normanh, 1982. Surt o de *Scrobipalpula absoluta* (Meyrick) em to m ateiro no tr o Â pic o semi-arido. *Pesquisa Agropecua Âria Brasileira* 17: 503 – 504

Motoyama N, Suganuma T, Maekoshi Y (1990). Biochemical and physical characteristics of insecticide resistance in diamondback moth. P 411-418 in: N.S. Talekar (ed.). Diamondback Moth and othercrucifer pests: Proceeding of the Second International Workshop, 11-15 December 1992, Asian Vegetable Research and Development Center, Shanhua, Taiwan.

Nakagome T, Kato K (1981). Control of insects in cruciferous vegetables in Aichi Prefecture with special reference to diamondback moth. (In Japanese). P 79-92. In Insects in Cruciferous Vegetables and their Control with Special Reference to Diamondback Moth. Takeda Chemical Industries Ltd., Tokyo.

Potting, R.P.J., D.J. Van der Gaag, A. Loomans, M. Van der Straten, H. Anderson, A. MacLeod, A., J.M.G. Castrillon and G.V. Cambra, 2013. *Tuta absoluta*, Tomato leaf miner moth or South American tomato moth. Ministry of Agriculture, Nature and Food Quality, Plant Protection Service of the Netherlands.

SAS (Statistical Analysis System) software, 2009. Version 9.2. Inc. Carry, North California, USA

Souza, J.C., P.R. Reis, 1992. TracË a-do-tomateiro, histoÂrico, reconhecimento, biologia, prejuõÂzos e controle. EPAMIG. Bull., 32. Belo Horizonte: EPAMIG 1-19.

Sivapragasam A, Abdul AAM (1990). Cabbage Worm on crucifers in Malaysia Cited in N. S

Talekar(1990). Diamondback moth and other crucifer pest: Proceedings of the Second International Workshop Taina, Taiwan 10-14 December, Asian Vegetable Research and Development Center. AVRDC Publication No. 92-68 P. 75-79.

Thomas, M.B., 1999. Ecological approaches and the development of 'truly integrated' pest management. *Proc. Natl. Acad. Sci. USA* 96: 5944–5951.

Willcox, J.K., G.L. Catignani and S. Lazarus, 2003. Tomatoes and cardio-vascular health, Critical. *Reviews in Food sciences and Nutrient* 43: 1-18.