Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(4): 732-734

Received: 19-05-2019
Accepted: 21-06-2019

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Bio-efficacy of insecticides against tomato pinworm, *Tuta absoluta* (Meyrick)

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Abstract
Study on bio-efficacy of insecticides against tomato pinworm, *Tuta absoluta* (Meyrick) on tomato was carried out under laboratory conditions at AICRP on Biocontrol of crop pests, Anand Agricultural University, Anand. Maximum (77.05%) mortality was obtained under laboratory conditions when larvae were treated with flubendiamide (0.014%) which was followed by emamectin benzoate (0.002%) and dichlorvos (0.02%) in which larval mortality was 75.91 and 74.77 per cent, respectively. Lower (32.79%) larval mortality was observed in the treatment dimethoate (0.03%), followed by thiamethoxam (0.01%) where larval mortality was 35.96 per cent.

Keywords: Bio-efficacy, tomato pinworm, tomato, insecticides

Introduction
Tomato (*Lycopersicon esculentum* Mill.) is one of the very important vegetable crops grown all over the globe and ranks second in importance after potato. A new invasive pest of tomato pinworm, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) is recently invaded to India and causing devastation in both open fields of tomato and in protected crops [9]. It is also popularly known as South American tomato pinworm or South American tomato moth, or tomato leaf miner or South American tomato leaf miner or tomato borer. It is originated from South America mainly Peru. It is a neotropical oligophagous moth, which is associated with solanaceous crops. Its primary host is tomato although potato, brinjal, common bean and various wild solanaceous plants are also suitable hosts [3]. Since 1960s, this moth has become one of the key pests of tomato crops in South America [6]. In India incidence of the tomato leaf miner, *T. absoluta* was recorded for the first time on tomato at Indian Institute of Horticultural Research (IIHR), Hessaraghatta, Bengaluru during the *rabi* season of 2014 [11]. This pest is also reported from Maharashtra, Pune [10], Maland, Hyderabad-Karnataka region [7], Telangana [8]. *T. absoluta* is one of the most havoc insect pest attacking on tomato plant. The larvae can destroy up to 100% of the leaf surface and damage 50-100% of fruits in severely attacked fields [4]. In view of this, the present investigation on bio-efficacy of insecticides against tomato pinworm, *Tuta absoluta* under laboratory conditions was conducted in at AICRP on Biocontrol of Crop Pests, Anand Agricultural University, Anand.

Materials and Methods
Details of Experiment

Treatments	:	10
Repetitions	:	4
Design	:	Completely Randomized Design
Crop & Variety	:	Tomato, GT-2 (Gujarat Tomato-2)
Instar	:	Second Instar

Maintenance of culture
The larvae of tomato pinworm, *T. absoluta* were collected from the unsprayed tomato fields. The collected larvae were brought to laboratory and reared on tomato leaves and food was changed as and when required. This culture was kept in plastic jar (1 litre) and covered with muslin cloth. For collection of pupae, individual tomato leaves were observed and pupae were collected with camel hair brush. The collected pupae were kept in separate acrylic cages (30 × 30 × 30 cm) for emergence of adults. The plant with young leaves was placed inside the cage for egg laying. Absorbent cotton was dipped in 10 percent honey solution and placed as food for the adults.

Table 1: Details of insecticides used for bio-efficacy study

Treatment No	Insecticides	Concentration (%)	Dosage (ml or g/litre)
T_1	Chlorantraniliprole 18.5 SC	0.006	0.3
T_2	Thiamethoxam 25 WG	0.01	0.4
T_3	Dichlorvos 76 EC	0.02	2.0
T_4	Indoxacarb 14.5 SC	0.015	1.0
T_5	Flubendiamide 480 SC	0.014	0.3
T_6	Emamectin benzoate 5 SG	0.002	0.4
T_7	Tolfenpyrad 15 EC	0.03	2.0
T_8	Chlorfluazuron 5.4 EC	0.016	3.0
T_9	Dimethoate 30 EC	0.03	1.0
T_{10}	Water	-	-

Methodology and Observation

The larvae were collected from the rearing culture. The bio-assay was carried out in Petri dishes by using leaf dip method. The 5 cm leaflet dipped in different insecticidal solution (Table 1) for twenty seconds and was dried for 10 minutes. For control treatment, 5 cm leaflet was dipped in distilled water. In each Petri dish, five larvae of tomato pinworm, *T. absoluta* were released and each dish was covered with the lid so as to avoid the escape of the larvae. The data on the mortality was recorded after 24, 48 and 72 hours of release separately by counting the dead and alive larvae and dead larvae were removed after each count.

Percent (%) mortality was calculated by using formula [1] which is given below.

$$P = \frac{P^1 - C}{100 - C} \times 100$$

Where,

P= Corrected mortality (%)

P^1= Observed mortality (%) of the test insect in insecticidal treatments.

C = Observed mortality (%) in control treatment.

Method of Analysis

Statistical analysis was carried out by following ANOVA technique [13].

Results and Discussion

To determine the bio-efficacy of insecticides against tomato pinworm, *T. absoluta* laboratory experiment was conducted during 2017-18. The data obtained on percent mortality after 24, 48 and 72 hrs of insecticides application on second instar larvae of *T. absoluta*, were statistically analyzed and summarized (Table 2).

Twenty four hours

Maximum (77.05%) mortality was observed when larvae were treated with flubendiamide (0.014%) which was remained at par with emamectin benzoate (0.002%) and dichlorvos (0.02%) where larval mortality was 73.64 percent. Least (26.55%) larval mortality was observed in treatment thiamethoxam (0.01%) and dimethoate (0.03%). The order of effectiveness after 24 hrs after application was found to be flubendiamide ≥ emamectin benzoate = dichlorvos ≥ chlorantraniliprole ≥ indoxacarb ≥ chlorfluazuron = tolfenpyrad ≥ thiamethoxam = dimethoate.

Forty eight hours

Maximum (77.05%) mortality was observed when larvae were treated with flubendiamide (0.014%) and emamectin benzoate (0.002%) which was remained at par with dichlorvos (0.02%) where larval mortality was 73.64 percent. Least (29.72%) larval mortality was observed in treatment dimethoate (0.03%). The order of effectiveness after 48 hrs after spray application was found to be flubendiamide = emamectin benzoate ≥ dichlorvos ≥ chlorantraniliprole ≥ indoxacarb ≥ chlorfluazuron ≥ tolfenpyrad = thiamethoxam ≥ dimethoate.

Table 2: Bio-efficacy of insecticides against tomato pinworm, *T. absoluta*

Treatments	Mortality (%)			Pooled over periods
	24 hrs	48 hrs	72 hrs	
Chlorantraniliprole 18.5 SC, 0.006%	63.41^{b} (79.97) *	63.41 ^{b} (79.97)	66.82^{a} (84.51)	64.55 ^{b} (81.53)
Thiamethoxam 25 WG, 0.01%	26.55^{e} (19.98)	39.22^{d} (39.98)	42.10^{a} (44.95)	35.96^{e} (34.48)
Dichlorvos 76 EC, 0.02%	73.64^{a} (92.07)	73.64^{a} (92.07)	77.05^{a} (94.98)	74.77^{a} (93.10)
Indoxacarb 14.5 SC, 0.015%	48.15^{c} (55.49)	53.91^{c} (65.30)	53.91^{a} (65.30)	51.99^{c} (62.08)
Flubendiamide 480 SC, 0.014%	77.05^{a} (94.98)	77.05^{a} (94.98)	77.05^{a} (94.98)	77.05^{a} (94.98)
Emamectin benzoate 5 SG, 0.002%	73.64^{a} (92.07)	77.05^{a} (94.98)	77.05^{a} (94.98)	75.91^{a} (94.07)
Tolfenpyrad 15 EC, 0.03%	39.22^{d} (39.98)	39.22^{d} (39.98)	53.91^{a} (65.30)	44.12^{d} (48.46)
Chlorfluazuron 5.4 EC, 0.016%	39.22^{d} (39.98)	45.26^{cd} (50.45)	50.75^{a} (59.97)	45.08^{d} (50.14)
Dimethoate 30 EC, 0.03%	26.55^{e} (19.98)	29.72^{e} (24.58)	42.10^{a} (44.95)	32.79^{e} (29.33)
S. Em. ±	2.51	2.75	2.32	1.46
C. V.%	9.65	9.94	7.71	9.07

Note: * Figures in parenthesis are retransformed values of *arc sine*
Treatment means with the letter (s) in common are not significant by DNMRT at 5% level of significance

Seventy two hours

Highest (77.05%) mortality was observed when larvae were treated with flubendiamide (0.014%), emamectin benzoate (0.002%) and dichlorvos (0.02%). Least (42.10%) larval mortality was observed in treatment dimethoate (0.03%) and thiamethoxam (0.01%) which was remained at par with

chlorantraniliprole (0.006%), indoxacarb (0.015%), tolfenpyrad (0.03%), chlorfluazuron (0.016%) where larval mortality was 66.82, 53.91, 53.91 and 50.75 percent, respectively. The order of effectiveness after 72 hrs after spray application was found to be flubendiamide = emamectin benzoate = dichlorvos ≥ chlorantraniliprole ≥ indoxacarb = tolfenpyrad ≥ chlorfluazuron ≥ thiamethoxam =dimethoate.
The active ingredient flubendiamide has a desirable biological activity against the *T. absoluta* larvae due to its lower ability to penetrate the plant tissue.

Pooled over period
Maximum (77.05%) mortality was observed when larvae were treated with flubendiamide (0.014%) which was remained at par with emamectin benzoate (0.002%) and dichlorvos (0.02%) in which larval mortality was 75.91 and 74.77 percent, respectively. Lower (32.79%) larval mortality was observed in treatment dimethoate (0.03%), which was remained at par with thiamethoxam (0.01%) where larval mortality was 35.96 percent. Overall order of effectiveness of the treatment pooled over period was found to be flubendiamide ≥ emamectin benzoate ≥ dichlorvos ≥ chlorantraniliprole ≥ indoxacarb ≥ chlorfluazuron ≥ tolfenpyrad ≥ thiamethoxam ≥ dimethoate.
Our findings are found more or less similar with the findings given by Sridhar *et al*. (2016) [12] described that flubendiamide 480 SC @ 0.3 ml/L was the most efficacious insecticides against the *T. absoluta*. Gacemi and Guenaoui (2012) [5] reported that emamectin benzoate showed a good efficacy (87% larval mortality) against tomato leaf miner *T. absoluta*. Deleva and Harizanova (2014) stated that flubendiamide (Belt® 24 WG) [2] caused considerable mortality against early larval stages of *T. absoluta*. The above reports are strongly in support of the present findings.

Summary and conclusion
In laboratory experiments maximum (77.05%) mortality was observed when larvae were treated with flubendiamide (0.014%) which was remained at par with emamectin benzoate (0.002%) and dichlorvos (0.02%) in which larval mortality was 75.91 and 74.77 percent, respectively. Lower (32.79%) larval mortality was observed in treatment dimethoate (0.03%), which was remained at par with thiamethoxam (0.01%) where larval mortality was 35.96 percent. Among the chemical insecticides flubendiamide was found effective.

References

1. Abbott WS. A method of computing the effectiveness of an insecticide. Journal of Economic Entomology. 1925; 18(2):265-267.
2. Deleva EA, Harizanova VB. Efficacy of evaluation of insecticides on larvae of the tomato borer *Tuta absoluta*, Meyrick (Lepidoptera: Gelechiidae) under laboratory conditions. International Journal of Science. Publications: Agriculture and food published at: http://www.scientific-publications.net, 2014; 2:158-164.
3. Desneux N, Wajnberg E, Kag W, Burgio G, Arpaia S. Narvaezvasquez CA. Biological invansion of european tomato crops by *Tuta absoluta*: ecology, history of invasion and prospects for biological control. Journal of Pesticide Science. 2010; 83:197-215.
4. European and Mediterranean Plant Protection Organization. Data sheets on quarantine pests. Bulletin OEPP/EPPO Bulletin .2005; 35:434-435.
5. Gacemi A, Guenaoui Y. Efficacy of emamectin benzoate on *Tuta absoluta* Meyrick (Lepidoptera: Gelechiidae) infesting a protected tomato crop in Algeria. Academic Journal of Entomology. 2012; 5(1):37-40.
6. Garcia MF, Espul JC. Bioecology of the tomato moth (*Scrobipalpula absoluta*) (Meyrick) in Mendoza, Argentine Republic. Revista de Investigaciones Agropecuarias. 1982; 17:135-146.
7. Kalleshwaraswamy CM, Murthy M, Shankara, VCA, Kumar NKK. Occurrence of *Tuta absoluta* (Lepidoptera: Gelechiidae) in the Malnad and Hyderabad-Karnataka regions of Karnataka, India. Florida Entomologist. 2015; 98(3):970-971.
8. Kumari DA, Anitha G, Anitha V, Lakshmi BKM, Vennila S, Rao NHP. New record of leaf miner, *Tuta absoluta* (Mayrick) in Tomato. Insect Environment. 2015; 20(4):136-138.
9. Nayana BP, Kalleshwaraswamy CM. Biology and external morphology of invasive tomato leaf miner, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae). Pest Management in Horticultural Ecosystems. 2015; 21(2):169-174.
10. Shashank PR, Chandrashekar K, Naresh NM, sreedevi, K. Occurrence of *Tuta absoluta* (Lepidoptera: Gelechiidae) an invasive pest from India. Indian Journal of Entomology. 2015; 77(4):323-329.
11. Sridhar V, Chakravarthy AK, Asokan RS, Vinesh KB, Rebijith S. New record of the invasive South American tomato leaf miner, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) in India. Pest Management in Horticultural Ecosystems. 2014; 20(2):148-154.
12. Sridhar V, Onkaranaik S, Nitin KS. Efficacy of new molecules of insecticides against South American tomato moth, *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae). Pest Management in Horticultural Ecosystems. 2016; 22(2):137-145.
13. Steel RGD, Torrie JH. Principles and Procedures of Statistics – A Biometrical Approach. 1980, 137.