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BIOLOGY AND MANAGEMENT OF TOMATO LEAF MINER *(LIRIOMYZA TRIFOLII)* IN MEGHALAYA

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ABSTRACT
Laboratory experiments and field experiments were carried out to study the biology and bio-efficacy of different insecticides against *L. trifolii* on tomato. The results of the laboratory experiments revealed that the duration of various developmental stages *i.e.* oviposition, incubation, larval and pupal periods were recorded with a mean of 2.41 ± 0.63, 3.39 ± 0.62, 2.87 ± 0.33 and 12.29 ± 1.13 days respectively and the adult stages lasted for 8-13 days with a mean of 10.02 ± 1.25 days. The fecundity ranged from 13 to 23 eggs per female with a mean of 17.5 ± 3.28 and egg hatching per cent ranged from 84.21 to 100%. The length and breadth of various developmental stages i.e. egg, larva, pupa, adult male and female were found to 0.18 ± 0.02, 0.10 ± 0.01; 0.10 ± 0.01, 0.53 ± 0.06; 1.60 ± 0.08, 0.74 ± 0.03; 1.62 ± 0.07, 0.77 ± 0.03 and 1.78 ± 0.05, 0.81 ± 0.03 mm respectively. The field experiments revealed that fourteen days after treatment Imidacloprid 200SL showed the best in controlling the *L. trifolii* compared with the other treatments.

INTRODUCTION

Tomato is a good source of all nutrients especially vitamin C, B and K. The highest productivity of tomato is incurred by Spain having 66.81 t/ha while India has only 17.50 t/ha (Meena and Raju, 2014). Tomato leaf miner, *Liriomyza trifolii* (Diptera: Agromyzidae) is a highly polyphagous pest registering its incidence on crops belonging to 25 families (Spencer, 1990) causing insurmountable loss (Gerling, 1986) and damage is mainly caused by the maggots which feed by mining into the leaves and affect the photosynthesis of the plant drastically (Sharma *et al.,* 2011). It also caused considerable losses to tomato crop in the district of Jalpaiguri, West Bengal (Chaudhuri *et al.,* 2004). Its severe infestation starting from nursery and continued till fruiting stage which resulted into severe yield loss (Ravindra Tarate *et al.,* 2016).Leaf miners are difficult to control using a contact insecticide as they are protected by leaf membrane (Simon, 2009). Though synthetic and natural insecticides are extensively used for the leaf miner control, their effectiveness has been thwarted by their indiscriminate use, impact on natural enemies, and the development of resistance within fly populations (Waterhouse and Norris, 1987). Other control techniques such as yellow board traps and host plant resistance have been also developed in Western Europe and are now used in a very local basis with some countries (Mikenberg *et al*., 1986). Abamectin, in combination with mineral oil, was introduced for chemical control of the tomato leaf miner in Bella Vista in 1994 and it is still effective in the field (Caceres, 2000). Current study was aimed to study the biology and bio-efficacy of different insecticides against tomato leaf miner in Meghalaya.

MATERIALS AND METHODS

Laboratory experiment was carried out in the Department of Entomology; ICAR-RC for NEH, Barapani, Meghalaya, India Region during March to May, 2013. Pupae of leaf miners were collected from the infested tomato plants from the field and were kept in small plastic containers (15 × 10 cm²). After hatching, twenty pairs of leaf miner adults were selected from the newly hatched adults and each pair was reared inside a plastic container measuring 15 × 10 cm² and provided with honey solution enabling the adults to lay more eggs as suggested by Vercambre (1980) and covered with wet muslin clothes to provide aeration under laboratory conditions. Fresh, uninfested and healthy leaves were exposed to the pairs to study the oviposition, incubation, larval and pupal periods respectively. Each exposed leaves were observed everyday under the microscope for counting the eggs laid by each female on the leaves. The percentage of hatching was calculated by the formula

$$\text{Hatching percentage (\%)} = \frac{\text{No. of eggs hatched}}{\text{No. of eggs laid}} \times 100$$

The Morphometrics of various developmental stages of *L. trifolii* were also studied with the help of Leica Application.

The field experiment was conducted in the field of Department

of Entomology for NEH Region, Barapani, Meghalaya, India to assess the bio-efficacy of different insecticides against *L. trifolii* on *tomato*. The experiment was conducted in Randomized Block Design (RBD) with eight treatments (including control) and three replications. Counting of pretreated (one day before spraying) and post treatment (at 1, 3, 5, 7 and 14 DAS) of leaf miner infested leaves was done as suggested by Parrella *et al*. (1985).

RESULTS AND DISCUSSION

Biology

A perusal data contained in Table 1, and 2 revealed that the ovipositional, incubation, larval, pupal period varied from 2 to 4, 2-5, 2 to 3, and 9 to 15 days respectively and the female and male adults survive from 9-13 and 8-11 days respectively. And the length and breadth of various developmental stages *i.e.* egg, larva, pupa, adult male and female were found to 0.18 ± 0.02, 0.10 ± 0.01; 0.10 ± 0.01, 0.53 ± 0.06; 1.60 ± 0.08, 0.74 ± 0.03; 1.62 ± 0.07, 0.77 ± 0.03 and 1.78 ± 0.05, 0.81 ± 0.03 mm respectively. Similar to the present studies Parrella (1987), Carlos (2005) and Hemalatha and Maheswari (2004) also reported similar findings. A perusal data contained in Table 3 also revealed that the fecundity of *L. trifolii* varied from 13 to 23 eggs and the egg hatching percentage varied from 84.21 to 100 % which is supported by the similar findings of Mizoguchi *et al*. (2011) and Ozawa (2001).

Bioefficacy

A perusal data contained in Table 4 revealed that Imidacloprid 200SL amongst the synthetic insecticides with 29.29 % leaf

Table 1: Duration of various developmental stages of leaf miner on tomato

Sl.no	Developmental stages	Duration (days) Mean ± SD	Range
1.	Ovipositional period	2.41 ± 0.63	2-4
2.	Incubation period	3.39 ± 0.62	2-5
3.	Larval period	2.87 ± 0.33	2-3
4.	Pupal period	12.29 ± 1.13	9-15
5.	Adult longevity	10.02 ± 1.25	8-13
6.	Female longevity	10.6 ± 1.27	9-13
7.	Male longevity	9.45 ± 0.94	8-11

*Observation based on twenty replications

Table 2: Morphometrics of the different life stages of leaf miner on tomato

Life stages	Length Mean ± SD	Range	Breadth Mean ± SD	Range
Egg	0.18 ± 0.02	0.15-0.21	0.10 ± 0.01	0.08-0.12
Larva	2.04 ± 0.13	1.91-2.25	0.53 ± 0.06	0.46-0.64
Pupa	1.60 ± 0.08	1.49-1.72	0.74 ± 0.03	0.70-0.80
Adult male	1.62 ± 0.07	1.52-1.75	0.77 ± 0.03	0.73-0.82
Adult female	1.78 ± 0.05	1.72-1.86	0.81 ± 0.03	0.76-0.90

*Observation based on twenty replications

Table 3: Fecundity and egg hatching percentage of *L. trifolii*

	Fecundity	Egg hatched	Hatching %age
Mean ± SD	17.5 ± 3.28	16.35 ± 3.01	93.63 ± 6.28
Minimum	13	11	84.21
Maximum	23	22	100

Turalnt of Agril. halaya. *Observation based on twenty replications

Table 4: Bio-efficacy of different insecticides against leaf miner on tomato

Treatments	Conc.(%) Dosage	Pre-treatment count	Infestation (%) of leaf miner after spraying 1 DAS	3 DAS	5 DAS	7 DAS	14 DAS	% Reduction over control	Yield Tones/ha
Imidacloprid	1.5 ml/l	72.09(58.15)	66.38(54.58)^{b}	59.98(50.77)^{c}	50.15(45.09)^{c}	44.73(41.96)^{d}	29.29(32.69)^{e}	54.76	4.33^{ab}
Dimethoate	2ml/l	73.47(59.03)	71.65(57.88)^{ab}	68.57(55.96)^{b}	63.46(52.83)^{b}	60.54(51.1)^{c}	45.21(42.25)^{d}	38.84	3.97^{ab}
Cypermethrin	2ml/l	69.84(56.73)	69.34(56.43)^{ab}	68.34(55.82)^{b}	62.77(52.43)^{b}	61.76(51.82)^{c}	52.85(46.65)^{c}	31.2	4.17^{ab}
Azadirachtin	5%	70.06(56.85)	66.38(54.57)^{b}	58.88(50.12)^{c}	48.93(44.39)^{c}	40.32(39.41)^{d}	38.77(38.49)^{de}	45.28	4.03^{ab}
Karanjin	2%	73.03(58.77)	69.76(56.68)^{ab}	67.99(55.61)^{b}	62.61(52.33)^{b}	60.55(51.11)^{c}	56.15(48.55)^{c}	27.9	3.47^{ab}
Beauveria bassiana	3g/l	76.43(60.98)	75.32(60.25)^{a}	75.32(60.25)^{a}	72.35(58.3)^{a}	71.90(58.01)^{b}	65.14(53.82)^{b}	18.91	3.24^{b}
Spinosad	1.5ml/l	68.89(56.27)	64.37(53.45)^{b}	58.92(50.17)^{c}	49.49(44.71)^{c}	44.25(41.68)^{d}	34.97(36.18)^{e}	49.08	4.10^{ab}
Control	Water spray	71.28(57.61)	71.99(58.07)^{ab}	74.1(59.42)^{ab}	77.28(61.55)^{a}	79.67(63.2)^{a}	84.05(66.53)^{a}		2.90^{b}
S.Ed. ±		O.77	0.67	0.65	0.61	0.58	0.69		0.91
C.D. (p = 0.05)		NS	3.89	3.81	3.54	3.38	4.02		1.87

*Figure followed by the different letters is significantly different

infestation and highest yield of 4.33 tones/ha proved to be the most effective in controlling the leaf miner at 14 DAS which was in agreement with the findings of Pawar *et al.,* 1996.

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