MONITORING AND MANAGEMENT OF TOMATO LEAF MINER, (*Tuta absoluta*, MEYRICK) IN KAVREPALANCHOWK, NEPAL

D. Adhikari[1], R. Subedi[2], S. Gautam[3], D. P. Pandit[4] and D. R. Sharma[5]

ABSTRACT

Tomato Leaf Miner Tuta absoluta (Meyrick 1917), an important invasive pest, was reported for the first time in Nepal during May 2016. In the year higher incidence of pest was recorded and crop damage of about 57.51% was found in Kavrepalanchowk district of Nepal. A study was carried out from December 2016 to October 2017 for monitoring and management practices of the pest. Results of plant clinic showed that out of 93 queries, 21 problems were related to tomato pests and 80.95% diagnosed as tomato leaf miner. Farmers had adopted multiple management measures of which chemical pesticides application was found the most adopted (94%). The incidence was recorded higher during transplanting time i.e. June-July and decreased gradually afterwards. Application of Chlorantaniliprole solution 50 ml/plant as soil drenching around root zones at transplanting and 30 days after transplanting showed significant reduction in pest population compared to control. Further research on management of the pest is recommended.

Keywords: Chemical control, monitoring, Nepal, tomato, *Tuta absoluta*

INTRODUCTION

Tomato is consumed as fresh table tomato and also as an essential raw material for a variety of food recipes. It belongs to the family Solanaceae, one of the most widely cultivated and consumed food crops among vegetables in the world. The cultivation of tomato during rainy season is highly profitable and popular among the farmers in Nepal. Tomato production faces several problems such as weather (temperature, humidity), diseases and insect pests.

There are several insect species which feed on tomato. Among them, recently, the South American Tomato Leaf Miner (TLM) *Tuta absoluta* (Lepidoptera: Gelechiidae) has emerged as one of the most devastating pests of tomato crop

1 PMAMP, Project Implementation Unit, Junar Superzone, Sindhuli, Nepal (Corresponding author: adhikari.debraj@gmail.com)

2 Center for Environmental and Agricultural Policy Research Extension and Development (CEAPRED)

3 Plant Protection Laboratory (Province no. 3), Hariharbhawan, Lalitpur

4 Agriculture Knowledge Centre, Gorkha, (Gandaki Provience), Nepal

5 Plant Quarantine and Pesticide Management Centre, Hariharbhawan, Lalitpur

all over the world (Tosevski *et al.,* 2011). *Tuta absoluta* (Meyrick 1917) is an invasive pest of tomato (*Lycopercum esculentum* L.) including other Solanaceous crop plants for example, potatoes (*Solanum tuberosum* L.), eggplant (*Solanum melongena* L.) and chili peppers (*Capsicum annum* L.) (Junior, 2016).

Tomato Leaf Miner *Tuta absoluta* (Lepidoptera: Gelechiidae) is an important invasive pest of tomato in Nepal. This pest was reported for the first time in Nepal from a commercial tomato farm of Kathmandu during May 2016. The pest is originated from Latin America and has spread via infested fruits and packaging material to other parts of the world (Curry, 2017). In Nepal, it is suspected to introduce from neighboring country India (Sah *et al.,* 2017). Kavrepalanchowk district was one of the districts that faced high damage on tomato crop due to this pest (Bhajracharya *et al.,* 2016). This is a serious threat to world's tomato production both in open and protected condition (Chidege *et al.,* 2016). It is very difficult to control this pest because the effectiveness of chemical control is limited due to rapid development of resistance to common insecticide and bio-control are limited due to inaccessibility by the farmers and higher costs. Thus, the integration of different available management measures such as cultural, use of traps can be used to reduce yield loss (Junior, 2016). The loss of tomato crop during the first incidence and damage was estimated 57.51 % in the Kavrepalanchowk district in 2016 (Joshi *et al.,* 2017). This study was accomplished to access the incidence of tomato leaf miner, its monitoring and management measures in Kavrepalanchowk district from December 2016 to October 2017.

METHODOLOGY

The monitoring of the pest was performed through regular e-plant clinic at Panchkhal, Kavrepalanchowk. Surveillance was also done during field visit of technical personnel of DADO Kavrepalanchowk. Review of literature was performed to assess the management practices of *T. absoluta* adopted by farmers. To assess the efficacy of Chlorantaniliprole (a systemic insecticide) drenching application at plastic house tomato cultivation in Rabiopi village of Kavrepalanchowk district with ALCORA 2 ml/lit water solution was prepared and used as following methods: i) root dipping for 15 minutes, ii) Insecticide solution was applied at the rate of 50 ml/plant as soil drenching around root zone after transplanting and 30 days after transplanting. For the experiment, 3 farmers were selected in Raviopi village of Kavrepalanchowk. These farmers were randomly selected however; they were participants of CEAPRED's Resilient Mountain Village (RMV) project. Two farmers were oriented for the application of Chlorantaniliprole for Tuta management whereas; a farmer in

the area was taken for control plot. The variety of tomato was Srijana, a Nepalese hybrid, in all treatments. The transplanting was done during last week of June, 2017 in all three plastic houses.

Data recordings of insect population in TLM lure on Wota-T trap was counted at weekly interval. The lure was replaced at every 15 days interval. The infestation of TLM larvae on leaves was recorded. Percentage of leaf damage was taken from 5 plants that were marked since the transplanting time. The data were scrutinized from the field, entered in MS-Excel and graphs prepared. The analysis of variance (ANOVA) was performed at 0.05 confidence level using R-stat software.

RESULTS AND DISCUSSION

RECORDS OF TLM IN REGULAR E-PLANT CLINIC AT PANCHKHAL, KAVREPALANCHOWK

The total records in regular e-plant clinic at Panchkhal, Kavrepalanchowk operated by DADO Kavrepalanchowk with the support of Plant Protection Directorate's Plantwise Program was 93, out of which queries on tomato was 22.5% (i.e. 21). Out of 21 records on tomato, 80.95% (i.e. 17) records were diagnosed as problem of tomato leaf miner (Fig. 1). Results of plant clinic showed that tomato leaf miner was major problem in the clinic coverage area of Panchkhal, Kavrepalanchowk. The annual report of District Agriculture Development Office, Kavrepalanchowk showed that the tomato is one of the major vegetable crops in the district (DADO, 2017)

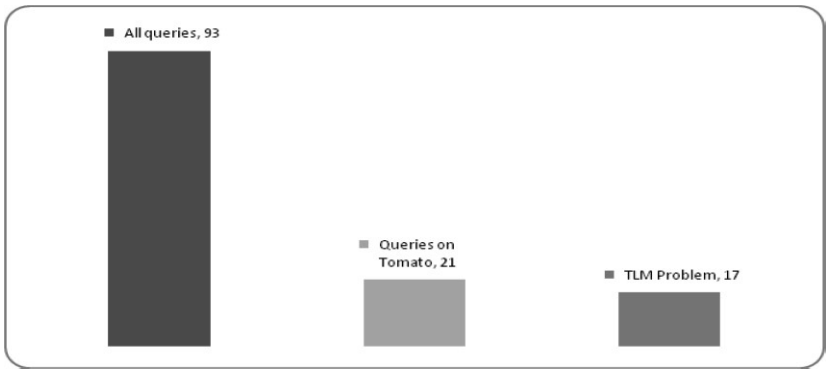

Figure 1. Results of plant clinic

(Source: Plantwise, 2017)

SURVEILLANCE OF TLM AT KAVREPALANCHOWK

The surveillance of TLM during field visit of Plant Protection Officer, other SMSs and technical staffs of District Agriculture Development Office (DADO) Kavrepalanchowk and Agriculture Service Centers (ASCs) were conducted regularly during the study period (Fig. 2). Moreover, the problematic plant samples brought by farmers at DADO, Kavrepalanchowk that were diagnosed damaged by TLM were recorded. The average infestation of tomato plants in the field level was 52.5%. Similar result was reported by Joshi *et al.,* (2017), i.e. 57.5% in Kavrepalanchowk district.

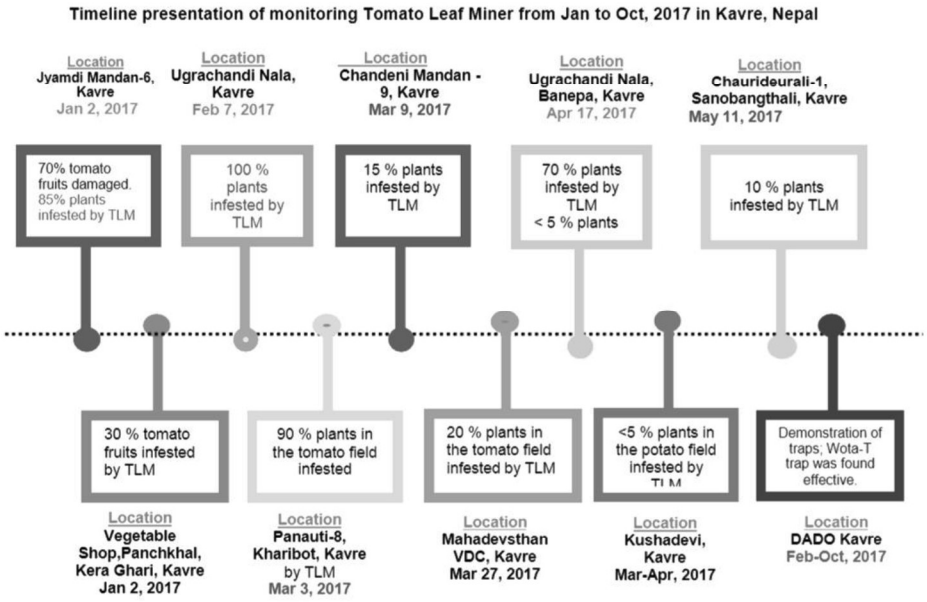

Figure 2. The incidence of Tomato Leaf Miner in different locations of Kavrepalanchowk

MANAGEMENT PRACTICES ADOPTED BY FARMERS IN KAVREPALANCHOWK

Different management practices such as cultural, physical, mechanical, quarantine, chemical attractant, botanicals, chemical practices were adopted by the tomato growers. Multiple responses of the respondents (n=50) were used as a tool for analysis of the most adopted management practices. Chemical pesticides were applied by almost all respondents (94%) followed by cultural practices (86%), Pheromone trap (66%), Quarantine measures (38%), Botanicals (32%), Mechanical methods (28%) and Physical methods (28%). Similar result was reported by Sah (2017), that 89% of the respondents used chemical

pesticide to manage TLM. Maximum use of chemical pesticide is related to its effectiveness and easiness to use. There are several measures recommended to manage this pest though, the chemical control measures are limited due to its nature of damage, life cycle and insecticide resistant nature (Agripest, 2017)

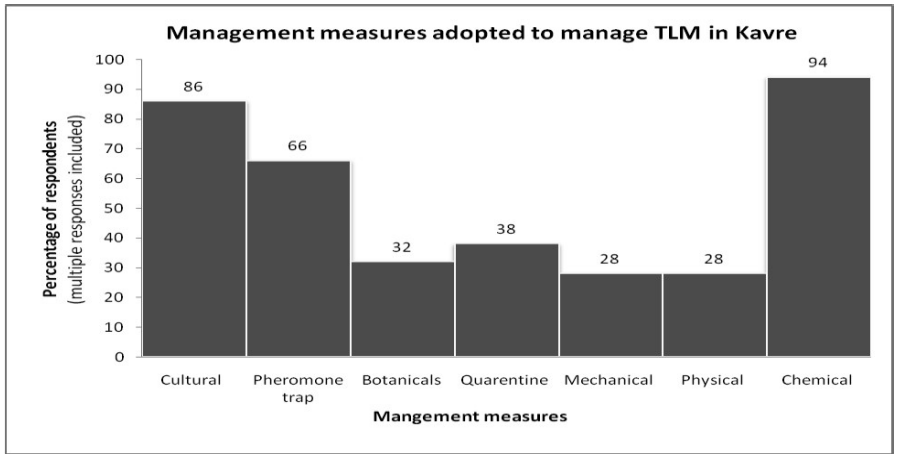

Figure 3. Management Practices adopted by Farmers in Kavrepalanchowk

(Source: Gautam et al., 2018)

Majority of tomato farmers removed and destroyed infested plant parts and followed crop rotation as cultural management of this pest. Hand picking of larva and use of insect exclusion net (especially in nursery condition) and sticky traps were mostly used as mechanical method. Use of light trap was mostly practiced under physical method. Para-pheromone TLM lure in Wota-T traps or locally prepared traps were used by the most of the tomato growers. In addition to this, they have adopted internal quarantine measures by avoiding transport of seedlings and farm equipment from one place to other. Neem based pesticides (Neem raj), Jholmol, and DADA guard plus were commonly used botanical pesticides whereas Emamectin benzoate (KINGSTAR, EMAR), Chlorantaniliprole (ALLCORA and CORAGEN), Spinosad (TRACER), Chloropyriphos and Cypermethrin etc. were mostly used chemical pesticides in Kavrepalanchowk. About one quarter of respondents who used chemical pesticides didn't know which chemical pesticide they used (Gautam et al., 2018). *Tuta absoluta* is a very difficult pest to control. Chemical control is difficult as the insect is often sheltered in the leaf mines, and have a fast ability to develop resistance to insecticides. Para-pheromone traps are used to monitor the adult moths (Curry, 2017).

MONITORING OF TLM ADULTS AND ASSESSMENT OF THE EFFICACY OF CHLORANTANILIPROLE DRENCHING TO MANAGE TLM

TLM adult trapped in pheromone trap

TLM adult trapped in pheromone trap were recorded by counting the number of adults trapped in Wota-T trap. The result of TLM adults populations trapped in pheromone trap showed higher number during the transplanting time i.e. during June-July. This result is similar with an experiment where fluctuation of the pest was peak during mid June and decreased later on (AL-Sawy *et al.*, 2016). However, the population gradually decreased. The trend line shows decreasing of Tuta population both in treatment and control plots. However, in treatment plots the decreasing trend was more rapid than the control plot. In initial days, the population of adult TLM was higher inall the plots but during 15 weeks of interval Tuta population decreased more at two treatment plots and slightly less in control plots. The ANOVA results show that there were significant differences in TLM population among different treatments. The mean comparison with TUKEY HSD showed that there was significant difference in TLM population between ALC. 2 and Control but non-significant difference in ALC.1 and ALC. 2. Similarly non-significant difference was seen in ALC.1 and Control (Annex-1). Effective control of Tuta absoluta was achieved with treatment of Chlorantaniliprole in an experiment conducted at commercial farmers' field inside poly-house tomato (Bajracharya *et al.*, 2017).

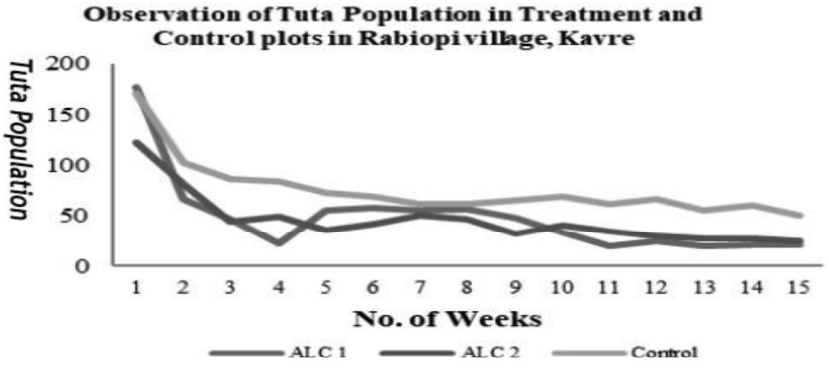

Figure 4. TLM adult trapped in Pheromone trap in treatment and control plots at Kavrepalanchowk

Percentage of leave affected by TLM

TLM infestation level was observed in tomato leaves. Percentage of leaf infested in an individual plant was recorded. The data for percentage of leaf infestation showed that there was higher infestation of TLM larvae on leaves in control plots. In two treatment plots the infestation levels were lower. However, the results were not statistically difference in percentage of leaf infestation by the insect (Annex-2). It was found that in control plots the percentage of leaf infestation was higher. Foliar application of Chlorantraniliprole insecticide is one of a recommended chemical measures to control TLM (PPD, 2016). Besides chemicals, application of neem-based products by soil drenching showed more stable effect under both laboratory and greenhouse conditions (Jacobson, 2016).

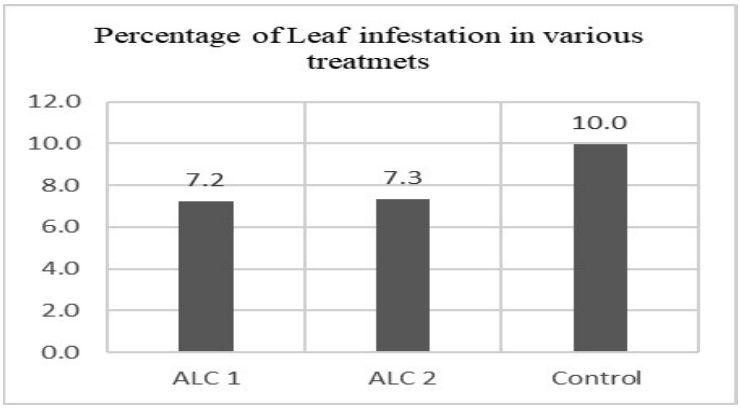

Figure 5. Percentage of leave affected by TLM in treatment and control plots at Kavrepalanchowk

CONCLUSION

Tomato Leaf Miner is an important pest of tomato in Nepal including Kavrepalanchok district. This pest occurred in the tomato growing area of district in all seasons during 10 months period of surveillance. Though, the level of infestation differed with management measures employed. Cultural measures and pheromone traps were used by the most of the farmers though, the integration of chemical insecticides were adopted by maximum farmers to manage this pest. Exploration of non-chemical measures including biological measures (parasitization) should be integrated for successful management of this pest. The initial result of chlorantaniliprol was found minimized the infestation by TLM larvae. Though, the further research is necessary. Awareness and adaptation of integrated measures in community level could be a strategy to combat this pest.

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Annex-1: ANOVA- TUTA Populations					
Source of Variation	*df*	SS	*MS*	*F*	*Pr(>F)*
Treatment	2	8249	4125	4.033	0.025 *
Residuals	42	42956	1023		
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1					
Tukey multiple comparisons of means (95% family-wise confidence level)					
Treatment	*Difference*	*LWR*	*UPR*	*p. adj*	
ALC.2-ALC.1	-2.60000	-30.970811	25.77081	0.9730599	
Control-ALC.1	27.33333	-1.037478	55.70414	0.0610576	
Control-ALC.2	29.93333	1.562522	58.30414	0.0366447*	

Annex-2: ANOVA- Effect on Leaf infestation						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Treatments	*63.6512*	*2*	*31.8256*	*35.69762*	*2.86E-09*	*3.259446*
Residuals	*32.09518*	*36*	*0.891533*			
Total	*95.74638*	*38*				