Journal of the Plant Protection Society

Volume 5 **2018**

Plant Protection Society Nepal

Research Article

EFFECTIVENESS OF DIFFERENT TYPES OF TRAPS FOR MANAGEMENT OF *TUTA ABSOLUTA* IN NEPAL

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ABSTRACT

Among the various potential vegetables, tomato is one of the high value crops, with growing market demand and higher level of return per hector. South American Tomato leaf miner, *Tuta absoluta* is one of the main constrains in tomato production in Nepal. Field experiments were conducted from June to October 2017 to determine the attractive action of trap colours against *T. absoluta* management in Lele VDC, Lalitpur, Nepal. Experiments were setup using different types of traps (Delta trap, Wota-T trap and solar light trap) each with pheromone capsule i.e. TLM lure. Particularly, in this experiment the influence of color (orange, white, yellow and green) in delta trap, height adjustment from ground level - 1 feet, 2 feet, 3 feet and 4 feet) in Wota-T trap and; locally prepared light traps of led bulb, solar light trap with high power of 65 lumens and solar light trap with low power of 25 lumens to capture *Tuta* moth were tested. For the evaluation of effectiveness of different types of traps, number of *Tuta* moths captured were recorded. The results demonstrated that *T. absoluta* moths can distinguish between the colours. White colored delta trap captured maximum mean number of *Tuta* moth (22) followed by green (16), yellow (13) and orange (10). Similarly, Wota- T trap when placed at different height, trap placed at ground level captured maximum mean number of *Tuta* moths (15) followed by One ft (12), Two ft(11), Three ft(8) and Four ft(2). Among the different types of light trap solar light trap with high power of 65 lumens captured maximum mean number of *Tuta* moth's (5) followed by solar light trap with low power of 25 lumens (3) and locally prepared light trap with led bulb (2). Significant differences between mean moth catches by different colored delta traps, wota-T trap placed at different height and different types of light traps were observed. Based on the study conducted with in a season

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it were found that trap color, trap height and light trap types are the characteristics that strongly affect the response of *T. absoluta* moths to pheromone-baited traps. From the study it is clear that, these traps can be used as one of the best sex pheromone based management strategy for the management of *T. absoluta* moths. Further research is recommended for better understanding of the effect of trap colour on the diversity and abundance of non target insects captured.

Key words: Color trap, Delta trap, Solar light trap, *Tuta absoluta*, Wota-T trap

INTRODUCTION

In Nepal, there is a great potentiality of growing wide range of vegetable crops because of the availability of a wide range of agro climatic and topographical variations from subtropical, temperate to cold climate. Among the various potential vegetables, tomato is becoming a high value crop, with growing market demand and higher levels of return per hector, can help to improve incomes for small landholders who are producing cereals and other agriculture commodities with relatively low returns. Tomato is being grown from Terai (<300 m above sea level) to an altitude of 2,500 meter above sea level (msl). It is cultivated in 20,046 ha area in Nepal with a total production of 484036 mt. In Kathmandu tomato is cultivated in 210 ha area with a total production of 8250 mt. In Bhaktapur, tomato is cultivated in 170 ha with a total production of 5372 mt and in Lalitpur it is cultivated in 148 ha with a total production of 4455 mt (MESD, 2015). Besides having enormous potentiality, yield losses due to several biotic and abiotic factors are main constraints to increase tomato production. Among these, incidence of insect pests and plant diseases are considered as a major factor. In the present context, South American tomato leaf miner, *Tuta absoluta* (Meyrick, 1917) has become one of the most serious insect pest to be managed for tomato cultivation (Korycinska *et al*., 2009). It is a devastating pest of tomato belonging to the order Lepidoptera and family Gelechiidae.

As a common knowledge, agricultural pests can reduce yield, increase costs (related to their management), and lead to the use of pesticides which ultimately lead to the disruption of existing natural control system (Thomas, 1999). *T. absoluta* can reduce the yield and quality of tomato in newly invaded areas up to 80-100% both in field and greenhouse conditions if control measures are not applied (CABI, 2011/13;Desneux *et al.* 2011). *This pest* is also associated with solanaceous cultivated crops such as eggplant and potato (EPPO, 2009; Desneux *et al*., 2010; Unlu, 2012; Megido *et al*., 2013). Since 1960s, this moth has become one of the key pests of tomato crops in South America. The first record of occurrence of this pest in Nepal was reported by Bajracharya *et al.* (2016) from a tomato farm of Tarakeshwor Municipality, (27°44.661' N latitude and 85°18.895' E longitude) of Kathmandu in 3rd May 2016. Later on, this pest is recorded from Kathmandu, Lalitpur, Bhaktapur, Kavre and Dhading districts (Bajracharya *et al.*, 2016). This pest imposes a serious threat to the

sustainability of tomato farmers as this is considered as one of the most demanding regions for tomato in Nepal.

Since the pest is most devastating and has been introduced in many countries, chemical sprays have been the main method of control used against *T. absoluta* (Galarza *et al*., 1984). In order to reduce the excessive use of chemical pesticides against *Tuta* , it is necessary to use the environmentally f control strategies including cultural methods such as crop rotation, removal and destruction of infected plant materials, use of natural enemies (parasitoids, predators, entomopathogens and nematodes), use of resistant varieties, use of insect sex pheromone for controlling and monitoring of *Tuta* moth. Insect sex pheromone has been widely used to monitor, forecast or trap moths in mass (Prasad *et al.*, 2012). There are different types of traps like wota-t trap, light trap, delta trap which are used in conjugation with the pheromones for effective monitoring, mass trapping and controlling of *Tuta* moth (Howse, 1998). It is utmost important to assess their efficiency of capturing moth in infested locations. Thus, this study was designed to assess the efficiency of various traps for monitoring, mass trapping and controlling of the moths. This pest is newly emerged in Nepal so farmers are unaware about what management practices to be applied to manage the pest population. Result of this study is much more useful for farmers to choose the most effective trap for controlling of *Tuta* moths. Moreover, the outcome of this study is useful for researchers and extension officers for further research and innovations directed towards the management of invasive pest like *T. absoluta*.

MATERIAL AND METHODS

Godawori Municipality in Lalitpur district was selected as a research site for the study. Crop grown by the farmers in this area includes tomato, potato, rice, wheat, barley, onion, cauliflower, cabbage, cucumber, bitter gourd etc. Farmers in this area mainly grows tomato in rainy season from June- September as an off season crop and in rest of the season vegetable like cauliflower, cabbage, cucumber, bitter gourd etc. are grown. The climate of this district is classified as warm and temperate. The summers are much rainier than the winters. The average annual temperature in Lalitpur is 17.8°C. The annual district precipitation is 1430 millimeters

The experiments was conducted in six farmer's field of Ranagaun, Godawari-6, Lele VDC Lalitpur from 16thJune 2017 to 13th October 2017 in the six farmers' poly houses. In the entire field, stages of the plant were same i.e. fruiting stage. The sizes of the plastic house were 60 m² (5 m X 12 m). Three experiments were carried out using three different types of traps viz Delta trap, Wota-T trap and Light trap, baited with TLM lure which is manufactured by Pest Control India each with different treatments. Delta sticky trap with four treatments (Orange, White, Yellow and Green colored delta sticky trap), Wota-T trap with five treatments (placed at Ground level, One ft, Two ft, Three ft and Four ft) and light trap with three treatments (Locally prepared light trap with led bulb, solar light trap with

high power of 65 lumens and solar light trap with low power of 25 lumens) were used in the experiments separately. All these treatments were replicated two times.

Experiment-1: The first experiment was conducted to determine the attractive action of different colours to *T. absoluta* moths. Delta traps with four different colours i.e. orange, white, yellow, and green colored delta traps were fitted inside the tunnel at different places. TLM lure used in different colored delta traps were changed at 60 days interval and the colored delta traps were changed at five weeks interval. During the experiment TLM lure were changed two times while the colored delta traps were changed three times.

Experiment-2: In the second experiment, Wota-T traps were fitted inside the tunnel at different places with five different treatments i.e. at different heights from ground level, 1 ft, 2 ft, 3 ft and 4 ft. Wooden stick was used to fit the Wota-T trap at different heights. Soap water were made and added in this trap and it was changed after counting the moth population at every week interval. TLM lure used in water trap were changed at 50 days interval and it were changed three times during the experiment

Experiment-3: Three different types of light traps : (i) locally prepared light trap with led bulb, (ii) low power solar light trap of 25 lumens, and (iii) high power solar light trap with 65 lumens, were fitted at different places inside the tunnel at the fruiting stage of the tomato plant. Bucket of soap water with pheromone lures for all three different types of lights were placed at the ground and light were fitted 20 cm above the ground. Soap water was changed after each recording.

Data Recording

Light traps data were recorded by counting the number of *Tuta* moths captured twice a day in the morning (5.00 - 6.00 AM) and evening (8.00 - 9.00 PM) time for one week continuously. In case of delta traps, data were recorded by counting the number of moths captured in different colored delta traps at weekly interval for 18 weeks while in wota-T trap data were recorded by counting the number of moths captured in wota-T trap placed at different height at weekly interval for 13 weeks.

RESULTS AND DISCUSSION

Evaluation of different colored delta traps

The weekly trend of trapping of the moths captured in different colored delta traps is shown in the figure 1. It was observed that the highest mean number of the moth were captured in white colored delta trap (22 ± 3.50) followed by green colored delta trap (16 ± 2.55), yellow colored delta trap (13 ± 2.17) and orange colored delta trap (10 ± 1.85). There were significant difference ($P = 0.023$) between the mean number of *T. absoluta* moth captured in different colored delta traps. The result of the experiment-1 indicates that white sticky delta trap with TLM lure is superior than delta trap with other colours. The similar result has also been reported by Mahmoud *et al*. (2014).

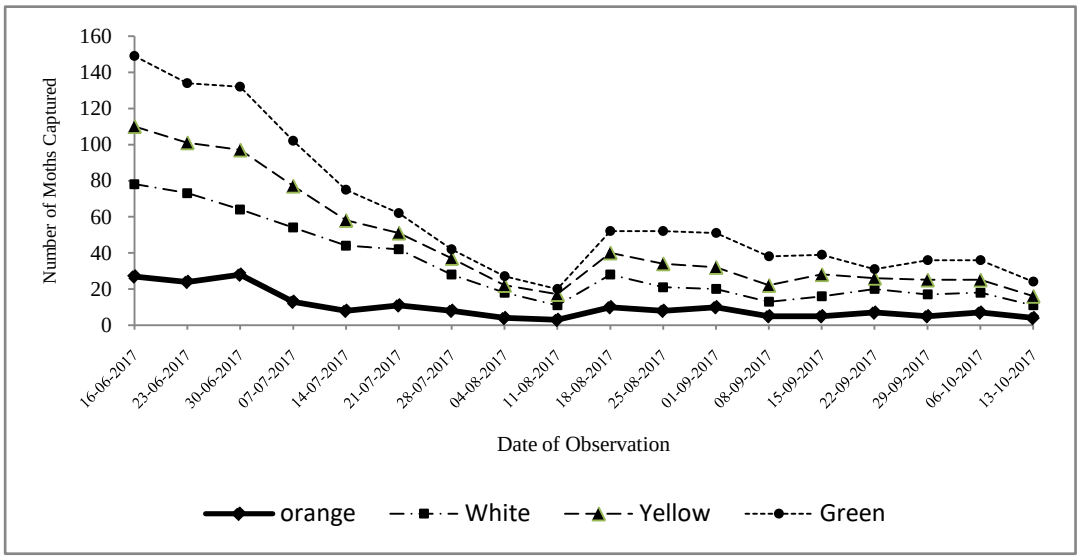

Fig. 1 : Weekly trend of trapping of *Tuta* moths captured in different coloured delta trap

Melaughlin *et al*. (1975) results found that, traps of low spectral reflectance were more effective in capturing *Trichoplusiani* (Hubner) and P*seudoplusia includes* (Walker). Moreover, Mitchell *et al*. (1989) mentioned that visual stimuli tended to overcome a normally strong attraction response to a powerful olfactor stimulant sex pheromone, while Parra-Pedrazzoli *et al*. (2009) found that the models and colour of the raps do not interfere with male *Phyllocnistis citrella* Stanton moth capture efficiency. Trap colour was not previously reported to be a specific factor influencing the capture of *T. absoluta* moth in Nepal. This study is the first report so far in Nepal on the effect of trap color on capture of *T. absoluta* moths. Trap color has been reported to be a significant factor affecting catches of several other moth species.(Taha *et al*. (2012); Medrek *et al*. (1972); Agee (1973); Melaughlin *et al*. (1975); Mitchell *et al*. 1989; Kinght and Fisher 2006).

In conclusion, white traps in our study appeared to be the most attractive color for monitoring *T. absoluta* moths and can be used to enhance the effectiveness of pheromone baited traps. Further research is recommended for a better understanding of the effect of trap color on the diversity and abundance of non target insects captured in the traps.

Evaluation of Wota-T trap placed at different heights

The height of Wota-T traps plays an important role in the moth capture. The weekly trend of trapping of the moth in Wota-T trap placed at different height is presented in the figure 2. It was observed that the highest mean number of *Tuta* moth were captured in Wota-T trap placed at ground level (15 ± 1.34) followed by the trap placed at one ft (12 ± 0.77), two ft (11± 1.86), three ft (8 ± 1.37) and four ft (2 ± 0.46). There was a significant difference between the mean number of the moth captured in Wota-T trap placed at different height (*P*

= 0.0008). The results of experiment-2 show that the best position to place Wota-T trap is at ground level. The similar result has also been reported by Mahmoud *et al*. (2014).

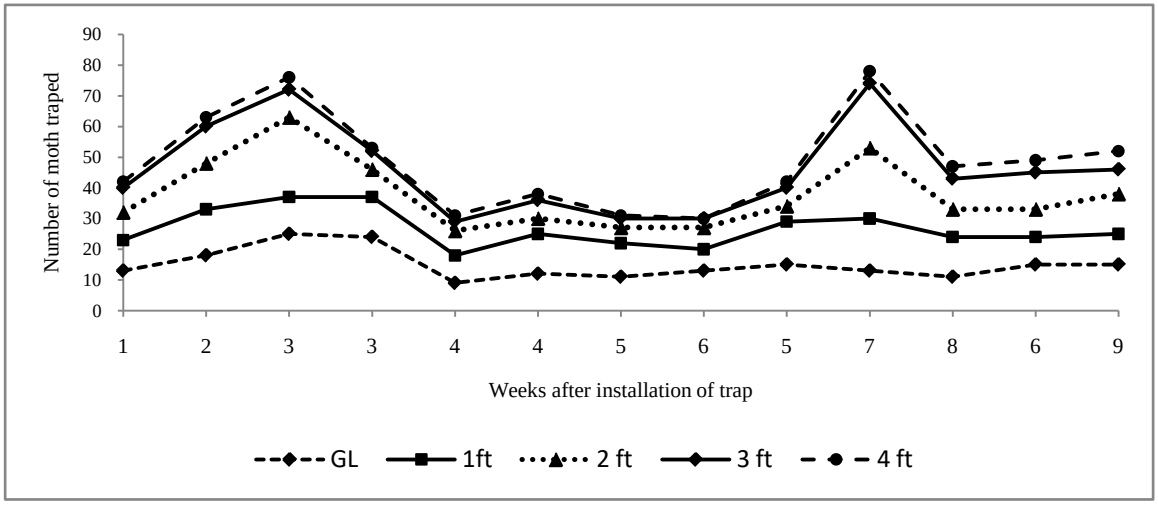

Fig. 2 : Weekly trend of trapping of *Tuta* moth in Wota-T trap placed at different height

Evaluation of different types of light trap

The mean number of *Tuta* adult captured in different types of light trap is shown in the figure 3.

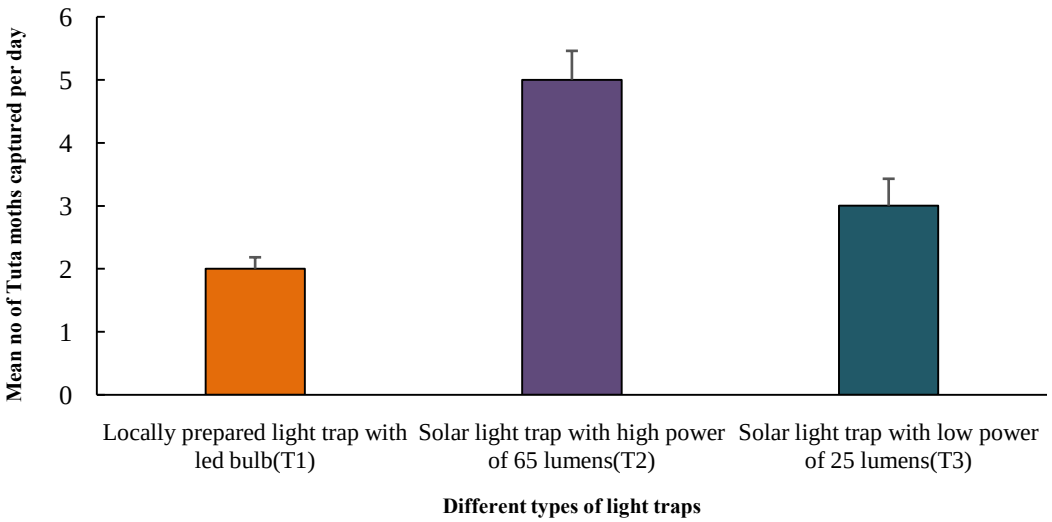

Fig. 3 : Mean number of the moths captured in different types of light trap

There were significant differences between the different types of light traps (P = 0.0001). Different types of light trap plays an important role on the moth capture. The highest mean number of the moths were found in solar light trap with high power of 65 lumens (5 ± 0.46)

followed by solar light trap with low power of 25 lumens (3 ± 0.43) and locally prepared light trap with led bulb (2 ± 0.18).The result of the experiment-3 shows that solar light trap with high power of 65 lumens is the most effective one.

CONCLUSION

The result indicated that among the different types of pheromone baited traps, delta sticky trap with white color, wota-T trap placed at ground level, and solar light trap with high power are the best option for controlling and monitoring *T. absoluta* adult population. These traps caught maximum number of *Tuta* moths in comparison to other options. These traps can be used as one of the best sex pheromone based management strategy for the management of *Tuta absoluta* moths.

ACKNOWLEDGEMENT

We would like to thank all the tomato growers of Godawori Municipality in Lalitpur district who helps in providing their field for the research trials. The authors also wish to thank USAID's Asian Vegetable and Mango IPM-IL and iDE, Nepal for providing the support for this research work. This research was made possible through the project funded by USAID under the cooperative agreement no. AID-0AA-15-00001 feed the Future Innovation Lab for Integrated Pest Management implemented by Virginia Tech globally and IDE in Nepal with consortium of CEAPRED.

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