

# INTEGRATED MANAGEMENT OF MANGO STEM BORER (*Batocera rufomaculata* Dejan) IN NEPAL

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## ABSTRACT

*Mango Stem Borer (Batocera rufomaculata Dejan) is a major insect pest of mango in Eastern Terai of Nepal, mainly Saptari, Siraha, Sunsari, Morang and Udaipur district. An experiment was carried out during 2010 and 2011 for management of mango stem borer at Regional Agricultural Research Station (RARS), Tarahara in Completely Randomized Design with eight treatments in four replications. Among eight treatments, Imidacloprid 17.8% SL, Thiamethoxame 25% WG and Trizophos 40% SL performed the best in management of mango stem borer. For the verification of on station result, on-farm experiment was carried out at Rupnagar, Bastipur, and Saptari during 2011 and 2012 including five promising treatments in four replications. Among the treatments, Imidacloprid 17.8% SL and Thiamethoxame 25% WG were effective for management of mango stem borer.*

**Key word-** Integrated Pest Management, Mango Stem Borer, *Batocera rufomaculata*, Imidacloprid 17.8% SL, Thiamethoxame 25% WG.

## INTRODUCTION

Mango (*Mangifera indica* L.) a member of family Anacardiaceae is known as king of fruits, for its sweetness, excellent flavor, delicious taste and high nutritive value in South Asia (Atwal, 1986). This important tropical fruit is being grown in more than 100 countries. It is also a valuable environmental and shade tree, which contributes to the protection of soil against erosion and different medicinal virtues. A number of insect pest are known to attack the mango trees and have been studied in detail ( Sen 1955, Giani 1968 and Herren 1981; Tandon & Verghese, 1985). Mango stem borer (*Batocera rufomaculata* Dejan) is a major pest of mango in Eastern Terai Region (ETR) of Nepal; the grub, which is a damaging stage, damages the tree by cutting and chewing of newly emerged twigs and shoots. Once the grub enters into the shoot, it creates tunnel inside the stem and damages the stem resulting in drying of shoots. Severe infestation affects the whole shoots and tree looks like burned trees causing heavy reduction in yield. The larvae of the pest live for long time (about 1 year) and hibernate in winter inside the dry shoot. When the weather warms up the larva activates and pupates inside. The adult emerges and starts laying eggs from July to August. This pest was minor in the region a decade back. Only few dry shoots were usually found hanging over the tree. But due to devoid of management tools including sanitation of orchard and timely pruning of dry shoots from the trees, multiplication of the mango stem borer takes place. Now a days, it has become a severe problem not only in Saptari but it is moving towards other districts of the ETR of Nepal.

Mango stem borer is one of the major pests of mango orchards. The farmers are destroying the orchards in eastern region due to the heavy infestation of this pest. A survey in Siraha and Saptari districts showed that mango fruit fly, mango hopper and mango fruit borer were mainly prevalent (Regmi *et al.*, 2004). Chaudhary (1999) worked on management of mango stem borer at RARS, Tarahara, but conclusive result could not be obtained. Mainali and Ojha (2001) found Thiodan 35 EC @ 0.05% solution ( 2 ml/hole of borer) as fairly effective. Kerosene and petrol, metacid and thiodan, in order, were found effective to control popular stem borer (*Apriona cinerea* Chevrollet) (Sagwal, 1987). Due to the lack of knowledge on time of insect pest incidence and their nature of damage, insect pest management programs become less effective. The mango stem borer feeds internally and thus becomes difficult to control once the larvae enter the mango stem/shoot. The past works at RARS, Tarahara was incomplete and was lacking conclusive results (Chaudhary 1999; Mainali and Ojha, 2001), because the time of treatment application was mis-matched with the growth stage of the insect.

## MATERIALS AND METHODS

### Survey of mango stem borer damage in ETR

Survey of stem borer damage in ETR was conducted using a questionnaire accompanied with field observation at different stages of mango in Saptari, Siraha and Udaipur districts. The survey and field observation of the orchards indicated that mango stem borer was/is a serious pest of mango in Saptari and it is also shifting to Siraha and Udaipur districts. A detailed farm and farmers' survey was conducted among 30 farmers in each district in ETR of Nepal during 2010-11 by using pre-tested semi-structured questionnaire. The survey gathered the information on insect pest incidence, their nature and extent of damage (symptoms, plant-parts infested, time of attack and extent of damage due to insect pests) in different cultivars of mango fruit and available management practices. Survey was also supported by focused group discussion and on farm verification through field inspection/observation, sample collection and insect pest identification. The relative importance of insect pests was assessed in 1-4 scale. The team for survey of insect pest of mango in ETR was led by Entomologist of RARS, Tarahara and it included Regional Director, RARS, Tarahara, Mr. Bedanand Chaudhary; International Mango consultant, Dr. Leo N Namuco, from UPLB, Philippines (hired by CADP) and Horticulturist of RARS, Tarahara. The finding of the survey showed that mango stem borer was the major problematic insect pest in ETR. In Saptari district almost all orchards were damaged by the pest and the mango growers were worried with this problem.

### Life cycle study of mango stem borer

The life cycle study was done at Horticulture Research Unit of RARS, Tarahara. The borer infested Amrapali mango trees were selected for the study purpose. The standing tree was covered by cloth net (mosquito net) and no any treatment was applied. The observation was taken at 15 days interval. The study was started from July 2011 to October 2012. It showed that the mango stem borer adult started laying eggs on the bark and dead shoots of mango tree from July to August and egg hatching took place within 10- 15 days. Newly hatched larvae of the pest started feeding upon the newly flushed leaves and started boring onward. Once the larva entered the shoot, they started cutting and boring the shoots.

### Insect pest management on RARS, Tarahara

The experiment was laid out in four replicated Completely Randomized Design (CRD) including following 8 treatments-

1. Bhath leaf extract @ 5% solution
2. Bojho stolen extract @ 5% solution
3. Gumma leaf extract @ 5% solution
4. Bordo mixture @ 10% solution
5. Thiomethoxame 25% WG 1 gm/L of water
6. Imidachloprid 17.8 SL 1 ml/L water
7. Trizophos 40% EC 2 ml/L water
8. Control (No treatment)

All the above treatments were sprayed on individual mango trees 5 times at 15 days interval from egg laying time of the pest (July-August). The spray was done on leaves, stems as well as main trunk of the tree properly. The dried branches and twigs after boring by the insect were counted. The recorded data were transformed using square root transformation and analyzed.

### On farm verification of treatments

The experiment was laid out in a completely randomized design with four replication at problematic farmer's orchard of Rupnagar VDC, ward number 1 ( Mr. Somnath Bhattarai and Mr. Rishiraj Nepal), Saptari district for verification of three best treatments. The treatments were as follows-

- T1 Imidacloprid 17.8 % SL @ 1 ml/l of water
- T2 Thiamethoxame 25% WG @ 1 gm/l of water
- T3 Trizophos 40% SL @ 2 ml/l of water
- T4 Chlorpyrifos 20 % EC @ 2 ml/l of water
- T5 Control (Untreated)

All the above treatments were sprayed on individual mango trees 5 times at 15 days interval from egg laying time of the pest (July-August). The spray included leaves, stems as well as main trunk of the tree properly. The dried branches and twigs after boring by the insect were counted. The recorded data were transformed by square root transformation and analyzed.

## RESULT AND DISCUSSION

### Mango insect pest survey

Mango stem borer was a major insect pest of mango in Saptari district. Almost all the mango orchards were infested with the pest. On an average, 30 % damage was recorded. In severe case, about 60 % dry shoots were observed in the orchards at Rupnagar VDC ( Survey report of RARS, Tarahara, 2067-68). Its infestation was also increasing in Udaipur where 20 % damage was recorded from different orchards. In addition, damage of fruit fly (*Dacus dorsalis*) was recorded severe (> 50 %) in almost all orchards in Udaipur. In Siraha, incidence of mango stem borer was recorded less than that of other two districts (10%), but damage was in increasing trend. In Siraha, mango hopper and mango mealy bug were more problematic. After harvest, farmers never used to visit the orchards. They did not follow weed management, fertilizer management, insect pest management and other practices like training, pruning, etc. properly. This led to build up of insect pest population.

### Life cycle study of mango stem borer

Mango stem borer damages the young shoots of mango trees resulting in their complete drying. Therefore, it is very important to know the actual stage of the pest that creates such type of damage, for its proper management. Once larva enter into shoots, it is very difficult to control them, because dry shoot does not carry any type of pesticides towards the place where larva remains. If we can know the actual egg laying time of the pest it will guide to manage them. The study conducted at RARS, Tarahara revealed that emergence of adults took place from May-June (Jestha) and they started laying eggs upon dry shoots and dead barks from June-July (Asadh). This result guided to start application of pesticides.

### Management of mango stem borer at RARS, Tarahara

The pesticides significantly differed in reducing borer infestation (Table 1). Chemical pesticides Trizophos 40% SL, Imidacloprid 17.8% SL and Thiamethoxame 25% WG were more effective in reducing dry shoot length over control. Other chemicals as well as botanical extracts were also effective in reducing borer damage than that of control.

**Table 1.** Efficacy of different chemical and botanical pesticides in controlling mango stem borer at RARS, Tarahara during 2010-2012.

SN	Treatment	Mean Dry Shoot Reduction over Control	Rank
1	Bhath leaf extract	119.00	BC
2	Sweet flag stolen extract	135.50	B
3	Gumma leaf extract	144.75	B
4	Bordo mixture	147.50	B
5	Thiomethoxame 25% WG	199.50	A
6	Imidachloprid 17.8 SL	199.50	A
7	Trizophos 40% EC	201.75	A
8	Control	0.00	
	F Test	**	
	LSD Value (alpha=0.05)	27.07	
	CV %	12.93	

**Table 2.** On farm verification of mango stem borer management technology at Rupnagar, Saptari during 2011-2012.

SN	Treatment	Mean Dry Shoot Reduction over Control	Rank
1	Imidachloprid 17.8% SL	768.75	A
2	Thiomethoxame 25% WG	803.75	A
3	Trizophos 40% SL	724.50	AB
4	Chloropyriphos 20% EC r	694.50	BC
5	Control	0.00	
	F Test	**	
	LSD Value (alpha=0.05)	71.37	
	CV %	7.92	

Based on on-station results, promising chemicals and methods were tested at Rupnagar VDC, Saptari for mango stem borer management. The tested chemicals varied significantly for minimizing borer damage (Table 2). All the tested chemicals were effective for stem borer management over control. Imidacloprid 17.8% SL and Thiamethoxame 25% WG were the most effective in reducing borer damage.

#### CONCLUSION

Based on the results, it shows mango stem borer is a major pest of mango in Saptari, Siraha and Udaipur districts. Orchard sanitation, training, pruning and destruction of dry shoots are crucial for management of mango stem borer. Application of Imidacloprid 17.8% SL @ 1 ml/l of water or Thiomethoxame 25% WG @ 1 gm/l of water 5 times starting from 2<sup>nd</sup> week of Asadh (July) at 15 days interval was effective for mango stem borer management.

#### RECOMMENDATION

Mango is a major commodity of ETR, but the mango orchard is being encountered by several harmful insect pests, especially mango stem borer. Orchard sanitation and timely pruning are the crucial activities for management of mango stem borer. The effective technology should be replicated in all mango orchards in ETR to mitigate borer damage and increase mango production. Rigorous training on mango stem borer management to mango growers and concerned stakeholders is required. Awareness activities are also necessary through different mass media such as radio, TV, leaflets, poster, etc., otherwise the status of mango orchard in ETR is in danger zone.

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## REFERENCES

- Atwal A S, 1986. Agricultural Pests of India and South-East Asia. Kalyani publication New Delhi. pp 529.
- Sagwal S S 1987. Control of Stem Borer (*Apriona cinerea* Chevrollet ) in *Populus ciliate* Wall ex. Royale Pesticides.
- Chaudhary, D K. 1998/99. Preliminary investigation on Mango Stem/Shoot borer. Annual Report, RARS, Tarahara pp: 61-62.
- Mainali, B P and M Ojha, 2000/2001. Management of Mango Stem Borer, Annual Report RARS, Tarahara pp:61-62.
- Bhusal, S J 2005/2006. Insect pest complex of Mango fruit in Koshi East Terai Region, Annual Report RARS, Tarahara pp:62-65.
- Hidayah B N , 2013. Effectiveness of Pesticides in controlling Major Pests and Diseases of Mango in West Nusa Tenggara Province, Indonesia. 3rd International Conference on Chemical, Biological and Environment Sciences (ICCEBS'2013), January 8-9, 2013. Kuala Lumpur (Malaysia), pp 53-55.