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Management of Potato Tuber Moth, *Phthorimaea operculella* (Zeller) of Rabi Harvested Potato Crop under Storage Condition in Hassan District of Karnataka

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ABSTRACT

The storage of potato is a major challenge faced by the farmer due to the infestation of potato tuber moth (PTM). For management of PTM under storage condition, various treatments were attempted which included botanicals, biological agent and chemical control method. The methods were repeated during consecutive year. During 2019, among the different treatments for storage of **rabi** harvested potato crops, the per cent PTM damage, larvae/tuber, tunnel/tuber and rotted tuber were significantly lower in T_2–*Azadiractha indica* leaves by 35, 5, 5 and 14%, respectively; followed by T_9–*Bacillus thuringiensis* (2%) as 41, 6, 6 and 15%, respectively. Treatment T_3–*Lantana camara* leaves showed 44, 7, 7 and 16% damage, respectively. During 2020, per cent PTM damage, larvae/tuber, tunnel/tuber and rotted tuber showed similar trend. Hence, mulching with *A. indica* leaves, treatment of 2% *B. thuringiensis* and mulching with *L. camara* leaves was found to be effective for post-harvest management of potato tuber moth under storage.

Key words : Potato tuber moth (PTM), percentage of infestation, **rabi** season

INTRODUCTION

Potato (*Solanum tuberosum* Linn.), popularly known as 'King of vegetables', is originally a native of South America. Potato is the world's fourth largest food crop after wheat, rice and maize. The crop is cultivated throughout the world as it is a staple food in majority of the places. The crop is suitable for various climatic conditions. However, storage is a major challenge faced by the farmers due to the infestation of potato tuber moth (PTM). In India, it has been found to cause 30-70% infestation in country stores.

The damage increases rapidly when several generations develop during the storage period. Larvae are capable of causing damage on potato crop both in the field and in the stores. Synthetic chemical pesticides have been used for many years to control agricultural insect-pests including those that damage durable food crops in storage. However, considerable problem may arise from the continuous application of these insecticides, including the development of resistance by insects, pollution of environment and hazards from handling toxic compounds (Yuan *et al.*, 2014; Meyer-Baron *et al.*, 2015).

Dougoud *et al.* (2019), in his review, stated the efficacy of homemade botanical insecticides based on traditional knowledge. Sharaby *et al* (2020) used botanical extracts against the potato tuber moth during storage conditions. Morey and Khandagle (2020) reported bioactivity of plant essential oils (*Cinnamomum verum, Cupressuss sempervirens* and *Cymbopogon nardus)* against potato tuber moth. Jie *et al.* (2020) investigated on entomopathogenic nematode, *Steinernema carpocapsae* for control of the potato tuber moth, under laboratory conditions. Erdogan and Yilmaz (2018) studied the efficacy of extracts from *Leptospermum petersonii* Bailey, *Achillea wilhelmsii* and *Tanacetum parthenium* on potato tuber moth

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using two different methods. Tefera (2017), in his research, studied evaluation of botanical insecticides (*Pyrethrum*, *Birbera* and Neem oil) for the management of potato tuber moth under laboratory condition.

MATERIALS AND METHODS

Traditional storage godown (30 x 15 feet) was covered with insect proof net mesh of about 1 mm thickness. Ten sub-partitions (6 x 3 feet) were made inside the godown by using insect proof net mesh of about 1 mm thickness for different treatments. Collected potato tubers were stored in the godown as per treatments. The botanicals were obtained from the vicinity. These were dried under shade for overnight. Tubers without treatment was T_1 (Control), *Azadiractha indica* leaves used as treatment T_2, leaves of *Lantana camara* as treatment T_3, *Pongamia pinnata* leaves as treatment T_4, *Eucalyptus globulus* leaves as treatment T_5, *Tagetes erecta* petals as T_6 treatment, *Dendranthema grandiflora* flowers petals as T_7, chopped dry Ragi straw as T_8 treatment, tubers treated with 2% *Bacillus thuringiensis* as T_9 treatment and in T_{10} chemical (Malathion 25 EC 2%) were applied. Each heap was treated as a replication.

Observations were recorded at 15 days intervals up to five months during each experimental period. Mean percentage of PTM infested tubers was worked out. Data were statistically analyzed using completely randomized design (CRD).

RESULTS AND DISCUSSION

For management of PTM under storage condition, various treatments (Table 1) were attempted which included botanicals, biological agent and chemical control method. The methods were repeated for two years during consecutive years 2019 and 2020.

The results revealed that leaf of *A. indica* treated for potato showed lowest PTM damage followed by larva, tunnel formation and rotting of tuber. Biological agent 2% *B. thuringiensis* revealed second best material for the treatment for control of PTM. However, the leaves of *L. camara* occupied the third position as a best material for less infestation and maximum protection of the potato tubers for the storage for a period of five months (Tables 2 and 3).

During 2019, among the different treatments in storage of **rabi** harvested potato crops, the per cent PTM damage, larvae/tuber, tunnels/tuber and rotted tubers were significantly lower in T_2–*A. indica* leaves (35, 5, 5 and 14%, respectively) followed by T_9–2% *B. thuringiensis* (41, 6, 6 and 15%, respectively). T_3–*L. camara* leaves showed 44, 7, 7 and 16% respective damage (Table 2).

During 2020, per cent PTM damage, larvae/tuber, tunnels/tuber and rotted tubers were significantly lower in T_2–*A. indica* leaves (37, 6, 5 and 15%, respectively) followed by T_9–2% *B. thuringiensis* as 40, 7, 6 and 16%. Treatment T_3–*L. camara* leaves showed 45, 8, 7 and 17% respective damages (Table 3).

The data of two years indicated that, out of 10 treatments, T_2–*A. indica* leaves noticed lowest per cent of PTM damage, larvae/tuber, tunnels/tuber and rotted tubers followed by T_9–2% *B. thuringiensis* and T_3–*L. camara* leaves.

Similar results were found in research work of Prasad *et al.* (2020) in tubers when dipped in Neem oil and *Bt* (both 1 and 2%) formulations including control. The per cent incidence of

Table 1. Different treatments and quantity used for management of potato tuber moth

S. No.	Treatment	Part	Quantity
1.	T_1–Control	-	-
2.	T_2–*Azadiractha indica* leaves	Leaves	250 g/100 tubers
3.	T_3–*Lantana camara* leaves	Leaves	250 g/100 tubers
4.	T_4–*Pongamia pinnata* leaves	Leaves	250 g/100 tubers
5.	T_5–*Eucalyptus globulus* leaves	Leaves	250 g/100 tubers
6.	T_6–*Tagetes erecta* flowers	Petals	300 g/100 tubers
7.	T_7–*Dendranthema grandiflora* flowers	Petals	300 g/100 tubers
8.	T_8–Ragi straw	Straw	150 g/100 tubers
9.	T_9–*Bacillus thuringiensis* (2%)	-	2% 20 ml/1 ltr water
10.	T_{10}–Chemical (Malathion 25 EC 2%)	-	2% 20 g/1 ltr water

Table 2. Treatments on per cent of PTM infestation during storage period from January 2019 to May 2019

Treatment	PTM damage (%)	Larvae/tuber (%)	Tunnels/tuber (%)	Rotted tubers (%)
T_1–Control	86.00	15.00	15.00	48.00
T_2–*Azadiractha indica* leaves	35.00	5.00	5.00	14.00
T_3–*Lantana camara* leaves	44.00	7.00	7.00	16.00
T_4–*Pongamia pinnata* leaves	68.00	14.00	13.00	40.00
T_5–*Eucalyptus globulus* leaves	46.00	8.00	8.00	17.00
T_6–*Tagetes erecta* flowers	57.00	12.00	11.00	25.00
T_7–*Dendranthema grandiflora* flowers	67.00	13.00	12.00	36.00
T_8–Ragi straw	48.00	10.00	9.00	26.00
T_9–*Bacillus thuringiensis* 2%	41.00	6.00	6.00	15.00
T_{10}–Chemical (Malathion 25 EC 2%)	48.00	11.00	10.00	29.00
S. Em	0.57	0.65	0.32	0.17
C. D.	1.71	1.95	0.98	0.52

Table 3. Studies on the effect of various treatments for PTM infestation under storage from January 2020 to May 2020

Treatment	PTM damage (%)	Larvae/tuber (%)	Tunnels/tuber (%)	Rotted tubers (%)
T_1–Control	87.00	17.00	17.00	47.00
T_2–*Azadiractha indica* leaves	37.00	6.00	5.00	15.00
T_3–*Lantana camara* leaves	45.00	8.00	7.00	17.00
T_4–*Pongamia pinnata* leaves	69.00	15.00	14.00	41.00
T_5–*Eucalyptus globulus* leaves	48.00	9.00	8.00	19.00
T_6–*Tagetes erecta* flowers	60.00	13.00	13.00	25.00
T_7–*Dendranthema grandiflora* flowers	66.00	14.00	15.00	33.00
T_8–Ragi straw	50.00	10.00	11.00	27.00
T_9–*Bacillus thuringiensis* 2%	40.00	7.00	6.00	16.00
T_{10}–Chemical (Malathion 25 EC 2%)	53.00	12.00	12.00	30.00
S. Em±	0.63	0.35	0.47	0.81
C. D.	1.92	1.12	1.41	2.48

tuber damage due to PTM was documented at monthly intervals for four months under room temperature conditions. Out of five treatments, 2% *Bt* formulation showed lowest mean incidence of tuber damage (24.05%) followed by 1% *Bt* formulation (29.30%). Similarly, Mahdavi *et al.* (2018) on synthesis of *Zingiber officinale* essential oil-loaded nanofiber and Mola (2018) on the efficacy of entomopathogens, botanicals and insecticides showed similar effect in storage.

CONCLUSION

Thus, mulching with *A. indica* leaves, treatment of 2% *B. thuringiensis* and mulching with *L. camara* leaves was found to be effective for post-harvest management of potato tuber moth under storage.

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