

## Integrative Managerial Approach for the Management of Potato Tuber Moth (*Phthorimaea operculella*) (Zeller) In the Potato Field and Storage

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### Abstract:

Potato Tuber Moth (PTM), *Phthorimaea operculella* (Zeller) is a destructive and cosmopolitan in nature, also called Potato tuber worm or Tobacco split worm attacks all the vegetative parts of the plant causing mines within the plant tissue due to larval feeding. Boring tunnels in the tubers can also lead to the entry of secondary pest, pathogens and mites. Therefore quality and market value of potatoes get reduced and cause yield reduction up to 70% and in stores yield losses up to 100%. Economic Threshold Level (ETL) of potato tuber moth is 5% leaf damage. This pest species can also destroy potatoes under non-refrigerated storage conditions. As it developed resistancy against several classes of insecticides that's the reason it necessitated to adopt Integrative managerial approach to manage this pest species.

**Keywords:** ETL, Integrative, *Phthorimaea operculella*, Storage, Tobacco split worm.

### Introduction:

The potato (*Solanum tuberosum* L.) is a key food source or staple food in the global diet as it has high in quantity production and by its nutritional value. Potato is native to Peruvian-Bolivian Andes. It is a carbohydrate rich vegetable and also rich in Potassium, Fibre, Protein and Vitamin C. Potato is also considered as poor man's friend. Potatoes are produced throughout the world and are grown both during summer in temperate areas of the northern hemisphere and during winter in subtropical areas such as in the Northern India, southern China, and Mediterranean region. Globally, India is the second largest producer of vegetables after China. In the world India stands second rank in the potato production. In India Potato is being cultivated in an area of 2203 thousand hectare with production of 56173 thousand metric tonnes. The seed potatoes or tubers are stored at low temperature at 2-4 for

the next year sowing. For processing and consumption potatoes are stored at higher temperature at 8-12, so that sugar level should not increase in tubers. Non-refrigerated storage method is very inexpensive and common alternative in the growing areas themselves. Potato Tuber Moth (PTM), *Phthorimaea operculella* (Zeller) is a destructive and cosmopolitan in nature, also called Potato tuber worm or Tobacco Split worm attacks all the vegetative parts of the plant causing mines within the plant tissue due to larval feeding. Feeding galleries in the tubers can also lead to the entry of secondary pest, pathogens and mites. Therefore quality and market value of potatoes get reduced and cause yield reduction up to 70% and in stores yield losses up to 100%. As PTM's are being developing resistancy against several classes of insecticides we must adopt some innovative as well as integrative managerial approach to suppress this devastating pest species.

### Potato Tuber Moth/ Tobacco Splitworm

**Scientific name:** *Phthorimaea operculella* (Zeller)

#### Taxonomic position:

- ❖ **Class:** Insecta
- ❖ **Order:** Lepidoptera
- ❖ **Family:** Gelechiidae
- ❖ **Genus:** *Phthorimaea*
- ❖ **Species:** *operculella*



**Fig. 1** Potato Tuber Moth (*Phthorimaea operculella*)

#### Alternate host and Distribution:

Potato Tuber Moth (PTM) is pest of both field and storage, an oligophagous pest attacking solanaceae family crops such as Tomato, Tobacco, Brinjal, Peppers *etc.* and solanaceous weed plants such as *Datura stramonium*. PTM is widely distributed throughout the world where ever solanaceous crop is grown such as Ethiopia, Egypt, Kenya, India, Iran, Syria, Latin America, Andes of Peru and Bolivia.

#### Identification of Pest species:

Eggs are smooth, oval, and white to yellowish in colour. Larvae are yellow in colour with dark brown head, the colour of larvae changes from white or yellow to pink or green as they mature. Pupae spun silken cocoon around themselves and covered with soil and debris. The adult moth has narrow body shape, silvery grey colour in appearance, as wings are

greyish-brown and both pair of wings have fringed edges. The forewings are yellowish grey with 2-3 dark dots on males and characteristic “X” pattern on females and the hind wings are grey in colour.

### Symptoms and Damage:

Potato Tuber Moth or Potato Tuber Worm (PTM/PTW) is a destructive and cosmopolitan in nature, its larvae attacks all the vegetative parts of the plant such as leaves, stems, petioles and tubers create mines within the plant tissue due to larval feeding. Larvae bore tunnels in tubers also lead to the entry of secondary pests, pathogens and mites. Larvae excrete within tuber which makes unfit for consumption and thus market value and Production drastically gets reduced.



Fig. 2. Damaging Symptoms of Potato Tuber Moth on tubers in field/storage

### Biological cycle:

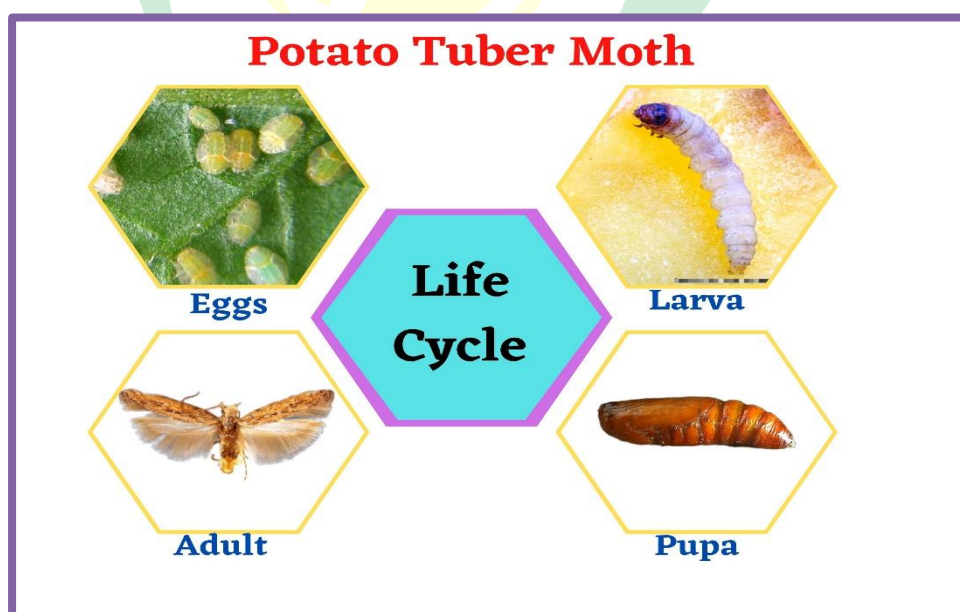


Fig. 3. Life Cycle of Potato Tuber Moth (*Phthorimaea operculella*)

Eggs are laid in groups in the range of 150-250 on the ventral surface of leaves and exposed tubers. These eggs hatch in 2-6 days. Larvae are 0.5 to 0.6 inch long which matures in 16-24 days. Pupation occurs within a cocoon among the trash, clods in the soil also on leaves, pupae hatch after 6-9 days. The moths are crepuscular feed on nectar, body length range 8-10 mm long and live up to 1-2 weeks. The adult females begin to lay eggs after 2-4 days. The total life cycle of potato tuber moth can be completed within 4-5 weeks or 20 to 35 days and 6-8 generations may occur in the field during summer.

### **Integrative managerial approach in the field and storage condition:**

#### **In field condition:**

- Reject seed lots from fields or storage that had been infested with PTM and select healthy tuber seed for sowing.
- Collect and destroy all the infested tubers from the field.
- Do not leave the harvested tubers in the field overnight.
- Adopt intercropping with chilies, onion or peas.
- Avoid shallow planting of tubers. Plant the tubers to a depth at 10 - 15 cm deep.
- Use resistance varieties or low susceptible to PTM that is King Edward, Russett Burbank and Kufribadshah or use Bt -transgenic varieties.
- Install pheromone traps at 15/ha.
- Do earthing up at 60 days after planting to avoid female moths laying eggs on the exposed tubers.
- Two spray of Lambda-Cyhalothrin 5 EC (600 ml), Spinosyn (720 ml) and Decamethrin 2.8 EC (650 ml) + BtDipel 8 L (1125 ml) in 750 L of water/ha are used at 15 days interval.
- Release egg larval parasitoid: *Chelonus blackburnii* @30,000/ha twice at 40 and 70 day after planting. Larval parasitoid –*Apanteles subandinus*, *Diadegma mollipla*, *Copidosoma koehlerii*, and Predatory spider *Selenops radiatus* is also seen effective
- Spray NSKE @5% in 500 L of water per hectare to manage foliar damage.
- Spray *Bacillus thuringiensis* @1 kg/ha at 10 days interval.

#### **In storage condition:**

- Sanitize storage facility like walls, floors, ceilings and also potato sacks, crates or other containers must be sanitized thoroughly before it is reused or use new one.

- Keep storage temperatures below 52 °F. If possible, store tubers below 9 °C.
- Screen storage area from the outside to keep out PTMs.
- Predatory mite *Blattisocius tarsalis* effective control agent against *P. operculella* under non-refrigerated potato storage conditions.
- The seed tubers can be dusted with quinalphos dust (1.5%) at 125 g/100 kg seed tubers before storing.
- Dip treatment of tuber with BT formulation @ 2% found very effective controlling potato tuber under storage and also Bt dust (109 spores/g) and PoGV dust (350 LE/kg powder) applied at 5 g/50 tubers provided complete control of PTM for 2 months under epidemic conditions.
- Cover the upper surface of potato tubers with the branches of Lantana and Eupatorium to repel the ovipositing moth in the godown.



**Fig. 4. Different integrative managerial approach i.e., Intercropping, Pheromone funnel trap, Fumigation**

#### **Conclusion:**

India is largest producer and exporter of potato crop after China. Potato is highly rich in nutritional value and used as staple food worldwide. In India Potato is being cultivated in an area of 2203 thousand hectare with production of 56173 thousand metric tonnes. One of the major insect-pest called Potato Tuber Moth (PTM), *Phthorimaea operculella* (Zeller) is very destructive and cosmopolitan in nature it cause yield loss upto 70% and leads to 100% damage in storage condition if heavily infested. Day by day management of this pest becoming challenging one as it continuously evolving resistancy against several classes of insecticides. So, keeping this in mind most reliable integrative managerial approaches are adopted in both the field and storage condition.

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