Potato Tuber Moth

(Phthorimaea operculella) or PTM, is a serious pest in potato fields and traditional country storage in the middle elevations and high hills of the Hindu Kush Himalayan region of India, Nepal, Bhutan and Afghanistan.

In the field, the adult moth typically lays eggs on the undersides of potato leaves during early vegetative growth. Upon hatching from eggs, the larva can drop to the ground and burrow through cracks in the soil to a tuber, entering it through the eye. This commonly takes place after vine desiccation.

It is also common for female PTMs to lay their eggs directly on harvested potatoes at or near the eye. When the eggs hatch, the larvae simply enter tubers through the eyes by making slender tunnels along the surface or deep into the tuber.
A tunnel can be detected by the black worm excrement (frass) at the entrance. Tunnels do not heal and are entryways for diseases, most notably soft rot and dry rot. In the store, PTM will continue to breed and lay eggs, which hatch into larvae that metamorphose into adult moths. The length of the life cycle can be two to six weeks, depending on the storage temperature.

Due to the lack of refrigerated storage facilities, farmers in Meghalaya, India are compelled to store their seed potato in low cost, non-refrigerated, open rustic stores. Under warmer conditions, these traditional stores provide an excellent environment for PTM to complete several life cycles, which represents a serious threat to stored seed tubers. Infestation can be very high, sometimes affecting all the tubers stored, if proper preventive measures are not taken.

In East Khasi Hills, the main potato growing area in Meghalaya, PTM causes extremely high losses (affecting up to 100% of stored seed) as farmers have limited to no awareness of this pest and the options for managing it in the field and storage. A few potato growers use highly toxic pesticides, which besides being expensive can have adverse effects on human health and the environment.

This brochure aims to support the implementation of the Meghalaya State organic policy by providing recommendations to potato growers and extension workers about managing PTM with organic inputs.

**Store Management:**
- The entry passage/windows of the store should be covered with a fine wire mesh to prevent entry of adult moths;
- Tin roofs should be covered with dry vegetation such as straw, sedge or palm leaves to keep the store from heating up;
- Border plants such as lantana, pine, bamboo should be planted around the store to avoid direct sun radiation;
- Seed tubers must be sorted and PTM infested ones discarded before storing;
- The store should be cleaned and left-over tubers from the previous storage season discarded before storing sorted and graded seed potatoes;
- Regularly monitor the store, remove all PTM infested tubers, and dump them in a pit away from the store;
- Avoid planting solanaceous crops (potato, tomato, peppers, etc.) in the vicinity because PTM can reproduce on those crops if potato is not available.

**PTM management:**
Several plants and plant parts, botanicals and bio-agents have been shown to control PTM in the past, as alternatives to chemical insecticides. The efficacy of Lantana camara plant parts and talcum-based Bacillus thuringiensis subsp. kurstaki (Btk) have been recently tested in the traditional country stores of East Khasi Hills and proved very promising for the control PTM population.

Lantana camara: Lantana is considered as invasive weed in Meghalaya, mainly used as border plant and not fit for animal and human consumption due to its toxicity. For PTM management, Lantana can be used as follows.
- Remove all PTM infested tubers before storing healthy medium sized tubers (45-100g) for seed;
- Chop lantana shoots (stem, leaves, flowers) in small pieces (3-5 cm) and shade dry them for 4-5 days;
- Cover the upper surface of potato racks/ heaps/bamboo baskets (polo) with dried lantana (~30g/kg seed tuber) immediately after seed storage;
- Monitor storage and remove PTM infested tubers (if any) at least once every 15 days;
- Apply an additional batch of chopped and dried lantana (if moths are seen) on the seed tubers after 3-4 months of storage.
Btk treated seed in the store

*Bacillus thuringiensis* subsp. *kurstaki* (Btk)

*Bacillus thuringiensis* (Bt) is a naturally occurring bacterium in soil. When Btk is ingested by the PTM larvae/adult, it produces lethal toxins in the insect’s guts. To make it more economical and easier to apply, Btk is often mixed in with an inert base material like talcum, which is available in any market.

The talcum-based commercial product Lipel® was found to be very effective in controlling PTM. This product can be used as follows.

- Lipel® can be further re-formulated (60g Lipel®/kg of talcum) for cost reduction;
- Seed-sized tubers should be treated with re-formulated Lipel® at a rate of 5g/kg seed tuber (this is equivalent to using 1g of pure commercial Lipel® per 3.5kg of tubers);
- Place 15-20 kg of seed tubers in a plastic bag with 75-100g of re-formulated Lipel® and shake gently to ensure uniform mixing;
- The same bag can be used to treat many batches of seed tubers;
- Treated seed tubers should be spread in a thin layer (2-3 tiers) on racks for best results, or kept in pile/bamboo basket (polo);
- Store must be monitored least at least once every 15 days during the storage period and any PTM infested tubers found should be discarded and dumped into the pit away from the store.

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