Tomato Leaf Miner, *Tuta absoluta*

**Surveillance Protocol for NAPPO Member countries**

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Tomato Leaf Miner, *Tuta absoluta*

**Purpose of Survey:**

- Early Detection
- Delimitation
- Management
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**Life Cycle**

Up to 12 generations per year at 24-27°C Celsius

**EGG:**

Small, 0.35 mm long, cylindrical, creamy white to yellow orange. Laid on the underside of leaves or stems and to a lesser extent on fruits. Hatch in 4 – 6 days.
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Life Cycle

**LARVA:**
After hatching, young larvae penetrate leaves, aerial fruits or stems. Cream colored, dark head and a dark oblique band that does not cover the dorsal midline.
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Life Cycle

LARVA: Attack the foliage by penetrating into leaf and feeding on mesophyll tissue that results in irregular lines on leaf surface. Damaged leaves shrivel, decreasing photosynthetic activity. When the attacks are severe, the leaves have a burnt appearance.
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**Life Cycle**

**LARVA:** Larvae can feed on all parts of tomato plants. They burrow into stalks, apical buds and green & ripe fruits. Pupation in the soil, though pupation may also occur on leaves or under calyx.
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**Life Cycle**

**PUPA:**

Pupae are cylindrical in shape, greenish when just formed becoming darker as they near emergence. Pupae often coated with white silky bud. Pupae found in the mines, outside the mines, in the soil, beneath pots and under greenhouse benches.
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**Life Cycle**

**ADULT:**

5-7 mm long, wingspan 8-10 mm. Filiform antenna, silverfish-grey scales and black spots present on anterior wings. Female lays eggs on the aerial parts of host plants. Mature females lay up to 260 eggs and lives two weeks. Males live only one week.
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**Hosts**

*Tomato, Solanum lycopersicum* is the major host.

Minor hosts: Potato, eggplant, Peruvian pepino, tobacco and peppers (Capsicum).

Wild Hosts: Mostly in the Family Solanaceae as granadillo, common nightshade, black nightshade, silverleaf nightshade, wild tomato etc.
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Pathways to introduction

1. **Seedling**: If tomato plants are being imported from infested areas, probability of pest survival during transport / storage is high as tomato plants are shipped alive with leaves.

2. **Tomato fruit**: Fresh tomatoes are considered high risk as the probability of larvae associated with fresh tomatoes surviving transport is high. Fruits in trade should have no signs of insect damage.

3. **Production facilities**: Several production facilities also repack and /or distribute tomato fruit. There is a high risk in repacked tomato consignments as if pest arrives in late larval stage or as pupa it can develop into a moth at the packing station. Outdoor markets that sell tomatoes from infested countries and are located in areas with suitable summer conditions for survival of *T. absoluta*, also pose a risk.

4. **Farm equipment and transportation vehicles**: Farm equipment from infested areas that is associated with transportation should be kept clean. Importing countries should ensure that crates that are returned to tomato producers from packing operations are sterilized. All packaging with infested fruit should be disposed of properly.
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Detection Survey

**Purpose:** Early detection of pest in a country.

**Target life stages:** Adult moths-by trapping.

**Timing and duration:** To be implemented as soon as Tomato production cycle starts – in open fields and in protected cultivation and concluded after harvest. For tomato production facilities the timing of survey is directly linked to tomato production cycle.
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**Detection Survey - continued**

**Site Selection:** Survey sites should be chosen with priority given to sites in proximity to urban centers, packing houses, commercial growers (field and/or greenhouses), international ports where host material is received, communities with back yard tomatoes or markets.

**Field Location:** Within each place as tomato fields, market stalls selling tomatoes or high risk sites as nurseries selling tomato seedlings, tomato farms, reception area in packing houses, sorting and packing areas, truck loading area, waste disposal area, wholesale vegetable markets, stores of bulk tomatoes, reception area of incoming trucks, vegetable repacking and distribution centers, customs inspection area, truck waiting yards, sea ports and airports.
Purpose: To establish the boundaries of an area considered to be infested by *T. absoluta*.

Target life stages: All stages-egg, larva, pupa and adult.

Timing and duration: The timing will be set by the date of the first detection that was observed and how quickly a survey can be planned and organized.
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Detection Survey

Traps

Two types of Delta traps are available

1. Cardboard delta triangle with sticky surface
2. Cardboard delta triangle with a removable liner

Either one is suitable, although delta traps with non-drying sticky liners are preferred. Traps are available from several suppliers in multiple colors and all should be considered equivalent for this survey.
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Pheromone Lure

**Tomato Leafminer lure** - Mixture of (3E,8Z,11Z)-3,8,11-tetradecatrien-1-yl acetate and (3E,8Z)-tetradecadien-1-yl acetate).

This is loaded on rubber septum at a concentration of 0.5 mg. Depending on environmental conditions this concentration should last up to 6 weeks.

All pheromones should be stored in sealed containers at temperatures below 0°C. Only one pheromone component should be stored per container - do not mix with other types of pheromones. Pheromones can be stored for a maximum of two years if refrigerated properly. During transportation to the field, the pheromones should be kept cool and out of direct sunlight - in a cooler. Disposable gloves should be worn when handling pheromones and a new pair of gloves between types of pheromones. Gloves should not be disposed in the vicinity of traps.
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**Trap Placement and Density**

For detection survey, a minimum of one trap per trap placement location at each survey site should be placed. For areas larger than 2500 M², two traps/ha are recommended.

The delimiting survey is done by pheromone trapping using Delta traps at distances of 2-5 kilometers at the rate of two traps per hectare from the initial site of infestation. Once another positive trap occurs, additional 2-3 traps are placed at shorter intervals, 30 to 100 meters for example. Sites to be chosen depends on the location of high areas as host plants, alternate or weed plants presence or location of tomato packing plants.
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**Servicing the trap**

- Gloves should be used to handle traps and inserts in order to prevent their contamination.
- Traps and lures should be checked every two weeks and lures replaced every four to six weeks.
- Traps should be replaced if missing, damaged, or if the sticky surface has been compromised by debris.
- Traps with suspect moths must be collected for diagnostic submission and replaced with new trap and lure.
- Inserts should be replaced at the two week servicing if they are covered with dust or insects; the lure should be transferred to the new insert with gloves and forceps.
- Old (older than 4-6 weeks) and missing pheromone lures should be checked and replaced.
- At the end of the survey, if the trap is empty, it should be collapsed, squashed flat and placed in a suitable container for disposal.
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**Data to be collected**

- Data collected could be positive trap counts and/or records of infested tomato plants.

- Records should be maintained as, GPS coordinates, name of the facility or land owner, the name of the trapper, the day the trap was placed at a particular site, servicing dates, when the trap was decommissioned and the results of each trap.

- Positive results also should include the day the pest was detected and how many target pests were in the trap.

- Records of infested tomato plants or alternate hosts also should be collected.

- Site numbers should be assigned that should generally conform to the following: two letter pest code-one letter for region-site number-trap letter (Ex: TA-D-0001-a).
Data Storage

Existing country databases may be used to store all survey data. The files should be updated at least weekly or as new information becomes available.
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Sample handling and laboratory submission

- If trap catches show no moths or moths with body length more than 1.0 cm, do not remove the trap or trap insert from the field as the size would preclude *T. absoluta*

- If the moths have a body length less than 1.0 cm, examine the moths with a hand lens in the field or bring the trap insert to the office and examine the moths using a dissecting microscope.

- If suspect moths are present, or there is uncertainty of the species the sample should be carefully packaged and sent to the designated identifier in the country.
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Phytosanitary measures to be applied upon Pest detection

- Cultural, mechanical
- Use of Insecticides
- Biological control
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Thank you

Questions?