Two-Spotted Spider Mites in Greenhouse Cucumbers

A BC Small-Scale Farmer's IPM Guide- *Guide series, March 2021*

Two-spotted spider mites (*Tetranychus urticae* Koch), or TSSM, can cause damage on a broad range of crops, including cucurbits, strawberries, eggplants, and tomatoes. They are often an issue in greenhouse crops as they thrive in hot and dry conditions. There are thousands of species of mites that can be found in fields, and not all mite species are harmful to crops. TSSM is one of many species that will feed on plants, and they can cause serious yield loss in high infestations. This manual contains integrated pest management (IPM) guidelines geared towards small-scale production, but they are applicable to any operation wanting to improve pest identification, monitoring and management.

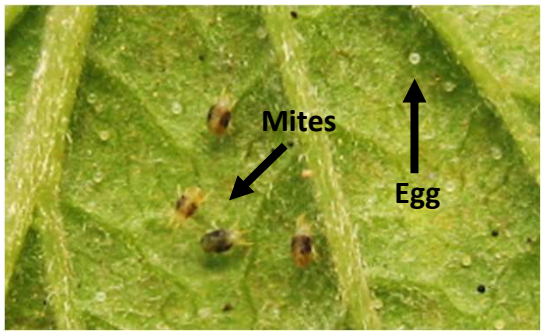
Identification

Eggs:
- Minute, spherical and shiny.
- Colourless to straw-colored.
- Laid on underside of leaves.

Larvae:
- Six-legged.
- Colourless.
- Resemble the nymph and adult but smaller.

Adults:
- Adults are about 0.5 mm long.
- Eight-legged.
- Pale tan coloured with two black spots (one on each side).
- Lay up to 200 eggs.

Nymphs:
- Eight-legged.
- Slightly smaller than adult.
- Resemble the adult: Pale tan coloured with two black spots (one on each side).



What they actually look like

TSSM overwinter as adults
- Orange-red coloured when emerging in the spring and when preparing to overwinter in late summer/early fall.
- In crop debris, ground, or in cracks and crevices in greenhouses.

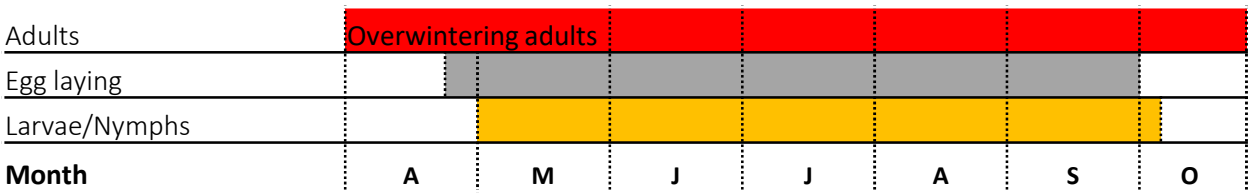
Damage Identification

Two-spotted spider mites feed on plant cells with their piercing and sucking mouthparts. They mostly feed directly on the undersides of the leaves, but the damage is visible on both sides of the leaves.

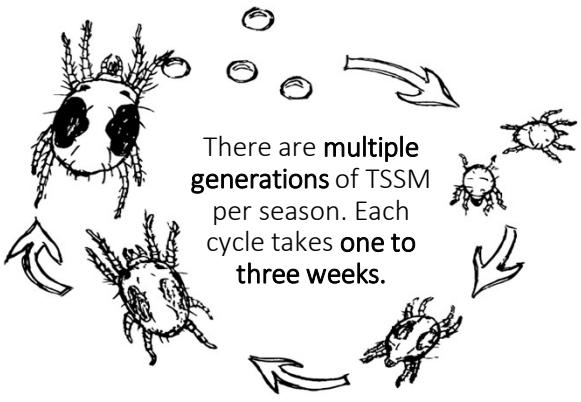
Look for:

- Tan to yellow specking or mottling on leaves.
- Webbing on the underside of leaves.
- Large populations produce webbing that completely covers the leaves and can result in plant death.

Lifecycle



Under optimal conditions (27 °C and dry), eggs can hatch in 3 days and become mature egg-laying adults in 5 days. This makes timeliness in monitoring and action very important for this pest.



How to Monitor

Monitoring period and frequency

- Monitor once a week from transplant stage up until harvest.

Method

- Make **one to two passes** through each planting.
- A pass involves starting at one end of the row, sampling the first plant, then walking down the row, sampling plants at regular intervals until the end of the row to obtain a minimum of **five samples per planting (for a 100-200 feet long planting).**
- At each sample, inspect **five leaves** using 10-15 X magnifying lens for the eggs, mites and webbing.

Record

- Record the number of leaves with TSSM and/or the number of leaves with **Low (1-5), Medium (6-10), and High (>11)** levels using a printout of the data sheet template provided in this guide.
- Make a note if predators are found.

Quick method - monitoring while doing other farm activities

- Look for the early signs of mite infestation: light specking on the upperside of leaves.
- Carry a 10-15 X magnifying lens to look for mites if damage is suspected.
- Mites can also be found by shaking symptomatic leaves onto a sheet of white paper.

When to Act

Early season detection of mites will require management options to be put in place, especially if temperatures are expected to be hot. Low levels may require only one management action, and high levels may require a combination of actions.

Late season detection may not require management actions to be put in place. However, cultural controls should be implemented to prevent overwintering of adults.

Risk factors to consider

- Have mite levels increased since last week?
    - More leaves infested? This indicates spread through the planting. See Equation #1 below.
    - Larger colonies? This indicates population growth, increasing the potential for damage to plants. See Equation #2 below.
    - Are there eggs present with most colonies? Remember they could hatch in 3 days (under optimal conditions).
- Is the weather forecast favourable for mites?
    - Will the temperature be around 27 °C? This is optimal for mite development.
- Are there high levels of predators?
    - Remember that most predators are voracious eaters and relatively small numbers can limit the growth of TSSM populations.
    - If you consistently find predators across your samples, and mite levels aren't too high, consider waiting to apply controls.
- Is there a history of high mite pressure in your greenhouse cucumbers?
    - TSSM will overwinter in plant material and soil in the greenhouse.
    - Farms with TSSM history can require more preventative, early management actions.

Calculations to help track mite levels over time:

1. Proportion of leaves infested with TSSM:

$$= \frac{\textit{total \# of leaves with TSSM present}}{\textit{total \# leaves checked}}$$

2. Average number of TSSM per leaf:

$$= \frac{\textit{total \# of TSSM present}}{\textit{total \# leaves checked}}$$

Note: You can choose one of the two calculations to track levels over time or use both. For Equation #2 use an estimate of 3 for a low, 8 for a medium, and 20 for a high leaf.

Example calculation:

In a cucumber planting with 5 sample points, we looked at 5 leaves at each point for a total of 25 leaves checked. 6 leaves had TSSM present. Using our estimation method, we recorded 3 Low, 2 Medium, and 1 High.

1. Proportion of TSSM = $\frac{6}{5 \times 5}$ = 0.24 = **24% leaves with TSSM**

2. Average # of TSSM per leaf= $\frac{(3x3)+(2x8)+(1x20)}{5 \times 5}$ = **1.8 mites per leaf**

How to Manage

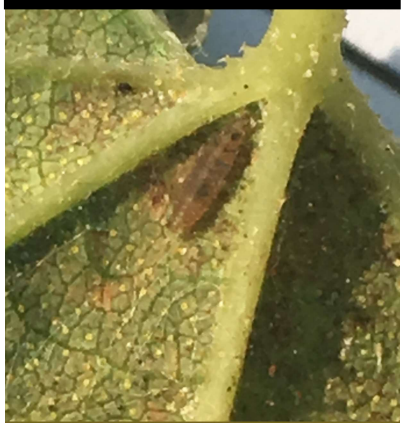
Biological control- *Natural predators*

- Help the establishment of natural predators. Plants such as alyssum attract predators and provide pollen and nectar which can help natural enemies establish earlier on the crop.
- Predators of mites include, but are not restricted to, lacewings, orius, predator mites, and ladybugs, including the spider mite destroyer ladybug (*Stethorus punctillum*).

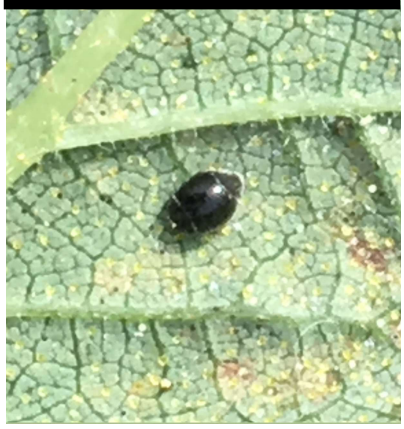
Alyssum

Predator Identification

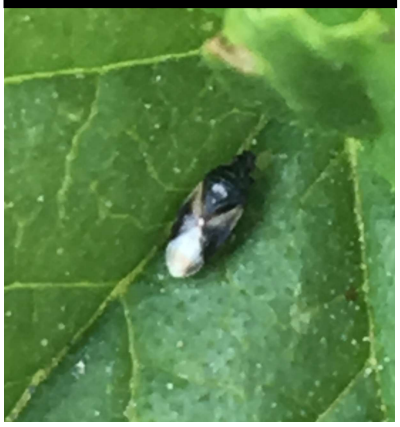
Stethorus larva



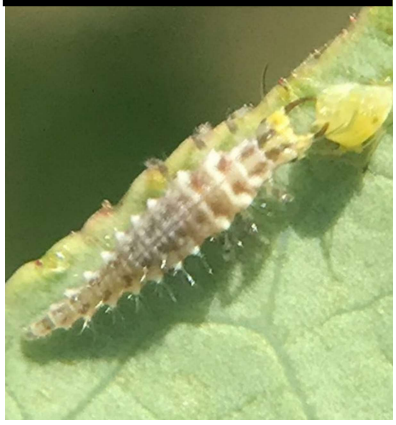
Stethorus adult



Orius



Lacewing larva



Ladybug larva

Predator mite

Biological control- *Predator release*

- Predator mites can also be purchased and released in greenhouse cucumbers.
  - *Amblyseius californicus*, a predator mite, can be introduced at low spider mite density in dry conditions.
  - *Phytoseiulus persimilis*, another species of predator mite, can be introduced in hotspots as it is effective in high spider mite density.
  - Contact biocontrol suppliers for timing and rates. **If you have had TSSM issues in the past, consider a preventative release at the very early stage of infestation.**
  - Predator mites should be released on dry plant foliage, and not on the soil/growing media. Distribute evenly across the planting/infested area using a higher release rate in hot spots.

Predator release using sachets

Cultural and physical control

- Do not overfertilize.
- Frequently control/mow weeds and grassy areas around greenhouses.
- Remove and destroy (burn) heavily infested plants if infestation is localized.
- Remove plants from the greenhouse as soon as harvest is done and discard in landfill or burn.
  - If plants are left in the greenhouse for an extended period of time in the fall, mites have a greater chance of moving into the soil to overwinter, increasing spring populations the following year.
- Overhead irrigation can slow the population growth of TSSM.
  - However, this method should not be used if there are issues of leaf spot diseases, as they develop under humid conditions.
- Beware of workers' movement. TSSM can spread from infested crop to clean crop on clothes and tools.
  - Monitor and know where infestations are.
  - Plan farm activities so that movement from infested to clean plantings is avoided.

Leaf spot disease

Chemical control

- Consider spraying if populations are increasing, but before they cause significant damage.
- Complete coverage, including under the leaves, is necessary for sprays to be effective.
- Registered pesticides used in **organic production** for control of TSSM include the active ingredients mineral oil and potassium salts of fatty acids (insecticidal soap) for suppression only. Always check with your organic certification body before using any pesticide products.
- Please refer to the **BC Vegetable Production Guide** for current organic and conventional spray options for TSSM in greenhouse cucumbers.
- Both organic and conventional spray options may have negative impact on predators. Consult Biobest Side Effect Manual below for toxicity information.
- Always read the label prior to applying any pesticide products.

References and Links:

BC Production Guide – Cucurbits
https://www2.gov.bc.ca/gov/content/industry/agriservice-bc/production-guides/vegetables/cucurbits
Biobest – Side Effect Manual
https://www.biobestgroup.com/en/side-effect-manual
OMAFRA – Mite Pests in Greenhouse Crops: Description, Biology and Management
http://www.omafra.gov.on.ca/english/crops/facts/14-013.htm

Funding for this project has been provided by the Governments of Canada and British Columbia through the Canadian Agricultural Partnership, a federal-provincial-territorial initiative. Additional funding has been provided by the British Columbia Blueberry Council, the Raspberry Industry Development Council, the British Columbia Strawberry Growers Association, and the Lower Mainland Horticultural Improvement Association. The program is delivered by the Investment Agriculture Foundation of BC.

Disclaimer: Opinions expressed in this document are those of the author and not necessarily those of the Governments of Canada and British Columbia, the British Columbia Blueberry Council, the Raspberry Industry Development Council, the British Columbia Strawberry Growers Association, and the Lower Mainland Horticultural Improvement Association, or the Investment Agriculture Foundation of BC. The Governments of Canada and British Columbia, the British Columbia Blueberry Council, the Raspberry Industry Development Council, the British Columbia Strawberry Growers Association, and the Lower Mainland Horticultural Improvement Association, and the Investment Agriculture Foundation of BC, and their directors, agents, employees, or contractors will not be liable for any claims, damages, or losses of any kind whatsoever arising out of the use of, or reliance upon, this information.

Two-Spotted Spider Mite in Cucurbits Data Sheet Template

Date	Planting ID	Sample #	# leaves with Low TSSM	# leaves with Medium TSSM	# leaves with High TSSM	Percentage of leaves with TSSM	Average # of TSSM per leaf	Predators/ Comment
		1						
		2						
		3						
		4						
		5						
		1						
		2						
		3						
		4						
		5						
		1						
		2						
		3						
		4						
		5						
		1						
		2						
		3						
		4						
		5						
		1						
		2						
		3						
		4						
		5						
		1						
		2						
		3						
		4						
		5						
		1						
		2						
		3						
		4						
		5						
		1						
		2						
		3						
		4						
		5						

Low= 1-5 TSSM , Medium= 6-10 TSSM, and High >11 TSSM

1. Proportion of leaves infested with TSSM:

$$= \frac{total\ \#\ of\ leaves\ with\ TSSM\ present}{total\ \#\ leaves\ checked}$$

2. Average number of TSSM per leaf:

$$= \frac{total\ \#\ of\ TSSM\ present}{total\ \#\ leaves\ checked}$$

Note: Use an estimate of 3 for a low, 8 for a medium, and 20 for a high leaf for Equation #2.