Do You Know?

- Western tentiform leafminer is an indirect pest that mines the leaves of apple and cherry.
- It can diminish the photosynthetic capability of trees and reduce fruit size and quality.
- Leafminer populations can fluctuate dramatically within and between years.
- Biological control by numerous, naturally occurring wasps is common.
- Successful management requires a good sampling program and knowledge of treatment thresholds:
  1. mine per leaf in early June
  2. mines per leaf in mid-June to July
  3. mines per leaf in August
- Numbers of mines on leaves should be sampled from June through August.
- Leafminers are resistant to many common insecticides.
- Insecticides have a detrimental effect on their natural biological control agents—parasitic wasps.

Western tentiform leafminer populations can vary tremendously between years or even between generations within a single year. Increasing resistance to organophosphate insecticides and variable effectiveness of at least six parasitic wasp species that attack the leafminer can influence the population size.

In Utah, the leafminer typically has three generations per year but may have as many as four in some years. The immature larval stages—sap feeders and tissue feeders—feed on apple and cherry leaves. When densities are high enough, feeding can cause a reduction in fruit size and quality.

Hosts

- apple
- cherry
- pear
- prune
Western Tentiform Leafminer Life History

**Sap Feeder**
- Instars 1–3
- **Size and color:** 0.1 inch long by the third instar, cream in color
- **Shape:** flat, wedge-shaped, and legless
- **Where:** feeds on sap from the spongy mesophyll layer of leaves with sucking mouthparts
- Separates outer layer of the leaf underneath from the tissue above to form a mine, which often follows leaf veins
- Mines appear as a blight and are only visible from the undersides of leaves at this stage

**Tissue Feeder**
- Instars 4–5
- **Size and color:** 0.1/4 inch long, cream turning yellow by the fifth instar
- **Shape:** cylindrical with legs, round head, and chewing mouthparts
- **Where:** feeds on leaf tissue just up to, but not through, the epidermis
- Attaches silken threads to both sides of the mine pulling them together to form a tent-like structure inside the leaf
- Mines can be seen from the upper leaf surface and have a characteristic motled appearance with white spots on top where green tissue has been removed
- Fifth instar larvae spin a silken chamber for pupating inside the mine

**Host Injury**
- Larvae feeding on leaves can:
  - Disrupt the growth and photosynthetic capability of leaves
  - Disrupt the growth and photosynthetic capability of leaves
  - Affect fruit quality by slowing sugar development
  - Cause leaf drop, premature ripening, and fruit drop in severe infestations
  - Increase susceptibility to chemical blight in heavily infested leaves
  - Increase fruit sunburn if leaves surrounding fruit are curled or have fallen prematurely

**Timing Control**
Sampling should focus on the number of mines in leaves. The best time to sample for western tentiform leafminer larvae is at the beginning of the second generation, which usually occurs from mid-June to early July. Sampling earlier in the season for first generation eggs and sap feeder larvae is possible, but the eggs are difficult to locate and identify, and there is a poor relationship between the number of first generation eggs and the resulting mines.

**Quick Evaluation Method**
- **How to Sample**
  - Begin sampling in mid-June.
  - Walk through the orchard and quickly scan tree tops (leaf clusters at the ends of shoots) to estimate the number of mines per leaf.
- **Sap feeders** are the predominant stage at this time, so look on the undersides of leaves for mines.

**Sampling Threshold**
- **Second Generation:** Mid-June To Early July
- Results may vary, but the sample should contain no more than 0.5 mines per leaf for harvesters and no more than 1.5 mines per leaf for sap feeders.

**Complete Sampling Method**
Scouting for western tentiform leafminer can be done at the same time as mine sampling (see “Web-Spinning Spider Mite” bulging). If there is a large acreage of apple trees and cherries, you may want to select several representative blocks where you will conduct the scouting program. Randomly select 10 times scattered throughout a 2–5 acre block to sample. If the orchard block is larger than 5 acres, it is necessary to sample more trees.

**How to Complete**
- Use the quick evaluation method to determine if parasites are necessary. When using the quick evaluation method, the number of mines per leaf for harvesters and sap feeders should be 0.5 and 1.5, respectively.
- If no mines are found, the orchard should not be treated.

**Management**
- Insecticides targeted for leafminer control are most effective against the sap feeder stage. However, for the sap feeder stage, parasites are not usually evident until the tissue feeder stage. Therefore, pesticide levels from earlier generations should be considered along with current sap feeder and mine densities during the second and third generations to determine if treatment thresholds have been reached.

**Treatment Thresholds**
- **Leafminer Generation**
  - **Second Early June:** 1 or more mines per leaf and parasitism of larvae is less than 30%
  - **Mid-June to July:** 2 or more mines per leaf and parasitism of larvae is less than 30%
  - **Third August:** 5 or more active mines per leaf

**Insecticides**
- **Chemical control** is most effective against sap-feeding larvae in mines and adult moths flying in orchards. Insecticide sprays only should be applied when leafminer treatment thresholds are exceeded during the second or third generation (see above). Pre-bloom applications targeting first generation sap feeders are only recommended in large numbers of adult moths are observed in the orchard during April or May, or crop counts exceed three per tree during lightcancer to pink stage of apple.

**Parasitized Leafminer**
To determine if a leafminer has been parasitized, open a mine and look for the following:
- A wasp larva emerging from a silken larval leafminer larva
- The sap stage of the wasp along with a shrivelled leafminer larva
- An empty mine with the remains of a leafminer larva and a young wasp on top
- Scouting for western tentiform leafminer can be done at the same time as mine sampling (see “Web-Spinning Spider Mite” bulging). If there is a large acreage of apple trees and cherries, you may want to select several representative blocks where you will conduct the scouting program. Randomly select 10 times scattered throughout a 2–5 acre block to sample. If the orchard block is larger than 5 acres, it is necessary to sample more trees.

**Biological Control**
There are at least six species of parasitoids that attack leafminers in the Northwest, and their presence in Utah orchards is common. Leafminer parasites can be as high as 90% and can eliminate the need for chemical control of even a formerly high population. The wasps lay their eggs inside the mines of the leafminer larvae. Larval wasps hatch from the eggs and feed on developing leafminer larvae from the outside.

**Insecticides to Avoid**
Insecticides that are toxic to the parasites should be avoided during mid- to late summer if possible. In Washington studies, the following insecticides were shown to have moderate to high toxicity to *Platynota flavipes*, the main parasite of western tentiform leafminer in the Northwest:
- **encephalitidis methylothrin (Permen)**
- **chlorpyrifos (Loribar)**
- **esfenvalerate (Asana)**
- **endosulfan (Thiodan)**
- **oxamyl (Vydac)** — controls adults and sap feeders

**Cooperative Extension Service. Utah State University.**
Western Tentiform Leafminer Sampling Form—Apple and Cherry
Complete Sampling Method for Second and Third Generations
(Mid-June to August)

Orchard Block ___________________________ Scout ___________________________ Date ___________________________

<table>
<thead>
<tr>
<th>Number of Mines Per Leaf</th>
<th>Leaf 1</th>
<th>Leaf 2</th>
<th>Leaf 3</th>
<th>Leaf 4</th>
<th>Leaf 5</th>
<th>Leaf 6</th>
<th>Leaf 7</th>
<th>Leaf 8</th>
<th>Leaf 9</th>
<th>Leaf 10</th>
<th>Tree Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tree 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tree 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tree 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tree 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tree 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tree 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tree 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tree 9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tree 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total number of mines for 10 trees</th>
<th></th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Average number of mines per leaf for 10 trees (divide above sum by 100)</th>
<th>per leaf</th>
</tr>
</thead>
</table>

Instructions
1. Every 1-2 weeks, choose one or several representative orchard blocks for sampling.
2. Randomly select 10 trees scattered throughout a 2- to 5-acre block. If orchard is larger than 5 acres, it may be necessary to sample more trees.
3. On each sampling date, collect 10 leaves from each of the 10 trees (100 leaves total). These same leaves can be used to monitor for mites (refer to mite sampling form).
4. Count the number of mines and determine the average number of mines per leaf for each orchard block (to find the average, divide the total number of mines by 100).
5. If leaf mine counts are high, record counts from every leaf. Otherwise, record only total mine counts from all 10 leaves for each tree.

Treatment Thresholds*

Second Generation
- Early June—one or more mines per leaf and parasitism less than 30%
- Mid-June to July—two or more mines per leaf and parasitism less than 30%

Third Generation
- August—five or more active mines per leaf

*See manual for more complete information