Utah State University Extension

Orchard IPM Series HG/Orchard/07

White Apple Leafhopper

Typhlocyba pomaria

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Look on the undersides of leaves for leafhopper nymphs and adults.

Do You Know?

- White apple leafhopper is an indirect apple pest with two generations per year.
- Decision for control should be based on economic justifications as well as orchard and other pest considerations.
- White apple leafhopper can cause three types of injury:
  1. white mottling of leaves and chlorophyll removal
  2. sticky black spots on leaves and fruit
  3. large populations at harvest can be annoying to pickers
- Early nymph stages should be monitored from bloom through petal fall by observing 100 terminals or spur leaf clusters per 10-acre orchard.
- First generation control should target nymph instars 1-4 at about petal fall.
- White apple leafhopper has developed resistance to some insecticides.

The white apple leafhopper is the most common and serious of the leafhoppers found on apple. The rose leafhopper is also found on apple and pear in the Northwest. The two leafhopper species are similar in appearance, feeding habits, and life cycle and occur as mixed populations or individually in orchards. White apple leafhopper is native to North America and appears throughout fruit growing regions of the United States and Canada. It is primarily an economically important pest of apple. There are two generations of white apple leafhopper per year in Utah.

Feeding on leaves causes white speckling or mottling. Leaves with heavy infestation become almost completely white.

Hosts

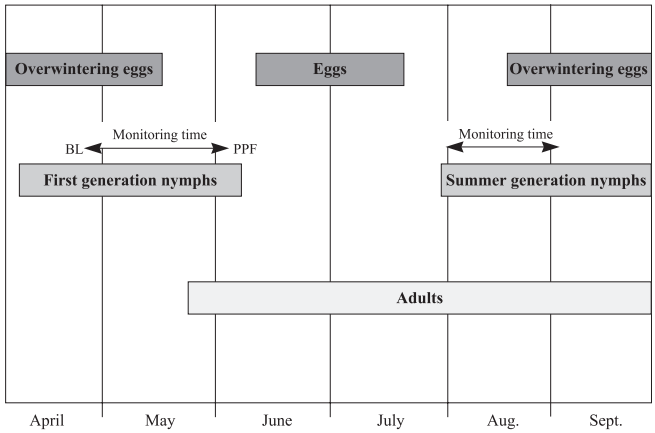
apple	peach
cherry	hawthorn
plum	pear (rose leafhopper)

Life History

Egg—Overwintering Stage

- **Size and shape:** about $^{1}/_{25}$ inch long and oblong shaped
- **Where:** inserted just beneath the bark creating blister-shaped swellings on 1- to 5-year-old tree limbs
- Overwintered eggs are deposited by second generation females from the previous year
- Overwintered eggs hatch at about pink stage of apple and peak near bloom

White Apple Leafhopper Life History



The arrows indicate the times of year when monitoring of nymphs should occur on apples (BL = bloom, PPF = postpetal fall).

Nymph—Damaging Stage

- **Size and color:** newly hatched nymphs are about 1/30 inch long and translucent white to yellow
- **Where:** first instar nymphs are found in orchards beginning late April to early May
- Feeds on the undersides of leaves developing through five stages or instars
- Wing pad development is noticeable by the third instar (See Figure 1)
- As they grow they cast off their old skins, which can be seen hanging from the undersides of leaves
- By the fifth instar they are 1/10 inch long with obvious wing pads (see Figure 1)

Adult—Damaging Stage

- **Size, shape, and color:** about 1 inch long, elongated, and pale yellowish white
- **Where:** feeds on the undersides of leaves and easily flies away when disturbed
- Wings are held roof-like over the body
- Can live for several months
- Females lay about 60 eggs during their life span

First Generation

- Appears in late May or early June in small numbers
- Smaller than the second generation and peaks in early to mid-June
- Females begin producing eggs about 10 days after emerging for a 3-week period
- Summer eggs are inserted into leaf petioles and veins and begin hatching in July

Second generation

- Nymphs and adults can be found in orchards from late July throughout the remainder of the season
- During the summer, generations and life stages overlap
- Adult densities peak in September around apple harvest time
- Overwintering eggs are deposited mainly during September until the first hard frost ends adult activity

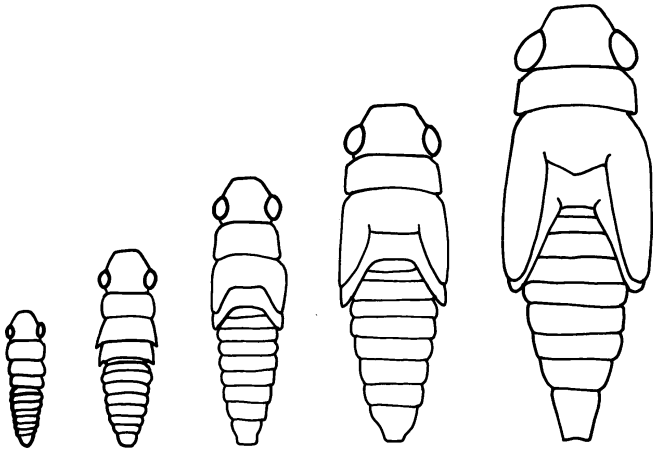


Figure 1. Wing pad development in white apple leafhopper nymph instars 1-5.

Host Injury

- Leafhopper nymphs and adults have piercing, sucking mouth-parts and feed on leaves removing the cellular contents.
- The larger second generation causes the most problems in orchards.
- Leafhoppers cause three types of injury:
  1. Feeding on leaves causes white speckling or mottling. (Leaves with heavy infestation become almost completely white. Spur leaves in particular can be heavily damaged.)
  2. Nymphs and adults excrete a sticky honeydew while feeding that can cause black spots on leaves and fruit.
  3. Large second generation populations at harvest time can be a nuisance to pickers.

Timing Control

First Generation

- Although second generation densities tend to be much larger, control should usually target first generation nymphs.
- Careful scouting for first generation young leafhopper nymphs should begin at bloom and continue through early June.
- A total of 100 terminals or spur leaf clusters should be examined in a 10-acre or smaller orchard.
- Examining 10 terminals on 10 randomly selected trees per block should provide an adequate assessment of leafhopper populations (see White Apple Leafhopper Sampling Form).
- Observe undersides of leaves as nymphs will congregate there.
- Nymph instars 1-4 are easiest to control so they should be targeted for monitoring and control decisions.
- An action threshold of 0.5–1.0 early nymphs (instars 1–4) per terminal or spur leaf cluster during the first generation (petal fall through first cover) is recommended if there is concern about flying adults annoying pickers.

Second Generation

- White apple leafhopper populations should again be monitored in August during the second generation by inspecting terminals for nymphs and adults (see White Apple Leafhopper Sampling Form).

- Adults can also be sampled with a beating tray.
- Orchards with nearby sources of white apple leafhopper, such as unsprayed orchards or backyard trees, should especially be monitored for reinfestation by adults.

Management

Because white apple leafhopper is an indirect pest that causes minimal reductions in fruit size, quality, and return bloom in otherwise healthy trees, it should only be controlled when necessary.

The key to management of the white apple leafhopper is to prevent the second generation from reaching nuisance levels by controlling the first generation. Although the first generation population may be small and non-threatening, even low numbers of young nymphs at petal fall (0.5–1.0 early nymphs per terminal) can result in problems for pickers at harvest. Waiting until late in the season to control the leafhopper may require several sprays and still not result in effective control. Also, timing of late season sprays may be more difficult because of chemical residue concerns (i.e., required preharvest intervals). Furthermore, these adults will lay eggs that overwinter and contribute to numbers the following year.

Multiple Stresses

Orchard factors such as tree vigor, tree age, drought stress, and injury by multiple pests, should be considered when deciding if leafhopper control is necessary:

- In young trees with small canopies, substantial loss of leaf chlorophyll could stunt growth.
- In low vigor trees with a low leaf-to-fruit ratio, moderate to heavy injury may reduce fruit set, size, quality, and return bloom.
- Trees susceptible to drought, such as those growing in light soils or during extremely high temperature periods, should be considered for leafhopper control.
- If multiple foliar pests occur such as mites, leafminers, aphids, and leafhoppers, their multiple effects should be considered.

Insecticide Resistance

White apple leafhopper appears to have developed resistance to some organophosphate and organochlorine insecticides commonly used in orchards. Variable control levels of 40–70% kill have been reported for diazinon, azinphosmethyl (Guthion), and phosmet (Imidan).

- Avoid overuse of any one chemical class for leafhopper control.
- If using insecticides, time application for optimal leafhopper control, which is usually when nymph instars 2–4 are predominant. Do not wait for codling moth timing to apply insecticides if this is past the optimal time for leafhopper control.
- One well-timed spray during the first generation may reduce resistance selection pressure as compared to multiple sprays during the second generation.

Biological Control

The primary biological control agent is a parasitic wasp, *Anagrus* sp., that attacks the egg stage. It attacks both overwintering and summer eggs. *Anagrus* appears to be reduced by the use of synthetic insecticides in orchards. Parasite levels in orchards with moderate to heavy synthetic chemical use are generally too low to prevent leafhopper populations from occurring. Since biological control of overwintering eggs by *Anagrus* takes place by petal fall, the impact on the leafhopper population has already occurred when first generation control decisions are made.

Control of First Generation

White apple leafhopper is best controlled around petal fall when the majority of nymphs are still small (instars 1–4) and egg hatch is nearly complete. Larger nymphs are increasingly difficult to control and adults often escape by flying away. When an action threshold is reached, a treatment decision should be made based on the biological factors described above (multiple stresses, insecticide resistance, biological control) and economic factors, such as market destination and crop value. The following are the most effective chemicals for control:

- endosulfan (Thiodan)
- imidacloprid (Provado)
- diazinon (Diazinon): resistance to diazinon is documented in Utah where the chemical has been used extensively
- soft insecticides: insecticidal soaps have been shown moderately effective against leafhoppers in Washington studies

The following materials will also provide control but may be toxic to predatory mites:

- carbaryl (Sevin)
- formetanate hydrochloride (Carzol)

If Sevin is used for thinning fruit and tree coverage is adequate, then an additional first generation treatment should not be needed. Pyrethroids should be avoided because of their toxicity to beneficials. Guthion and Imidan sprays timed for codling moth cover sprays are often too late to provide good control of leafhopper nymphs and can only provide 40–70% kill.

Control of Second Generation

Second generation leafhoppers should be monitored even though an orchard was cleaned up by first generation control. Adults fly easily and can reinfest a clean orchard if infested ones are nearby. Optimum timing for the second generation is generally more difficult because the vulnerable stages are spread out over time. Control can be achieved by a split application: one spray timed for first emergence of the second generation nymphs, the second spray 2 weeks later. This is an expensive option. If only one spray is to be applied, it should be timed for about 2 weeks after the second generation nymphs emerge. Sevin or Carzol are not recommended for second generation control because they are toxic to beneficial insects and mites and disruptive to an IPM program.

White Apple Leafhopper Sampling Form

First and Second Generations

(Bloom to August)

Orchard Block_____**Scout**_____**Date**_____

Number of Early Nymphs (Instars 1-4)

	Terminal 1	Terminal 2	Terminal 3	Terminal 4	Terminal 5	Terminal 6	Terminal 7	Terminal 8	Terminal 9	Terminal 10	**Total**
Tree 1											
Tree 2											
Tree 3											
Tree 4											
Tree 5											
Tree 6											
Tree 7											
Tree 8											
Tree 9											
Tree 10											
						Total number of nymphs for 10 trees					
						Average number of nymphs per terminal for 10 trees (divide above sum by 100)					**per terminal**

Stage of Bud Development _____

Instructions

1. Choose one or several representative orchard blocks for sampling. For orchard-specific pest control, all orchards should be sampled.
2. Randomly select 10 trees scattered throughout a 1- to 10-acre block.
3. First generation: begin sampling at bloom for early leafhopper nymphs (instars 1-4).
4. Examine the undersides of all leaves in 10 terminals or spur leaf clusters on each of the 10 trees (100 terminals total).
5. Count the number of early leafhopper nymphs (instars 1-4) per terminal and record counts on the sampling form. If leafhopper counts are high, record counts from every terminal. Otherwise, record only total counts from all 10 terminals for each tree. Determine the average number of leafhopper nymphs per terminal for each orchard block by dividing the total by 100.
6. Second generation: sample again in August if the first generation was not treated or if there is a reinfestation of leafhoppers from nearby sources such as unsprayed orchards or backyard trees.

Treatment Threshold*

First Generation

Petal fall to early June— 0.5–1.0 early nymphs (instars 1-4) per terminal or spur leaf cluster.

*See bulletin (HG/Orchard/07) for more complete information.