

WOOLLY APPLE APHID

Woolly apple aphid is a pest that has increased in stature as Washington apple growers transition away from the use of organophosphate insecticides. Though the reasons for increased woolly apple aphid problems are not completely understood, the predominate theories are: 1) some of the new, reduced-risk insecticides that have been used to replace azinphos-methyl (Guthion) for codling moth control are disrupting biological control of woolly apple aphid,

and/or 2) the reduction or elimination of the use of broad-spectrum organophosphate insecticides [Chlorpyrifos (Lorsban), Guthion, methyl parathion (Penncap)], which had previously suppressed woolly apple aphid, is allowing populations to grow through the season and become more problematic - especially near harvest. New and ongoing research projects, such as the Enhancing Western Orchard Biological Control Project (<http://enhanced-bc.tfrec.wsu.edu>) hope to increase



Woolly apple aphid axillary colonies (E. Beers)

our understanding of the interaction between insect pests, beneficial insects, and the new insecticides that are being introduced into our orchard systems.

LIFE-CYCLE



Woolly apple aphid shoot colony on young apple tree (E. Beers)

In Washington, woolly apple aphid has adapted to live and reproduce on apple year round. Though American elm is considered the primary host

of this pest, it is common in areas that do not have American elm for the aphid to survive and reproduce on apple only. Woolly apple aphid overwinters as a nymph, either below ground on the roots of the apple tree or above ground in protected areas of the tree. Severe winters may kill above-ground colonies; however, underground nymphs can move upward providing a source for above-ground infestations. The woolly apple aphid egg stage is not known to occur in Pacific Northwest orchards; in the spring overwintering aphids mature

and produce live young that migrate up and down the tree. In the summer, woolly apple aphid colonies are first established in the leaf axils of terminal shoots, and can eventually grow and coalesce to envelope the entire shoot. Substantial infestations are easily detected because of the white, cottony mass that is produced by the aphid colony. High levels of aerial colonies can occur almost any time during the growing season, from bloom through harvest, although mid-summer and fall outbreaks are the most common.

DAMAGE

Aphid feeding produces galls on both roots and shoots. The damage that is caused by underground woolly apple aphid colonies may be the most detrimental because galls (where aphids have fed on roots) interfere with water and nutrient uptake and continued feeding can kill roots, reduce tree growth, and even kill young trees. Woolly apple aphid feeding that occurs above

ground can result in blind wood and honeydew that drips onto fruit causing sooty mold, russetting, downgrading of fruit, and sticky conditions for workers. Woolly apple aphid can also infest the stem and calyx end of fruit, and in some varieties even reach the apple core. The presence of woolly apple aphid in packed apples can be a quarantine issue.



Woolly apple aphid galls on root system of apple

BIOLOGICAL CONTROL



Woolly apple aphid parasitized by *Aphelinus mali* (E. Beers)

There are several beneficial insects in Washington orchards that contribute to the biological control

of woolly apple aphid. *Aphelinus mali*, a small parasitic wasp, lays its eggs directly into the body of the aphid. The larva fully develops and pupates inside of the aphid's body and the adult parasite emerges from the aphid by cutting a circular exit hole. Because its presence is easily identifiable - hardened, black aphid mummies with a circular exit hole - *A. mali* is often given the most credit for biological control; however, recent research in Washington orchards has shown that a complex

of generalist predators (lady beetles, syrphid fly larvae, *Deraeocoris brevis*, and green lacewings) may actually play a more important role.



Syrphid larva in green apple aphid colony (E. Beers)

INSECTICIDAL CONTROL

Pre-bloom Lorsban applications can suppress early peaks in woolly apple aphid activity; however, Lorsban does not always provide full season control. Further, many growers are seeking to eliminate the use of Lorsban from their programs. There are only a few insecticides currently registered that provide effective control of woolly apple aphid. Diazinon and endosulfan (Thiodan) are the most commonly used products for late season control of this pest. Though reactive applications of these products can be effective,

regulatory changes have made them more difficult to use. At this time, alternative options for controlling late-season woolly apple aphid are few. Repeated applications of horticultural mineral oil, or Saf-T-Side oil, may help to suppress small populations. The neonicotinyl insecticides may provide some suppression, but they are much less effective on woolly apple aphid than other aphid species. Spirotetramat (Ultror/Movento) is a new insecticide that appears to have potential for the control of this pest. Prelimi-

nary research indicates that repeated applications of Ultror in the petal fall period can reduce underground woolly apple aphid colonies. Left uncontrolled, these colonies would later contribute to above-ground populations. When Ultror was tested as a late-season, reactive treatment it reduced aerial colonies but did not provide the same level of control as Diazinon or Thiodan.

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Pest Management Transition Project
Washington State University
1100 North Western Avenue
Wenatchee, WA 98801