

Weed Interference with Insect Management in Desert Crops

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Effective weed management is critical for the profitable production of vegetable crops in the desert southwest for all the obvious reasons. However, weed management is also essential for another important, but often overlooked, reason. Several common weed species found in and around vegetable crops can serve as host plants to many insect pests that can later infest nearby crops. Additionally, when weeds are not controlled in the field, they can be an impediment to effective insect control. Although weeds can serve a beneficial role by harboring insect natural enemies and pollinators, the consequences resulting from weeds harboring insect pests largely outweighs the benefits they potentially provide. This report focuses on the practical interactions between weeds and insect pests, and specifically on how poor weed management can contribute to insect pest problems in vegetable crops.

Weeds as Refuges for Beneficial Insects

There are numerous examples of how weeds can serve as a refuge for natural enemies of insect pests. Parasitic wasps and predatory insect species can build up to large numbers in weedy areas and subsequently migrate into adjacent vegetable fields where they can feed on damaging insect pests. Unfortunately, given the high cosmetic standards in many vegetable crops, these natural enemies are not generally capable of preventing economic damage to the harvested product. In contrast, flowering weed species can provide a source of nectar and pollen for several important insects such as honeybees and other native pollinators important for cucurbits and seed crop production. Of course, these same weedy refuges can serve as host sources for many key insect pests that cause economic damage to vegetable crops (Figure 1).

Weeds as Reservoirs for Insect Pests

Many of the common insect pests found in vegetable crops are polyphagous, capable of feeding and reproducing on crops and weeds in numerous plant families. For instance, a weed species such as common lambsquarters, is known to serve as a host for a variety of economic insect pests in fresh-market vegetables and melons (Table 1). Weeds such as these found on field margins and ditch banks can provide insect pests with suitable resources needed for rapid population growth which subsequently can lead to insect infestations occurring in adjacent vegetable crops. For example, it is not uncommon for green peach aphids and false chinch bugs to build up to high numbers on cheeseweed (Figure 2) and London rocket during the winter, only to later invade nearby seed crops in the spring.

Many weed species can also be important for these economic insect pests by providing host plants that serve as a bridge between cropping seasons when vegetables crops are not in production (May-August). Since most of these key insect pests can move relatively long distances to find new food sources, weeds that can grow unchecked in fallow fields during the summer often serve as a key source of insect infestations for fall vegetable and melon plantings. For example, pale-striped flea

beetle and beet armyworm populations will commonly develop on common purslane (Figure 3) that has been allowed to grow in fallow fields prior to fall vegetable and melon plantings.

Another host source for insect pests of vegetables are volunteer crops that are considered weeds ("a plant out of place") when allowed to grow in fallow fields, on field margins and within crops. Each summer, volunteer melons and cotton can be found germinating in fields being prepared for or planted in fall vegetable crops. If not controlled in a timely manner, these weedy volunteer plants can sustain large numbers of insect pests, as well as many of the plant viruses that are transmitted by insect vectors, that can migrate onto newly planted fields.

Weeds as Reservoirs for Insect-transmitted Viruses

Weeds can also serve as alternate host plants for three important groups of viruses that affect vegetable and melons; tospoviruses, potyviruses and criniviruses. These viruses utilize a few important weeds as hosts and are vectored by key insect pests, some of which are shown in Table 1. For example, one of the primary insect vectors of the tospovirus, tomato *spotted wilt virus*, is the western flower thrips. Not surprising, two common weed species (lambsquarters and cheeseweed) serve as hosts to both the vector and the virus. Similarly, these weed species serve as a host reservoir for several potyviruses (e.g., *Watermelon mosaic virus-2*) vectored by several aphid species. *Cucurbit Yellow Stunting Disorder Virus*, a crinivirus vectored by the sweetpotato whitefly, is a major problem in fall melons. Initially it was believed that only cucurbits could host the virus but has since been determined that several common weeds serve as reservoir hosts including: redroot pigweed, London rocket, lambsquarters, sowthistle, alkali mallow, Wright's groundcherry, and silverleaf nightshade (Wintermantle et al. 2009).

Weeds as Impediments to Insecticide Applications

Foliar Sprays: Weed control can be critical during stand establishment to prevent interference with foliar insecticide sprays necessary for insect control on small plants. Weeds infesting vegetable or melon fields can negatively influence insecticide deposition onto plant foliage, resulting in reduced insecticide efficacy. This may be especially important for a weed such as Wright's groundcherry, or a volunteer "weed" such as cantlaoupe, both of which can produce a canopy over seedling vegetable plants (Figure 4). Dense weed foliage can intercept insecticide spray droplets before reaching the target crop, resulting in less insecticide deposition and unacceptable plant damage from insect feeding on untreated foliage.

Soil Insecticides: Many fields planted to vegetable and melons crops each year are treated with soil systemic insecticides (i.e., imidacloprid, rynaxypyr, cyazypyr) for early season control of whiteflies, aphids, beet armyworms, cabbage loopers and diamondback moth. These insecticides are injected beneath the seedline just prior to- or at-planting and become systemically active in plants via root uptake during germination and seedling growth. Much like weeds growing during stand establishment can compete with the crop for water and fertilizer, they can also compete with crop plants for soil insecticides. Excessive weed densities can significantly intercept insecticides and reduce the amount available for uptake by the target crop.

Herbicide interactions: Anecdotally, it has been suggested that root injury in leafy vegetables resulting from applications of pre-emergent herbicides such as Kerb and Prefar could potentially reduce uptake of soil insecticides during stand establishment. Herbicide effects causing root pruning or clubbed roots could potentially impede normal uptake of the systemic insecticides until root growth resumed.

Table 1. Common weeds that are known to serve as hosts for the major insect pests of leafy vegetables and melons crops grown in the desert southwest.

	Beet armyworm	Corn earworm	Variegated cutworm	Liriomyza leafminers	Western flower thrips	Green peach aphid	Potato Aphid	Sweetpotato whitefly	Flea beetles	False chinch bug	Bagrada bug
Sunflower	■	■						■			■
Silverleaf nightshade					■	■	■	■	■	■	
Cheeseweed					■	■	■	■	■	■	■
Lambsquarters		■			■	■	■	■	■	■	■
Nettleleaf Goosefoot	■								■		■
Jimsonweed			■		■	■	■	■			
Wright's groundcherry		■	■					■			
Common purslane	■	■							■	■	
Ragweed		■	■				■		■		
Pigweed	■	■			■	■	■	■	■		
Sheperd's purse			■				■	■		■	■
Russian thistle	■									■	
London rocket						■	■		■		■
Wild mustard						■	■			■	■

Sources: Common names of weeds from Parker 1972; List of hosts for insects from Capinera 2001.

Relevant References

- Capinera, J.L. 2001. Handbook of Vegetable Pests. Academic Press, New York. 729 pp.
- Parker, K.F. 1972. An Illustrated Guide to Arizona Weeds. Univ. of Arizona Press. Tucson.
- Wintermantle W.H., L.L. Hladky, A. A. Cortez and E.T. Natwick. 2009. A New Expanded Host Range of *Cucurbit yellow stunting disorder virus*, Plant Dis. 93:685-690



Figure 1. Beet armyworm moth finding refuge in a groundcherry plant.



Figure 2. Green peach aphid infesting cheeseweed found adjacent to a lettuce field.



Figure 3. Flea beetle feeding signs on purslane leaves in a fallow field prior to lettuce planting.



Figure 4. Volunteer cantaloupes infesting a direct-seeded lettuce field during stand establishment.