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Aphid Pests on Vegetables

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Do You Know?

- Aphids are small, soft-bodied insects that suck sap from plant tissues.
- Aphid feeding distorts and stunts plants, produces honeydew that supports sooty mold fungi, and can vector plant viruses.
- During spring and summer, aphids can be abundant.
- One of the most serious problems caused by aphids to vegetable crops is the spread of plant viruses.
- Biological control from predators and parasitoids is a key contributor to suppressing aphid populations.
- Insecticidal soap or horticultural oil sprays can reduce aphid populations and conserve natural enemies.

Aphids are a diverse family of insects with many species that inflict similar plant damage, and can be managed using similar tactics. This fact sheet will focus on four of the most common aphids that are pests of vegetable crops in Utah:

Green peach aphid *(Myzus persicae)*
Potato aphid *(Macrosiphum euphorbiae)*
Melon (or cotton) aphid *(Aphis gossypii)*
Cabbage aphid *(Brevicoryne brassicae)*

DESCRIPTION

Aphids are small, soft-bodied, pear-shaped insects with two tailpipe-like appendages called "cornicles." Cornicles are unique to aphids, and excrete defensive compounds (waxes and alarm pheromones).

Aphids vary in color, including within species, depending on maturity, food source, genetic lineage, and their environment. Juvenile aphids (nymphs) look like adults, except smaller in size (Fig. 1). As nymphs feed and grow they molt, casting off white skins (exoskeleton) that can be seen near the colony (Fig 2). Nymphs develop through about four molts before becoming adults.

Fig. 1. A green peach aphid giving birth to live young (vivipary).

Fig. 2. A tomato infested with aphids. When aphids molt, white "skins" are left behind.

Adult aphids can be winged or wingless (apterous). Winged forms generally have slimmer bodies and transparent wings. The winged form of the green peach aphid has dark spots on its green body (Fig. 3).

Fig. 3. Winged form of an adult green peach aphid.

Aphid Species	Description	Plant Hosts
Green Peach Aphid  Fig. 4	Yellow to green in summer; vary from pale to dark-green, pink, or red in fall. Range in length from 0.06 to 0.09 in (1.5 to 2.3 mm).	*Extensive host range.* **Fall - Spring:** peach, apricot, nectarine **Summer:** vegetables - tomato, potato, pepper, eggplant, squash, pumpkin, cucumber, spinach, mustards, cabbage, broccoli, legumes, celery, okra, corn; other crops - tobacco, canola, sunflower, other flowers; and weeds - lambsquarters, common tumbleweed, nightshade, sowthistle, mustards, many others
Potato Aphid  Fig. 5	Pink or green; 0.07 to 0.16 in (1.8 to 4.1 mm) long.	*Similar host range to the green peach aphid.* **Fall - Spring:** wild and ornamental rose **Summer:** vegetables & fruit - potato, tomato, eggplant, sunflower, pepper, pea, bean, apple, turnip, corn, sweet potato, asparagus; and weeds - ragweed, lambsquarters, jimsonweed, pigweed, shepherd's purse, wild lettuce, clover
Melon (Cotton) Aphid  Fig. 6	Mottled light and dark green or almost black; however, yellow forms do occur. Average 0.06 in (1.5 mm) long.	*Extensive host range, many cucurbits.* **Fall - Spring:** catalpa, rose of Sharon **Summer:** vegetables - cantaloupe, honeydew, casaba, Persian melon, watermelon, cucumber, squash, pepper, asparagus, eggplant, okra; other crops - cotton, citrus; and weeds - milkweed, jimsonweed, pigweed, plantain, field bindweed
Cabbage Aphid  Fig. 7	Gray to green with a grayish waxy covering and short cornicles. About 0.07 to 0.1 in (1.8 to 2.5 mm) long.	*Cole crops, other mustard family plants, and related weed species.* **Fall – Spring:** cole crop residue, weeds **Summer:** vegetables - broccoli, cauliflower, cabbage, Brussels sprouts, kale, collards, kohlrabi, oilseed rape, Chinese broccoli, Chinese cabbage, radish, kale; and weeds - Indian mustard, white mustard, black mustard

LIFE CYCLE

The life cycle of aphids can be complex, and differs among species. A generalized description is shown in Fig. 8.

Green peach, potato and melon aphids

These aphids require a woody host to complete their life cycle. They overwinter as eggs on woody hosts and hatch in spring, producing only females. These spring aphids feed on the succulent new growth, and when mature, give birth asexually (parthenogenesis) to live female offspring. As the weather warms (70-81°F is optimal), aphids can complete a generation in as little as 7-8 days. Females can produce up to 12 nymphs per day for 50-100 total offspring. After 2-6 generations on the woody hosts, the aphids form wings and migrate to vegetable crops and other hosts for the summer, where they complete many more generations. As temperatures cool in the fall, aphids again form winged offspring (male and female) and return to winter host plants, where sexual mating occurs and eggs are laid for overwintering.

Cabbage aphids

These aphids do not require an alternation of host plants. In northern Utah, they overwinter as eggs on crop debris, and in southern Utah, they may overwinter as adults. In spring, eggs hatch to all females, and reproduction occurs as noted above on mustard family plants. Winged aphids form when colonies become too crowded, resulting in dispersal to other brassica hosts. Cool fall temperatures cause sexual mating and egg-laying for overwintering.

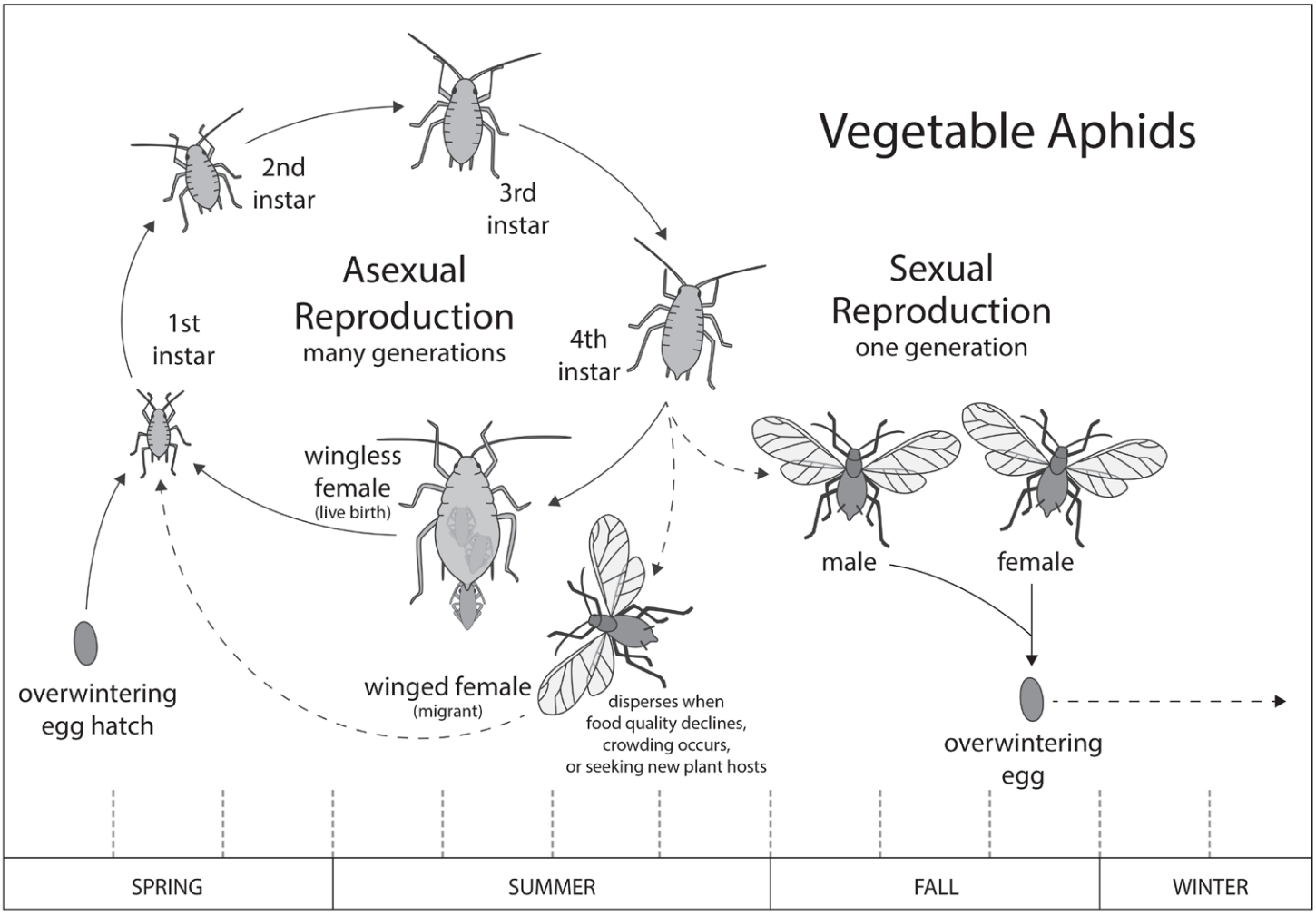

Fig. 8. Generalized aphid life cycle in Utah. Many species of aphids live on a woody host from fall to spring, and migrate to vegetables or weeds for the growing season.

INJURY

Aphids feed on buds, leaves, flowers, stems, and fruits with piercing-sucking mouthparts. Feeding causes plant structures to become stunted, yellowed, and distorted. Curled leaves create a micro-environment that protects aphids from predators, insecticides, and the environment (Fig. 9).

Fig. 9. Aphid infestations can cause leaves to curl (top left) and/or become yellow (top right). Aphids also feed on stems (bottom left) and fruit (bottom right).

Aphid feeding results in an overall loss of plant vigor. Early in the season, young vegetable plants can suffer loss of productivity and reduced plant health. Cabbage aphids can cause significant economic losses due to contamination of produce. In broccoli, they feed within the flower stalks, and in Brussels sprouts, they feed within the developing heads.

Aphids excrete a sugary substance called honeydew which can cover plant surfaces and harm crop quality and marketability. Sooty mold fungi may grow on the honeydew, blocking sunlight and reducing plant vigor. Honeydew attracts ants, which can protect aphids by warding off predators to protect their honeydew food source.

Aphid-vectored plant viruses

One of the most serious problems caused by aphids to vegetable crops is the spread of plant viruses. Viruses can dramatically reduce crop yield, and even kill plants. All four of the aphids discussed here can transmit viruses to vegetable crops. The green peach aphid is known to transmit more than 100 different viruses.

Winged aphids can spread viruses from infected to healthy plants. Even when aphid numbers are below detectable levels, there is still a risk of virus introduction from virus-infected aphids immigrating into a field.

Utah's most common aphid-vectored viruses are non-persistent, meaning, they do not survive and replicate within the insect. After an aphid obtains virus particles on its mouthpart from an infected plant, it can transmit the virus to an uninfected plant only once. The feeding process must be repeated for further spread. (Fig. 11).

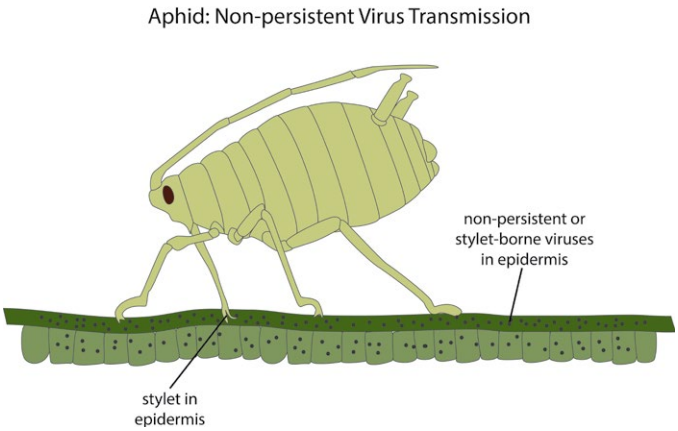

Fig. 11. In non-persistent transmission, aphids need only very short feeding times (usually from tissues near the surface of leaves) to obtain the virus on their mouthparts.

Vegetables susceptible to aphid-transmitted viruses

• beans	• cauliflower	• pepper
• beets	• chard	• potato
• bok choy	• cucumber	• pumpkin
• broccoli	• kohlrabi	• squash
• Brussels sprouts	• lettuce	• tobacco
• cabbage	• melon	• tomato

Common aphid-vectored vegetable viruses

There are numerous plant viruses, and plants can be infected with more than one type of virus. Viruses are typically named for the first host plant on which they were described; however, most viruses can infect more than one plant species. Some viruses also infect weeds.

Some virus symptoms mimic those of other problems; diagnostic tests are typically required to confirm a virus infection. The mosaic viruses, however, cause unique symptoms that can be visually identified. Although there are many types of mosaic viruses, most cause mottled shading of green and yellow or other colors, on leaves and fruit (Fig. 12).

Fig. 12. Mosaic virus symptoms on a pumpkin leaf (left). Mosaic virus symptoms can also occur on fruits, such as squash (right).

Aphid-Vectored Vegetable Viruses Detected in Utah

Name	Common Vegetable Hosts		Symptoms
	Detected in Utah	Other potential hosts	
Alfalfa mosaic virus	tomato, pepper, potato, pea, bean	n/a	Bright yellow blotches with some mottling, turning to a bronze discoloration on leaves; necrotic phloem tissues; necrotic rings and spots on fruit; sometimes solid brown necrosis on surface of fruit; plant death
Cucumber mosaic virus	cucurbits	tomato, pepper, bean, lettuce, spinach, carrot, celery, beet	Symptoms vary with the host, mottling on leaves and fruit; sometimes severely stunted plants
Potato virus Y	potato	tomato, pepper	Symptoms will vary among potato cultivars, mild to severe mosaic or mottling on leaves; sometimes leaf drop; stunted plants; necrotic or dead rings on tuber skin
Watermelon mosaic virus	cucurbits	pea	Strong mosaic on foliage; leaf distortion and deep leaf serration; malformed fruit with knobby bumps; host range is not limited to cucurbits and may overwinter in leguminous species such as clover

MANAGEMENT of VIRUSES

Plants cannot be cured of virus infections; thus, prevention and reduction of spread are the most effective management practices. While predators play an important role in reducing aphid populations, their action is too slow to prevent the transmission of most viruses.

Remove and destroy infected plants. Migrating aphids can spread non-persistent viruses rapidly, which makes controlling the spread of viruses with insecticides ineffective. A better management tactic is to eliminate plant sources of viruses, including weeds. Once vegetable harvest is complete, use effective field sanitation practices such as removal and disking under of crop debris.

Plant resistant cultivars. If virus infection has been a problem in the past, check to see if there are resistant cultivars available.

Plant early. Crops planted late in the season tend to be more susceptible to viral diseases because they are young during peak virus infection and spread periods. Planting early may decrease virus symptom intensity. If planting early isn't an option, avoid planting next to crops that are also susceptible to the virus since these crops may be a virus source.

Use reflective mulches. The use of reflective or aluminum mulches early in the season has been found to repel migratory aphids from young plants; thus, reducing the spread of viruses.

Use vegetable or mineral oil sprays. Viral transmission may be reduced by coating foliage with vegetable or mineral oil (in crops not damaged by oil sprays). The oil coats the mouthparts (stylets) of feeding aphids and interferes with virus transmission. The use of oil sprays is most effective when disease and aphid populations are low, and temperatures are below 90°F.

MANAGEMENT of APHIDS

Monitor

Scout frequently. Since aphid colonies can quickly increase, it is important to scout plants at least twice weekly when plants are young and growing rapidly. Look on the underside of leaves where aphids congregate, and look for ant activity. Once aphid feeding causes leaf curling, it is more difficult to reduce aphid numbers. Most species of aphids cause the greatest damage when temperatures are warm, but not hot (65° to 80°F).

Use yellow sticky traps to monitor aphid populations. Yellow sticky cards will attract winged aphids. Online vendors of sticky cards include Great Lakes IPM, Peaceful Valley Farm and Garden Supply, Gempler's, Trécé, and Alpha Scents.

Thoroughly scout fields and nearby crops and weeds. Aphid infestations typically begin as scattered colonies within a field. Therefore, it is important to monitor all sections of a field and nearby crops and weeds that may serve as aphid sources. Aphid "hot spots" can be managed by removing infested plants or treating the infested area with insecticides

Cultural and Mechanical Control

Use preventive measures. Before planting, remove weeds and volunteer crops that can serve as aphid hosts.

Encourage natural enemies. Plant strips of yarrow, alyssum, herbs and other plants with small, attractive flowers that provide nectar and pollen for beneficial insects.

Inspect transplants for aphids before planting; dispose of infested plants.

Manage nitrogen levels. High levels of nitrogen fertilizers tend to encourage aphid reproduction. Use several,

staggered applications of lower concentrations of nitrogen rather than a single high dose. Also, use delayed-release formulations.

Use row covers. Row covers put in place at planting through start of bloom can exclude melon aphids in cucurbit crops.

Use reflective mulches. Reflective silver or aluminum mulches can repel winged aphids.

Biological Control

Conservation and attraction of native natural enemies is one of the most effective means to prevent aphid outbreaks. In some situations, such as within greenhouse tunnels, purchasing and releasing biocontrol agents for aphid management can be of value. Some suppliers of beneficial organisms include Arbico Organics, Biocontrol Network, Do My Own Pest Control, and Rincon-Vitova Insectaries.

Generalist predators not only control aphid populations, but also feed on other pests such as thrips, leafhoppers, and mites. Low levels of aphids in the environment are desirable in order to maintain healthy populations of beneficial insects. The most well-known aphid predators include lady beetles (Fig. 13), lacewings, and syrphid flies. Others include soldier beetle, minute pirate bug, damsel bug, and predatory midges (Fig. 14).

Fig. 13. Lady beetle adults often lay eggs (left) near aphids so that larvae (right) will have food available when they hatch.

Fig. 14. Aphid predators include: damsel bug (top left), syrphid fly larva (top right), predatory midge (bottom left), and lacewing larva (bottom right).

Parasitic wasps are specialized aphid natural enemies. Female wasps lay a single egg inside each of several hundred aphids. The egg hatches into a wasp larva that consumes the body of the aphid. The wasp larva then pupates inside the aphid, turning it into a mummy, and burrows out through a circular exit hole, leaving the mummified aphid behind (Fig. 15). Parasitoid wasps can complete a life cycle within a few weeks; aphid populations may decline quickly once aphid mummies are noted.

Fig. 15. Parasitic wasps parasitize aphid bodies turning them dark in color (upper left); a wasp pupates within the aphid body, turning it into an enlarged mummy (upper right); and a new adult wasp emerges from the aphid leaving an exit hole in the aphid body (bottom).

Figs. 16. This off-color aphid has been infected and killed by the entomopathogenic fungus *Beauveria bassiana*.

Aphids may also fall victim to insect fungal diseases under humid conditions leaving them off-color, bloated, or flattened (Fig. 16).

Adequate populations of natural enemies can suppress aphid infestations without the need for insecticide treatment. There is typically a delay in the increase of natural enemies following a rise in aphid populations; however, provision of attractive flowers to provide nectar and pollen, and avoidance of toxic insecticides are the key factors in encouraging aphid biological control.

Insecticides

General action thresholds to determine whether and when to treat for aphids in vegetable crops include:

- When plants are young, aphid populations are increasing, and aphids occur on 50-60 % of the leaves.
- When aphid populations remain at 8 to 10 or more per leaf for two or more consecutive weeks.

Cabbage aphid thresholds:

- Cabbage, broccoli, and cauliflower: treat as soon as 1 to 2% of plants are infested with one or more aphids and after treating, continue checking fields and treat if populations reappear.
- Brussels sprouts: treat when 15% of plants are infested (this is conservative). Brussels sprouts can tolerate 40% infested plants from transplanting up until 2 weeks before harvest.

Only use insecticide applications when needed. Rotate among different insecticide classes between applications as aphids are prone to developing resistance. This has already occurred with pyrethroids for populations of green peach aphid and melon aphid in agriculturally-intensive areas of the U.S. Select insecticides with the least harmful effects to beneficial insects, and high selectivity for the target pest.

Botanigard is a biological insecticide for commercial growers labeled for control of aphids. The active ingredient, *Beauveria bassiana*, is an entomopathogenic fungus that causes the white muscadine disease in aphids and other insects.

Insecticidal soap and horticultural oils (discussed below) are good options to treat aphids before populations increase to high levels. Thorough spray coverage is important for good aphid control. It can be difficult to reach aphids on the underside of leaves or in curled leaves. Ground sprays using hollow-cone nozzles or air-assist sprayers will provide the best canopy penetration. Higher spray volumes are also helpful.

Organic

Organically approved insecticides include insecticidal soap and oils (petroleum, mineral, canola, clove, garlic, rosemary, and neem). Oil and soap sprays kill aphids on contact by physical means (suffocation and disruption of waxes in the exterior cuticle), so thorough coverage is essential for good efficacy. These products also kill beneficial insects in the same way, but there is no residual activity, so natural enemies that arrive post-spray are unharmed. Beneficial insects are most active during the day, so the best time to spray is early in the morning, late afternoon, or at or after dusk.

Caution: Do not use soap or oils on water-stressed plants or when temperatures will exceed 90°F within 4 hours of application. These materials may be phytotoxic to some plants, so always check the label. If unsure about phytotoxicity, test the spray on a few plants before treating an entire field.

Additional certified organic products include pyrethrins, and other botanical and microbial insecticides.

Conventional

Keep in mind that some conventional insecticides also kill beneficial insects that help keep aphids and other pests under control. If a conventional product is necessary, recommended active ingredients include acetamiprid, bifenthrin, cyfluthrin, imidacloprid, and malathion.

Caution: Some insecticides are labeled for use against aphids but should not be used on food crops. Always check product labels for registered uses.

For more information on vegetable pests and aphids, see the **Vegetable Production and Pest Management Guide website**.

See the **Utah Vegetable Production and Pest Management Guide website** for examples of **COMMERCIAL USE** insecticides registered in Utah that are effective for control of aphids in vegetable crops.

Examples of **HOME USE** insecticides registered in Utah that are effective for control of aphids in vegetable crops.

Active Ingredient	Brand Name	Mode of Action*	Residual (days)
malathion	Hi Yield, Spectracide Malathion, Ortho Malathion	1B	7
bifenthrin	Fertilome Broad Spectrum Insecticide, Bonide Eight Insect Control, Ortho Bug-B-Gon Max Lawn and Garden Insect Killer	3	14
cyfluthrin	Bayer Vegetable and Garden Insect Spray	3	14
deltamethrin	Green Light Many Purpose Dust	3	14
esfenvalerate	Monterey Bug Buster II	3	---
gamma-cyhalothrin	Spectracide Triazicide	3	14
permethrin	Bayer Complete Insect Dust, Lily Miller Multi-Purpose Insect Spray	3	3
pyrethrins	Monterey Bug Buster-O[OB]	3	5
pyrethrins + canola oil	Earth-tone Insect Control, Monterey Take Down Garden Spray	3/UN	5
pyrethrins + piperonyl butoxide	Bonide Pyrethrin Garden Insect Spray[B], Garden Tech Worry-Free Insecticide and Miticide[B]	3	3
pyrethrins + potassium salts of fatty acids (insecticidal soap)	Safer Tomato & Vegetable Insect Killer[O], Safer Yard & Garden Insect Killer[O]	3/UN	5
pyrethrins + sulfur	Bonide Tomato and Vegetable 3 in 1, Natria Insect Disease & Mite Control[B], Ortho Insect Mite & Disease 3 in 1	3/UN	5
acetamiprid	Ortho Flower Fruit & Vegetable	4A	14
capsaicin and related capsaicinoids	Bonide Hot Pepper Wax Insect Repellent	NC	---
oil: canola, neem, rosemary, clove, cottonseed	Natria Multi-Insect Control[OB], Monterey All Natural 3 in 1 Garden Insect Spray	physical	1
potassium salts of fatty acids (insecticidal soap)	Natria Insecticidal Soap, Safer Insecticidal Soap[OB]	physical	1

[B]= Biopesticide
[O]= Organic
UN=compounds of unknown or uncertain MoA
NC= not classified

*Insecticide mode-of-action (MOA) classification number based on guidelines from the Insecticide Resistance Action Committee. Rotate among insecticide classes to reduce the development of resistance; 1B = organophosphate, 3 = pyrethroids and pyrethrins, 4A = neonicotinoid, 5 = spinosyns, and 11A = bacterial microbe.

[O]Organically certified insecticide products.

Note: All brand names are registered trademarks. Examples of brands may not be all-inclusive, but are meant to provide examples of insecticides registered on vegetables in Utah. The availability of insecticides and active ingredients in brands can change. Always check the label for active ingredient(s), registered uses, application and safety information, and protection and pre-harvest intervals.

Additional Reading

Boucher, J. 2012. Pepper IPM: Aphids. University of Connecticut Extension IPM. http://ipm.uconn.edu/documents/raw2/Pepper%20IPM%20Aphids/Pepper%20IPM%20Aphids.php?aid=59

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The authors thank Dr. Claudia Nischwitz, Utah State University Plant Pathologist, for contributing her expertise on vegetable viruses and detections in Utah. For additional reading on aphid-vectored viruses, see the following links:

Alfalfa Mosaic Virus

Watermelon Mosaic Virus

Potato Virus Y

Photo Credits

[2] J. Obermeyer, Purdue Extension Entomology

[4] David Cappaert, Michigan State University, Bugwood.org

[5] Joseph Berger, Bugwood.org

[6] Mississippi State University Archive, Mississippi State University, Bugwood.org

[7] Alton N. Sparks, Jr., University of Georgia, Bugwood.org

[3] Scott Bauer, USDA Agricultural Research Service, Bugwood.org

[14] Syrphid fly larva: Clemson University – USDA Cooperative Extension Slide Series, Bugwood.org; Predatory midge: Whitney Cranshaw, Colorado State University, Bugwood.org; Lacewing larva: Joseph Berger, Bugwood.org

[15] Parasitized aphids (left): Patrick Porter, Texas Cooperative Extension, Bugwood.org; Aphid mummies (right): Alton N. Sparks, Jr., University of Georgia, Bugwood.org; Emerged Wasp (bottom): Jack Kelly Clark, Communication Services and Information Technology

[16] Whitney Cranshaw, Colorado State University, Bugwood.org