



Scouting Guidelines and Biological Control Options for Vegetable Bedding Plants and Transplants

Pest	How to Monitor	Where to Look	Biological Control Options
Aphids	Monitor weekly. Rely on plant inspection, not sticky cards. Look for small, 1/16-inch-long aphids with two cornicles or “tailpipes” at the rear of their body. Identification species to determine which host specific aphid parasite to release when using biological controls. If uncertain, mixes of different species are available.	Underside of leaves and along stems on tips of new growth on eggplant, pepper, tomatoes, and many different leafy vegetables. Signs of aphid activity: shed white skins, shiny honeydew, presence of ants, curled new leaves, and distorted growth.	<i>Adalia bipunctata</i> (predatory lady beetle) <i>Aphelinus abdominalis</i> (aphid parasite) <i>Aphidius colemani</i> (aphid parasite) <i>Aphidius ervi</i> (aphid parasite) <i>Aphidius matricariae</i> (aphid parasite) <i>Aphidoletes aphidimyza</i> (aphid midge, predator) <i>Chrysoperla spp.</i> (green lacewing, predator) <i>Hippodamia convergens</i> (predatory ladybeetle) Aphid Banker Plants (starter)
Bacterial Leaf Spot	On peppers, at first, chocolate-brown spots are less than 1/4 inch in diameter, & water-soaked in appearance. Severely spotted leaves appear scorched and defoliation may occur. Some strains also cause leaf spot on tomatoes.	Seed-borne disease. More prevalent during moderately high temperatures, long periods of high humidity and leaf wetness.	

<i>Botrytis</i> blight	Look for leaf blight and tan stem cankers. <i>Botrytis</i> blight produces characteristic gray fuzzy appearing spores on the surface of infected tissues during humid conditions.	In areas where plants are spaced close together and where condensation dripping from plastic greenhouse coverings.	Biological fungicides: <i>Bacillus amyloliquefaciens</i> <i>Bacillus subtilis</i> <i>Clonostachys rosea</i> <i>Reynoutria sachalinensis</i> extract <i>Streptomyces</i> sp. <i>Streptomyces lydicus</i> <i>Swinglea glutinosa</i> <i>Ulocadium oudemansii</i>
Broad Mites	Look for symptoms of damage: leaf edges curling downward, twisted, and distorted growth. With a 20x hand lens, or under a dissecting microscope, look on underside of leaves, especially on newest growth, for mites and their distinctive eggs.	Near ornamental crops affected with broad mites. Near whiteflies, (broad mites may hitch a ride on their legs). Peppers are especially susceptible.	<i>Amblyseius swirskii</i> (predatory mites) <i>Neoseiulus (Amblyseius) californicus</i> (predatory mites) <i>Neoseiulus (Amblyseius) cucumeris</i> (predatory mites)
Caterpillars	Inspect plants when adult moths are active, especially near Cole crops. Look for caterpillars, their feeding damage, and fecal droppings (frass).	Inspect plants near doors, openings, weedy areas and in greenhouses near vegetable fields.	<i>Bacillus thuringiensis</i> subsp. <i>kurstaki</i> <i>Trichogramma</i> spp. (egg parasite)
Cyclamen Mites	Look for symptoms of damage: inward curling, puckering, and crinkling of leaves. With a 20x hand lens or under a microscope, look within buds for mites and their eggs.	Near ornamental crops affected with cyclamen mites.	<i>Amblyseius swirskii</i> (predatory mites) <i>Neoseiulus (Amblyseius) californicus</i> (predatory mites) <i>Neoseiulus (Amblyseius) cucumeris</i> (predatory mites)

Damping-Off (Pythium root and stem Rot)	Monitor seed flats of susceptible plants. Inspect weekly. Visually examine roots for cortex that sloughs off leaving central core.	Inspect plants weekly for signs of disease: wilted, stunted, off-color plants with discolored root systems. Focus on areas where plants stay wet or where there may be high populations of shore flies that may carry disease spores. High soluble salts/fertility increases susceptibility.	Biological fungicides: <i>Bacillus amyloliquefaciens</i> <i>Bacillus subtilis</i> <i>Clonostachys rosea</i> <i>Reynoutria sachalinensis</i> extract <i>Streptomyces lydicus</i> <i>Trichoderma asperellum</i> & <i>T. gamsii</i> <i>Trichoderma harzianum</i> <i>T. harzianum</i> & <i>T. virens</i>
Damping-Off (Rhizoctonia root and crown rot)	Monitor seed flats of susceptible plants including cole crops, peppers, and tomatoes. Look for small, water-soaked spots on stems or leaves before seedlings collapse.	Seed flats near walkways or near dust and debris. Overcrowded seedling flats are more susceptible to damping-off.	Biological fungicides: <i>Bacillus amyloliquefaciens</i> <i>Bacillus subtilis</i> <i>Clonostachys rosea</i> <i>Reynoutria sachalinensis</i> extract <i>Streptomyces griseoviridis</i> <i>Streptomyces lydicus</i> <i>Trichoderma asperellum</i> & <i>T. gamsii</i> <i>Trichoderma harzianum</i> <i>T. harzianum</i> & <i>T. virens</i>
Fungus gnats	Use sticky cards to monitor for adults. Place cards horizontally above soil surface. Use potato chunks to monitor for larvae. Check every two days.	Favorable habitats include areas with standing pools of water, mud floors, spilled media, and low growing weeds.	<i>Bacillus thuringiensis</i> subsp. <i>israelensis</i> (pathogen) <i>Dalotia coriaria</i> (predatory beetles) <i>Stratiolaelaps scimitus</i> (predatory mites) <i>Steinernema feltiae</i> (nematodes)
Late Blight	Look for sunken, water-soaked lesions on leaves and brown lesions on tomato stems.	Overwinters in potato cull piles or outdoors in field soil that is not completely frozen.	
Leafminers (Spinach and beet)	Look for small, oblong, white eggs laid in clusters on the	Scout underside of leaves of beet, spinach, and Swiss chard	The wasp parasitoid, <i>Diglyphus isaea</i> , which is most often used against

	underside of beet, spinach, and Swiss chard leaves. Inside the mines, look for one or several pale, white maggots.	leaves for eggs. Treat when they are first observed to target the larvae as they hatch.	<i>Liomyza</i> leafminers, has been reported to control leafminers in Swiss chard and works best in warm weather.
Powdery mildew	Scout weekly. Look for faint, white fungal threads, and spores on leaves.	Scout near vents, or any location with a sharp change between day and night temperatures.	Biological fungicides: <i>Bacillus amyloliquefaciens</i> <i>Bacillus subtilis</i> <i>Clonostachys rosea</i> <i>Reynoutria sachalinensis</i> extract <i>Streptomyces lydicus</i> <i>Swinglea glutinosa</i>
Shore flies	Use sticky cards to monitor for adults.	Found near algae, their food source. Adults found on leaves, may leave fecal droppings that are larger than thrips fecal droppings.	<i>Dalotia coriara</i> (predatory beetles) <i>Steinernema carpocapsae</i> (nematodes)
Slugs	Look for chewed holes in leaves and shiny patches of slime. Slugs hide under dense foliage, and beneath pots and benches and other protected locations.	Chewed, irregular holes with smooth edges in leaves and slime that dries into silvery trails on the foliage.	
Spider Mites (Two-spotted Spider mites)	Rely on plant inspection. Look for light flecking, speckling or discolored foliage, and webbing if high populations have developed.	Look in hot, dry locations in greenhouse (i.e. near furnace) or near entranceways.	<i>Amblyseius andersoni</i> (predatory mites) <i>Neoseiulus (Amblyseius) californicus</i> (predatory mites) <i>Neoseiulus (Amblyseius) fallacis</i> (predatory mites) <i>Feltiella acarisuga</i> (predatory midge) <i>Phytoseiulus persimilis</i> (predatory mites)
Thrips (western flower thrips)	Rely on sticky cards (placed just above crop canopy) and	Inspect plants by tapping tender new growth over a sheet	<i>Amblyseius swirskii</i> (predatory mites) <i>Dalotia coriaria</i> (predatory beetles)

	foliage inspection of key plants for early detection.	of white paper. Watch for curled, emerging leaves, distorted new growth on pepper. Look for white scarring and black fecal spots, especially on cucumber and eggplant.	<i>Neoseiulus (Amblyseius) californicus</i> (predatory mites) <i>Neoseiulus cucumeris</i> (predatory mites) <i>Orius spp.</i> (pirate bug, predator) <i>Steinernema feltiae</i> (nematodes) <i>Stratiolaelaps scimitus</i> (predatory mites) Ornamental Pepper Banker Plants “Purple Flash” & Lobularia for <i>Orius</i>
Tobacco Mosaic Virus	Dark line patterns and distortion of leaves.	Spread by plant handling (no insect vector.) TMW may be seen on tomato, pepper, and eggplant, however many vegetable varieties are resistant.	
Tospovirus Impatiens Necrotic Spot Virus (INSV) & Tomato Spotted Wilt Virus (TSWV)	Symptoms will vary depending upon the host. On pepper, look for necrotic spots on the leaf. Ringspots may also develop. On tomato, young leaves may develop small, dark brown spots.	Spread primarily by western flower thrips. Symptomless weeds may also be a source of virus.	None See thrips.
Whiteflies	Rely on plant inspection to detect immature stages. Use sticky cards to monitor adults.	Egg laying adults are found on the uppermost tender leaves of tomatoes, eggplant and leafy greens. Immature stages are found on the undersides of leaves.	<i>Amblyseius swirskii</i> (predatory mites) <i>Chrysoperla spp.</i> (green lacewing, predator) <i>Delphastus pusillus</i> (predatory beetles) <i>Dicyphus hesperus</i> (predatory bug) <i>Encarsia formosa</i> (greenhouse whitefly parasite) <i>Eretmocerus eremicus</i> (sweetpotato whitefly parasite)

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