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Insect pest control in Colorado organic vegetable gardens

[1]Whitney Cranshaw

Quick Facts

Organic gardeners rely solely on naturally derived sources of fertilizer and pesticides.

Avoid garden practices that favor pest problems.

Most vegetables can tolerate substantial leaf loss without affecting yield.

Crop rotation is effective for insect control.

Tilling can help control insect and mite pests that overwinter and are in fairly immobile stages.

A wide variety of beneficial insects feed on insect and mite pests in Colorado.

For a variety of reasons, many Colorado home gardeners try to grow vegetables with minimal reliance on pesticides, particularly insecticides. Among these growers are "organic" gardeners, who rely solely on naturally-derived sources of fertilizer and pesticides, if needed. Furthermore, in recent years, production of organic food in Colorado has taken on a legal definition. State laws, and some federal laws, are now in effect that codify practices that allow produce to be marketed as certified organic. Gardeners that want to market foods as organic must follow these regulations. The following insect control practices should be consistent with Colorado regulations. With the vegetable insect and mite pests present in Colorado, acceptable levels of insect control often can be achieved in home gardens and commercial farms using organic control techniques.

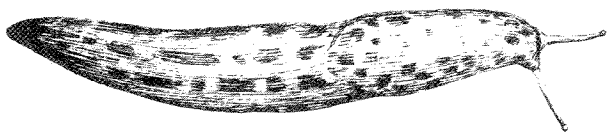

Figure 1: Spotted garden slug.

Environmental Modifications

Avoid certain gardening practices that favor pest problems. Turning under large amounts of undecayed organic matter into the soil, particularly animal manures, can cause an increase in egg-laying and damage by seedcorn maggots. To reduce this problem, till the organic matter during fall and water it so it can be partially decomposed by spring.

Watering and mulching, which affect humidity around a garden, can have variable effects. Slugs (Figure 1) like high humidity and problems can be

This information provided by:

[1]*Whitney Cranshaw, Colorado State University Cooperative Extension entomologist and associate professor, entomology (revised 2/94). Some recommendations change regularly, please contact your Colorado State University Cooperative Extension county office for current recommendations.*

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discouraged by reducing watering or by using drip irrigation or soaker hoses. On the other hand, higher humidities retard build-up of spider mites and overhead irrigation can wash off and destroy many insect pests.

Considerable research has been done on how various types of intercroppings affects insect populations in small plots. Often, an increase in plant diversity results in a decrease of insect pest populations. However, this effect usually is only significant in large acreages of the same crop. The small scale changes by intercropping in a home garden usually have small impact on pest insect numbers. This includes intercropping with repellent or companionate plants (certain herbs and flowers). Studies indicate little effect of these repellent plants on insect populations. However, increasing the diversity of a planting can encourage beneficial insects, including the natural enemies of insect pests.

Plant Health and Culture

Cultural conditions that promote rapid germination and plant growth can greatly minimize the effects of insect damage. This is particularly important for controlling seedling pests such as seedcorn maggot, cutworms and flea beetles. Vigorous seedlings can outgrow the effects of these feeding injuries. Plant vigor also is important for controlling damage by insects that attack more mature plants. Most vegetables tolerate substantial leaf area loss without affecting yield, particularly before reproductive or storage tissues begin to form (fruits, tubers, bulbs, head).

Plant varieties resistant to insect pests is another way to control insects. Examples of vegetables grown in Colorado are red varieties of cabbage to reduce cabbageworm infestations, onions with more open top growth to limit onion thrips, and certain tomatoes less favored by tomato psyllid.

Unfortunately, there are relatively few insect-resistant varieties available for home vegetable gardens. (Many varieties are resistant to plant diseases.) In general, most healthy and vigorous plants can tolerate insect injuries without serious damage.

Crop Rotation

Although space in a backyard garden often is limited, rotation of certain crops helps insect control. This is primarily true for the few pest insects that overwinter as eggs or larvae in the soil around susceptible plants. For example, crop rotation is effective for control of corn rootworm larvae that destroy the roots of sweet corn planted in the same site each year.

Most garden insects are mobile and crop rotation has relatively little effect if practiced in areas limited to the size of a typical garden. However, in larger fields, rotation helps control many other insects, such as Colorado potato beetle and squash bug. Furthermore, crop rotation provides many excellent advantages for controlling crop diseases.

Tillage and Sanitation

Turning over or tilling the garden can help control insect and mite pests that overwinter and are fairly immobile in the adult stages. Certain cutworms, white grubs, and wireworms may be exposed and killed by deep tillage. Spider mite eggs may also be buried and killed by tillage.

Various types of sanitation practices affect garden pest problems. For example, many insects survive the winter associated with old crop debris such as the eggs of asparagus aphid on the old ferns or borer larvae in stems of berry plants. Cleaning out this infested material reduces problems for the subsequent season. Removing weeds and debris around a garden may reduce later problems with insects that use these sheltered areas for winter protection (flea beetles, spider mites, millipedes, slugs). Moving decomposing organic matter away from gardens can reduce insect breeding at these sites (seedcorn maggots and slugs).

One of the most important sanitation efforts is to avoid introducing problems into a garden. Carefully check transplants for whiteflies that are easily moved outdoors from the greenhouse. Also, examine if roots or bulbs are soft or dark. It may indicate activity by root-boring insects or root-rotting disease.

Biological Controls

A wide variety of beneficial insects feed on insect and mite pests in Colorado. These include: insect predators (lady beetles, lacewings, syrphid flies, paper wasps, earwigs, minute pirate bugs, etc.) and insect parasites (tachinid flies, Figure 2, braconid and ichneumonid wasps, etc.). These beneficial insects are constantly reducing pest insect problems and are often effective enough to completely control pest insect populations.

The most effective way for a gardener to utilize biological controls is to learn how to recognize and work with those that already exist in a garden. One important consideration is that some pest insects need to be maintained to provide food for the beneficial insects. Care in selection and use of insecticides is important. Available insecticides vary widely in their effects on beneficial species. Among the more selective insecticides are *Bacillus thuringiensis* - products, insecticidal soaps, and neem-based insecticides.

Another biological control is to use plants that produce nectar and pollen used by the adult insect stages as a source of energy and protein. Shallow flowers that are easily accessible to the insects are most useful. Dill, alyssum, and most members of the mint family are most commonly visited by beneficial insects.

In addition, several predators and parasites or insect pests are commercially available for release. Among the most commonly available include lady beetles, lacewings, Trichogramma wasps, and praying mantids. Several dozen other species are available through specialty catalogs.

Evidence suggests that releasing these organisms produces variable beneficial effects. Artificial releases of lady beetles and praying mantids are worthless to control plant pests, although they may add interest to a garden. Other insects that can be

purchased, such as green lacewings and Trichogramma wasps, may be useful for managing some pest problems. (Many effective control options are available for control of insect and mite pests in greenhouses.)

Physical and Mechanical Controls

Other methods can be used to exclude or destroy insects and other plant pests. Handpicking is one of the more obvious techniques that controls larger insects such as the tomato hornworm, Colorado potato beetle, and the Mexican bean beetle. Small insects, such as aphids and whiteflies, are easily crushed by hand.

Various barriers can prevent insects from reaching the plant. These include small caps that prevent flea beetles from injuring seedlings, collars to avoid cutworm injury, and wood ashes placed around plants to reduce slugs.

Many traps can control plant pests. The most effective are those that attract insects to food or shelter. Others capture winged stages of insects that seek new plants or plant parts to colonize (see Table 1).

Table 1: A summary of useful insect traps for the garden.

Plant Pest	Type of Trap
Slugs, millipedes	Beer or some other fermenting material in a shallow saucer.
Slugs, earwigs	Moistened rolled newspaper, grapefruit rind, or some other moist dark site, placed on the ground
Codling moth	Burlap band or corrugated cardboard placed on the trunk to concentrate pupating stages for easy collection.
Apple maggot, whiteflies	Yellow sticky trap
Apple maggot	Red, sticky sphere

Considerable attention has been given to certain insect traps that involve insect sex attractants (pheromones) or lights. These traps are useful for sampling insects. However, neither trap is effective for controlling garden insect pests. Pheromones attract only male moths and do not control egg-laying females. Light traps may catch large numbers of flying insects but few of these are pest species.

Sprays and Dusts

Various sprays are compatible with organic gardening and are useful for pest control on vegetables in Colorado. The simplest treatment is vigorously hosing plants with water to dislodge and destroy spider mites. This is an effective technique and should be used for any spider mite control.

Bacillus thuringiensis (BT) is a naturally occurring bacterial disease of some insects that is produced and sold under a variety of trade names (Thuricide, Dipel, Biological Worm Spray, etc.). BT acts as an insect-stomach poison and effectively controls most caterpillars, such as the tomato hornworm and the worm complex on the cole crops (cabbage, broccoli, cauliflower, etc.). BT often takes one to three days to kill a caterpillar after it eats

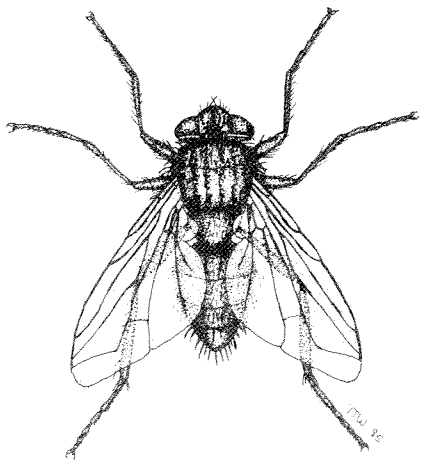

Figure 2: Tachinid fly.

treated foliage. However, insects stop feeding on the plant almost immediately.

Pyrethrins are the insecticidal-active ingredients extracted from certain chrysanthemums. Pyrethrins are highly effective in control of many of the larger insects found on foliage, such as beetles and caterpillars. Whiteflies, thrips and certain aphids also may be controlled. Pyrethrins are extremely fast-acting, and produce a "knockdown" of the pests within minutes. Pyrethrins also are rapidly broken down by sunlight and usually do not persist more that a day.

Pyrethrins formulated for use on garden plants have become increasingly available in recent years. Many different products are available, alone or in combination with rotenone, diatomaceous earth, insecticidal soaps, or other materials. However, most insecticides containing pyrethrins also include piperonyl butoxide, a chemical (synergist) that greatly increases the potency of pyrethrins. Although piperonyl butoxide was originally extracted from a lilac-relative native to South America, it is currently manufactured synthetically. As such, pyrethrins formulations that contain piperonyl butoxide are not allowed for use in production of certified organic fruits and vegetables.

Rotenone is an insecticide derived from the ground roots of certain South American plants (cube). It usually comes as a dust or in a liquid extract and affects many types of insects, particularly beetles and caterpillars that chew plants.

Among the pesticides acceptable for organic production is rotenone. Rotenone is one of the few that requires a preharvest interval following an application. Typically, the waiting period is one to three days. Although only moderately toxic to humans, fish and hogs are more sensitive. Rotenone often is sold in products combined with pyrethrins.

Sabadilla is a botanical insecticide produced by grinding the seeds of a lily-family plant native to the Caribbean (Schoenocalon officinale). Sabadilla dust is reportedly effective against many vegetable insects, such as squash bug, harlequin bug and many beetles. It is considered one of the least toxic insecticides, although it is irritating to mucous membranes.

Diatomaceous earth are mined deposits of fossil diatoms, the bodies of minute marine organisms. Most diatomaceous earth is heat treated and used for filtering water, such as swimming pools. However, some non-processed diatomaceous earth is used for control of insects, which it affects by scratching the insect body, causing excessive water loss by the insect. Its abrasive characteristics also allow it to be used as a repellent for slugs and some insects. Most diatomaceous earth products that are registered for garden use also include pyrethrins.

Effectiveness of diatomaceous earth in gardens often is hampered because the light dust drifts easily. Wetting from dew, rainfall, or irrigation also limits its ability to control insects. Because diatomaceous earth is easily inhaled and irritating, use a dust mask to apply.

Ground insect or plant extracts often are mentioned in gardening magazines as sprays to control various insect pests. Anecdotal cures are commonly stated but in controlled experiments little or no insect control has been demonstrated. In one situation where insects dying from a disease organism (virus, bacteria) are included in these homemade sprays, some control may be expected by spreading the disease organism.

Horticultural oils are highly refined petroleum oils used for managing plant pests. They are widely used on trees and shrubs, primarily to smother overwintering stages of scales, aphids, and mites that remain on the plant during the dormant season. However, some of the currently available oils allow safe use on the foliage of vegetables.

One type of oil used for insect control are *mineral oils*. These are heavier oils, most commonly used in pharmaceuticals. However, if directly injected into the ear tip, they also are effective controls for corn earworm in the tips of sweet corn. *Soaps* can be highly effective for controlling small bodied plant pests such as aphids, spider mites and the potato/tomato psyllid. Insecticidal soaps are now commercially available in Colorado and some liquid dishwashing soaps are effective for insect control. Certain plants can be injured, so always do test a first. Thorough plant coverage and repeat applications are essential when using soaps for insect control. For more information on soaps, see Service in Action sheet 5.547, *Use of soaps and detergents for insect control in Colorado.*

Remaining Insect Problems

A few insect problems in Colorado vegetable gardens cannot be controlled with organic techniques and are difficult to control with any method. The most obvious are the many grasshoppers that move into a garden from breeding areas in pastures, along roadsides and waste areas. Management of grasshopper breeding areas is the best control for this problem, although some people have success using poultry as grasshopper predators.

Insects that transmit plant diseases (aster yellows, mosaic viruses, beet curly top) also are difficult to control since the insects are highly mobile and transmit the disease organisms rapidly. The best control for insect-transmitted plant diseases is often using plants resistant to the disease.