



Natural Yard & Garden

a guide to **ALTERNATIVES TO PESTICIDES**



THE CITY OF
VANCOUVER



Original printed version of this guide was written, edited
and designed by Metro and illustrated by Antonia Manda.

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Introduction

What exactly is a pesticide? Pesticides include insecticides, herbicides and fungicides, which are designed to kill insects, weeds and diseases respectively. Using pesticides may be necessary at times, but in many cases there are alternatives that are often more effective in the long run and less harmful to the environment and the applicator.

While the environmental problems of the world may seem beyond your control, you can make a difference right in your own backyard. Begin by learning good gardening strategies, many of which will result in fewer pest problems. Then learn how to use less harmful methods for managing insect pests, weeds and diseases in your yard before reaching for chemical controls.

This guide introduces some gardening tips that reduce pest occurrence and includes a hierarchy of steps to take before using chemicals. Finally, it introduces some of the pests common to the Pacific Northwest. Since it is not a comprehensive resource, refer to the Resources section for sources of additional information.

Happy and healthy gardening!

Healthy Yard and Garden Strategies

Gardening can be a rewarding hobby or a frustrating chore. How you view it depends not only on the problems you encounter but on the strategies you use to tackle those problems. If you are just beginning, consider starting small. Gardening should be fun. The more you know about your garden, the better your choice of strategies will be, so read on!

Had Benjamin Franklin considered the subject, he would have agreed that an ounce of prevention is worth a pound of pesticides. There are many ways to prevent pest problems. Applying some or all of the following strategies will result in a healthier garden and help keep pest problems outside your garden gate.

Grow suitable plants

Native plants are the best choice for trouble-free gardening. Because they thrive naturally in our climate and soils, they do not need extraordinary cultural care to help them along. You should, however, still be aware that some can be hosts to imported pests such as root weevils and dogwood anthracnose.

Many plants that are infamous for pest problems, such as roses, cherries and rhododendron, have cousins or look-alikes that are less prone to pests. Look for resistant varieties when choosing plants, and ask nursery personnel for advice. This is especially important for plants that are prone to diseases since there are few control alternatives to fungicides.

Garden in raised beds

Raised-bed vegetable gardening is a great way to garden in Washington. Raised beds allow for closer plantings, more root development, exceptional drainage (which is especially nice for those with heavy clay soil) and earlier springtime plantings. Raised beds require minimal paths, which means less space is needed to grow a fixed amount of food and less room for weeds to take hold. All told, raised beds can reduce your use of fertilizer, compost, water, and, if used, pesticides.

Studies show that chromium, copper and arsenic all leach from treated wood. If you decide to make raised beds, consider using untreated wood, which you can treat yourself; cedar, locust or cypress wood, which are naturally rot-resistant; or plastic lumber, which is made from recycled milk jugs and other plastic.

Practice crop rotation and garden diversity

If you grow vegetables, rotate planting locations for each type of vegetable from year to year. This will help prevent diseases and nematodes from building up in the soil and causing damage. To be most effective, planting areas should be large enough to allow plenty of distance and time between vegetables from the same family. Ideally, the rotation should extend for three or four years.

Rotate vegetable plantings using the following listings as a guide. Do not plant two things from any of the following groups or families in the same place in consecutive seasons. If you will grow vegetables not included on these lists, rotate them each year as well.

- Legumes and pod crops: okra, all beans, all peas
- Alliums: all onions, leeks, garlic
- Brassicas: kale, cauliflower, cabbage, brussels sprouts, broccoli, kohlrabi, rutabagas, turnips, radishes, bok choy, oriental mustards, mizuna greens, others
- Solanaceous, root, and tuberous crops: any peppers, tomatoes, eggplant, potatoes, sweet potatoes, celery, beets, carrots, parsnips, others

Incorporating many types of plants into your landscape has numerous benefits. Diverse plantings provide food and cover for a variety of living things, including beneficial insects, that help your garden's ecosystem. Diversity also minimizes the impact a specific pest will have on the overall visual effect of your garden, since many attack only one species of plant.

Build healthy soil

Healthy soil contains many things – clay, silt and sand; air and water; and organic matter in various stages of decomposition. Organic matter is simply the stuff that at one time was part of a living plant or animal – leaves, bark, twigs, manure, dead insects and more. The real “magic” of soil is in fungi, bacteria and other microscopic life. These miracle workers break down organic matter into carbon, nitrogen and other elements, which are then taken up by plant roots and used again. The more organic matter in your soil, the “livelier” it will be. Fertilizers, whether synthetic or organic, can add these elements plants need, but organic fertilizers provide them over a longer period of time, more in keeping with the extended needs of the plants. It’s also easier to “overdose” with synthetic fertilizers, resulting in burned plants and fertilizer runoff into storm drains and eventually streams and rivers.

A traditional farmer’s adage is “to feed the plant, feed the soil.” To determine what type of soil you have, test the pH (the acidity or alkalinity) with a kit available at many plant stores. You can obtain more detailed information about soil tests from your local Washington State University Cooperative Extension Service office. A soil test is a good idea for anyone putting in a vegetable garden, and is strongly recommended for anyone planning to put in perennials such as berries or fruit trees. The test will tell you about your soil and what you can do to correct it for the crops you want to grow. Call your county extension office for more information.

Pay attention to your garden

One of the best things you can do for your garden is look at it! The English have a saying, “the best fertilizer is the owner’s footprints.” No matter how long you’ve been gardening, you are the expert in your own yard and will be the first to notice if something is amiss. If you inspect your plants regularly, perhaps every other day, you will learn what plants tend to dry out more frequently than others, which ones are prone to aphids, when root weevils begin to feed on the leaves in the summer, and many other interesting things. You may even see the beneficial insects at work! And most important, monitoring allows you to identify a pest occurrence before it becomes a problem. It’s much easier to deal with a small aphid colony than with 10 large aphid colonies. Monitoring is never having to say, “Where in the heck did that come from?”

Know a friend from a foe

To reduce pesticide use, learn what is and is not a pest. Many insects you'll find in your yard neither help nor harm plants, and many others are helpful predators or parasites. When you see a "crawly thing," figure out what it is before running for the bug spray. Even if you identify it as a plant eater, consider that the predators and parasites in your garden would probably like to eat it much more than you would like to spray it. Also ask yourself if this one pest will cause damage that will adversely affect the whole plant. If not, let it go and spend your time on more fruitful endeavors, such as producing an environment that will result in healthy plants and lots of places for predators to thrive.



Least-harmful Pest Control Strategies

If you use all the tactics mentioned previously, you may never see a pest problem, and if pests do occur, their impact will probably be limited. However, despite your best efforts, unwanted pests sometimes take hold in the garden. In those cases, take the following steps to tackle the problem with pesticides as your last option.

Identify the problem

Before considering what control measure to use, correctly identify the pest, disease or weed you are facing. Nursery personnel are a good resource, as are many books in garden stores and the library. WSU Cooperative Extension Master Gardeners or a county extension agent can be helpful. Keep in mind that most plant problems are not caused by insects or diseases at all, but are caused by inappropriate growing conditions. Furthermore, insects and diseases often attack plants that are already stressed from poor growing conditions.

Use appropriate controls

The choice of controls depends on the problem. Generally, options fall into the categories of hand removal, barriers, traps, biological control and least-toxic chemical control. Once you understand how each tactic works, you can make informed decisions on their best use.

Hand removal

Remember that every weed you pull and every insect you smash is one less to deal with later on. A sturdy blast of water can take out aphid populations, and pruning shears are all you need to control tent caterpillars. Removing diseased leaves, either by hand or rake, can help slow the spread of diseases. These leaves should not go to the compost pile, however, since diseases may not be destroyed in the composting process. However, diseased leaves can go into curbside yard debris containers for recycling.

Barriers

Barriers don't kill pests. They simply keep pests away from the places you don't want them. A good example is a screen door, which keeps flies out. Following are brief descriptions of common types of barriers:

Floating row covers: These are thin, lightweight fabrics or plastics that are placed over growing plants. They allow light, air and water to reach plants, but keep insects off. They are simply draped over the plants and secured on the sides with stones or soil. As plants grow, they push the fabric up.

Netting: Netting is good for keeping birds off plants, especially as they come into fruit.

Copper slug barriers: Slugs cannot cross a three-inch-wide sheet of copper. Sheet copper can be cut to size and attached to raised beds or planters, keeping slugs out. This method can also keep slugs in, so be sure to remove all slugs before banding. Apply banding vertically (like a fence) rather than horizontally (like a deck). It will continue to be effective after it has turned green. Despite the initial investment, this is an effective, inexpensive and long-lasting slug control tactic.

Sticky barrier: Marketed under the trade name Tanglefoot or Tangletrap, a sticky barrier will prevent insects and mites from walking up trunks of trees or shrubs. Note that root weevils walk, rather than fly, to the leaves of their hosts, so it can be used around the trunks of rhododendrons (as long as there are no branches touching the ground) to stop their movement. Apply the sticky material to a wide piece of tape that is first wrapped around the trunk.

Traps

All traps work by attracting a target pest into a container from which it cannot escape. Traps work best when there isn't much competition. For example, a slug might smell a slug trap in the middle of the garden, but it will also smell – and eat – many other tasty things along the way. Following are brief descriptions of common types of traps:

Sticky traps: These use a sticky barrier, such as Tanglefoot, with one or more attractants such as color, smell or shape, to bring the target pest in and keep it there. Yellow is a color commonly used since many insects associate yellow with flowers and, hence, plants.

Beer-filled slug trap These bring slugs out of the woodwork, so to speak. Just be sure to place them away from the garden and refill daily.

Biological controls

Some of your garden's best friends are natural enemies.

Biological controls, also called beneficials, are "the good guys" that are hard at work eating insects, slugs, mites and other creatures in your landscape. Some have very specialized tastes; others will eat just about anything smaller and slower than they are. These heroes of the garden are described in the section titled "Beneficial Insects and Others."

In all cases, beneficials will come to your landscape and set up housekeeping if you provide them with the following basics. Put your energy into attracting them naturally rather than purchasing them at a nursery and releasing them. If conditions aren't right to begin with, they'll move on anyway.

Water: This could be as small as a jar or bird bath or as large as a pond, just as long as it is available and filled with fresh water all year.

A place to live: Every animal needs a home to protect it from enemies and raise its young. Although you can't build little beneficial insect houses, you can grow them. Simply allow a variety of plants, including annual flowers, perennial flowers, bulbs, grasses, small shrubs, large shrubs, deciduous trees, and evergreen trees, to grow in your landscape. The beneficials will find their niches.

An alternate food source: Pollen and nectar, mainly produced by flowers, sustain insect predators and parasites when insect food is not available. Vertebrates, such as birds and squirrels, will enjoy fruits, grain, seeds and other things, especially during the winter when other foods are scarce. Once the beneficials get to know your landscape as a place to find food all year, they will keep coming back for the food you provide or the insects they pick off your plants.

Least-toxic chemical controls

Although using the practices mentioned previously will minimize, and possibly eliminate, the need for pesticides, there may be times when you choose to use them. In order to make informed decisions, it is important to understand them.

A few words about toxicity

All pesticides (synthetic and organic) are, by definition, toxic to some living thing – insecticides to insects, herbicides to weeds, fungicides to fungi, and so on. When a pesticide or any other material is described as “toxic,” it often makes people think of the effects the material has on human health. However, pesticides (and other chemicals) can also have toxic effects on the environment in which they are released.

There are many different ways to describe the toxicity of a material. For example, toxic effects on living organisms can be either acute (occurring immediately after the material is ingested or absorbed) or chronic (occurring after long-term exposure to the material). A substance may be short-lived (breaking down to harmless elements in a matter of hours or days) or persistent (remaining in their original state for months or years). Materials may bind readily to soil (making them more likely to remain in the site where they were applied) or may be very mobile (making them more likely to travel into surface or groundwater). Still others may be very soluble (dissolvable in water), volatile (likely to explode), or flammable (able to burn). In addition, some can cause secondary poisoning (direct or indirect effects on other living things that eat the original target).

Is “organic pesticide” an oxymoron?

How about “synthetic organic?”

Ask a chemist what “organic” means, and he or she is likely to say, “contains carbon.” All living things contain carbon, so organic matter is simply the stuff that at one time was part of a living plant or animal. Some fertilizers and pesticides can be produced from animal and plant parts, thus they can be called organic as well. The word “synthetic,” when referring to garden products, means “created by humans: not occurring in nature.” Synthetic pesticides are chemical compounds invented in a laboratory. Ironically, those synthetic compounds that contain carbon can, technically, be called “synthetic organic.”

Note that although the word organic, when it is used to describe the way foods are grown, has come to imply “pesticide-free,” a more accurate definition of the term in this case might be “grown without synthetic pesticides.” Note also that some pesticides are not derived from plants or animals yet are still considered safe to use, and they are allowed in organic food production. Examples include insecticidal soap, horticultural oil,

copper and sulfur. For more information about certified organic foods and food production, contact Oregon Tilth listed in the Resources section of this book.

The bottom line is this: no pesticide, synthetic or organic, is considered “safe.” But, because of the effects on other living things, some are safer to use than others. Before selecting a pesticide, become informed about all the effects it may have. When you use any pesticide, follow all these points:

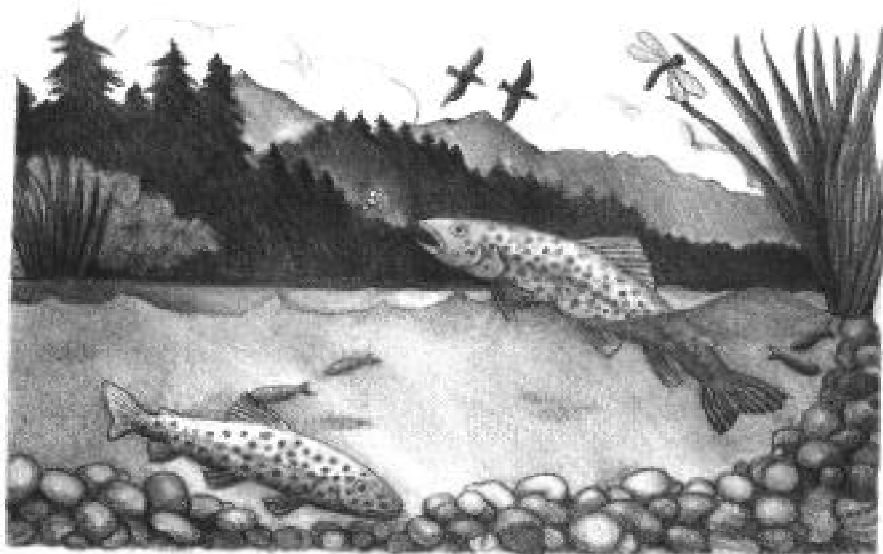
1. Read and follow all label directions. Never use more than is recommended.
2. Protect yourself. Wear a long-sleeved shirt, long pants, boots, rubber gloves, goggles, a hat and a respirator whenever mixing and applying pesticides of any kind.
3. Never apply anything on a windy or rainy day.
4. Only mix as much as you will use in one day.
5. Dispose of empty containers properly. When a product label says “triple rinse the container,” rinse it three times, pour the rinsate into the sprayer and apply it to the target area according to label instructions. Wrap empty and/or rinsed containers in newspaper and dispose of them in your trash can. Home-use pesticide containers are not recyclable.
6. Dispose of unwanted pesticides safely. Because pesticides are hazardous, they should never be disposed of in your garbage can or poured down the drain, into storm drains or onto the ground. Take them to a hazardous waste disposal facility or community collection event. In Clark County, call Environmental Services at 397-6118, ext. 4016 for more information.

Water Quality and Household Chemicals

Clark County residents get 97% of their drinking water from groundwater. Improper use or disposal of hazardous products can directly affect the water we drink and harm wildlife. Many of the pesticides and fertilizers used at home can cause water quality problems not only in our own backyards, but also miles away. Pesticides that pollute our region's streams and rivers, harm fish, aquatic plants and animals, swimmers and those who eat the fish they catch.

Water from rain or irrigation can carry pesticides and fertilizers from lawns and gardens into nearby street drains and into the groundwater. Many storm drains feed directly to neighborhood waterways. Once in the water, pesticides dissolve, dilute or combine with other chemicals to create harmful combinations that can kill fish and aquatic life, limit beneficial plant and animal populations, and increase growth of algae. Excess algal growth causes light deficiencies for plants and depletes oxygen levels that fish need to survive.

Clean water is an essential part of our quality of life. We can help protect our rivers, streams and lakes by rethinking and reducing our use of pesticides and other household chemicals.



Beneficial Insects and Others

The following listings describe common beneficial insects that help control harmful insects. Other beneficials include centipedes, dragonflies, damselflies, big-eyed bugs, predatory mites and many, many more. A very general rule of thumb for identifying a predator is this: if the jaws of the creature are pointing **DOWN** (that is, pointing at the surface they are walking on), they are plant-eaters. If the jaws are pointing **OUT** (that is, parallel to the surface they are walking on), they are predators.

In addition to these predators, there are many vertebrates such as birds, frogs, snakes, ducks, bats, mice, moles, squirrels and others snack on the eggs, larvae, pupae and adults of insects, mites and slugs.

Flower flies

Actual size:
Adult 1/2"
Larva 1/2"



Sometimes called hover or syrphid flies, these predators look somewhat like yellowjacket wasps but are much smaller and will not sting humans or other mammals. They are often found hovering near flowers, where they feed on pollen and nectar. Their larvae are legless and feed on aphids.

Honeybees

Actual size:
3/8" – 5/8"



Honeybees, although not predators, are very beneficial pollinators of many fruits and vegetables. Periodically a hive can become overcrowded and a large number of bees and a queen will leave to find a new home. These swarms, while spectacular to see, pose no real stinging threat since bees in a swarm are engorged with honey. The best way to deal with an unwanted swarm of bees is to call a reputable beekeeper who can, in 20 to 30 minutes, capture the queen bee. The rest of the swarm will follow. The swarm may leave on its own in as short a time as 30 minutes or remain clustered for as long as several days. (Calling the beekeeper, who wants the bees, as soon as possible will keep the bees from becoming pests in the neighborhood.) WSU Cooperative Extension Master Gardeners keeps a listing of beekeepers. The phone number is listed in the back of this book under Resources.

Lacewings

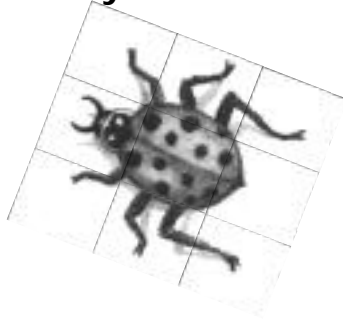
Actual size:
Adult 3/4"
Larva 1/2"



The most common lacewings are bright green insects with large gold eyes and delicate wings. They are about 3/4" long and eat pollen, honeydew and nectar. The larvae look something like tiny alligators, are tan, and eat aphids and other soft-bodied insects. A similar looking winged creature that is brown rather than green is the brown lacewing. It is also an effective aphid predator and is more tolerant of cool weather than the green lacewing.

Ladybird beetles

Actual size:
Adult 1/4" - 3/8"
Larva 1/8" - 1/2"



Better known as ladybugs, these black and red beetles are found throughout the world. There are thousands of species, many of which prefer only one or a few creatures for food. The most common species in Oregon eat aphids and other small, soft-bodied insects. The larvae of this beetle are usually black, 1/8" to 1/2" long, somewhat spiny, and look something like tiny alligators. They also eat many aphids.

Parasitic wasps

Actual size:
Adult 1/16" - 1/8"

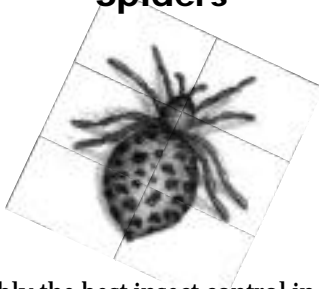
*Parasitic wasp
on aphid*



Most insects and many insect eggs are host to one or more species of parasitic wasps. Often tiny and delicate, parasitic wasps sting their host insects and lay eggs inside them. The eggs hatch inside the host and feed on it, eventually killing it. Aphids are commonly parasitized in this region, and some caterpillars are also attacked. Parasitic wasps are extremely effective at controlling insects, but are susceptible to most sprays. Parasitic wasps do not sting humans.

Spiders

Actual size:
1/16" – 3/4"



Spiders are probably the best insect control in your yard. They eat a wide variety of insects and are very common.

Predaceous ground beetles

Actual size:
Up to 1 3/8"



The large, glossy dark brown or black beetle with grooves down its back is a predator and will eat many insects.

Yellowjackets

Actual size:
Adult 1/2" – 3/4"



Yellowjackets are picnic pests because they are attracted to the protein in chicken, hot dogs and other barbecue fare. When they aren't at your barbecue, however, they are busy collecting insects to take back to the hive and feed the growing larvae. They are efficient predators, and do the gardener much more good than harm.

Pests

Ants

Actual size:
1/16" – 1"



There are many species of ants found in homes and gardens in the Northwest. Ants do not directly harm plants, but if they are a nuisance, have your particular type identified by someone at a nursery or WSU Cooperative Extension office. Also see the “Carpenter ants” listing.

Prevention

Store food in tightly sealed containers. Keep all kitchen surfaces clean and free of food scraps and standing water.

Physical control

If a line of ants is marching across the kitchen, find the point of entry and seal it. Use a silicone seal. Use petroleum jelly for a short-term fix until you have time to do a better job. Remove what the ants are eating and mop them up with soapy water. Some have found that sprinkling red chili pepper at the entry point helps discourage ants. Wrap a band of tape, paper or cotton coated with a sticky substance such as Tanglefoot around the main stem of outdoor plants to trap ants.

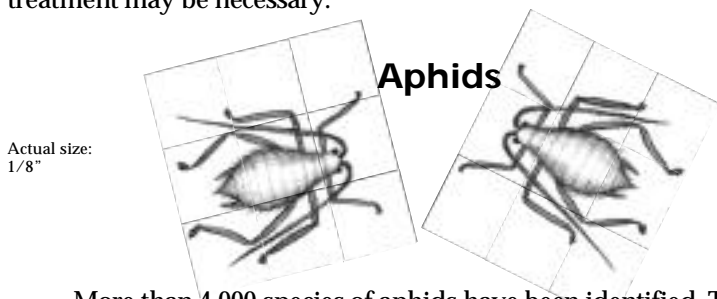
Biological control

Birds, bee flies, humpback flies and thick-headed flies are natural predators outdoors.

Least-toxic chemical control

Diatomaceous earth, silica gel, boric acid and pyrethrum can be effective. Diatomaceous earth and silica gel are dusts that kill insects by drying them out. They are dangerous to breathe, so if they must be blown

into wall spaces, a professional should do the job. Pyrethrum can be combined with silica gel to give a faster effect; one form comes in a non-aerosol squeeze dispenser that allows for application in cracks and crevices to minimize human and pet contact. Boric acid can be used in cracks, but only in areas not accessible to crawling children or pets. Prepare 1 percent boric acid solution by mixing one teaspoon boric acid, six tablespoons granulated sugar and two cups warm water. Store in a clear container. Use on cotton balls placed in the bottom of a plastic cup or tub with holes cut for ants to enter. Recharge each week. After three to four weeks, use 1/2 percent solution for continuous control. You can also use insecticidal soap to drench an ant colony outdoors or in a crawl space. More than one treatment may be necessary.



More than 4,000 species of aphids have been identified. There are black, brown, red, purple, pink, green and yellow aphids. Some have wings and others do not. They all have a soft body about 1/8" long and a soda-straw mouth part adapted for extracting plant juices. Because aphids bear live young, their populations grow rapidly. Late in the fall, males are born to fertilize overwintering eggs. These eggs, deposited in plant crevices and garden debris, withstand inclement weather to hatch in the spring. Most aphids excrete a sweet, sticky substance called honeydew as they feed. It serves as food for ants, bees and flies and as a growing medium for sooty mold.

Prevention

Avoid planting species that attract aphids. These include birch trees, roses and certain vegetable varieties such as brussels sprouts. Consult your local county extension office or nursery for help choosing aphid-resistant plants. Also be sure that plants are healthy and have proper growing conditions. Weak or stressed plants are more susceptible to attack.

In the fall, get rid of all garden debris where aphid eggs can overwinter, and cultivate the garden soil 6" to 8" deep where possible.

Physical control

For small infestations, hand pick and destroy the aphids. On sturdy plants, use a strong spray of water to wash them off. If ants are also present, follow the steps outlined in the “Ants” section.

Biological control

Aphid predators include syrphid flies, green lacewing larvae and ladybugs (also called ladybird beetles). Chalcid and braconid wasps are aphid parasites. Parasite and predator populations often lag behind aphid populations, so there may be periods in the year, particularly in the spring, when the aphids appear to be out of control. Often the predators can catch up and restore control, but be patient. Remember to provide the basics: water, shelter and food. Plants may develop some damage but should outgrow it. If pesticides are applied when predator populations are present, they may be harmed and prevented from keeping aphids in check.

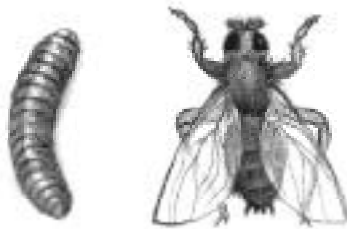
Ladybugs and lacewings can be effective in controlling aphids. They are available from many nurseries. Before introducing any predators, reduce aphid numbers by pinching off severely affected plant parts or hosing off most of the aphids. For best results with ladybugs, choose the right time of year and time of day to release them. Ladybugs are most active when the weather is warm, from April through September. Dusk is the best time of day to release them. Water the foliage where the aphids are feeding. The hungry and thirsty ladybugs will be attracted to the water-drenched foliage and find the aphids for food. They do have a tendency to disperse when released. Both the ladybug adult and larvae are predators. Green lacewing larvae are also effective predators of aphids and can be purchased and released.

Least-toxic chemical control

Insecticidal soap sprays are often very effective in controlling aphids, although you may need repeat applications. To make your own, mix one tablespoon castile or ivory soap in one gallon of water. Spray on infested plant parts. (This also works for mites.) It is important to use pure soap only. Detergent can burn plants. Use rotenone, sabadilla or pyrethrum only as a last resort for severe infestations. A dormant oil spray applied in the winter may smother overwintering aphid eggs, but you may want to wait to take action until the problem reappears.

Apple maggots

Actual size:
Adult 1/4"
Maggot 1/4"



This pest makes brown tunnels inside apples with external symptoms so slight they may go unnoticed. The adult apple maggot is a fly, similar to the common housefly. Flies lay their eggs in the apples, and the legless white maggots develop in the flesh of the fruit. The insect spends the winter in the soil in its pupal stage.

Physical control

Collect dropped apples to reduce the apple maggot population. If not too badly damaged, these apples can be made into cider.

Trap adult flies with a solution of one part blackstrap molasses or malt extract, nine parts water and enough yeast to create fermentation. Once the fermentation subsides, pour the liquid into wide-mouthed jars, coffee cans or milk cartons. Hang the containers in the trees as traps.

Another effective trap is a red plastic sphere, made sticky by applying a commercially available sticky compound such as Tanglefoot, hung in trees to trap the insects when they land. These traps are available at garden centers or can be made at home.

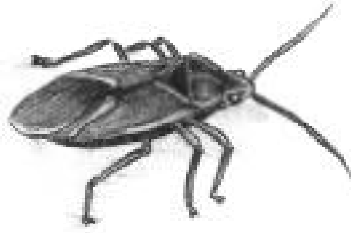
If apple maggots are a consistent problem, consider planting thicker-skinned later varieties such as Winesap and Jonathan.

Biological control

Yellow and red sticky boards, available at garden centers, attract apple maggot flies. The flies are drawn to the color and are caught on the trap's sticky surface.

Boxelder bugs

Actual size:
1/2"



These bugs feed on the seeds of box elder, maple and ash trees. Full-grown boxelder bugs are about 1/2" long with reddish brown or black bodies and red lines. The young are bright red. After feeding on plants in your yard during the summer, boxelder bugs may enter your house for a warm place to winter. However, they will not feed on anything and will not cause damage.

Physical control

For smaller infestations, try hand picking the bugs. Reduce their numbers by removing nearby unwanted female box elder trees (they produce the seeds). Inside, sweep them up and dispose of them. If you use a vacuum, dispose of the bag so bugs can't crawl back out once the vacuum is stored away or place the bag in the freezer for a few days to kill the bugs. Also, seal cracks in exterior walls and around windows. Look for boxelder bugs in warm, sunny places in spring, such as on the south side of a house. They tend to congregate under such conditions and can be vacuumed up with little effort.

Least-toxic chemical control

Spray trees with insecticidal soap or summer oil when pests appear. However, don't use this approach on Japanese maples as it may damage foliage.

Carpenter ants

Actual size:
1/4" – 1"



Unlike termites, carpenter ants don't actually eat wood. They nest in it. If you find them in your house, look for a good professional who understands your concerns about toxic chemicals and will work with you to select a least-toxic control program. While they can cause serious damage to houses, these ants are actually beneficial insects in the forest, where their excavations help speed the decomposition of dead trees. In fact, they prefer to build their nests in decayed or rotted wood, but will eventually extend their tunneling into sound wood if they can't find decayed wood.

Positive identification requires collecting a few of the largest ants and inspecting them under a magnifying glass. Carpenter ants have a smooth upper back, while most other ants have a dip in this area. Suspicious signs include sawdust and debris, rustling sounds in the walls and trails of ants between the foundation and wood outside the home.

Carpenter ants eat dead insects, honeydew exuded from aphids, plant juices and sweet or fatty foods in the home. To assess the extent of the problem, locate the main colony. Seventy-five percent of all main nests are located outside the house where there is abundant moisture, such as in an old tree or tree stump above or below the soil surface. Satellite nests may be found inside your house, in walls and ceilings, under outdoor siding, near downspouts or roof gutters, in floors – particularly bathrooms – or in insulation. Begin with the basement and work up to the attic, looking for the ants and sawdust-like wood shavings.

Prevention

Remedy whatever attracts them to your house in the first place. Repair any rotten or weather-damaged wood and make sure that attic and crawl space ventilation is adequate. Inspect gutters and downspouts to be sure they do not leak and that water is being diverted away from the house. Clean out the gutters. Remove any wood in contact with soil at any part of the house, porch, deck, etc. Firewood should not be piled against the side

of the house. It should be elevated off the ground and kept away from the house. Trees and shrubs should be pruned back so that they do not touch the house or garage, including roofs. Stumps should be completely removed. Even decorative bark may harbor carpenter ants and provide nesting sites.

Physical control

Locate and remove all nests, capture stray ants, caulk access points and replace all damaged wood. This sounds like a tall order, but if the infestation is accessible and has not spread too far, you can be successful.

Least-toxic chemical control

Use desiccating dusts, such as diatomaceous earth or silica aerogel. Boric acid is a powder that can be blown into wall voids. Pyrethrum is also effective.

Carpet beetles

Actual size:
1/4" – 3/8"



This small beetle eats articles made of natural fibers, like wool sweaters and cotton or linen apparel. They leave an unmistakable calling card: their shed skins in the bottom of drawers and holes in articles stored there.

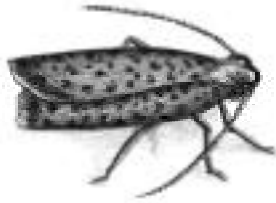
Prevention

The most effective control measure is to prevent infestations of carpet beetles. The best way to do this is to store items in a clean condition; beetle larvae are attracted to soiled areas, especially food stains. Store infrequently used items (that are clean) in well-sealed plastic bags or containers. Sachets made from rosemary, mint, thyme and cloves help repel these pests. Check cut flowers for adult carpet beetles before you bring them into the house.

Least-toxic chemical control

If you discover beetles inside the house, apply boric acid to the areas in which you find them.

Clothing moths



Actual size:
Wingspan $\frac{3}{8}$ " – $1 \frac{3}{8}$ "

These moths are very small, no longer than $1\frac{1}{2}$ ". They like to settle in dark places such as stored clothing or under furniture slipcovers, where they leave their eggs. The eggs hatch into larvae, which feed on anything containing wool, fur or feathers. They will also eat other fabrics if dirty and blended with wool. They are primarily attracted to dirt, lint, salt, stains, moisture and dead insects.

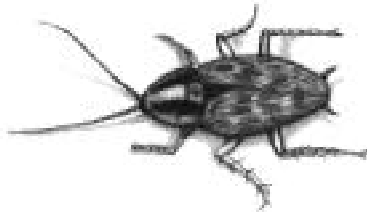
Prevention

Clean any used clothing or furniture you purchase before bringing them inside. Keep stored clothes and furniture clean and dry. Minimize humidity with good ventilation and control moisture sources.

Physical controls

Vacuum rugs, furniture and closets frequently. Clean out drawers used to store clothing. Store clothes in airtight containers or bags sealed with tape. While cedar and natural sachets smell wonderful, they are not effective at repelling moths. Shake out or brush clothing you wear infrequently to destroy any larvae present. Expose to air and sunlight. Placing clothing items in the freezer for several days will kill clothing moth adults and larvae.

Cockroaches



Actual size:
 $\frac{1}{2}$ " – $\frac{5}{8}$ "

These six-legged, hard-bodied insects can carry disease, contaminate food and induce allergies. They hide in cracks and crevices during the day

and feed at night on water and food crumbs, even wallpaper paste or envelope glue. They prefer warm, moist areas such as kitchens, bathrooms and around washing machines and hot water heaters.

Prevention

Cleanliness is crucial. Properly store and dispose of all kitchen wastes. Keep the kitchen clean and free of food scraps. Wash dishes immediately after eating. Keep areas where grease accumulates clean. Wash pastry cloths. Do not leave pet food or water bowls out at night. Enclose food in sealed containers. Fix dripping faucets and other leaks and make sure your dish rack drains properly. Damp, dirty mops can also attract roaches. Sweep frequently.

Physical control

If you find a cockroach nest, wash and vacuum the area if it is accessible. Plug cracks around baseboards, cupboards, pipes, sinks and water heaters with latex or silicone caulk. Move debris, firewood and garbage away from the house.

Least-toxic chemical control

Use boric acid, but keep it away from areas children or pets may explore. It is particularly useful under the stove and refrigerator or in cracks that cannot easily be plugged. Use roach traps that contain boric acid to monitor the effectiveness of your prevention and control measures.

Codling moths



Actual size:
Moth wingspan 3/4"
Larva 1"

Codling moths emerge in the spring and lay eggs that hatch into larvae that pupate during late summer and fall. Codling moth larvae are a unique white color tinged pink with a brown head. They tunnel directly to the core of fruit, usually apples or pears.

Physical control

Wrap bands of burlap or corrugated cardboard around tree trunks just after bloom, before caterpillars begin to move down the tree (late spring) and maintain them through fall. This draws larvae looking for a place to pupate. Use several thicknesses and wire or tie them on. The corrugated cardboard ridges should be 3/16" wide and face toward the tree with the ridges running vertically. Remove the bands once a week in warm weather (every two weeks in cooler weather) and kill the larvae. Continue until you have harvested all the fruit. Even in the best situations, banding will control only a small percentage of codling moths because many pupate elsewhere in the tree or drop to the ground, bypassing the trunk.

Scrape away loose bark and destroy overwintering cocoons before warm spring weather.

Biological control

Garden centers carry pheromone traps that attract the male moths and kill them. Trichogramma wasps and braconid wasp larvae are natural parasites of moths. These wasps are available through various mail-order companies. You can attract parasitic insects by growing sweet alyssum or daisies nearby to provide a good nectar source.

Bt (*Bacillus thuringiensis*) has been used with some success to help control codling moths. However, to be effective, applications must be frequent and carefully timed to reach the larvae just as they hatch.

Least-toxic chemical control

Horticultural oil spray or ryania, a botanical insecticide, may be applied as eggs are laid and before they hatch. Time these sprays to coincide with moth catches in pheromone traps.

Crane fly larvae (European)

Actual size:
Larvae 1" – 1 1/2"



European crane fly is a recent arrival in Washington and looks much like the variety commonly found here. Adult crane flies look like giant mosquitoes, and are sometimes called mosquito hawks or mosquito eaters. The common variety is harmless and usually found around marsh areas. Crane fly larvae or grubs are worm-like insects up to 1 1/2" long that live in the soil and destroy grass roots, crowns and shoots, leaving brown patches in the lawn.

Prevention

Crane flies are attracted to soggy areas of your lawn, so minimize watering and/or improve drainage.

Physical control

Begin monitoring for larvae in early spring. Shorten the grass in one-square-foot patches in several places around your yard. Pour warm water mixed with a little soap (not detergent) on the patch and count the grubs that emerge. If levels are above 25 grubs per square foot, treatment may be appropriate. Consult with the WSU Cooperative Extension service for treatment options. A warm, dry fall may reduce the number of larvae because of their sensitivity to dryness.

Research in Colorado has shown that aerator shoes that strap onto your feet can be used to control grubs. The long spikes on the bottom of the aerator shoes pierce the grubs as you walk over the infected sod. Also, thatching or aerating the lawn can reduce populations. Do these treatments on a cool, moist day when grubs are at the surface.

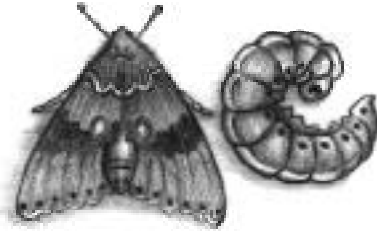
More than 100 species of birds are known to feed on crane fly larvae. Crane fly larvae are among starlings' favorite foods.

Biological control

Beneficial nematodes are effective when applied to the sod according to package directions. Use it once soil temperature rises above 55 degrees, usually in late spring, when the crane fly is in its larval stage.

Cutworms

Actual size:
Adult 1 1/2" wingspan
Caterpillar 1" - 2"



Cutworms are gray or brownish caterpillars that curl up when disturbed. They feed at night and hide in the soil during the day. Eggs are laid in the soil, and the larvae or pupae overwinter in the soil. A sure sign of cutworms is sliced-off stems of seedlings at soil level.

Physical control

Protect individual seedlings with a 3" tube made from stiff paper or plastic pressed 1" into the ground. Toilet paper tubes work well. Spread cornmeal or molasses near the base of each plant. Cornmeal wells up inside worms when they eat it, killing them. Molasses immobilizes them, but is effective only during dry weather.

Biological control

Beneficial nematodes or Bt (*Bacillus thuringiensis*) can be used. Follow package directions and apply under recommended conditions. Bt is most effective with younger, smaller cutworms.

Earwigs

Actual size:
3/8" – 5/8"



Earwigs are brown, beetle-like insects distinguished by a pair of long pincers at the tail end. Earwigs are scavengers of decaying matter and predators of insect eggs and larvae, slug eggs, snails and other slow-moving bugs. They are nocturnal feeders, spending the day under bark, stones and garden trash. They occasionally feed on foliage, flowers and other parts of many plants, including dahlias, zinnias, corn, hollyhock, lettuce, strawberries, celery, potatoes, seedling beans and beets. They usually come into the house only as transients and won't stay unless there is plant material for them to eat.

Physical control

Set sections of bamboo or damp rolled up newspapers horizontally through the garden or flower beds. Check the traps early each morning and dump the insects into a bucket of soapy water. Empty tuna cans containing 1/2" of vegetable oil also attract and drown earwigs.

Elm leaf beetles

Actual size:
1/4"



Elm leaf beetles are generally found on the big American, Siberian and Chinese elm trees and on zelkova, occasionally planted in place of elm. In spring, the adults lay eggs on the leaves. When the eggs hatch, the immature beetles eat all the fleshy parts of the leaf, leaving only the skeleton or veins. After a month or so, they are ready to pupate into the cocoon stage and descend to the base of the elm. They are about 1/4" long, and usually yellowish or golden in color with black markings.

Physical control

Because the pupae are visible on the ground around the tree, you can destroy them by simply smashing them. The elm leaf beetle can produce as many as three generations in the summer, which can seriously weaken the tree.

After feeding on plants in your yard during the summer, beetles try to enter your house during the fall for a warm place to winter. However, they do not feed on anything inside and will not damage your home. Sweep them up and dispose of them. If you use a vacuum, dispose of the bag so they cannot escape after the vacuum is stored away, or place the bag in the freezer for several days to kill the beetles.

Biological control

Check with your nursery for a specific variety of Bt (*Bacillus thuringiensis* var. *san diego*) that attacks beetle larvae. Tachinid flies and chalcid wasps are effective enemies of elm leaf beetles.

Least-toxic chemical control

Summer oil can control elm leaf beetle eggs and can be applied in the spring.

Fleas

Actual size:
Adult fleas – 1/16"



Fleas are a common pest west of the Cascades where winters are mild and homes are relatively damp. They inflict annoying bites, transmit tapeworms and can cause allergies in both animals and humans. Fleas are almost impossible to eradicate. You may kill most of the adults, but new eggs or larvae are waiting to carry on, and your pet will bring in more fleas from outside. Don't dismay. You can keep the flea population low enough that it won't be bothersome, and you can do it without using highly toxic products.

Decide at what level a flea problem becomes unacceptable to you. This may be one flea bite per week or finding two fleas each time you comb your pet. When fleas reach an unacceptable level, apply control measures starting with the physical ones. At any time, fleas may exist in all four life-cycle stages (egg, larva, pupa and adult) in your home. Follow these recommendations closely and use chemical controls only if necessary.

Physical control

Establish one regular sleeping area for your pet in a place you can clean easily and regularly. This is easier for dogs than for cats. With cats, you may have to place removable cloths in several places where they like to sleep. Any bedding materials and nearby rugs should be removed frequently and washed. Vacuum all areas to which your pets have access every week with a strong canister-type machine. Use a crevice tool and don't forget the upholstered furniture. During the "flea season" in the late summer and fall, you may need to vacuum more often – every third day or so. Dispose of the vacuum bag immediately so that the fleas cannot escape after the vacuum is stored away.

Severe flea outbreaks may require shampooing or steam cleaning rugs and upholstered furniture. Restrict your pets to certain rooms in the house. Do not allow them in bedrooms, hard-to-clean rooms such as basements and attics, or rooms belonging to family members particularly susceptible to flea bites. In severe cases, keep animals either outside or inside, but don't let them go back and forth. Small areas outside where your pet spends a lot of time (concrete areas, dog houses, garages or decks) can be kept relatively free of fleas by vacuuming. However, it is better to focus your efforts indoors, where you have more control.

To remove adult fleas from pets, comb them with a flea comb and bathe them. A flea comb has specially designed tines spaced to allow hair, but not fleas, to pass through. Several tine spacings are available. As you run the comb through your pet's fur, some fleas will jump away, but others will stay on the comb. Remove the fleas from the comb and drop them into a container of soapy water. When finished, flush them down the toilet. Count the fleas removed to estimate the flea population and monitor the need for other controls. Shampooing an animal knocks some fleas off and drowns others. Ordinary soap or shampoo work to a degree, but an insecticidal shampoo is more effective. Keep the soap away from the pet's eyes and stop using any product that produces skin irritation or allergies.

Least-toxic chemical control

Flea collars are not recommended because they contain very potent chemicals that may harm your pet. The safest chemical for killing fleas is an insecticidal soap. Separate soaps can be purchased for treating the pet and its surroundings. There are also insecticidal soap sprays available for inside/outside use to which a small amount of pyrethrum is added. Many other pyrethrum-based products are available. Cats are especially sensitive to pyrethrum, so if your cat does not tolerate it, try something else.

After soaps, the safest chemicals to kill adult fleas are the natural constituents of lemon peel oil, which are quite toxic to adult fleas and relatively safe to vertebrates. Use shampoos or area sprays that contain linalool. Do not substitute these products for a year-round program of non-chemical control.

Lufenuron (Program), also known as “flea birth control,” is a once-a-month oral medication veterinarians can prescribe for pets. Fleas that feed on a dog or cat treated with the drug produce eggs that are unable to develop. When administered to all pets in a household, the treatment can be effective in reducing indoor flea populations. Because it does not kill adult fleas or prevent new fleas from being introduced from outside, it should be used in combination with other controls. Tests performed on dogs and cats taking lufenuron for two consecutive summers revealed no obvious side effects. However, because long-term toxicity studies have not yet been published, possible cumulative effects on pets are unknown.

Imidaclopril (Advantage) and fipronil (Frontline) are liquid formulations that are applied externally in one spot on the animal’s back and kill adult fleas. They are effective for one month. They work by spreading over the body through skin oils, and kill fleas within 24 hours.

Methoprene, an insect growth regulator, mimics natural insect hormones and prevents immature fleas from becoming adults. It is quite specific to the target insect and is fairly safe to mammals. However, it does not kill adult fleas or eggs, so it must be used in combination with other controls. It is more effective when flea populations are just beginning to build, but you may not know that the problem is going to be serious enough to need chemical treatment. Methoprene is available in aerosol foggers and a concentrate. Foggers are not recommended because they do not concentrate the application in the areas where adults and larvae hide (carpets, bedding, etc.) and often contain other toxic ingredients. Spray the concentrate as directed.

Boric acid can be applied on inside carpets and diatomaceous earth can be spread over lawns. These materials kill fleas by drying them out instead of poisoning them, but are dangerous to humans, especially young children, if inhaled or absorbed through a cut in the skin. Wear rubber gloves and breathing protection when applying these yourself or have them applied by professionals. Avoid these methods if you have young children.

Flies

Actual size:
1/8" – 1/4"



There are many different types of flies, but only four kinds are found indoors and are considered house pests. The common house fly is gray and about 1/4" long. It breeds in garbage cans, dumpsters, compost piles or other sources of food waste. It can pose a health hazard because it carries disease organisms. The drain fly is somewhat smaller and breeds in sewage and kitchen drains. The tiny yellow-brown fruit fly hovers over fruits and vegetables in the kitchen. The fourth type, the cluster fly, is not associated with garbage or manure. It is larger and darker than the housefly, is a sluggish flier and is often found in clusters on windowsills in winter.

Prevention

The key is to prevent odors. Properly store and dispose of all kitchen wastes. Keep the kitchen clean and free of food scraps and overripe fruit. Wash dishes immediately after eating and keep drains fresh with baking soda and vinegar, followed with hot water. Rinse recyclable cans and bottles before storing. Bury or dispose of pet feces. Install properly fitting screens on windows and doors and keep them in good repair.

Physical control

The best way to dispense with a fly is the old-fashioned way, with a fly swatter. You can also try rolls of sticky flypaper, particularly in garages, near garbage cans and other areas where appearance is not important. These methods should control cluster flies, but will be inadequate for controlling the other types of flies unless proper sanitation practices are followed. Try a saucer of red wine to attract and drown fruit flies.

Ultraviolet light and electrocution traps are not recommended for outside use because they kill as many beneficial insects as they do flies. Chemical insecticides, including impregnated hanging strips, are not recommended as they pose risks to human health and should not be needed if the source of the problem is addressed.

Honeybee swarm

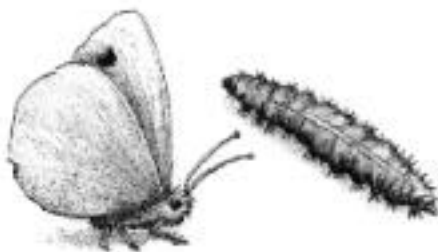
Actual size:
3/8" – 5/8"



The best way to remove a swarm of bees is to call a reputable bee keeper who can, in 20 to 30 minutes, capture the queen bee. The rest of the swarm will follow. Bees in a swarm are engorged with honey and pose very little stinging threat. WSU Master Gardeners keep a list of beekeepers willing to come get the swarm.

Imported cabbageworm

Actual Size:
Butterfly 1" – 2"
Larva 1 1/4"



Adult imported cabbageworms are the white butterflies (with black tips and 2-3 spots on each wing) that flit about in the garden for almost the entire growing season. The larvae, which are medium green, eat large, ragged holes in leaves of cabbage-family plants and cabbage heads and soil the leaves with dark green excrement.

Prevention

Cover plants with a floating row cover all season or until fully mature.

Physical control

Hand-picking imported cabbageworm larvae in light infestations can be very effective. Eggs are conical and light in color and are laid on the undersides of leaves of cabbage family plants such as broccoli and cauliflower. They can be scraped away easily with your fingernail. Use yellow sticky traps to catch female butterflies.

Biological control

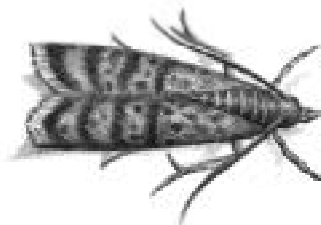
The relatively docile paper wasps, which pose no threat to humans, are known to eat imported cabbageworm larvae (caterpillars) and other soft-bodied insects such as aphids.

Least-toxic chemical control

Larvae may be controlled with Bt (*Bacillus thuringiensis*).

Indian meal moths

Actual size:
Wingspan 5/8"



Indian meal moth larvae are generally brought home in purchased food such as cereal, flour, oatmeal, trail mix, etc. The larvae may stay in the food, feeding on it all year. When it emerges, it seeks out the warmest place, which, in your house, is the ceiling. If you miss seeing them in their pupae stage, you probably won't miss the adult moth fluttering around in your house.

Prevention

Never leave opened packages of food in your pantry. Always store food in sealed containers. If you have a problem with a particular dry good, store it in the freezer. This also kills the eggs in food that is already infested. Freezing newly purchased packages for 24-48 hours will usually destroy all eggs.

Physical control

The best solution is to check your dry goods and find the container where the moth has laid her eggs and larvae have hatched. As the larvae feed, they make webs that look like spider web strands tangled up in the infested food. Put the infested food in a sealed paper bag and dispose of it. Pheromone traps for catching Indian meal moth adults are available commercially.

Leaf miners

Actual size:
Adult 1/10"
Larva 1/4"



*Leaf miner
damage*

Leaf miners are insects that tunnel between the upper and lower surfaces of leaves. Hatching larvae tunnel through the mid-leaf tissue, feeding as they go, and leave characteristic wavy lines that are visible on the top of the leaf. When ready to pupate, the larvae leave the leaf and drop to the soil, emerging in 10 to 15 days as adult flies. A certain amount of tunneling can usually be tolerated, but the damage is especially troublesome on spinach, chard and sometimes beets since these plants are grown in order to harvest the leaves.

Prevention

Covering the vegetable crop with a floating row cover for the entire life of the plants can be extremely effective. Fall-sown crops are less susceptible. Move plantings at least several feet away from where you planted last year.

Physical control

For small infestations, pick off and destroy the affected leaves. Scratch the small white egg clusters from the backs of the leaves with your fingernail. In enclosed areas such as greenhouses, use yellow sticky traps to catch adults. Plastic mulches prevent leaf miner larvae from reaching the soil to pupate.

Biological control

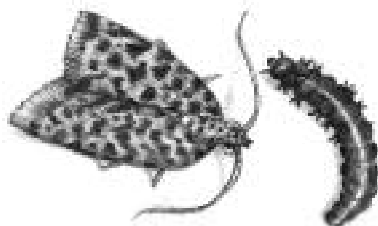
Encourage beneficial predators such as lacewings and spiders for egg and adult control. Other natural enemies include ants, true bugs, flies and birds. Parasitic wasps are able to attack the larvae through the leaf.

Least-toxic chemical control

Neem oil operates as a repellent to adult leaf miners and as a systemic insect growth regulator on larvae. Recent studies also indicate that horticultural oils (not dormant oils) may work against leaf miner eggs, but timing the spray is crucial.

Leaf rollers

Actual size:
Moth 3/4"
Larva up to 1"



There are many types of leaf rollers that infest many different plants, including apple, willow and plum trees, blueberries, photinia and laurel. The larval stage is a caterpillar that folds the leaf and webs it, then feeds inside it.

Physical control

Remove them or the leaves they are in from the plant. Do not put them in your compost bin unless you bury the leaves in the deepest, hottest part. It is better to put them in a sealed paper bag and place it in the garbage.

Biological control

Encourage native parasitic wasps such as *Trichogramma*. Bt (*Bacillus thuringiensis*), the bacterium that paralyzes the digestive system of the pest, may be used according to label directions. However it is difficult to deliver to the areas where the larvae are feeding. The rolled leaves provide good protection.

Least-toxic chemical control

Dust or spray with pyrethrum or rotenone for severe infestations only. Apply in two applications, 30 minutes apart. The first drives the caterpillars from hiding, the second kills them.

Moles

Actual size:
7"



Some moles are beneficial – they eat pest insects and improve the soil through aeration. Some, such as the Townsend's mole, which is found here in the Northwest, eat more vegetation than do other species. All moles eat earthworms, and all species, regardless of their feeding habits, can disfigure lawns, heave up seedlings and sever tender roots as a result of tunneling. Sometimes, though, moles get blamed for damage done by field mice or gophers.

Prevention

Moles cannot dig through soil that is severely compacted, stony or heavy in clay. To discourage mole invasion, build borders of stone-filled, clay and/or compacted soil around the areas you want to protect. These barriers must extend at least 2' into the ground and be 6" to 12" wide. Or try burying small-mesh fencing 18" to 24" deep so that it stands 2" or 3" above the soil surface. Moles also don't readily invade very wet or very dry soils.

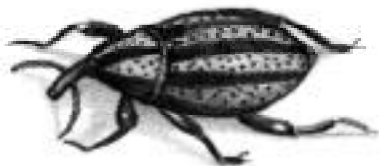
Physical control

Catch live moles in pit traps and release them away from your garden area. Or try flushing moles out of their tunnels with water from a garden hose. This may have the greatest impact in the spring when the young are still in the nest. However, lethal trapping is the most effective and reliable method for getting rid of moles. Success depends on your

perseverance. Scissors-type traps seem to be the most effective. Set the trap in a main run – usually a foot or more under the surface – and not in a shallow, surface-feeding run.

Root weevils

Actual size:
Adults 1/4"



Root weevils commonly infest the root systems of ornamental shrubs such as azalea, primrose, rhododendron and small fruits such as blueberry and strawberry.

Larvae live in the ground around the base of a plant and chew on the bark and the surrounding surface roots primarily during the fall and winter months. Adult root weevils are nocturnal feeders, notching the edges of the leaves, and are most active from late spring through summer.

Physical control

Prune any branches that are touching the ground to prevent adults from crawling up them to feed. Rake any mulch away from the stem to reduce their hiding places. You can apply a collar with a band of a sticky substance such as Tanglefoot around the base of the trunk to trap them and prevent them from reaching their food source. Handpicking the adults at night is an effective control method.

Biological control

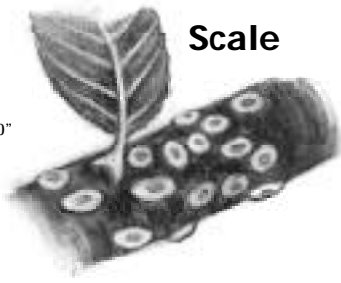
Use beneficial nematodes available at a nursery or garden center. When the nematodes are rehydrated, they attack and kill the root weevil larvae. This treatment is effective in early fall. Follow label instructions.

Least-toxic chemical control

Use Neem to control adults in early summer. Applying diatomaceous earth around plants may help in dry weather. Wear nose and mouth protection when applying, and keep pets away from the area.

Scale

Actual size:
Adult female 1/100" – 1/10"



There are many varieties of scale, which suck plant sap, weakening plants and causing leaves to yellow and drop. Some excrete large quantities of honeydew. There are two to four larval stages. The first looks like a mite, and subsequent stages look like smaller versions of the adult females. Adult females look like hard or soft bumps on stems, leaves and fruit. Males, minute flying insects with yellow wings, do not feed.

Physical control

For small infestations, hand picking or dabbing scale with rubbing alcohol is effective. Prune and dispose of infested branches and twigs.

Biological control

Encourage predators such as aphid lions (green lacewing larvae), syrphid fly larvae, ladybugs (adults and larvae) and parasitic wasps.

Least-toxic chemical control

Use insecticidal soap or horticultural oil spray in early summer on the crawler stage. Do not use oil sprays when the plant is flowering. Apply dormant oil spray only in the winter, or it may defoliate your plant.

Silverfish

Actual size:
3/8" – 1/2"



Silverfish are attracted to carbohydrate substances such as the glue on the back of wallpaper or in the spine of books. They can be a problem in boxes where books are stored. They are attracted to dark, damp areas.

Least-toxic chemical control

Boric acid can be applied on inside carpets and applied in hard-to-reach cracks using spray or powder in a duster bottle with a needle-nose applicator. Never use in areas where crawling children or pets may have contact.

Slugs

Actual size:
1/8" – 5"



Slugs feed at night and prefer moist plant material. They eat many types of vegetables, fruits and flowers. Some of their favorites are strawberries, lettuce, spinach, carrot tops, dahlias and marigolds.

Prevention

Remove garden debris, boards, bricks and tall grass where slugs may hide during the day.

Physical control

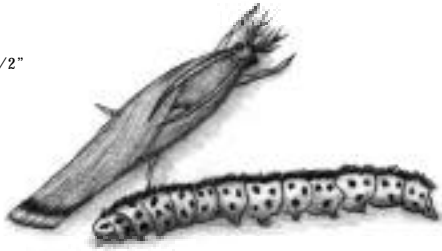
Do a “search and destroy” mission at night by patrolling your yard with a flashlight and killing the slugs you find. You can cut them in two with scissors, spray them with a mixture of one part ammonia in three parts water, or drop them into a bucket of soapy water.

Recent research suggests that sheet copper buried in the soil to create a fence several inches high is very effective barrier. Other barriers, applied as a ring around the base of plants or around the entire garden, include diatomaceous earth, wood ashes, sharp sand and crumbled egg or oyster shells. These may be effective only under dry conditions.

A container of beer, buried part way so that the rim is slightly above ground level, attracts and drowns slugs. There are also several slug traps available at garden centers that attract slugs into them and then prevent them from getting out. You can also make one by simply turning over a wet clay pot in a shady area of the garden. Create a gap for them to crawl through by resting the edge of the pot on a twig or on some irregularity in the ground. The slugs will collect under the pot during the warmest part of the day. Check for slugs and destroy them.

Sod webworms

Actual size:
Moth wingspan 1/2 " – 1 1/2"
Larva 1/2"



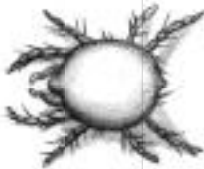
The larvae of this lawn moth feeds on the shoot and crown of the grass, but not the roots. Irregular brown patches appear on the turf and the grass dies back, leaving irregularly sized dead areas. The 1/2" larvae are slender and gray with brown heads. They can be seen when the brown or dead sod is lifted.

Biological control

Beneficial nematodes are effective when applied according to package directions.

Spider mites

Actual size:
1/64"



Spider mites are found on a wide variety of plants. If the leaves start to look pale or mottled, it may be from mites sucking the juices. They are almost too small to see, but can be identified by tapping a suspect leaf over a sheet of white paper. If the little spots move, it's likely they are mites. You may also be able to see webbing on the back of the leaf or between leaves. Spider mites especially like dry conditions. If spider mites have been a problem on your house plants, try raising the humidity around the plants by misting them regularly or setting bowls of water among them.

Physical control

Wash spider mites off with a strong stream of water. You will need to repeat this every several days. Be sure to spray all sides of the leaves thoroughly.

Biological control

Predatory mites, available from nurseries, prey on all types of harmful mites but are most effective in greenhouses. Ladybugs, praying mantis and lacewing larvae also eat mites.

Least-toxic chemical control

Try an insecticidal soap, which is effective when sprayed directly on the mite. Repeated applications may be necessary. Pyrethrum, sabadilla or horticultural oil are also effective. Use dormant oils only in winter. Don't use summer oils when the plant is flowering.

Spiders

Actual size:
1/16 " – 3/4"



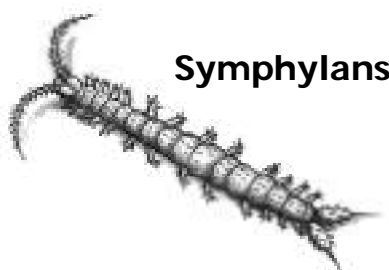
Spiders are beneficial predators that consume many destructive insects. There are many types, but only black widow spiders and hobo spiders pose any threat to humans in our area. Hobo spiders build funnel-shaped webs in crawl spaces, wood piles, or around the perimeters of homes. They rarely climb vertical surfaces and are uncommon above basements or ground level. They wait inside the tube and dash out to bite any prey that becomes entangled in the web. They can grow to 3/4" long and may bite intruders with little provocation. Bites are touch sensitive and cause a severe headache in the first several hours following the bite. Bites can be serious and should be treated.

Prevention

Keep tall weeds and grasses away from the house. Shut basement and first floor windows tight or use screens. Make sure the bottoms of doors have insulation stripping that can keep spiders from entering. Avoid areas where spiders congregate.

Physical control

The best way to get rid of a spider in your home is to place a glass jar over it, slip a card underneath and carry it outside. They are fragile and will usually be killed by sweeping with a broom. Spraying with a pesticide is usually pointless because woodpiles and similar areas are so attractive to spiders that they usually return.



Symphylans

Actual size:
1/20" – 1/4"

Symphylans, sometimes called garden centipedes, are found in rich, moist soils. Symphylans are about 1/4" long at their largest, white, have 12 pairs of legs, and feed on plant roots. Note that true centipedes have 15 pairs of legs and eat other insects, so correct identification is very important.

Symphylans are usually brought into a landscape in manure or compost and thrive in very moist soils high in organic matter. They feed on the roots of many different plants and, in high numbers, can kill young starts. Older plants often can outgrow the damage as long as the have adequate water. Susceptible plants include tomatoes, lettuce, sugar beets, chrysanthemum, asparagus, beans, brassicas, celery, cucumber, parsley, peas, peppers, potatoes and strawberries.

Symphylans are especially difficult to get rid of once they have become established in a garden. None of the following suggestions are foolproof, but, when used together, can probably reduce their numbers.

Prevention

The best bet for symphylan control is to not get them in the first place. If you are bringing in manure to add to the garden, look it over with a magnifying glass for symphylans before applying it. If your soil tends to be wet, be careful not to over apply organic matter, don't use organic matter as your only source of fertilizer or consider moving the garden to a drier location. If they inhabit your compost pile, eliminate that pile and resume composting on a plastic sheet or concrete slab. Symphylans tend to occur in spots in the garden, so crop rotation into non-susceptible plants may help.

Biological control

Beneficial nematodes may help to control symphylans. Be sure to follow label directions.

Physical control

If the site is level and on the wet side, you can try flooding the area for several days in winter to drown symphylans. Or, cover the site with plastic on a sunny, warm day to heat the site and kill the pests. Symphylans are fairly delicate creatures, and cultivation will also help reduce their numbers. Rototill in the spring and fall and hand cultivate around plants during the season to stir up the soil and destroy symphylans.

Tent caterpillars

Actual size:
Up to 3"



These caterpillars spin the silky white tents that cover the tips of branches. They damage plants by eating foliage as it emerges. They eat leaves off many deciduous trees and shrubs, especially walnut, alder, willow, fruit trees and roses. If a tent has been on a branch for awhile, chances are some caterpillars are fully grown (up to 3") and have left the tent to select a site to spin cocoons. After about two weeks, adult moths emerge, mate, lay eggs and die. The eggs are laid in a foam-like band around small twigs or branches of the host tree where they hibernate over the winter. When new leaves begin to appear in the spring, the eggs hatch.

Physical control

Consider tolerating a few tents. These caterpillars are native insects and are controlled in the long term by natural factors. Prune out branches containing tents in particularly valued trees or those with heavy infestations. Prune early in the morning or in the evening when caterpillars are in their tents. Put tents in a sealed paper bag in the garbage. During the winter, examine branches and rub off egg masses that appear as hardened gray or brown frothy material, somewhat similar to Styrofoam. Egg masses

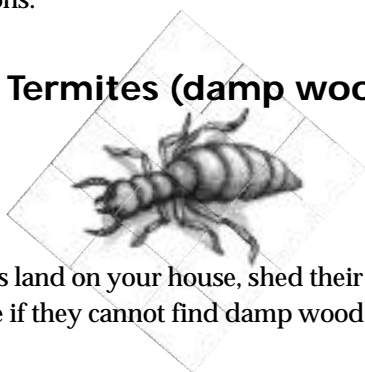
are usually 1/2" long bands surrounding twigs. Deposit in a bag, seal it and place it in the trash.

Biological control

Tachinid flies deposit white eggs, natural parasites, in visible rows on the caterpillars' backs. If you look closely at the caterpillars and see these eggs, natural controls are working. You can introduce the bacterium Bt (*Bacillus thuringiensis*), but to be effective, it must be sprayed to thoroughly coat the leaves since Bt is a stomach poison effective only when ingested. Bt will kill all caterpillars, including those that mature into desirable butterflies. If you use Bt, use it only on the affected plant and follow label directions.

Termites (damp wood)

Actual size:
3/4" - 1"



These termites land on your house, shed their wings and try to find a home. They will die if they cannot find damp wood.

Prevention

Do not leave soil piled up next to your house or in contact with any wood structures. Also, repair any leaky pipes that keep surrounding wood moist. Firewood should be stored in a dry place; wet wood attracts termites.

Thrips

Actual size:
Up to 1/5"



Thrips are tiny, elongated, fast-moving insects 1/5" long or less. Adults and nymphs suck sap from plant tissue, leaving silvery spots or streaks on leaves. In the Pacific Northwest, thrips are a particular problem

on gladioluses. Thrips can apparently produce young without mating. The process, which is also common in aphids, permits a very rapid population buildup.

Physical control

In greenhouses, hanging blue sticky traps helps catch adults before they move into the plant.

Biological control

Encourage native predators such as lacewings and lady beetles. Because most thrips pupate in the soil, they are potentially susceptible to insect-eating nematodes. Two predatory mites also appear to have substantial potential for thrips control.

Least-toxic chemical control

Insecticidal soap or horticultural oils can be used to provide temporary relief from thrips while you are waiting for predators to arrive. As a last resort, spray with alcohol, neem, pyrethrin or sabadilla, or apply diatomaceous earth, just on the undersides of leaves and on soil around affected plants.

Wasps and yellow jackets

Actual size:
1/2" – 3/4"



Wasps and yellow jackets are beneficial. They eat other insects. If they become a nuisance, use traps specifically designed to capture the type of pest you have. Consult a knowledgeable nursery person for advice on which one to use. Place traps away from high-use areas. Traps only work early in the season (before August).

Prevention

Cover garbage cans and outdoor foods, especially fruit and other sweets.

Weeds

What is a weed?

*A plant whose virtues have
not yet been discovered.*

– Ralph Waldo Emerson

Blackberries



Although blackberries are native to this region, the species of blackberry that is most invasive is the Himalayan blackberry, an imported species that has naturalized here. It is, however, a source of food and cover for many species of wildlife, not to mention the source of countless jars of blackberry jam. It arrives in your landscape through the help of birds, which introduce seeds in their droppings, or by the invasive roots that creep under fences and out of naturalized areas into your yard.

Nothing other than hard labor and natural decomposition will make the canes go away. Furthermore, no herbicide will completely control the roots, so if you use physical methods or chemical methods to control blackberries, continual, persistent removal of the new growth will be necessary for at least a year following your initial efforts.

Prevention

Encourage the growth of desirable plants, especially vigorous shrubs that will cover the ground, and use mulches wherever possible.

Physical control

Remove canes by hand and pull as many roots as possible. Wear leather gloves, a long-sleeved shirt and long pants to protect yourself from the thorns. Winter is an especially good time since the heavy clothing will

be more comfortable and the leaves will be off the plants, making them a little easier to work through. During the growing season, continue to remove the new canes as they appear. If there are no desirable plants within a foot or two of the cut blackberry canes, pour boiling water on the cut stumps. Also, remember that if a site has been neglected for a very long time, this will be heavy, uncomfortable work. Do yourself a favor and be realistic about how much area you can clear in a day.

Least-toxic chemical control

If chemical control is necessary, paint a systemic herbicide on the leaves while the plant is actively growing. The herbicide will move through the plant to kill the roots.

Bittercress



This member of the mustard family has a circle of leaves at its base and produces 6" to 8" stems with white flowers. The flowers mature into inch-long seeds that pop off when disturbed. This plant is prolific only in the spring; by summer, it should be no problem.

Prevention

In flower or ornamental plant beds, use a deep organic mulch to reduce their numbers.

Physical control

In late February, before the flowers go to seed, manually pull them or hoe them. If you manually remove them early in the season as soon as they start to grow, the seeds won't spread and increase the problem.

Clover



Clover comes in many varieties, all three-leafed and low-lying. Clover spreads by sending out shoots.

Prevention

Clover in a lawn is usually the result of excess phosphorus or low nitrogen. Lawns need more nitrogen than either phosphorus or potassium. Since clover makes its own nitrogen, it is stimulated to grow in high phosphorus conditions. Fertilize with a nitrogen-phosphorus-potassium mix of 15-5-10 or 23-8-12, or use a nitrogen-rich organic fertilizer such as alfalfa meal or cottonseed meal. Do not over fertilize; excess chemicals can run off and contaminate water.

Dandelion



Dandelions have a long thick tap root that stores food reserves. Dandelion seeds are dispersed by wind.

Prevention

Minimize them by not allowing the flower to go to seed. Mow lawns often to keep the flowers from maturing. In flower or ornamental plant beds, use a deep organic mulch to reduce their numbers.

Physical control

Hand dig them out, removing as much of the root as possible. Spot treating with boiling water is an effective control, especially when you

pull the weed first and treat the root. In lawns, removing dandelions leaves small bare areas where new weed seed can germinate. Spread a little grass seed in those spots to prevent weeds from establishing.

Horsetail rush



Horsetail rush is an ancient plant that can be attractive in natural settings, but easily becomes a pest in the garden. It spreads by spores or by its root system, which can be as deep as 12'. Its presence indicates that the soil is wet clay, tending to be acidic. Try drying out the area if possible. Or consider planting other water-loving plants, such as rushes and sedges, to add a more natural element to your landscape.

Physical control

Hand pull or hoe out the above ground growth as it appears. Persistence is necessary, but over time, this will deplete its energy reserves and achieve control. When the weed dies down in winter, cover the area with weed barrier cloth and leave in place for two years to prevent weeds from photosynthesizing. Even then, roots may still be able to push up new growth.

Morning glory



Morning glory is a weedy vine that will twine all over the garden, covering plants to the point of smothering them. It is usually spread by seed or invasive roots. Its thick fleshy roots can travel long distances just under the soil surface.

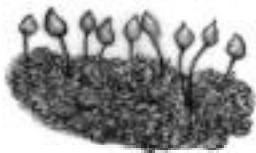
Physical control

Hand weeding can remove large quantities of roots, but any broken pieces are capable of sprouting new growth. Never dispose of morning glory in your compost pile. Repeated, persistent digging or rototilling as the new growth sprouts can deplete the food reserves and allow other plants to compete successfully. Keeping all green parts removed from mid-summer to late fall will starve the roots and help control morning glory and other perennial weeds. Be persistent; it can take a long time to eliminate morning glory from your yard.

Least-toxic chemical control

If chemical control is required, do not spray. Paint the leaves with the least-toxic systemic herbicide available when the plant is actively feeding its roots. A systemic will move from the leaves through the plant's vascular system to kill the roots. Do not put plant parts that have been treated with herbicides into your compost pile.

Moss



Moss is a natural part of the Pacific Northwest's native groundcover. If your lawn has moss, consider leaving it there or allowing it to spread in planting beds to form an attractive groundcover. It prefers shade, moisture, and poor acid soils.

Prevention

Correct the conditions that encourage moss to grow. Water infrequently but deeply, making sure that the water is penetrating and not running off. Proper aeration and thatching of lawns will help air flow. Do not apply water faster than the soil can absorb it. Soil should be limed and fertilized to encourage the growth of desired plants or turf. If trees shade an area, consider pruning them to introduce more sunlight.

Physical control

Rake moss out of lawns.

Least-toxic chemical control

Apply an herbicidal soap or an iron-based product that turns the moss black as it dies. Keep these products off concrete, as they will stain.

Poison oak



In the open or in filtered sun, poison oak grows as a dense leafy shrub. Where shaded, it becomes a climbing vine. Its leaves are divided into three leaflets. Poison ivy, which grows in eastern Washington, is very similar, but it is more sprawling in growth habit and rarely climbs. The foliage of both turns bright orange or scarlet in the fall.

Prevention

Poison oak will eventually die out if you keep it clipped to within an inch or two of the ground with a power mower or hand clippers. Grasses tend to crowd it out so it can't get enough height to put out leaves.

Physical control

Woody perennials, such as poison oak and wild blackberries, have high reproductive capacities, and established plants are difficult to eradicate by digging. But it is not impossible. Mulching is the easiest way to rid yourself of stubborn perennial weeds, but it may take a year or two. Grub out rootstocks, treat with boiling water, mulch heavily. Mulch options include old carpeting, old swimming pool liner, 10 to 20 sheets of weighted newspapers or sheet metal, such as old tin roofing. To eradicate young plants, put on a long-sleeved jacket and leather gloves and pull them out by hand as fast as they appear to destroy the roots.

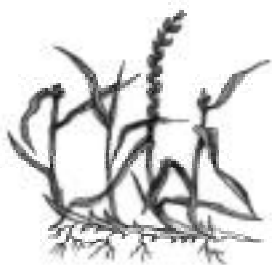
Biological control

If the plant is young and not woody, goats, if managed properly, can be helpful in eliminating woodier weeds such as poison oak and ivy, wild blackberry, bamboo and scotch broom.

Least-toxic chemical control

If plants persist, paint the leaves with the least-toxic systemic herbicide available rather than spraying.

Quackgrass



Quackgrass forms dense spreading mats with white, fleshy roots.

Physical control

Keep pulling it out. Pieces of root left in the soil can sprout new growth. Sift the soil carefully to make sure you remove all root pieces. Try covering it with weed barrier cloth. If mowed regularly, quackgrass does not seriously detract from the appearance of a lawn. Mowing will gradually cause quackgrass to decline.

Least-toxic chemical control

Try spot treating with boiling water. If the grass still persists, do not spray. Paint the leaves when they are about 8" high with the least-toxic systemic herbicide available when the plant is actively feeding its roots. A systemic will move from the leaves through the plant's vascular system and kill the roots. Do not put plant parts that have been treated with herbicides into your compost pile.

Thistles



Thistles have leaves with sharp prickles and spread by seed or underground shoots.

Prevention

In flower or ornamental plant beds, use a deep organic mulch to reduce their numbers.

Physical control

Pull them out and cover troublesome areas with weed barrier cloth. Spot treat with boiling water.

Diseases

Black spot

Black spot is a fungus common to rose bushes. Symptoms appear as coal-black lesions on upper and lower surfaces of leaves. Heavily diseased leaves tend to turn yellow and drop prematurely. When excessive premature defoliation occurs, the plant forms a new set of leaves, which causes a considerable drain on food reserves in the roots. This results in a weakened plant with poorly matured wood. A few days after the spots first appear, little black pimples show up in the spots; this signals that the spores are about to be discharged and you should act fast to remove and discard those leaves. Spores are carried by air currents, insects, tools, hands and clothing.

Prevention

When selecting a rose bush to buy, consult a knowledgeable nursery person or the WSU Extension agent or Master Gardeners for varieties that are less prone to black spot. Some varieties are more susceptible than others.

Physical control

Remove infected leaves from the bush and those already fallen on the ground so they can't reinfect the plant. Prune away excess foliage and sickly canes to improve air circulation. In the spring, remove the mulch around the base of the plant and rake the ground thoroughly to expose it to the sun. When new shoots appear, apply generous amounts of new mulch. Never water roses from overhead. Keep the foliage as dry as possible because dry leaves won't support the fungus.

Least-toxic chemical control

Dust with a finely ground sulfur when temperatures are under 85 degrees. It tends to burn leaves if applied in very hot weather.

Blight

The term blight is used to refer to a great number of plant diseases that affect a number of plants in one area, rather than isolated cases. Most

blights are caused by pathogenic organisms, generally fungi, but sometimes bacteria, and are manifested by browning foliage, reduced vigor and death of the plant. Early and late blight, which strikes potatoes and tomatoes, and brown rot blossom blight, which affects cherries, peaches and plums, are common in the region. Blights spread readily when plants are wet. A warm, humid spring increases the chance of blight problems. Warmer, drier weather may check the spread of blight.

Prevention

Most diseases – including blights – are almost impossible to eliminate once they have taken hold of a plant. The best we can hope for is to try to prevent them from starting and, if that fails, to prevent them from spreading. Blight-resistant varieties of plants are available. Don't water tomatoes overhead at night. The foliage can't dry off and this increases the potential for blight problems.

Physical control

As mentioned above, once the plant is infected with blight, it is virtually impossible to control. Pick off and destroy infected parts when you spot the first sign to prevent the disease from spreading.

Least-toxic chemical control

A fungicide spray of copper may be effective in preventing late blight on tomatoes and brown rot blossom blight on fruit trees.

Dogwood anthracnose

Not to be confused with the disease of oaks, maples, sycamores and other plants, anthracnose is a common name used for many unrelated plant diseases that cause leaf spots and dieback. Because of its lethal effects on many species of dogwood, this particular fungus has earned the scientific name *Discula destructiva*. It attacks most species of dogwood, including flowering dogwood and our native dogwood, but does not occur on Korean (also known as kousa) dogwood.

Diseased plants typically have spots on the leaves and flowers that are light to dark brown with purplish margins. These spots produce spores,

which spread via wind and rain to other leaves and create more spots. Severely infected trees will have poor growth, produce few leaves, small leaves and many sprouts at or near the base of the tree, and will eventually decline and die.

Prevention

Whenever possible, plant kousa dogwoods. They are lovely trees, with dark, glossy green leaves and creamy white flowers. There is at least one pink-flowering variety available as well. They bloom after other dogwoods, usually in June.

Physical control

Rake up diseased leaves and remove them. Prune the tree to increase air circulation, which may lessen the occurrence of leaf spots. Also, infected trees often produce many sprouts at or near the base of the tree, which are especially susceptible to infection. These should be removed. Finally, be sure the tree receives adequate water, preferably from an irrigation source that does not wet the leaves.

Least-toxic chemical control

The only effective control is a chemical leaf spray available only through tree care companies. It must be applied several times a year, beginning in early spring.

Powdery mildew

Powdery mildew is a white or grayish powdery coating on the surfaces of leaves, stems and buds. It germinates on dry leaves in high humidity and is commonly found on fruit trees, roses and big shade trees. Rain inhibits it and warm, damp nights encourage it. It can cause stunting and distortion of leaves, buds and growing tips, a general decline in plant growth, yellowing of leaves and premature leaf fall.

Physical control

Prune and thin out excess branches to increase air circulation. Plant resistant varieties, and put them in sunny locations.

Least-toxic chemical control

Spray with a mixture of 1 gallon water, 3 teaspoons baking soda, 2 1/2 tablespoons horticultural oil and 1/2 teaspoon insecticidal soap. Spray this on an unobtrusive area of your plant first, and watch for signs of adverse effects before spraying your entire plant.

Rust

Rust is a fungus with orange to brownish pustules on the underside and pale yellow spots on the tops of grass blades, snapdragon or hollyhock leaves, raspberries and rose bushes. It is common on Kentucky bluegrass and on the weed annual bluegrass.

Prevention

Pick off and destroy affected leaves as soon as they are noticed. Leaves must be wet for four hours to become infected, so careful watering can help prevent it.

Mow the lawn shorter to improve air circulation and apply a nitrogen-predominant fertilizer that contains sulfur. Choose a grass seed mixture containing fine fescues and perennial rye grass, two species that are less susceptible to rust.

Least-toxic chemical control

Periodic dustings of sulfur have been found to be somewhat effective, but you should not need this unless preventive measures have failed. Sulfur can be highly irritating to the respiratory system. Wear nose and mouth protection when applying.

Scab

Scab is a name given to several fungus diseases. One infects apple and other fruit trees, another infects cucumbers and yet another can infect potatoes. On fruit trees, scab generally appears first on the undersides of the leaves as pale yellow spots that gradually darken until they are nearly black. Leaves may have numerous scab spots and become distorted. The scab fungus overwinters on the fallen infected leaves, producing spores in

spring. The spores are wind borne and infect the young leaves and fruit during periods of rain. Warm rainy weather is ideal for scab.

Prevention

For potatoes, scab is particularly severe in alkaline soils and usually worse in dry soil. Avoid using lime, fresh manure or wood ashes on your potato beds, as these will increase the alkalinity. If potato scab has been a problem, you should practice a three- to five-year crop rotation schedule. Always plant resistant varieties of potatoes and apples.

Physical control

Because the fruit tree fungus spends the winter on fallen infected leaves, rake them up carefully and dispose of them. Careful pruning for good air circulation creates a less favorable environment for the spread of scab.

Least-toxic chemical control

Dormant lime sulfur sprayed on the fruit trees during the winter will help control it. In the spring, if your plants are in serious trouble, continue using lime-sulfur spray or wettable sulfur.



Glossary

Bacillus thuringiensis (Bt)

a bacteria used to control certain pest larvae, primarily caterpillars. Bt is not toxic to humans or other mammals but will kill butterfly ("friendly") caterpillars as well as the problem ones. The bacteria kills larvae by interfering with digestion. Bt lasts on leaf surfaces five to seven days and must be ingested to be effective. There are many strains of Bt commercially available now, including strains for controlling mosquito and beetle larvae.

Boric acid

slow acting, low-toxicity, long-lasting (if kept dry) powder that is effective against ants, cockroaches and other structural pests. It is a digestive and contact poison and is usually applied as a dust. Products often come with a duster-type applicator. It is toxic if ingested, inhaled or comes into contact with abraded or broken skin. It poses a risk to children and pets if they come into contact with it. It is safe to place it in wall voids because it does not evaporate and cannot enter living spaces.

Diatomaceous earth

made from ground up fossils, it comes in a powder form and is very abrasive. It is a dust that abrades the skin and body joints of insects. Dry diatomaceous earth makes an effective slug barrier. Do not inhale the dust.

Dormant oils

act by coating the plant surface and suffocating any insects that are

present. Target pests are aphids, mites, scale insects, whiteflies and eggs of many pests, including some caterpillars. Dormant oils are meant for use on leafless, deciduous plants (especially fruit trees) in the winter to reduce pest populations before they hatch. If used in summer, these oils might defoliate the tree.

Horticultural oils

also called summer oils, these are more highly refined than dormant oils, making them appropriate for use on leaves during the growing season. Consult a nursery to locate a suitable product and follow all precautions. Don't use horticultural oils when plants are flowering.

Insecticidal soaps

highly refined liquid soaps (technically the potassium salt of fatty acids), sometimes combined with citrus oil. Soaps are normally mixed with water and sprayed onto leaves to control spider mites, aphids, scale insects, whiteflies and other soft-bodied insects. They are contact insecticides, meaning you must wet the pest for them to be effective. As always, follow package directions and cautions when using these products.

Neem

a relatively new botanical insecticide derived from a tree. This product is reported to be very effective, with slightly more staying power than some other botanical insecticides. It does, however, break down completely and is less toxic to humans than some botanicals.

Pheromone

a chemical substance produced by insects and animals that stimulates certain behavior of other members of the same species. Traps use female pheromones to attract males and prevent reproduction.

Pyrethrum

an effective, short-lived, naturally derived insecticide made from chrysanthemum flowers. It is toxic to all insects, including beneficial ones, and moderately toxic to birds and mammals. It should be the last resort for ornamentals and is not recommended on food crops. Avoid using formulations that contain piperonyl butoxide, which is currently being evaluated for its carcinogenicity. Pyrethrins are the individual chemicals found in pyrethrum. Pyrethroids are a new array of synthetic chemicals, such as cyfluthrin and cypermethrin. They resist breakdown, thus negating their major environmental advantage. With the three names being so similar, they can easily be confused. Pyrethrum is the least hazardous.

Rotenone

a tropical plant-derived insecticide that is harmful to insects, fish, birds and mammals. Read labels to see if the product is mixed with other pesticides. Check the label to see if the pest problem and the plant you want to protect are listed. It is toxic and should be handled with care. Follow label instructions exactly.

Ryania

a shrub native to South America is the source of this insecticide. It incapacitates fruit moths, corn borers, codling moths and imported cabbage worms.

As always, read the label before you buy to see what other ingredients may be mixed with it and if it is safe to use on your particular plants.

Sabadilla

the seeds of this South and Central American plant are ground into a powerful insecticidal dust. It is effective against grasshoppers, codling moth larva, webworm, aphid, cabbage looper, chinch bug and many household pests. It can irritate mucous membranes and cause sneezing. Honeybees are vulnerable to it. Handle it carefully.

Resources

Organizations

Clark County Environmental Services

(360) 397-6118, ext. 4352

Information about household and business hazardous waste, waste reduction, recycling, composting, and watershed resources

Vancouver Solid Waste

(360) 696-8186

Information about waste reduction, recycling, composting and other solid waste issues.

Washington Department of Ecology – Vancouver Field Office

(360) 690-7171

Information on business generated waste and water quality issues.

24 Hour Emergency Spill Response

(360) 407-6300

Cleanup of chemical and hazardous waste spills and leaks.

Hazardous Substance Information Office

1-800-633-7585

Information about the proper disposal of business generated hazardous products/waste.

Recycle Hotline

1-800-RECYCLE

Information about recycling non-toxic products and the disposal of household hazardous waste products.

WSU Cooperative Extension

(360) 254-8436

Northwest Coalition for Alternatives to Pesticides

PO Box 1393

Eugene, OR 97440

(541) 344-5044

www.efn.org/~ncap/

e-mail: info@pesticide.org

Washington Toxics Coalition

4649 Sunnyside Ave. N

Suite 540 East

Seattle, WA 98103

(206) 632-1545

www.accessone/~watoxics/

e-mail: Info@watoxics.org

Bio-Integral Resource Center

PO Box 7414

Berkeley, CA 94707

(510) 524-2567

www.social.com/health/nhic/data/hr1600/hr1694.html

Oregon Tilth

1860 Hawthorne NE, Suite 200

Salem, OR 97303

(503) 378-0690

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