

Garden Bugs, Diseases & Non-Toxic Alternatives

Buggy Facts

There are more insects in the world than any other kind of animal. They are THE MOST successful animals on the planet. They live on every continent, in all climates, in all different social dynamics and eat anything—but they are tiny.

The differences in these animals are good to know. By identifying, you can use specific remedies instead of wide-spread pesticides or traps which might harm beneficial critters, you or the environment.

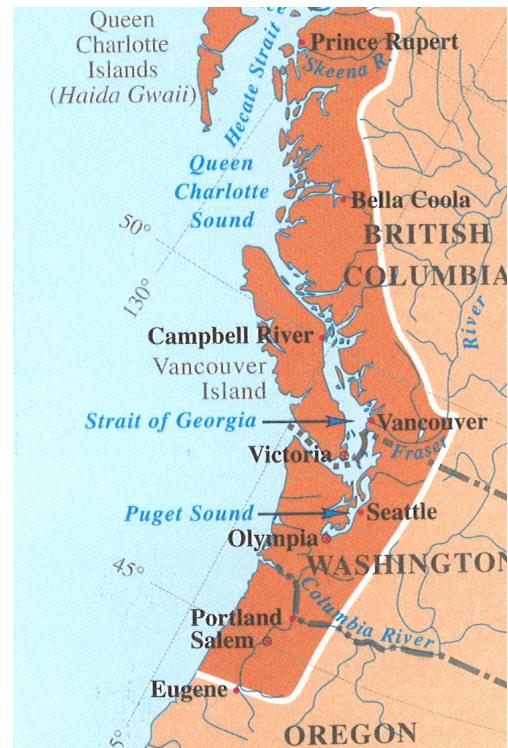
This class is focused on vegetable gardens in Western WA (and nearby similar regions). Our climate is different than Eastern WA, CA, etc. What you find in your gardens as far as plant diseases and pests are quite specific to this area.

There can be much variety in common names (i.e. Pear or Cherry Slugworm is also called Pear Sawfly). If you're trying to look up more information on a critter, find its scientific name and search that. Different regions also have one name for very different animals (i.e. June bugs are very different depending on where you live).

Bug Basics

Parts and metamorphosis. They will help us in figuring out which insect is which.

Different species spend different amounts of time in each of these stages and can do different types of damage. For example, many larvae cause the most damage to plants and live in that stage for a few months. Then when they morph into adults, they may not even feed and only live a few days to reproduce. Others cause different damage in every stage of their life. Don't forget, not all insects are bad! Only a small percentage of insects cause damage. Other insects, like bees, are beneficial.



Signs of critter damage

- Turn leaves over and inspect underside
- Bite or chew marks
- Rainbow-like slime trails
- Plant chewed loose of its roots
- Damage is localized, single attack

Signs of disease

- Spots
- Mildew or rot
- Powdery
- Entire plant is changing color
- Entire plant looks like it's in bad shape

Mimicry

Something amazing that these animals do. To avoid prey, insects can use mimicry to either blend into their surroundings or look like another species entirely (usually a poisonous or venomous one). For example, a hoverfly is just a fly, but its coloration mimics that of a stinging wasp and benefits from the protection of that association.

Warning Coloration

Almost all poisonous insects are brightly colored. What is the difference between poisonous and venomous?

IPM (Integrated Pest Management) Steps

1. Prevention
2. Physical
3. Organic / non-toxic remedies
4. Toxic but natural chemical remedies
5. Toxic and not natural but super effective and a last resort

Proper soil and water, crop rotation, climate and generally healthy plants should fight off most problems on their own. Promote a healthy ecosystem: include bat boxes, bird houses and a water feature around your garden. Provide habitat for butterflies and other pollinators. Attract good bugs with flowers. (**Maritime Northwest Garden Guide** by Seattle Tilth has great suggestions for other plants to plant.)

Beneficial insects

Encourage beneficial predators of the pests in your garden. Lady bugs aren't the only beneficial thing out there. Encourage green lacewing bugs, bats, frogs, spiders, wasps, beetles and nematodes. Cosmos flowers, for example, attract hoover flies, whose young prey on aphids. Create a poly-culture with vegetables, flowers and herbs like mint, cosmos, daisies, dill, fennel, sunflowers, Echinacea and yarrow.

Pests eat plants (herbivorous)

usually camouflage with the plant they're eating
usually look plump, still in the larval stage
have chewing mouthparts
have no real defense against predators, tend to forage at night

Beneficials eat other bugs (carnivorous)

can be brightly colored
usually look icky and like they'd hurt you
have jaws, pincers, or stingers
they are out at different times to hunt

Basic pest remedies

For specific remedies for pests, see the other handout Critter and Disease Information. General remedies are preventative, let plants breathe, clear away debris at the base of plants, try not to water the plant but the roots, keep the soil healthy and you'll have healthy plants, rotate crops.

Beneficial nematodes are microscopic, translucent, non-segmented worms that are 1/25 inch long (up to several inches). They occur naturally in soil throughout the world. Their roles in the garden vary. Some are soil dwellers that break down organic matter and are common in compost heaps. These decomposers are easily visible. Other nematodes attack and kill insects either by injecting bacteria that kill the host within 24-48 hours, or by entering the host, parasitizing, and feeding on it. Beneficial nematodes are effective against a variety of pests, including weevils, borers, cutworms, and grubs of all sizes (potentially beneficial insects/worms too). These can be purchased at most home and garden centers, sometimes they are kept with worms for sale in a refrigerator. Follow directions on the box carefully, they need to be kept cool and moist, even after application.

Diatomaceous earth (DE) is a dust that is thought to kill insects by wicking moisture out through the waxy coating on their bodies, so that they die of dehydration. There is also an edible form of DE that some people consume for health reasons, this is not the same! They are different! DE from the health food section will say it's edible, the DE for pest problems is sold in home and garden centers. DE is as lethal to beneficial insects as it is to pests, reserve it as a last resort for garden problems. Be careful not to inhale this fine powder and use gloves when applying.

Insecticidal soap (technically potassium salts of fatty acids) kills all insects and mites by penetrating the exoskeleton and causing the cell walls to collapse. Soap is not a poison. It kills only when it is wet, so spray directly on the pest. You can buy ready-made insecticidal soaps, or make your own.

Polycultures help by providing biodiversity. Growing different kinds of plants simultaneously can attract varying species of insects that can help regulate problems.

Row cover is also known as floating row cover or garden fabric. It can be used in many ways. It is white and lets light through, but usually not enough water so the use of drip or soaker hoses is necessary. It is useful for protecting plants from the burning sun, birds, the spread of diseases, and it prevents insects from attacking or laying eggs. Do not apply after the disease or pests have attacked.

Sanitize

This is a term used to describe the act of cleaning out any pest or diseases-ridden plant material. It is the first thing you should do if you have heavy infestations or rapidly spreading disease or infection. Pick, prune or break off any part of the plant that is badly affected. Clean tools thoroughly and wash your hands before handling healthy plants. Place removed parts in the trash.

The **Critter Information** sheet has been pared down by our gardening experts as ones you are most likely to experience around Pierce County. Between that and the WSU Pest Control sheet, you should be able to identify and remedy most of the buggy and sluggy issues you would have in western Washington.

Diseases

Plant diseases come in three major forms in northwest Washington: bacterial, fungal and viral (galls and nematodes are rare).

Before any disease symptoms show up on your plant, the following three conditions must be met:

1. The pathogen must be present. This could be in the form of a virus particle, bacterial cell, fungal spore or hypha, or a piece of a parasitic plant.
2. There must be a susceptible host plant. Certain diseases only infect certain plants or certain stages of plants.
3. Environmental conditions must be favorable. The most important factors affecting disease development are moisture, temperature, light and soil fertility. In many cases of disease, a susceptible plant and the pathogen may be present all year long. Daily changes in the environment are what determine the extent of disease infection.

Bacterial diseases

Type of disease	Symptoms
Rot	Rots are diseases that decay roots, stems, wood, flowers and fruit. Some diseases cause leaves to rot, but those symptoms tend to be described as leaf spots and blights. Rots can be soft and squishy or hard and dry.
Wilt	Plants wilt when they don't get enough water. When fungi or bacteria attack or clog a plant's water-conducting system, they can cause permanent wilting, often followed by the death of all or part of the plant. Wilt symptoms may resemble those of blights.

One distinctive symptom of some bacterial diseases is sticky, gummy material, which is secreted by the bacterial cells. If the leaves on your cucumber plant are wilting and you suspect bacterial wilt disease, cut the stem or leaf stalk with a sharp knife. If you see threads of slime when you pull the stem or stalk apart, this confirms bacterial wilt disease.

These diseases are spread by splashing rainwater, running water, insects and animals, or on tools and diseased plants that you move from one place to another. The cells can enter a susceptible plant through wounds or natural openings.

Bacterial Remedies

There are no remedies once bacterial infections have set in. Prevention is key, choose resistant cultivars, keep areas at base of plants clear of debris and decaying plant material, try a baking soda spray solution as some infections are similar to fungal infections (see Recipes).

Fungal diseases

Type of disease	Symptoms
Blights	Leaves or branches suddenly wither, stop growing and die. Plant parts may later rot. Common blights include fire blight, <i>Alternaria</i> blight and bacterial blights.
Club Root	Commonly infects cabbage family plants, causing large swellings on roots and stunted or dead plants.
Damping-off	Damping-off can kill seedlings before they even break through the soil, but it also strikes seedlings just an inch or so tall. The fungi rot the stem at the soil line and, overnight, infected seedlings topple over.
Mildews	There are two type of common mildews, downy mildew and powdery mildew. The primary symptom of downy mildew is a white to purple, downy growth, usually on the undersides of leaves and along stems, which turns black with age. Powdery mildew first appears as a white to grayish powdery growth, usually on the upper surfaces of leaves.
Molds	Gray, White and Black/Sooty molds are usually fluffy and found on soaked parts of the plant. Sometimes you can see little black seed-like lumps in the fuzz.
Rust	Typical rust symptoms include a powdery tan to rust-colored coating or soft tentacle-like growths.
Smut	Occuring on corn and alliums, smut causes gall-like swellings filled with black powdery spores. Smut on the ears of corn is considered a Mexican delicacy. Spores are spread by the wind.

The disease problems you'll deal with most frequently are caused by fungi. Though most fungi are beneficial from the gardener's perspective, some can cause problems. Fungal infections can fall into two general categories. Those from fungi that live in the soil, attacking the roots or crowns of plants and those from fungi whose spores are dispersed in the air, attacking aboveground parts of the plants.

Fungal spores are easily picked up and carried by water, wind or animals, even by you! Spores are light enough to waft up into plants from the ground.

Fungal remedies

Baking soda inhibits fungal spores from germinating and causes the cell walls of the fungi to collapse. It has no known side effects and is non-toxic to mammals, insects, and fish, but it can burn the leaves of some plants. Spray a few leaves as a test, wait a couple of days to see if there's a negative reaction. If there is no negative reaction, use it in a wider application. Spray your plants thoroughly, covering all sides of the leaves, stems, and fruits. Repeat every two weeks as needed. Rain and watering will wash it off. You can purchase already made sprays, or you can may your own baking soda spray (see Recipes).

Trichoderma harzianum is a beneficial fungus that prevents fungal infections (but does NOT cure existing infections). It grows into colonies around the roots of plants and outcompetes pathogenic fungi. In addition to fighting off the bad guys, TH seems to promote healthy root growth. Use it on seedlings if you see signs of damping off (the fungal infection that causes roots to rot and seedlings to collapse). TH is a live fungus that comes in powder form, use it right away, mix with water that you use to water your seedlings. Look for it at garden centers.

Other remedies include **neem**, **sulfur**, **copper** and ***Bacillus subtilis***. These remedies have very specific applications, equipment, warnings and potential hazards to other parts of the ecosystem.

Viral diseases

Type of disease Symptoms

Tobacco Mosaic	Causes normally green leaves or fruit to become mottled with patches of light green, yellow, or white areas. On flowers, mosaics can result in color breaks and the flowers may be disfigured as well. This virus only comes from tobacco.
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Viral problems you encounter in your garden are the most difficult to identify. Symptoms of a specific viral disease can vary from one plant to the next and also may vary depending on plant age or growing conditions. A plant can harbor a virus but not show any symptoms, or may slowly become more pronounced, causing a gradual decline and ending in death of the plant. Luckily, we don't have many viruses that will infect your garden around here.

Viral diseases are not spread by wind or water. The virus particles must be brought in contact with plants and then either rubbed against or injected into the plant so they can enter the sap. Smokers are likely to pick up this virus on their fingers and from there, transmit it to other susceptible plants. The virus can infect hundreds of different plants including tomatoes, peppers, eggplants, apples and grapes and can survive for decades in dried tobacco leaves.

Tobacco Mosaic Virus (TMV) affects a wide variety of plants, including beans, tomatoes, potatoes, and peppers.

Viral Remedies

There are no remedies once the virus has set in. Prevention is best, look to plant resistant cultivars, row covers to keep pests from spreading the disease, remove and destroy infected plant parts immediately, avoid working in the garden during damp conditions.

Remember there are good bacteria and bad bacteria. Good fungus and bad fungus. There are many more good guys than bad in our soils and on our plants. We don't want to eliminate the good guys.

Vermicastings (worm compost) have proven to be extremely beneficial to helping soils and plants stay healthy.

Resources

Recommended Books on Vegetable Gardens (general info and problems)

- *The Maritime Northwest Garden Guide: Planning Calendar for Year-Round Organic Gardening*, Seattle Tilth
- *Simple Steps to Success: Vegetable Gardening*, Jo Whittingham
Comprehensive beginners book from DK Publishing
- *Simple Steps to Success: Pests and Diseases*, Andrew Halstead and Beatrice Henricot
Another great book from DK Publishing
- *Insects of the Pacific Northwest*, Peter Haggard and Judy Haggard

Websites and Downloads

- **Pest Control in Home Vegetable Gardens (WSU Ext Manual)**
<http://cru.cahe.wsu.edu/CEPublications/em009/em009E.pdf>
- **Organic Pest Control in the Vegetable Garden (WSU King County Ext, Fact Sheet)**
<http://bit.ly/1dAgSZI>
- WSU Master Gardener Website
<http://gardening.wsu.edu>
- **Pierce County Master Gardeners ("Ask a Master Gardener")**
<http://ext100.wsu.edu/pierce/mg/>
- **Insect Identification**
<http://bugguide.net>

Non-toxic Recipes

Keep in mind that sprays may harm beneficial insects or pollinators, apply only to prevent or ease a specific pest problem. As always, use caution when applying any kind of spray, avoid spraying in the presence of children and pets, use proper equipment to keep from entering the eyes and lungs and hands while preparing and applying sprays.

All-Purpose Insect Pest Repellent Spray

Chop, grind, or liquify one garlic bulb and one small onion

Add 1 teaspoon of powdered cayenne pepper

Mix with 1 quart water

Steep 1 hour, strain through cheesecloth

Then add 1 tablespoon of liquid dish soap*

Baking Soda Spray (for bacterial and fungal infections)

1 Tablespoon of baking soda

2 ½ Tablespoons of vegetable oil

1 teaspoon of liquid dish soap*

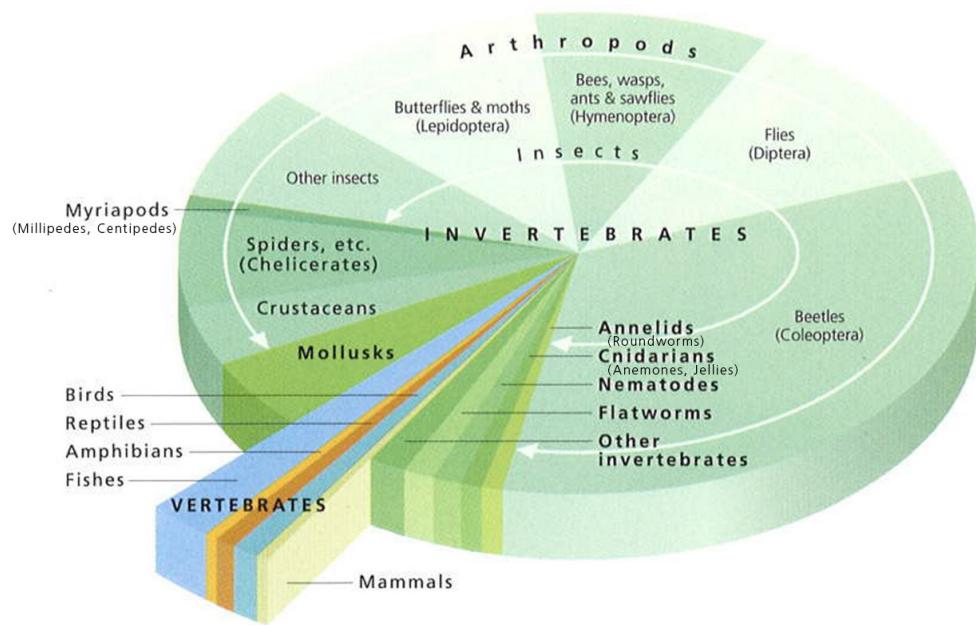
Mix with 1 gallon of water

Insecticidal Soap

1 Tablespoon liquid dish soap*

1 quart of water

* = soaps often contain impurities, fragrances, whiteners, dyes, and other additives that can damage plants.
Use the most pure soap you can find.



Remember this?

Kingdom: Animalia

Phylum: Invertebrata (no spine)

Class: Arthropoda (many jointed legs) or Class Mollusks for snails and slugs

Order: Diptera (for flies), Coleoptera (for beetles), Lepidoptera (for butterflies and moths)

Family: a specific group of flies (hoverflies), beetles (scarabs) or butterflies (monarchs)

Genus: paired first with species name to indicate a specific kind of organism (always capitalized)

Species: follows genus to indicate a specific organism (always lower case)

Most widely used Family or Genus names for common vegetables

Amaranthaceae/Chenopods	Beets, Chard, Spinach, Quinoa
Amaryllidaceae (alliums)	Garlic, Leeks, Onions, Scallions, Shallots
Apiaceae	Carrots, Parsnips
Asters	Artichokes, Chicory, Endive, Escarole, Lettuces, Sunflowers, Fennel, Sweet Potato
Brassicas (cruciferous vegetables)	Arugula, Bok Choy, Broccoli, Brussels Sprouts, Cabbage, Cauliflower, Chinese Cabbage, Collard Greens, Kale, Kohlrabi, Mustard Greens, Radishes, Rutabagas, Turnips
Cucurbits (gourds)	Cucumbers, Melons, Pumpkins, Summer Squash, Winter Squash, Watermelon, Zucchini
Faboids (legumes)	Fava Beans, Green Beans, Lima Beans, Peas, Soybeans
Poaceae (true grasses)	Corn
Solanums (nightshades)	Eggplant, Peppers, Potatoes, Tomatillo, Tomatoes

