Insects and Vertebrate Pests

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More than one million insect species have been described, approximately 90,000 species are found in North America. Less than one percent of all insect species are serious pests that affect humans. These small number cause problems such as crop loss, damage to ornamental plants and forest trees, and the transmission of disease-causing pathogens.

Insects cause many kinds of plant disorders and it's important to distinguish insect damage from that caused by diseases and environmental stresses (abiotic factors). Symptoms of destructive insects are usually observed before the insects themselves are found. In many cases, insect injury can be confirmed by locating the causal insect. Locating an insect on a plant, however, doesn't necessarily mean that particular insect is responsible for the plant's symptoms. In addition, damage may not be observed until after the insect pests have completed the damaging part of their life cycles and left the plant.

Some common insect damage may be confused with plant diseases. A careful comparison of all possible causes of these general plant symptoms is necessary to make a correct diagnosis of the plant problem. The insects mentioned in this chapter are among the most common insects found in the Intermountain region. Integrated Pest Management (IPM) is the most effective approach to insect problems. Use caution when the use of pesticides is necessary for effective treatment. See Chapter 6 for more information on IPM.

Symptoms of Insect Attacks

Leaf Spots

Although leaf spots are most frequently caused by plant pathogens, sucking insects, such as plant bugs and leafhoppers, may also cause them. When an insect's saliva is toxic to a plant, a dead spot may develop around the feeding site and holes may develop when the damaged tissue becomes brittle and falls out. Holes produced in this way are 'BB' to pencil sized and are round.

Branch Dieback

Wood-boring insects, such as the bronze birch borer, damage plant vascular tissues, resulting in dieback of the infested limbs or branches. Branches damaged by other causes and weakened trees in general are particularly susceptible to insect borers. Diseases, environmental stresses, cultural problems, insects, or a combination of these factors may cause branch dieback.

Another type of branch dieback is twig dieback caused by twig girdlers or twig pruners. Twig dieback may be caused by beetle larvae boring inside twigs or by the feeding of adult beetles that completely girdle the twigs. This type of damage occurs most frequently to oaks and maples.

Bronzing

From a distance, trees heavily infested with spider mites may appear discolored. Close examination of infested foliage reveals a bronze discoloration of the leaves. To confirm a diagnosis of spider mite injury, tap infested branches over a white piece of paper. Dislodged spider mites appear as tiny specks moving on the paper.

Cankers and Swellings

Many beetle larvae and caterpillars bore into tree trunks or limbs, causing the infested tissues to swell or form cankers. When these swellings are cut open, insect tunnels and frass (sawdust) should be visible. Insect borers often attack trees that are weakened or damaged by other causes. In some cases, borers and plant pathogens are associated with the same canker.

Chewed or Skeletonized Leaves

Some insects, such as leaf beetles and some sawflies, chew off one face of a leaf while leaving the opposite leaf face and veins intact. The damaged leaves look like lacy skeletons. Most caterpillars and adult beetles chew entirely through leaves. This type of damage appears as tiny or large holes in leaves, or as irregularly shaped leaves with jagged edges. If leaves are still growing when a chewing insect feeds, the leaves may later develop smooth edges around the holes. Only insect feeding causes this symptom.

Leaf Drop

Plant pathogens, squirrels, or environmental problems generally cause leaf drop. One exception is the early summer leaf drop of maples caused by the maple petiole borer. Diagnose leaf drop caused by insects by looking for tunneled or chewed leaf petioles (leaf stems).

Leaf Curling, Puckering or Rolling

The saliva of some sucking insects, especially aphids, may cause plant leaves to fold, curl, or pucker. These symptoms can be confused with some plant diseases that cause similar symptoms. You can positively diagnose insect damage if the aphids themselves are inside the curled leaves. Some caterpillars, called leaf rollers, use silk threads to hold leaves in curled or rolled shapes. Leaf roller caterpillars may be found inside rolled leaves.

Leaf Miners

Trees heavily infested with leaf miners may appear brown, as if portions of the tree are dying. When you examine the damaged leaves, the leaf miners become apparent. Leaf miners feed inside leaves between the upper and lower leaf surfaces, leaving only a paper-thin layer covering the mined areas. Brown frass and the worm-like larvae can be found between the leaf surfaces.

Stem and Leaf Galls

Galls are distorted, sometimes colorful swellings on leaves, flowers, twigs or branches. Several groups of insects contain gall-forming species, such as gall wasps, gall midges, aphids or adelgids, eriophyid mites, and sawflies. Some families of gall forming insects are so diverse that an insect species exists for almost every common tree species. Stem and leaf galls may be caused by plant pathogens, but most commonly they are caused by insects or mites. Small aphids or midge-like larvae may be found in fresh leaf galls. Some gall-forming pests are tiny, and can only be seen with a hand lens or microscope.

Witches' Broom

Some eriophyid mites and aphids cause witches' broom symptoms on infested plants. A good example of witches' broom is the dense, twisted growth of honeysuckle twigs and leaves caused by the honeysuckle witches' broom aphid. Mites or plant pathogens can cause similar dense, irregular growths.

Erinea Leaf Patches

Some microscopic mites, called eriophyid mites, give off chemicals that cause plant tissues to grow in irregular ways. For example, fuzzy or spongy patches may develop on leaves infested by mites. These patches, known as erinea, usually appear between leaf veins, are irregularly shaped, and may be white, red, or silver. Because the mites responsible are too small to be seen without a microscope, the damage may be incorrectly blamed on a mysterious plant disease.

Pitch Flow

Many trees respond to trunk or twig injury by exuding sap or pitch around the injured area. This pitch flow may be a defense mechanism to prevent additional injury from insects and diseases. Wood-boring insects and bark beetles often cause plants to exude pitch into the feeding site. Plant pathogens and mechanical injury can also induce pitch flow.

Root Damage

Nematodes and the larvae of some insects, such as root weevils and June beetles, feed on and can seriously damage roots. Because roots aren't readily visible, diagnosing insect injury to roots can be difficult. The primary symptom is a gradual decline in plant vigor. The characteristic notches that the feeding adults make in leaf margins normally diagnose root weevils.

Gophers can also damage roots, but they feed on much larger roots than insects and nematodes. Insect-damaged roots normally have a spindly skeleton of primary and secondary roots, but lack fine feeder roots. Nematode-damaged roots may be short and stubby or exhibit small galls.

Common Groups of Insects That Damage Landscape Plants

Although thousands of insect species have been identified as pests of landscape plants, most of them can be placed into 26 groups within seven major categories, as shown in Table 8-1. An additional category of plant pest is mites. This classification system can be used to recommend control strategies. Knowing what kind of insect is responsible for plant damage is critical to successfully controlling the pest because some insects are more susceptible to some insecticides than others. Table 8-2 list the common insect pests in the Intermountain Region.
Table 8-3 summarizes the common signs of damage and the possible causes for that damage.

Table 8-1. Common insect and mite pest categories

Sucking Insects	Leaf Chewing Insects	Shoot, Stem, and Trunk Borers	Tent and Case-making Insects
Aphids	Caterpillars	Flat-headed borers	Bagworms
Leafhoppers	Sawflies	Round-headed borers	Casebearers
Plant bugs	Leaf beetles	Clear-wing moth	Webworms
Lace bugs	Leaf miners	Bark beetles	Tent
Spittle bugs	Weevils		
Thrips	Scarab beetles		
	Grasshoppers		

Gall-forming Insects & Mites	Root-feeding Insects	Scale Insects	Mites
Gall mites and Eriophyid mites	White grubs	Armored scales	Spider mites
Gall wasps	Weevil grubs	Soft scales	
Gall midges			

Table 8-2. Common pests in the Intermountain West

Established Pests

*Bronze birch borer
*Elm leaf beetle
*Black locust borer
*Spider mites
Plant bugs
*Pacific flatheaded borers
Leafhoppers(honeylocust, sophora
Aphids
Cottony maple scales
Elm bark beetles
Barberry looper
*Black vine weevils
Pine needle scale
*Spruce bud scale
Soft scales
Adelgids
*Pine shoot moth
Boxelder bugs

Potentially Serious Pests

* European Gypsy moth
* Asian Gypsy Moth
Ash borer
Ash bark beetles
Lilac borer
Spruce budworm
Sawflies
* European pine shoot moth

* Particularly serious pests

Table 8.3. SIGNS OF DAMAGE. Source: Missoula, MT County Extension Service.

DAMAGE	POSSIBLE CAUSES
Leaves	
Leaves with large, ragged holes	Adult or larval stages of beetles; grasshoppers; moth larvae; slugs or snails; animal pests.
Round holes on leaf margin	Leafcutter bees
Leaves curled, twisted, puckered or distorted	Aphids; leafhoppers; tarnished plant bugs; nutrient deficiency; chemical injury, virus disease
Leaves curled, webs present	Webworms; leafrollers
Leaves with numerous small holes	Adult flea beetles; plant diseases
Leaves spotted	Tarnished plant bugs; spider mites, thrips; lace bugs; plant diseases
Leaves or stems speckled and often blacks spots present	Thrips
Leaves and stems with hardened scales, or cottony growths	Scales; mealybugs; woolly aphids, plant diseases
Leaves with tunnels just under leaf surface	Leafminers; sawflies
Leaves with shiny, sticky coating	Aphids; mealybugs; slugs; pear psyllas; scales; whiteflies; plant diseases
Leaves with frothy coating	Spittlebugs
Fruit	
Fruit with tunnels throughout	Cherry and apple maggots; moth larvaue (like codling moths)
Fruit distorted, twisted	European corn borers; tarnished plant bugs
Fruit spotted, sticky	Aphids; leafhoppers; plant diseases
Roots or bulbs with signs of feeding or dead spots	Root maggots; wireworms; many kinds of beetle grubs; black vine, or strawberry root weevils
Roots or stems with galls, swellings	Gall wasps; nematodes; plant diseases
Roots or stems with excessive branching	Nematodes
Stems	
Stems hollowed with larvae inside and leaves wilted	Borers
Flowers	
Flowers fall before opening	Tarnished plant bugs
Seedlings chewed off at soil level	Cutworms, animal pests

Other Invertebrate Pests

Grasshoppers

There are over 600 species of grasshopper (locust) native to the U.S. They are usually not a problem unless they occur in large numbers stripping plants of foliage. They over-winter as eggs in the soil or on weeds. Nymphs hatch out in mid-spring and molt 5 or 6 times. Adults mate in the fall and die when weather turns cold.

Prevent population buildups by clearing weeds. During serious outbreaks plants can be covered with floating row cover fabric. A biological control, Nosema locustrae, targets only grasshoppers. It is a disease-causing protozoan that is most effect on young grasshoppers. The disease can pass on through the eggs of infected females giving carry over control the next year. Spraying perimeter areas with an appropriate insecticide can also halt a feeding swarm.

Mosquitoes

There are many different kinds of mosquitoes in the Intermountain region. Most don't bother people and are relatively harmless to landscape plants. When mosquitoes do create problems by biting nursery workers and customers, the pests can be controlled.

The most common mosquitoes (Adedes) hatch from eggs after heavy rains and grow as larvae, or "wrigglers," in pools of water. The adults are generally most abundant in dense shrubbery, weeds, tall grass, and shaded lawns. The larvae can be controlled through good sanitation, such as removing cans and tires that hold water.

One effective biological control is the use of mosquito dunks. Bacillus thuringiensis israelensis discs are floated in pools or ponds and kill mosquito larvae. Citronella candles also deter mosquitoes.

Insecticides can be applied with hand sprayers to shrubbery, weeds, grass, and other resting places. Fogs or space sprays kill mosquitoes on contact but are a temporary treatment method. Always follow the label directions when using any insecticide.

If you elect to use repellent rather than insecticides, those with higher repellent chemical concentrations give the longest protection. Repellents are most effective when applied directly to the skin, but some repellents can't be applied this way. Always follow the label directions when using repellent.

Slugs

Slugs are usually described as snails without shells. They vary in size from 1/4 inch to 2 inches long, depending upon age and species, and can become troublesome during damp seasons in areas of dense vegetation or areas that are heavily mulched. Greenhouses are also prime targets for slug infestations. Slugs require very humid environments to live and can't survive dry, hot conditions for long periods of time. They are frequently abundant in gardens, and injure seedlings, flowers, and vegetables by eating large, irregular holes in the foliage. Slugs usually feed at night or during dark, cloudy weather. Chewed or skeletonized leaves with shiny slime trails confirm slug damage.

There are several non-chemical methods that can be used to control slug populations. Good sanitation is the most important step in controlling slugs. Remove excess mulch, dead leaves, boards, and other debris. You can also reduce moisture levels by watering in the morning and only when necessary. Stake large foliage plants, such as tomatoes, to reduce hiding places. Trapping and handpicking also reduce slug populations. Trap slugs by placing boards, shingles, and pieces of tarpaper or black plastic on the ground in the garden. Check in the mornings and remove slugs hiding under the traps. Fresh or stale beer in cups sunk into the ground will attract slugs, which then fall into the beer and drown.

Chemical baits can also be used to control slugs. Some types of slug bait can't be used near food crops. Always follow label directions.

Nightcrawlers

Nightcrawlers are beneficial because they help decompose organic material, and should be tolerated whenever possible. Large nightcrawler populations, however, cause lumpiness in and may reduce the recreational value of lawns. Mounds of dirt produced by the worms are especially noticeable in spring as the worms begin activity and clean out their tunnels.

Thatch control can help reduce nightcrawler populations by removing food material used by the worms and allowing better aeration and drying of the soil. Reduce thatch by using a power rake (also called a vertical mower). Power rakes also help knock down dirt mounds produced by nightcrawlers.

Chemical control for nightcrawlers is temporary and doesn't correct the underlying cultural problems that contribute to nightcrawler population buildups. Deeper, less frequent watering will encourage nightcrawlers to stay deeper in the soil.

Review

A. Match the following symptoms and probable pests by writing the letter of the pest type next to the symptom. Give several examples of each type of pest. Try to fit each of the Intermountain pests listed in Table 8-2 into the examples.

Symptoms	Pest
1. Leaf Spots	____
2. Branch Dieback	____
3. Bronzing	____
4. Cankers and Swellings	____
5. Chewed or Skeletonized Leaves..	____
6. Leaf Drop	____
7. Leaf Curling, Puckering, or Rolling	____
8. Leaf Mining	____
9. Stem and Leaf Galls	____
10. Witch's Brooms	____
11. Erinea Leaf Patches	____
12. Pitch Flow	____
13. Root Damage	____

Pest	Examples of Pests
A. Scale Insects	_____
B. Leaf Chewing Insects	_____
C. Tent and Case-Making Insects	_____
D. Gall-Forming Insects and Mites	_____
E. Sucking Insects	_____
F. Mites	_____
G. Shoot, Stem, and Trunk Borers	_____
H. Root-Feeding Insects	_____

B. Briefly describe three methods of controlling mosquitoes.

1. _____

2. _____

3. _____

C. What are slugs and what kind of damage do they do? _____

_____

D. Describe the conditions that favor slugs and list three control methods. _____

_____

1. _____

2. _____

3. _____

Causes of Insect Outbreaks and Plant Injury

Trees and shrubs are often planted in unfavorable environments, which predisposes them to insect damage. For example, the pine needle scale is seldom destructive in forests, where it's found in low population densities, but in nursery and landscape situations the same insect often reaches outbreak proportions and can ruin the aesthetic value of pines and even kill them. The unnatural conditions found in man-made environments can result in unusually high and destructive insect populations.

Despite quarantine regulations, many foreign insect species have been accidentally or purposely introduced into the United States. Away from their natural environments, many of these insects become pests. The honeysuckle witches' broom aphid, the European elm bark beetle, and the gypsy moth are examples of introduced species that have become serious problems. These insects became pests when they found abundant food supplies, favorable climates, and few or no effective natural enemies.

Many trees and shrubs are chosen for their beauty and planted without consideration of their suitability for a particular site. Some trees and shrubs planted in the Intermountain region are native to warmer climates and become severely stressed because of winter injury. Examples include forsythia, sycamore, and azalea. Winter injury can make plants more susceptible to attack by insects.

Many commonly used shade trees are native forest species. When planted in an urban landscape these trees, while visually healthy, may lack vigor because of exposure to full sunlight, poor soil and moisture stress. Insect pests of native species always abound in neighboring woodlots, but there they are usually only secondary problems. In weakened urban trees, the same insects may build up to damaging levels.

Drought stress or nutrient stresses also weaken trees and shrubs and make them more susceptible to insect attack. Birch trees that are adequately watered and fertilized are less likely than stressed trees to be attacked by the bronze birch borer.

Controlling Insects on Landscape Plants

Insect pests are naturally kept under control by predators, parasites, and pathogens that regulate populations of plant feeding insects. Ladybird beetles, lacewings, predaceous mites, parasitic wasps, and other natural enemies devour or parasitize aphids, scales, and mites, keeping populations under control. Without beneficial organisms, populations of pest insects would rapidly increase and defoliate their host plants.

Nursery personnel, landscapers and homeowners should take advantage of beneficial insects whenever possible. Learn to identify all forms of these beneficial organisms so they can be maintained as part of an integrated pest management program. Insect injury to landscape plants can also be prevented or reduced by proper cultural practices and plant selection.

Sometimes natural enemies and cultural practices don't provide acceptable control of landscape insects. In these situations, you may have to apply insecticides to suppress pest populations and reduce or prevent plant injury.

Relying on insecticides alone is not wise because insecticides can have a greater impact on enemies of insect pests than on the pests themselves. For this reason, applying insecticides may stimulate a rapid outbreak or delayed resurgence of mites and aphids, depending on the relative toxicity of the pesticide applied. Outbreaks of scale insects, leaf miners and other insects protected inside plant tissues or under waxy secretions are frequently associated with pesticide application because the pests are physically protected from insecticides but their natural enemies are not. Pesticides adversely affect natural enemies of all plant feeding insects. Aphids, scale insects and mites have been used as examples because they reproduce rapidly and have the most obvious outbreaks associated with pesticides.

Other reasons for minimizing insecticide use include potential plant injury, toxicity to mammals (humans included), and contamination of groundwater.

It's possible to maintain healthy trees and shrubs and prevent insect problems in many ways. Utilizing as many practical management strategies as possible is called Integrated Pest Management. (See chapter 6 for more on IPM). Some of the more widespread insect management strategies include cultural practices, natural or biological controls, host plant resistance, and insecticide or miticide management. Several types of insecticides and miticides, such as horticultural spray oils and microbial insecticides, are compatible with other IPM strategies designed to maximize natural control. Consider all of the following strategies when deciding how to control a particular insect problem.

The first step in a sound landscape management program is proper identification of pest problems. Insects found on a sick-looking tree may have nothing to do with the problem. At the same time, it may be difficult to find some serious insect pests, such as borers and root weevils. Insects suspected of damaging a plant should be properly identified by a reliable source. Most insects can be preserved in a small bottle of rubbing alcohol. County agricultural agents and Cooperative Extension Services can assist in insect identification.

Once an insect is identified, gather additional information on its life cycle and biology. An excellent source of information and color photographs of tree and shrub insects is the book Insects that Feed on Trees and Shrubs, by Warren Johnson and Howard Lyon. Other references are listed at the end of this chapter.

Natural Control

Insects reproduce rapidly and some are capable of building up tremendous populations in a few weeks or months. Fortunately pathogens, parasites, and predators usually prevent insect populations from reaching outbreak proportions. The regulatory role of natural enemies is referred to as biological or natural control. Biological control may also include the release of predators or parasites, and the application of insect pathogens, such as microbial insecticides.

Each insect species has a complex of viruses, bacteria, fungi, and protozoans capable of producing disease. Some of the more spectacular diseases are the viral infections of caterpillars that leave thousands of flaccid, black caterpillars hanging dead from tree branches, and the fungal diseases of grasshoppers and flies. Some pesticides have adverse effects on these insect pathogens. Fungicides in particular, may suppress important insect pathogens.

Parasites of insects live in or on the bodies of their hosts, where they feed during at least part of their life cycle. Many insect parasites are referred to as parasitoids because they consume large portions of their hosts, eventually killing them. Most insect parasites are flies and wasps.

Predators usually feed on insects smaller then themselves, ingesting one or more for a single meal. In general, they are very active insects that seek out other insects to feed on. Some of the more important beneficial insects are ground beetles, ladybird beetles (ladybugs), lacewings, some stinkbugs, assassin bugs, robber flies, and some midge flies. Predaceous insects can be more sensitive to insecticides than the insect pests they prey on.

Apply insecticides when the target insect is at the most vulnerable stage. Insecticide drift may destroy natural enemies on other plants in the area. Pesticides destroy natural enemies and interfere with natural control. Use cultural and biological controls whenever possible to prevent the need for insecticides.

Host Plant Resistance to Insects

Plants have many mechanisms of defense against insects, and some plants are more susceptible to insect attack than others. Leaves may contain natural chemicals that harm insects feeding on them. Some plants have extremely hairy leaves or thick, waxy cuticles that deter insect feeding. Other plants tolerate insect feeding and can sustain substantial defoliation without suffering serious injury. These are all considered host plant resistance.

Some species of plants are more prone to insect problems than others. As an example, European white birch and paper birch trees are susceptible to the birch leaf miner and bronze birch borer, while the river birch is immune to the bronze birch borer. Avoid problem plants and select more insect-tolerant plants when possible.

Many popular, widely used landscape trees and shrubs are asexually propagated clones in which all of the individuals have identical genetic compositions. Some of these clones may lack the pest and/or disease resistance characteristics found in other clones. For example, 'Sunburst' honeylocust is more apt to be damaged by attack from the honeylocust plant bug than other clones of the same species. In another example, many honeysuckle cultivars are extremely susceptible to attack by the honeysuckle witches' broom aphid, but cultivars such as 'Clavey's Dwarf' demonstrate significant resistant. Using resistant cultivars in the landscape significantly decreases the amount insect and disease damage.

Microbial Insecticides

Some naturally occurring pathogens of insects have been developed into microbial insecticides (a natural control). By far the most widely used microbial insecticide is Bacillus thuringiensis or B*t*. This bacterium produces spores containing a toxin that is deadly to many butterfly and moth larvae. The crystallized toxin dissolves only in the high pH conditions found in caterpillar digestive systems. B*t* is not toxic to mammals and has little effect on most natural enemies so it is strongly promoted for use in IPM programs.

Other microbial insecticides are commercially available: Bacillus thuringiensis israelensis for fly larvae (mosquitoes, black fly, and fungus gnats), Bacillus thuringiensis San Diego for beetle larvae (elm leaf beetle), and milky spore disease for Japanese beetle larvae.

As with chemical insecticides, however, overusing microbial insecticides can lead to problems. Diamondback moths in Hawaii, for example, eventually became resistant to Bacillus thuringiensis insecticides that had been used frequently and at high rates.

Conventional Miticides and Insecticides

It is a violation of law to use a pesticide in any way other than that specified on the product label. It is the pesticide applicator's legal responsibility to read and follow current label directions.

Conventional insecticides are generally broad spectrum in their activity, and must either come in contact with or are ingested by target insects. Sometimes people go to considerable trouble to spray a plant with an insecticide only to be dissatisfied with the results. The following are reasons why insecticide applications may not be effective:

1. Correct Timing and Thorough Application

You can use the best, most effective insecticides available, but if you don't apply them effectively and at the proper times, your results will be poor. To perform properly, insecticides must be applied when pests are present and vulnerable, and at the proper rates. You must ensure thorough coverage of the upper and lower surfaces of leaves and branches. For best results, you may have to repeat insecticide applications.

Correct timing of sprays is important. For example, the cankerworm (a pest of elm, hackberry, and apple trees) begins feeding very early in the spring about the time buds are breaking and leaves are starting to unfold. By mid-June, the caterpillars have completed their development and disappeared from trees. Spraying in June, when damage is most apparent, isn't effective because the damage has already occurred and the insects have left. The best time to control cankerworms is about ten days after the eggs hatch in early to mid-May.

Insects are usually much easier to control when they're young. Scale insects, for example, are a problem on many ornamental plants. The most effective time to control scales is immediately after the larvae have emerged, while they're in the crawler stage. During this stage, which may last only about a week, the tiny scales are unprotected and easily killed. Once the larvae secrete protective coverings over themselves, they are very difficult to kill.

2. Wrong Insecticide Used

No insecticide controls every insect, and if the wrong chemical is used, you will get little or no control. Make sure you know what the target pest is and that you have selected an appropriate pesticide.

3. Adverse Weather

Most insecticides don't perform efficiently or give satisfactory results when used at temperatures below 50 degrees F. Rain may wash off insecticides that haven't yet dried. Wind alters spray coverage, preventing sprays from reaching targets and carrying the chemicals into sensitive areas that should not be treated. It's usually best to apply insecticides when temperatures are above 50 degrees F but below 85 degrees F, and when no rain is expected for at least 12 hours.

Tree Injections and Implants

Tree injections and implants are used to place pesticides or micronutrients directly inside the tree, where they are carried to all parts of the tree through the vascular system. Injections have become the preferred method of treating trees for many diseases and pests such as Dutch elm disease, bronze birch borer and emerald ash borer. Injections allow for directed placement of chemicals without concern of applicator exposure and drift to non-target areas, and provide complete distribution throughout the canopy where tree size or location may otherwise limit spray coverage. The spread of emerald ash borer over the past decade has driven advancements in injection methods and chemicals. Only certified professionals should perform these procedures to avoid serious injury to the tree.

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Review

A. Describe briefly how each of the following natural enemies helps keep insect and mite pest populations under control. Give several examples of each natural enemy.

1. Pathogens _____

2. Parasites _____

3. Predators _____

B. Give several examples of conditions that make plants more susceptible to insect attack. Describe briefly how the listed conditions predispose plants to insect infestation.

1. _____

2. _____

3. _____

4. _____

C. Describe in some detail how insect infestations can be aggravated by improper insecticide use.

_____

_____

D. Why are introduced insect and mite pests often more serious problems than native pests?

_____

E. What are microbial insecticides? Describe briefly how they work and give an example of a popular microbial insecticide.

_____

_____

F. List three primary factors that limit pesticide effectiveness, and describe how they operate.

1. _____

2. _____

3. _____

G. Describe tree injections, and give an example of their application.

_____

Vertebrate Pests

There are many two and four legged vertebrate pests that cause damage to landscape plants and gardens. Some pose a greater threat than others. Most homeowners are willing to overlook a few chewed twigs or holes in the lawn. Problems occur when damage is constant and widespread. Peace-loving attitudes change in a hurry when hungry animals decimate valuable trees, shrubs, flowers and vegetables.

Two main methods of control are available, mechanical and chemical. Mechanical controls include fencing, motion sensors that emit light, water or noise, netting, trunk guards, traps and stationary or hanging objects that are meant to frighten. Chemical controls include baits, poisons, scented sprays, pepper or garlic sprays, blood meal, soap, hair, urine, etc.

Rodents

Small rodents such as mice, pocket gophers, and ground squirrels can be controlled with traps, poison bait placed in tunnels or holes, 'whirly gig' wind devices that emit thumping noises in the ground, and ultra sonic noise. Some of these measures are limited in their effective range.

Poison needs to be carefully used so as to not harm pets, children, or other wildlife. Traps can be very effective if the infestation is small. Live traps are available but this poses the problem of where to release the captive pest. Smoke bombs can be used against pocket gophers and ground squirrels. Their effectiveness depends on constantly smoking and filling all the burrows that are in use. This can be a costly method in terms of time and money.

Ground squirrels prefer higher grass and dryer areas, so keeping the lawn areas properly mowed and irrigated can reduce the invasion of this rodent. In some areas shooting is allowed as a means of control. Check local regulations regarding the use of firearms. A lapse in any of the control measures may well result in the return of the rodents.

Rabbits

Rabbit repellents are available commercially as either pellets or sprays. The pellets last longer but could be eaten by pets. The spray products are usually only for use on non-edible plants. Read and follow the label directions carefully. Sprays will have to be reapplied after heavy rains or overhead watering. Rabbits can be fenced out of a vegetable garden with small-holed wire such as chicken wire. The wire needs to be installed in an "L" shape with the short "leg" buried about 6-8" deep and facing away from the garden, so that if rabbits attempt to dig under the fence they encounter the buried portion of the fence. The buried section should be at least 12" and the upper section at least 18" tall. This type of fence can also keep out skunks and woodchucks, however the height may have to be increased.

In landscaped areas where fencing is not desirable an application of blood meal may deter rabbits. Reapply after rain or heavy watering. Rabbits may get used to the smell of blood meal and it will lose its effectiveness. (Some dogs really like the smell of blood meal leading to a whole new set of problems). Some of the cat repellents may also work for rabbits. In addition a dog may be useful in keeping rabbits away.

Raccoons and Porcupines

Raccoons are almost impossible to deter. As they are adept at climbing, most fences are useless and they can dig quite well too. Motion sensors that emit noise, water or light may have some effect. A properly positioned electric fence can work against raccoons. Traps might also be effective. Raccoons adapt easily to the suburban areas and can be a great nuisance to the home gardener.

Porcupines are most damaging to evergreen trees by eating the bark off along the trunk, often up in the tree. A collar of sheet metal with a flange around the trunk will prevent them from climbing the tree. The collar should be refitted every year so that the tree will not become girdled.

Deer

The most common damage from vertebrate pests is attributed to deer. Where subdivisions are located in the foothills, conflicts with deer can be expected. Deer are creatures of habit; deer will continue to use an area they have historically used and control may be difficult. In such situations, the only really effective deterrent is fencing. This may mean fencing off the entire property or just specific plants. Fencing may not be attractive but can be better than replacing plants year after year. Fencing can be used seasonally during peak feeding times or left up year round. It can also be removed after a few years when the plants are large enough to withstand some browsing.

Deer like some plants less than others. In planning a new landscape or replacing damaged plants, it would be wise to choose these species. No plant is totally deer proof, but planting deer resistant species will reduce the overall damage. Other plant species are especially attractive such as tulips, daylilies, arborvitae, and plums. Do not plant species such as these in deer areas. Check with local extension services, nurseries or libraries for deer resistant plant recommendations. Remember, hungry deer will eat just about anything.

Antlered deer will rub and scrape the bark off small trees and large shrubs in the fall. Fence off the plants or wrap the trunks with chicken wire to prevent this type of damage. Fencing in general must be at least 5' in height and closely wrapped around the plant or plants to prevent the deer from jumping in. For larger areas fencing should be at least 8 feet in height. A couple stands of electric fencing would be an effective addition. Consult with a professional for installation requirements and techniques for electric fencing. Black plastic netting is also effective. It is less visible than wire fencing but only lasts a few seasons.

There are several types of deer repellant available. In spray form sulfur based products can be used on ornamental plants. Some sprays have a latex base, which helps them last a little longer. Most need to be reapplied after rain or overhead watering. Other sprays have a hot pepper taste, a garlic taste and smell, or even predator urine scent. Blood meal can deter deer if applied at the base of the plants. Hanging bars of deodorant soap or bags of human hair can also be effective. All of these repellents are only effective until the deer get used to them. Rotate between different repellants. Motion sensors that emit lights, noises or sprays of water might be helpful. There are no guarantees.

Do not tempt deer into your yard with birdseed spilled from feeders or fruit left on the ground under trees. Keeping your yard clean of debris will also keep other vertebrate pest such as skunks away. Barrier hedges or prickly plants located across access trails can discourage deer from entering the property. Try to have reasonable expectations for landscapes located in deer habitat.

Birds

Birds can be both beneficial and bothersome. Some birds are very effective at insect control, however these same birds can ruin a fruit crop. Many crops can be protected with netting. The netting is laid over the plants or small trees and secured to keep the birds from getting in underneath. When netting is not feasible, scare tactics can be used. Reflective tape or discs can be hung around as well as devices that vibrate in the wind. Predator decoys such as owls and snakes can be effective, however they should be re-situated every few days.

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Review

A. What are some of the mechanical methods used to control vertebrate pests?

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B. What are some of the chemical methods used to control vertebrate pests?

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C. Describe one fencing method used to keep rabbits out of a vegetable garden.

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D. List four deer repellants and their application and effectiveness.

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E. What is the minimum height for fencing a large area to keep deer out?

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F. When and how should the trunks of young trees be protected to prevent damage from deer rubbing?

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G. Is planting deer resistant plants a reliable way to prevent deer damage, why or why not?

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