

# PEST MANAGEMENT A Compilation of information

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*The information was originally compiled by Carolyn Carver for her own use. It was presented as a seminar at the Bonsai Societies of Florida convention in West Palm Beach in May 1999. Mrs. Carver wants to remind all readers that all chemicals should only be applied in strict accordance with recommended rates and only on labeled pests and plants. (ed note: does not address organics)*

### *Brief History of Pesticides*

#### **1920's and 30's**

There was a technological and chemical revolution in all areas.  
Research led to the development of chemical pesticides and fungicides (DDT: 1939).

#### **1940's and 50's**

Huge increase in number of pesticides available.  
Chemicals were thought to be the miracle cure for all problems

#### **1960's**

Rachel Carson wrote ***The Silent Spring*** the first wide read warning of pesticide overuse.

Realized the critical link of insects in the food chain.

Began searching for the more "natural" remedies of our ancestors

#### **1970's**

Came up with the concept of IPM Integrated Pest Management. Instead of annihilating the insect population manage the pest.

#### **1980's**

Development of "softer insecticides" less harmful to beneficial insects and the environment.

Lots of research on low rate materials (1oz/active ingredient /acre rather than 2 lbs.)

### 1990's

- Lots of focus on development of bio-rationals materials based on some type of biological insect hormone or venom things found to poison insects and then synthetically reproduce those things.
- Plants have defense mechanisms exploit those. (cayenne pepper extract, plant material extracts, etc.)
- Chemicals that disrupt pest behavior, not kill them (pheromones, chemosterilants).
- Pheromones are insect hormones.
- Spot treatments treat only infected areas.
- "Scout" your area to determine threshold levels how much damage can you withstand before you need to take action.
- Manages pests, but allows beneficials to exist.

Prior to the 1960's pesticides had a pretty good reputation. Due to mosquito transmitted diseases, the French lost 30,000 people in the 1800's trying to build the Panama Canal. Americans finished the project in 1914. The Bubonic Plague is credited for killing over 65 million people transmitted by fleas on rats. It's estimated that Malaria has killed over 200 million people over the course of history and up until 1939, killed 6 million people per year. If it weren't for herbicides we would still have 10-12% of the population working on farms rather than the 2% to produce enough food to sustain the U.S. population. Globally one third of crops are lost due to pests and in Latin America 40% of everything is lost due to weeds and diseases. When an actual new chemistry comes along, it takes 15 years to develop it and about \$20 million.

**OVERALL CONCLUSION:** Pesticides are indispensable for feeding, clothing, and protecting the world population from diseases and discomfort. Pesticides are one spoke in the wheel that makes up IPM (Integrated Pest Management). \*\*Less than one-half of one percent of all insects are considered pests of plants.

## 7 Principles of IPM—Integrated Pest Management

- Physical/Mechanical: oldest method, hand picking, traps, fences, screening, etc.
- Cultural: sanitation (remove leaf litter, keep garden and work area clean), fertilization, proper planting, etc.
- Genetic: choose resistant plant varieties.
- Biological: use beneficials (ladybugs, lacewings, parasitic wasps, etc.) or harmless organisms to control or suppress pests encourage by not spraying.
- Behavioral: synthetic chemicals to attract, repel, confuse, or inhibit pests (pheromone lures).
- Regulation: legal control certification, inspection, quarantine (prevent entry or eradicate in limited area).
- Chemical: specially designed chemicals to kill or harm pests last resort.

## Pest Management Terms

- **Broad-Spectrum Insecticides**— destroys many pests in many situations. Diazinon is one such broad-spectrum, eliminating over 100 different pests, including aphids, mealybugs, mites, and flea beetles.
- **Specific Insecticides**—designed to control only one or two particular types of insects. For example, Kelthane was designed to kill only mites and will not affect other pests.
- **Systemic**—is absorbed by the plant and moves throughout the whole plant, therefore can kill any pest feeding on any part of the plant Orthene, Avid, Cygon, Di-Syston, Marathon (\$20/lb. 4 mos.)
- **Contact**—Does not penetrate plant tissues, just kills any pest it physically lands on, or any pest that feeds on plant tissues that have been sprayed (Malathion, Sevin, Diazanon).
- **Selective**—More toxic to certain types of plants or animals (Kelthane for mites).
- **Non-selective** Kills everything it touches (Roundup/ herbicide \$1.50 lb.)
- **Phytotoxic** harmful to plants.

## How Insects Injure Plants: Mouth Parts

- **Chewing**—(grasshoppers, caterpillars, beetles & grubs) - bites/holes.
- **Piercing/Sucking** (aphids, scale, mealybugs, whitefly) causing stunting, discoloration.
- **Rasping/Slurping** (mites and thrips) scrape epidermal layer, lap out
- chlorophyll symptoms are chlorosis (yellowing), stippling (dot effect).
- **Miners** (flies, moths) eggs laid between layers of the leaf, larvae hatch and feed as they travel, pupate inside leaf, emerge as adult. (Serpentine or blotch paths)

## Terms

**Honeydew**—a sweet secretion produced by sucking insects that falls on leaves below. On this secretion grows:

**Sooty mold**—a black fungus which does not harm the plant, it is growing only on the honeydew and can be washed off. **Note:** *Some ants feed on honeydew; you are often alerted to a pest problem by the presence of many ants on the plant.*

## Examples of Common Insect Pests

**APHID** (Homoptera) sap-suckers: piercing/sucking mouthparts

**Description:** Soft bodied, pear shaped, cornicles on rear, in clusters, can be different colors

**Life Cycle:** Incomplete; from eggs or live birth, winged forms when crowded population

Symptoms: Stunted and deformed new growth where population concentrates

**Signs:** Pest, shed skins, honeydew/sooty mold, see ants harvesting honeydew

**Hosts:** Tender new growth of most plants (Raintrees, Seagrape, Citrus, Pyracantha, Jaboticaba, etc.)

**Management:** Biological, many natural predators, parasites and fungi naturally exist

**Physical** Wash them off with a garden hose Chemicals, soaps

**MEALYBUG** (Homoptera) piercing/sucking mouthparts

Description: Soft-bodied sucking insects, close relatives of scale insects. Covered with powdery white or gray threads of wax.

**Life Cycle:** Incomplete: egg to adult in one month

**Symptoms:** Stunted and deformed new growth, chlorotic patches, weakened plants

**Signs:** See pests esp, on new growth and in leaf axils, honeydew/sooty mold

**Hosts:** Most ornamentals (Fukien tea, Nashia, Malpighia, Sago Palms, Grewia caffra, etc.)

**Management:** Horticultural oil spray (alone or combined with pesticide), soaps, systemics

**SCALE** (Homoptera) Piercing/sucking mouthparts

**Description:** Many shapes, sizes and colors. (Tea scale, Oleander scale, Cottony-cushion scale.)

**Life Cycle:** Incomplete. Scale eggs hatch into male and female crawlers, nymphs with legs. These crawl briefly before becoming stationary and growing hard shells. Males pupate beneath their shells and emerge as winged adults. They mate with stationary females, then die.

**Symptoms:** Stunted, sickly plants, yellow chlorotic spots on upper leaf surface

**Signs:** Scales on underside of leaves, pick off to see if alive, soft scales usually on twigs or petioles, Honeydew/sooty mold

**Hosts:** Ornamentals, palms (Podocarpus, Sago Palm, Acacia)

**Management:** Successful control can be determined by sliding your thumbnail across a group of scales. If they are dry, hollow and flake off readily, they are dead. Live ones stick more firmly and are juicy when squashed.

**Cultural** - prune out

**Chemical systemics**, suffocate with oils or soaps (alone or in combination with pesticide). Be sure to spray leaf undersides.

**WHITEFLY** (Homoptera) piercing/sucking mouthparts

**Description:** Tiny, snow-white insects that resemble moths if viewed under a magnifying glass. Without magnification, they look more like flying dandruff. (They are not moths: whiteflies are related to scale insects.)

**Life Cycle:** Incomplete. Adult female whiteflies lay eggs on the undersides of leaves. These hatch into nymphs, which crawl briefly and then settle down, scalelike, to suck plant juices. After a short pupal stage, adults emerge to feed and mate.

**Symptoms:** Leaf yellowing or mottling.

**Signs:** Flying "dandruff", black sooty mold

**Hosts:** Ornamentals, citrus

**Management:** Horticultural oils and soaps. Pesticides easily eliminate whitefly adults and crawling nymphs. However, eggs, feeding nymphs and pupae defy insecticides. You must spray four times at 4 to 6 day intervals to control nymphs as they hatch. Be sure to spray leaf undersides, where whiteflies congregate. Cygon or Di-Syston for

systemic control.

**BARK BEETLES** and **TREE BORERS** (Coleoptera) chewing mouthparts

**Description:** Beetles and their larva (borers)

**Life Cycle:** Complete Adult beetles mate and then lay eggs in tunnels under tree bark. The eggs hatch into larvae, which make galleries as they feed. The fully grown larvae form pupae which emerge as adult beetles.

**Symptoms:** Foliage or branch declines. The tunneling of the larvae and adults severs the tree's nutrient transport system; equally damaging is the plugging of the water transport system by fungi which are introduced by the adults.

**Signs:** shot-gun holes, sawdust, pitch or sap on tree stem branches, beetles

**Hosts:** Conifers, Cypress, Ficus, Black Olive, Maple, Orange Jasmine, etc.

**Management:** drench bark surfaces with Lindane or Dursban. Spray anytime from March to early July every 4-6 weeks. Destroy infested branches.

**SPIDER MITES:** (Arachnida) not insects, closely related to spiders and ticks

**Description:** tiny need magnification to see them. 2 body parts, 8 legs.

**Life Cycle:** under Florida conditions, mites complete their life cycle in 7 to 10 days at 80 degrees, so spray again in 5 or 6 days

**Symptoms:** Tiny chlorotic spots (stippling), general yellowing, leaf drop

**Signs:** Webs in crotches of branches or petioles, on older leaves and underside, see eggs, nymphs, adults, shed skins. Hold a clean, white sheet of paper under the sick plant leaf. Briskly thump the leaf several times. You should see several minute specks on the paper. With a pen, draw a tight circle around each speck. Now, wait. If the specks move out of the circles, then they are alive.

**Hosts:** Junipers, fruit trees, citrus, Pyracantha, Buttonwood, etc.

**Management:** Chemicals systemics, contacts, Kelthane, (Soaps and oils)

*\*Horticultural oils on woody plants (read label carefully to be certain your plant is listed). Dormant oil on deciduous trees to kill mite eggs, during growing season, oil sprays destroy mites at varying states. Because oil works by suffocating mites, it will only be effective if you spray all plant surfaces.*

**FLEA BEETLES:** (Coleoptera) chewing mouthparts.

**Description:** 1/16 inch long, enlarged flea-like hind legs. They jump like fleas, though not related. Some are striped, but most are either black, brown or green. Larvae are small slender and white with a black band.

**Life Cycle:** Complete.

**Symptoms:** Adults chew numerous small round holes in leaves of most vegetable crops as well as many flowers and weeds. Leaves appear to have been peppered with

fine shot. When feeding damage is heavy and there are many holes, leaves may wilt and turn brown; the host plant may become stunted and may even die. The larvae feed on roots or tubers.

**Signs:** Adult beetles. Begin control as soon as you first see damage in the spring.

**Hosts:** Serissa, vegetables

**Management:** Chemical

### **LEAFMINER** (Diptera)

**Description:** Flattened larvae of Diptera (flies)

**Life Cycle:** Complete. Eggs laid between the layers of the leaf, larvae hatch and tunnel while they feed, pupate outside the leaf, emerge as adults.

**Symptoms:** mines either winding (Serpentine) or blister (Blotch)

**Signs:** Sometimes pupal cases, larva as leaf tiers

**Hosts:** Citrus, *Severinia buxifolia* (Orange Boxwood), Schefflera, Azalea, Lantana, Bougainvillea, Ilex

**Management:** Physical (remove fallen leaves, hand-pick leaves with mines).  
Chemical, systemics.

## **Pesticide Classes**

### **I. Inorganic—No Carbon**

**Minerals—Esp. Fungicides** (Copper Sulfate, Boric Acid)

**Salts—Esp. Herbicides, some fertilizers** (MgCl)

### **II. Organic—Contains Carbon**

#### **A. Natural** (Botanicals)

From Chrysanthemums = pyrethrum 10

Derris Sp. = rotenone

Calabar Bean = physotigmine

**B. Synthetic—Man Made—**most work on nervous system, also some stomach poisons, anti-coagulants:

#### **1. Organochlorines—**chlorinated hydrocarbons

- long environmental residue (good and bad)
- DDT\*, Lindane\* (lindane), Kelthane\* (difocol), methoxychlor, chlordane
- (no longer available), mirex, heptachlor, Toxakil\* (toxaphene)

## 2. Organophosphates—contain phosphorus.

- There are 6 subclasses based on varying combinations of oxygen, carbon, sulfur and nitrogen attached to the phosphorus.
- Quick action, low toxicity, low residual.
- Inhibits nerve reaction (like LSD or other drugs).
- Malathion\* (malathion), Orthene\* systemic (acephate), Diazinon\* (diazinon), Dursban\* (chlorpyrifos), Thimet\* (phorate), Dasanit\* (fensulfothion), Abate\* (temophos), Sumithrin\* (phenothrin), Nemacur\* (fenamiphos), Guthion\* (azinphos- methyl), (ethyl parathion), Cygon, Di- syston, Marathon\* (imidacloprid)

## 3. Carbamates—are derivatives of carbonic acid

Quick action, low toxicity, longer residual.

Sevin\* (carbaryl), Furadan\* (carbofuran), Baygon\* (propoxur), Temik\* (aldicarb).

**4. Pyrethroids**—based on extract of a species of chrysanthemum. There are "natural" pyrethrin products and "synthetic" pyrethrin products. The natural ones are not very stable in sunlight whereas the synthetics are stable in sunlight, and many are quite effective at very low use rates.

Low mammalian toxicity, high pest toxicity, low rates, high fish & reptile toxicity.

Ambush\* & Pounce\* (permethrin), Pydrin\* (fenvalerate), Temik\*, aldicarb, resmethrin, permethrin.

\*Brand name ( ) chemical name

**Alternate the pesticides you use to help prevent insect resistance.**

## Other Sprays for Pest Control

**Fungicides**—The 2 most commonly used acceptable fungicides are sulfur and copper.

- They are highly toxic to humans and other mammals, fish and aquatic invertebrates.
- Fungicides act as protectants that inhibit the germination and growth of fungal spores.
- Apply prior to periods of wet and humid weather when disease organisms can spread and grow easily.
- Since copper is a protectant, cover the entire plant surface to prevent invasion by

disease organisms. Spray in the early morning in dry, bright weather so that plants have time to dry. If the solution remains on leaves too long, it may penetrate the cuticle and kill the tissue.

- Commercial Products: Bluestone (copper sulfate) Bonide Liquid Copper, Kocide, Top Cop, Top Cop with Sulfur.

*\*Never apply oils within 1 month before or after applying sprays containing sulfur.*

## **SOME OIL SPRAYS AND FUNGICIDES ARE NOT COMPATIBLE - CHECK LABELS!**

**Oil Sprays**—Prior to the 1970's, orchardists sprayed their fruit trees each spring with heavy petroleum oils known as dormant oils, which killed insect pests and their overwintering stages before the next season began. It was important to spray before leafing out, since the heavy oil damaged the leaves of plants. Most of today's horticultural oil sprays are lighter and contain fewer of the impurities that made the heavy dormant oils phytotoxic, so they can be used year-round on a variety of plants. These products are called superior, summer or supreme oils. They are especially effective at controlling pests because they spread thoroughly over the leaf surface. They work physically to smother and kill pests and their eggs. Superior oils are unique because they control a broad variety of insect pests while going easy on beneficial insects. Oils smother insects and their eggs. Use superior oils to control aphids, mealybugs, mites and scales on a variety of fruit, nut, ornamental and shade trees. Cover both upper and lower leaf surfaces as well as to reach the trunk and small branches. You cannot over apply oil unless you repeat a spraying after the first spray dries. (Label may provide directions for mixing in other pesticides for even-more-effective growing season control. Also check label to make sure your tree is listed - certain plants & conifers should not be treated with oils).

**Precautions:** Do not apply oil when the temperature is lower than 40 degrees or higher than 80 degrees or if the humidity exceeds 90%, because these factors affect the oil's evaporation and plants can be injured. Nor should you spray with oil 30 days before or after applying any type of sulfur spray or certain fungicides.

Commercial products: SunSpray Ultra-Fine oil, Volck Oil Spray.

**Soap Sprays** - Insecticidal soaps control insect pests by penetrating their cuticles, which causes their cell membranes to collapse and leak, resulting in dehydration. While some insects can overcome the effects of a soap spray, others are immediately

affected and die.

Protection offered: soft-bodied insects like aphids, mealybugs, and whiteflies. (Non-toxic to humans, but will kill beneficials, so limit their use to problem areas.)

Household soaps that can be used: Ivory Snow, Ivory Liquid, or Shaklee's Basic H. (Shaklee Basic H mix 1 tablespoon per gallon.)

Soaps can be mixed with other insecticides, horticultural oil, pyrethrin and rotenone to boost their toxicity.

Commercial Products: Aphid-Mite Attac, Safer Garden Fungicide (soap and sulfur), Safer Insecticidal Soap, Savona.

## **Pesticide Safety**

- **READ THE LABEL THE LABEL IS THE LAW.** When an actual new chemistry comes along, it takes 15 years to develop it and about \$20 million.
- **CHOOSE WISELY (ID YOUR PROBLEM).**
- **CHOOSE THE LEAST TOXIC OPTION.**
- **BUY ONLY WHAT YOU NEED.**
- Mixing is the most dangerous time (when handling the concentrate) wear rubber gloves.
- Keep pesticide downwind of mixer and below eye level.
- Mix only what you need (Loses effectiveness after mixed).
- Put the water in first, then add the chemical.
- Always follow the recommended rates.
- Do not eat, drink or smoke while mixing or applying.
- Spray out anything left in tank on labeled plants.
- Triple rinse sprayer, reapplying rinse water to labeled site.
- Never pour down sewer, drain, or directly onto ground. Follow label for disposal of empty containers.
- Clean up Body (hair and neck), clothes, triple rinse sprayer.

## **Recommended Books**

***Controlling Lawn & Garden Insects.*** Created and designed by the editorial staff of ORTHO BOOKS. 1984. (Home Depot, Barnes & Noble, \$7.95)

***A Field Guide to Florida Critters.*** Bill Zak. Taylor Publishing Company. Dallas, TX. 1986. (Barnes & Noble, \$12.96)

***The Organic Gardeners Handbook of Natural Insect and Disease Control.*** Edited by: Barbara W. Ellis and Fern Marshall Bradley. Rodale Press. Emmaus, PA. 1992. (Barnes & Noble, \$27.95.)

Old gardeners saying: "If it moves slow kill it; if it moves fast leave it." Generally predators are faster than prey.