# Control Garden Pests Using the Least Toxic Methods

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Studies show that home gardeners are apt to apply more pesticides in their backyards than farmers or landscapers—up to 10x as much per square foot—because they lack the financial and regulatory incentives to ensure that pesticides are prudently applied. Last year, the National Garden Association reported that 72% of all U.S. households (85 million) engaged in do-it-yourself gardening activities. With so many Americans gardening, the collective misuse of pesticides is an issue of growing concern. Misuse of pesticides can have a number of unintended consequences, including damaging the plants (phytotoxicity) you're trying to protect; intensifying pest problems by increasing selection pressure towards resistance or killing natural enemies; and contributing to soil, air, or water pollution. Certain pesticides persist in the environment for years, posing a threat to human health, wildlife, and the overall health of the environment. In light of these repercussions, pesticides should never be used without careful consideration or outside of an Integrated Pest Management (IPM) program.

A systematic, preventative approach combining cultural, physical, biological, and chemical controls, *IPM is the only effective and sustainable way to manage pests.* There are several non-chemical IPM strategies that can reduce or eliminate the need for pesticides in the home garden.

**Cultural controls** are preventative practices that impede the colonization, spread, and survival of pests. Some examples of cultural controls include: crop rotation, intercropping, sanitation, the use of pest-resistant varieties, soil solarization, trap cropping, and proper cultivation practices (i.e., soil preparation, plant spacing, fertilization, irrigation) to ensure that plants have the optimum conditions for health.

**Physical controls** are techniques that prevent pests from reaching host plants, including hand removal, traps, and barriers such as floating row covers, sticky barriers, or abrasive dusts.

**Biological control methods** involve the use and conservation of beneficial organisms such as natural predators, parasitoids, or pathogens that prey on pests in your garden.

**Chemical controls** are a last resort in IPM, when the aforementioned strategies are unable to keep pest populations below the target

*Hover flies are beneficial insects that can be helped by a reduction in pesticide use. Adult hover flies are important pollinators, and their larvae are voracious predators of aphids and other garden pests.*
*Photo by Dr. Ethel Villalobos of CTAHR.*

threshold. The first step when considering chemical control is to accurately identify the pest. The second step is to understand its biology and life cycle. Most pesticides are only effective if applied at a certain stage in a pest's life cycle. Many insecticides, for example, only kill pests in the larval stage and have no effect on the eggs or adult stages. The final thing to consider is population size. Most plants can tolerate low to moderate levels of pest damage without noticeable effect; thus pesticides are not warranted, especially if natural enemies are present. If a problem is severe enough to require pesticides, it's important to select products that pose the least risks to human health and the environment. There are a variety of low-risk pesticides suitable for the home gardener. A few of the least toxic will be discussed here. For a more comprehensive guide, see The IPM Practitioner's 2013 Directory of Least-Toxic Pest Control Products, published by the Bio-Integral Resource Center of Berkeley, California. Compiled by IPM experts, this guide contains over 2,000 low-toxicity products suitable for use in an IPM system.

### Insecticidal Soaps

Insecticidal soaps are composed of fatty acids and potassium salts, which permeate the insect's outer covering and disrupt the cellular membranes. Chemically similar to the soaps we use at home, insecticidal soaps are specifically designed to control pests and minimize plant injury. They are among the safest pesticides available because they don't leave toxic residues and pose a minimal risk to non-target and beneficial organisms, with the exception of predatory mites. Insecticidal soaps are generally effective against small, soft-bodied arthropods including aphids, thrips, soft scales, whiteflies, psyllids, mealybugs, and spider mites. Soap sprays easily damage some plants; therefore, it's important to read the label before you spray. While some household soaps and detergents make effective insecticides, many are ineffective against pests and may contain additives damaging to plants.

### Insecticidal Oils

Insecticidal, or horticultural oils are highly-refined plant or petroleum-based oils that can be used to control certain pests and diseases, including aphids, whiteflies, mealy bugs, scale insects, spider mites, psyllids, thrips, certain insect-vectored diseases, and some fungal pathogens such as powdery mildew, black spot and rust. Oils work by disrupting insect respiration, cellular metabolism and feeding behaviors; smothering fungal organisms; and interfering with the transmission of plant viruses. In order to avoid direct contact with non-target organisms, horticultural oils must be applied in the late evening or early morning. If properly applied, horticultural oils are among the safest pesticides available because they leave no toxic residue and pose a mini-


*Bacillus thuringiensis insecticide products. Photo by Suzanne Paisley.*
http://ucipm.ucdavis.edu/PMG/IMAGES/L/C-CH-LABL-LS.016.jpg

mal risk to non-target organisms; however, certain types of plants (including drought-stressed plants) are sensitive to oils.

### Microbial Pesticides

Derived from microorganisms (viruses, bacteria, fungi, protozoa) or their by-products, microbial pesticides are typically very host specific and only work against one target pest or closely related species. However, some microbial pesticides are broader in spectrum and can have negative impacts on non-target species. The most commonly used microbial pesticides are derived from subspecies and strains of the bacterium *Bacillus thuringiensis*, or Bt. Most Bt products are effective in controlling caterpillars and worms, but some formulations can be used to control mosquitos, flies, or beetles. Spinosad is another commonly used microbial pesticide derived from the bacterium *Saccharopolyspora spinosa*, which is used to control a broader spectrum of pests, including caterpillars, thrips, fire ants, whiteflies, aphids, leaf miners, scales, and borers. If carefully applied according to the label, this product poses less of a risk than most conventional pesticides. However, if improperly applied, it can cause harm to beneficial insects, such as bees and natural enemies.

### For More Information:

UC Davis Less Toxic Insecticides: http://ucipm.ucdavis.edu/QT/lesstoxicinsecticidescard.html

Pesticide and Toxicity Information about Insecticidal Soaps (UC Davis IPM)
http://www.ipm.ucdavis.edu/TOOLS/PNAI/pnaishow.php?id=43

Pesticide and Toxicity Information about Horticultural Oil (UC Davis IPM)
http://www.ipm.ucdavis.edu/TOOLS/PNAI/pnaishow.php?id=39

The IPM Practitioner's 2013 Directory of Least-Toxic Pest Control Products
http://www.birc.org/Directory.htm