Some Organically Acceptable Pesticides Used in Gardens & Landscapes

Pesticides are substances applied to control, prevent or repel pests, or to reduce the problems they cause. Pesticides can be an important component of many IPM programs; however, some products pose significant hazards to humans, pets, wildlife, beneficial insects or the environment. Many of the pesticides commonly used are synthetic. **Organically acceptable** pesticides are derived from natural products such as plants or minerals (including petroleum oil), are not chemically processed and are listed for use by a recognized organic certification agency. Many, but not all, organic pesticides are unlikely to cause serious injuries to people or to most organisms other than the target pest, and therefore can be considered "**less-toxic pesticides**". Where appropriate, the less toxic pesticides listed below (those marked with an *) should be a first choice when pesticides are needed in urban environments.

Many of the products listed in this table have low toxicity to humans and other vertebrates and generally low or very short-term negative impacts on natural enemies, bees and other beneficial species. There are exceptions, such as acetic acid, which can cause nose, eye and skin irritation. Read the product label for details about where these products can be safely and legally used. Some of these products may only be available at stores that cater to professional landscapers.

Common Name (& examples)	**Active ingredient**	**Pesticide Type**	**Pests effective against**	**Comments**
**Bacillus thuringiensis* (B.t.) *(Safer Caterpillar Killer, Green Light BT Worm Killer)*	*Bacillus thuringiensis* var. *kurstaki* (var. *israelensis* is not effective on caterpillars but kills mosquito larvae and fungus gnats)	Insecticide	Caterpillar larvae of moths and butterflies, especially newly hatched larvae feeding exposed on leaves or buds	Bacteria-produced endotoxin kills caterpillars that eat it. Must be consumed by caterpillar within 24-48 hours of application. Breaks down rapidly. Not harmful to organisms outside moth and butterfly group. Good coverage essential.
*Codling moth granulosis virus (Cyd-X)	Codling moth (*Cydia pomonella*) granulovirus	Insecticide	Codling moth	Kills only codling moth larvae. Must be applied just as eggs hatch. Harmless to bees or other nontargets. Used for apples, pears and walnuts.
*Borate-based baits *(Gourmet Liquid Ant Bait)*	Boric acid, disodium octaborate tetrahydrate, borax	Insecticide	Ants, cockroaches	Low toxicity to humans and most non-targets. Used in bait stations. Must be 1% or less boric acid in water-sucrose solution for best control of ant colonies.
*Entomophagous nematodes (a biological control—not a pesticide)	*Steinernema* spp. *Heterorhabditis* spp.	Biocontrol for certain insects	Clearwinged moth larvae, carpenterworm, lawn cutworms, lawn grubs	Usually mail ordered and used right away. Read UC Pest Notes for directions. *Heterorhabditis* used for lawn grubs. *Steinernema* for others.
*Insecticidal soap *(Safer Insecticidal Soap)*	Potassium salts of fatty acids	Insecticide Miticide	Aphids, whiteflies, immature scale insects, spider mites	Good coverage essential-insect must be covered. Provides partial control (70-80%) and no residual, but natural enemies will mostly survive to help control the population. Repeat application may be required.

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Spinosad *(Garden Insect Spray)*	Spinosad	Insecticide	Caterpillars, leafminers, thrips, katydids, lace bugs, spotted wing drosophila	Some beneficial insects or bees may be killed in first 24 hours, but rapidly breaks down. Low toxicity to people. Derived through fermentation of a naturally occurring bacterium.
Pyrethrins or pyrethrum	Pyrethrins	Insecticide	A range of insects	Derived from the chrysanthemum daisy. Products formulated with Piperonyl butoxide (PBO) are not organically acceptable. High toxicity to fish, aquatic organisms and bees.
Neem seed extract *(Safer Brand Bioneem Multi-purpose Insecticide & Repellent Concentrate)*	Azadirachtin	Insecticide	Beetles, thrips, aphids, white grubs, mole crickets, crane flies, psyllids, lace bugs, lawn moths	Insect Growth Regulator, repellent and other modes of action. Not as effective on adults. May cause injury to some tender plant tissue.
*Horticultural oil, insecticidal oil *(Saf-t-Side, Ready-to-Use Year-Round Spray Oil, Volk Oil Spray, JMS Stylet Oil)*	Petroleum oil, superior oil, supreme oil, narrow range oil, paraffinic oil	Fungicide Insecticide Miticide	Aphids, whiteflies, scale insects, spider mites, mealybugs, lace bugs, psyllids, thrips, other sucking insects, some insect eggs; also powdery mildew on many plants, black spot on roses	Good coverage essential. Insect must be smothered. Best activity on insects when temperatures are >45˚F. Some products may cause injury if applied when temperatures are above ~85°F. Do not apply during periods of drought or when plants exhibit moisture stress. Natural enemies may be killed by contact, but not by residue.
*Neem oil *(Green Light Rose Defense, Garden Safe Fungicide 3, Safer Brand 3-in-1 Garden Spray)*	Neem oil	Fungicide Insecticide Miticide	Aphids, whiteflies, scale insects, spider mites, mealybugs, lace bugs, psyllids, thrips, other sucking insects, some insect eggs. Also powdery mildew on many plants, black spot on roses	Good coverage essential. Insect must be smothered. Best to apply in early morning/late evening to minimize the potential for leaf burn. May also cause injury to plants with tender tissue. Do not apply during periods of drought or when plants exhibit moisture stress. Natural enemies may be killed by contact, but not by residue.
*Other plant-based oils (Many product brands and mixtures)	d-Limonene, canola oil, cottonseed oil, rosemary, thyme, clove and sesame oils	Insecticide, Miticide, Herbicide	Soft-bodied insects and mites as described for other oils. Some products also used as fungicides or herbicides.	These oils work similar to horticultural oils. Good coverage essential. Herbicidal products only burn back weeds.

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**Bacillus subtilis* *(Serenade, Bayer Advanced Natria Disease Control)*	Biological fungicide	Fungicide	Powdery mildew on fruits, vegetables and ornamentals	Harmful if inhaled. Not as effective as oils against powdery mildew.
*Jojoba oil *(no products currently available)*	Jojoba oil	Fungicide	Powdery mildew on fruits, vegetables, and ornamentals	Good coverage essential. Don't use on drought-stressed plants or when it is hot.
Copper-based fungicides (*Kop-R-Spray*)	Copper ammonium complex	Fungicides	Dormant treatments for peach leaf curl, shothole disease	Copper products can be toxic to aquatic organisms and build up in soil.
Copper soap	Copper octanoate	Fungicide	Dormant treatments for leaf curl, scab, shothole.	Copper products can be toxic to aquatic organisms and build up in soil.
Bordeaux mixture	Copper sulfate mixed with hydrated lime	Fungicide	Dormant treatments for peach leaf curl, shothole	Must be mixed up just prior to treatment. For dormant use only. Mixing hazards.
Wettable sulfur (with soap surfactants)	Sulfur	Fungicide	Powdery mildew (applied before disease symptoms appear)	Products formulated with soap (potassium salts of fatty acids) are easiest for garden users. Avoid sulfur dusts—they can cause skin and eye irritation.
*Iron phosphate snail bait *(Sluggo, WorryFree Slug and Snail Bait)*	Iron phosphate	Molluscicide	Snails and slugs	Works more slowly than metaldehyde, but is safer around pets.
*Plant-based herbicide oils *(Avenger Weed Killer, BurnOut II)*	Plant-based oils (e.g. clove, eugenol, lemongrass, *d*-limonene)	Herbicide	Young plants, especially broadleaf plants	Best used at high spray volumes and when temperatures are > 70˚F.
Herbicidal soaps (*Monterey Herbicidal Soap*)	Pelargonic acid, Ammoniated soap of fatty acids	Herbicide	Algae, moss, young annual weeds	Best used at high spray volumes and when temperatures are > 70˚F. Some products carry WARNING signal word for skin and eye hazards.
Vinegar *(Weed Pharm)*	Acetic Acid	Herbicide	Young plants, especially broadleaf plants	Best when temperatures are > 70˚F. Household vinegar is not effective. Signal word for *Weed Pharm* is DANGER. Can cause severe eye injury and skin burns.

*Less toxic products

updated March16, 2015

Pest Notes featuring less toxic management methods can be found at www.ipm.ucanr.edu/homegarden

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