

LEGAL PEST MANAGEMENT PRACTICES FOR MARIJUANA GROWERS IN CALIFORNIA

PESTS OF MARIJUANA IN CALIFORNIA

Marijuana pests vary according to cultivar (variety), whether the plants are grown indoors or outdoors, and where the plants are grown geographically. The pests included in this review are based on two sources: a presentation given in 2013 by Whitney Cranshaw, an extension entomologist at Colorado State University, and a review article by John M. McPartland, a professor of family medicine at the University of Vermont.

HOW TO INTERPRET THE TABLES

Table 1 lists active ingredients not illegal to use on marijuana and the pests that these active ingredients target.

These active ingredients are exempt from **residue tolerance requirements**¹ and either exempt from **registration requirements**² or registered for a use that's broad enough to include use on marijuana. Residue tolerance requirements are set by U.S. EPA for each pesticide on each food crop and is the amount of pesticide residue allowed to remain in or on each treated crop with "reasonable certainty of no harm." Some pesticides are exempted from the tolerance requirement when they're found to be safe. Some of these pesticides are bacterial-based insect pathogens (e.g., *Bacillus thuringiensis*) or biofungicides (e.g., *Bacillus subtilis*, *Gliocladium virens*).

Active ingredients exempt from registration requirements are mostly food-grade essential oils such as peppermint oil or rosemary oil.

Tables 2 and 3 list pests of marijuana grown outdoors and indoors, and **Table 3** shows pests arranged by the portion of the plant they attack. An explanation of the column labels for Tables 2 and 3 follow.

PESTS. The tables show the most likely pests in California based on Cranshaw's presentation and McPartland's list and gleaned from California-based web sites and blogs. Some pests that drew attention on several blogs (e.g., hemp russet mite) may be worse during drought years. Many have cyclic population

fluctuations and others are mainstays of general greenhouse cultivation (e.g., whiteflies, thrips, and fungus gnats). We'll add weeds to this compendium when we have more information.

DAMAGE. For damage caused by greenhouse pests, we derived information from Cranshaw's presentation; for that of outdoor pests when there wasn't any overlap, McPartland's list was used and information from UC IPM for various crops. Accounts of damage by rodents is anecdotal.

IPM PRACTICES. Most of these are standard practices for pests on hosts other than marijuana. For more detailed explanations, see information compiled by the University of California Statewide IPM Program (UC IPM) at www.ipm.ucdavis.edu. You can enter a pest name in the search box (e.g., cutworm) and read about IPM practices for the pest on crops other than marijuana. For marijuana grown indoors, go to the UC IPM [home page](#), click on [Agricultural Pests](#) and scroll down the alphabetical list until you reach [ornamental nurseries](#).

Some practices were excluded because they apply to nearly all of the pests. For example, when targeting aphids, whiteflies, and thrips, growers can attract predaceous and parasitic arthropods by planting cover crops (e.g., California buckwheat) and insectary plants—especially those in the carrot, mustard, and sunflower families.

LEGAL PESTICIDES. These are covered above in the Table 1 description and are exempt from **residue tolerance requirements** and either exempt from **registration requirements** or registered for a use that is broad enough to include use on marijuana.

Table 4 shows marijuana pests by plant part. Not all of these pests are important, but their collective damage may affect the overall health of the plant.

REFERENCES

Cranshaw, Whitney. 2013. Challenges and opportunities for pest management of medical marijuana in Colorado. Presentation.

McPartland, J.M. 1996. *Cannabis* pests. J. Internatl. Hemp Assoc. 3(2): 49, 52–55.

¹ 40 CFR (Code of Federal Regulations)

² under FIFRA section 25(b) and 3 CCR section 6147

Table 1. Active ingredients that are exempt from residue tolerance requirements^a and either exempt from registration requirements^b or registered for a use broad enough to include use on marijuana.

ACTIVE INGREDIENT	PEST OR DISEASE
azadirachtin ^a	aphids, whiteflies, fungus gnats, leafminers, cutworms
<i>Bacillus subtilis</i> QST ^{a1}	root diseases, powdery mildew
<i>Bacillus thuringiensis</i> ^{a2} subsp. <i>aizawai</i> or <i>kurstaki</i>	moth larvae (e.g., cutworms, budworms, hemp borer)
<i>Bacillus thuringiensis</i> ^{a2} subsp. <i>israelensis</i>	fly larvae (e.g., fungus gnats)
<i>Beauveria bassiana</i> ^{a3}	whiteflies, aphids, thrips
cinnamon oil ^b	whiteflies
<i>Gliocladium virens</i> ^{a1}	root diseases
horticultural oils ^a (petroleum oil)	mites, aphids, whiteflies, thrips; powdery mildew
insecticidal soaps ^a (potassium salts of fatty acids)	aphids, whiteflies, cutworms, budworms
iron phosphate ^a ; sodium ferric EDTA ^a	slugs and snails
neem oil ^a	mites; powdery mildew
potassium bicarbonate ^a ; sodium bicarbonate ^a	powdery mildew
predatory nematodes ^a	fungus gnats
rosemary + peppermint essential oils ^b	whiteflies
sulfur ^a	mites, hemp flea beetles
<i>Trichoderma harzianum</i> ^{a1}	root diseases

^a 40 CFR (Code of Federal Regulations)

^b FIFRA §25(b) and 3 CCR §6147 [FIFRA = the Federal Insecticide, Fungicide, and Rodenticide Act; CCR = California Code of Regulations]

¹ Biofungicides

² Bacterial-based insect pathogen

³ Fungal-based insect pathogen

Table 2. PEST MANAGEMENT PRACTICES FOR MARIJUANA GROWN OUTDOORS

PEST	DAMAGE	IPM PRACTICES (monitoring; cultural, physical, mechanical, biological)	PESTICIDES
MITES & INSECTS			
two-spotted spider mites <i>Tetranychus urticae</i>	Suck plant sap; stipple leaves	<ul style="list-style-type: none"> ▪ Keep dust down by hosing off plants (if dust is a problem) ▪ Release predatory mites 	neem oil, horticultural oil, sulfur
hemp russet mites <i>Aculops cannabicola</i>	Suck plant sap; kill leaves and flowers	<ul style="list-style-type: none"> ▪ Release predatory mites 	neem oil, horticultural oil, sulfur
crickets (field & house) <i>Gryllus desertus</i> , <i>G. chinensis</i> , <i>Acheta domesticus</i>	Eat seedlings	<ul style="list-style-type: none"> ▪ Use floating row covers or cones on individual plants 	—
termites	Eat roots	<ul style="list-style-type: none"> ▪ Flood nests 	—
leafhoppers	Suck plant sap; weaken plants	<ul style="list-style-type: none"> ▪ Encourage natural enemies by planting nectar sources 	horticultural oil or insecticidal soaps for nymphs
aphids <i>Phorodon cannabis</i> , <i>Myzus P. cannabis</i> (bhang aphid) vectors tobacco mosaic virus <i>Persicae</i> , <i>Aphis fabae</i>	Suck plant sap; weaken plants	<ul style="list-style-type: none"> ▪ Hang up yellow sticky cards (alates) ▪ Hose off plants 	azadirachtin, horticultural oil, insecticidal soaps, <i>Beauveria bassiana</i>
whiteflies <i>Trialeurodes vaporariorum</i> , <i>Bemisia tabaci</i> , <i>B. argentifolii</i>	Suck plant sap; weaken plants	<ul style="list-style-type: none"> ▪ Hang up yellow sticky cards ▪ Reflective plastic mulch 	azadirachtin, horticultural oil, insecticidal soaps, rosemary + peppermint oils, <i>Beauveria bassiana</i>
leafminers <i>Liriomyza</i> spp.	Bore into roots and leaves	<ul style="list-style-type: none"> ▪ Remove older infested leaves ▪ Use biocontrol: release <i>Diglyphus</i> parasitoids 	azadirachtin

PEST		DAMAGE	IPM PRACTICES (monitoring; cultural, physical, mechanical, biological)	PESTICIDES
LEPIDOPTERA	cutworms <i>Agrotis ipsilon</i> , <i>A. segetum</i> , <i>Spodoptera litura</i> , <i>S. exigua</i> , <i>Mamestra brassicae</i> (Noctuidae)	Eat seedlings	<ul style="list-style-type: none"> Use pheromone traps to detect adults. Remove weeds, which serve as a reservoir for cutworms and other noctuids 	Vegetative stage only: Use <i>Bacillus thuringiensis kurstaki</i> if egg-laying adults found, insecticidal soap; azadirachtin
	budworms <i>Helicoverpa armigera</i> , <i>H. zea</i> (Noctuidae)	Eat flowering buds	<ul style="list-style-type: none"> Shake plants to dislodge larvae Remove infested buds Plant corn as trap crop 	Vegetative stage only: Use <i>Bacillus thuringiensis kurstaki</i> , insecticidal soap
	hemp borers (= hemp moth) <i>Grapholita delineana</i> (Tortricidae)	Bore through stalks (caterpillars)	<ul style="list-style-type: none"> Plow crop under in fall; remove plants still standing; remove nearby hemp and hop plants Use light traps at night for monitoring Use biocontrol: <i>Trichogramma</i> 	<i>Bacillus thuringiensis kurstaki</i>
COLEOPTERA	hemp flea beetles <i>Psylliodes attenuata</i> (Chrysomelidae)	Bore into stems (grubs); feed on seedlings and leaves of larger plants (beetles)	<ul style="list-style-type: none"> Use reflective mulches Plant trap crops (e.g., radish or Chinese mustard) 	sulfur
	scarab grubs (possibly other beetles)	Bore into stems	<ul style="list-style-type: none"> Use parasitic nematodes 	—
MAMMALS				
mice (e.g., house mice)	Eat young sprouts and seeds	<ul style="list-style-type: none"> Strip bark from stems to build nests Tunnel through planting areas; feed on plants; gnaw on irrigation lines 	<ul style="list-style-type: none"> Double wrap a 3'-tall chicken wire fence around plants Trap (minus rodenticides) Mount barn owl boxes 	Rodenticides (see footnote below)
roof rats , <i>Rattus rattus</i> wood rats , <i>Neotoma</i> spp.				
pocket gophers , <i>Thomomys</i> spp.				
Columbian black-tailed deer , <i>Odocoileus hemionus columbianus</i>	Knock over plants; leave dander, droppings, and ticks behind	<ul style="list-style-type: none"> Install deer fencing 	—	
black bears , <i>Ursus americana</i>	Knock over plants	<ul style="list-style-type: none"> Install electric fencing 	—	

Rodenticides that are not DPR-restricted materials or federally restricted use pesticides *and* are registered for a broad enough use to include use in or around marijuana cultivation sites. If using a rodenticide always read and follow the label and check to make sure that the target rodent is listed. Second-generation anticoagulant products are DPR-restricted materials not labeled for field use and as such, should never be used in or around marijuana cultivation sites.

Table 3. PEST MANAGEMENT PRACTICES FOR MARIJUANA GROWN INDOORS
(e.g., greenhouses, sheds, and grow rooms)

PEST	DAMAGE	IPM PRACTICES (monitoring; cultural, physical, mechanical, biological)	PESTICIDES
DISEASES			
powdery mildew <i>Sphaerotheca macularis</i>	Grow on leaves as white and gray powdery patches	<ul style="list-style-type: none"> Use fans to improve air circulation 	horticultural oil; neem oil; sodium bicarbonate, potassium bicarbonate; <i>Bacillus subtilis</i>
pythium root rots <i>Pythium</i> spp.	Attack root tips and worsens when plants grow in wet soil	<ul style="list-style-type: none"> Avoid hydroponic production or wet soil conditions 	Incorporate biocontrol agents into root-growing media (e.g., <i>Gliocladium virens</i> , <i>Trichoderma harzianum</i> , <i>Bacillus subtilis</i>)
MITES & INSECTS			
two-spotted spider mite <i>Tetranychus urticae</i>	Suck plant sap; stipple leaves	<ul style="list-style-type: none"> Disinfest cuttings before introducing to growing area Release predatory mites 	neem oil, horticultural oil, sulfur
leafhoppers	Suck plant sap; weaken plants	<ul style="list-style-type: none"> Encourage natural enemies by planting nectar sources 	horticultural oil or insecticidal soaps for nymphs
whiteflies <i>Trialeurodes vaporariorum</i> , <i>Bemisia tabaci</i> , <i>B. argentifolii</i>	Suck plant sap; weaken plants	<ul style="list-style-type: none"> Hang up yellow sticky cards Use biocontrol: <i>Encarsia formosa</i> 	azadirachtin, <i>Beauveria bassiana</i> , cinnamon oil, horticultural oil
thrips <i>Heliethrips haemorrhoidalis</i> , <i>Frankliniella occidentalis</i> , <i>Thrips tabaci</i>	Stipple leaves and vector viruses	<ul style="list-style-type: none"> Hang up yellow or blue sticky cards 	
dark-winged fungus gnats (Diptera: Sciaridae) <i>Bradysia</i> spp.	Damage roots and stunt plant growth	<ul style="list-style-type: none"> Avoid overwatering Use growing media that deters gnat development Hang up yellow sticky cards Use biocontrol: soil-dwelling predatory mites 	<i>Bacillus thuringiensis israelensis</i> (BTI); predatory nematodes; azadirachtin soil drenches

Table 4. PESTS OF MARIJUANA BY PLANT PART

Seedlings	Flower & Leaf (grown outdoors)	Flower & Leaf (grown indoors)	Stalk & Stem	Root
cutworms	hemp flea beetle	spider mites	hemp borer	hemp flea beetle
birds	hemp borer	aphids	rats	white root grubs
hemp flea beetle	budworms	whiteflies		root maggots
crickets	leafminers	thrips		termites & ants
slugs		leafhoppers		fungus gnats
rodents				wireworms