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# CURRENT CONTROL OF INSECT PESTS[1]

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**Labeled Pesticides.** Table 1 is a list of pesticides registered for use on ornamental plants. The pesticides are listed in alphabetical order according to their common names. Trade names are placed in parenthesis and capitalized. If the chemical has no common name the trade name is used. Applications of certain pesticides have restricted usages and are indicated by asterisk(s) or lower case letters following the name of the pesticide. Explanations appear as footnotes at the bottom of the table.

Under the heading of "Ornamental Plants" the plant names are listed as common or scientific names, and general categories. Notice such categories as *annual plants, Christmas trees, deciduous trees, eastern hardwoods, evergreens, forest trees, herbaceous plants, nursery stock, ornamental foliage plants, ornamentals, ornamental trees, shade trees, shrubs, trees,* and *woody plants.* After each plant category is listed the number of the corresponding pesticide(s) that is registered on that particular plant. The pesticide usage is as a foliar spray unless otherwise indicated by the upper case letters referring to the footnotes. Insects and mites are listed according to their common names. After each name the numbers correspond to the pesticide(s) that is registered for control use. As an example of how Table 1 can be used, the question may arise as to whether carbaryl can be applied to ash for the control of plant bugs. Note that no. 12 (carbaryl) is not included in the listing of numbers following ash, however, under the category of trees no. 12 is listed. As ash is a tree species, then it is safe to assume that carbaryl can be used. Under the heading of "Insects and Mites" note than no. 12 follows the plant bug listing, and therefore, it is legal to use carbaryl on ash to control plant bugs. I have only listed the pesticide information as it appears on the label, so it is very important to check the general categories as stated previously.

At the bottom of Table 1, the pesticides are arranged according to their oral and dermal toxicities. The footnote indicates the pesticide ranking according to toxicity.

There are many hundreds of insects that attack ornamental plants. I have chosen a few of the more important pests and give here a brief life history description and the control measures for each.

**Bronze Birch Borer.** The bronze birch borer is one of the most serious insect pests of white, paper, and yellow birch trees. Dieback, especially of the terminal branches, is a symptom of birch borer attack. Evidence of small ridges and bumps, as well as occasional "D" shaped holes in the bark of the affected branches or trunk, are additional proof of birch borer injury. It is not uncommon for heavily infested trees to die.

The bronze birch borer adult is a small beetle slightly more than ¾ inch in length and has a rather bronze appearance. In northern Illinois adults of the bronze birch borer emerge from the birch branches from late May into the 4th week of June, with the peak of emergence during the 1st week of June. A few days after their emergence the beetles mate and the female beetles deposit oval shaped eggs in crevices of the tree bark. The eggs hatch in a period of 10 to 14 days. The young larvae bore into the bark and

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begin feeding. The winter is passed as a light yellow larva inside the branch or trunk of a tree.

Table 2 summarizes the results of dimethoate (Cygon) sprays applied onto birch trees during the 1st and 3rd weeks of June for 2 consecutive years (Appleby et al. 1973). After 2 consecutive years, no beetles emerged from branches treated with dimethoate.

**Ash Borer.** Ash borer is becoming an extremely important pest of ash. During the months of August and September, as well as April and May in Illinois, frass can be found coming from tiny holes in trunks of infested ash trees. The borer overwinters in the larval stage and emerges as an adult moth in Illinois during the months of May and June. The adult moth is about 1 inch in length and dark purple with some rust-colored markings, especially near the base of the wings. The moth is very wasp-like in appearance as well as in behavior. Nielsen (1974) has been working several years on the life history and use of pheromones in studying this insect. In central Illinois from May to August, pheromone traps were placed among infested ash trees. The adult male ash borers are attracted to the sex pheromone and when they fly inside the traps, are caught in a sticky substance painted on the sides of the trap. Ash borer adults were caught from the 3rd week in May until the 1st week of July, with the largest number caught during the 3rd week in June. Although our control results are not yet completed, it appears that trees treated with Dursban during the 4th week in May and 2nd week of June are borer free.

**Fall Cankerworm.** The fall cankerworm feeds on many species of deciduous trees. When abundant the larvae may cause complete defoliation. In metropolitan areas people not only are annoyed by the damage to the trees, but usually are more disturbed by the larvae falling onto their sidewalks, patios, automobiles, and clothing. This insect overwinters in the egg stage. The tiny eggs can be found on the lower bark surfaces of the branches. The eggs hatch about the time the spring foliage appears. The larvae consume the foliage of the host plant, generally eating the entire leaves except for the main veins. When mature the larvae usually has a black stripe down the back and the sides of the larva are slightly yellowish, however, the larvae vary considerably in coloration.

Control studies were conducted at the Morton Arboretum in northern Illinois, where selected tree branches heavily infested with cankerworms were sprayed with different insecticides and then enclosed in large nylon nesh bags (Appleby et al. 1974). Foliar sprays of the listed chemicals were applied on May 15 (Table 3). Three days later on May 18 the bags were removed and the larvae examined. Note that on May 18, with the exception of the *Bacillus thuringiensis* treatment, all other treatments gave 100% control. The larvae treated with *B. thuringiensis* were still alive on May 18, but were not feeding. However, 7 days later the *B. thuringiensis* treatment gave 100% mortality. Unfortunately, in some cities having municipal insect control programs, the public is not informed about the expected results of *B. thuringiensis* treatments and quickly conclude that the treatment is ineffective and demand that another insecticide be used. It is very important to know that sufficient time is required for the bacteria to invade the digestive tract of the cankerworms. The larvae stop feeding soon after an ingestion of the lethal dosage although they may remain alive. In areas that have had a history of cankerworm outbreaks, and where an abundance of larvae might result in great annoyance to the public, tree branches should be examined carefully for fall cankerworm eggs in late winter. The eggs appear as large masses of tiny kegs tightly packed against one another. If a large number of eggs are found, branches containing eggs should be pruned and held at room temperatures for about 2 or 3 weeks to ascertain their viability. If egg viability is high, control preparations should be planned. Unfortunately, in most municipal areas, public complaints are voiced when the larvae are mature and the damage has already occurred.

**Mimosa Webworm.** The matted foliage of honey locust and mimosa trees is a common sight in early summer until late fall in eastern and central regions of the United States. The insect responsible for this damage is the mimosa webworm. The webworm overwinters in the pupal stage in white cocoons on the trunk of the tree or

in nearby debris. In late spring the tiny gray moths emerge and the female moths deposit their eggs on the honey locust foliage. The eggs hatch and the tiny gray-yellow-green larvae begin constructing the characteristic mats of foliage.

Foliar sprays of insecticides applied in early July (Table 4) gave 100% control of the actively feeding larvae (Appleby et al. 1973). It is very important that this insect be controlled when the tiny webs are first noted on the tree, as larvae were not killed when insecticides were applied after the larvae had matured and finished feeding.

Schuder (1973) has found that certain clones of honey locust are much less susceptible to mimosa webworm attack (Table 5). The clone Moraine appears much less susceptible to attack than Imperial. Unfortunately, Moraine is the preferred host of the honey locust mite which is responsible for the near complete defoliation of that clone during the late summer and fall months. Shademaster or Skyline might be a better choice of honey locust clones so that there would be a compromise between mite and mimosa webworm susceptibility.

**Gypsy Moth.** The most serious defoliator of trees in the eastern half of the United States is the gypsy moth. During certain years thousands of forested acres are defoliated by the feeding of this pest. During the winter and early spring months in heavily infested areas the egg masses, which are covered with what appears to be brownish hairs, can be found on tree trunks and other debris. The mature larva is almost 2 inches long with brownish or gray background. Except for the first segment behind the larva's head, the upper surface of each segment has a pair of tubercles. The first 5 pairs are blue, the last 6 are a dark red. In heavily infested areas, roadways, the sides of buildings, picnic tables, and almost any object outside may be covered with the larvae and/or their droppings. In New Jersey, Kegg (1973) conducted a host preference study and found that all oak species are preferred by the gypsy moth larvae, especially the white oak and chestnut oak (Table 6). Trees that were not preferred were the white ash and the yellow birch. It might be wise for city governments to encourage future plantings of less preferred and nonpreferred tree species so that some tree specimens will not be attacked as severely as others. Kegg stated that, in New Jersey, infestations build rapidly and severely defoliate the host trees for 2 or 3 consecutive years, then the population dramatically lapses. This is generally due to a very high incidence of virus disease. When the larvae die from the virus disease, they become very flaccid and hang from the branches. Kegg suggested that in new infestations of gypsy moth, if the objective is to prevent economic tree loss, direct control measures using chemical insecticides should be considered, especially when the forest is threatened with a second consecutive year of defoliation. Insecticides having label clearance for gypsy moth control are *Bacillus thuringiensis*, carbaryl (Sevin), Imidan, Phosvel, and trichlorofon (Dylox).

When the female gypsy moth emerges in early summer it gives off a very strong sex pheromone which attracts the male moth. When scientists found how to synthetically produce the sex lure it opened a new frontier on gypsy moth control. This method is the application of a sex lure to prevent male moths from finding the female moths. Beroza et al. (1974) conducted such an experiment in Massachusetts using Disparlure, the sex pheromone of the gypsy moth. Two separate 24 square miles of forested lands infested with the moth were chosen. One area was left untreated. The other area was treated with an aerial spray application of Disparlure. In each of the areas baited traps containing the sex lure were distributed. In the untreated area, 2,193 male moths were caught in the baited traps, whereas in the treated area most of the males were confused as to finding the female moths or the sex lure and only 63 male moths were caught. Similarly, when live females were placed in baited traps in the untreated area, 1,136 male moths were caught, whereas in the treated area, only 1 male moth was caught. These data indicate the potential use of microencapsulated Disparlure for suppressing low level gypsy moth populations. Beroza and Knipling (1972) stated that a reasonable strategy is to suppress the gypsy moth population to a very low level by applying an insecticide to larvae emerging in the spring, and then following with an application of Disparlure microcapsules during the mating season to prevent males from finding female survivors.

**Spruce Needleminer.** There are several insect species that act as needleminers in spruce, however, they all have similar life histories. The larvae overwinter as tiny leafminers and in the spring begin feeding on the needles and incorporating them into web mats. When such a nest is pulled apart, a greenish larva is often found inside. After completing the feeding, the larvae change into the pupal stage and a few weeks later to the adult stage. Adult moths emerge in the spring and lay their eggs on the spruce needles.

Tests conducted by Tashiro (1974) in New York have shown that when foliar sprays were applied in late June to spruce trees heavily infested with needleminers most of the insecticides gave very good control (Table 7). None of the insecticide treatments resulted in any phytotoxicity to the spruce.

**Eastern Spruce Gall Aphid.** Another pest common on species of spruce is the eastern spruce gall aphid. Close up the galls resemble tiny pineapples. The immature aphids overwinter on the lower surfaces of the branches. In the spring the aphids mature and produce large numbers of eggs. These eggs hatch and the tiny nymphs crawl to the galls and begin feeding inside. In the fall months the adult aphids emerge from the galls and produce the eggs which later hatch into the overwintering nymphs. Cameron et al. (1973) in Pennsylvania found that when foliar sprays were applied in early spring before the aphids began producing their eggs that carbaryl and diazinon gave particularly good control (Table 8). Later, when the aphids began producing eggs, treatments were not very effective. In October, after all the eggs had hatched, Cameron found that insecticide applications gave extremely good control (Table 8). None of the treatments resulted in any symptoms of phytotoxicity.

Table 1.—A list of some pesticides registered on ornamental plants.

## PESTICIDES

| Code No. | Pesticide |
|---|---|
| 1 | acephate (Orthene) |
| 2 | aldicarb (Temik)* |
| 3 | aldrin 20G |
| 4 | Aldrite |
| 5 | azinphosmethyl (Guthion) |
| 6 | Azodrin 3.2* |
| 7 | Bidrin 2EC* a/g/ |
| 8 | *B. thuringiensis* (Biotrol-Plus) |
| 9 | *B. thuringiensis* (Biotrol XK) |
| 10 | *B. thuringiensis* (Dipel) |
| 11 | *B. thuringiensis* (Thuricide) |
| 12 | carbaryl (Sevin) |
| 13 | carbofuran (Furadan) |
| 14 | carbophenothion (Trithion) |
| 15 | chlordane |
| 16 | chlorobenzilate (Acaraben) |
| 17 | chlorpyrifos (Dursban) |
| 18 | dieldrin 1.5 EC* * |
| 19 | demeton (Systox)* |
| 20 | diazinon (Spectracide) |
| 21 | dichlorvos (Vapona) |
| 22 | dicofol (Kelthane)c/ |
| 23 | dimethoate (Cygon) |
| 24 | disulfoton (Di-Syston)* |
| 25 | endosulfan (Thiodan) |
| 26 | endrin |
| 27 | ethion |
| 28 | fensulfothion (Dasanit)* |
| 29 | fenthion (Baytex & Entex)* |
| 30 | heptachlor |
| 31 | Imidanb* |
| 32 | Inject-A-Cide B (Bidrin)e/ |
| 33 | Inject-A-Cide (Metasystox R)* d/ |
| 34 | Karathane |
| 35 | malathion (Cythion) |
| 36 | Mesurol |
| 37 | methomyl (Lannate) |
| 38 | methoxychlor (Marlate) |
| 39 | Morestan |
| 40 | Nemagonf/ |
| 41 | Nudrin |
| 42 | oxydemetonmethyl (Metasystox-R) |
| 43 | Pentac |
| 44 | Phosdrin |
| 45 | Phosvel |
| 46 | Pirimor |
| 47 | Plictran |
| 48 | Pyrenone |
| 49 | tetradifon (Tedion) |
| 50 | trichlorofon (Dylox & Proxol) |
| 51 | trichlorofon (Dylox + oil) |
| 52 | Zectran |

## ORNAMENTALS AND PLANTS

| Plant | Labeled Pesticide |
|---|---|
| Acacia | 1 |
| African violet | 14,34,40(J),48 |
| Ageratum | 1,40(J) |
| Alder | 1 |
| Almonds | 47 |
| Aloe | 28(A),40(J) |
| Alyssum | 1,45 |
| Annual plants | 12 |
| Aralia | 40(J) |
| Arborvitae | 1,7,12,14,15,16,20,27,29 31,40(J),43 |
| Ardisia | 28(A),40(J) |
| Ash | 1,29,31,32(N) |

| | |
|---|---|
| Ligustrum | 40(J) |
| Lilac | 12,14,20,25,34,40(J) |
| Lilies | 2(A),8,14,19(E),29 |
| Linden | 1,14,32(N) |
| Locust | 1,20 |
| Magnolia | 1,14,15 |
| Mahonia (Calif. barberry) | 1,28(A),40(J) |
| Maples | 1,12(G),15,20,29,31,40(J) |
| Marigolds | 1,29,48 |
| Metrosideros | 28(A) |
| Mimosa | 1,20 |
| Moonflower | 14 |
| Mountain ash | 14 |
| Myrtle | 14 |
| Narcissus | 50 |
| Nasturtium | 14,30 |
| Natal plum | 28(A) |
| Norfolk Island pine | 14 |
| Northern hardwoods | 12(G) |
| Nursery crops | 18,40(J) |
| Nursery ornamentals | 26 |
| Nursery plants | 5 |
| Nursery stock | 3(A),5,18,22,43,49(H) |
| Nursery trees | 42 |
| Oak | 1,12,15,20,29,31,32(N),40(J) |
| Oleander | 1,14 |
| Orchids | 14 |
| Orchids (greenhouse) | 2(A) |
| Ornamental foliage plants | 28(A),45 |
| Ornamental pear | 1 |
| Ornamentals | 3(A),5,9,11,17,18,22,28,40(J),47,49(H) |
| Ornamental trees | 31 |
| Palms | 1,14 |
| Pansy | 1,14 |
| Pecans | 5,27 |
| Peony | 29,40(J) |
| Periwinkle | 1 |
| Petunia | 1,29 |
| Philodendron | 40(J) |
| Phlox | 1,14,29,40(J) |
| Photinia | 1 |
| Pine | 1,7,12(G),14,20,23,25,30,31,32(N),40(J) |
| Pine seedlings | 13(D) |
| Pittosporum | 1,14,40(J) |
| Plum | 1,20,22,25,31 |
| Poinsettia | 1,14,43(I) |
| Poinsettia (greenhouse) | 2(A),47 |
| Poplar | 1,14,20 |
| Primrose | 14,19(E) |
| Privet | 1,7,14,15,28(A),40(J) |
| *Prunus* spp. | 14 |
| Pyracantha (firethorn) | 1,14,28(A) |
| Red leaf barberry | 28(A),40(J) |
| Rhododendron | 14,15,20 |
| Roses | 1,2(A),7,8,12,15,20,23,28(A), 40(J),42(E),43(H),48 |
| Roses (greenhouse) | 2(A),34,40 |
| Rubber plant | 14 |
| Sago palm | 14 |
| Salvia | 1 |
| Sasangua | 7 |
| Sassafras | 1 |
| Shade trees | 5,9,11,17,20,25,26,31,35,36, 38,42,50,51(F) |
| Shrubs | 1,11,12,17,18,19(E),24(A),25,27,35, 36,38,39,42,50,52 |
| Siberian elm | 1 |
| Silver maple | 1 |
| Slash pine | 5 |
| Small-leaf spirea | 1,40(J) |
| Snapdragon | 1,8,14,29,34,43(I) |
| Snapdragon (greenhouse) | 2(A) |
| Spirea | 1 |
| Spruce | 1,6,12(F),16,20,25,27,29,31,40(J),43 |
| Staghorn sumac | 1 |
| Sumac | 1 |
| Surinam cherry | 28(A) |
| Sweet bay | 15 |
| Sweetgum | 1,29 |
| Sweet peas | 8,14 |
| Sycamore | 1,14,32(N) |
| Trees | 12,17,18,19(E),24(A),42,50,52 |
| True fir | 31 |
| Tulip tree | 29 |
| Verbena | 29 |
| Viburnam | 1,28(A),29,40(J) |
| Vinca | 1 |
| Vines | 17,52 |
| Violets | 14,40(J) |
| Walnuts | 5,12,16,27,39,44,47 |
| Willow | 1,15,20,31 |
| Woody plants | 12 |
| Yaupon | 1 |
| Yew (*Taxus*) | 1,7,15,16,27,28(A),29,31,40(J) |
| Zinnia | 1,12,29,43(I) |

## INSECTS AND MITES

| **Pest** | **Labeled Pesticide** |
|---|---|
| Andromeda lace bug | 45 |
| Ant | 18,29 |
| Aphid | 1,2(A),5,6,7,8,14,17,19(E),20,23,24(A), 25,27,29,32(N),35,39,42(E),44,46,48,52 |
| Aphid (greenhouse) | 2(A),25 |
| Apple & thorn skeletonizer | 20 |
| Apple aphid | 12,14 |
| Arborvitae leafminer | 20 |
| Armyworm | 29,45,50,52 |
| Ash borer | 17 |
| Ash hornworm | 1 |
| Azalea leafminer | 20,45 |
| Azalea scale | 35 |
| Bagworm | 1,7,10,12,14,15,17,18,23,29,35,50 |
| Barberry looper | 1 |
| Beet armyworm | 37,40,45 |
| Birch leafminer | 12,18,19(E),20,24(A),31(K),35,42,45,52 |
| Birch sawfly | 1 |
| Black bean aphid | 14 |
| Black nut casebearer | 25 |
| Black pecan aphid | 25 |
| Black pine leaf scale | 5 |
| Black scale | 1 |
| Black scale crawler | 14,35 |
| Black vine weevil | 15,18,25 |
| Blister beetle | 12,18,38 |
| Boisduval's scale | 14 |
| Borer | 15 |
| Boxelder bug | 12,25 |
| Boxwood leafminer | 12,19(E),20,35,45 |
| Brownheaded ash sawfly | 1 |
| Brown mite | 27 |

| | |
|---|---|
| Brown soft scale | 5 |
| Cabbage looper | 1,6,8,10,37,41 |
| Calendula budworm | 1 |
| Calico scale | 12 |
| California oak worm | 1 |
| California red scale | 14 |
| Camellia scale | 7,19(E),23,24(A) |
| Canadensis mite | 49(H) |
| Carnation bud mite | 20 |
| Carnation shoot mite | 20 |
| Carpini mite | 49(H) |
| Catalpa sphinx moth | 1 |
| *Cerococcus* scale | 5,7 |
| Cherry laurel leaftier | 1 |
| Citricola scale | 14 |
| Citrophilus mealybug | 14 |
| Citrus mealybug | 14 |
| Citrus red mite | 14 |
| Citrus rust mite | 14 |
| Clearwing borer | 13(D) |
| Climbing cutworm | 18,50 |
| Clover mite | 16,20,46 |
| Codling moth | 5,12 |
| Cone midge | 5 |
| Cone moth | 5,33(N) |
| Coneworm | 5 |
| Cooley spruce gall aphid | 25 |
| Corn earworm | 37,41 |
| Cotoneaster webworm | 20 |
| Cottonwood leaf beetle | 13(D) |
| Cottonwood twig borer | 13(D) |
| Cottony cushion scale | 1,14,20 |
| Cottony maple scale | 27 |
| Cottony scale | 7 |
| Cuban laurel thrips | 1,6 |
| Cucumber beetle | 38 |
| Cutworm | 17,52 |
| Cyclamen mite | 20,26 |
| Cyclamen mite (greenhouse) | 25 |
| Cypress tip moth | 1 |
| Desert mite | 22 |
| Dipterous leafminer | 20,50 |
| Dogwood borer | 18,25 |
| Douglas fir needle midge | 25 |
| Dusky sawfly | 1 |
| Eastern tent caterpillar | 1,17 |
| Elm bark beetle | 18 |
| Elm leaf aphid | 12 |
| Elm leaf beetle | 1,12,18,24(A),32(N),33(N) |
| Elm spanworm | 10,31(K) |
| Euonymus scale | 5,7,20,23,27,35 |
| European elm scale | 5,24(A),27,32(N) |
| European fruit scale | 37 |
| European fruit lecanium scale | 12 |
| European pine sawfly | 1,32(N),45 |
| European pine shoot moth | 5,14,20,23,25,49(H),52 |
| European red mite | 16,20,22,47 |
| Fall cankerworm | 1,10,11,12(F),18,38 |
| Fall webworm | 1,10,11,17,18 |
| Filbert worm leafroller | 12 |
| Flea beetle | 12,18,20,38,45,48 |
| Fleahopper | 38 |
| Fletcher scale | 35 |
| Florida red scale | 14,35 |
| Flower thrips | 1,38 |
| Foliar nematodes | 19(F) |
| Forbes scale | 14 |
| Forest tent caterpillar | 1 |
| Fourlined leaf bugs | 35 |
| Frosted scale | 12 |
| Fruit tree leafroller | 12,44 |
| Grasshopper | 17,18 |
| Great basin tent caterpillar | 11(M),12(F) |
| Greedy scale | 14 |
| Green peach aphid | 6,46 |
| Gypsy moth | 1,9,10,11(K),12(G),31(K),45 |
| Gypsy moth larvae | 1,10,11(K),51(F) |
| Hackberry psyllid | 32(N) |
| Hemispherical scale | 1,14 |
| *Hemlock cherme* | 20 |
| Hemlock scale | 1,23 |
| Hickory shuckworm | 5 |
| Holly bud moth | 20 |
| Holly leafminer | 18,19(E),20,24(A),42 |
| Honey locust pod gall midge | 1 |
| Imported cabbage worm | 8,10 |
| *Iris borer* | 25 |
| Ivy scale | 14 |
| Jackpine budworm | 45 |
| Japanese beetle adult | 12,15,18,35,38 |
| Japanese wax scale crawler | 1 |
| June beetle adult | 12,18 |
| Juniper scale | 5,27,29,35 |
| *Juniper webworm* | 20 |
| Juvenile dusky wing moth | 1 |
| Kuno scale | 1 |
| Lace bug | 1,2(A),5,12,15,18,19(E),23,24(A),35 |
| Larch sawfly | 45 |
| Latania scale | 14 |
| Leaf beetle | 15 |
| Leafhopper | 2(A),5,6,12,17,20,24(A),29,38,42,48,52 |
| Leafhopper (nymphs) | 8 |
| Leafminer | 1,2(A),6,7,15,23 |
| Leafroller | 1,8,11,12 |
| Lecanium scale | 14,20,27,29 |
| Lilac borer | 18,25 |
| Looper | 52 |
| Lygus bug | 50,52 |
| Magnolia scale | 27,35 |
| Maple shoot moth | 1 |
| McDaniel mite | 14,49(H) |
| Mealybug | 1,12,17,19(E),20,23,35,52 |
| Mealybug (greenhouse) | 2(A) |
| Mexican long-tailed mealybug | 14 |
| Millipede | 12 |
| Millipede (in greenhouse) | 27 |
| Mimosa webworm | 1,12,17,20,24(A) |
| Mite | 2(A),5,6,7,17,19(E),20,22,23,24(A),27, 29,39,42(E),44,52 |
| Mite eggs | 39 |
| Monterey pine aphid | 14 |
| Monterey pine scale | 35 |
| Myzocalles aphid | 32(N) |
| Nantucket pine tip moth | 1,5,23,50 |
| Narcissus bulb fly | 30,50 |
| Nematodes | 2(A),28(A),40(J) |
| Nesting pine sawfly | 1 |
| Nipple gall psyllid | 32(N) |
| Oak kernes | 35 |
| Oak leafminer | 12,20 |

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|---|---|
| Oak lecamium scale | 17 |
| Oak looper | 20 |
| Oak moth larvae | 11 |
| Oblique-banded leafroller | 1 |
| Obscure root weevil | 20 |
| Obscure scale | 32(N) |
| Oleander aphid | 14 |
| Oleander caterpillar | 1 |
| Olive parlatoria scale | 14 |
| Olive scale | 5 |
| Omnivorous leafroller | 7,40 |
| Omnivorous leaftier | 20 |
| Omnivorous looper | 1 |
| Orange-striped oakworm | 1,17 |
| Orange tortrix | 12,44 |
| Oystershell scale | 5,7,14,27,35 |
| Pacific spider mite | 47 |
| Pales weevil | 13(D) |
| Peach tree borer | 25 |
| Pear slug | 20 |
| Pecan casebearer | 5 |
| Periodical cicada | 12 |
| Pine leaf scale | 35 |
| Pine needle scale | 1,17,20,27,35 |
| Pine sawfly | 1,7 |
| Pine spittlebug | 18,32(N) |
| Pine tip moth | 7 |
| Pine tortoise scale | 1 |
| Pine tube moth | 1 |
| Pink bark aphid | 14 |
| Pitch eating weevil | 13(D) |
| Pit-making scale | 32(N) |
| Pit scale | 20 |
| Plant bug | 6,12,18 |
| Poplar tentmaker | 1 |
| Potato leafhopper | 1,14,35 |
| Privet mite | 20 |
| Privet thrips | 45 |
| Psyllid | 1,12,18 |
| *Pulvinaria* scale | 5 |
| Puss caterpillar | 12 |
| Putnam scale | 5,14 |
| Redheaded pine sawfly | 1 |
| Redhumped caterpillar | 1,11(L),12,17 |
| Red pine sawfly | 52 |
| Red spider mite | 32(N),34 |
| Rhododendron scale | 19(E) |
| Rose aphid | 12,14 |
| Rose chafer | 18,38 |
| Rose leafhopper | 35 |
| Rose slug (sawfly) | 12,38 |
| Rose stem sawfly | 1 |
| Rosy apple aphid | 14 |
| Rosy maple moth | 1 |
| Saddled prominent caterpillar | 1,12(F) |
| San Jose scale | 14,20,27,31 |
| Sawfly | 6,18 |
| Scale crawler | 50(J),52 |
| Scurfy scale | 27,35 |
| Seedworm | 5 |
| Sixspotted mite | 14 |
| Soft brown scale | 19(E) |
| Soft scale | 5,14,20,24(A),27,35,52 |
| Southern armyworm | 1 |
| Southern green stink bug | 5 |
| Southern pine beetles (spp) | 32(N) |
| Southern red mite | 16 |
| Spider mite | 1,2(A),27,35 |
| Spider mite (greenhouse) | 2(A) |
| Spiny elm caterpillar | 1 |
| Spring cankerworm | 1,10,11,18,31(K) |
| Spittlebug | 1,17,18,26 |
| Spruce budworm | 45 |
| Spruce gall aphid | 25 |
| Spruce spider mite | 14,16 |
| Stink bug | 50 |
| Sunflower moth | 1 |
| Sweetgum leaftier | 1 |
| Sycamore leaftier | 1 |
| Sycamore scale | 32(N) |
| Tarnished plant bug | 35,50 |
| Taxus bud mite | 25 |
| Taxus mealybug | 7 |
| Tea scale | 1,7,17,18(E),24(A) |
| Tent caterpillar | 11,12,15,18,20,35,38 |
| Texas citrus mite | 14,49(H) |
| Thorn bug | 12 |
| Thrips | 1,2(A),5,6,7,12,15,17,18,20,24(A),35, 37,41,42(E),52 |
| Tobacco budworm | 1,6,50 |
| Tree cricket | 15 |
| Tropical mite | 49(H) |
| Tulip tree scale | 27 |
| Tussock moth | 1 |
| Twig girdler | 5 |
| Twospotted spider mite | 1,14,16,20,22,27,45,49(H) |
| Variable oak leaf caterpillar | 1 |
| Viburnum plant hopper | 1 |
| Walnut aphid | 27 |
| Walnut caterpillar | 1,5 |
| Walnut husk fly | 27 |
| Wax scale | 35 |
| Western tussock moth | 44 |
| Whitefly | 1,2(A),7,8,17,19(E),20,23,24(A),35,42,52 |
| Whitefly (greenhouse) | 2(A),25 |
| White peach scale | 17 |
| White pine weevil | 30,42 |
| Willow leaf beetle | 1,12,15 |
| Wooly apple aphid | 14 |
| Yellownecked caterpillar | 1,17 |
| Yellow scale | 14 |
| Yellow striped armyworm | 1 |
| Yuma mite | 14 |
| Zimmerman pine moth | 23,25,50 |

X = foliar
A = granular
B = drench
C = clay slurry
D = clay slurry or granular
E = drench or foliar
F = aircraft application only
G = aircraft or foliar
H = greenhouses and outside
I = greenhouses only
J = soil fumigant
K = Northeast states only
L = California only
M = Western United States only
N = injection

a/ Do not use this product for implant treatments of trees or ornamentals.
b/ Commercial applicators only in northeastern states.
c/ For use in greenhouses or outdoors.
d/ All government and private application organizations must be approved by the J.J. Mauget Company.
e/ For use only under the supervision of personnel specifically trained in the use of Bidrin insecticide as an implant in elm trees as specified in Shell Chemical Company's Instruction Manual ACD: 64: 64-100.
f/ Additional plants may have label clearance.
g/ No longer labeled by Shell.
* For use by commercial growers or professional applicators only — read label.
** For use only by commercial spray operators and nurserymen.

## CHEMICAL TOXICITY

| *Oral LD* | *Chemical* | *Dermal LD 50* |
|---|---|---|
| 2-6 | demeton (Systox) | 8-14 |
| 2-7 | disulfoton (Di-Syston) | 6-15 |
| 2-11 | fensulfothion (Dasanit) | 3-30 |
| 4-6 | Phosdrin | 4-5 |
| 5-10 | aldicarb (Temik) | 1,400 |
| 8-14 | carbofuran (Furadan) | 10,200 |
| 8-18 | *endrin* | 15-18 |
| 10-30 | carbophenothion (Trithion) | 27-54 |
| 11-13 | azinphosmethyl (Guthion) | 220 |
| 17-24 | methomyl (Lannate) | 1,500 |
| 18-43 | endosulfan (Thiodan) | 74-130 |
| 20 | Nudrin | — |
| 21 | Azodrin 3.2 | 354 |
| 22 | *Bidrin 2 EC* | 225 |
| 25-37 | Zectran | 1,500-2,500 |
| 27-65 | ethion | 62-245 |
| 56-80 | dichlorvos (Vapona) | 75-107 |
| 65-75 | oxydemetonmethyl (Metasystox-R) | 250 |
| 76-108 | diazinon (Spectracide) | 455-900 |
| 91 | Phosvel | 800 |
| 97-276 | *chlorpyrifos* (Dursban) | 2,000 |
| 100-162 | heptachlor | 195-225 |
| 130-135 | Mesurol | 200 |
| 147 | Pirimor | — |
| 147-216 | Imidan | 3,160 |
| 173 | Nemagon | 2,400 |
| 215 | dimethoate (Cygon) | 400-610 |
| 215-245 | fenthion (Baytex & Entex) | 330 |
| 335-430 | chlordane | 690-840 |
| 500-850 | carbaryl (Sevin) | 4,000+ |
| 560-630 | trichlorofon (Dylox) | 2,000+ |
| 700 | chlorobenzilate (Acaraben) | — |
| 866-945 | acephate (Orthene) | 2,000+ |
| 980-1,190 | Karathane | 4,700-9,400 |
| 1,000 | Pyrenone | — |
| 1,000-1,100 | dicofol (Kelthane) | 1,000-1,230 |
| 1,000-1,375 | malathion (Cythion) | 4,444 |
| 1,100-1,800 | Morestan | 2,000+ |
| 1,675 | Plictran | — |
| 3,160 | Pentac | 3,160+ |
| 5,000 | methoxychlor (Marlate) | 6,000+ |
| 14,700 | *tetradifon* (Tedion) | 10,000 |

50 or less = very high toxicity
50-150 = moderately high toxicity
150-750 = moderate toxicity
750 or greater = low toxicity

Table 2. Effectiveness of insecticidal sprays applied to white birch trees at the Morton Arboretum, Lisle, Ill. for control of the bronze birch borer. Sprays applied June 3 and 20, 1969; June 3 and 24, 1970.

| Treatment | Rate of 100 gal water | No. adults emerging from branches | | |
|---|---|---|---|---|
| | | 1970 | 1971 | Total |
| Dimethoate (Cygon) 2 EC | 1 qt | 2 | 0 | 2 |
| Untreated | — | 13 | 32 | 45 |

Table 3. Effectiveness of insecticidal sprays applied to trees at the Morton Arboretum, Lisle, Ill. for control of the fall cankerworm. Sprays applied May 15, 1973.

| Treatment | Rate per 100 gal water | Mortality | |
|---|---|---|---|
| | | May 18 | May 25 |
| Acephate (Orthene) 75SP | 1.3 lb | 100% | — |
| *B. thuringiensis* (Dipel) | 0.5 lb | 0% | 100% |
| Carbaryl (Sevimol) 4E | 1 pt | 100% | — |
| Malathion 5EC | 1 qt | 100% | — |
| Untreated | — | 0% | 0% |

Table 4. Results of foliar sprays of insecticides applied to honey locust trees heavily infested with mimosa webworm larvae on July 10, 1970, Urbana, Ill.

| Treatment | Rate per 100 gal water | Mortality July 21 |
|---|---|---|
| Diazinon 25E | 1 qt | 100% |
| *B. thuringiensis* (Dipel) | 1 lb | 100% |
| Acephate (Orthene) 75SP | 1.3 lb | 100% |
| Carbaryl (Sevimol) 4E | 1 pt | 100% |
| Malathion 5EC | 1 qt | 100% |
| Check | — | 0% |

Table 5. Susceptibility of honey locust clones to mimosa webworm and honey locust mite.

| Clone | Webworm colonies | Mites |
|---|---|---|
| Moraine | 9 | 71 |
| Skyline | 18 | 32 |
| Shademaster | 19 | 21 |
| Sunburst | 27 | 33 |
| Imperial | 38 | 34 |

Table 6. Classification of some tree hosts according to feeding preference by the gypsy moth in New Jersey by Kegg (1973).

| *Highly preferred* | *Preferred* |
|---|---|
| White oak | Red oak |
| Chestnut oak | Black oak |
| | Scarlet oak |
| | Eastern hemlock |
| *Less preferred* | *Nonpreferred* |
| Red maple | White ash |
| Bitternut hickory | Yellow birch |
| Black birch | |
| Sugar maple | |

Table 7. Spruce needleminer control on nursery-grown spruce in New York, with foliar sprays applied on July 24, 1974.

| Treatment | Rate per 100 gal water | Control on Sept. 2 |
|---|---|---|
| Dizainon 4EC | 1 pt | 100% |
| Carbaryl (Sevimol 4) | 1 pt | 100% |
| Trichlorofon 80WP | 1¼ lb | 100% |
| Oxydemetonmethyl 25EC | 1 pt | 17% |
| Check | — | 48% |

Table 8. Control of the eastern spruce gall aphid with foliar sprays of insecticides applied in Pennsylvania in 1973.

| *Application April 23 before eggs produced)* | | |
|---|---|---|
| Treatment | Rate per 100 gal water | Average galls per tree in June |
| Carbaryl (Sevin) 80WP | 1¼ lb | .5 |
| Diazinon 2EC | 1 qt | 6 |
| Acephate (Orthene) 75SP | 1.3 lb | 34 |
| Untreated | — | 41 |

| *Application October 15 after eggs hatched* | | |
|---|---|---|
| Treatment | Rate per 100 gal water | Reduction |
| Carbaryl (Sevin) 80S | 1¼ lb | 100% |
| Chlorpyrifos (Dursban) 4EC | 1 pt | 100% |
| Diazinon 2EC | 1 qt | 100% |

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