Insects and Diseases of Vegetables in the Home Garden

Cucumber mosaic.

Late blight of tomato.

Bacterial blight of bean.

Bacterial spot of pepper.
MEXICAN BEAN BEETLE (× 4)

STRIPED CUCUMBER BEETLE (× 5)

SPOTTED CUCUMBER BEETLE (× 5)

ASPARAGUS BEETLE (× 5)

BEAN LEAF BEETLE (× 5)

PEA WEEVIL (× 6)

CABBAGE APHID (× 8)

Wingless

Winged

POTATO LEAFHOPPER (× 8)

POTATO FLEA BEETLE (× 10)

VEGETABLE WEEVIL (× 8)
Insects and Diseases of Vegetables in the Home Garden

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This bulletin has been prepared especially for the home gardener. It tells how to recognize the more common insects and diseases that attack vegetable crops and what to do to prevent damage.

The farmer and the market gardener will also find it useful. They will note, however, that it does not include certain insecticides that are ordinarily recommended for use by experienced growers.

For some purposes insecticides other than those mentioned might be recommended; however, with few exceptions only those considered likely to be most generally available and to have widest use in the home garden are included. The dusts and baits come ready-mixed from dealers, and the sprays are easy to prepare. If directions are followed, they are safe to use.

It is not possible to cover all aspects of the subject in a single bulletin. If your problem goes beyond the scope of this discussion, you can get more detailed information by writing to your county agricultural agent, to the agricultural college or department of agriculture in your State, or to the U. S. Department of Agriculture.

When writing for information, send specimens of the insects (in a small bottle of formalin or rubbing alcohol) or diseased portions of plants.

Cover photographs illustrating black rot of cabbage, bacterial blight of pea, and bean rust are by courtesy of the Wisconsin Agricultural Experiment Station; the one illustrating bacterial blight of bean is by courtesy of the Nebraska Agricultural Experiment Station.

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INSECTICIDES and FUNGICIDES

INSECTICIDE DUSTS AND SPRAYS

You can use an insecticide as a dust or spray, depending on the equipment that is available.

Dusts are usually preferable for insect control in the home garden. They require no preparation by the home gardener and can be applied with less expensive equipment.

But whether you use a dust or spray, make sure that it contains the correct amount of the proper active ingredient. Read the label on the package carefully before making a purchase.

For best results, start your control efforts early. Dust or spray at the first sign of insects, and repeat treatment in a week or 10 days if infestation continues.

Dusts

Dusts recommended in this bulletin are available ready for use from insecticide dealers. You can often buy one that contains a fungicide and one or more insecticides. Such a preparation is very practicable to use in the garden; it kills a larger variety of pests than a dust containing only one insecticide or fungicide.

Apply an even, light coating of dust at the rate of 1½ ounces per 50 feet of row. Force it through the foliage so that it reaches both sides of each leaf. Dust when the air is still.

Sprays

Few sprays come ready to use. It is usually necessary to prepare sprays by mixing wettable powders or emulsifiable concentrates, which are sold in different percentages, with water.

Before buying a powder or concentrate, make sure it will give effective control without injuring plants.

The table below shows how to prepare sprays in the strengths suggested in this bulletin. References to spray numbers are found under What to do headings in the Insects and Diseases section.

Small measures are given for each ingredient. If you require a larger quantity of spray, add proportionately more ingredients to the mixture. If you use an ingredient in which the percentage differs from the one suggested, mix proportionately more or less of it with the water.

Stir the powder or concentrate vigorously until it is thoroughly mixed into the water. When applying wettable-powder sprays, shake the applicator frequently to keep the powder from settling to the bottom of the spray chamber.

Apply 1 quart of spray per 50 feet of row.

**SPRAY NO. 1—MALATHION:**
- 25-percent wettable powder ................................................. 4 level tablespoons
- Water ................................................................. 1 gallon
- or
- 50-percent emulsifiable concentrate ........................................ 1½ teaspoons
- Water ................................................................. 1 gallon

**SPRAY NO. 2—METHOXYCHLOR:**
- 50-percent wettable powder ................................................. 2 level tablespoons
- Water ................................................................. 1 gallon
- or
- 25-percent emulsifiable concentrate ........................................ 1 tablespoon
- Water ................................................................. 1 gallon

**SPRAY NO. 3—DDT:**
- 50-percent wettable powder ................................................. 3 level tablespoons
- Water ................................................................. 1 gallon
- or
- 25-percent emulsifiable concentrate ........................................ 1 tablespoon
- Water ................................................................. 1 gallon
SPRAY NO. 4—NICOTINE SULFATE:
40-percent concentrate (solution) ............ 2 teaspoons
The nicotine sulfate concentrate is very poisonous; do not get it on the skin or about the eyes or mouth.
Soap (mild laundry type) ..................... 1 cubic-inch cake (or 2 level tablespoons of soap flakes)
Water ............................................. 1 gallon
Dissolve soap in 1 pint of warm water. Add nicotine sulfate concentrate. Stir this mixture and add enough water to make 1 gallon of spray.

SPRAY NO. 5—ROTENONE:
Derris or cube root powder (5-percent rotenone content). 4 level tablespoons
Water ............................................. 1 gallon
If the available powder is of a lower rotenone content, use proportionately more of it. First, mix the powder with a small quantity of water; then add more water to make 1 gallon of spray.

SPRAY NO. 6—PYRETHRUM:
Use a ready-prepared pyrethrum spray; follow dilution instructions given on the package.

SPRAY NO. 7—CHLORDANE:
40- or 50-percent wettable powder .......... 1½ level tablespoons
Water ............................................. 1 gallon
or
45-percent chlordane emulsifiable concentrate .... 3 teaspoons
Water ............................................. 1 gallon

SPRAY NO. 8—BORDEAUX MIXTURE:
Bluestone (copper sulfate) .................. 4 ounces (7 tablespoons)
Hydrated lime .................................. 4 ounces (12 tablespoons)
Water ............................................. 3 gallons
Dissolve the bluestone in hot water, using a wooden, earthenware, or glass vessel. (Bluestone corrodes metal.) Dilute with half the total water specified. Make a paste of the lime in a small quantity of water, and add the rest of the water to it. Pour the diluted bluestone and lime solutions together and mix thoroughly. Strain the mixture through a fine cheesecloth directly into the sprayer before using it. Make a fresh mixture for each treatment.

SPRAY NO. 9—CRYOLITE:
Cryolite ........................................ 2½ ounces (5 level tablespoons)
Water ............................................. 1 gallon
Do not use lime or bordeaux mixture with cryolite.

SPRAY NO. 10—TOXAPHENE:
40-percent wettable powder ................. 3 level tablespoons
Water ............................................. 1 gallon
or
About 60-percent emulsifiable concentrate .... 1 tablespoon
Water ............................................. 1 gallon

SPRAY NO. 11—TDE:
50-percent wettable powder ................ 4 level tablespoons
Water ............................................. 1 gallon

SPRAY NO. 12—SULFUR:
Wettable sulfur ................................ 3 level tablespoons
Water ............................................. 1 gallon

SPRAY NO. 13—ARAMITE:
15-percent wettable powder ................. 1 level tablespoon
Water ............................................. 1 gallon

You will find the following tables of measures useful in preparing small quantities of insecticides for the garden:

Liquid measures:
3 teaspoons = 1 tablespoon
2 tablespoons = 1 fluid ounce
8 fluid ounces = 1 cup
2 cups = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon
Approximate quantities required to weigh 1 ounce:

- Aramite wettable powder: 4 level tablespoons
- Chlordane wettable powder: 3 level tablespoons
- Copper sulfate powder: 5 level teaspoons
- Cryolite: 2 level tablespoons
- DDT wettable powder: 6 level tablespoons
- Hydrated lime: 3 level tablespoons
- Malathion wettable powder: 4 level tablespoons
- Methoxychlor wettable powder: 4 level tablespoons
- Nicotine sulfate solution: 5 teaspoons
- Pyrethrum flowers: 5 level tablespoons
- Sulfur (dusting): 2\(\frac{1}{2}\) level tablespoons
- Sulfur (wettable): 3 level tablespoons
- Toxaphene wettable powder: 3 level tablespoons

**FUNGICIDE DUSTS AND SPRAYS**

You can use a fungicide as a dust or spray.

Sprays are usually preferable for disease prevention in the home garden. They stick to the plant surfaces better than dusts. They are most effective if you use a compressed-air sprayer.

Dusts are effective if used properly. (See discussion under “Dusts,” on p. 2.)

For best results, apply a fungicide before there is any evidence of plant damage. Repeat treatment every week to 10 days. More frequent applications may be necessary during moist weather, when plant diseases have a tendency to be most severe.

Whether you use a dust or spray, only those parts of the plant are protected that are actually coated with the fungicide.

The following is a discussion of the fungicides recommended in this bulletin, and a guide to the kinds of dusts and sprays to use. References to them are found under What to do headings in the Insects and Diseases section.

**Copper Fungicides**

Bordeaux mixture, a copper fungicide, is very effective in preventing such plant diseases as late blight of potatoes and tomatoes, leaf blight of celery, and downy mildew of cucumbers and melons. A ready-mixed powder is convenient to use in small gardens, but a freshly prepared spray is usually more effective. (See directions for preparing spray No. 8 on p. 3.)

Bordeaux mixture may injure the foliage of certain crops (cucumber, muskmelon, and tomatoes), particularly if it is used frequently. You can reduce injury by substituting one of the fixed copper compounds such as basic copper sulfate, copper oxychloride, copper oxychloride sulfate, or cuprous oxide. These compounds are sold under various trade names and should be used according to directions given on the packages.

If you prefer a dust, use a fixed copper dust containing 5 to 7 percent of actual copper or a dust containing 20 parts of monohydrated copper sulfate and 80 parts of hydrated lime.

**Organic Fungicides**

Organic fungicides such as captan, ferbam, maneb, nabam, zineb, and ziram, are frequently used instead of copper fungicides. They are sold under various trade names, some of which are listed below:

<table>
<thead>
<tr>
<th>Common name</th>
<th>Trade name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Captan</td>
<td>Orthocide 50-W, Orthocide 50 (Wettable)</td>
</tr>
<tr>
<td>Ferbam</td>
<td>Fermate, Karbam Black, Ferradaw, Ferberk.</td>
</tr>
<tr>
<td>Maneb</td>
<td>Manzate, Dithane M-22.</td>
</tr>
<tr>
<td>Nabam</td>
<td>Liquid Parzate Fungicide, Dithane D-14.</td>
</tr>
</tbody>
</table>
Common name  Trade name
Zineb..... Dithane Z-78, Dry Par-
zate Fungicide.
Ziram.... Zerlate, Zirberk, Karbam
White.

Ferbam is not used as extensively
for vegetable disease control as the
other organic fungicides listed above.
It is effective for control of certain
blackberry and raspberry diseases.

To prepare a spray, mix one of the
purchased products, except nabam,
with water according to directions on
the package. Nabam, a liquid, must
be mixed with water and zinc
sulfate.

Use a dust containing 5 to 10 per-
cent of the fungicide.

Seed Treatment Chemicals

Protective Fungicides for Seed Decay
and Damping-Off

Certain chemicals, dusted on the
seed of some crops, can reduce injury
caused by seed decay and damping-
off. They are sold under various
trade names, some of which are listed
below.

Common name  Trade name
Thiram.... Arasan, Thiram-50.
Chloranil.. Spergon.
Dichlone.. Phygon Seed Protectant.
Captan.... Orthocide-75 Seed Pro-
tectant.
   Captan 50-W.
None..... Semesan.
None..... Vancide 51.

Follow these directions for treating
a small quantity of seed: (1) Tear off
the corner of the seed packet. (2)
Dip the small blade of a penknife into
the dust. (3) Lift out as much dust
as will go on the tip of the blade. (4)
Insert dust through the hole in the
packet. (5) Fold down corner of
packet. (6) Shake the seed thor-
oughly.

The directions on the fungicide
package will tell you how much dust
to use for treating a large quantity of
seed. Place the dust and seed in a
closed container. Shake the con-
tainer 1 to 2 minutes.

Seed Disinfectants

A number of seed disinfectants can
be used to control destructive seed-
borne organisms. The two that are
mentioned below—corrosive subli-
mate and Semesan—are effective.
Use these poisons according to di-
rections. Your county agent or State
agricultural college can give you
information on other disinfectants.

Corrosive Sublimate.—Some organ-
isms that attack such crops as cu-
cumber, muskmelon, pepper, and
tomato, can be controlled by soaking
the seed in a corrosive sublimate so-
lution. The strength of the solution
and the length of the soaking period
depend on the kinds of seed to be
treated.

To prepare the solution, dissolve
one corrosive sublimate tablet in the
following amounts of water: 1:1,000
solution, 1 pint of water; 1:1,500 solu-
tion, 1½ pints of water; 1:2,000 solu-
tion, 2 pints of water.

Treat seed as follows: Put seed in
a loosely woven cloth bag; do not get
the bag more than half full. Prepare
about 3 times as much solution as
seed to be treated. Soak seed in
solution. Stir solution frequently
during soaking period. Soak cucumber,
muskmelon, and watermelon seed
for 5 minutes in a 1:1,000 solution,
and pepper and tomato seed for 5
minutes in a 1:2,000 solution. Re-
move the seed from bag after soaking,
and rinse it in cold running water for
15 minutes. Make sure that the seed
is dry before storing or planting.

Use only earthenware, wooden, or
glass containers for mixing the solu-
tion; the chemical corrodes metal.

This treatment will not prevent
damage from damping-off. For pro-
tection against this disease, treat seed
with one of the protective fungicides
listed on this page.

Semesan.—A Semesan solution can
be used as a disinfectant for most
vegetable seeds, and it also protects
against damping-off. Mix and use
it according to directions on the pack-
age. See Precautions on page 7.
SPRAYING AND DUSTING EQUIPMENT

EFQ-1854
This hand atomizer has a copper spray chamber. Some atomizers come with removable glass chambers, which resemble fruit jars.

EFQ-1851
This plunger-type duster is ideal for treating small areas.

EFQ-1855
This compressed-air sprayer holds 2 gallons of spray, and it operates at about 50 pounds of pressure, which is obtained by a built-in plunger-type hand pump. The handle of the pump also serves as the handle of the sprayer.

EFQ-1853
The crank duster is an efficient garden tool. By turning the crank, the gardener drives a fan that creates an air blast that blows dust through the nozzle and down into the plants.

A wide assortment of hand sprayers and dusters are available under different trade names. You can apply insecticides and fungicides easily and efficiently if you use good equipment manufactured expressly for the purpose. The following are some points to consider in selecting sprayers and dusters:

Sprayers

Hand Atomizers.—Hand atomizers vary in capacity from 1/2 pint to 3 quarts. They are very useful for spraying small plantings, but some types are not effective in directing the spray to the underside of leaves. Choose an atomizer with an adjustable nozzle that can be turned upward or downward and that will deliver a continuous spray. The nozzle and spray chamber should be made of a noncorrosive material and should be so constructed that they can be easily cleaned.

Compressed-Air Sprayers.—Compressed-air sprayers, which are usually made of galvanized steel, range in capacity from 1 to 5 gallons. They are the most satisfactory sprayers to
use in the garden. Some types are not equipped with an agitator and must be shaken frequently during spraying.

**Dusters**

**Plunger.** — Plunger-type dusters range in capacity from 1 to 3 pounds. They are the most practicable applicators for the small garden. They are usually equipped with tube and nozzle attachments, which permit the dust to be directed to the underside of leaves.

**Fan or Crank.**— Fan- or crank-type dusters have capacities up to 15 pounds and can be used satisfactorily in small and large areas. These dusters are more efficient and durable than other types of hand dusters, such as the small plunger and the knapsack bellows.

**PRECAUTIONS**

Most insecticides and fungicides are poisonous. Those that are recommended in this bulletin can be used with safety provided these precautions are carefully followed.

Handle insecticides and fungicides with care. Follow all directions and heed all precautions on the labels.

In handling, mixing, or applying insecticides and fungicides, avoid inhaling them; keep them out of eyes, nose, and mouth. Work on the windward side of the areas treated.

Chlordane, dieldrin, heptachlor, malathion, Semesan, and toxaphene can be absorbed through the skin. After working with these materials, wash all exposed surfaces of the body with soap and water. Change clothing if these materials are spilled on it.

Be sure insecticides and fungicides are clearly labeled. Store them where children and animals cannot reach them.

**Poison Residues.** When foliage or fruit that is intended to be eaten is on the plants, do not apply calcium arsenate, captan, chlordane, cryolite, DDT, dieldrin, ferbam, heptachlor, manebl, nabad, toxaphene, TDE, zineb, or ziram unless the poison residues can and will be removed by washing, wiping, or stripping. Do not depend upon washing to remove residues of these poisons from asparagus, snap bean, okra, berries, and the leafy vegetables such as broccoli or cabbage.

Do not apply Aramite spray or dust to melons, celery, cucumber, beans, or tomato within 15 days before harvest or to strawberry within 21 days before harvest.

Do not apply malathion to beans, broccoli, cucumber, eggplant, melons, onion, peas, pepper, potato, squash, strawberry, or tomato within 3 days before a harvest; or to leafy vegetables such as beet tops, brussels sprouts, cabbage, cauliflower, celery, kale, lettuce, mustard, spinach, and turnip tops within 7 days before a harvest. Do not apply malathion to okra while the pods are on the plants or to blackberry or raspberry while the fruit is on the plants.

Do not apply methoxychlor to beans, broccoli, cucumber, eggplant, peas, pepper, radish, squash, or strawberry within 7 days before a harvest: to beet tops, blackberry, brussels sprouts, cabbage, cauliflower, kale, kohlrabi, lettuce, raspberry, or spinach within 7 days before a harvest. Do not apply methoxychlor to okra while the pods are on the plants or to celery within 30 days before harvest.

Do not apply insecticides or fungicides immediately before a harvest.

Apply an insecticide or fungicide only to those crops on which it is recommended. Apply light, even dosages. Do not apply heavier dosages than those recommended.
OTHER CONTROL MEASURES

Insecticides and fungicides, although effective in controlling a large number of garden pests, will not eradicate all insects or cure all diseases. Plant diseases can rarely be cured, but must be controlled by prevention.

The following measures will help prevent losses caused by insects and diseases:

1. Use fertile, well-drained soil and a good-grade fertilizer.
2. Plant crops that are suited to the soil and climate.
3. Keep down weeds and grass.
4. Purchase disease-free seed. Buy certified seed where possible.
5. Treat seed with chemicals for protection against decay and damping-off.
6. Purchase disease-free plants; make sure they do not have swellings on the roots, cankers on the stems, or spots on the leaves.
7. Grow disease-resistant varieties if available. Resistant varieties are available for only a few diseases of certain crops. Some of these varieties are highly resistant; others give partial protection.
8. Destroy plants of each annual crop as soon as harvest is completed.

INSECTS and DISEASES

ASPARAGUS

Asparagus Beetle

Description.—Adult: Metallic blue to black; orange to yellow markings; ¼ inch long. Larva: Olive green to dark gray; ½ inch long. Eggs, which are laid on spears by female beetles, look like shiny black specks. (See inside front cover for natural-color illustrations of adult and larva.)

Damage.—Adults and larvae eat foliage; shoots are disfigured.

Distribution.—Throughout United States.

What to do.—During cutting season (when shoots are infested), apply a ⁴/₅-percent rotenone dust or spray No. 5 (p. 3). After cutting season, apply a 5-percent DDT dust or spray No. 3 (p. 2).

Rust (fungus)

Symptoms and damage.—Elongated, orange-red, powdery pustules (blisters) on stems and foliage; early death of plant tops; reduction in following year’s crop. Disease is worst during moist seasons. Fungus lives on remains of diseased tops of previous year.

Distribution.—Throughout United States.

What to do.—Grow rust-resistant varieties such as Mary Washington and Martha Washington; use a dependable strain of seed. Cut diseased tops close to the ground, and burn them in the fall.

BEANS

Mexican Bean Beetle

Description.—Adult: Copper-colored; oval; ¼ inch long; 16 black spots in its back. Larva: Orange to yellow; fuzzy or spiny; up to ½ inch long. (See inside front cover for natural-color illustrations of adult, larva, and pupa.)

Damage.—Adults and larvae feed
on pods and on underside of leaves; pods and leaves are skeletonized.

**Distribution.**—In most States east of Rocky Mountains.

**What to do.**—Apply spray No. 5, 1, or 2 (pp. 2, 3) to underside of leaves; or use a dust containing 3/4 percent of rotenone, 5 percent of malathion, or 5 percent of methoxychlor. **Caution:** Do not apply malathion within 3 days before a harvest, or methoxychlor within 7 days before a harvest.

### Leafhoppers

**Description.**—Several species. Adults: Green; wedge shaped; up to 1/8 inch long; they fly quickly when disturbed. Nymphs resemble adults but are smaller; they crawl sidewise like crabs. (See inside front cover for natural-color illustration of adult potato leafhopper.)

**Damage.**—Adults and nymphs attack beans. Leaves of beans curl, or roll downward, crinkle, and tend to become yellow or bronze. Some plants are dwarfed and may die.

**Distribution.**—Throughout United States.

**What to do.**—Apply a dust containing 5 percent of methoxychlor, malathion, or DDT; or use spray No. 2, 1, or 3 (p. 2). **Caution:** Apply DDT sparingly; heavy dosages may injure beans. Do not apply DDT to snap beans after pods begin to form.

### Spotted Cucumber Beetle

**Description.**—Yellowish green; 12 black spots on back; 1/4 inch long. (See inside front cover for natural-color illustration.)

**Damage.**—Eats holes in leaves; chews on pods.

**Distribution.**—East of Rocky Mountains. (Closely related species are found throughout United States.)

**What to do.**—Same as for bean leaf beetle, above.

### Corn Earworm

**Description.**—Green, brown, or pink; light stripes along sides and on back; up to 1 3/4 inches long. When insect occurs on tomatoes, it is called tomato fruitworm. (See inside back cover for natural-color illustration.)

**Damage.**—Eats holes in pods; attacks beans in the fall. Damage is worst in warm, coastal areas.

**Distribution.**—Throughout United States.

**What to do.**—Apply methoxychlor or DDT as for leafhoppers on p. 9.

### Seed-Corn Maggot

**Description.**—Yellowish white; legless; 1/2 to 1/4 inch long.

**Damage.**—Bores into sprouting seed and prevents development of plants; particularly destructive to early planted seed.

**Distribution.**—Throughout United States.

**What to do.**—Immediately before planting, treat seed as follows: Thoroughly mix 1/4 level teaspoon of 50-percent chlordane wettable powder with 2 level teaspoons of chloranil. Then, put the dry mixture and the seed into a paper bag, or fruit jar, and shake well. (These quantities are sufficient to treat 4 pounds of bean seed.) Sift out excess powder before planting.

Plant seed in warm weather; cool, wet periods retard germination and
make seed more susceptible to maggot injury. Replant immediately if maggot damage is heavy.

**Bean Aphid (plant louse)**

*Description.*—Adult and young: Tiny black insect; looks like cabbage aphid. Bean aphids cluster on stems and under leaves. (See inside front cover for natural-color illustration of cabbage aphid.)

*Damage.*—Leaves curl and thicken; plants become yellow and unthrifty. Aphids spread virus of common bean mosaic.

*Distribution.*—Throughout United States; infestations localized.

*What to do.*—Apply a 5-percent malathion dust; or use spray No. 1 or 4 (pp. 2, 3). Nicotine sulfate (spray No. 4) is not effective at temperatures below 70° F. Caution: Do not apply malathion within 3 days before a harvest.

**Lima-Bean Pod Borer**

*Description.*—Pink; pale yellow head; up to 5/8 inch long; wriggles violently when disturbed.

*Damage.*—Bores through lima bean pods and eats seed. Seldom a pest of snap beans.

*Distribution.*—Southern part of the country; most damaging in California.

*What to do.*—Apply a 3- or 5-percent DDT dust or spray No. 3 (p. 2). Caution: Apply DDT sparingly; heavy dosages may injure beans.

**Seed Decay (fungi)**

*Symptoms and damage.*—Seed rots in soil. Disease is most common during cool, moist weather. Fungi live in soil.
spray No. 8 or 12 (p. 3). Grow varieties such as Stringless Black Valentine, Landreth Stringless Green Pod, Tendergreen, Pencil Pod Black Wax, Round Pod Kidney Wax, and Rust-Resistant Kentucky Wonder (pole), which have some resistance to rust.

**Common Bean Mosaic (virus)**

*Symptoms and damage.*—Mottled (light and dark green) and curled leaves; stunted plants; reduced yields. Virus is carried in seed and spread by aphids (plant lice). (See back cover for natural-color photograph.)

*Distribution.*—Throughout United States.

*What to do.*—Grow common bean mosaic-resistant varieties such as Topcrop, Contender, Wade, Tenderlong No. 15, Improved New Stringless, Puregold Wax, Kentucky Wonder (pole), and Blue Lake (pole).

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**Blister Beetles**

*Description.*—Many species. Gray, black, or striped; slender; ½ to ¾ inch long.

*Damage.*—Eat leaves.

*Distribution.*—Throughout United States; usually occur late in season. Infestations localized.

*What to do.*—If foliage is to be eaten, apply a 5-percent methoxychlor dust or spray No. 2 (p. 2). Do not apply methoxychlor within 7 days before a harvest. If foliage is not to be eaten, apply a dust containing 5 percent of DDT or at least 50 percent of cryolite; or use spray No. 3 or 9 (pp. 2, 3). Handpick beetles; wear gloves while doing so; the beetles discharge a caustic fluid that may blister skin.

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**Cutworms.** (See p. 40.)

**Flea Beetles.** (See p. 44.)

**Grasshoppers.** (See p. 42.)

**Wireworms.** (See p. 46.)

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**Damping-Off (fungi)**

*Symptoms and damage.*—Seed decay in soil; young plants collapse and die. Fungi live in soil.

*Distribution.*—Throughout United States.

*What to do.*—Treat seeds with a protective fungicide (p. 5).

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**Leaf Spot (fungus)**

*Symptoms and damage.*—Numerous small, round spots with light-tan centers and dark brown borders on leaves. Fungus is carried on seed and lives in soil or on remains of diseased plants.

*Distribution.*—East of Rocky Mountains.

*What to do.*—Apply spray No. 8 (p. 3), or a spray containing a fixed copper, zineb, or nabam (use with
zinc sulfate); or use a dust containing copper or zineb (p. 4). Disease usually is not severe enough to require regular treatments.

**BLACKBERRY AND DEWBERRY**

**Raspberry Fruitworms**

*Description.*—Several species. **Adults:** Yellow to brown beetles; 1/4 inch long. **Larvae:** Brown and white, up to 1/2 inch long.

*Damage.*—Adults make long, narrow slits in blossom buds and newly formed leaves; larvae feed in berries.

*Distribution.*—In Northern States.

**What to do.**—Apply a 3/4-percent rotenone dust or spray No. 5 (p. 3) 7 days after the first blossoms appear. Repeat treatment twice at 10-day intervals.

**Orange Tortrix**

*Description.*—Yellow to green larva; light-brown head; up to 1/2 inch long.

*Damage.*—Feeds in berries or within a web on leaves.

*Distribution.*—Destructive to bramble berries in California, Oregon, and Washington.

**What to do.**—Apply a dust containing 5 percent of TDE or at least 50 percent of cryolite in the spring when plants begin to grow; or use spray No. 9 or 11 (p. 3). Repeat treatment at 10-day intervals until the plants begin to bloom.

**Red-Necked Cane Borer**

*Description.*—Adult: Dark-bronze or black beetle; shiny, copper-red neck; slender; about 3/4 inch long. **Larva:** White; flat head; slender; up to 3/4 inch long.

*Damage.*—Adults eat margins of leaves; larvae tunnel canes, causing spindle-shaped swellings on surfaces.

*Distribution.*—Eastern half of United States.

**What to do.**—Apply a 3/4-percent rotenone dust or spray No. 5 (p. 3) immediately before plants bloom. Repeat treatment in about 2 weeks. Cut off infested canes well below the points of injury and destroy them.

**Raspberry Cane Borer**

*Description.*—Adults: Black, long-horned beetle; 2 black spots on yellow neck; slender; 1/2 inch long. **Larva:** Dark yellow; dark head; up to 3/2 inch long.

*Damage.*—Adults girdle tips of tender canes, causing ends to wilt and fall over; larvae tunnel down the canes. Damaged canes die.

*Distribution.*—In Northwest and in areas east of North Dakota and Texas; infestations localized.

**What to do.**—Same as for red-necked cane borer, above.

**Rose Scale**

*Description.*—White, circular, and scaly; 1/8 inch in diameter.

*Damage.*—Incrusts bark at base of canes; weakens or kills canes by feeding on sap.

*Distribution.*—Throughout United States.

**What to do.**—Keep down weeds in the planting. Remove and destroy infested canes. Apply a 5-percent malathion dust or spray No. 1 (p. 2) after harvest. If the scales persist until the dormant season, apply a spray containing 1/2 cup of a white-oil emulsifiable concentrate in 1 gallon of water.

**Rose Chafer.** (See p. 41.)

**Aphids.** (See p. 40.)

**Japanese Beetle.** (See p. 43.)

**Anthracnose (fungus)**

*Symptoms and damage.*—Small gray spots with dark margins on leaves; purplish spots (about 1 inch in diameter) with ash-gray centers and
raised, purplish margins on canes. Spotted canes may crack lengthwise. Fruits of many varieties of blackberries are not badly damaged; but those of Lawton are particularly susceptible. Disease also attacks raspberries. Fungus lives on remains of diseased canes of previous year.

**Distribution.**—Throughout United States.

**What to do.**—Make three applications of spray No. 8 (p. 3) or ferbam. Begin first application just as leaves appear; second, just before blooms open; third, just after blossoms have fallen and young berries are well set. In North Carolina and regions southward, cut all canes close to the ground and destroy them after harvest. In the North, prune away only the fruiting canes.

### Double Blossom (fungus)

**Symptoms and damage.**—Twisted and wrinkled petals; abnormally large flower buds. Short, broomlike growths emerge from infected buds; no berries grow at these points. Diseased canes produce poor fruits. New canes infected in early summer show no outer symptoms until following spring. Fungus lives in infected blossoms and canes.

**Distribution.**—Chiefly in southeastern States.

**What to do.**—Make three applications of spray No. 8 (p. 3) as recommended for anthracnose, above. Remove and destroy infected blossoms. In North Carolina and regions southward, cut all canes close to ground after harvest.

### BROCCOLI. (See Cabbage.)

### BRUSSELS SPROUTS. (See Cabbage.)

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**CABBAGE AND RELATED PLANTS**

### Cabbage Looper

**Description.**—Pale-green measuring worm; light stripes down back; up to 1 ½ inches long; doubles up, or loops, when it crawls. (See inside back cover for natural-color illustration.)

**Damage.**—Feeds on underside of leaves, producing ragged holes; large loopers burrow into heads.

**Distribution.**—Throughout United States.

**What to do.**—Before formation of parts of plants that are to be eaten, apply a 10-percent toxaphene dust, or spray No. 10 (p. 3). In some areas, a 5-percent DDT dust or spray No. 3 (p. 2) may be effective. Repeat treatment once a week. **After formation of parts of plants that are to be eaten,** apply a dust containing 1 percent of rotenone or 0.5 percent of rotenone plus 0.15 percent of pyrethrins; or use spray No. 5 (p. 3) or a rotenone-pyrethrins extract spray (available ready for use). A 5-percent malathion dust or spray No. 1 (p. 2) is partially effective. **Caution:** Do not apply malathion to broccoli within 3 days before a harvest; or to cabbage, brussels sprouts, cauliflower or kale within 7 days before a harvest.

### Imported Cabbageworm

**Description.**—Velvety green; up to 1 ¼ inches long. (See inside back cover for natural-color illustration.)

**Damage.**—Feeds on undersides of leaves, producing ragged holes; bores into heads.

**Distribution.**—Throughout United States.

**What to do.**—Apply a ¾-percent rotenone dust or spray No. 5 (p. 3) at first sign of cabbageworms. Repeat treatment once a week for as long as necessary. **Note:** Insecticides recommended for the cabbage looper, above, will also control the imported cabbageworm.

### Diamondback Moth Caterpillar

**Description.**—Larva: Light green; slender; up to ½ inch long. It wriggles rapidly when disturbed, and often drops from the plant and hangs by a silken thread, which it produces.

**Damage.**—Larva eats small holes in
leaves and buds; adult (diamondback moth) does no damage.

**Distribution.**—Throughout United States.

**What to do.**—Apply a ¾-percent rotenone dust or spray No. 5 (p. 3) at the first sign of larvae. Repeat treatment once a week. **Note:** Insecticides recommended for cabbage looper will also control diamondback moth.

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**Cabbage Aphid (plant louse)**

**Description.**—Adult and young: Tiny green to powdery blue; soft bodied; covered with a fine whitish wax. Aphids cluster on leaves. (See inside front cover for natural-color illustration.)

**Damage.**—Curlcled and distorted leaves; stunted plants. Aphids may severely damage cabbage, collards, brussels sprouts, broccoli, and kale.

**Distribution.**—Throughout United States; particularly troublesome in the South.

**What to do.**—Remove and destroy heavily damaged plants early in season. Cut off and destroy old leaves from large infested collard, broccoli, cauliflower, and kale plants. Apply a 5-percent malathion dust or spray No. 1 or 4 (pp. 2, 3). Nicotine sulfate (spray No. 4) is not effective at temperatures below 70°F. **Caution:** Do not apply malathion to broccoli within 3 days before a harvest; or to cabbage, brussels sprouts, cauliflower, or kale within 7 days before a harvest.

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**Root Maggots**

**Description.**—Several species (include seed-corn and cabbage maggots). Yellowish white; legless; ¼ to ½ inch long.

**Damage.**—Destructive in seedbeds and on young transplants. Tunnel roots and stems, causing rot; plants wilt and die.

**Distribution.**—Seed-corn maggot, throughout United States. Cabbage maggot, in northern part of country.

**What to do.**—Apply a 5-percent chlordane dust or spray No. 7 (p. 3) around each plant when first 2 leaves appear. Repeat treatment shortly after thinning or transplanting. Add 2 level teaspoons of a 40-percent chlordane wettable powder to each gallon of transplanting water; use ¾ cup of water per plant. **Caution:** Do not apply chlordane to plants past seedling stage.

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**Harlequin Bug**

**Description.**—Adult and young: Black; brilliantly colored with red or yellow; shield shaped; up to ¾ inch long.

**Damage.**—Plants wilt; leaves turn brown as if scalded.

**Distribution.**—In southern part of country, from California to Virginia; infestations localized.

**What to do.**—Before formation of parts of plants that are to be eaten, apply a 5-percent DDT dust or spray No. 3 (p. 2). After formation of parts of plants that are to be eaten, apply a 10- to 20-percent sabadilla powder or a ¾-percent rotenone dust; or use spray No. 5 (p. 3). Rotenone is only partially effective. Handpick bugs and crush egg masses (effective if done often).

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**Cabbage Webworm**

**Description.**—Dull grayish yellow; fat; 5 brownish-purple stripes down back; up to ½ inch long.

**Damage.**—Bores into buds and stems, killing young plants. Feeds under a protective web that it produces. Does little or no damage to spring crop.
Distribution.—Southern part of the country.

What to do.—Apply a dust containing 5 percent of DDT or 3/4 percent of rotenone; or use spray No. 3 or 5 (pp. 2,3). In the South, where the insect causes heavy damage to young plants in late summer and early fall, apply insecticide as soon as plants come up. Caution: Do not apply DDT to parts of plants that are to be eaten.

Cutworms. (See p. 40.)
Flea Beetles. (See p. 44.)
Vegetable Weevil. (See p. 42.)
Fall Armyworm. (See p. 43.)

Damping-Off (fungi)

Symptoms and damage.—Seed decay in soil; young plants collapse and die. Fungi live in soil.
Distribution.—Throughout United States.
What to do.—Treat seeds with a protective fungicide (p. 5).

Clubroot (slime mold)

Symptoms and damage.—Large, irregular swellings, or "clubs," on roots; unthrifty and stunted plants. Disease attacks plants in seedbeds and in field. May severely damage cabbage, cauliflower, broccoli, brussels sprouts, and kohlrabi. Slime mold lives in soil and enters roots.
Distribution.—Throughout United States.
What to do.—Grow seedlings in clean soil. Do not grow cabbage in soil where disease has occurred. Do not set plants that have swellings on roots. Rotate crops. The use of 1/2 cup of a 1:1,500 corrosive sublimate solution (p. 5) as transplanting water helps to protect against infection.

Black Rot (bacterial)

Symptoms and damage.—Blackened veins; stems show a blackened ring when cut across. Leaves turn yellow and drop. Plants may die. Bacteria are carried on seed and live in soil. (See back cover for natural-color photograph.)

Distribution.—In Central, Southern, and Eastern States.
What to do.—Use seed from Pacific Coast regions; they are free from black rot. Do not plant seed in soil that has previously grown cabbage.

Blackleg (fungus)

Symptoms and damage.—Ashen-gray spots speckled with tiny black dots on leaves and stems; stems girdled; plants wilt and die. Most common on cauliflower, broccoli, and brussels sprouts. Fungus is carried on seed and lives on crop refuse in soil.
Distribution.—In Central, Eastern, and Southern States.
What to do.—Same as for black rot, above.

Yellows, or Wilt (fungus)

Symptoms and damage.—Yellowish-green leaves; stunted plants; lower leaves drop. Disease first attacks one side of plant. May severely damage cabbage, kohlrabi, and kale. Cauliflower, broccoli, and brussels sprouts are resistant. Fungus lives in soil and enters roots.
Distribution.—Throughout United States.
What to do.—Plant seed in clean soil. Grow yellows-resistant varieties such as Jersey Queen, Resistant Detroit, Marion Market, Badger Market, Globe, Wisconsin Ballhead, and Wisconsin All-Season. Spraying is of no value for control of yellows.

Rhizoctonia Disease (fungus)

Symptoms and damage.—Seedling stems dark and shrunken just above soil (injury called wire stem); lower leaves of older plants droop, decay, and turn dark, but do not drop. In cabbage, base of head may rot. Fungus lives in soil.
Distribution.—Throughout United States.
What to do.—Do not set plants that have wire stem. Rotate crops, if possible.
CANTALOUP. (See Muskmelon.)

CARROT

Carrot Caterpillar

Description.—Green; banded with black and yellow markings; up to 2 inches long.

Damage.—Eats leaves; destroys tops. Seldom numerous enough to reduce yield.

Distribution.—Throughout United States.

What to do.—Handpick caterpillars.

Carrot Rust Fly

Description.—Larva: Yellowish white; legless; up to \( \frac{1}{2} \) inch long.

Damage.—Larva tunnels into fleshy roots; destroys fibrous roots.

Distribution.—In Northeastern States and coastal areas of Washington and Oregon.

What to do.—Apply 2 pounds of a 5-percent chlordane dust per 1,000 square feet of soil surface; or use \( \frac{3}{4} \) cup of a 40-percent chlordane wettable powder or \( \frac{1}{4} \) cup of a 75-percent chlordane emulsifiable concentrate in \( 2\frac{1}{2} \) gallons of water. Apply the dust or spray to the soil surface before planting and then work it thoroughly into the upper 6 inches.

Six-Spotted Leafhopper

Description.—Adult and young: Light, greenish yellow; slender; wedge shaped; very active; several pairs of tiny black dots on face; up to \( \frac{1}{2} \) inch long. Looks like potato leafhopper, but is broader. Prefers open areas. (See inside front cover for natural-color illustration of potato leafhopper.)

Damage.—Spreads the virus of aster yellows to carrots, lettuce, and asters.

Distribution.—Throughout United States.

What to do.—Leafhoppers must be controlled on all host plants or they will continue spreading disease. On carrots, asters, and weeds, apply a 5- or 10-percent DDT dust or spray No. 3 (p. 2) at weekly intervals. For control on lettuce, see recommendations on page 21. Caution: Do not use DDT-treated carrot tops for food or feed.

Vegetable Weevil. (See p. 42.)

Wireworms. (See p. 46.)

Leaf Blight (fungus)

Symptoms and damage.—Black or brown spots appear on leaves and leaf stalks; older leaves dry and die. Fungus is carried on seed and lives in remains of infected plants in the soil.

Distribution.—Throughout United States.

What to do.—Rotate crops. If plants show damage, apply spray No. 8 (p. 3), or a spray containing a fixed copper or organic fungicide; or use copper or organic fungicide dust (p. 4).

Yellows (virus)

Symptoms and damage.—Yellowed young leaves (at center of crown) followed by appearance of a large number of yellowed shoots; reddened and twisted old leaves. Roots are small and of poor quality. Virus, which causes aster yellows, attacks other cultivated and wild plants; it is spread by leafhoppers and lives through winter in perennial plants.

Distribution.—Throughout United States.
What to do.—Same as for six-spotted leaf hopper, (p. 16).

CAULIFLOWER. (See Cabbage.)

**CELER\_Y**

Celery Leaf Tier

**Description.**—Greenish; up to \( \frac{3}{4} \) inch long.

**Damage.**—Eats holes in leaves and stalks. Rolls and folds leaves; ties them together with webs.

**Distribution.**—Throughout United States; sometimes damages celery in Florida, California, and in northern celery-growing areas.

**What to do.**—Make two applications of a pyrethrum dust containing 0.2 percent of pyrethrins (active ingredient) \( \frac{1}{2} \) hour apart. First application should drive tiers from webs and second should kill them. One application of 5-percent DDT dust or spray No. 3 (p. 2) is also effective. Do not apply DDT within 30 days of harvest.

Aphids. (See p. 40.)

Spider Mites. (See p. 45.)

Wireworms. (See p. 46.)

Vegetable Weevil. (See p. 42.)

**Damping-Off** (fungi)

**Symptoms and damage.**—Seed decay in soil; young plants collapse and die. Fungi live in soil.

**Distribution.**—Throughout United States.

**What to do.**—Treat seed with a protective fungicide (p. 5).

**Early Blight** (fungus)

**Symptoms and damage.**—Small, circular, yellowish-brown spots on old leaves. Spots enlarge and later are ashen gray. Disease affects stalks. Fungus is spread by rain and lives in soil.

**Distribution.**—Throughout United States.

**What to do.**—Apply spray No. 8 (p. 3), or a spray containing a fixed copper, zineb, nabam (to be used with zinc sulfate) or ziram (pp. 4, 5); or use a dust containing copper, zineb, or ziram (pp. 4, 5). Remove and destroy plant debris in the fall. Rotate crops. If damage is heavy, grow Emerson Pascal, a blight-resistant variety.

**Late Blight** (fungus)

**Symptoms and damage.**—Small yellow spots on old leaves and stalks. Spots turn dark gray and are speckled with tiny black dots. Fungus is carried on seed and lives in the soil.

**Distribution.**—Throughout United States.

**What to do.**—Same as for early blight, above. If disease is common, spraying or dusting should begin in the seedbed; grow Emerson Pascal, a blight-resistant variety.

**Pink Rot** (fungus)

**Symptoms and damage.**—Water-soaked spots and white to pink cottony growth at base of stalks. Stalks rot and taste bitter. Fungus, which also attacks cabbage and lettuce, lives in soil for several years.

**Distribution.**—In Northeastern, North Central, and Southern States.

**What to do.**—Rotate crops, if possible. Avoid successive planting of celery, lettuce, or cabbage in same soil. Remove and destroy diseased plants.

**Yellows** (fungus)

**Symptoms and damage.**—Yellowed leaves; stunted plants. Some plants may die. Fungus lives in soil and enters roots.

**Distribution.**—In Central and Eastern States.

**What to do.**—Plant seed in clean soil. Do not set diseased plants. If self-blanching varieties are wanted, grow yellows-resistant varieties such

**CHARD.** (See Beet and Chard.)

**COLLARDS.** (See Cabbage.)

**CORN.** (See Sweet Corn.)

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**CUCUMBER**

**Striped Cucumber Beetle**

*Description.*—Adult: Yellow to black; 3 black stripes down back; \( \frac{3}{4} \) inch long. Larva: White; slender; brownish at the ends; up to \( \frac{3}{4} \) inch long. (See inside front cover for natural-color illustration of adult.)

*Damage.*—Adults feed on leaves, stems, and fruit, and spread bacterial wilt. Larvae bore into roots and also feed on stems at or below soil line. Insects usually attack young plants. Damaged plants wilt and sometimes die.

*Distribution.*—East of Rocky Mountains; related species are found in some Western States.

*What to do.*—Apply a dust containing \( \frac{3}{4} \) percent of rotenone, at least 50 percent of cryolite, or 5 percent of methoxychlor as soon as plants come up; or use spray No. 5, 9, or 5 (p. 3). Repeat treatment once or twice a week. **Caution:** If you use cryolite, wash or peel harvested cucumbers to remove insecticide residues. Do not apply methoxychlor within 7 days before a harvest.

**Aphids.** (See p. 40.)

**Spider Mites.** (See p. 45.)

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**Damping-Off (fungi)**

*Symptoms and damage.*—Seed decay in soil; young plants collapse and die. Fungi live in soil.

*Distribution.*—Throughout United States.

*What to do.*—Treat seed with a protective fungicide (p. 5).

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**Bacterial Wilt**

*Symptoms and damage.*—Large vines gradually wilt and die (no yellowing of leaves); young plants die rapidly. Old plants may first have only one shoot affected. Bacteria, spread by cucumber beetles, enter and plug water vessels of stems, leaves.

*Distribution.*—North, Central, and Northeastern States.

*What to do.*—Remove and destroy wilted plants found early in season. Follow same recommendations as for striped cucumber beetle, above.

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**Downy Mildew (fungus)**

*Symptoms and damage.*—Yellowish, angular spots on older leaves; fruits not affected. Leaves dry, curl, and die. Also attacks muskmelons and watermelons. Fungus is not carried on seeds and does not overwinter in soil. (See back cover for natural-color photograph.)

*Distribution.*—Atlantic Coast and Gulf States.

*What to do.*—Apply spray No. 8 (p.
3), or a spray containing a fixed copper or organic fungicide, except ferbam, to plants; or use a copper or organic fungicide dust, except ferbam (pp. 4, 5). Grow mildew-resistant varieties such as Palmetto, Santee, Ashley, Stono, and Palomar.

**Anthracnose (fungus)**

*Symptoms and damage.*—Reddish-brown, circular spots on leaves; elongated, tan cankers on stems; round, sunken spots with pinkish-tan centers (later turning dark) on fruits. Also attacks muskmelons and watermelons. Damage worst in warm moist weather. Fungus is carried on seeds and lives in soil.

*Distribution.*—Central, Eastern and Southern States.

*What to do.*—Do not grow cucumbers or melons in same soil oftener than once in 3 years. Treat seed with 1:1,000 corrosive sublimate (p. 5). Apply spray No. 8 (p. 3), or a spray containing a fixed copper or organic fungicide, except ferbam, to plants; or use a copper or organic fungicide dust, except ferbam (pp. 4, 5).

**Scab (fungus)**

*Symptoms and damage.*—Sunken, dark-brown spots on fruits. Gummy substance oozes from fruits. In moist weather, spots are covered by grayish-olive fungus growth. Some small, brown spots on leaves and stems. Fungus also attacks summer squash, particularly crookneck and yellow straightneck. Damage worst in cool, moist weather. Fungus lives in soil.

*Distribution.*—North Central and Northeastern States.

*What to do.*—Do not grow cucumbers or squash in same soil oftener than once in 3 years. Grow scab-resistant varieties such as Highmoor, a slicing variety; and Wisconsin SR 6, and Wisconsin SMR 12, pickling varieties. Spraying or dusting is not very effective against scab.

**Mosaic (virus)**

*Symptoms and damage.*—Mottled (green and yellow) and curled leaves; warty, misshapen and spotted fruits; stunted plants; reduced yields. Also attacks muskmelon, squash, pepper, celery, and tomatoes. Virus lives in perennial weeds—milkweed, ground cherry, catnip—and is spread by aphids (plant lice). (See front cover for natural-color photograph.)

*Distribution.*—Throughout United States.

*What to do.*—Remove and destroy perennial weeds. Follow recommendations for aphids on page 40. Grow mosaic-resistant varieties such as Niagara, Shamrock, Sensation Hybrid, Burpee Hybrid, Surecrop Hybrid—slicing varieties; and Ohio MR 17, Ohio MR 25, Yorkstate Pickling, Wisconsin SMR 12—pickling varieties.

**Root Knot (nematode)**

*Symptoms and damage.*—Galls, or swellings, on roots; stunted plants. Galls on small roots are tiny; compound galls on large roots are up to an inch in diameter. Pearly white specks inside galls are egg masses of root knot nematode, which lives in soil. Damages many kinds of plants.

*Distribution.*—Southern part of the country; most common south of 40° latitude.

*What to do.*—If soil is heavily infested, the best thing to do is to move garden to another location, if possible. For some crops and in some locations, the treatment of the soil with nematocides is practicable. Information on the use of these in your area is best obtained from your State agricultural experiment station or county agent.

**Colorado Potato Beetle**

*Description.*—Adult: Yellow; black-striped; ¾ inch long. Larva: Brick-red; humpbacked; up to ¾ inch long. (See inside back cover for natural-color illustration of adult and larva.)
**Damage.**—Adults and larvae defoliate plants; they are especially destructive to small plantings.

**Distribution.**—In all States except California and Nevada; principal damage in Eastern States.

**What to do.**—Apply a dust containing 5 percent of DDT or \( \frac{3}{4} \) percent of rotenone; or use spray No. 3 or 5 (pp. 2, 3). Handpick beetles and crush egg masses (effective if done often).

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**Eggplant Lacebug**

Description. — Adult: Grayish to light brown; flat; lace-like wings; \( \frac{1}{6} \) inch long. Nymph: Yellowish; louse-like; spiny; up to \( \frac{1}{10} \) inch long.

**Damage.**—Adults and nymphs feed in groups on underside of leaves. Leaves turn yellow and brown; plants usually die.

**Distribution.**—The South.

**What to do.**—Apply a 4- or 5-percent malathion dust or spray No. 1 (p. 2). **Caution:** Do not apply malathion to eggplants within 3 days before a harvest.

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**Hornworms**

Description. — Two species. Green; diagonal lines on sides; prominent horn on rear end; up to 4 inches long.

**Damage.**—Eats foliage and fruits.

**Distribution.**—Throughout United States; infestations localized.

**What to do.**—Handpick worms. If damage is heavy, apply 5- to 10-percent TDE dust, or spray No. 11 (p. 3). A 5- or 10-percent DDT dust or spray No. 3 (p. 2) is effective for controlling the hornworm most common in the northern part of country.

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**Damping-Off (fungi)**

Symptoms and damage. — Seed decay in soil; young plants collapse and die. Fungi live in soil.

**Distribution.**—Throughout United States.

**What to do.**—Treat seeds with a protective fungicide (p. 5).

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**Fruit Rot (fungus)**

Symptoms and damage. — Brown and shrunken stems at soil line; brown or gray spots on leaves; large, ringed, circular, tan or brown spots covered with small pustules (blisters) on fruits. Fungus is carried on seed and lives in soil.

**Distribution.**—Throughout United States.

**What to do.**—Grow rot-resistant varieties such as Florida Beauty and Florida Market.

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**Wilt Diseases (fungi)**

Symptoms and damage. — Slow wilting and stunting of plants. Plants sometimes die. Fungi live in soil.

**Distribution.**—Throughout United States.

**What to do.**—Do not plant eggplant in soil that has recently grown tomatoes or potatoes. Rotate crops.

**KALE.** (See Cabbage.)

**KOHLRABI.** (See Cabbage.)

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**LETTUCE**

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**Cabbage Looper**

Description. — Pale-green measuring worm; light stripes down back; up to 1\( \frac{1}{2} \) inches long; doubles up, or loops, when it crawls. (See inside back cover for natural-color illustration.)

**Damage.**—Feeds on underside of leaves, producing ragged holes.
Distribution.—Throughout United States; insect is particularly troublesome in Florida, California, and Arizona.

What to do.—Loose Lettuce: Before thinning, apply a 10-percent toxaphene dust or spray No. 10 (p. 3). After thinning, apply a ¾-percent rotenone dust or a pyrethrum dust containing 0.2 percent of pyrethrins (active ingredient) or spray No. 5 or 6 (p. 3). Head lettuce: Follow recommendations for cabbage looper on cabbage (p. 13).

Six-Spotted Leafhopper

Description.—Adult and young: Light-greenish yellow; slender; wedge shaped; very active; several pairs of tiny black dots on face; up to ½ inch long. Looks like the potato leafhopper, but is broader. Prefers open areas. (See inside front cover for natural-color illustration of potato leafhopper.)

Damage.—Spreads the virus of aster yellows to lettuce, carrots, and asters.

Distribution.—Throughout United States.

What to do.—Plant lettuce in sheltered areas—near hedges, buildings, etc. Apply a 5-percent malathion dust or a 5-percent methoxychlor dust or spray No. 1 or 2 (p. 2) when plants are ½ inch high; repeat treatment once a week. Caution: Do not apply malathion or methoxychlor to lettuce within 7 days before a harvest. Leafhoppers must be controlled on all host plants or they will continue spreading disease to lettuce. For control on carrots, asters, and weeds, see page 16.

Wireworms. (See p. 46.)
Fall Armyworm. (See p. 43.)

Drop (fungus)

Symptoms and damage.—Wilting of outer leaves; watery soft rot on stems and old leaves; wilted and decayed plants. Disease worst in moist weather.

Distribution.—Central, Eastern, and Southern States.

What to do.—Avoid close planting and poorly drained soil. Ridge soil slightly about plants to prevent water from accumulating.

Yellows (virus)

Symptoms and damage.—Yellowing, blanching, curling, and twisting of inner leaves. Virus, which causes aster yellows, attacks other cultivated and wild plants. Virus lives in perennial plants and is spread by leafhoppers.

Distribution.—Throughout United States.

What to do.—Same as for six-spotted leafhopper.

Tipburn (physiologic)

Symptoms and damage.—Margins of the tender leaves turn brown and dry. Most severe damage on head lettuce.

Distribution.—Throughout United States.

What to do.—Grow tipburn-resistant varieties such as Great Lakes, Cornell 456, and Pennlake.

Striped Cucumber Beetle

Description.—Adult: Yellow to black; 3 black stripes down back; ½ inch long. Larva: White; slender; brownish at the ends; up to ¼ inch long. (See inside front cover for natural-color illustration of adult.)

Damage.—Adults feed on leaves, stems, and fruit, and spread bacterial wilt. Larvae bore into roots and also feed on stems at or below soil line. Insects usually attack young plants. Damaged plants wilt and sometimes die.

Distribution.—East of Rocky Mountains; related species are found throughout United States.

What to do.—Apply a dust con-
containing \( \frac{3}{4} \) percent of rotenone, at least 50 percent of cryolite, or 5 percent of methoxychlor as soon as plants come up; or use spray No. 5, 9, or 2 (pp. 2, 3). Repeat treatment once or twice a week as needed.

**Pickleworm**

*Description.*—Yellowish white; brownish head; up to \( \frac{3}{4} \) inch long. Numerous dark spots on young worm. (See inside back cover for natural-color illustration.)

*Damage.*—Feeds on flowers and leaf buds; tunnels flowers, terminal buds, vines, and fruits.

*Distribution.*—Southeastern part of the country as far north as Connecticut, Illinois, Iowa, and Kansas. Winters in southern Florida and Texas; spreads northward late in season.

*What to do.*—Very early spring plantings are seldom damaged. Apply a dust containing at least 50 percent of cryolite or \( \frac{3}{4} \) percent of rotenone; or use spray No. 9 or 5 (p. 3). Begin treating plants at first sign of worms in blossoms and buds; worms must be killed before they enter fruits. Repeat treatment once a week.

**Aphids.** (See p. 40.)

**Spider Mites.** (See p. 45.)

**Downy Mildew (fungus)**

*Symptoms and damage.*—Irregular brownish spots on older leaves; fruits not affected. Leaves dry, curl, and die. Also attacks cucumbers and watermelons. Fungus is not carried on seed, does not overwinter in soil.

*Distribution.*—Atlantic Coast and Gulf States.

*What to do.*—Apply spray No. 8 (p. 3), or a spray containing a fixed copper or organic fungicide, except ferbam and maneb, to plants; or use a copper or organic fungicide dust, except ferbam and maneb (pp. 4, 5). Grow mildew-resistant varieties such as Texas No. 1, Rio Sweet, and Rio Gold.

**Leaf Spot (fungus)**

*Symptoms and damage.*—Numerous small, round, brown spots on leaves; no spotting of fruits. Many leaves may be killed. Fungus lives on remains of diseased vines in soil.

*Distribution.*—Central, Southern, and Atlantic States.

*What to do.*—Do not grow melons or cucumbers in same soil oftener than once in 3 years. Apply spray No. 8 (p. 3), or a spray containing a fixed copper or organic fungicide, except ferbam and maneb to plants; or use a copper or organic fungicide dust, except ferbam and maneb (pp. 4, 5).

**Mosaic (viruses)**

*Symptoms and damage.*—Mottled (green and yellow) and curled leaves; stunted plants; reduced yields. East of Mississippi, disease caused by cucumber mosaic virus; in the Southwest, by cucumber, muskmelon, and squash mosaic viruses. Viruses live in perennial weeds; muskmelon and squash viruses are carried in muskmelon seed. Cucumber and muskmelon viruses are spread by aphids (plant lice); squash virus, by aphids and cucumber beetles.

*Distribution.*—Throughout U. S.

*What to do.*—Remove and destroy perennial weeds and diseased plants. Do not plant seed from infected plants. Follow recommendations for aphids (p. 40) and striped cucumber beetle (p. 21).

**Damping-Off.** (See p. 18.)

**Anthracnose.** (See p. 19.)

**Bacterial Wilt.** (See p. 18.)

**Root Knot.** (See p. 19.)

**MUSTARD.** (See Turnip.)

**OKRA**

**Corn Earworm**

*Description.*—Green, brown, or pink; up to \( 1\frac{3}{4} \) inches long. (See inside back cover for natural-color illustration.)
Damage.—Eats holes in pods.

Distribution.—Wherever okra is grown.

What to do.—Handpick and destroy worms and damaged pods. Apply a 5-percent DDT dust or spray No. 3 (p. 2) before pods form. After pods form, remove them before applying DDT.

Aphids. (See p. 40.)

Japanese Beetle. (See p. 43.)

Stink Bugs. (See p. 45.)

●

Wilt (fungi)

Symptoms and damage.—Yellow and wilted leaves; stunted plants. Occasionally does serious damage.

Distribution.—In the South.

What to do.—Do not grow okra in soil where wilt has occurred, or in any soil oftener than once in 3 years.

Root Knot (nematode)

Symptoms and damage.—Galls, or swellings, on roots; stunted plants. Galls on small roots are tiny; compound galls on large roots are up to an inch in diameter. Pearly white specks inside galls are egg masses of root knot nematode, which lives in soil. Damages many kinds of plants.

Distribution.—In southern areas; most common south of 40° latitude.

What to do.—If soil is heavily infested, the best thing to do is to move garden to another location, if possible. For some crops and in some locations, the treatment of the soil with nematicides is practicable. Information on the use of these in your area is best obtained from your State agricultural experiment station or county agent.

Onion Maggot

Description.—White root maggot; legless; up to 3/8 inch long.

Damage.—Burrows into bulbs.

Distribution.—Northern part of country.

What to do.—Add 1/8 teaspoon of a 50-percent heptachlor wettable powder to each 1/8-ounce packet of onion seed. Shake each packet well before using seed. Apply excess powder into planting furrow.

Wireworms. (See p. 46.)

Onion Thrips

Description.—Adult: Yellow or brownish; winged; active; about 3/25 inch long. Larva: White; wingless; looks like adult but is smaller.

Damage.—Adults and larvae suck out juices from plants. White blotches appear on leaves; tips of leaves wither and turn brown.

What to do.—Apply a 10-percent DDT dust or spray No. 3 (p. 2). If tops are to be eaten, apply a 4-percent malathion dust or spray No. 1 (p. 2). Caution: Do not apply malathion within 3 days of harvest. For more information on controlling onion thrips, see Leaflet 372, The Onion Thrips: How To Control It.

●

Smut (fungus)

Symptoms and damage.—Black pustules (blisters) filled with masses of fungus on leaves. Disease often kills young plants. Fungus overwinters in soil.

Distribution.—Northern States.

What to do.—Avoid soil where disease has occurred. If it is not possible to do so, sprinkle a formaldehyde solution (1 teaspoon to 1 quart of water) in row where seeds have been dropped before covering them with soil. Use 3 quarts of solution to 10 feet of row.

PARSNIP. (See Carrot Rust Fly, p. 16.)
Description.—Adult: Black; hump-backed; snout beetle; $\frac{1}{4}$ inch long. Larva: whitish; legless; yellowish head; up to $\frac{3}{4}$ inch long.

Damage.—Adults eat small holes in pods and peas. Larvae feed within the green seed.

Distribution.—East of Mississippi River and south of Tennessee and Virginia.

What to do.—Apply a 5-percent methoxychlor dust or spray No. 2 (p. 2). Caution: Do not apply methoxychlor within 7 days before a harvest.

Description.—Adult: Brownish; white, black, and grayish markings; $\frac{1}{6}$ inch long. Larvae: White; small brown head and mouth; up to $\frac{3}{4}$ inch long. (See inside front cover for natural-color illustration of adult.)

Damage.—Adults feed in blossoms and lay eggs on young pods. Larvae burrow into green seed.

Distribution.—Throughout United States; most troublesome in Utah, Idaho, Washington, Oregon, California, and New York.

What to do.—Apply a dust containing $\frac{3}{4}$ percent of rotenone, 5 percent of DDT, 5 percent of methoxychlor, or 4 percent of malathion; or use spray No. 1, 2, 3, or 5 (pp. 2, 3). Treat plants while adults are in blossom and before first pods form. Do not apply DDT to varieties with edible pods after the pods form. Do not apply methoxychlor within 7 days before a harvest, or malathion within 3 days before a harvest.

Aphids. (See p. 40.)
Root Maggots. (See p. 45.)
Cutworms. (See p. 40.)

Seed Decay (fungi)

Symptoms and damage.—Seed rots in soil. Disease is most common during cool, moist weather. Fungi live in soil.

Distribution.—Throughout United States.

What to do.—Treat seed with a protective fungicide (p. 5).

Bacterial Blight

Symptoms and damage.—Large, watersoaked spots on pods; irregular dark spots on leaves; cream-colored, shining ooze in centers of spots. Bacteria are carried on seed and live in remains of vines. (See back cover for natural-color photograph.)

Distribution.—Throughout United States, except in semiarid regions of the West.

What to do.—Plant western-grown seed (infection less likely than in seed grown east of Rocky Mountains).

Root Rot (fungus)

Symptoms and damage.—Yellowish, unthrifty plants; rotted and yellowish-brown, red, or black stems (below ground) and roots. Disease often kills plants at flowering time. Fungus lives in soil.

Distribution.—Throughout United States.

What to do.—Avoid growing peas continually in same soil. Make sure soil is well-drained; excessive moisture favors disease.

Fusarium Wilt (fungus)

Symptoms and damage.—Yellowed leaves; wilted plants. Interior of
stems are lemon yellow. Disease sometimes kills plants. Fungus lives in soil and enters through roots.

Distribution.—Throughout United States.

What to do.—Grow wilt-resistant varieties such as Alaska, Improved Gradus, Dwarf Alderman, Alderman, and Teton.

**Ascochyta Pod Spot (fungus)**

**Symptoms and damage.**—Irregular, light-colored spots with dark margins on pods; concentric circular spots with tiny dark dots on leaves; spots on stems near soil. Fungus is carried on seed and lives on remains of old infected vines.

**Distribution.**—Central, Southern, and Northeastern States.

**What to do.**—Remove and burn diseased vines after crop is picked. Plant western-grown seed.

**Hornworms**

**Description.**—Two species. Green; diagonal lines on sides; prominent horn on rear end; up to 4 inches long.

**Damage.**—Eat foliage and fruit.

**Distribution.**—Throughout United States; infestations localized.

**What to do.**—Handpick worms. If damage is heavy, apply 5- to 10-percent TDE dust or spray No. 11 (p. 3). A 5- or 10-percent DDT dust or spray No. 3 (p. 2) is effective for controlling the species most common in northern part of country. Caution: Wash treated pods thoroughly.

**Aphids.** (See p. 40.)

**Cutworms.** (See p. 40.)

**Flea Beetles.** (See p. 44.)

**Damping-Off (fungi)**

**Symptoms and damage.**—Seed decay in soil; young plants collapse and die. Fungi live in soil.

**Distribution.**—Throughout United States.

**What to do.**—Treat seeds with a protective fungicide (p. 5).

**Bacterial Leaf Spot**

**Symptoms and damage.**—Small, yellowish-green spots on young leaves; spots (1/8 to 1/4 inch in diameter) with dead, straw-colored centers and dark margins on old leaves; small, rough, corky looking spots on fruits. Old leaves turn yellow and drop. Bacteria are carried on seed and live in soil. (See front cover for natural-color photograph.)

**Distribution.**—In all but semiarid regions.

**What to do.**—Treat seed, for 5 minutes, in a 1:2,000 corrosive sublimate solution (p. 5). Follow up treatment with a protective fungicide.
for protection against damping-off. Plant seed in new seedbed soil. If plants show damage, apply a copper dust (p. 4); or use spray No. 8 (p. 3) or a fixed copper spray (p. 4).

Cercospora Leaf Spot (fungus)

Symptoms and damage.—Circular, water-soaked spots on leaves and stems. Spots enlarge ¼ to ½ inch in diameter, turn white in centers, and have dark margins. Infected leaves often drop. Occasionally does serious damage. Fungus is carried on seed. Distribution.—Most common in Southeastern and Gulf States.

What to do.—Same as for bacterial leaf spot, above.

Anthracnose (fungus)

Symptoms and damage.—Large, dark-brown or black spots (whose centers have black specks) on fruits. Sun-scalded fruits often attacked by another fungus that causes spotting similar to anthracnose. Fungus is carried on seed and lives in soil. Distribution.—Central, Southern, and Atlantic Coast States.

What to do.—Plant clean seed. Do not grow peppers in same soil.

Mosaic (viruses)

Symptoms and damage.—Mottled (green and yellow) and curled leaves; fruits sometimes are yellowed or show green ring spots; stunted plants; reduced yields. Disease is caused by tomato or cucumber mosaic viruses. Distribution.—Throughout United States.

What to do.—Follow recommendations for cucumber mosaic (p. 19) and tomato mosaic (p. 37). Grow varieties such as Burlington, Yolo Wonder, and Rutgers World Beater No. 13; they are resistant to tomato mosaic but not to cucumber mosaic.

Blossom-End Rot (physiologic)

Symptoms and damage.—Light-colored, sunken, water-soaked spots near blossom end of fruits. Spots enlarge; one-third of fruit may become dark and shriveled. Fungi may grow over spots. Distribution.—Throughout United States.

What to do.—Avoid excessive use of nitrogenous fertilizer and use ample amounts of superphosphate. Avoid overwatering or drying out soil; maintain even soil moisture at all times.

![POTATO](image)

Colorado Potato Beetle

Description.—Adult: Yellow; black-striped; 3/8 inch long. Larva: Brick-red; humpbacked; up to ½ inch long. (See inside back cover for natural-color illustration of adult and larva.) Damage.—Adults and larvae defoliate plants; they are especially destructive to small plantings. Distribution.—In all States except California and Nevada; principal damage in Eastern States.

What to do.—Apply a dust containing 5 percent of DDT or ½ percent of rotenone; or use spray No. 3 or 5 (pp. 2, 3). Handpick beetles and crush egg masses (effective if done often).

Blister Beetles

![Blister Beetles](image)

Description.—Many species. Gray, black, or striped; slender; ½ to ¾ inch long. Damage.—Eat leaves. Distribution.—Throughout United States; usually occur late in season. Infestations localized.

What to do.—Apply a dust containing 5 percent of DDT, at least 50 percent of cryolite, or 5 percent of methoxychlor; or use spray No. 3, 9, or 2 (pp. 2, 3). Handpick beetles;
wear gloves while doing so; the beetles discharge a caustic fluid that may blister skin.

**Leafhoppers**

*Description.*—Several species. Adults: Green; wedge shaped; up to \( \frac{1}{2} \) inch long; they fly quickly when disturbed. Nymphs resemble adults but are smaller; they crawl sidewise like crabs. (See inside front cover for natural-color illustration of adult potato leafhopper.)

*Damage.*—Adults and nymphs attack potatoes and cause hopperburn. Tips and sides of potato leaves curl upward, turn yellow to brown, and become brittle. Potato and western potato leafhoppers are most destructive.

*Distribution.*—Potato leafhopper: Eastern half of United States. Western potato leafhopper: Parts of Southwest.

*What to do.*—Apply a dust containing 5 percent of DDT, methoxychlor, or malathion; or use spray No. 3, 2, or 1 (p. 2).

**Potato Tuberworm**

*Description.*—Pinkish-white; brown head; up to \( \frac{1}{2} \) inch long.

*Damage.*—Tunnels in stems, leaves, and tubers; shoots wilt and die.

*Distribution.*—Some southern States and in California; infestations localized.

*What to do.*—Keep garden free of weeds, and keep potato plants deeply hilled with soil. Apply a 5-percent DDT dust or spray No. 3 (p. 2). Do not expose tubers to infested foliage after digging.

*Aphids.* (See p. 40.)

*Aphids.* (See p. 44.)

*Wireworms.* (See p. 46.)

*Mole Crickets.* (See p. 41.)

*White Grubs.* (See p. 44.)

*White-Fringed Beetles.* (See p. 42.)

*Millipedes.* (See p. 45.)

*Sowbugs.* (See p. 41.)

**Common Scab (fungus)**

*Symptoms and damage.*—Rough, scabby, raised or pitted spots on tubers. Fungus is carried on tubers and lives in soil.

*Distribution.*—Throughout United States.

*What to do.*—Plant clean tubers. Do not grow potatoes in soil where disease has occurred. Do not use lime, woodashes, or fresh stable manure on infested soil. Grow scab-resistant varieties such as Cayuga, Cherokee, Early Gem, Menominee, Ontario, and Seneca.

**Early Blight (fungus)**

*Symptoms and damage.*—Leaves show small, irregular, dark-brown spots, which often enlarge and have targetlike markings. Disease injures foliage, reduces yields. Fungus is carried in soil, may be present in tubers.

*Distribution.*—Central, Southern, and Eastern States.

*What to do.*—Plant clean tubers. Apply spray No. 8 (p. 3), or a spray containing a fixed copper or organic fungicide (pp. 4, 5) at 7- to 10-day intervals; or use a dust containing a copper or organic fungicide (pp. 4, 5).

**Late Blight (fungus)**

*Symptoms and damage.*—Dark, irregular dead areas on leaves and stems. Infected tubers may rot in storage. Disease may kill plants early in season; it is worst in cool, moist weather. Fungus is carried in tubers. Also affects tomatoes.

*Distribution.*—Most common in North Central, Northeastern, and Atlantic States.

*What to do.*—Plant clean tubers. Apply spray No. 8 (p. 3), or a spray containing a fixed copper or organic fungicide, except ferbam and ziram (pp. 4, 5), every 7 to 10 days; or use a dust containing a copper or organic fungicide, except ferbam and ziram (pp. 4, 5). Grow blight-resistant varieties such as Sebago, Kennebec, Saco, Pungo, and Essex. Do not dig up tubers from diseased plants until tops are dead.
Wilt and Dry Rot (fungi)

Symptoms and damage.—Yellow leaves; drooping plants; brown rings inside stems and tubers. Infected tubers rot in storage. Fungi are carried in tubers and live in soil.

Distribution.—Throughout United States.

What to do.—Do not plant internally discolored tubers; plant certified seed. Do not grow potatoes in soil where disease has occurred.

Mosaic (viruses)

Symptoms and damage.—Mottled (light and dark green) and curled leaves; stunted plants; reduced yields. Caused by several viruses that are carried in tubers and spread by aphids.

Distribution.—Throughout United States.

What to do.—Plant clean tubers; use certified seed. Grow disease-resistant varieties (resistant to some forms of mosaic): Cherokee, Chippewa, Katahdin, Kennebec, Pungo, Saco, and Sebago.

Leaf Roll (virus)

Symptoms and damage.—Upward rolling of lower leaves; yellow and stunted plants; brown specks in tubers. Virus is carried in tubers and spread by aphids.

Distribution.—Throughout United States.

What to do.—Plant clean tubers; use certified seed. Grow disease-resistant varieties. Katahdin and Saco are resistant to tuber discoloration and have some resistance of leaf rolling. Kennebec, Sebago, and Chippewa are also resistant to tuber discoloration but leaves may roll.

Radish

Root Maggots

Description.—Several species (includes seed-corn and cabbage maggots). Yellowish white; legless; \( \frac{1}{4} \) to \( \frac{1}{3} \) inch long.

Damage.—Tunnel edible roots.

Distribution.—Throughout United States.

What to do.—Apply a 5-percent chlordane dust or spray No. 7 (p. 3) when first leaves appear. Repeat treatment shortly after thinning. Caution: Do not apply to plants past the seedling stage.

Raspberry

Raspberry Fruitworms. (See p. 12.)
Orange Tortrix. (See p. 12.)
Red-Necked Cane Borer. (See p. 12.)
Stink Bugs. (See p. 45.)
Raspberry Cane Borer. (See p. 12.)
Aphids. (See p. 40.)
Rose Chafer. (See p. 41.)
Japanese Beetle. (See p. 43.)

Anthracnose (fungus)

Symptoms and damage.—Small gray spots that have dark margins on leaves; purplish spots (about 1 inch in diameter) that have ash-gray centers and raised purplish margins on canes. Badly infected canes are girdled; canes crack lengthwise. Fruits often fail to ripen normally, or wither on canes. Black raspberry canes are more susceptible than those of red varieties. Fungus lives on diseased canes.

Distribution.—Throughout United States.

What to do.—Plant clean nursery stock. Cut and burn fruiting canes after harvest. Remove and destroy new canes that become badly infected. Keep rows free from weeds. Make 3 applications of spray No. 8 (p. 3) or ferbam (p. 5). Begin first application just as leaves appear; second, just before blooms open; third, just after blossoms have fallen and young berries are well set.

Orange Rust (fungus)

Symptoms and damage.—Spindly shoots; small, pale-green leaves; blis-
terlike pustules on underside of leaves. Pustules burst, releasing reddish-orange fungus spores. When disease occurs in old hills, only a few canes may be rusted the following spring; on new plantings, infected canes do not blossom the following spring, and plants are rusted as long as they live. Attacks black raspberries; rarely affects red varieties. Fungus lives in diseased canes.

**Distribution.**—Throughout United States.

**What to do.**—Plant only rust-free stock. If young plants show rust, dig and burn them. If plants in old hills are infected, cut and burn parts of crowns that are injured; remainder of plant may be saved.

**Leaf Spot (fungus)**

**Symptoms and damage.**—Circular or irregular gray spots, about 1/8 inch in diameter, on leaves; stunted canes; reduced yields. Severely spotted leaves drop; canes may be nearly bare in fall. Disease is worst in hot weather. Fungus lives in diseased leaves on the ground.

**Distribution.**—Eastern United States; particularly in southern half of country.

**What to do.**—Make 3 applications of spray No. 8 (p. 3) every 3 or 4 weeks. Begin first application after harvest, when old canes have been removed.

**Mosaic (virus)**

**Symptoms and damage.**—Red raspberries: Raised dark-green spots surrounded by yellow-green tissue on leaves; stunted plants; reduced yields. Leaves that develop in hot weather show only faint symptoms of disease. Black raspberries: Dwarfed and mottled leaves; stunted plants. Virus may kill tips of shoots; severely stunted plants die. Other viruses attacking only black raspberries cause leaves to become flecked with yellow and green, dwarfed, yellowed, and to curl upward at edges. Mosaic viruses are spread by aphids (plant lice).

**Distribution.**—Throughout United States.

**Leaf Curl (virus)**

**Symptoms and damage.**—Leaves are curled and rounded; tissue between veins is arched upward; fruits ripen prematurely and are not edible. Symptoms first appear at tip of a single cane; following season all canes affected; in a few years shoots may be only a few inches high. Virus attacks both red and black varieties; it is spread by aphids.

**Distribution.**—From Ohio westward.

**What to do.**—Same as for mosaic, above.

**Foot Rot or Crown Rot (fungus)**

**Symptoms and damage.**—Brown sunken spots at base of leaf stalks; decayed stalks; wilted leaves. Disease spreads rapidly in row. Fungus is carried on roots and lives in soil.

**Distribution.**—Central and Eastern States.
What to do.—Remove and destroy diseased plants. Do not use roots from beds where disease has occurred. Apply spray No. 8 (p. 3) or a fixed copper spray (p. 4) deep into crowns of plants. Note: Spray No. 8 (bordeaux mixture) should be applied very early in spring or after harvest; it causes spotting on stalks if applied during harvest.

SPINACH

Aphids. (See p. 40.)
Root Maggots. (See p. 45.)
Cutworms. (See p. 40.)
Vegetable Weevil. (See p. 42.)
Beet Webworm. (See p. 11.)

Seed Decay (fungi)

Symptoms and damage.—Seed rots in soil. Disease most common in cool, moist weather. Fungi live in soil. Distribution.—Throughout United States.
What to do.—Treat seed with a protective fungicide (p. 5).

Blue Mold (fungus)

Symptoms and damage.—Yellow spots on upper surfaces of leaves; downy, purple, or blue-colored mold on undersides of leaves. Disease is worst during cool, highly humid weather.
Distribution.—Southeastern and Central States.
What to do.—If disease occurs, harvest all mature plants at once.

Blight, or Yellows (virus)

Symptoms and damage.—Yellowed and curled leaves; stunted plants; reduced yields. Disease is caused by cucumber mosaic virus, which is spread by aphids (plant lice).
Distribution.—Throughout United States.
What to do.—Grow blight-resistant varieties such as Virginia Savoy and Old Dominion. Follow recommendations for cucumber mosaic (p. 19).

SQUASH AND PUMPKIN

Pickleworm

Description.—Yellowish white; brownish head; up to \( \frac{3}{4} \) inch long. Numerous dark spots on young worm. (See inside back cover for natural-color illustration.)
Damage.—Feeds on flowers and leaf buds; tunnels flowers, terminal buds, vines, and fruits.
Distribution.—Southeastern part of country as far north as Connecticut, Illinois, Iowa, and Kansas. Winters in southern Florida and Texas and spreads northward late in season.
What to do.—Very early spring plantings are seldom damaged. Apply a dust containing at least 50 percent of cryolite or \( \frac{3}{4} \) percent of rotenone; or use spray No. 9 or 5 (p. 3). Begin treating plants at first sign of worms in blossoms and buds; worms must be killed before they enter fruits. Repeat treatment once a week. Caution: If you use cryolite, wash or peel harvested squash to remove insecticide residues.

Squash Bug

Adult

Nymph

Description.—Adult: Brownish, flat-backed stink bug; \( \frac{5}{8} \) inch long. Nymph: Varies from bright green with red head and legs to dark greenish-gray with black head and legs; up to \( \frac{3}{8} \) inch long. Egg clusters are shiny brick-red; they are found on leaves.
Damage. — Adults and nymphs feed in colonies; they suck sap from leaves and stems. Plants wilt and die. Distribution. — Throughout United States.

What to do. — No satisfactory control is known. Handpick adults and eggs. Trap bugs under boards placed on soil around plants; collect and destroy bugs every morning. Apply a dust containing 10 to 20 percent of sabadilla to the plants; or apply 5-percent DDT dust or spray No. 3 (p. 2) to soil beneath plants. Caution: Do not apply DDT directly to squash foliage as it may cause injury.

Squash Vine Borer

Description. — Larva: White; up to 1 inch long.

Damage. — Bores in vines; eats holes in stem near base of runner. Runner wilts.

Distribution. — East of Rocky Mountains.

What to do. — Locate points of injury. Split one side of stem with razor blade or sharp knife and puncture worm. Put a mound of moist dirt around each cut stem to prevent drying and to induce root growth beyond point of injury. Partial control may be obtained by applying dust containing \( \frac{3}{4} \) percent of rotenone or spray No. 3 (p. 2). Begin application when runners develop; repeat treatment once a week.

Striped Cucumber Beetle

Description. — Adult: Yellow to black; 3 black stripes down back; \( \frac{3}{8} \) inch long. Larva: White; slender; brownish at the ends; up to \( \frac{3}{8} \) inch long. (See inside front cover for natural-color illustration of adult.)

Damage. — Adults feed on leaves, stems, and fruit; they spread bacterial wilt and squash mosaic. Larvae bore into roots and also feed on stems at or below soil line. Damaged plants wilt and sometimes die.

Distribution. — East of Rocky Mountains; related species are found in some Western States.

What to do. — Apply a dust containing \( \frac{3}{4} \) percent of rotenone or 5 percent of methoxychlor as soon as plants come up; or use spray No. 5 or 2 (pp. 2, 3). Repeat treatment once or twice a week. Caution: Do not apply methoxychlor within 7 days before a harvest.

Cutworms. (See p. 40.)
Root Maggots. (See p. 45.)

Mosaic (viruses)

Symptoms and damage. — Yellow spots on leaves, and occasionally, on fruits; stunted plants; reduced yields. Most common on straightneck and crookneck summer squash. Disease caused by cucumber and squash mosaic viruses. Cucumber mosaic virus is spread by aphids (plant lice), and squash mosaic virus by aphids and cucumber beetles. Viruses live in perennial weeds. Squash virus, unlike cucumber virus, is carried in some of the seeds of mosaic plants.


What to do. — Remove and destroy diseased plants and perennial weeds. Follow recommendations for cucumber beetle, above, and aphids (p. 40).

Bacterial Wilt (bacterium). (See p. 18.)
Scab (fungus). (See p. 19.)

Strawberry Weevil

Description. — Adult: Chestnut-brown; 2 black spots on back; about \( \frac{1}{8} \) inch long; its snout is half the
length of the body. Larva: Creamy white; curved grub; up to $\frac{1}{10}$ inch long.

**Damage.**—Adults sever stems of fruit buds, which fall to the ground. Larvae feed within fruit buds.

**Distribution.**—Eastern States.

**What to do.**—Apply a 5-percent methoxychlor dust or spray No. 2 (p. 2). **Caution:** Do not apply methoxychlor within 7 days before a harvest.

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**Spider Mites (Red Spiders)**

**Description.**—Several species. Adults and young: Tiny (barely visible to naked eye); red or greenish red; found on underside of leaves. Not classified as insects.

**Damage.**—Yellow specks and fine webs on leaves. Plants and fruits are stunted.

**Distribution.**—Throughout United States.

**What to do.**—Apply a 3-percent impregnated Aramite dust or spray No. 13 (p. 3). **Caution:** Do not apply Aramite within 21 days before a harvest. If plants need treating during the harvest period, apply dusting sulfur (at least 25 percent) or spray No. 12 (p. 3). These insecticides are only partially effective against mites.

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**Strawberry Root Weevil**

**Description.**—Adult: Dark brown to black snout beetle; $\frac{3}{4}$ inch long. Larva: White to pinkish; legless; brown head; up to $\frac{1}{4}$ inch long.

**Damage.**—Adults feed on edges of leaves. Larvae burrow into crowns of plants and feed on roots. Similar damage is caused by several related species.

**Distribution.**—Northern part of country, particularly Northwestern States.

**What to do.**—Apply a 5-percent chlordane dust or spray No. 7 (p. 3) before plants begin to bloom and again after harvest. In preparing new beds, treat soil with chlordane, as recommended for white grubs (p. 44). Commercial poison baits, available in some areas, are often effective against adults.

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**Spittlebugs**

**Description.**—Several species. Nymphs: Pinkish to yellowish green; up to $\frac{3}{16}$ inch long; usually found under masses of white froth, or spittle, which they produce. They hatch in spring from eggs laid by leafhopper-like adults the previous fall.

**Damage.**—Nymphs suck plant juices, causing stunted plants. (Adults do no damage.)

**Distribution.**—Northern States.

**What to do.**—Apply a dust con-
taining 5 percent of methoxychlor or \( \frac{3}{4} \) percent of rotenone when masses of spittle form; or use spray No. 2 or 5 (pp. 2, 3). Caution: Do not apply methoxychlor within 7 days before a harvest. (See Leaflet 341, The Meadow Spittlebug: How To Control It, for further information.)

Aphids. (See p. 40.)
Flea Beetles. (See p. 44.)
White Grubs. (See p. 44.)
Mole Crickets. (See p. 41.)
Ants. (See p. 39.)
Earwigs. (See p. 46.)

Leaf Spot (fungus)

Symptoms and damage. Brown to white spots (\( \frac{1}{4} \) to \( \frac{1}{2} \) inch in diameter) that have purplish borders on leaves. Fungus lives in diseased leaves.
Distribution.—Throughout United States; particularly in Gulf States.

What to do.—Not often serious. Can be controlled by applying spray No. 8 (p. 3) or a fixed copper fungicide spray (p. 4) as soon as new spring growth appears. Repeat treatment every 10 days until first berries are about one-third grown. Remove and destroy old leaves when making new plantings, and after harvest.

Red Stele (fungus)

Symptoms and damage.—Small, slightly bluish leaves with short petioles; red centers in large, live roots. Fibrous roots rot; plants wilt and die at fruiting time. Fungus is carried in soil; it thrives in poorly drained soil.
Distribution.—Pacific Coast, Central, Northeastern, and Middle Atlantic States.

What to do.—Dig out and burn diseased plants. Do not replant in soil where disease has occurred unless resistant varieties such as Temple, Pathfinder, Sparkle, Fairland, or Vermillion are used.

Berry Rots (fungi)

Symptoms and damage.—Decayed fruits, which vary in color from gray to leathery brown (color depends on fungus causing rot). Disease is worst during rainy harvests. Fungi live in soil.
Distribution.—Throughout United States.

What to do.—Mulch plants to keep berries off the soil. Space plants 6 to 8 inches apart to prevent shading of berries. Do not use nitrogenous fertilizers early in spring.

Yellows and Crinkle (viruses)

Symptoms and damage.—Yellowed, dwarfed, crinkled, and twisted leaves; malformed fruits. Plants do not die, but yields are reduced. Runners from diseased mother plant are affected.
Distribution.—Pacific Coast States.

What to do.—No control. Dig out and destroy diseased plants. Use only disease-free plants.

Leaf Variegation, or June Yellows (noninfectious)

Symptoms and damage.—Yellow spots or streaks on leaves. Plants do not die, but yields are reduced. Runners from diseased mother plant are affected.
Distribution.—Wherever Blake more and Premier are grown.

What to do.—Do not use runners from diseased mother plants. Grow "yellows-resistant" strains of Blakemore and Premier varieties.

Berry Rots (fungi)

Symptoms and damage.—Decayed fruits, which vary in color from gray to leathery brown (color depends on fungus causing rot). Disease is worst during rainy harvests. Fungi live in soil.
Distribution.—Throughout United States.

What to do.—Mulch plants to keep berries off the soil. Space plants 6 to 8 inches apart to prevent shading of berries. Do not use nitrogenous fertilizers early in spring.

Yellows and Crinkle (viruses)

Symptoms and damage.—Yellowed, dwarfed, crinkled, and twisted leaves; malformed fruits. Plants do not die, but yields are reduced. Runners from diseased mother plant are affected.
Distribution.—Pacific Coast States.

What to do.—No control. Dig out and destroy diseased plants. Use only disease-free plants.

Leaf Variegation, or June Yellows (noninfectious)

Symptoms and damage.—Yellow spots or streaks on leaves. Plants do not die, but yields are reduced. Runners from diseased mother plant are affected.
Distribution.—Wherever Blakemore and Premier are grown.

What to do.—Do not use runners from diseased mother plants. Grow "yellows-resistant" strains of Blakemore and Premier varieties.

Red Stele (fungus)

Symptoms and damage.—Small, slightly bluish leaves with short petioles; red centers in large, live roots. Fibrous roots rot; plants wilt and die at fruiting time. Fungus is carried in soil; it thrives in poorly drained soil.
Distribution.—Pacific Coast, Central, Northeastern, and Middle Atlantic States.

What to do.—Dig out and burn diseased plants. Do not replant in soil where disease has occurred unless resistant varieties such as Temple, Pathfinder, Sparkle, Fairland, or Vermillion are used.

Berry Rots (fungi)

Symptoms and damage.—Decayed fruits, which vary in color from gray to leathery brown (color depends on fungus causing rot). Disease is worst during rainy harvests. Fungi live in soil.
Distribution.—Throughout United States.

What to do.—Mulch plants to keep berries off the soil. Space plants 6 to 8 inches apart to prevent shading of berries. Do not use nitrogenous fertilizers early in spring.

Yellows and Crinkle (viruses)

Symptoms and damage.—Yellowed, dwarfed, crinkled, and twisted leaves; malformed fruits. Plants do not die, but yields are reduced. Runners from diseased mother plant are affected.
Distribution.—Pacific Coast States.

What to do.—No control. Dig out and destroy diseased plants. Use only disease-free plants.

Leaf Variegation, or June Yellows (noninfectious)

Symptoms and damage.—Yellow spots or streaks on leaves. Plants do not die, but yields are reduced. Runners from diseased mother plant are affected.
Distribution.—Wherever Blakemore and Premier are grown.

What to do.—Do not use runners from diseased mother plants. Grow "yellows-resistant" strains of Blakemore and Premier varieties.
1, 4, and 7 days after silks appear. A 10-percent DDT dust is partially effective.

**European Corn Borer**

*Description.*—Pale, pink, or brown; dark-brown head; up to 1 inch long.

*Damage.*—Feeds in stalks and ears; may enter ear at base, side, or tip.

*Distribution.*—From northern South Carolina, northward to Maine and westward to Montana, Colorado, and Oklahoma.

*What to do.*—Apply spray No. 3 (p. 2) or a 10-percent DDT dust to ear shoots and centers of leaf whorls at first sign of borers. Repeat treatment at least three times at 5-day intervals. The spray is more effective than the dust. Use about 1½ gallons of spray per 100 stalks, and apply it until runoff occurs at the base of the plants.

**Corn Sap Beetles**

*Description.*—Several species. Adults: Usually black; 3/16 inch long. Larvae: White to cream colored; maggotlike; active; up to ¼ inch long; they scatter over ear when exposed to light.

*Damage.*—Adults seldom do damage. Larvae eat into kernels of roasting ears.

*Distribution.*—Eastern United States; and as far west as Colorado.

*What to do.*—No satisfactory control. Recommendations for corn earworm (p. 33) are partially effective.

**Wireworms.** (See p. 46.)  
**Japanese Beetle.** (See p. 43.)  
**Root Maggots.** (See p. 45.)  
**Cutworms.** (See p. 40.)  
**White Grubs.** (See p. 44.)

**Seed Decay and Seedling Blight (fungi)**

*Symptoms and damage.*—Seed decay in soil; young plants die. Fungi are carried in seed and live in the soil.

*Distribution.*—Throughout United States.

*What to do.*—Treat seed with a protective fungicide (p. 5).

**Bacterial Wilt**

*Symptoms and damage.*—Wilted and dwarfed plants; tassels whiten early. Yellow, bacterial slime oozes from cut stalks. The bacteria are carried on seed; also carried by insects that spread them in the field.

*Distribution.*—Central, Southern, and Eastern States.

*What to do.*—Grow wilt-resistant varieties such as Stowell’s Evergreen, Golden Cross Bantam, Marcross, Spancross, or Whipcross. Most white late varieties are somewhat resistant; other resistant varieties are listed by seedsmen.

**Smut (fungus)**

*Symptoms and damage.*—Large, irregularly shaped white galls, or outgrowths, form on stalks, ears, and tassels. Galls burst, releasing masses of black fungus spores. Fungus lives in soil.

*Distribution.*—Throughout United States.

*What to do.*—Remove and destroy galls. Do not use diseased plants in making compost.

**Sweetpotato Weevil**

*Description.*—Adult: Reddish snout beetle; shiny; antlike; slender-bodied; bluish-black head; ¼ inch long. Larva: White; legless; pale-brown head; up to ½ inch long.

*Damage.*—Adults seldom cause damage. Larvae tunnel through sweetpotatoes and vines.

*Distribution.*—Parts of Texas,
Louisiana, Mississippi, Alabama, Florida, Georgia, South Carolina.

What to do.—Apply 2- to 2 3/8-per cent dieldrin or heptachlor dust along the row in a strip 6 to 8 inches wide. Direct the dust to the surface of the soil beneath the foliage at the bases of the plants. Apply as soon as the roots begin to enlarge; repeat treatment 2 weeks later. Do not apply dieldrin or heptachlor within 30 days before harvest. Do not allow the weevil to breed in your stored sweet potatoes. For information on how to protect stored sweet potatoes, consult the agricultural college or department of agriculture in your State.

Wireworms. (See p. 46.)

Stem Rot, or Wilt (fungus)

Symptoms and damage.—Yellowed and wilted plants. When cut across, stems have a black discoloration; roots, a black ring. Fungus overwinters in fleshy roots and in the soil, and infects roots and stems of young plants.

Distribution.—Throughout U. S.

What to do.—Use plants with clean, white roots. Remove and destroy diseased plants. Do not plant sweet potatoes in same soil every year.

Black Rot (fungus)

Symptoms and damage.—Black, sunken, roundish spots on sweet potatoes; black cankers on underground parts of stems. Fungus overwinters in diseased roots and in the soil, and attacks slips in plant bed. Disease is spread in storage.

Distribution.—Throughout U. S.

What to do.—Same as for stem rot, above.

Black Rot (fungus)

Symptoms and damage.—Black, sunken, roundish spots on sweet potatoes; black cankers on underground parts of stems. Fungus overwinters in diseased roots and in the soil, and attacks slips in plant bed. Disease is spread in storage.

Distribution.—Throughout U. S.

What to do.—Same as for stem rot, above.

Colorado Potato Beetle

Description.—Adult: Yellow; black-striped; 3/8 inch long. Larva: Brick-red; humpbacked; up to 3/8 inch long. (See inside back cover for natural-color illustration of adult and larva.)

Damage.—Adults and larvae defoliate plants. Insect is a new pest of tomatoes.

Distribution.—In all States except California and Nevada; known as a pest of tomatoes in Middle Atlantic States only.

What to do.—Apply a dust containing 5 percent of DDT, 3/4 percent of rotenone, or at least 50 percent of cryolite; or use spray No. 5, 3, or 9 (pp. 2, 3). Handpick beetles and crush egg masses (effective if done often). Caution: Do not apply DDT or cryolite within 5 days before a harvest.

Tomato Russet Mite

Description.—Not visible to naked eye; mite can be seen with a 20-power hand lens. It is white and pear shaped. Not classified as insect.

Damage.—Lower stems become bronze, or russet; damage spreads up the plant and to underside of leaves; fruit may become bronzed. Plants have smoked appearance.

Distribution.—Mite is a new pest of
tomatoes. It is most common in California, but localized infestations have been scattered over the country.

**What to do.**—Apply a dust containing 25 to 50 percent of dusting sulfur when fruit begins to set; or use spray No. 12 (p. 3). Repeat treatment every 2 weeks. **Caution:** Higher dosages of sulfur dust may injure plants.

### Stalk Borer

**Description.**—Slender; up to 1¼ inches long. **Young borer:** Creamy white; dark purple band around the body; several brown or purple stripes running lengthwise down the body. **Full-grown borer:** Creamy white to light purple without band and stripes.

**Damage.**—Eats tunnel in stem, causing plant to wither and die. Tunnel usually has opening up to ¼ inch in diameter at its lower end.

**Distribution.**—Eastern part of country.

**What to do.**—Remove and destroy weeds; the insect breeds in weeds. Plant may be saved by puncturing the insect. To locate the borer split the stems lengthwise above opening to tunnel. Bind split stem and keep plant watered.

### Hornworms

**Description.**—Two species. Green; diagonal lines on sides; prominent horn on rear end; up to 4 inches long.

**Damage.**—Eat foliage and fruit.

**Distribution.**—Throughout United States; infestations localized.

**What to do.**—Handpick worms. If damage is heavy, apply undiluted cryolite dust, a 5- to 10-percent TDE dust, or spray No. 9, 3, or 11 (pp. 2, 3). A 5- or 10-percent DDT dust is effective for controlling the hornworm most common in the northern part of the country. **Caution:** Do not apply these insecticides within 5 days before a harvest.

### Blister Beetles

**Description.**—Many species. Gray, black, or striped; slender; ½ to ¾ inch long.

**Damage.**—Eat leaves.

**Distribution.**—Throughout United States; infestations localized.

**What to do.**—Apply a dust containing 5 percent of DDT, or methoxychlor, or at least 50 percent of cryolite; or use spray No. 2, 3, or 9 (pp. 2, 3). Handpick beetles; wear gloves while doing so; the beetles discharge a caustic fluid that may blister skin. **Caution:** Do not apply these insecticides within 5 days before a harvest.

### Damping-Off (fungi)

**Symptoms and damage.**—Seed decay in soil; young plants collapse and die. Fungi live in soil.

**Distribution.**—Throughout United States.

**What to do.**—Treat seed with a protective fungicide (p. 5).

### Fusarium Wilt (fungus)

**Symptoms and damage.**—Gradual yellowing and wilting of foliage (beginning with lower leaves); browning of woody tissue under the outer green portion of the stem. Plants may die. Fungus lives in soil and enters through roots. (See back cover for natural-color photograph.)

**Distribution.**—Throughout United
States; particularly in Southern States.

What to do.—Grow highly wilt-resistant varieties such as Pan America, Southland, Jefferson, Manalucie, Homestead, Brookston, and Sunray (a yellow variety). Marglobe, Rutgers, Pritchard, Pearson, and Break O’Day are fairly resistant to the disease. Spraying or dusting not effective.

Early Blight (fungus)

Symptoms and damage.—Leaves show small irregular dark-brown spots which often enlarge into circular spots that have targetlike markings. Brown cankers on stems that may girdle plants at ground line. Dark, leathery, decayed spots at stem end of fruits. Disease is worst in warm, moist weather. Fungus may be carried on seeds; it lives in soil.

Distribution.—Throughout United States, with the exception of semiarid regions.

What to do.—Use clean plants. Apply spray No. 8 (p. 3) or a spray containing a fixed copper or organic fungicide (pp. 4, 5) to plants every 7 to 10 days; or use a dust containing a copper or organic fungicide (pp. 4, 5).

Late Blight (fungus)

Symptoms and damage.—Dark, water-soaked spots on leaves; large water-soaked spots on fruits; white fungus growths on underside of leaves and occasionally on fruits during moist weather. Spots on leaves enlarge and turn brown; leaves wither. Spots on fruits turn brown and remain firm. Disease is worst in cool, moist weather. Fungus also causes late blight of potatoes. (See front cover for natural-color photograph.)

Distribution.—In humid areas, particularly east of the Mississippi River.

What to do.—Apply spray No. 8 (p. 3) or a spray containing a fixed copper or organic fungicide (pp. 4, 5), except ferbam or ziram, about 30 days after plants blossom; or use a dust containing a copper or organic fungicide, except ferbam or ziram (pp. 4, 5). Repeat treatment every 7 to 10 days.

Leaf Spot (fungus)

Symptoms and damage.—Small spots that have light centers and dark margins on leaves; dark specks in centers of spots. Many leaves may be killed, and crop reduced. Disease worst in warm, moist weather. Fungus lives in soil and on perennial weeds.

Distribution.—North Central, Northeastern, and Southeastern States.

What to do.—Remove or turn under vines in the fall. Destroy perennial weeds. Rotate crops. Apply spray No. 8 (p. 3) or a spray containing a fixed copper or organic fungicide (pp. 4, 5); or use a dust containing a copper or organic fungicide (pp. 4, 5).

Blossom-End Rot (physiologic)

Symptoms and damage.—Large, dark, sunken, leathery spots at the blossom ends of fruits. Disease occurs because soil dries too rapidly when plants are making a vigorous growth; most common during and following droughts. (See back cover for natural-color photograph.)

Distribution.—Throughout United States.

What to do.—Avoid excessive use of nitrogenous fertilizers, especially stable manure. Use ample amounts of superphosphate. When watering garden, maintain even moisture in soil.

Mosaic (virus)

Symptoms and damage.—Mottled (green and yellow) and curled foliage; stunted plants (if attacked early in season); reduced yields. Caused by tobacco mosaic virus, which is often present in manufactured tobacco; smokers may carry it on their hands and transmit it to tomato plants. The disease is spread by persons who handle plants and also by aphids (plant lice). Virus is not carried in seed and does not live long in soil. (See back cover for natural color photograph.)
Distribution.—Throughout United States.

What to do.—No remedy, except prevention. Avoid handling young plants. If you smoke, wash hands with soap and water before working in the garden; do not smoke while working with tomato plants.

Root Knot (nematode)

Symptoms and damage.—Galls, or swellings, on roots; stunted plants. Galls on small roots are tiny; compound galls on large roots may be an inch in diameter. Pearly white specks inside galls are egg masses of root knot nematode, which lives in soil. Damages many kinds of plants.

Distribution.—Southern part of country; most common south of 40° latitude.

What to do.—If soil is heavily infested, the best thing to do is to move garden to another location, if possible. For some crops and in some locations, the treatment of the soil with nematicides is practicable. Information on the use of these in your area is best obtained from your State agricultural experiment station or county agent.

Turnip Aphid (plant louse)

Description.—Tiny; greenish; looks like cabbage aphid but is not covered with whitish wax. Feeds in colonies on underside of leaves. (See inside front cover for natural-color illustration of cabbage aphid.)

Damage.—Curl leaves and yellowed plants.

Distribution.—Throughout United States, except in the Northwestern States. (Related species are found on turnips and mustard.)

What to do.—Apply a dust containing 3/4 percent of rotenone or 4 to 5 percent of malathion as soon as true leaves form; or use spray No. 1 or 5 (pp. 2, 3). Repeat treatments every 7 to 10 days. Caution: Do not apply malathion within 7 days of harvest.

Root Maggots

Description.—Several species (includes seed-corn and cabbage maggots). Yellowish white; legless; ¼ to ½ inch long.

Damage.—Tunnel edible roots.

Distribution.—Throughout United States.

What to do.—Apply a 5-percent chlordane dust or spray No. 7 (p. 3) when leaves appear. Repeat treatment shortly after thinning. Caution: Do not apply chlordane to foliage that is to be eaten. Do not apply to plants past the seedling stage.

Harlequin Bug

Description.—Adult and nymph: Black and brilliantly colored with red or yellow; shield shaped; up to ¾ inch long.

Damage.—Plants wilt; leaves turn brown as if scalded.

Distribution.—In southern part of country from California to Virginia. Infestations localized.

What to do.—Apply a 10- to 20-percent sabadilla powder, a 5/8 percent rotenone dust, or spray No. 5 (p. 3). (Rotenone is only partially effective.) If only the roots are to be eaten, apply a 5-percent DDT dust or spray No. 3 (p. 2). Caution: Do not apply DDT to foliage that is to be eaten.

Cabbage Looper. (See p. 13.)

Imported Cabbageworm. (See p. 13.)

Diamondback Moth. (See p. 13.)

Cabbage Webworm. (See p. 14.)

Vegetable Weevil. (See p. 42.)
Flea Beetles. (See p. 44.)  
Wireworms. (See p. 46.)

**WATERMELON**

**Striped Cucumber Beetle**

*Description.*—Adult: Yellow to black; 3 black stripes down its back; \(\frac{1}{2}\) inch long. Larva: White; slender; brownish at the ends; up to \(\frac{3}{4}\) inch long. (See inside front cover for natural-color illustration of adult.)

*Damage.*—Adults feed on leaves, stems, and fruit. Larvae bore into roots, also feed on stems at or below soil line. Plants wilt, may die.

*Distribution.*—Throughout United States; particularly east of Rocky Mountains. (Related species are found wherever melons are grown.)

*What to do.*—Apply a dust containing \(\frac{2}{5}\) percent of rotenone, at least 50 percent of cryolite, or 5 percent of methoxychlor as soon as plants come up; or use spray No. 5, 9, or 2 (pp. 2, 3). Repeat treatment once or twice a week, as needed.

**Anthracnose (fungus)**

*Symptoms and damage.*—Round, watersoaked spots on fruits; dark spots on leaves, which may give vines a scorched appearance. At first, spots on fruits are small and raised; later, they enlarge and become sunken; they have dark centers, which may show a pinkish fungus growth in moist weather. Fungus also affects cucumber and muskmelon; it is carried on seed and lives in soil on remains of diseased plants.

*Distribution.*—Throughout United States.

*What to do.*—Congo, Fairfax, and Charleston Gray are resistant varieties. Follow seed treatment, spraying, and dusting recommendations for anthracnose on cucumbers (p. 19).

**Wilt (fungus)**

*Symptoms and damage.*—Stunted seedlings; wilted vines; reduced yields. Plants eventually die. Wiltting starts at tips of runners and slowly spreads to entire vine. Fungus is carried on seed, lives indefinitely in soil, and enters through roots. (Not identical with bacterial wilt of cucumber and muskmelon.)

*Distribution.*—In the South and in California; in some Central States.

*What to do.*—Grow wilt-resistant varieties such as Kleckley No. 6, Improved Stone Mountain No. 5, Fairfax, Charleston Gray, Hawkesbury, Missouri Queen, Miles, Leesburg, Blacklee, Klondike R-7, and Baby Klondike.

**Root Knot (nematode)**

*Symptoms and damage.*—Galls, or swellings, on roots; stunted plants. Galls on small roots are tiny; compound galls on large roots may be an inch in diameter. Pearly white specks inside galls are egg masses of root knot nematode, which lives in soil.

*Distribution.*—Southern United States; most common south of 40° latitude.

*What to do.*—If soil is heavily infested, the best thing to do is to move garden to another location, if possible. For some crops and in some locations, the treatment of the soil with nematicides is practicable. Information on the use of these in your area is best obtained from your State agricultural experiment station or county agent.

**GENERAL FEEDERS**

**Ants**

*Description.*—Many species. Ants are black, brown, yellow, or red, and \(\frac{3}{8}\) to \(\frac{1}{2}\) inch long; they have small necks and waists. Ants usually live in colonies.
Damage.—Few species actually attack or eat vegetable plants. Ants' most common damage to plants is due indirectly to their fondness for honey dew excretion of certain aphids and mealybugs. They protect these insects for the food they supply. Example: The cornfield ant takes the strawberry root aphid into its burrows and places it on strawberry roots where it feeds. In so doing, the roots are disturbed by the burrowing activities of the ants, exposed to excessive drying, and damaged by the aphids. Without the ants, the aphids would be unable to reach the roots.

Distribution.—Throughout United States.

What to do.—Apply a chlordane drench to infested soil. To treat 30 square feet of soil surface, use 1 level teaspoon of 50-percent wettable powder (or \( \frac{1}{2} \) teaspoon of 45-percent emulsifiable concentrate) mixed with 3 gallons of water; 1,000 square feet, 4 ounces (\( \frac{1}{4} \) cup) of 50-percent wettable powder or 6 tablespoons of the emulsifiable concentrate in 100 gallons of water. Apply drench with a sprinkler can.

Aphids (plant lice)

Description.—Many species. Adults and young are tiny, green to black, and soft bodied; they cluster on underside of leaves or on stems or roots. (See inside front cover for natural-color illustrations of a winged and a wingless cabbage aphid.)

Damage.—Curl ed and distorted leaves; stunted plants. Severely damage most vegetable crops, particularly turnip, melons, cucumber, peas, beans, tomato, potato, celery, pepper, spinach, strawberry, blackberry, raspberry, and okra. Aphids transmit certain virus diseases of vegetables.

Distribution.—Throughout United States.

What to do.—Apply a 4- or 5-percent malathion dust or spray No. 1 (p. 2). Caution: Do not apply malathion to beans, broccoli, cucumber, melons, peas, pepper, potato, squash, strawberry, or tomato within 3 days before a harvest; to leafy vegetables such as beet tops, brussels sprouts, cabbage, cauliflower, celery, kale, lettuce, mustard, spinach, or turnip within 7 days before a harvest; to blackberry or raspberry while the fruit is on the plants; or to okra while the pods are on the plants. Make sure that cucumber, squash, and cantaloup plants are dry before applying malathion.

Spray No. 4 (p. 3) can be used if temperature is above 70° F. A \( \frac{3}{4} \)-percent rotenone dust or spray No. 5 (p. 3) is partially effective against aphids, except the cabbage aphid on cabbage and related crops and the bean aphid on beans. A 5-percent DDT dust or spray No. 3 (p. 2) will control aphids on potatoes and peas. Aphids that feed on roots of strawberries and corn can be controlled by killing ants that put them there.

Cutworms

Description.—Many species. Cutworms are dull gray, brown, or black, and may be striped, or spotted. They are stout, soft bodied and smooth, and up to \( \frac{1}{2} \) inches long; they curl up tightly when disturbed.

Damage.—Cut off plants above, at, or below soil surface. Some cutworms feed on leaves, buds, or fruits; others feed on the underground portions of plants. Particularly destructive to early-season plantings of pepper, tomato, cabbage and related crops, peas, beans, beet, and squash.

Distribution.—Throughout United States.
What to do.—Apply a 10-percent toxaphene or DDT dust, or spray No. 10 or 3 (pp. 2, 3), to soil surface when garden is being prepared for planting; toxaphene is more effective than DDT. Ready-mixed poison baits that contain 3 percent of toxaphene are effective against species that feed above the soil surface. Spread bait at 1 pound per 1,000 square feet late in the afternoon; it remains fresh until cutworms come out of the ground to feed. Caution: Do not apply toxaphene or DDT to foliage of cucumbers, squash, or melons; it may injure plants. Do not apply to foliage or fruit that is to be eaten.

Note: You can prevent cutworm injury to transplants without using an insecticide. Place a stiff 3-inch cardboard collar around the stems; allow it to extend about 1 inch into soil and protrude 2 inches above the soil; clear the stem by about ½ inch.

Rose Chafer

**Description.**—Gray or fawn-colored beetle; reddish-brown head; long-legged and slender; ½ inch long.

**Damage.**—Feeds on foliage, buds, flowers, and fruits of many plants, including blackberry, raspberry, strawberry, cabbage, beans, beet and pepper.

**Distribution.**—Eastern United States.

What to do.—Apply a dust containing 5 percent of methoxychlor or DDT; or use spray No. 2 or 3 (p. 2). Caution: Do not apply DDT to parts of plants that are to be eaten unless you are certain that the residues can and will be removed by washing or stripping. Do not apply methoxychlor to beans or squash within 7 days before a harvest; or to berries or leafy vegetables, such as cabbage or beet tops, within 7 days before a harvest.

**Mole Crickets**

**Description.**—Several species. Adults and nymphs: Light-brown; large,�eady eyes; short, stout front legs with shovellike feet; up to 1½ inches long.

**Damage.**—Make burrows in soil; uproot plants; cause damage to celery, strawberry, potato, tomato, eggplant, pepper, sweet corn, cabbage, and lettuce.

**Distribution.**—In Florida and in coastal areas of North Carolina, South Carolina, Georgia, Alabama, and Mississippi.

What to do.—Mix chlordane into the upper 6 inches of soil before planting. Use 2 pounds of 5-percent dust per 1,000 square feet of soil surface; or use ¾ cup of 40-percent wettable powder in 2½ gallons of water. For an effective alternative method, apply a ready-mixed 3-percent chlordane bait to the soil surface in the late afternoon following rain or watering. Use about 1 pound of bait per 1,000 square feet of soil surface.

**Sowbugs and Pillbugs**

**Description.**—Several species. Dark-gray; oval; flattened bodies; seven pairs of legs; up to ½ inch long.
Hide under boards, crop refuse, and other damp places. Some species roll up and look like pills when disturbed. Not classified as insects.

**Damage.**—Feed on roots and tender plant parts of all kinds of vegetables.

**Distribution.**—Throughout United States.

**What to do.**—Look for and eliminate hiding places. Apply a 5-percent DDT dust or spray No. 3 (p. 2) to the soil of infested places.

### White-Fringed Beetles

**Description.**—Several species. Adults: Dark-gray snout beetles; light band along the side of its body; \( \frac{1}{2} \) inch long. Larvae: Yellowish white; curved; legless; fleshy; up to \( \frac{1}{2} \) inch long.

**Damage.**—Larvae feed on roots and tubers of potato, turnip, sweet corn, strawberry, and cabbage and related plants.

**Distribution.**—Southeastern part of country; infestations localized.

**What to do.**—Kill larvae in soil: Apply \( \frac{1}{4} \) pound of DDT or \( \frac{1}{10} \) pound of chlordane wettable powder in about 2 gallons of water; or use about 2 pounds of 10-percent DDT dust or 2 pounds of 5-percent chlordane dust.

### Grasshoppers

**Description.**—Many species. Adults and nymphs: Brown, gray, black, or yellow; strong hind legs; up to 2 inches long. Most grasshoppers are strong flyers.

**Damage.**—Feed on any available vegetation; when abundant, they may destroy complete plantings of such crops as beet, sweet corn, melons, beans, berries, and potato.

**Distribution.**—Throughout United States; especially troublesome in Central and Northwestern States.

**What to do.**—Apply a 5-percent malathion dust or spray No. 1 (p. 2) to infested vegetables and to all weed patches within and surrounding the garden. See “Precautions” (p. 7) for restrictions on the use of malathion.

For further information on controlling grasshoppers, see Farmers’ Bulletin 2064, Grasshoppers: A New Look at an Ancient Enemy.

### Vegetable Weevil

**Description.**—Adult: Dull, grayish-brown; 2 oval pale-gray marks on back; \( \frac{3}{8} \) inch long. Larva: Light-green body and light-yellow to brown head; \( \frac{5}{8} \) inch long when full grown. (See inside front cover for natural-color illustration of adult.)

**Damage.**—Adults and larvae feed on leaves and roots of many plants, including turnip, carrot, celery, cabbage and related plants, spinach, tomato, and potato.

**Distribution.**—Southern part of country.

**What to do.**—Apply a 5-percent DDT dust or spray No. 3 (p. 2) to
soil and a 1-percent rotenone dust or spray No. 5 (p. 3) to infested plants. **Caution:** Do not apply DDT to parts of the plants that are to be eaten unless you are certain that the residues can and will be removed by washing or stripping.

**Japanese Beetle**

*Description.*—Adult: Shining metallic green; oval; coppery-brown outer wings; about ½ inch long and ¾ inch wide. Larva: White body; brown head; up to 1 inch long when full grown.

*Damage.*—Adults may attack foliage of such crops as raspberry, blackberry, beans, and okra, and silk and foliage of sweet corn. Larvae feed on roots of many plants including bean, tomato, beet, sweet corn, onion, and strawberry.

*Distribution.*—From central New England to Virginia and eastern Ohio.

*What to do.*—**Before formation of parts of plants that are to be eaten,** apply a 5-percent DDT dust or spray No. 3 (p. 2). **After formation of parts of plants that are to be eaten,** apply a 5-percent methoxychlor dust or spray No. 2 (p. 2). For partial control, apply a ¾-percent rotenone dust or spray No. 5 (p. 3). For control of the larvae in the soil, apply chlor-dane as for white grubs (see p. 44). **Caution:** Do not apply methoxychlor to beans, blackberry, or raspberry within 7 days before a harvest; or to okra while the pods are on the plants.

**Fall Armyworm**

*Description.*—Light green to black; striped; white inverted Y on front of head; up to 1½ inches long.

*Damage.*—Feeds chiefly on grasses and grains but may attack the foliage of such vegetables as sweet corn, lettuce, and cabbage and related crops.

*Distribution.*—East of Rocky Mountains, except in extreme northern sections.

*What to do.*—Apply a 5-percent DDT or TDE dust, or spray No. 3 or 11 (pp. 2, 3) to grasses and weeds around the garden and to foliage in the garden that is not to be eaten. Ready-mixed cutworm baits are also effective.

**Garden Centipede**

*Description.*—White; fragile; 12 pairs of legs on adult (fewer legs on young); up to ¾ inch long. Not classified as insect. Found in moist soils that contain decayed plant material, particularly near greenhouses.

*Damage.*—Eats numerous tiny holes, or pits, into underground portions of plants; eats off tiny roots and root hairs. Roots of injured plants have blunted appearance. Damages beans, peas, sweet corn, beet, carrot, celery, spinach, and radish.

*Distribution.*—Throughout humid areas of United States.

*What to do.*—Difficult to control. For partial control, follow recommendations for wireworms on p. 46.
Slugs and Snails

Description.—Many species. Bodies are grayish, wormlike, legless, slimy. Snails have shells, and slugs do not.

The shells of snails vary from off-white to brown or black and may be striped or mottled with contrasting colors; usually ½ to 1 inch in diameter when full grown. Slugs are usually mottled with shades of gray, but may be whitish yellow, brown, or black; most are ½ to 4 inches long when full grown. Slugs and snails hide in damp places during the day and feed at night. Not classified as insects.

Damage.—Feed on leaves of small plants; leave a glistening trail of slime. Damage such crops as strawberry, cabbage and related crops, turnip, carrot, lettuce, and tomato.

Distribution.—Throughout United States; particularly on west coast.

What to do.—Use a commercially prepared bait containing metaldehyde, which attracts slugs and snails from their hiding places. Sprinkle it on soil, or place it in small piles (each pile about the size of a 50-cent piece) within 5 or 6 feet of damaged plants. Another method is to dust hiding places with a 5-percent chlordane dust. Caution: Do not apply metaldehyde or chlordane to parts of plants that are to be eaten.

Flea Beetles

Description.—Many species. Black; brown; or striped; jumping beetles; about ¼ inch long. (See inside front cover for natural-color illustration of the potato flea beetle.)

Damage.—Attack potato, tomato, eggplant, pepper, beet, spinach, turnip, radish, strawberry, and cabbage and related crops. Young plants, especially transplants, are severely damaged; leaves look like they have been shot full of holes.

Distribution.—Throughout United States.

What to do.—Before formation of parts of plants that are to be eaten, apply a 5-percent DDT dust or spray No. 3 (p. 2). After formation of parts of plants that are to be eaten, apply a dust containing ¾ percent of rotenone or 5 percent of methoxychlor; or use spray No. 5 or 2 (pp. 2, 3). See “Precautions” (p. 7) for restrictions on the use of methoxychlor.

White Grubs

Description.—Several species. White or light yellow; hard brown heads; curved; ½ inch to 1½ inches long when full grown. White grubs live in soil and are larvae of common brown May beetles.

Damage.—Feed on roots and underground parts of potato, strawberry, sweet corn, and many other plants.

Distribution.—Throughout United States.

What to do.—Grassland is likely to be infested with white grubs; avoid planting vegetables in newly plowed grasslands. Treat surface of infested soil with ¼ pound of chlordane per 1,000 square feet. To obtain this dosage, mix ½ pound of a 50-percent chlordane wettable powder in about 2½ gallons of water; or use about 2 pounds of a 10-percent chlordane dust. Caution: Do not apply excessive amounts of chlordane to soil. Do not apply chlordane to foliage that is to be eaten.
Root Maggots

Description.—Several species (includes seed-corn and cabbage maggots). Yellowish white; legless; 1/4 to 1/2 inch long when full grown.

Damage.—Bore into sprouting seeds and prevent development of plants. Destructive in seedbeds and on young transplants. Tunnel roots and stems; plants wilt and die. Attack beans, peas, sweet corn, carrot, melons, spinach, cabbage, turnip, onion, and radish. Particularly destructive to early-season plantings.

Distribution.—Throughout United States.

What to do.—Consult your State agricultural experiment station or county agent for information on seed treatments for root maggot control in your area. Also see recommendations for controlling the seed-corn maggot on beans (p. 9), the onion maggot (p. 23), and root maggots on cabbage (p. 14) and on turnip (p. 38).

Stink Bugs

Description.—Several species. Adults: Brown, green, or black; with or without markings; shield shaped; up to 5/8 inch long and 1/2 inch wide. Nymphs: Resemble adults but are smaller. Stink bugs discharge a foul odor. (See inside back cover for natural-color illustrations of adult and nymph of the southern green stink bug.)

Damage.—Adults and nymphs suck sap from many plants including tomato, bean, okra, and berries. Plants become weakened, and buds and young fruits are malformed. Pimples, or wartlike growths, appear on okra, bean, and pea pods.

Distribution.—Throughout United States; particularly in the South.

What to do.—Before formation of parts of plants that are to be eaten, apply a 5-percent DDT dust or spray No. 3 (p. 2). After formation of parts of plants that are to be eaten, apply a 10- or 20-percent sabadilla dust. Do not allow weeds to grow in and around garden.

Millipedes

Description.—Several species. Brown or grayish; wormlike; hard-shelled; many pairs of legs; 1 inch to 1 1/4 inches long when full grown. Found under boards, flower pots, and other sheltered areas, or in decayed manure. Not classified as insects.

Damage.—Feed on roots, tubers, bulbs, and fleshy stems; also attack seeds. Damages such crops as potato, carrot, beet, turnip, lettuce, and cabbage and related crops.

Distribution.—Throughout United States.

What to do.—Apply a 5-percent DDT dust or spray No. 3 (p. 2). Eliminate millipede hiding places.

Spider Mites (Red Spiders)

Description.—Several species. Adults and young: Tiny (barely visible to naked eye); red or greenish red. Found on underside of leaves. Not classified as insects.

Damage.—Yellow specks and fine webs on leaves; plants and fruits are stunted. Attacks such crops as strawberry, beans, celery, cucumber, melons, and tomato.

Distribution.—Throughout United States.

What to do.—Apply a 4- or 5-percent malathion dust or a 3-percent Aramite dust; or use spray No. 1 or 13 (pp. 2, 3). Partial control may be obtained by applying a dust containing 25 to 30 percent of sulfur or spray No. 12 (p. 3). Caution: Do not apply Aramite dust or spray to melons, celery, cucumber, beans, or tomato within 15 days before a harvest; or to strawberry within 21 days before a harvest. Do not apply malathion to beans, broccoli, cucumber, egg-
plant, melons, peas, pepper, potato, squash, strawberry, or tomato within 3 days before a harvest; to leafy vegetables such as celery and lettuce within 7 days before a harvest; to blackberry and raspberry while fruit is on the plants; or to okra while pods that are to be eaten are on the plants. Do not apply sulfur to cucumbers, squash, and melons; it may injure the foliage. Note: In southern California and in other areas where cyclamen mites are a problem, do not use malathion on strawberry; it kills predators that help control cyclamen mites. See recommendations for spider mites on strawberry on p. 32.

**European Earwig**

*Description.*—Adult and nymph: Reddish-brown; prominent forceps at tail end; up to $\frac{3}{4}$ inch long. The earwig hides during day and forages at night; it discharges a foul odor.

*Damage.*—Insect is chiefly a health hazard and public nuisance; it feeds on filth and all kinds of food. Seldom causes severe damage to vegetables but feeds on such crops as strawberry, sweet corn, celery, and lettuce.

*Distribution.*—Northwestern and Northeastern States; infestations localized. Related species may occur in other areas.

*What to do.*—Apply a 5-percent chlordane dust or spray No. 7 (p. 3) to infested soil. Also treat walks, fence rows, bases of buildings, trees, shrubbery, and wood piles. Caution: Do not apply chlordane to foliage or fruit that is to be eaten. Do not contaminate food with dust or spray.

**Nematodes, or Eelworms**

*Description.*—Usually less than $\frac{1}{16}$ inch long. Many species injure plants. 

*Damage.*—Stunted plants. Root system damaged. If root knot nematodes are present, roots have distinct galls ranging from pinhead size to 1 inch in diameter. Attack all vegetable plants.

*Distribution.*—Throughout United States. 

*What to do.*—If the soil is heavily infested, the best thing to do is to move garden to another location, if possible. For some crops and in some locations, the treatment of the soil with nematocides is practicable. Information on the use of these in your area is best obtained from your State agricultural experiment station or county agent.

**Wireworms**

*Description.*—Many species. Yellow to white; dark heads and tails; slender; $\frac{1}{2}$ to $1\frac{1}{2}$ inches long when full grown. Resemble a jointed wire. (See inside back cover for natural-color illustration.)

*Damage.*—Puncture and tunnel stems, roots, and tubers. Severely damage such crops as beans, carrot, beet, celery, lettuce, onion, potato, sweet corn, sweetpotato, and turnip.

*Distribution.*—Throughout United States; particularly in irrigated lands of Western States.

*What to do.*—Avoid planting vegetables in infested soil. **Western States**: About 6 weeks before planting, apply 2 pounds of a 10-percent DDT dust per 1,000 square feet of soil surface; or use about $\frac{1}{2}$ pound (2$\frac{3}{8}$ cups) of a 50-percent DDT wettable powder in 2$\frac{1}{2}$ gallons of water. Apply the dust or spray to soil surface, and then work it thoroughly into upper 6 or 8 inches of the soil. DDT is effective against wireworms in irrigated lands; it will prevent reinfestation for several years. **Eastern States** (and dry lands): Apply 2 pounds of a 5-percent chlordane dust per 1,000 square feet of soil surface; or use $\frac{3}{4}$ cup of a 40-percent chlordane wettable powder or $\frac{1}{4}$ cup of a 75-percent chlordane emulsifiable concentrate in 2$\frac{1}{2}$ gallons of water. Apply the dust or spray to soil surface, then work it thoroughly into the upper 6 or 8 inches.
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U.S. GOVERNMENT PRINTING OFFICE: 1956
Black rot of cabbage.

Bean mosaic.

Downy mildew of cucumber.

Bean rust.

Tomato mosaic.

Bacterial blight of pea.

Fusarium wilt of tomato.

Blossom-end rot of tomato.