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CONTROLLING THE JAPANESE BEETLE



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CONTROLLING THE JAPANESE BEETLE

The Japanese beetle causes extensive damage in many of the Eastern States. A native of Japan, it was first found in this country in 1916 near Riverton, N. J. It has continued to spread, and is now present from southern Maine southward into South Carolina and Georgia and westward into Kentucky, Illinois, Michigan, and Missouri.

DESCRIPTION AND HABITS

Japanese beetles are a little less than $\frac{1}{2}$ inch long, and are a shiny, metallic green. They have coppery-brown wings, and six small patches of white hairs along the sides and back of the body, under the edges of the wings. Males and females have the same markings, but males usually are slightly smaller than females.

The Japanese beetle spends about 10 months of the year in the ground in the form of a white grub. This grub is similar to our native white grub, but it is usually smaller—about an inch long. It lies in the soil in a curled position.

Adult beetles first appear on their favorite food plants in late spring or early summer, depending on locale. If you live in eastern North Carolina, for example, expect them in mid-May; in the Philadelphia area, about June 15; in New England, about July 1 or later. In the Midwest, they show up about June 15 in the St. Louis area, and July 1 in Michigan. They fly only in the daytime. They are very active

on warm sunny days, and move readily from one plant to another.

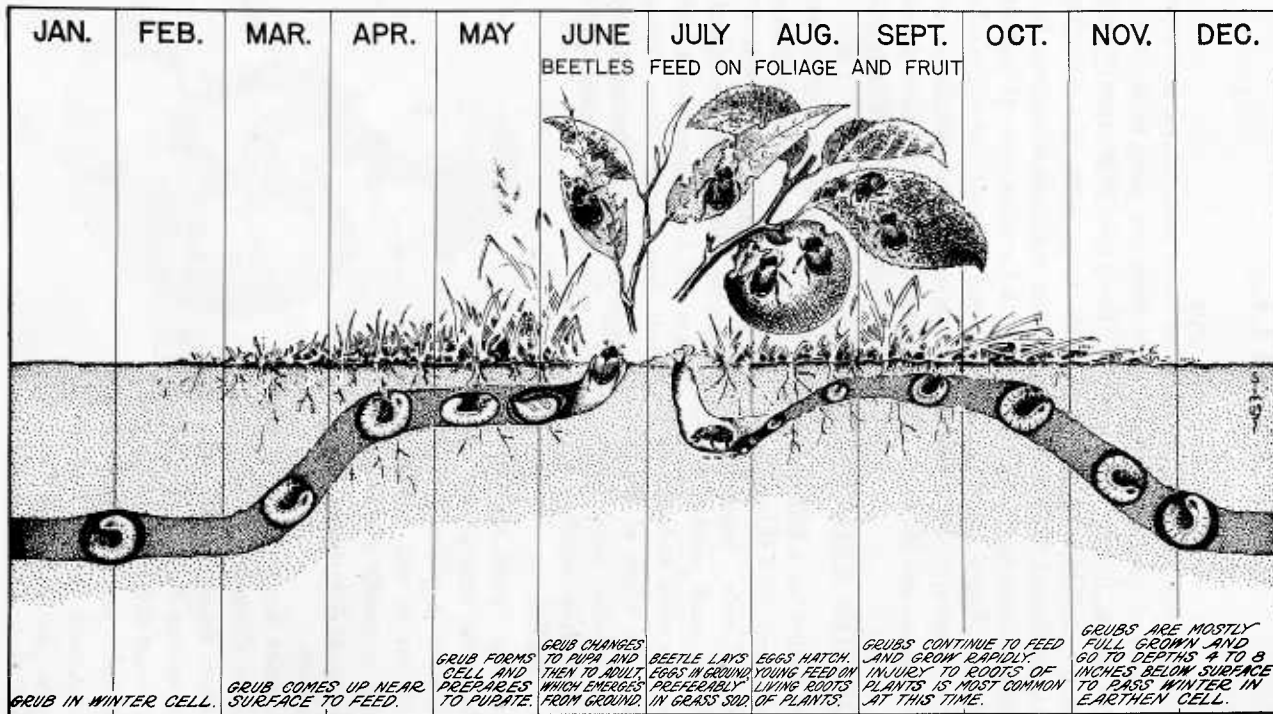
The period of greatest beetle activity lasts from 4 to 6 weeks. Then the beetles gradually disappear. In eastern North Carolina, most of them are gone by early August, but in New England, some are present until frost. The color plate on page 8 shows how the Japanese beetle looks in its different stages of development.

From time to time, the females leave the plants on which they have been feeding and burrow about 3 inches into the ground, usually in turf. There they lay a few eggs from which grubs will later hatch. After laying these eggs, the females return to the plants for more feeding. The drawing on page



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Full-grown Japanese beetle grub. Grubs lie in the soil in a curved position.



Seasonal life cycle of the Japanese beetle in the vicinity of Philadelphia.

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4 outlines the seasonal cycle of Japanese beetles.

Populations may be lower in some localities than in others. This may be the result of one or more of the following: a dry summer season, suppression by milky disease and other natural control agents, cultural factors, and intensive chemical control measures.

New housing developments are especially subject to high local beetle populations. Turf infested with Japanese beetles, but not containing the beetles' natural enemies, is often imported into these areas. In addition, adult beetles often fly into housing tracts having soil that contains no beetle enemies. The beetles then can become established easily.

DAMAGE

Grubs feed on the roots and underground stems of plants, particularly



Beetles feeding on grape leaf. Beetles chew out the tissue between the veins, leaving a lacy skeleton.



BN-31855

Beetles congregated on fruit of peach. Beetles often mass on ripening fruit and eat until nothing is left.

grasses. Often this feeding goes unnoticed until the plants fail to make proper growth, or die. When grubs are numerous, they can cause serious injury to turf.

Adult Japanese beetles will feed on more than 275 different plants. In some cases, damage is slight. In others, insecticide or other control methods are necessary to prevent serious injury. The beetles often congregate and feed on flowers, foliage, and fruit of plants and trees exposed to bright sunlight.

Beetles feeding on leaves usually chew out the tissue between the veins, leaving a lacy skeleton. They may eat many large, irregular areas on some leaves. A badly attacked tree or shrub may lose most of its leaves in a short time.

The beetles often mass on ripening fruits, and feed until nothing edible is left. They seldom touch unripe fruit.

They seriously injure corn by eating the silk as fast as it grows. This keeps kernels from forming.

NATURAL CONTROLS

Nature itself exerts many controls on Japanese beetle grubs, or adults, or both. Weather, disease, parasites,

and other natural enemies can play a part in determining whether or not a beetle infestation will occur, and how serious it may be.

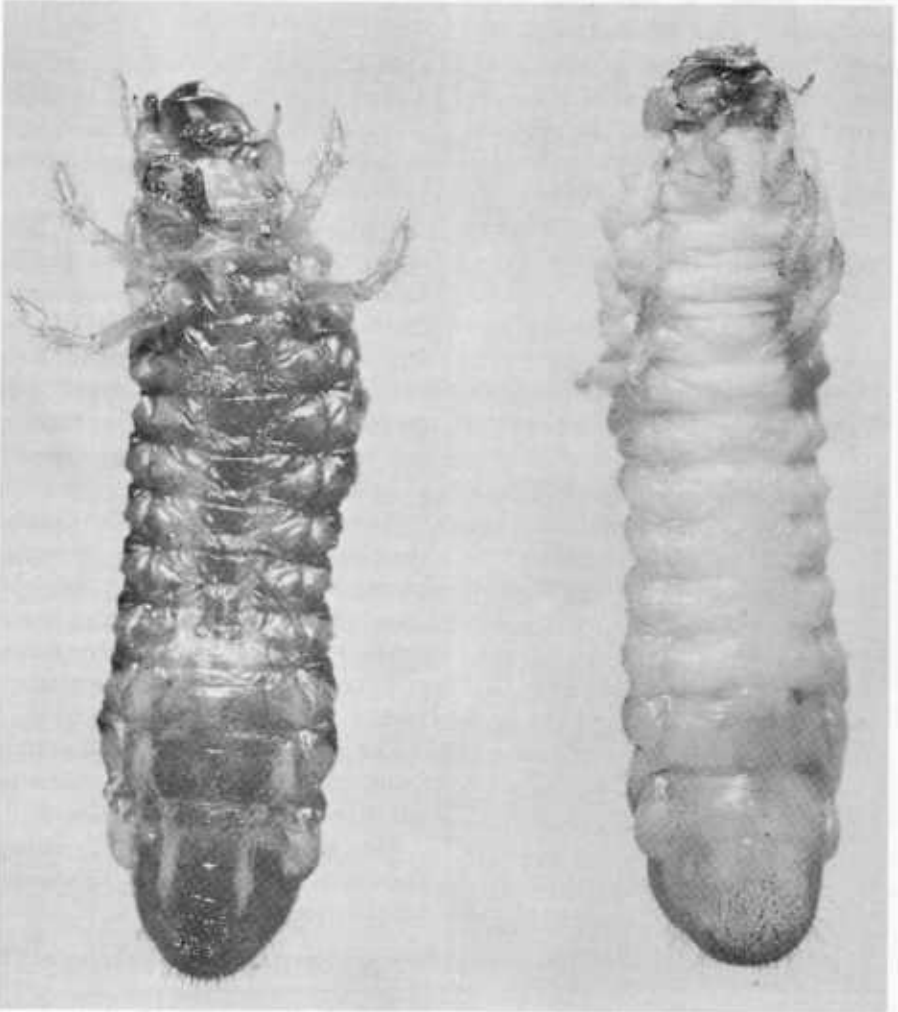
Weather

Extremely dry weather during summer destroys many of the eggs and kills newly hatched grubs. On the other hand, wet summers are favorable to the development of eggs and

grubs, and are usually followed by seasons of increased numbers of beetles.

Diseases

Japanese beetles and grubs are subject to several diseases. The most important is known as milky disease. It kills grubs after causing their normally clear blood to become milky in appearance.



DN-219

The effect of milky disease. Grub on left is healthy; grub on right is infected with milky disease, so named because it turns the blood a whitish color.

The milky disease spores live in the soil for long periods, ready to infect and kill successive broods of Japanese beetle grubs as they move about in the soil, feeding on plant roots. The disease is harmless to human beings, warmblooded animals, and plants—the bacterium can reproduce only in the blood of certain white grubs. This disease, which occurs naturally, is also used in beetle eradication programs. In such cases it is intentionally introduced into certain areas where it is not present in sufficient strength to control the beetle infestation.

Insect Parasites

A number of the more important insect parasites that prey upon this pest have been brought in from Asia. Two of them, the spring *Tiphia* from Korea and the fall *Tiphia* from Japan, have become established in areas inhabited by the Japanese beetle and are important natural control agents. These small, wasplike parasites can live only on the grubs of the Japanese beetle.

These insect parasites have been established on an area-wide basis and are being dispersed by the U.S. Department of Agriculture. They are not available to individuals or groups.

Other Enemies

Japanese beetle populations are sometimes reduced by other enemies. Both beetles and grubs are fed upon by several of the more common birds, including starlings and English sparrows. Where the ground has been plowed, sea gulls and domestic poultry often consume grubs. Moles and skunks also feed on the grubs, but in



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The spring *Tiphia*, a wasplike insect parasite that lives on and destroys grubs of the Japanese beetle.

digging for them often cause considerable damage to lawns.

Supplementing Natural Controls

In spite of the many natural factors that can exercise control of Japanese beetle grubs and adults, it is common for infestations to be so serious that additional control measures are required. Such methods and programs for controlling grubs and adults are outlined in the sections that follow.

CONTROL OF GRUBS

Milky-Disease Spore Dust

You can control Japanese beetle grubs most satisfactorily by applying milky-disease spore dust to infested areas. This spore dust is produced commercially by manufacturers who collect grubs and inoculate them with the disease. Grubs infected in this way are then incorporated into dust mixtures that homeowners and others can distribute over lawns to kill healthy grubs.



Plate 1.—A, Mature grub in spring, feeding on roots in underground burrow. B, Pupa in underground cell. C, Adult beetle, emerged from earth. D, Beetles feeding on smartweed. E, Beetles feeding on grape leaves. F, Beetles feeding on apple leaves. G, Female beetle depositing eggs in soil at bottom of shallow burrow. H, Egg. I, Egg hatching, and young grubs. J, Partly grown grub in fall.

Treatments are most effective when they are made on a community-wide basis. If you and your neighbors wish to cooperate in buying and applying milky-disease spore dust in your area, contact your county agricultural agent. He can help coordinate the effort.

The U.S. Department of Agriculture does not distribute milky-spore dust to private individuals or organizations, but the dust is sold by many garden supply stores. If your local dealer does not handle it, your county agent can tell you the nearest source of supply.

Apply the spore dust at any time when the ground is not frozen. Usually it is applied at a rate of 2 pounds per acre, in spots 10 feet apart. Use about 1 level teaspoonful to each spot. If you apply it in spots 5 feet apart, the disease will become established more

quickly. In this case, about 7½ pounds of spore dust will be needed per acre. Do not expect immediate results, as several years may elapse before the milky disease becomes fully effective.

More detailed information on use of the spore dust is given in U.S. Department of Agriculture Leaflet No. 500, "Milky Disease . . . For Control of Japanese Beetle Grubs." You may obtain a copy for 5 cents from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Please include your name, full address, and ZIP code when ordering.

Chemical Control

You can protect lawns, golf courses, and ungrazed grassy areas from injury by Japanese beetle grubs for 8 to 9 years



Applying milky-disease spore dust. Here a hand corn planter is used.

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by top-dressing once with chlordane. Apply it at 2 ounces active ingredient per 1,000 square feet or 5½ pounds per acre.

A granulated formulation of chlordane is the easiest to disperse uniformly and is less likely to drift to other areas during application. However, free-flowing dust formulation can be used. Both may be applied with a fertilizer spreader.

Emulsifiable concentrates or wettable powders mixed with water may be substituted for the dry application. On large grassy areas—a golf course, for example—these formulations may be applied as a coarse spray by means of a boom attached to a sprayer, or with a hose and nozzle, at the rate of 25 gallons per 1,000 square feet or 1,000 gallons per acre. On lawns or other smaller grassy areas it is generally best to use a small compressed air sprayer. These usually range from 1 to 5 gallons in capacity. Some types are not equipped with an agitator and must be shaken frequently during spraying.

You may apply the insecticide at any time when the ground is not frozen. After it has been applied to a lawn, it is advisable to wash the material into the ground with a hose. Treated turf may be mowed, watered, and fertilized as usual.

Usually the treatment will kill a high percentage of the full-grown grubs in the turf at the time of application. The speed of insecticidal action will depend on the temperature of the soil—the warmer the soil, the faster the action.

Chlordane can be harmful if swallowed or absorbed through the skin. Keep small children and domestic ani-

mals away from treated grass until it has been watered or rain has fallen.

Do not apply milky-disease spore dust and a chemical insecticide to the same turf; insecticide will keep the grub population at a very low level and will prevent buildup of milky-disease bacteria. An exception is when spore dust has been applied and the control is found to be inadequate. Chemical treatment is needed if more than 10 grubs per square foot are present and are damaging the turf by their feeding.

A garden should not be planted on land known to be infested with Japanese beetle. Plowing up infested grassy areas and planting immediately often result in injury by grubs to garden plants.



N-2056

Beetles feeding on the flower of a rose plant.

CONTROL OF BEETLES

Spraying or Dusting

Japanese beetle adults seldom become a problem where regular spray schedules are followed for control of other insects. However, if there is a specific need for beetle control, you



BN-32253

Dead turf rolled back, exposing Japanese beetle grubs that have been feeding on the roots.

can protect the foliage and fruit of most plants by spraying them with carbaryl or malathion.

But insecticides will not fully protect roses, which unfold too fast and are especially attractive to beetles. When beetles are most abundant on roses, nip the buds and spray the bushes to protect the leaves. When the beetles become scarce, let the bushes bloom again.

Limited numbers of rose blooms for show purposes can be protected from beetle damages by tying perforated plastic bags or netting over the buds before the beetles appear.

Timeliness and thoroughness of application are very important. Begin treatment as soon as beetles appear, before damage is done. Use insecticides only on plants for which they are indicated, and carefully follow directions on container labels.

Apply insecticides thoroughly, so that all parts of the plant are covered by a protective deposit. More than one application may be necessary to maintain protection, especially of new foliage and ripening fruit. Additional applications may also be necessary if heavy rain occurs.

Dilute sprays have been used for many years to control beetles on fruit trees, small fruits, shade trees, ornamental shrubs, and other plants.

You can use hand sprayers for low-growing plants. High-pressure equipment is necessary to apply the spray properly to fruit and shade trees and to the taller ornamental shrubs.

Follow the mixing guide in Table 1 for mixing insecticide sprays.

When insecticides are applied to edible plants, it is important to observe the required waiting period between the last application and harvest. This is

specified on the insecticide container label. Waiting periods are established to insure that excess residues do not remain on the plants at harvest.

The time required varies with the insecticide and the plants to which it is applied. Some of the food plants most subject to attack by beetles, and the waiting periods required before harvest after application of carbaryl, malathion, or methoxychlor are given in Table 2. Do not apply these insecticides to other plants, except as may be directed on the container label.

Always wash edible plant parts before cooking or eating them.

Carbaryl is very effective in killing beetles and protecting plants from attack. The spray deposit on the plants will usually protect them from attack for about 7 days. Make additional applications if beetles again begin to collect on the plants.

Mites and aphids sometimes become a problem on plants treated with carbaryl because of its toxic action on

beneficial insects that usually control these pests.

Malathion is also effective in killing beetles, and it can be applied near harvesttime. (See Table 2.)

Apply malathion spray every 7 to 10 days. It is not effective for longer periods.

Malathion also is useful in controlling aphids and mites except in localized areas where some strains have developed resistance.

Methoxychlor can be used near harvesttime. (See Table 2.) Apply the material as needed at about 10- to 14-day intervals.

Hazard to honey bees

Carbaryl and malathion dusts or sprays are highly toxic to honey bees. If application of these materials to plants is necessary during the bloom period, do not apply during hours when bees are visiting the flowers. You may need to contact nearby beekeepers in

Table 1.—*Guide for mixing sprays for fruits, vegetables, and ornamentals.*
(Do not exceed rates of 1 quart of spray per 50 feet of row or 1 quart per 125 square feet for vegetables and berries; do not exceed 15-20 gallons per tree for fruit trees.)

Common Formulation (purchased product)	Amount of insecticide to mix with—	
	1 gallon water	10 gallons water
Carbaryl:*		
50-percent wettable powder	1½ tablespoons	3 ounces
Malathion:		
57-percent emulsifiable concentrate	1 teaspoon	1½ fluid ounces
Methoxychlor:		
50-percent wettable powder	3 tablespoons	5 ounces
25-percent emulsifiable concentrate	6 teaspoons	9 fluid ounces

* Use of carbaryl may also require treatment for aphids and mites.

advance so that they can protect their colonies.

Collecting by Hand

When only a few small plants are attacked, partial temporary relief from beetle damage may be obtained by collecting the beetles by hand. Jar or shake the shrubs, trees, or individual branches early in the morning, when it is cool and the beetles are quiet. Place a sheet under the plant to catch the beetles as they fall, and drop them into a bucket containing water and a little kerosene. You should do this every day, because more beetles are continually flying in.

Table 2.—*Waiting periods required from last application of carbaryl, malathion, or methoxychlor, to harvest.*

Crop	Minimum days before harvest after last application of—		
	Carbaryl	Malathion	Methoxychlor
Apple	1	3	7
Beans (lima, snap)	1	1	3
Blackberry	7	1	3
Blueberry	1	1	14
Cherry	1	3	7
Corn (sweet)	0	5	7
Grape	0	3	14
Okra	1	1	2
Peach	3	7	21
Raspberry	7	1	3
Strawberry	1	3	14

¹Do not apply malathion after the pods begin to form.

²Methoxychlor is not registered for use on this crop and is not recommended.

Trapping

Cooperative Federal-State efforts to retard Japanese beetle spread into new areas include extensive use of traps along the margins of the infested areas, at airports, and elsewhere to obtain information on the distribution of the insect. These traps are painted yellow. Traps are not available for distribution to individuals or community groups.

Mass trapping large areas has reduced injury as much as 30 percent, but has not been recommended as a control measure. Studies are in progress to determine further the value of mass trapping and to improve available beetle attractants.

Cultural Control

Diseased and poorly nourished trees and plants are especially susceptible to attack by beetles. Keep your trees and plants in condition by the proper use of fertilizers and by other measures.

Prematurely ripened or diseased fruit is very attractive to beetles. Remove this fruit from the trees and ground. The odor of such fruit attracts beetles, which then attack sound fruit.

Beetles reduce the yield of corn by feeding on silk and preventing proper pollination. Corn that silks out before beetles become abundant is not subject to serious damage. In some sections it is possible to delay planting to avoid damage. Consult your county agricultural agent with reference to planting dates for your area.

Beetles are very fond of certain weeds and other noneconomic plants such as bracken, elder, evening primrose, Indian mallow, sassafras, poison



BN-31636

Setting a trap for Japanese beetles. Lure-baited traps are used along margins of infested areas and elsewhere to provide information on the distribution of the insect.

ivy, smartweed, wild fox grape, and wild summer grape. These plants are often a continuous source of infestation for other plants. Eliminate them whenever practicable.

PRECAUTIONS

Insecticides used improperly can be injurious to man and animals. Use them only when needed and handle them with care. Follow the directions and heed all precautions on the labels.

Some States have special restrictions on the use of certain insecticides. Before applying insecticides, check State and local regulations.

Keep insecticides in closed, well-labeled containers in a dry place. Store

them where they will not contaminate food or feed, and where children and animals cannot reach them. Promptly dispose of empty insecticide containers; do not use for any other purpose.

When handling an insecticide, wear clean, dry clothing.

Avoid repeated or prolonged contact of insecticide with your skin.

Wear protective clothing and equipment if specified on the container label. Avoid prolonged inhalation of insecticide dusts or mists.

Avoid spilling an insecticide on the skin and keep it out of the eyes, nose, and mouth. If you spill any on your skin or clothing, remove contaminated clothing immediately and wash the skin thoroughly with soap



BN-31990

Beetles on silk of corn. They seriously injure corn by eating the silk as fast as it grows. This prevents kernels from forming.

and water. Launder clothing before wearing it again. If the insecticide gets in the eyes, flush with plenty of water for 5 minutes and get medical attention.

Carbaryl, methoxychlor, and malathion can be used without special protective clothing or devices if they are in a diluted dust or spray form.

Chlordane can be absorbed through the skin in harmful quantities. When working with these insecticides in any form, take extra care not to let them come in contact with the skin.

After handling an insecticide, do not eat, drink, or smoke until you have washed your hands and face. Wash any exposed skin immediately after applying an insecticide.

Avoid drift of insecticide to nearby wildlife habitats, bee yards, crops, or livestock. Do not apply insecticides under conditions favoring drift from the area to be treated.

Many insecticides are highly toxic

to fish and aquatic animals. Keep insecticides out of all water sources such as ponds, streams, and wells. Do not clean spraying equipment or dump excess spray material near such water.

Do not apply insecticides to plants during hours when honey bees and other pollinating insects are visiting them.

Have empty insecticide containers buried at a sanitary land-fill dump, or crush and bury them at least 18 inches deep in a level isolated place where they will not contaminate water supplies. If you have trash-collection service, thoroughly wrap small containers in several layers of newspaper and place them in the trash can.

It is difficult to remove all traces of herbicides from equipment. For this reason, do not use the same equipment for applying herbicides that you use for insecticides and fungicides.



Use Pesticides Safely
FOLLOW THE LABEL

U.S. DEPARTMENT OF AGRICULTURE

PREPARED BY
ENTOMOLOGY RESEARCH DIVISION
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