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PROTECTION OF ORCHARD AND SHADE TREES AND ORNAMENTAL SHRUBS FROM INJURY BY THE JAPANESE BEETLE¹

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INTRODUCTION

The Japanese beetle is a serious pest of apples, peaches, plums, cherries, and small fruits and also causes considerable injury to certain ornamental shade trees and shrubs in the eastern part of the United States. This brilliantly colored, green and reddish-bronze beetle feeds on the foliage, blooms, and fruit.

This circular gives the latest recommendations for the control of the beetle on different fruits and ornamental plants. The recommendations given are intended to apply only to the generally infested area. In those areas where the infestation is so light that no appreciable injury is caused, there will be little need for the adoption of control measures.

DISTRIBUTION OF THE BEETLE

The Japanese beetle is a native of Japan. It was first discovered in the United States in Burlington County, N.J., in the summer of 1916. The area of continuous infestation wherein general injury may occur comprises southern and central New Jersey, eastern Pennsylvania, northern Delaware, and the District of Columbia. Similar injury is also found locally in parts of Maryland. The beetle has also been found at several points in New England, New York, Ohio, Michigan, Virginia, West Virginia, North Carolina, and South Carolina, but those captured in the more southern and western of these States may have been carried there by train or otherwise a short time before discovery and may thus not represent established infestations.

¹This circular supersedes Circular 237, Control of the Japanese Beetle on Fruit and Shade Trees.

DESCRIPTION OF THE BEETLE

The Japanese beetle has a very distinctive appearance. It is a brightly colored insect, broadly oval, and about three eighths inch long. It is a brilliant metallic green except for the greater part of the wing covers, which are reddish bronze. On the sides and tip of the abdomen are 12 tufts of hairs which resemble small white dots (fig. 1).

FIGURE 1.—The Japanese beetle. About 4 times natural size.

NATURE OF THE INJURY

The Japanese beetle has chewing mouth parts. In general, it consumes the tissue between the veins of the leaves and also eats portions of the blossoms and of the fruit. The leaves are skeletonized wholly or in part (fig. 2), and the remnants of these leaves soon turn brown and fall. A partial second crop of leaves may be produced after feeding by the beetle has ceased (fig. 3). The beetle prefers to feed on portions of the plant exposed to the direct rays of the sun. It usually begins to feed on the

upper and outer portions and works downward and inward (fig. 4). When the infestation is severe, even large fruit and shade trees may be completely defoliated within a few days.

Of the susceptible fruits, those that ripen in the early summer are most subject to attack. Very little feeding—only a few punctures in the skin—is sufficient to destroy the market value of the fruit, but at times beetles gather on ripening apples and peaches in such large numbers as to cover the fruit completely and ruin it (fig. 5). The riper fruit is attacked first by the beetles, and when the infestation is relatively light the damage may be confined to these riper fruits.

The female beetles lay eggs in the soil, and these hatch into grubs which sometimes injure lawns. For suggestions as to the prevention of such lawn injury see Department of Agriculture Circular 238, Control of Larvae of the Japanese and the Asiatic Beetles in Lawns and Golf Courses.

FIGURE 2.—Grape leaf showing injury by Japanese beetle.

FRUIT AND ORNAMENTAL PLANTS ATTACKED

The Japanese beetle feeds on a large number of plants. It has a marked preference for the foliage and fruit of apple, peach, plum, quince, cherry, raspberry, and blueberry, and the foliage of grapes. It rarely injures dewberries and the Black Diamond variety of blackberries but occasionally attacks certain other varieties of blackberries. Pears are rarely attacked. Among the shade trees, it is especially fond of linden, chestnut, horsechestnut, sassafras, and elm. Other trees such as buttonwood, willow, birch, Lombardy poplar, Norway maple, and certain varieties of oak are occasionally attacked. The beetle rarely feeds on the foliage of most maples, ash, magnolia, mulberry, sweet gum, sour gum, tuliptree, hackberry, and beech.

FIGURE 3.—Sprayed and unsprayed apple trees in an orchard near Moorestown, N.J. Note the new growth on the tree defoliated by feeding of the Japanese beetle.

As a rule, conifers are untouched, although occasionally the needles of larch and of bald cypress are injured. The beetle is likely to injure such ornamentals as flowering cherry, flowering quince, flowering peach, spirea, hawthorn, althea, rose, hibiscus, and Virginia creeper.

METHOD OF PROTECTING PLANTS

It is possible to protect the foliage and fruit of many of these plants by maintaining a deposit of spray residue on all portions of the plants subject to attack, during the period when the beetles are flying. The spray residue largely repels the beetle and prevents extensive feeding, the protection being obtained primarily by making the plant non-attractive rather than by poisoning the beetle.

Diseased and poorly nourished plants are more susceptible to attack than those in a healthy condition. It is practically impossible to prevent the beetles from becoming established in orchards where brown rot and similar diseases are present. Orchards should be

protected from plant diseases and insect pests other than the Japanese beetle by the regular spraying recommended for the various localities.

Timeliness and thoroughness in the application of the repellent sprays are very important. As a general rule, and especially in localities where the beetles are very numerous, the first sprays should be applied when the beetles begin to appear in the vicinity, before they become established on the plants. In localities where the infestation is not so dense, the first application may be delayed until the beetles begin to appear on the plants to be protected. However, if,

FIGURE 4.—Elm tree injured by Japanese beetles. Note how the upper and outer portions of the tree have been defoliated.

in the heavily infested localities, the spraying is delayed until beetles appear on the plants, it is often difficult to prevent injury. In Burlington County, N.J., the first application should be made the latter part of June; it should be made somewhat earlier in localities farther south and somewhat later in localities farther north than Burlington County.

To obtain satisfactory protection, all portions of the plants must be kept covered with the spray (fig. 6), as any unprotected portion of the foliage, blossom, or fruit will be selected by the beetle for attack. Repellent sprays will not protect the unfolding blooms of orna-

mental shrubs. If heavy rains occur after the application, it may be necessary to repeat the spray.

To apply the sprays properly to fruit and shade trees, and to high ornamental shrubs, power-spraying equipment is necessary. The high-pressure equipment in general use for the control of other insects and diseases has been employed with satisfactory results.

RECOMMENDATIONS FOR DIFFERENT PLANTS

The sprays recommended in this circular have been tested for several years and have been found to be the most satisfactory for protecting the plants in connection with which they are mentioned. All of the sprays leave some residue on the fruit at the time of harvest.

Any visible spray deposit should be removed from the fruit by suitable washing or wiping equipment, as it may interfere with marketing. If a spray containing a poison has been used, this removal of any deposit must be particularly thorough.

APPLES

Late apples can be protected by spraying with 6 pounds of acid lead arsenate, to which is added a suitable sticker, in 100 gallons of water. The use of 4 pounds of wheat flour to each 6 pounds of lead

arsenate has been found to be one of the most satisfactory ways of increasing the adherence of lead arsenate to fruit and foliage. However, if other stickers or spreaders, such as cold-water-soluble powdered skim milk or a safe summer oil, have been used previously in the spray schedule, these materials may be substituted for the flour. Two pounds of powdered skim milk should be used to 6 pounds of lead arsenate. When oil is used enough should be added to give the diluted spray an oil content of from 0.5 to 0.6 percent. When an application of lead arsenate is made for the control of the codling moth at the time when the spray for the Japanese beetle

FIGURE 5.—Japanese beetles clustered on peach fruit. All the fleshy part of the fruit is destroyed, leaving only the pit. Early Rose is the variety of peach shown.

would normally be applied, the latter may not be necessary, but it may be necessary to make 1 or 2 additional applications of these sprays to give adequate protection throughout the season.

Arsenical sprays are not recommended for early apples, because of the excessive arsenic residue at the time of harvest, unless equipment is available for removing this residue. Some protection, however, can be obtained by spraying with 32 pounds of hydrated lime in 100 gallons of water, without the arsenical.

Since the question of residue on the fruit is not a factor with non-bearing apple trees, other stickers may be substituted for the flour when young stock is to be sprayed. Satisfactory results have been

obtained by replacing the flour with 1½ pints of light-pressed fish oil with a saponification value of 190 to 198, a specific gravity of 0.927 to 0.933 at 59° F., an iodine number of 139 to 193, and free-fatty-acid content of less than 5 percent. The oil should be added after the lead arsenate is in suspension in the water. As the oil and lead arsenate residue is not readily washed off the foliage by rain, one application usually gives protection for the season.

PEACHES

Arsenical sprays are not recommended for peaches because they have at times occasioned some injury to the fruit and foliage. Elberta and later varieties of peaches and young trees that have not come

FIGURE 6.—Unsprayed and well-sprayed foliage. This figure illustrates the deposit on foliage which is necessary to obtain protection from the Japanese beetle.

into bearing can be protected by the timely application of 32 pounds of hydrated lime in 100 gallons of water. It cannot be overemphasized that the protection of peaches is dependent upon applying the spray before the beetles become established on the trees. As this residue is easily washed off by rain, it may be necessary to make several additional applications to obtain adequate protection throughout the season.

It has not been possible to overcome satisfactorily the attractiveness of ripening peaches by applying sprays, and no spray is entirely effective in protecting peaches ripening before the Elberta. The lime spray recommended for the late peaches will give some protection to the early varieties. The application of lime to peaches, particularly shortly before harvesting, calls for the use of equipment for removing the residue in order not to interfere with marketing.

PLUMS

The lime spray recommended for peaches is also effective in protecting plums.

CHERRIES

The cherry crop is usually harvested before the Japanese beetle appears in sufficient numbers to cause damage to the foliage or fruit. After the fruit is harvested, an application of 6 pounds of lead arsenate and 4 pounds of flour in 100 gallons of water is recommended for the protection of the foliage. When leaf spot or yellow leaf is present in the orchard, 2½ gallons of commercial lime-sulphur solution should be added to the mixture. It may be necessary to repeat the application 2 or 3 weeks later.

GRAPES

Bearing and nonbearing grapevines can be protected by spraying thoroughly with 6 pounds of lead arsenate and 4 pounds of flour in 100 gallons of water, or with 32 pounds of hydrated lime in 100 gallons of water. The Japanese beetle does not feed on the fruit. The spray should be directed downward from above to avoid excessive residue on the fruit at the time of harvest, but every leaf should be covered. Where it is the practice to use 8-12-100 bordeaux mixture² on the grapes about the latter part of June, lead arsenate without the flour may be added. Additional applications of these sprays are usually necessary to protect the new growth that develops after the first application.

SMALL FRUITS

As there is no satisfactory procedure for removing the spray residue from raspberries, blackberries, and blueberries without causing damage to the fruit, the bushes should not be sprayed until after the crop is harvested. The lead arsenate and flour mixture may then be applied to protect the foliage.

SHADE TREES AND ORNAMENTAL SHRUBS

The foliage of shade trees and ornamental shrubs that are subject to attack by the Japanese beetle can be protected by spraying with 6 pounds of acid lead arsenate and 4 pounds of wheat flour in 100 gallons of water, or with 6 pounds of acid lead arsenate and 1½ pints of light-pressed fish oil in 100 gallons of water. These sprays, however, will not protect from damage the unfolding blooms of flowering plants. The spray residue adheres well to the foliage, but it may be necessary to make a second application 2 or 3 weeks later.

² Copper sulphate, 8 pounds; hydrated lime, 12 pounds; water, 100 gallons.

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