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MILKY DISEASE
for
CONTROL *of* JAPANESE
BEETLE GRUBS



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This publication was prepared by C. H. Hadley,
of the Division of Fruit Insect Investigations

MILKY DISEASE FOR CONTROL OF JAPANESE BEETLE GRUBS

What is the milky disease of Japanese beetle grubs? How does it work? How is it used? How does the milky disease compare in effectiveness with insecticides such as DDT or lead arsenate? Will milky disease control adult Japanese beetles? These questions are often asked by home owners and others faced with the necessity for fighting the Japanese beetle and protecting their lawns or other turf areas from damage by Japanese beetle grubs.

The control of the Japanese beetle is in reality a dual problem which involves both the grub and the adult stages. The first problem is the control of the young, or grub stage, in the soil. The grub is a particularly bad lawn pest, since it feeds mostly on grass roots. Milky disease spore dust is intended for use against this stage.

What Is the Milky Disease of Japanese Beetle Grubs?

Japanese beetle grubs are subject to a number of diseases. The bacteria that cause the milky diseases of the Japanese beetle are the most effective of a number of the tiny disease-causing organisms that have been studied by the Bureau of Entomology and Plant Quarantine of the United States Department of Agriculture at its research laboratory at Moorestown, N. J. The milky diseases are caused by spore-forming bacteria known to scientists as Bacillus popilliae Dutky and Bacillus lentimorbus Dutky. The former is the predominant species and is the one referred to in this discussion.

How Does the Milky Disease Work?

The milky disease bacteria normally occur in the soil as spores. As the Japanese beetle grubs work their way through the soil, feeding on grass roots and other vegetable matter, they take in the spores of the organism along with particles of soil and food material. After a grub has become infected in this manner, the bacteria multiply rapidly in its body and soon cause its death. The billions of spores produced in the blood, which is normally clear, give it a milky appearance--hence the name "milky disease." Under conditions favorable to its development this disease is fatal to a high percentage of the grubs of the Japanese beetle. It also attacks, to a limited extent, a few closely related species of white grubs. Against other kinds of insects and earthworms it has no effect.

The milky disease spores are remarkably resistant to dryness or excess moisture and to high or low temperatures. They remain alive in the soil for long periods, ready to infect and kill successive generations of Japanese beetle grubs as the latter move about in the soil and feed. Milky disease spores remain alive even after they have passed through the digestive tracts of

birds and small animals that have eaten diseased grubs. This is one of nature's methods of distributing the organism. Fortunately, the milky diseases do not affect human beings, warm-blooded animals, or plants.

How Is the Milky Disease Used?

Bureau workers have developed a device for inoculating living Japanese beetle grubs with measured doses of the disease organism, and a method of using inoculated grubs for the mass production of spores of the milky disease organism. Infected grubs are processed with talc to form a spore-dust mixture, which can be applied to turf and other grub-infested areas. Since the fall of 1939 nearly 144,000 pounds of spore dust have been produced at the Moorestown laboratory.

The Department of Agriculture does not have spore dust available for distribution to private individuals or organizations, but several concerns have been licensed by the Secretary of Agriculture to manufacture it for sale. Milky disease spore dust prepared under this license is standardized to contain 100 million spores per gram (approximately one-half teaspoonful). The spore dust is available commercially with directions for its use, and may be applied by individuals or community groups.

A program for utilizing the milky disease organism in a practical way is being carried on by the Department of Agriculture in cooperation with State agencies. This program has been in progress since the fall of 1939. Thus far more than 90,700 sites in 13 eastern States and the District of Columbia have been treated, to extend the distribution of the disease into areas where it did not previously occur. Beetle infestations have already been reduced markedly in many of the treated areas, owing largely to the rapid development of the disease, but in some localities conditions have not been entirely favorable for its rapid establishment and development.

The spore dust may be applied to infested turf in various ways. In the spot-treatment method 2 grams of the material is usually applied at intervals of 3 feet (at 3-foot intervals in rows 3 feet apart), 5 feet, or 10 feet, depending on the degree of infestation. Usually less time is required for the disease to become effective when the 3-foot spacing is used. An ordinary hand-operated corn planter with a rotary disk seeder (fig. 1) is a cheap and convenient tool for spot-treating areas of an acre or more. The planter can be adjusted to deliver about 2 grams (approximately 1 level teaspoonful) each time it is tripped. When the spore dust is applied with a corn planter and placed at intervals of 3 feet, about 20 pounds will be required to treat 1 acre; 5-foot intervals will require about 7 1/2 pounds, and 10-foot intervals about 1 3/4 pounds. For smaller areas, such as an ordinary lawn, a teaspoon can be used to distribute the spore dust.

The spore dust may also be broadcast over the turf by hand or spread with a garden-type fertilizer distri-

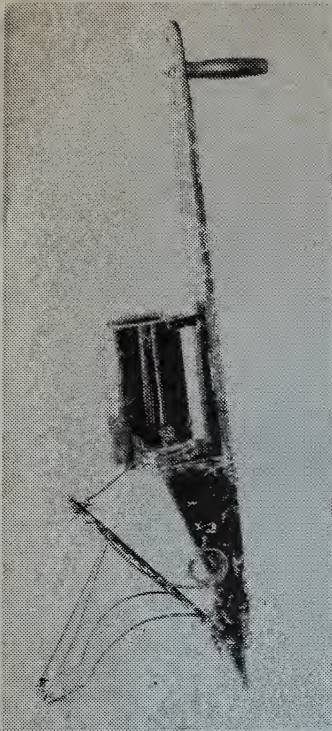


Figure 1.--A hand-operated corn planter with a rotary disk seeder.

butor, not less than 10 pounds per acre being applied. The spore dust should be thoroughly mixed with several times its volume of topsoil, fairly coarse sand, or commercial fertilizer.

One treatment of infested turf with spore dust will usually insure establishment. When the organism of the milky disease becomes thoroughly established in the soil, the grub population in those areas will ultimately be greatly reduced. The period required for thorough establishment of the milky disease in any area depends on many factors, including the amount of spore dust applied and the grub population in the treated area. Several seasons may be required before treatments reach their greatest effectiveness. The first noticeable effects will be a reduction in the grub population and less turf injury in the areas where

the spore dust has been applied. The disease will gradually spread to adjoining areas. The grub is usually found in comparatively small numbers in cultivated soil, unless sod or turf has been turned under for garden purposes. Treatments of garden areas are therefore of less importance than treatments of lawns and other grass areas.

How Does Milky Disease Compare With Chemical Insecticides?

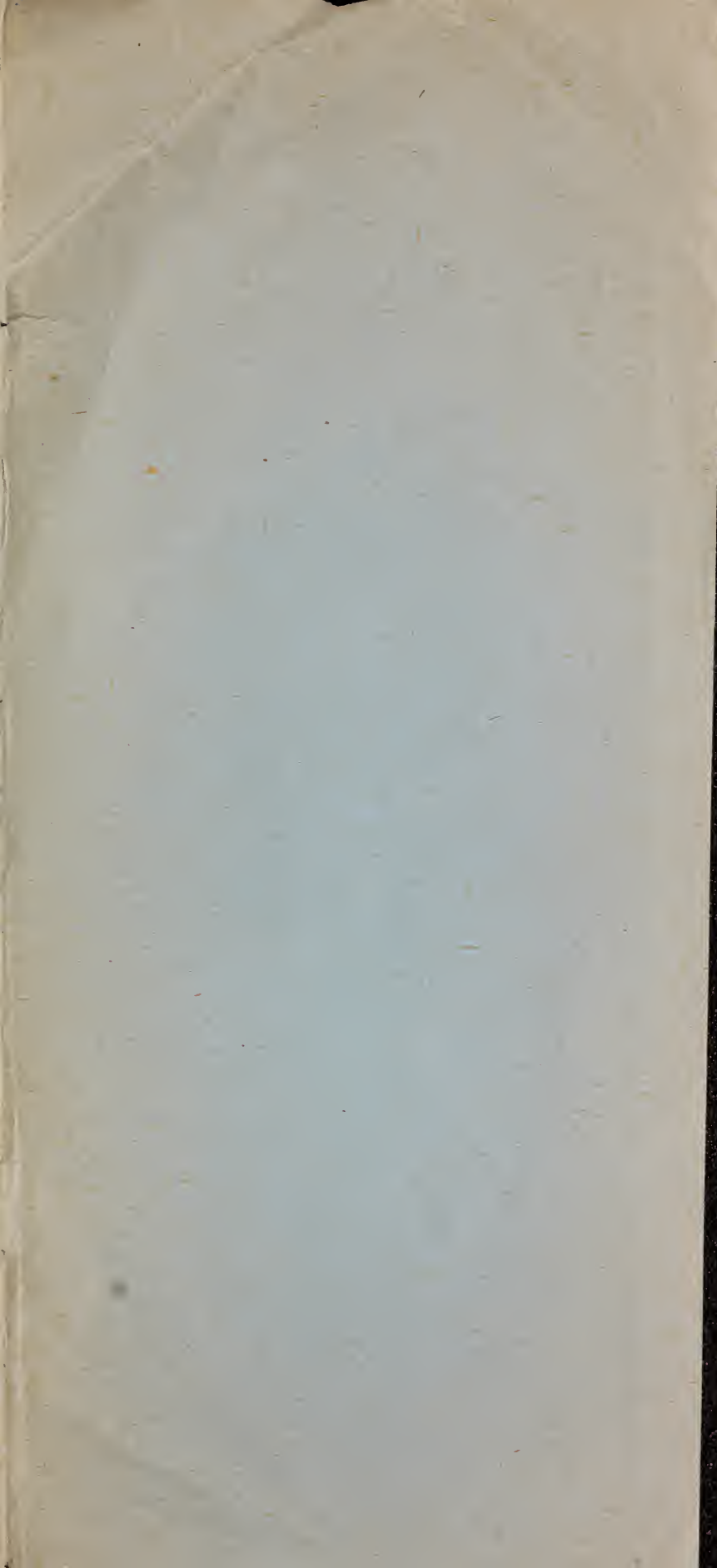
Where a quick kill of the grubs is necessary to prevent damage to the turf, the use of the milky disease is not advised in preference to the application of chemical insecticides. Where there is a heavy grub population and the turf is being damaged or is likely to be injured in the near future, the milky disease does not act quickly enough, at the dosages usually advised, to stop or prevent the injury. Under such conditions an application of one of the chemical insecticides, such as DDT or lead arsenate, will be more effective in a much shorter time. If these chemicals are used in the soil they will be effective for at least 5 years, and there is no reason for using the spore dust at the same time.

Will Milky Disease Control Adult Japanese Beetles?

The second problem in the control of this insect is the control of the adult beetle, which feeds on a wide variety of plants, including certain fruits, ornamentals, and vegetables. The milky disease is not a direct remedy for the adult beetle, although it will reduce the numbers of beetles that originate in treated acres when the disease has become well established. Beetles are active fliers and many that develop elsewhere may invade an area where the disease is established. Elimination of grubs from turf areas does not necessarily mean, therefore, that adult beetles will not injure vegetation in or surrounding the treated area, especially a small area.

General information on the Japanese beetle and the various control measures that have been developed by the United States Department of Agriculture is given in Department publications, which are available upon request.





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