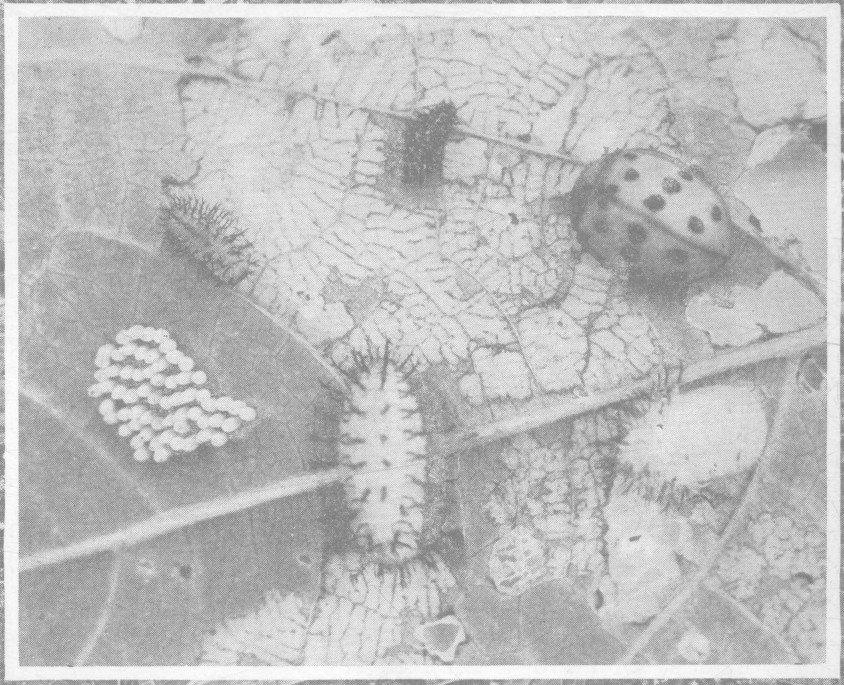
Mexican Bean Beetle



Bulletin 75
of the
Agricultural College Extension Service, The Ohio State University

SUMMARY

The Mexican bean beetle is an insect pest of beans that has recently entered Ohio.

It promises to be a permanent and serious pest of all varieties of garden beans.

The insect has four stages in its development: beetle, egg, larva, and pupa.

The beetle is nearly hemispherical, about ¼ inch long, copper colored, and has 16 black spots on the back. It lives over winter in protected places, such as in fallen leaves, in woodland areas, and, to less extent, in crop remnants and under debris.

The eggs are yellow and are deposited in clusters on the underside of the leaf.

The larvae, or grubs, are yellow or orange, covered with short spines, and feed in largest numbers during June and July, but are more or less present until frost.

The pupa is yellow or orange, and is attached to the leaf.

The beetles and grubs feed on the underside of the leaf. They eat out parallel cavities of leaf tissue through to the upper surface, leaving a lace-like appearance of the leaf. There are two broods of the insect in Ohio.

Damage first occurred to garden beans in southern Ohio in 1924. In some places the entire crop was destroyed.

Injury can be avoided by applying a dust or spray to the undersides of the bean leaves. Calcium arsenate or magnesium arsenate is the preferred insecticide to use. It must be diluted and applied according to the directions given in this bulletin.

Arsenate of lead is likely to injure the foliage if used as a spray or dust for killing bean beetles.

The arsenical must be applied with a duster or sprayer suitable for the work and equipped to direct the material against the undersides of the leaves.

Four applications at 10-day or 2-week intervals will protect bush varieties of beans until the crop is harvested. Pole varieties may require more applications.

The insecticide should be applied as soon as the pest appears and before damage occurs.

The insect will probably continue to spread and increase in numbers. Spraying or dusting will be necessary to grow beans where the beetle becomes established.

THE MEXICAN BEAN BEETLE

By

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The Mexican bean beetle *(Epilachna corrupta Muls.)* has caused considerable damage in southern and eastern Ohio. This insect is probably a native of the higher plateau of Mexico. It has been known there for more than 75 years. Its damage in the United States was confined to the southwest until 1919, at which time it was discovered to be established in Alabama.

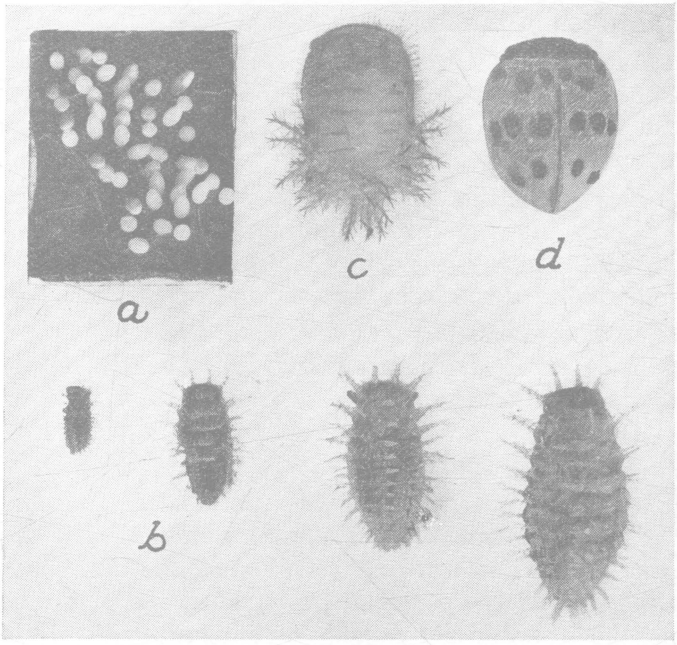

Fig. 1.— Stages in the life history of the Mexican bean beetle; (a) eggs; (b) larva during four stages of growth; (c) pupa; (d) adult or beetle.

After it was once established in the southeastern states, it began to spread rapidly, and was found for the first time in Ohio in 1923. Since that time it has caused considerable damage in twenty-five counties in Ohio.

The beetle is causing almost no damage in the northwestern third of the state. The growers in the southeastern two-thirds will

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Much of the information and some of the pictures used in this bulletin were given the author by Mr. N. F. Howard and his staff of the United States Department of Agriculture.

apparently have to apply insecticides if they expect to continue growing beans. But by using the proper spray equipment and materials and by applying them thoroughly to the under surface of the leaves, they need not fear the ravages of the Mexican bean beetle.

WHAT IS IT?

This insect is sometimes called the bean lady bird, because it belongs to the ladybird family of insects, most of which are beneficial. The bean beetle, like many other insects, passes through four stages during its life. Each stage is so much unlike the others, that it is often taken for a different insect. The following is a brief description of the four stages:

The Beetle.—The term "beetle" refers to the adult insect. It is hemispherical in shape, about one-fourth inch long, copper colored, and has sixteen black spots on its back. It is in this hard shelled stage that the insect spends the winter.

The Egg.—The egg is yellow, oval, and about the size of the head of a pin. The eggs are easily seen on the leaf, however, because the female always deposits them in clusters of from 40 to 60 on the undersides of the bean leaves.

The Larva.—This stage is a small and fuzzy yellow grub when first hatched. As it reaches maturity, it is about 5/16 of an inch long and the fuzziness proves to be transverse rows of branched spines. The long, formidable, branched spines make the larva appear much larger than it really is.

The Pupa.—After attaching the rear end of the body to the plant, the larva contracts, sheds its skin, and becomes more hemispherical. The color remains yellow and the skin bearing the spines slips back to the posterior or attached end of the body. At this time, the insect is not capable of moving about. Within this so-called resting stage, the body segments, legs, wings, and antennae are being formed. After spending about a week in the pupal stage the adult beetle emerges. The adult has the power of rapid reproduction.

SEASONAL LIFE HISTORY

There are two broods each season. The overwintering hard shelled beetles come out of winter quarters during the month of May, and begin depositing eggs in about three weeks. They are deposited in several clusters; in favorable weather a female deposits a cluster about every other day during her active season.

Though 843 eggs have been recorded for one beetle in Ohio, 300 is about the average per individual.

The eggs hatch in about a week and the larvae start feeding at once. About three weeks after hatching the larvae are full grown. They then crawl to the shaded portion of their food plant or adjoining plants of any variety and pupate.

After spending about a week in this stage the adult beetles emerge. They are a much lighter yellow than those which come

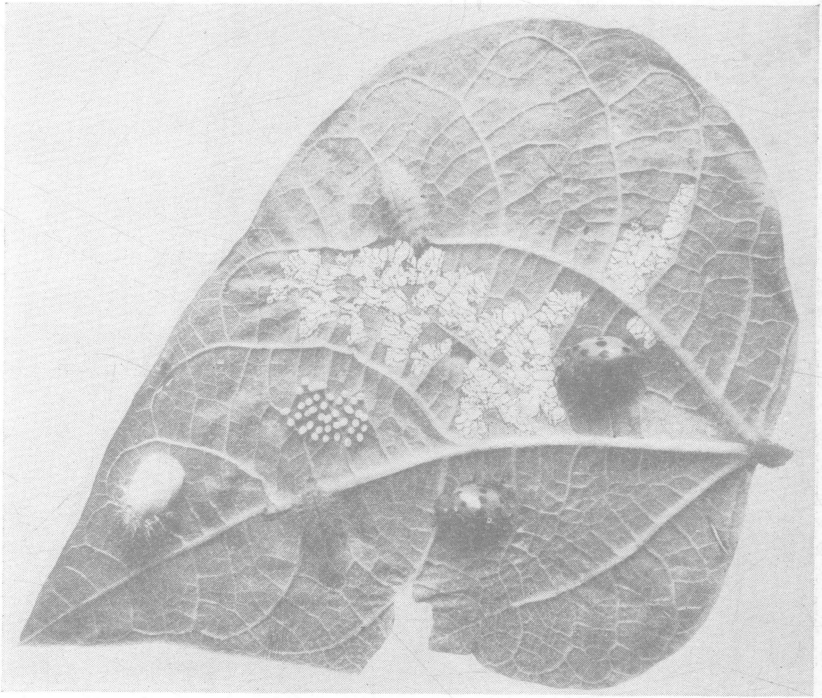


Fig. 2.— Bean leaf showing feeding marks, eggs, larva, pupa, and adults or beetles.

out of the winter quarters. Under favorable weather conditions it takes from thirty to forty days from the time the egg is laid until the adult emerges—from five to ten days for the egg to hatch, from eighteen to twenty-five days for the larva to complete its development, and from six to ten days for pupation. This brings the first brood of adult beetles in August. After a few days' feeding these beetles start depositing eggs. Quite often an early freeze kills many larvae and pupae of the second brood, thereby preventing an entire second brood of adults.

How It Causes Damage

When the eggs hatch the small larvae begin feeding near the point of hatching, but as they get older they scatter out and feed on all parts of the bean plant. The lace-like injury from feeding is characterized by the series of uneaten portions, ladder-like in appearance, remaining between the portions chewed out by the insect. The feeding is done almost entirely in the shade. The

Fig. 3.— Total destruction of beans by bean beetles in Pike County, Ohio, 1924.

larvae seldom eat entirely through, but rather leave a thin film intact on the upper surface. The adult feeding is very similar. Much feeding on the leaves causes them to turn brown, and, after the first rain, most of the severely damaged foliage falls. Under heavy infestation the feeding is not necessarily confined to the leaves, but the insects may also feed on the pods, blossoms, and branches.

In southern and southeastern Ohio the beetle has caused almost total loss to many home and market garden plantings.

Its Food Plants

The choice food plants of the insect are all varieties of garden beans in foliage. Probably the second choice is a wild plant, a species of Meibomia or tick trefoil, sometimes called beggar lice. In the absence of the preferred food plant the insect will feed on many other legumes, but rarely causes damage to them. The beetles do not often reproduce on soybeans in nature, and about the only case in which damage occurs is when, to prevent starvation, the beetles and larvae migrate from adjoining completely defoliated fields of garden beans.

How to Control It

The essential factors in the control of this insect are: (1) the selection of the proper arsenicals, (2) a correct mixture with proper strength, and (3) thorough and timely applications made to the undersides of the leaves.

For string and dry beans three or four applications during the life of the bean should be sufficient, but, owing to the longer growing season of pole beans, more applications may be necessary.

In regions where these insects are very abundant, it will no doubt be necessary to spray for the overwintering beetles which make their appearance on the beans in early June. In locations where the beetles are not so common, it may not be necessary to spray until damage from the first brood of larvae begins to show. As a rule the characteristic skeletonizing of the leaves is confined to a few plants at first, and, if all the beans are sprayed at this time, it will be early enough for the first application.

Green beans should be washed thoroughly before using.

The arsenicals recommended for control in Ohio, at present, are calcium arsenate and magnesium arsenate. Both can be purchased quite generally over the state and are giving satisfactory results, *when properly applied.* Both are sold as a white powder and can be diluted and applied as a dust or in water as a spray.

Experiments to date show that magnesium arsenate spray gives best control, but the time saved and ease of dusting with calcium arsenate more than offsets the difference in control. The type of equipment at hand, the material which can be procured, and the acreage of beans to be treated should be considered. Calcium arsenate must be applied with hydrated lime in order to prevent burning of the foliage.

Both materials can be ordered in advance and they do not

deteriorate if kept dry. Only high grade arsenicals with a minimum amount of water soluble arsenic should be used.

Some manufacturers are diluting the materials and selling the diluted dust with directions for applying it. Those people who are not familiar with spray materials had better use such mixtures and follow the methods of application as given on the containers. For the growers who prefer to mix their own materials, calcium arsenate with an As_2O_5 content of not less than 40 per cent, or magnesium arsenate with an As_2O_5 content of not less than 33 per cent should be used. Calcium arsenate should be prepared according to the following formulae:

Calcium Arsenate

Dust—

Calcium arsenate	1 part
Hydrated lime	7 parts

Apply at the rate of from 15 to 20 pounds per acre.

Spray—

Calcium arsenate	1 lb.	or	1 ounce*
Hydrated lime	2 lbs.		2 ounces
Water	50 gals.		3 gallons

Magnesium Arsenate

This material is recommended highly for Mexican bean beetle and, when used as a spray, is considered superior to calcium arsenate. It has not been known to burn the foliage.

Spray—

Magnesium arsenate	1 lb.	or	1 ounce*
Water	50 gals.		3 gallons

Dust—

Magnesium arsenate	1 part
Hydrated lime	5 parts

Apply at the rate of 15 to 20 pounds per acre.

Bordeaux Mixture

Tests made the past two years show that bordeaux mixture 4-6-50 is an excellent carrier for the arsenical as a spray, and apparently gave enough fungicidal value and protection against leafhopper to recommend its use. It will not kill Mexican bean beetles and the proper arsenical must be added to it.

* An ounce of calcium or magnesium arsenate is approximately 3 level tablespoons of the material.

Fluosilicates

A new insecticide sold under the name of sodium fluosilicate has been developed in Tennessee and tested in Ohio for the bean beetle. Although results have varied, when used at the rate of 1 part sodium fluosilicate to 2 parts hydrated lime by weight, the results under most conditions have been satisfactory. When used stronger than this, it reduces the yield, and a weaker strength gives little control. It should be applied as a dust to the underside of the leaves. Sodium fluosilicates vary in their physical condition

Fig. 4.— Four rows to left, untreated beans; the adjoining four rows saved by applying proper arsenicals.

and only the finest material, suitable for dusting, should be purchased. Sodium fluosilicate as it now appears on the market varies so much in physical condition that it is not recommended for general use.

Calcium fluosilicate at the present time has given no promise of controlling the bean beetle.

Paris Green and Arsenate of Lead Not Dependable.

Some of the older spray materials, such as Paris green and arsenate of lead, cannot be used on beans with safety. When used at sufficient strength to kill the beetle they often burn the foliage, thereby stunting or killing the plant.

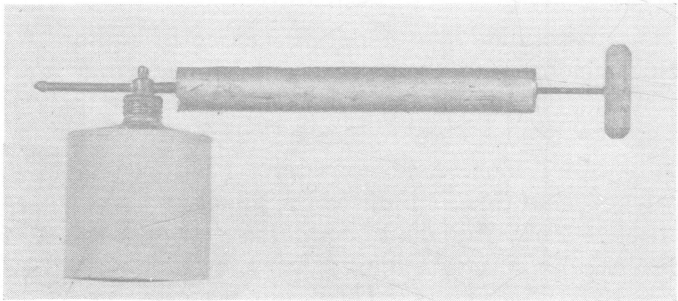


Fig. 5.— Small sprayer with a nozzle cap that throws the spray on the underside of leaves.

Dusting and Spraying Equipment

For the small garden there are on the market many types of hand sprayers and dusters, equipped for delivering the material to the underside of the leaves (see Figs. 5 and 6). The prices of these range from 50 cents to $5.

For the gardener growing up to five acres of beans, many knapsack types of sprayers and dusters can be procured. Any three to five gallon compressed air sprayer can be adjusted to spray the undersurface of the beans by removing the nozzle and attaching

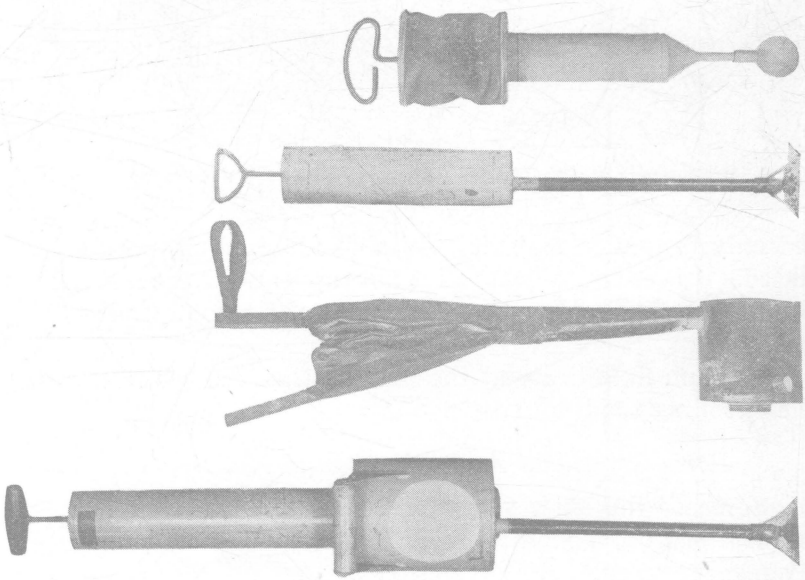


Fig. 6.— Small hand dusters suitable for home gardens.

a 3-foot length of straight ¼-inch pipe. To the free end of the pipe attach a 90- and a 45-degree ell behind an angle nozzle, as in Fig. 8. Copper or brass pipe is preferred as it will not corrode and clog the nozzle. Many sprayers today come equipped with the extension pipe and an adjustable nozzle.

Fig. 7.—A convenient duster, equipped with deflector, as in Fig. 12, for use in gardens and small truck patches.

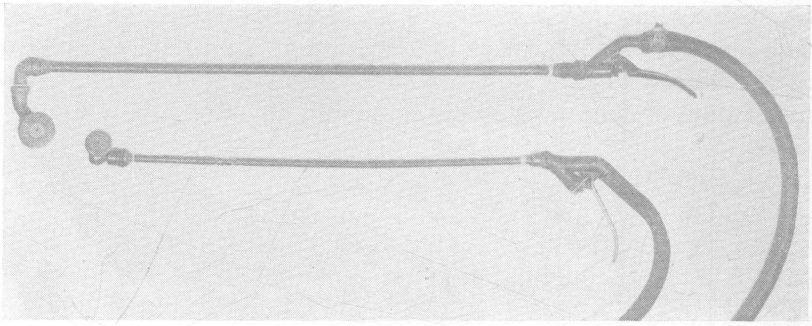


Fig. 8.— Extension rods fitted with cut-off and angle nozzles for spraying undersides of leaves.

Fig. 9.— Knapsack bellows type of dusters for truck gardens.

Knapsack dusters of both bellows and fan type can be had (see Fig. 9). These range in price from $10 to $25. For bean acreages larger than five acres, traction or gasoline power equipment is advisable. It is necessary, however, to provide a spray boom that will apply the material to the undersides of the leaves.

Aids in Control

It is a good practice to clean up plant refuse in the garden as a control measure for many insects and diseases. This will help materially in the control of the bean beetle, if the clean-up is made

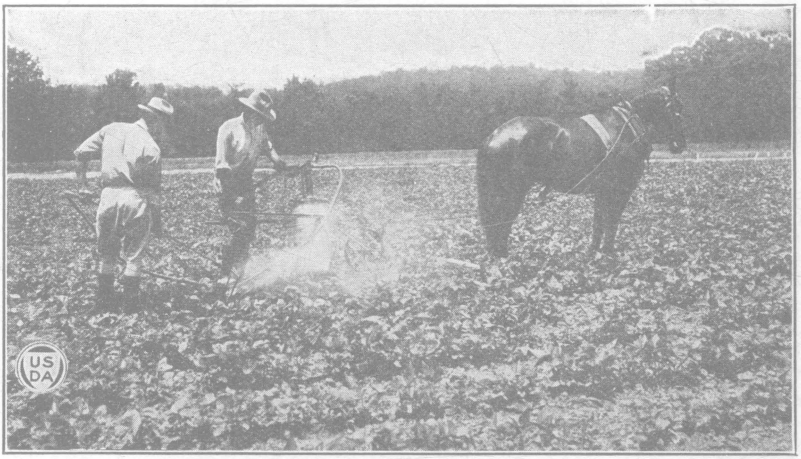


Fig. 10.—Spraying beans in small field with wheelbarrow sprayer mounted on slide and drawn by horse. *(U. S. Dept. Agr.)*

immediately after the beans have been harvested or the crop destroyed by the insect. At this time the larvae and pupae can still be found clinging to the under portions of the plants in the bean patch. The adult beetles feign death and when present drop to the ground and are likely to be passed unnoticed. Plowing under in this case would be better than burning.

Only a small percentage of the beetles spend the winter within the fields but fly to orchards, wooded areas, or around the buildings. Many go into winter quarters in September. About the only beetles remaining in the fields are those which emerge too late in the fall to migrate to better cover.

Many growers in the southern part of Ohio reported that beans planted about the second or third week of June, 1927, suffered very

little from bean beetle injury. This allowed the crop to mature during the period between the first and second broods of larvae. Experimental work is being carried on along this line, but at present no conclusive information is available.

Natural Control

Climatic Conditions.—There are several factors which help suppress this pest, but at present they play only a small part. The

Fig. 11.— Compressed air sprayers for truck gardens and small field use.

direct rays of the sun in midsummer will kill almost any stage of the insect. The proportionate amount of kill from this probably increases with the infestation. For instance, last summer the beetles were very abundant and many of the larvae pupated on the underside of the bean leaves. As the young larvae continued to feed they practically skeletonized the foliage, which exposed many pupae to the direct rays of the sun. Even though the leaves were almost completely skeletonized they did not drop off until it rained.

Then they fell to the ground and exposed a very much larger percentage of the pupae. From the pupae exposed to the bright sun only a very few adults emerged.

Also in a very dry season the percentage of eggs which hatch is very much reduced. An early frost often cuts off the food supply of the immature stages, thus preventing them from becoming adults.

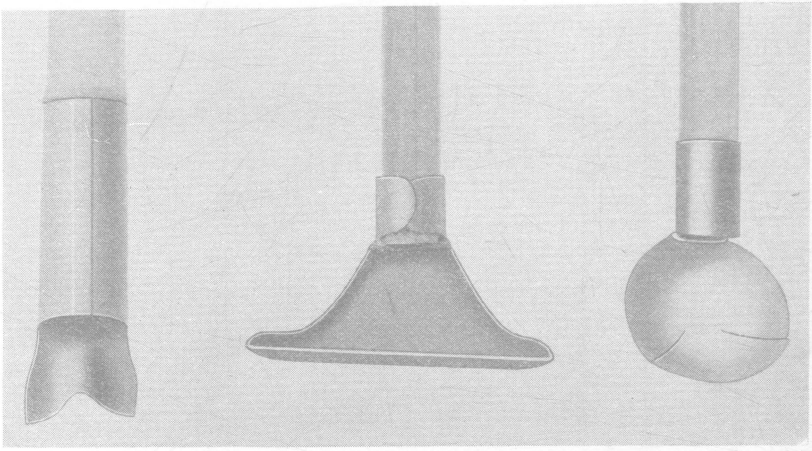
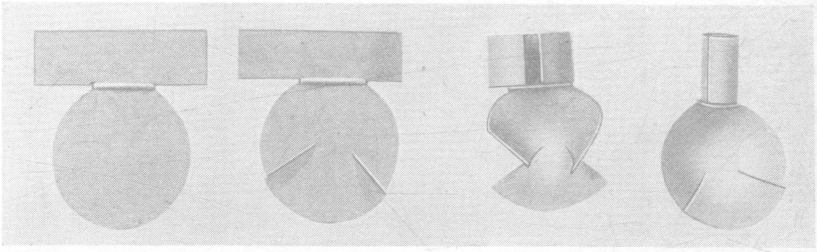


Fig. 12.—Various attachments to apply dust to the undersides of leaves.



a *b* *c* *d*

Fig. 13.— Steps in shaping the home-made "spoon" device, shown at right in Fig. 12, from a piece of tin; *a* shows first step (circle is 1½" in diameter); cut gashes as shown in *b*; fold tin as in *c*. The finished "spoon" is shown in *d*.

Natural Enemies.—At present the insect enemies of the bean beetle do not offer much assistance in its control. Some of our friends in the insect world which feed upon the bean beetle are, the smaller spotted lady-bird beetles,[1] a spined soldier bug (stink bug),[2] a parasitic fly,[3] and a small anthocorid beetle.[4]

The most of the control by the enemies is done while the bean beetles are in the immature stages.

[1] Megilla maculata De G. Hippodamia Convergens Guer.
[2] Podisus maculiventris Say.
[3] Phorocera claripennis, Marg.
[4] Triphleips insidiosus Say.

ARSENICAL DUSTS AND SPRAYS

(For further details, time of application, etc., see pages 7-8 of Bulletin)

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Hydrated lime..... 7 parts

Apply at the rate of from 15 to 20 pounds per acre.

Spray—

Calcium arsenate.....	1 lb.	or	1 ounce*
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