Strains from *D. archippus*, *P. turnus*, *P. rapae*, *E. eurytheme*, *P. huntera*, *C. promethea*, and *A. luna* were used in the experiment. In each case the gross clinical picture showed the larvae to be turgid and immobilized, blackened, and the internal organs to be disintegrated. The microscopic picture in all cases showed many lancet shaped pairs of gram positive cocci markedly resembling pneumococci. These conditions are practically identical with those found by Rief and by Glaser in their work fifteen or twenty years ago with the gipsy moth.

In the laboratory, using *Pyramais huntera* and *Callosamia promethea*, the disease proved to be highly successful both as to fatality and contagion. Field work, however, was again disappointing and only in colonies weakened by crowding and lack of food was any measure of success attained. At this time three methods of infection were used, with about equal success or lack of success; first, the early method of spraying; second, the surface infection of several individuals entering the nest; and third, injection of cultures into individual larvae and their release into the nests. The last method was perhaps the most successful but at the same time it is the least applicable.

To summarize, no real success has been met with in efforts to artificially infect healthy field colonies of the common tent caterpillar, *Malacosma americana*, with wilt disease caused by *Staphylococcus flaccidifex* of known pathogenic character. However, I am convinced that someone will find a successful method of using this organism or some other insect pathogen for the economic control of insect pests.

I wish here to acknowledge my indebtedness to Dr. F. E. Lutz of the American Museum of Natural History and to Dr. A. F. Burgess of the Gipsy Moth laboratory for their constant encouragement.

THE OCCURRENCE OF THE NOSE FLY, *CEPHENOMYIA*, IN THE DEER OF PENNSYLVANIA

By Dr. NORMAN H. STEWART, *Bucknell University*

(Withdrawn for publication elsewhere.)

SOME PHASES OF THE MEXICAN BEAN BEETLE CAMPAIGN

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ABSTRACT

A general account of the campaign against the Mexican bean beetle showing how all forces joined in preparing the growers to fight the Mexican bean beetle and how energetically and successfully the growers took hold of the proposition, together with information on spraying materials and practices and their costs.

During 1928 the Mexican bean beetle became established throughout Maryland and destroyed many bean fields. As a result bean growers, particularly the bean canners, became thoroughly aroused to the necessity of combating the pest during 1929. Maryland is a large grower of early string beans, and early and late (October) bush limas for market. The State ranks third in the canning of green beans and is well up in the list in the canning of lima beans. Therefore, with such large interests at stake and with the motivating force of destroyed crops in 1928, the problem of arousing interest was simplified.

A campaign of education was begun in the late summer of 1928 by the Department of Entomology, through the County Agricultural and Home Demonstration Agents. By means of exhibits at fairs and lectures, supplemented by circulars and information cards, the story of the beetle and its control was carried to the home gardener, the trucker and market gardener and to the canner and his associates. The Tri-State Packers' Association, The State Vegetable Growers Association, The Peninsula Horticultural Society, and the University Canners' School all served as agencies to receive and spread the gospel of control in 1929.

By conferences with Federal workers and officials of other states, an attempt was made to avoid as far as possible all debatable recommendations, and to make the directions as few and as concise as possible. One outstanding question, whether to dust or spray, had to be answered on the basis of individual conditions of terrain, water supply, and other factors. While spraying had given better results in all territories previously invaded, it was felt necessary to advocate dusting under certain conditions. Otherwise it was certain that many growers would have felt that control, in the hilly sections, was impracticable or impossible.

The number of materials recommended was cut down to magnesium arsenate for spraying and magnesium arsenate and lime or 20% copper sulphate, 20% calcium arsenate, and 60% hydrated lime for dusting. Pyrethrum sprays were advocated for any applications that were necessary on beans after the pods were formed as arsenicals were distinctly discouraged after pod formation on snap beans.

Emphasis was placed on applications as soon as beetles began to appear in considerable numbers in the fields with repetitions every 8 to 10 days depending upon the weather, rate of growth of the plants and the continuance of migration into the fields. Plowing down vines immediately after the last picking was urged and generally practiced.

Even though only four materials were recommended, the number and variety of the combinations put on the market was remarkable. As a general thing, canners and the largest truckers adhered to the recom-

mended materials. However, so numerous were the materials sold in the state, that it was found advisable to test twenty of the principal combinations for their effectiveness in control and safety on the foliage.

Materials tested to determine whether they would make the arsenicals less likely to injure the foliage resulted in showing advantage from the admixture of copper sulphate, litharge and zinc to calcium arsenate. Copper sulphate in all tests reduced the injury from arsenic, whether the combination was a dust or a spray. Magnesium arsenate used as a liquid spray is the most effective measure for commercial control where conditions permit the use of a power or large traction sprayer. Where dusting is advisable, the copper arsenic lime dusts should be used and it is probable that a 15–15–70 formula will be most satisfactory.

Early applications were necessary on all but the earliest market beans. Some fields were dusted as early as May 14. Emergence began in our cages at College Park on May 4 and continued to July 1 with the peak between June 1 and 8 though in other parts of the state the first adult was collected on March 30, the first eggs on April 6 and the first larva on April 27. An average of 15% emergence was recorded for 4,000 beetles put in the 4 cages. The first adult of the first generation emerged June 27.

Commercial dusting was begun in Western Maryland on May 29 and on the Eastern Shore the first spraying and dusting began May 27 to June 12 depending upon how far south the fields were located.

Cost and time figures were difficult to secure from commercial operations. Hand dusting required 2¼ hours per acre; four row dusters ½ hour per acre; and four row sprayers ¾ hour per acre. These averages varied with the size of the fields and the proximity of the water supply, though the latter item was offset in some operations by the use of water tanks hauled to the fields. The reduced time of spraying was one of the unlooked for developments. Fields as large as 80 acres were dusted twice with excellent results and plantings of 110 acres were sprayed twice with even better results at a lower acre cost. The average cost of dusting for 3 fields ranging from 1 to 7 acres, using the copper arsenic lime dust at 20 lbs. per acre, was $2.91. In another set of records, dusting 2 fields of 10 and 14 acres, the average cost was $1.04, using 14½ lbs. per acre. The average cost of spraying plantings ranging from 1 to 14 acres, using 3 lbs. of magnesium arsenate per 100 gallons, was $1.78 per acre.

The need for an efficient small sprayer appears to be partly satisfied by a two row sprayer and mopping machine that operates effectively at low

pressure and with about 1/3 the amount of liquid usually applied. This has been under test and observation in Maryland.

A combination of cool nights and drought during August cut down the second generation by reducing the egg deposition. Many late plantings were not treated and satisfactory crops were harvested. Likewise most of the extra early snap beans were not dusted or sprayed and good crops were picked, but the amount of injury developed amazingly toward the last and, if plowing had not been done promptly, all the later plantings would have been more difficult to protect.

Thorough preparation for combating the pest was universal; a vast amount of insecticides was sold; one company alone sold 96 traction or power dusters and sprayers and over 300 hand dusters; other companies sold more machines than the most sanguine would have dared to predict; the recommendations in the main were followed carefully; and the result in education and actual control exceeded the normal expectancy.

PLOWING AS AN AID IN MEXICAN BEAN BEETLE CONTROL

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ABSTRACT

Several tests show that plowing may be effective in destroying the Mexican bean beetle, especially the immature stages. Observations are included on the longevity and food habits of beetles unfed since emergence; observations which apply to survivors of plowing done while the population is in the pupal stage.

Possibly no advice on insect control is more freely given than that of clean culture, plowing under of infested hosts and related practices. For such oft-quoted recommendation there is a surprising dearth of experimental evidence to indicate the ways that these methods are truly of economic value to an individual or to a community. We suspect that the originators of many such statements feel justified in the strength of the common sense principle that "every little bit helps." Far from quarreling with such obvious logic, we take the position that before more than the usual emphasis is placed on these control methods an attempt should be made to measure their worth.

This type of problem is admittedly one about which it is difficult to obtain much precise information. We have reported (Va. Truck Exp. Sta. Bul. 65; 691, 1928) on our 1928 observations in this connection as they apply to the Mexican bean beetle. These were burial tests conducted in wooden frames under more or less controlled conditions. The present paper is a report of field trials of burying by means of plowing—with additional related observations.