MR. S. C. CHANDLER: I might make the suggestion that we can't judge from one year's experiments in regard to burning. We carried on some tests to ascertain the burning of arsenate of lead with varying strengths of lime, and, to our surprise the arsenate of lead alone with no lime whatever, showed no injury to peach foliage, though ordinarily we think it is not safe and use lime to prevent burning.

CHAIRMAN G. M. BENTLEY: The next paper is by N. F. Howard.

SOME NOTES ON THE MEXICAN BEAN BEETLE PROBLEM

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ABSTRACT

The Mexican bean beetle spread widely in 1927, and reached the province of Ontario, Canada, as well as the great bean producing states of Michigan and New York. It spread further eastward in the Atlantic seaboard states from South Carolina to Pennsylvania. The damage done in 1927 in areas previously infested, establishes this pest as an important one which will require continued effort on the part of the extension and the research entomologist.

Magnesium arsenate or calcium arsenate and lime have proved to be superior to sodium fluosilicate in combating this insect. Analyses of sprayed beans indicate that there is no danger from the use of these poisons when applied as recommended. Native parasites have not aided materially in suppressing this pest in the United States.

DISTRIBUTION

After two years of very slight migration to the northeast, the Mexican bean beetle spread over 150 miles northeastward in 1927, and reached Ontario County, Ontario. The migration to the east in the eastern United States was greater than usual, ranging from 25 miles to over 100 miles, averaging possibly 75 miles from South Carolina to New York State. The spread westward was relatively slight; but the spread northward on the western edge of the infested territory was remarkable, extending as far as Oakland and Macomb Counties in southeastern Michigan. (See Map, Fig. 14).

After two years of relatively light infestations over much of the territory in the southeastern states, the beetle increased in numbers in 1927. As a whole, considering the increased territory involved, this past year from the economic standpoint has probably been the most important bean beetle year to date.

DIRECT CONTROL

Studies of 15 fluorine compounds in 1925, involving a large series of cage tests indicated that sodium fluoride, sodium fluosilicate, barium fluoride, barium fluosilicate, and copper fluoride were the most toxic

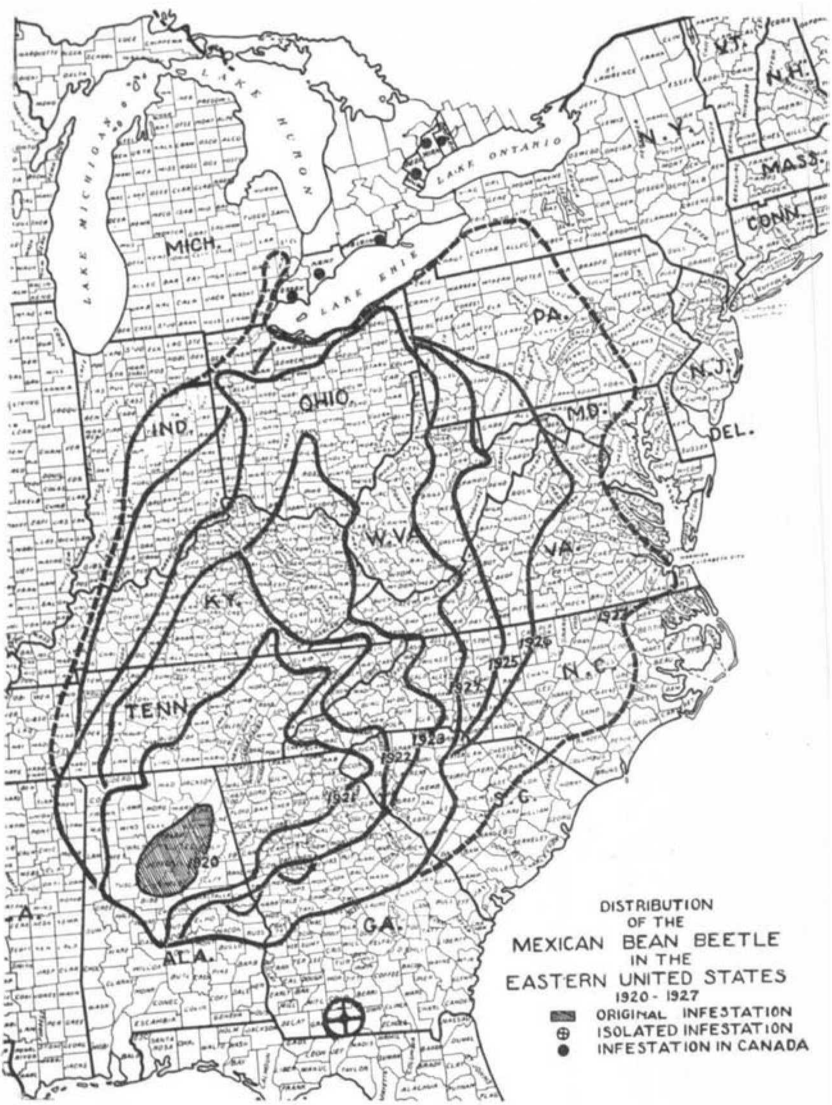

FIG. 14. Map showing the known distribution of the Mexican Bean Beetle in the eastern United States and Canada, December, 1927. The records of spread were obtained through the cooperation of the entomologists in the various states and provinces, and were supplemented in many instances with records of scouting by State and Bureau men. (Original).

to the larvae and adults of the Mexican bean beetle. All of these compounds were injurious to the bean plants in the field except barium fluoride and barium fluosilicate, but these were used in only one field test involving three applications. Sodium fluosilicate received the most attention. The results showed that when this compound was dusted on the plants and the insects placed in the cage, the material did not kill as high percentages as the arsenates of magnesium or calcium used similarly. When the insects themselves were heavily dusted, the sodium fluosilicate killed a higher percentage than the arsenicals men-

Comparison of Toxicity of Sodium Silicofluoride from Different Sources and 4 Commercial Arsenicals to the Mexican Bean Beetle (Cage Experiments)

Material	No. of Tests	Average Per cent Killed: Plants Dusted[1]		Average Per cent Killed: Insects Dusted[2]	
		Beetles	Larvae	Beetles	Larvae
Sodium silicofluoride................	3	39			
Sodium silicofluoride................	2		30		
Sodium silicofluoride................	3			90	90
Sodium silicofloride (sieved 200 mesh)	1			95	90
Sodium silicofluoride (from aother source)..........................	3	36			
Sodium silicofluoride................	2		30		
Sodium silicofluoride................	3			77	73
Sodium silicofluoride (sieved 200 mesh)	1			85	60
Sodium silicofluoride C. P...........	2	44			
Sodium silicofluoride C. P...........	1		90		
Sodium silicofluoride C. P...........	1			50	65
Average........................		39	42	83	79
Magnesium arsenate................	4	62			
Magnesium arsenate................	3		60		
Magnesium arsenate................	1			30	55
Calcium arsenate..................	3	53			
Calcium arsenate..................	2		70		
Calcium arsenate..................	1			20	55
Lead arsenate.....................	3	26			
Lead arsenate.....................	2		18		
Lead arsenate.....................	1			50	65
Zinc arsenite......................	3	48			
Zinc arsenite......................	2		58		
Zinc arsenite......................	1			60	65

[1]The plants were first dusted, then the insects were placed in the cage with the plant.

[2]The insects were placed on a flat wire screen and dusted thoroughly and then placed in a cage with an untreated plant. 20 insects were used in each test with a few exceptions, when 10 were used.

tioned. (See Table.) Results of numerous field tests during the past three years, indicate that the superiority of the arsenates of magnesium and calcium (used with lime) for bean beetle control is marked. This is no doubt due to the physical properties of the sodium fluosilicate now available and the resulting poor residual effect due to poor sticking properties. As for freedom from plant injury, the superiority of the arsenicals mentioned is even more marked.

Plant injury from the use of sodium fluosilicate is decreased by the addition of hydrated lime but toxicity to the insect is also decreased. In field tests in 1926, bentonite and diatomaceous earth were used as diluents (2 parts to 1 part of sodium fluosilicate) in comparison with hydrated lime, used in the same proportions by weight.

The bentonite mixture gave poorer control than the lime mixture; the diatomaceous earth mixture gave the same degree of insect control and plant injury as the lime mixture.

Numerous tests during the past three years have shown that a calcium fluosilicate compound is too low in toxicity to be of practical use when the infestation is heavy unless excessive amounts are applied.

Pyrethrum and pyrethrum extracts have been tried rather extensively. Both are very toxic to the beetle and the larva. The extract may be diluted 5 to 8 times more than recommended for the Japanese beetle, but when used in the field under conditions of heavy infestation, poor control was obtained when 5 applications were made a week apart. This is probably due to the absence of a toxic residue shortly after application. The compound has value, however, in that it can no doubt be used after the bean blossoms by those who refuse to use an arsenical on green beans.

The problem of the control of the Mexican bean beetle, is one which requires considerable assistance from the extension entomologist and the county agricultural agent. So many compounds are sold locally, some of doubtful merit, that the grower needs advice on the choice of materials. The necessity of reaching the undersides of the leaves, whatever material is applied, is one that is not always appreciated by the grower.

In the southeastern states where three or four broods of the beetle occur, the date of planting to avoid injury is not always important. But further north where only two broods, or two broods and a small third brood develop, a proportion of the bean crop may be planted late enough to escape the majority of overwintered females and thus avoid considerable injury. When planting is delayed in southern Ohio until middle or late June fewer dust or spray applications are required.

The importance of clean up practices when the infestation is heavy cannot be over emphasized. A crop of bush beans may have an adult population of 3 million adults to the acre and several times as many of the immature stages. Pole beans may have a much higher population The benefit derived from plowing under or otherwise destroying this large number of insects is obvious.

Arsenical Residue

Beans which were sprayed with arsenicals in accordance with recommended practices, were run through the cannery in the normal manner, and then analyzed. The highest arsenical content was .001 grains per pound in two instances and others ran far lower.

A large number of samples of sprayed and dusted beans from our experimental plats have been analyzed by the Food, Drug and Insecticide laboratory of the United States Department of Agriculture. These samples were not washed, it being desired to have data on extreme cases. Some of the samples picked immediately or within three days after treatment showed more than .01 grains per pound, but a portion of these had been treated with heavy dosages for the purpose of obtaining experimental data. In rinsing and cooking the arsenic content would have been greatly reduced. There has been no indication, on the basis of numerous analyses of treated beans, that the recommendations for controlling the bean beetle, if followed carefully, are dangerous from the standpoint of arsenical residue.

Natural Enemies

During the seven years that the Mexican bean beetle has been present in the southeastern states, very little assistance in suppressing it has been given by parasites and predators. The potential value of at least one parasite in Mexico, the tachinid fly, *Paradexodes epilachnae* Ald., is great, and further efforts to introduce this species should be made.

Chairman G. M. Benltey: The next paper is by D. M. De Long.