tain that the continued welfare of all the people requires that the place of the intellectual worker should be one of far greater respect, influence and serviceableness than at present. Professor MacDonald, in this book, has made a notable and useful contribution to progress in this direction.

WALTER P. TAYLOR

BIOLOGICAL SURVEY

SPECIAL ARTICLES

PROMISING PLANT INSECTICIDES

SODIUM fluoride is one of our most efficient insecticides, as it is both a contact and stomach poison. When a roach walks over sodium fluoride the material adheres to the antennae, legs and tarsi, and according to Shafer (Mich. Agr. Expt. Station Tech. Bull. No. 21) some of the powder dissolves in the exudations of the integument. It is possible for death to take place through contact alone in from five to twenty-two hours. Due to the habits of the roach in cleaning itself, the feet and antennae are drawn through the mouth. It then acts as a stomach poison and death ensues more rapidly.

Sodium fluoride can not, however, be used on plants, because it is soluble in water. A study of other fluorine compounds revealed several that are but slightly soluble, very efficient and cheap. Sodium fluosilicate, calcium fluosilicate and cryolite all gave good results in tests against the Mexican bean beetle (*Epilachna corrupta* Muls.) Field experiments were carried out at Knoxville with sodium fluosilicate mixed with 9 parts of lime by volume against the Mexican bean beetle. 4 or 5 applications were sufficient in giving excellent protection and showed a net return of $187.60 per acre due to the control of the beetle.

The sodium fluosilicate is more efficient against the adult beetles than the larvae, due to the habits of the beetle of using its mouth to clean the feet on which the powder may be adhering. In order to get good control, therefore, the dust applications should be made as soon as the beetles appear and before egg-laying gets under way.

Tests with sodium fluosilicate undiluted showed it to be effective against the cotton boll weevil (*Anthonomus grandis* Boh.). In all the tests conducted under cages, the weevils were killed in from 5 to 24 hours. It was also observed that the weevils could be killed entirely by contact after crawling over plants dusted with the powder. To make sure that the weevils were killed by contact only, they were placed on a bean plant dusted with sodium fluosilicate. After crawling over the bean plant (which weevils do not eat) 50 per cent. of the weevils were dead in 6 hours, while the rest were found dead the next morning. In the control cage, untreated, all were alive.

As obtained on the market to-day, the density of sodium fluosilicate is rather high for dusting purposes, but this factor could very likely be overcome with further research.

In the search for new insecticides, experiments were also conducted with various volatile substances, since gases are more rapidly absorbed than solids or liquids. The gases used in the late war have undoubtedly been tried out by many workers, but when used in the ordinary ways of fumigating, they are very detrimental to plants. In order not to injure the plants the gases were adsorbed on charcoal, so as to liberate only a small amount at any one moment. A rapid kill could not be obtained in this way, but death takes place with no less certainty after several hours.

.01 per cent. of mustard gas (dichlorethylsulfide) with a little ether absorbed on charcoal which was dusted over a bean plant killed Mexican bean beetles in from three to six hours. 4 per cent. mustard gas without ether was no more effective. As high as 16 per cent. mustard gas on charcoal did not injure plants. These samples of impregnated charcoal were supplied by C. W. Exton, of the Chemical Warfare Service.

A field trial of 5 per cent. liquid nitrobenzene in charcoal gave good control against the Mexican bean beetle.

As the cotton boll weevil has not the habit of putting its foot in its mouth, it is not as readily killed with impregnated charcoal as the bean beetle, yet the results obtained in cage tests are promising. In many cases boll weevils succumbed in four hours after crawling over charcoal with .01 per cent. mustard and a little ether. Others became more or less inactive and died in 1 to 5 days.

When a weevil crawls over impregnated charcoal it begins to rub its legs and tries to fly away. After making several attempts at flying, it becomes weakened and unable to fold its wings beneath the wing covers.

Further study with a larger range of gases should yield a combination that will be worthy of field tests on a large scale against the boll weevil. Wood charcoal can be obtained on the market to-day at less than $2.00 a hundred. The cost of impregnating should not be great when conducted on a large scale. Adsorbed gases on charcoal or some other substances such as silica offer promising insecticides at a small cost.

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