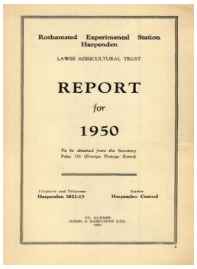
ROTHAMSTED RESEARCH

Report for 1950

Full Table of Content



Insecticides and Fungicides Department

C. Potter

C. Potter (1951) *Insecticides and Fungicides Department ;* Report For 1950, pp 101 - 111 **- DOI: https://doi.org/10.23637/ERADOC-1-72**

INSECTICIDES AND FUNGICIDES DEPARTMENT

By C. Potter

The secondment of Mr. M. J. Way to Zanzibar to work on sudden death of cloves and the absence of Dr. A. H. McIntosh in the United States of America, and of Dr. K. A. Lord at Cambridge, has considerably upset the general programme of work of the department, although it is hoped that the department will ultimately benefit when they return.

During the year Mrs. Gillham resigned from the department and Miss C. M. Hutt was appointed in her place. Mr. J. Ward has been appointed as chemist to work on deposits of insecticides on plant surfaces. Miss Helen Salkeld of the Ontario Agricultural College has arrived to work in the department for two years, and Mr. R. W. Kerr, of the Commonwealth Council of Scientific and Industrial Research, Canberra, has arrived for a stay of one year.

During the course of the year Mr. T. D. Mukerjea was awarded the Ph.D. degree of London University and has now returned to India.

The work of the department during the year is set out below.

Chemical

Physical chemistry

(a) *The effect of particle size of suspensions of contact insecticides on their toxicity as contact poisons.*

Before his vist to Connecticut, Dr. McIntosh had shown that the contact toxicity of both rotenone and D.D.T. to adults of *Oryzaephilus surinamensis*, the saw-toothed grain beetle, and of D.D.T. to adult *Tribolium castaneum*, the flour beetle, was dependent on the size of the crystals of the poison in suspension. The relative toxicity of different sizes of D.D.T. crystal was shown to be dependent on the temperature of after-treatment. To explain these effects, Dr. McIntosh put forward a hypothesis based on the relative solubility of different poisons and of crystals of different sizes in the cuticular lipoids. He has continued to work at Connecticut using an injection technique to determine the differences in toxicity that occur when the insecticide does not have to penetrate the lipoid layer of the cuticle. The milkweed bug (*Oncopeltus fasciatus*) was used as test subject. When the insects were kept at 27°C. after treatment, crystals of both rotenone and D.D.T. were equitoxic with their colloidal material after two days, and afterwards the kills from the two types of suspension increased slowly and at the same rate.

If the insects were kept at 10°C. after treatment, colloidal rotenone was about 100 times as toxic as the crystals at the end of two days, but the ratio decreased with time and at the end of three weeks the total kill from the two types was about equal. When this comparison was made using D.D.T., which is more fat-soluble than rotenone, similar results were obtained; but the difference at the end of two days was approximately fifteen times instead of a hundred and the two types became equitoxic after about eight

https://doi.org/10.23637/ERADOC-1-72

days. When the experiment was carried out using the fluorine analogue of D.D.T. (D.F.D.T.), which is about five times more soluble in olive oil than D.D.T., there was no difference in toxicity at the end of two days or subsequently.

It appears that when suspensions of poisons of different crystal size are applied externally to the cuticle, differences both in speed of action and ultimate toxicity may occur. When these same poisons are injected, differences in speed of action can occur but the ultimate toxicity is the same. Dr. McIntosh considers these experiments provide further evidence of the importance of fat solubility and has prepared a paper in which the facts and their possible explanation are discussed in detail.

(b) *Effect of surface active agents on action of contact poisons.* Very little work on this subject has been done in the current year since it was discovered that with the technique in use, residual effects might obscure direct contact effects. Before continuing further therefore, an investigation of the technique was started and has not yet been completed.

Biochemical

Since Dr. Lord has been working at Cambridge during the current year, his study of the effect of insecticides on the oxygen uptake of insects has been left in abeyance, but it will be resumed on his return.

The study of insect esterase has been continued and the inhibiting action of the organo-phosphorus compounds on them has been studied, both Dr. Potter and Miss Hutt have taken part in this work. Various samples of T.E.P.P.-containing materials have been examined and a correlation between content of tetraethyl pyrophosphate, as determined chemically, and esterase inhibition has been established. This was also related, though less closely, to the insecticidal potency to adult *Tribolium castaneum* Hbst. of the various materials. A limited survey of the occurrence of insect tissues has been carried out and it has been shown, *inter alia*, that eggs of *Diataraxia oleracea* in an early stage of development (within 24 hours of oviposition) give this reaction and that it is inhibited by tetraethyl pyrophosphate-containing materials. This work affords some evidence that esterases other than choline esterase, may be important when considering the mechanisms of insecticidal action of the organo-phosphorus compounds. Since January, Dr. Lord has been working in the Sir William Dunn Institute of Biochemistry mainly on the purification and properties of the esterase obtained from the larvae of *Tenebrio molitor*. At the same time he has been studying techniques for the investigation of other enzyme systems, so that the scope of our investigations on the interaction between insecticides and insect enzymes may be widened.

Relationship between chemical constitution and insecticidal activity

Mr. Elliott has continued his work on the synthesis of compounds related to the pyrethrins.

Previous work provides evidence that pyrethrolone, cinerolone and the chrysanthemum mono- and dicarboxylic acids have very limited insecticidal action on their own. Further, esterification of

https://doi.org/10.23637/ERADOC-1-72

either keto-alcohol with other acids, or of chrysanthemum monocarboxylic acid with other alcohols not closely related to pyrethrolone or cinerolone, leads to compounds which do not have the rapid action and high toxicity of the pyrethrins themselves. These facts, amongst others, indicate that the high biological activity of these compounds is a function of the molecule as a whole; moreover, since tetrahydropyrethrin I and dihydro-cinerin I, whilst retaining some of the rapid paralytic action characteristic of these esters, are relatively non-toxic, the double bond(s) in the side chain are very important.

Two lines of work based on these considerations have been pursued.

(a) The synthesis of ketones related to the naturally occurring keto-alcohols in which a 3-methyl-*cyclo*pent-2-en-1-one derivative having an unsaturated side chain in the 2-position contains a group in the 4-position enabling it to be linked to (+)-*trans*-chrysanthemum monocarboxylic acid or to a compound derived from it. Such compounds would differ from synthetic compounds produced hitherto in their physical and chemical properties, whilst retaining a similarity to them in the relative positions in space of the chrysansumum acid residue and the unsaturated side chain.

$\gamma\gamma$-disubstituted-γ-lactones can by cyclized to *cyclo*pentenones in low yield by dehydrating agents. It has been shown in this work that β-carbethoxy-$\gamma\gamma$-disubstituted ethylenic acids and the corresponding lactones can be prepared in yields above 90 per cent by the modified Stobbe condensation of methyl *n*-alkyl and *n*-alkenyl ketones with diethyl succinate in the presence of potassium tertiary butoxide or of sodium hydride. The resulting half-esters can be cyclized by distillation from a slight excess of phosphorus pentoxide to 4-carbethoxy and 4-carboxy-*cyclo*pent-2-en-1-ones, which are characterized by their analysis, by their absorption in the ultra-violet region (λ max. 2350A), by their red 2 : 4-dinitrophenylhydrazones, and by their salts with aniline. A full description of this synthetic work and the reactions of these compounds will be published.

Investigations are in progress into possible methods of condensing these acids, or compounds derived from them, with chrysanthemum monocarboxylic acid, thus producing compounds in which the stereo-chemical configuration would closely resemble that of the naturally occuring keto-esters, which could be examined for biological activity. However, the *cyclo*pentenone ring in these compounds undergoes fission on treatment with dilute alkali or aqueous ammonia even in the cold, rendering the synthesis of such compounds difficult. Further study is being carried out on these compounds and on methods of esterifying the 4-carboxy-*cyclo* pentenones with alcohols closely related to chrysanthemum monocarboxylic acid.

(b) The investigation of the insecticidal activity of a range of synthetic esters related to the pyrethrins, very kindly donated at our request by Drs. LaForge and Schechter of the United States Department of Agriculture, Division of Entomology and Plant Quarantine, and by Dr. S. H. Harper of the Chemistry Department, King's College, London, in which the side chain of the keto-alcoholic component and the optical and geometrical isomeric forms

https://doi.org/10.23637/ERADOC-1-72

of the chrysanthemum monocarboxylic acid are varied. The work is being carried out by Mr. Elliott, Mr. Needham and Dr. Potter.

Preliminary results were described in the 1949 report, when the natural pyrethrins were compared with the (±)-allyl keto-alcohol esterified with the naturally occurring (+)-*trans* and synthetic (±)-*cis-trans* chrysanthemum monocarboxylic acids. This work has now been completed and published. The evidence obtained indicated that the ester with the (±)-*cis-trans* acid was generally approximately one half as toxic as that with the natural acid.

Further tests by contact spraying using the last stage instar larvae of *Plutella maculipennis*, using the ester of the allyl keto-alcohol with the natural acid and the ester with the (–)-*trans* acid have now shown that the latter has about 1/40 the toxicity of the former.

Results of contact spraying tests on adult *Phaedon cochleariae* and fully grown larvae of *Plutella maculipennis* comparing esters from mixtures of the geometrical and optical isomeric forms of chrysanthemum monocarboxylic acid with keto-alcohols with allyl and methallyl side chains indicate that there are not great differences in the insecticidal activity of the esters from the (±)-*cis-trans* form of the acid, and that the compounds with a methallyl side chain are only slightly less toxic than the corresponding esters with an allyl grouping. Of considerable importance is the fact that a compound with a but-3′-enyl side chain in which the double bond is shifted by one carbon atom further from the *cyclo*pentenone ring to the terminal position, has apparently an order of toxicity comparable to that of the ester with an allyl side chain.

In order to take into account specific differences in effect between the various compounds, work is in progress to extend the range of species used for the tests. Furthermore, to determine if any effects are due to differences in cuticular penetration, an attempt is being made to provide comparisons using an injection method, in addition to the usual contact techniques.

Biological

Bioassay

(a) *Tannin extract from Quebracho tree.* Quebracho timber is reported to be almost immume from insect attack. The Forestal Research Laboratories, Harpenden, kindly supplied us with a commericial extract used in the tanning industry which was tested for insecticidal properties.

The extract proved to be almost ineffective both as a stomach and as a contact poision to three species of lepidopterous larvae and three species of adult coleoptera. The test species were : *Diataraxia oleracea, Plutella maculipennis, Pieris brassicae, Phaedon cochleariae, Oryzaephilus surinamensis*, and *Tribolium castaneum.*

When injected into the haemocoel of final instar larvae of *Diataraxia oleracea* a dose of 0·2 mg. per individual of a 2 per cent aqueous solution of the extract produced 90 per cent mortality, but in view of the stomach and contact poison results no further work was done on the material.

(b) *Isothiocyanates.* These substances were thought to have some possibilities as insecticides and a quantity of a phenyl

https://doi.org/10.23637/ERADOC-1-72

isothiocyanate derivative was obtained from Roche Products Ltd., and tested.

Roche Products Ltd., has already found that the material was an effective anthelmintic.

The material was found to have some activity, but when tested as a contact poison was considerably less toxic than D.D.T., ranging from 1/64 as toxic with *Oryzaephilus surinamensis* L. adults as test subjects, to 1/8 as toxic with *Phaedon cochleariae* Fab., adults.

Following these tests it has been decided to examine the insecticidal activity of a series of related isothiocyanates which show considerable variation in their activity with nematodes as test subject, in an attempt to determine if similar changes occur with insects.

It is hoped that this work may give some information on the relationship between chemical constitution and insecticidal activity.

Bioassay techniques

A considerable amount of work has been carried out in the last year on techniques for the bioassay of insecticides.

(a) *Injection techniques.* Mr. Paul Needham has continued his studies on injection apparatus and technique.

A reservoir and tap have been fitted to the delivery arm of the micropipette injection apparatus described in last year's report, this makes refilling a more convenient operation.

Early tests using an extract of natural pyrethrins and *Locusta migratoria* L. and *Periplaneta americana* L., as test subjects, while giving probit regression lines that were not significantly heterogeneous, were not considered satisfactory since the scatter of the points was greater than was expected of this technique.

One reason for the wide scatter may have been the small number of insects that could be injected in one experiment when using the mechanical manipulator described in the 1949 report. This was due to the time taken to anaesthetise and secure the insect and position it accurately. Under these conditions only five insects would be injected at each concentration where a comparison of two poisons was required.

In later experiments the manipulator was dispensed with and the test insects held by hand. By this means the number of insects for any one test could be more than doubled and there was a marked improvement in the accuracy of comparison.

It is proposed to attempt to develop a better design of mechanical manipulator and to resume tests on the effect of precise manipulation of the test subject.

Some tests have been made on the suitability for injection experiments of the following insects—Adults : *Periplaneta americana* L (American cockroach) ; *Locusta migratoria migratoriodes* L. (African migratory locust) ; *Tenebrio molitor* (Meal worm) ; *Dysdercus fasciatus* (Cotton stainer) ; Larvae : *Diataraxia oleracea* L. (Tomato moth) ; *Pieris brassicae* L. (Large cabbage white butterfly).

L. migratoria and P. *americana* proved very suitable but require extra facilities in order to be reared in sufficient numbers to have enough individuals of a given age at any one time to obtain a comparison of two or more treatments.

https://doi.org/10.23637/ERADOC-1-72

D. fasciatus and *D. oleracea* appear, from the results so far obtained, to be most suitable test subjects. They have given the best probit regression lines and have the added advantage that they are easily reared in large numbers.

Some experiments have been carried out on the effect of the volume of liquid injected on the toxicity of the accompanying poison. Using *Diataraxia oleracea* L. larvae as test subject, an extract of the pyrethrins and allethrin as poisons, and a medium of 10 per cent v/v acetone, 0·1 per cent w/v sulphonated lorol in distilled water, it was found that the toxicity of the poison was affected by the amount of medium injected and that this effect varied with the mortality level. Thus for the pyrethrins, at L.D.75 the poison was twice as toxic when the same dose was injected in 0·02 c.c. of medium than in 0·01 c.c. while at L.D.25 the reverse held true. At L.D.50 there was no difference.

A similar result was obtained with allethrin but the ratios were obtained at different mortality levels. These experiments are to be continued.

(b) *Contact techniques.* Dr. Potter has continued to work on apparatus and technique for the examination of the effect of contact insecticides. There has been a continued interest in the laboratory apparatus for applying contact insecticides first described by Potter (1941) and it has now been installed in a number of laboratories both here and abroad. Requests have also been received for a description of the improved design and a considerable amount of time has been spent in the current year obtaining data on its performance.

The latest design has been shown to give a satisfactory distribution and replication of deposit with distilled water, a heavy petroleum oil and a light petroleum oil, this indicating that it is suitable for use with a wide variety of media. Electrostatic effects are now being studied.

Some further work on the relative importance of the direct contact effect and the residual film effect of poisons has been carried out and this is being continued.

(c) *Stomach poison technique.* Owing to Mr. Way's secondment to Zanzibar no further experimental work has been done on this subject, but a paper is in preparation for publication by Mr. Way on the relationship between insect body weight and resistance to insecticides, which includes data on the effect of stomach poisons.

The effect of stage of development on insect resistance

Mr. Mukerjea completed his study of the variation of resistance with the stage of development of the insect, using *Diataraxia oleracea* (Tomato moth), *Tenebrio molitor* (Meal worm) and *Periplaneta americana* (American cockroach) as test subjects and D.D.T. and Pyrethrum as insecticides. He has been awarded a Ph.D. of London University for this work which is now in preparation for publication.

The large differences in resistance that have been shown to occur throughout an insect's life history, clearly demonstrate the need both for accurate timing in the application of an insecticide and a detailed biological background.

https://doi.org/10.23637/ERADOC-1-72

Work on this subject is being continued by Miss Helen Salkeld who is studying the variation of resistance of insect eggs with their stage of development.

Factors affecting the toxicity and permanence of insecticidal deposits on plants

Work on this subject has been continued by Mr. Burt, and, towards the end of the year, by Mr. Ward. Experiments in 1949 on the toxicity of D.D.T. deposits on cabbage and turnip foliage showed, *inter alia*, that there was a fall in contact toxicity of the deposit over a period of two days immediately after spraying and that this was accompanied by an increase in stomach poison effect, thus indicating that the D.D.T. had not been removed from the leaf. The fall in toxicity could not be accounted for by dilution due to leaf growth and it was thought that it might be due to solution of the D.D.T. in leaf surface waxes. A study has therefore been made of the behaviour of D.D.T. on films of plant wax deposited on a glass surface.

Carnauba wax was first tried but no technique for preparation of an even film could be found and Sisal wax was then adopted, although it was not entirely suitable owing to its high melting point.

Some experiments showed that the thickness of the wax film on leaves varies with age. The maximum value found, 0·5μ for old cabbage leaves, was adopted as the standard.

A considerable amount of time was spent in developing a technique for the preparation of films of wax of known thickness; ultimately it was found that this could be achieved by dissolving the wax in warm toluene and spraying it through the Potter tower, and this procedure was adopted.

Wax films prepared in this way on plain glass plates were sprayed to give a known weight per unit area of D.D.T. crystals of needle form, average length 50μ. Some of the plates were subsequently kept at 65°F, and others at 110°F.

The temperature of 110°F. was included since preliminary experiments with thermocouples had shown that leaf temperatures of 18°F. higher than the air temperature could be reached in a glasshouse. The glasshouse temperature was 92°F. and thus 110°F. might be attained under field conditions. Experiments outdoors also showed that insolated leaf surfaces were above air temperature. With an air temperature of 75°F. the leaf temperature was 88°F.

It was found that the contact toxicity to adult *Tribolium castaneum* Hbst. of the D.D.T. deposits on wax was somewhat greater than on the plain glass surface, but this effect was overshadowed by the relatively rapid loss of toxicity of the D.D.T. both on the wax and glass surface when kept at 110°F. At 65°F. there was only a small loss of toxicity from both wax and plain glass surfaces over a period of three weeks; however, at 110°F. loss of toxicity was apparent after two days and after 14 days the L.D.50, determined from a range of concentrations, had approximately doubled, indicating a considerable loss of insecticide.

Weighing experiments using a micro-balance showed that the loss of toxicity was due to loss of D.D.T. from the surface and not to

https://doi.org/10.23637/ERADOC-1-72

solution in the wax. Between 60-100 per cent of the D.D.T. was lost in 21 days when the surface was kept at 110°F.

This loss was confirmed by analysis using the Schechter-Haller technique.

These experiments indicate that a comparatively rapid loss of toxicity of residual deposits of D.D.T. on foliage may occur due to volatility, at temperatures that can occur at leaf surfaces, particularly in warm climates.

None of the experiments however, showed the initial fall in contact toxicity found in the earlier experiments on cabbage leaves. It was thought that this might be due to differences in the constitution of sisal and cabbage leaf waxes and work is in progress to obtain some cabbage leaf wax and experiment with this material.

Mechanism of selection of strains of insect resistant to insecticides

Dr. Tattersfield carried out a series of experiments on selected strains of *Drosophila melanogaster* (the fruit fly). The progeny of survivors from insects treated with D.D.T. showed some evidence of increase in resistance over the untreated stock, but large variations in the resistance level of both treated and untreated stocks occurred throughout the series of tests and complicated the experiment. Examination of factors in the spraying and rearing technique that may be responsible for this variation is in progress in an attempt to determine whether the variation is inherent or not, and alternative methods of selection are under consideration.

Insect rearing

Eighteen species of plant feeding insects and nine species of stored products insects were reared during the current year.

Prodenia litura F. (the cotton worm), *Timarcha tenebricosa* F. (bloody nosed beetle), and *Dysdercus fasciatus* (cotton stainer) all plant feeding species have been added to the stocks during the current year. *Dysdercus fasciatus* and *Prodenia litura* have so far presented few difficulties for large scale rearing and the *D. fasciatus* is proving very useful for injection experiments. In view of the necessity for increasing the number of species of plant feeding beetles available as test subjects Miss P. Smith is working on the biology of *Timarcha tenebricosa* and has so far found that the diapause of the developed embryo in the eggs, can be broken by a period of refrigeration.

In view of their usefulness as test subjects further investigations have been made on the environmental factors affecting the biology of *Phaedon cochleariae* (mustard beetle), by Miss P. Smith and on *Diataraxia oleracea* (tomato moth) by Miss B. Hopkins.

A publication by Mr. Way, Miss Smith and Miss Hopkins embodying the work on rearing techniques up to date has been accepted for publication.

Insect diapause

Owing to the absence of Mr. Way only a little work has been done on this subject, but preliminary tests on *Pieris brassicae* (the large cabbage white butterfly) indicate that it reacts in a similar

https://doi.org/10.23637/ERADOC-1-72

manner to *Diataraxia oleracea* (tomato moth) since larvae reared at 65°F. with a 16-hour light exposure every 24 hours produce 100 per cent non-diapause pupae while those reared with a 9-hour light exposure gave 100 per cent diapause pupae.

Toxicity of plant protective chemicals to bees

Dr. Potter has continued to retain a supervisory interest in the work on the toxicity of plant protective chemicals to bees started by Mr. Glynne-Jones at Rothamsted in 1947 and now being carried on by him at the Seale Hayne Agricultural College.

Suitable testing equipment has been installed in the laboratory and the action of the organo-phosphorus compounds, Parathion, T.E.P.P. and Pestox III, have been examined when applied as stomach poisons, contact poisons and as residual films.

The M.L.D's of these substances applied as stomach poisons were: Parathion, 0·00004 mg./bee; T.E.P.P. 0·004 mg. (pure T.E.P.P.) /bee; Pestox III, 0·01 mg./bee.

The concentrations required to obtain an M.L.D. as a contact poison in aqueous medium were Parathon 0·0055 per cent w/v (deposit 0·00038 mg. Parathion/sq. cm.); T.E.P.P. 0·1108 per cent w/v (deposit 0·00012 mg. T.E.P.P./sq. cm.); Pestox III, > 1·0 per cent v/v (deposit 0·03 mg. Pestox III sq. cm.).

Parathion and T.E.P.P. proved highly toxic to bees when tested as residual poisons soon after application, but the toxicity fell off rapidly.

A 0·1 per cent v/v dilution in aqueous medium of both Parathion and T.E.P.P. applied to cabbage leaves gave 100 per cent mortality two hours after application following a minute exposure to the dry film. After 24 hours T.E.P.P. showed no toxicity and after 48 hours Parathion showed no toxicity. Parathion was not tested after 24 hours.

A 0·5 per cent v/v solution of Pestox III applied to cabbage leaves showed no toxic effects when tested 2 hours after application.

The work on factors affecting the toxicity of 3·4–dinitro–o–cresol, on the effect of inert dusts used as carriers of insecticides and on techniques for the evaluation of repellent chemicals is being continued.

For a number of reasons very little work was done on the natural fluctuation in the resistance of insect populations, the effect of host plant on resistance and the effect of environment on the toxicity of insecticides, but it is proposed to continue this work as soon as possible.

FIELD WORK

The experiment on the control of wireworms has been continued in collaboration with the Entomology and Statistics department, and the experiments on the control of insect vectors of potato viruses have been continued in collaboration with the Plant Pathology department. An experiment has been carried out on the control of *Aphis fabae* Scop. (bean aphis) on field beans.

Control of wireworms

The experiment started in 1947 has been continued to determine the long-term residual effects of the various treatments. Differences

https://doi.org/10.23637/ERADOC-1-72

showed on inspection during the growing season, and were obtained in the yield of wheat, although the differences were small. The following yield figures were obtained in terms of bushels/acre of wheat from the plots treated in 1947 and cropped with wheat since.

Untreated 15·5; B.H.C. (combine-drilled at 2·9 lb. crude B.H.C./acre) 15·0; B.H.C. (broadcast at 7·9 lb. crude B.H.C./acre) 16·1; B.H.C. seed dressing, 11·7; D.D.T. (7·2 lb. technical D.D.T./acre) 18·0; ethylene dibromide (45·5 lb./acre) 18·8; D.D. mixture (120 lb./acre) 16·9.

With the exception of the B.H.C. seed dressing, treated plots thus showed a slight improvement over the control, though the difference was only significant in the case of ethylene dibromide. The plots that had been sown with seed dressed with B.H.C. gave a yield significantly lower than that of the controls. In the second experiment in which B.H.C. was combine-drilled with the seed in 1947, the yield from the plots given the highest dosage (3·92 lb. crude B.H.C./acre) was significantly higher than the control plots.

Some further experiments were also carried out on the risk of tainting with the various B.H.C. treatments. The evidence obtained indicated that under the conditions of the experiment there was little risk of taint of crops grown in the third year after treatment. Dr. F. Raw of the Entomology Department carried out a survey of the wirewom population following the harvesting of the plots. The figures for the wireworm population of the plots showed good correlation with the figures for the yield.

A preliminary experiment on the effectiveness of aldrin and chlordane for the control of wireworms has been started.

Effect of insecticides on the population of Aphis fabae *Scop.* (bean aphis) *on field beans*

Aphis fabae Scop. is frequently a serious pest of field beans and some experiments were started to study the effect of various insecticides applied to control this pest. An attempt was made to determine both the immediate and subsequent effects of application of insecticides on the population of *Aphis fabae*, on its parasites and predators and on any other insects present. Yields were taken in the experimental plots.

Parathion, H.E.T.P., nicotine and D.D.T. were used on replicated large scale plots, two plots 198 ft. by 16 ft. of autumn sown beans and two plots 85 ft. by 16 ft. of spring-sown beans for each material. A set of preliminary trials were also made with a number of materials on small plots (42 ft. by 7 ft.) of spring-sown beans with no replication. The materials for this series were chlordane (technical) at 0·1 per cent w/v, allethrin (technical commercial sample) at 0·05 per cent w/v, pyrethrins at 0·05 per cent w/v total pyrethrins, toxaphene (technical) at 0·05 per cent w/v, aldrin (technical) at 0·1 per cent w/v, dieldrin (technical) at 0·1 per cent w/v, bis (bis-dimethyl-amino) phosphonus anhydrice (commercial technical sample) at 0·125 per cent w/v, D.D.T. and Wakefield half-white oil at 0·1 per cent w/v D.D.T. and 0·05 per cent w/v oil. The formulation was varied.

A single application was made of each material. The dates of application ranged from 10th–15th June, 1950. The table given below indicates the effect of the four insecticides used in the main

https://doi.org/10.23637/ERADOC-1-72

experiment on the aphid infestation on the spring-sown plots. There was a much lighter overall infestation on the autumn-sown plots.

Effect of insecticides on the population of Aphis fabae *Scop. (bean aphis) on field beans.*

Single application 12th–15th June, 1950

No. of aphid colonies on Spring-sown bean plots	*Parathion*	*H.E.T.P.*	*Nicotine*	*D.D.T.*	*Control*
10–15 days after treatment	34	105	105	2761	648
2 months after treatment	19	163	213	10240	1955

It appears that Parathion was the most effective material, and inspection showed that although aphid predators were also killed, the aphid population did not build up subsequently. H.E.T.P. and nicotine were also reasonably effective and they had a lower toxicity to the predators than Parathion. D.D.T. only killed in the order of 50 per cent of the aphids present, but was highly toxic to the predators and this is probably the reason why the final aphid population was markedly higher than on the control plots. The infestation was not heavy and there were very small differences in yield of seed from the treated and the control plots, except that the D.D.T. treated plots give appreciably lower yields.

Of the chemicals used in the preliminary tests allethrin, the pyrethrins, and dieldrin gave marked reduction of aphid infestation, the D.D.T. formulation again produced a higher population than the control.

It is proposed to continue these experiments.

Control of aphids carrying virus in potatoes

The experiments started in 1949 in collaboration with Dr. Broadbent of the Plant Pathology department, were continued in 1950. The 1949 results indicated that D.D.T., Parathion and Pestox III were preventing the spread of leaf roll but not virus Y. In 1950 the same insecticides were used again in an attempt to confirm this result and dieldrin and toxaphene were included to investigate their performance. It appeared that good control of the aphids was again obtained with D.D.T., Parathion and Pestox III. Dieldrin and toxaphene being less effective. The information on virus spread will not be available until 1951.

https://doi.org/10.23637/ERADOC-1-72