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## Report for 1934

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### The Plant in Disease : Control of Disease

#### Rothamsted Research

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THE PLANT IN DISEASE: CONTROL OF DISEASE.

(Departments of Entomology, Insecticides and Fungicides, and Plant Pathology.)

(a) INSECTS AND THEIR CONTROL.

- XLIII. H. F. BARNES. "*Studies of Fluctuations in Insect Populations. III. The gall midge, Rhabdophaga heterobia H.Lw., on Black Maul variety of Salix triandra at Syston, Leicestershire, 1927-33.*" *Journal of Animal Ecology*, 1934, Vol. III, pp. 165-81.

The changes in populations of the midge and its parasites in the overwintering generation have been traced over a period of six years. A drought which seriously damaged the growth of the willows is claimed to have caused a great diminution in numbers of both the host midge and its parasites. A sudden fall in relative parasitism in 1933 is discussed and compared with a similar occurrence in the second of this series of studies.

- XLIV. H. F. BARNES. "*Some Biological and Economic Aspects of the Gall Midges.*" *Science Progress*, 1934, Vol. XXIX, pp. 73-86.

A comprehensive survey of this family of flies dealing specially with the biological phenomena exhibited and its economic importance. Recent and hitherto unpublished data are included.

- XLV. F. TATTERSFIELD. "*An Apparatus for Testing Contact Insecticides.*" *Annals of Applied Biology*, 1934, Vol. XXI, pp. 691-703.

A description is given of the design of two atomisers for use in quantitative laboratory spraying for testing contact insecticides.

Tables and graphs are given showing the weights of spray delivered by each form upon known areas placed in different positions inside the spray jars, and an examination is made of the change in the distribution of the spray with the progressive closure of the orifice and increase in the distance from the orifice of the surface sprayed.

- XLVI. F. TATTERSFIELD and J. T. MARTIN. "*The Loss of Activity of Pyrethrum. II.*" *Journal of Agricultural Science*, 1934, Vol. XXIV, pp. 598-626.

The loss of activity of pyrethrum flowers and preparations has been studied.

The degree of concordance between the content of pyrethrin I, as determined by the acid method, and the insecticidal value of pyrethrinised dusts, before and after exposure to air and artificial illumination, has been statistically examined. The pyrethrin I values, corrected for a small residual amount of extraneous matter, indicate fairly closely the degree of activity of the samples. The loss of pyrethrins on exposure has been traced out quantitatively.

A comparison was made between two samples of pyrethrum flowers, one rich and the other poor in pyrethrins, in order to



determine the degree of concordance between the pyrethrin I content and their toxicity. The pyrethrin I value as determined by the acid method, subject to a small correction, gave a good indication of the relative activities of the samples.

Pyrethrum flowers, both finely and coarsely ground and as whole heads, have been exposed under various conditions for different periods up to one year. There was a relatively rapid loss of pyrethrin I in cases where the ground flowers were exposed to sunlight and air, but when stored in covered trays or tins the loss of pyrethrin I was much slower. The pyrethrins undergo change at a slower rate in flowers stored as whole heads than in the ground state.

Pyrethrinised dusts and ground flower-heads lose their pyrethrin content when exposed to sunlight in an atmosphere of air or nitrogen. The loss in nitrogen is less rapid than in air and appears to be due to a reaction other than oxidation by free oxygen. The effect of temperature upon the rate of loss of the pyrethrins is shown.

The rate of loss of the pyrethrins in a methyl alcoholic extract of flowers, when exposed to sunlight and air, was studied.

The stabilising effect of tannic acid and hydroquinone when added to a talc-pyrethrum dust was confirmed. It was shown that such mixtures lose their pyrethrins at a slower rate when exposed in thin layers to air and artificial illumination. Biological trials showed that the addition of these anti-oxidants did not augment the initial insecticidal activity of the pyrethrins.

(b) VIRUS DISEASES.

- XLVII. J. CALDWELL. "*The Physiology of Virus Diseases in Plants. V. The Movement of the Virus Agent in Tobacco and Tomato.*" *Annals of Applied Biology*, 1934, Vol. XXI, pp. 191-205.

It has been found that the virus may be present in tissues which do not show symptoms, and that symptoms of mosaic appear in those tissues which develop after infection. The concentration of virus is higher in the chlorotic areas than in the green areas. In no case was the virus found to be transmitted in the embryo. Under some conditions, the virus apparently travels in a direction opposite from metabolites.

- XLVIII. J. CALDWELL. "*The Physiology of Virus Diseases in Plants. VI. Some Effects of Mosaic on the Metabolism of the Tomato.*" *Annals of Applied Biology*, 1934, Vol. XXI pp. 206-224.

The effect of aucuba mosaic on the tomato, as regards growth and metabolism is examined. The carbohydrate content of the tissues is reduced by the disease while the respiration rate is actually increased. Nitrogen metabolism is apparently unchanged.

- XLIX. J. CALDWELL, G. C. AINSWORTH and G. H. BERKELEY. "*A Comparison of English and Canadian Tomato Virus Diseases.*" *Annals of Applied Biology*, 1934, Vol. XXI, pp. 566-580.

The mosaic and streak diseases and their causative virus or groups of viruses, found in Canadian and English houses were examined and compared.



- L. F. M. L. SHEFFIELD. "*Experiments Bearing on the Nature of Intracellular Inclusions in Plant Virus Diseases.*" *Annals of Applied Biology*, 1934, Vol. XXI, pp. 430-453.

The intracellular changes resultant on infection with aucuba mosaic and Hy. III diseases are described and are compared with the cytological effects of tobacco mosaic virus. With the two former viruses, inclusion bodies are formed by the aggregation and fusion of minute particles which appear in the cytoplasmic stream. With tobacco mosaic disease an amoeba-like body is produced and this persists for some weeks before suddenly disappearing again. It is accompanied by striate material all of which ultimately fuses into one large body. Similar amoeboid inclusions and sometimes also striate material are formed on infection with Wingard's ringspot disease of tobacco.

Attempts have been made to parallel these conditions in healthy cells of Solanaceous plants by treatment with substances known to coagulate protoplasm. Almost all the re-agents used induced stimulation of the cytoplasmic stream similar to the initial sign of virus infection. With salts of molybdic acid, all the cytological abnormalities due to aucuba mosaic or Hy. III disease have been imitated. Treatment with lactic acid induces the formation of amoeboid bodies like the X-bodies of tobacco mosaic, but these bodies persist for only a few hours.

Attempts have also been made to inhibit the formation of inclusion bodies induced by several different diseases in a number of hosts but no success was obtained.

The experiments support the view that the intracellular inclusions of plant virus diseases are essentially products of the host cell.

- LI. M. A. WATSON. "*Some Factors Influencing the Probability of Infection by Aphids with the Virus Hy. III.*" Report of the Third Imperial Mycological Conference, 1934, p. 19.

Regular weekly infections with Hy. III into *Hyoscyamus* and Tobacco showed that the per cent. infection bears a positive relation with the number of aphids used. Seasonal variations occur in the per cent. infection which may be correlated with (a) the amount of virus present in the host plant, (b) the condition of the plant to be infected, or (c) the condition of the aphid vectors. These variations may be due to differences in temperature or total radiation.

In winter and in cool dull weather the per cent. infection appears to be higher than in summer, or in bright sunny weather. This may be tested in the field by spraying experiments which should be most successful in the optimum infection periods of cool or overcast weather.

- LII. J. M. BIRKELAND. "*Serological Studies of Plant Viruses.*" *Botanical Gazette*, 1934, Vol. XCV, pp. 419-436.

Juice from virus-diseased plants contains an antigenic fraction inseparable from the virus in addition to the antigenic constituents of a normal healthy plant. This fraction is specific to the particular virus, and the anti-bodies induced by one virus differ qualitatively



from those induced by other viruses. It is possible to free a virus from the antigenic constituents of normal plants, but not possible to separate it from the antigenic factor accompanying it, and the latter is probably either the virus itself or a virus-protein complex of haptene nature.

- LIII. J. M. BIRKELAND. "*Photodynamic Action of Methylene Blue on Plant Viruses.*" *Science*, 1934, Vol. LXXX, pp. 357-358.

Unlike certain animal viruses, the viruses of aucuba, tobacco mosaic and tomato streak were found highly resistant to the photodynamic action, though (Wingard's) ring-spot virus was quickly inactivated.

## TECHNICAL & OTHER PAPERS

### GENERAL.

- LIV. E. J. RUSSELL. "*The School and the Research Institute.*" Durham County Association of Teachers' Magazine, "Deira," November, 1934.
- LV. E. J. RUSSELL. "*Wireless and the Farmer.*" *Discovery*, 1934, Vol. XV, pp. 245-246.
- LVI. W. G. COCHRAN. "*Recent Advances in Mathematical Statistics 1933.*" *Journal of the Royal Statistical Society*, 1934, Vol. XCVIII, pp. 83-127.

The sections contributed to this review cover papers dealing with moments and semi-invariants of sampling distributions and with orthogonal polynomial theory.

- LVII. O. GATTY. "*An Apparent Paradox in the Theory of Heats of Dilution of Completely Dissociated Electrolytes.*" *Philosophical Magazine*, 1934, Vol. XVIII, pp. 46-63.
- LVIII. O. GATTY. "*Membrane Equilibria and the Phase Rule.*" *Philosophical Magazine*, 1934, Vol. XVIII, pp. 273-288.
- LIX. G. W. SCOTT BLAIR and R. K. SCHOFIELD. "*The Constancy of Strong Lithium Chloride Solutions at Low Velocity Gradients.*" *Philosophical Magazine*, 1934, Vol. XVII, pp. 225-229.

Measurements of the logarithmic decrement of a cylinder executing rotational oscillation while immersed in a strong lithium chloride solution revealed no inconstancy in the viscosity, even though the final amplitude was so small that the maximum velocity gradient was only  $0.003 \text{ sec.}^{-1}$ .

The data confirm and extend that obtained by Ostwald and Mals using a capillary viscometer in which the velocity gradient at the wall for the lowest stress was  $0.6 \text{ sec.}^{-1}$ .

The anomalies reported earlier by the authors appear to have been due to the ability of the strong salt solutions used to "creep"