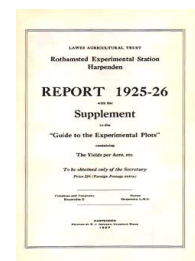


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## Report 1925-26 With the Supplement to the Guide to the Experimental Plots



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### The Plant in Disease; Control of Disease

#### Rothamsted Research

Rothamsted Research (1926) *The Plant in Disease; Control of Disease* ; Report 1925-26 With The Supplement To The Guide To The Experimental Plots, pp 78 - 84 - DOI:  
<https://doi.org/10.23637/ERADOC-1-84>

media containing mineral salts and 1 per cent. of certain soluble organic compounds. In the glucose medium, the degree of variance of the observed values (logarithmic) from the calculated straight line of nearest fit is shown to be greatly reduced by rigorous control of light and of temperature, and by continuous aeration of the medium. In this medium the organism is able to grow in the dark, retaining its green colour. There is some reason to believe that the rate of growth in the dark may be approximately equal to the difference between its activities in the light in the same medium and in that with mineral salts alone. In certain media containing substances less favourable to the growth of the organism, the degree of deviation of the observed values from the straight line is greater than in the glucose medium. With maltose there appears to be an initial "lag" period preceding the straight-line period of growth. In mannite there are conspicuous fluctuations in the growth rate due to death of the young cells. Xylose is completely toxic to the organism under the conditions observed.

The relative average rates of growth in the different media may be expressed quantitatively, as follows: Glucose in the light 100 per cent., maltose 100 per cent. preceded by a "lag" period, galactose 94 per cent., sucrose 84 per cent., fructose 73 per cent., mineral salts alone 60 per cent., glycerine 43 per cent., glucose in darkness 40 per cent., mannite 13 per cent., xylose 0 per cent.

In those media that are completely favourable to its growth, the increase in bulk of *Scenedesmus costulatus*, Chod., var. *chlorelloides*, follows the same laws as a simple exponential curve, for a limited period of time.

LIX. B. MURIEL BRISTOL ROACH. "Methods for Use in Studying the Algæ of the Soil." in Abderhalden—Handbuch der biologischen Arbeitsmethoden, 1926.

Details are given of a cultural method for estimating roughly the numbers of algæ (Chlorophyceæ and Diatoms only) in the soil. Methods are also described for the isolation and cultivation of soil algæ in (a) impure and (b) pure cultures, and suitable media are recommended for use. An account is given of a special method for estimating quantitatively the effect of any condition or chemical compound on the rate of growth of a unicellular soil alga, the rate of growth being regarded as an index of the metabolism of the organism.

Methods are also described for studying the biochemical activities of pure cultures of algæ under the following headings:—(1) Decomposition of protein (gelatine); (2) Fixation of nitrogen; (3) Transformation of insoluble mineral substances into soluble forms.

## V. THE PLANT IN DISEASE; CONTROL OF DISEASE.

(Entomological, Insecticides and Fungicides, Mycological Departments.)

### (a) INSECT PESTS AND THEIR CONTROL.

LX. W. M. DAVIES. "On the Tracheal System of *Collembola* with Special Reference to the Species *Sminthurus viridis*." Quarterly Journal of Microscopical Science, 1927, Vol. CXXI., pp. 15-30.

No extensive study of the tracheal system of Collembola has previously been made. The general plan of the tracheæ has been worked out on *Sminthurus viridis*; two independent systems exist. The presence of only a single pair of spiracles constitutes a unique condition among adult insects. The position of these is in the anterior region of the prothorax and not in the head as previously believed. The structure of the spiracles is extremely primitive and they possess no closing apparatus. The tracheæ branch dichotomously, but no anastomosis exists between the systems of the two sides of the body. Tænidia are present, but no "transition cells" have been observed, and the fine tracheæ terminate in unbranched tracheoles. The initial entrance of air into the tracheæ is through the spiracles; the displacement of fluid is very slow and the whole system is not completely filled with air until about 14 days after emergence from the egg. Tracheæ are found to be a constant feature in all members of the Sminthurinæ examined. Various methods of technique adopted are given.

LXI. W. M. DAVIES. "*Collembola Injuring Leaves of Mangold Seedlings.*" Bulletin of Entomological Research, 1926. Vol. XVII., pp. 159-162.

Damage to seedling mangolds due to the Collembolan *Bourletiella hortensis* Fitch is occasioned by the insects collectively perforating the leaves and the excessive bleeding that ensues. In the particular infestation studied the number of insects per acre worked out at about 1,500,000. Other hosts of the same insect were found to include groundsel, goosefoot and red-shank. During dry weather the insects were most numerous in early morning when the leaves are moistened with dew. Control methods were tested, including the trailing of paraffin-soaked sacks over the crop. The repellent effect of the paraffin proved evanescent owing to rain, and the dragging of tarred sacking hung between two wheels which were fastened together with long cross-bars was resorted to. By taking advantage of the leaping powers of the insect in this way the method proved completely successful, and enormous numbers of Collembola were trapped on the adhesive surface of the tar. No further control measure appears necessary, and a permanent movable contrivance, that can be used whenever occasion demands, is described and figured.

LXII. J. DAVIDSON. "*Biological Studies of Aphis rumicis* Linn. *Factors Affecting the Infestation of Vicia faba with Aphis rumicis.*" Annals of Applied Biology, 1925. Vol. XII., pp. 472-507.

Experiments were carried on during four years under controlled experimental conditions, and lead to the following conclusions.

Temperature influences the developmental period of the aphids and the number of young produced daily, thereby affecting the number of aphids produced in a given time.

On beans grown in sand watered with tap water fewer aphids developed in a given time than on beans grown in sand watered with normal culture solution, indicating a nutrition effect on the aphids.

On beans grown in sand watered with normal culture solution an increased number of aphids developed in a given time compared with beans grown in soil watered with the same solution, indicating the effect of the soil medium on the plant and the nutrition factor for the aphids.

Beans grown under varying daylight intensity gave varying degrees of increase in the number of aphids in a given time, indicating again a nutrition effect on the aphids in that the least number developed on the plants receiving the least amount of daylight.

On beans which were young and had not reached the flowering stage when infected in June the number of aphids which developed in a given time was 50 per cent. greater than on bean plants which were six weeks older and were setting pods.

On certain varieties of field beans the number of aphids which developed in a given time varied considerably, indicating that some varieties were more susceptible to infestation than others.

LXIII. J. DAVIDSON. "On the Occurrence of Parthenogenetic Intermediates in *Aphis rumicis* L. and Their Relation to the Alate and Apterous Viviparous Females." *Journal of the Linnean Society (Zoology)*, 1927. Vol. XXXVI., pp. 467-477.

During rearing experiments with *Aphis rumicis* 21 viviparous forms have been recorded which exhibit morphological characters intermediate between the apterous and alate parthenogenetic, viviparous females. Certain of these forms were reared and, in their behaviour, as regards the offspring they produced, they resembled the apterous members of the same generation rather than the alate members. The evidence obtained indicates that the occurrence of apterous forms in the parthenogenetic generations of this species is influenced by certain physiological conditions.

LXIV. J. DAVIDSON. "The Sexual Parthenogenetic Generations in the Life Cycle of *Aphis rumicis* L." III International Entomological Congress, Zurich, 1925, Vol. II., pp. 452-457.

A single strain of the black bean *Aphis rumicis* L. has been reared for 4 years on broad beans (*Vicia faba*) with the spindle tree (*Euonymus europæus*) as the winter host. Sexual forms were obtained on beans and on *Euonymus* and eggs were laid on both plants, but preferably on *Euonymus*. Sexual females and males appeared in the colonies on various dates from September to May, but no sexual forms were recorded during the period June to September. Certain individuals in the colonies continued parthenogenetic reproduction in the greenhouse throughout each winter and in addition sexual forms developed on various dates. The period in which the sexual forms developed indicates an adaptation to a periodic seasonal rhythm and factors of temperature associated with plant growth (nutrition) exert an influence by favouring or restricting their appearance.

LXV. C. T. GIMINGHAM. "On the Presence of an Egg-burster in *Aphididæ*." *Transactions of the Entomological Society*, 1925, pp. 585-590.

The eclosion of the embryo fundatrix of *Amphorophora lactuæ*, Kalt. from the winter egg is described and the presence of an egg-burster noted. The organ is seen as a dark brown chitinous toothed ridge over the vertex of the head and extending backward as far as the eyes; it is attached to an embryonic membrane and is left behind with this membrane on complete emergence of the young insect. Similar structures were found on embryos of *Phorodon humuli*, Schr. and *Aphis pomi*, DeG.

LXVI. F. TATTERSFIELD, C. T. GIMINGHAM and H. M. MORRIS. "Studies on Contact Insecticides. Part IV. A Quantitative Examination of the Toxicity of Certain Plants and Plant Products to *Aphis rumicis*, L. (The Bean Aphis)." *Annals of Applied Biology*, 1926. Vol. XIII., pp. 424-445.

An account is given of laboratory experiments on the toxicity to *Aphis rumicis* L. of extracts of a considerable number of plants, including some tropical fish-poisons, Lupins, Broom, Gorse, Lobelia and others.

Alcoholic extracts of certain tropical plants used as fish-poisons are shown to have a high toxicity under the conditions of the experiments. The roots and stems of White Haiari, and the stems of Black Haiari (both species of *Lonchocarpus* from British Guiana), the roots of *Tephrosia toxicaria* and the leaves of *T. vogelii*, all possess notable insecticidal properties. The roots and stems of *T. candida* are less toxic.

Preliminary experiments indicate that the Haiaris and *T. vogelii* and *T. toxicaria*, when tested as stomach poisons, exert both a repellent and toxic action to caterpillars.

Certain derivatives isolated from these plants were tested. The most toxic substance obtained from the Haiaris is shown to be identical with tubatoxin, the crystalline poison found in *Derris elliptica*. Tubatoxin proved to be several times more toxic than nicotine. In the case of *Tephrosia vogelii* and *T. toxicaria*, the most toxic substance isolated was resinous in nature. Crystals closely corresponding to tephrosin, as isolated by Hanriot, were less toxic.

A number of alkaloids was also investigated, Cytisine and lobeline, known to have a physiological action similar to that of nicotine, were found somewhat less toxic than nicotine to aphides. Eserine was the only other alkaloid tested which approached nicotine in toxicity.

LXVII. C. T. GIMINGHAM, A. M. MASSEE and F. TATTERSFIELD. "A Quantitative Examination of the Toxicity of 3:5-Dinitro-o-cresol and Other Compounds to Insects' Eggs, under Laboratory and Field Conditions." *Annals of Applied Biology*, 1926. Vol. XIII., pp. 446-465.

The toxicity of 3:5-dinitro-o-cresol and its sodium salt to eggs of the moth, *Selenia tetralunaria* Hüfn, has been determined quantitatively under controlled conditions in the laboratory. The figures obtained confirm earlier results and show (a) that these compounds have a very high toxicity to insect eggs, and (b) that

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the sodium salt of dinitro-o-cresol is only slightly less toxic than dinitro-o-cresol in the uncombined state.

Preliminary work indicates that dinitro-o-cresol is also highly toxic to insect eggs of a more resistant type than those of *S. tetralunaria*.

Spray fluids containing dinitro-o-cresol or the sodium salt showed a high efficiency against eggs of the Hop-Damson Aphis (*Phorodon humuli* Schr.) on plum trees on a larger scale under field conditions. The trees sprayed with these compounds remained almost free from aphids during the following spring when the control trees were badly infested.

A quantitative method for judging the results of the field experiments was worked out. This involved recording details of large numbers of eggs on selected shoots on sprayed and control trees before and after spraying, a numerical measure of the effect of the various treatments being thus obtained. The method gave consistent and reliable results.

The spray fluids containing dinitro-o-cresol and its sodium salt had a marked cleansing effect on the trees. No injury to the trees was observed.

LXVIII. D. M. T. MORLAND. "*On the Microscopic Examination of Bees for Acari.*" *Annals of Applied Biology*, 1926. Vol. XIII., pp. 502-505.

The discovery by Rennie and his collaborators of the mite which causes one form of adult bee disease, renders desirable a quick method of dissection to facilitate detection of the parasite. The method described allows of the whole of that portion of the thoracic tracheal system which is liable to invasion by the mite to be exposed to view.

(b) FUNGUS PESTS AND THEIR CONTROL.

LXIX. W. A. ROACH and W. B. BRIERLEY. "*Further Experiments on the Use of Sulphur in Relation to Wart Disease of Potatoes.*" *Annals of Applied Biology*, 1926. Vol. XIII., pp. 301-307.

Plots of light sandy soil at Ormskirk carefully fenced in to prevent re-contamination were treated with sulphur at rates of 10 cwts. and 15 cwts. per acre. The sulphur was incorporated by means of the "Simar" Rotary Tiller, kindly loaned by the Piccard Pictet Company. A planting of King Edward and a re-planting of Arran Chief varieties in the treated plots almost completely failed to grow. On the few plants which developed, Wart Disease was present in less quantity than on the plants in the untreated controls.

A plot of heavy clay soil at Hatfield was treated with 3 tons of sulphur per acre incorporated by means of the Simar Rotary Tiller. Plants of King Edward variety grew well, but showed a considerable amount of wart disease.

Plots of land at Ormskirk which in 1924 had received amounts of sulphur varying up to one ton per acre were in 1925 given a dressing of lime and planted with Majestic variety of potatoes. No effect of the previous treatment on the crop was apparent.

- LXX. MARY D. GLYNNE. "Wart Disease of Potatoes: The Development of *Synchytrium endobioticum* (Schlib.) Perc., in 'Immune' Varieties." *Annals of Applied Biology*, 1926. Vol. XIII., pp. 358-359.

By an infection method previously described small protuberances and surface irregularities were obtained on the shoots of six different "immune" varieties of potato. These did not seem to develop further or to produce ordinary warts, but microscopic examination showed that infection by *Synchytrium endobioticum* had taken place. Its development up to the liberation of the summer sporangia has been observed, but its further development, that is reinfection by zoospores from summer sporangia and the formation of winter sporangia, has not been detected.

- LXXI. MARY D. GLYNNE. "The Viability of the Winter Sporangium of *Synchytrium endobioticum* (Schlib.) Perc., the Organism Causing Wart Disease in Potato." *Annals of Applied Biology*, 1926. Vol. XIII., pp. 19-36.

A staining method for testing the viability of the winter sporangia of *Synchytrium endobioticum* is described. The sporangial contents are pressed out into acid fuchsin or after treatment by a strongly alkaline reagent into methylene blue. The staining reactions have been correlated with the results of infection experiments in pots. Sporangia which, like the controls, stain faintly, produce a high percentage infection and are therefore alive. Those which stain deeply and rapidly produce no infection and are presumably dead. There is an intermediate group in which some sporangia stain deeply and some are intermediate in reaction. This group tends to give less infection than the controls.

A method whereby sporangia which have been treated in soil may be extracted without affecting their viability, is described. The method depends on the difference in specific gravity of sporangia, which has been determined as about 1.17, and of soil which is in the region of 2.5. The sporangia are extracted by means of chloroform (sp. gr. 1.5 approx.), which does not affect their viability.

A study of the relation of temperature, time and viability shows that treatment for 5 minutes at 90° C., 15 minutes at 80° C., 1 hour at 70° C., and 8 hours at 60° C., have a similar effect in killing all the sporangia.

- LXXII. S. DICKINSON. "A Simple Method of Isolating and Handling Individual Spores and Bacteria." *Annals of Botany*, 1926. Vol. XL., pp. 273-274.

The method described consists of holding the bacteria in a film of water and then moving one of them to another part of that film by means of a local thickening, the whole process being observed through an oil immersion lens.

In practice the film of water used is that on the surface of a layer of agar on a coverslip, while the local thickening is obtained by bringing a fine glass rod in contact with the agar, and then withdrawing it slightly, so forming a column of water; it is in the

column so formed that a bacterium is carried to another part of the agar and that part is cut off and put into the new culture tube. The glass rod is capable of fine adjustment in all directions, being mounted on a three movement machine clamped to the microscopic stage, which is called an Isolator, being made for the purpose by Messrs. Ogilvy & Co.

With this instrument it is possible, starting from a culture, to isolate a single bacterium and transfer it to a fresh test tube in from 3—5 minutes.

LXXII. (a) S. DICKINSON. "*A Method of Isolating and Handling Individual Spores and Bacteria.*" Proceedings of the Royal Society of Medicine, 1926, Vol. XIX., Section of Pathology, pp. 1-4. (See preceding paper for abstract.)

LXXIII. S. DICKINSON. "*Experiments in the Physiology and Genetics of the Covered Smuts of Oats and Barley. Hyphal Fusion.*" Proceedings of the Royal Society, 1927. Ser. B., Vol. 101, pp. 126-136.

The cytology of the Covered Smuts of Oats and Barley in pure culture has been investigated, and the fusion, both within and across the species investigated between the mycelia of different "gender" derived from single sporidial isolations, is described. The fusion hypha is binucleate, and nothing has been seen which suggests that nuclear fusion occurs. The binucleate fusion-hypha gives rise to uninucleate hyphæ which are of different gender, these being produced at different ends of the fusion hypha.