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# Rothamsted Report for 1936

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## Microbiology

### Rothamsted Research

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as nitrate and correct figures are obtained by the estimation of the ammoniacal and nitrate-nitrogen present. For amounts higher than 5 mg. an average correction of 10 per cent. on the ammoniacal nitrogen formed gives results agreeing to within 98-100 per cent. of the Kjeldahl figure.

A procedure is described for the estimation of small amounts of nitrate in presence of large quantities of sulphuric and chromic acids.

#### MICROBIOLOGY

(Departments of Bacteriology, Fermentation and General Microbiology)

##### (a) BACTERIA

- XLIII. H. G. THORNTON. "*The Present State of our Ignorance Concerning the Nodules of Leguminous Plants.*" *Science Progress*, 1936, Vol. XXXI, pp. 236-249.

This outline of our knowledge of the nodule bacteria and their association with the host legume is intended to emphasise how great and important are the gaps in this knowledge—gaps which occur at the critical point in almost every line of investigation. The nodules on legumes afford problems, whose solution would illuminate much wider fields in biology: such as those of bacterial genetics, growth-promoting substances, and the formation of pathological growths. The great mystery of biological nitrogen-fixation itself remains unsolved.

##### (b) PROTOZOA

- XLIV. A. DIXON. "*Soil Protozoa; their Growth on various Media.*" *Annals of Applied Biology*, 1937, Vol. XXIV, pp. 442-456.

The investigation was started to test the present methods of culturing soil protozoa on peptone agar, as two earlier workers had obtained higher numbers by the use of soil-extract agar. Some 55 soils were used, from the tobacco growing regions of the U.S.S.R., sent by the State Institute of Tobacco Culture, Krasnodar. Protozoa of these soils, when grown on soil-extract agar and peptone agar gave, with three exceptions, considerably higher numbers with the former medium. The higher numbers of Rhizopoda and Ciliata were particularly noticeable. A complete list of protozoa from these soils on the two media is given. The same media were also used for samples of Woburn and Rothamsted soils, and for the latter soil extract and hay infusion as well. Soil extract agar and liquid soil extract as media gave the fullest record of protozoa, particularly for Rhizopoda and Ciliata. Hay infusion was useful for the development of Ciliata and an improvement on peptone agar.

##### (c) BIOLOGICAL ACTIVITIES

- XLV. J. MEIKLEJOHN. "*The Reduction of Nitrate by Individual Strains of Free-living Bacteria.*" *Transactions of the Third International Congress of Soil Science*, 1935, Vol. I, pp. 180-183.

Eighty free-living strains of bacteria were tested for their ability to reduce nitrate in media of known composition. Five types of reaction with regard to nitrate were observed, and an attempt was made to relate the known physiological properties of each strain to the type of reaction it gave; it was found that the strains conforming to each type had other properties in common.

- XLVI. J. MEIKLEJOHN. "*The Oxygen Uptake of Suspensions and Cultures of a Free-living Bacterium.*" *Journal of Experimental Biology*, 1937, Vol. XIV, pp. 158-170.

The oxygen uptake of pure cultures and suspensions of a bacterial species isolated during the effluent investigations was measured at 26°C. Cultures in a liquid medium gave the greatest oxygen uptake per cell at 48 hours after inoculation, and the greatest total oxygen uptake 72 hours after inoculation. The maximum stationary phase of growth was reached about 96 hours after inoculation, after which the oxygen uptake of successive samples rapidly fell to a very low value.

In suspensions deprived of nitrogen, and showing no growth, and in cultures in the stationary phase, oxygen uptake proceeds at a constant rate. But in both suspensions and cultures where active growth is taking place, the rate of



oxygen uptake rises continuously ; after a preliminary period of adjustment this rise is logarithmic. The rise in oxygen uptake in a growing suspension is proportionately greater than the rise in bacterial numbers ; it is therefore suggested that the respiration of a growing culture can be divided into two parts—"maintenance" respiration and "growth" respiration ; and a technique is outlined for estimating the amount of oxygen uptake due to each factor.

- XLVII. S. H. JENKINS. "*The Biological Oxidation of Stearic Acid in Percolating Filters.*" *Journal of the Society of Chemical Industry*, 1936, Vol. LV, pp. 315T-319T.

Stearic acid in the form of soap is a constituent of domestic sewage and its decomposition by methods which are ordinarily used for purifying sewage is therefore of interest. The decomposition of the acid in biological filters was studied with and without the addition of sewage using percolating filters made of glass and filled with glass medium.

The first filter without sewage developed a thick white film in the upper half and after operating for four months became clogged with growths. The growths consisted of fungal hyphae, bacteria and yeasts, and half of the film was stearic acid. About 80 per cent. of the stearic acid was removed from the crude liquid supplied to the filter. With domestic sewage over 90 per cent. of the impurity present in the crude liquid was removed by filtration, and as there was considerably less stearic acid present in the film in this filter than in the filter supplied with stearic acid alone it is assumed that the fatty acid was more completely oxidised in the presence of sewage. Thick growths of film containing bacteria, yeasts and algae developed in the upper part of the filter supplied with stearic acid and sewage, and in three months' time almost clogged the filter.

The experiments showed that high concentrations of stearic acid could be readily decomposed in percolating filters in the absence of sewage, and that the acid was more completely decomposed when it was present together with sewage liquors.

#### THE PLANT IN DISEASE : CONTROL OF DISEASE

(Departments of Entomology, Insecticides and Fungicides, and Plant Pathology, and Biochemistry Section)

##### (a) INSECTS AND THEIR CONTROL

- XLVIII. C. B. WILLIAMS. "*Collected Records Relating to Insect Migration. Third Series.*" *Proceedings of the Royal Entomological Society of London, A*, 1936, Vol. XI, pp. 6-10.

Information is given relating to eighteen movements of butterflies and one of dragonflies, of which accounts have been sent in by correspondents in different parts of the world.

- XLIX. K. J. GRANT. "*The Collection and Analysis of Records of Migrating Insects. British Isles 1931-1935.*" *Entomologist*, 1936, Vol. LXIX, pp. 125-131.

An analysis of records collected through the Insect Immigration Committee of the South Eastern Union of Scientific Societies, shows considerable evidence for a northerly flight of Red Admiral Butterfly (*Vanessa atalanta*) in Great Britain in May, June and the beginning of July, and a southerly return flight in September and October.

- L. P. S. MILNE. "*A Device for the Rapid Counting of Large Numbers of Small Insects.*" *Bulletin of Entomological Research*, 1936, Vol. XXVII, pp. 269-271.

The device is a large rotating trough which can be passed under the field of a low power binocular microscope. When the insects are counted they are drawn back into the storage box by suction current of air.