veloped by being caught and being thrown back. They are as good as dead when they are caught. Even if thrown back they do not survive. Fish can see a trawl coming, and see a hook on a line. Some fish are more intelligent than others, and have a better instinctive reaction, simply by being alert to a trawl coming through the water near them. Many more fish swim away than are ever caught.

Miss L. B. Moore said that Mr. Cassie's slide of the "vacuum-cleaner" fishing device had reminded her of the intake pump in use at Lake Grasmere salt works near Blenheim. This pumped in a considerable amount of sea water, and many other things as well. She wondered whether any modern biologist had thought of using it.

Dr. R. M. Williams asked whether Mr. Cassie had been assuming a stationary population.

Mr. Cassie said he had assumed that it was a stationary population. He had smoothed all natural fluctuations, mortality and so on, so that it was a stationary population.

# The Occurrence of Fungal Associations in New Zealand Soils

*P. J. Culliford*

Within the soil, mould fungi occur as spores and as actively growing mycelium. By plating on nutrient agar identifiable colonies are produced from these true soil organisms, both active and inactive, and also from spores present as chance inclusions from the air. Furthermore, the species so isolated are not the full complement since slow-growing fungi are swamped by others more suited by the culture media. Keeping these facts in mind the species lists secured by plating techniques may be reviewed to see if they provide any evidence that fungi form stable associations in the soil.

Three kinds of tests were applied.

*a*. Do similar habitats produce similar aggregations of species? The similar habitats chosen were the litter mounds characteristic of rimu (*Dacrydium cupressinum*). Such mounds, each derived largely from the litter of a single tree, display the same pH pattern throughout the profile and yield similar results from organic analysis by Waksman's method of proximate analysis of organic matter. Six litter mounds were studied, at Silverstream, Hunterville, Moawhango, Raurimu, Tokaanu, and Mt. Egmont. Of 37 species of mould fungi isolated eleven appeared to be typically present in rimu litter, the rest being only sporadic. Of the eleven constant species eight belonged to the genus *Penicillium* and one each to *Mucor, Fusarium* and *Trichoderma*. These organisms appear frequently in New Zealand soil, but have not previously been recorded all together. In contrast an adjacent site under beech (*Nothofagus truncata*) at Silverstream provided as dominants a *Trichoderma,* a *Cladosporium* and a different *Penicillium*.

*b*. Does the same habitat, if it remains unchanged otherwise, yield a similar list of species after a lapse of time?

An initial isolation from field samples from Himatangi sand yielded seventeen species amongst which *Penicillium* (2 spp.), *Stenophyllum, Geomyces,* and *Fusarium* (one sp. each) were numerically dominant. Twelve months later, from an adjacent spot, the same species were obtained in abundance, while two other species had increased in numbers. This flora seemed to have remained fairly stable over this period of time.

*c*. Does a change in the habitat produce a change in the species content?

Using Himatangi sand, as in the previous test, copper sulphate was applied at rates equivalent to 5 lb. and 25 lb. per acre, the samples and controls being incubated at 22° C. and kept at a constant moisture level for the experimental period of 96 days. The lighter application which about doubles the amount of copper in the soil was regarded as a rather slight change, the heavier dressing as a major change. After the initial period of disturbance due to addition of copper sulphate and transportation and mixing of the soil, the environment remained constant under each treatment. The 5 lb. treatment showed the same general pattern as the control though *Penicillium decumbens* had given way to *P. chrysogenum* as the dominant and some copper-tolerant species had increased in frequency. With more copper about two-thirds of the species disappeared and of the four principal species left two were *Penicillium* species well-known for their ability to

withstand high copper concentrations. Stability was reached after about 25 days and there was little later change.

In these tests similar environments produced similar floras, a stable environment produced a stable flora and change in the environment induced a parallel change in the flora. Even allowing that the recorded lists of species give a quite erroneous picture of what constitutes the microflora of the soil there does seem to be some close harmony between the moulds and the environment.

DISCUSSION

Dr. R. H. Thornton emphasized the importance of methods of study in investigations of micro-organisms. The plating method gives an indication of the potential of the soil, rather than any measure of the current activity in the soil. Only in the mycelium stage is the fungus active in the soil, but the plating method favours spore-forming fungi. This may be why the results presented showed a predominance of *Penicillium* which is notorious as a spore-forming group. In litter decomposition mounds under rimu one would expect Basidiomycetes and cellulose-decomposing organisms that were not represented in the lists. He would recommend using as many techniques as possible, including those that involved a minimum of change from natural conditions.

Dr. R. G. Everson suggested that succession would be expected as the fungi altered their substrata. He too criticized the method used and suggested that more might be learned by sterilizing the soil and material of the litter mounds and inoculating with individual fungi to see how they exploited this substratum.

Mr. Culliford pointed out that in a rimu litter mound new material is constantly being added so that various stages of decomposition are always present through the depth of the mound. He agreed that more variety of method would have been desirable had the experiments been planned for this particular purpose.

Dr. J. G. Gibbs referred to the wide field for investigation of rhizosphere problems in crop plants, still almost untouched in New Zealand.

# Exhibits

As an adjunct to the more formal Annual Meeting members of the Society were asked if they could bring to the Conference exhibits illustrative of aspects of their work. A most heartening response was received. The exhibits, which had been brought by members from as far away as Auckland and Dunedin, covered a wide range of topics and took the form of photographs, maps, diagrams, specimens and apparatus. They were displayed on the walls and benches of the zoology laboratory, where supper was served after the Annual General Meeting. Although the exhibition had been intended only as part of the arrangements for the evening gathering, it proved so popular that members flooded round it at every opportunity throughout the rest of the meeting. In addition to the photographs and specimens illustrating ecological work in progress, the exhibits included two student publications, "Tane", produced by the Auckland University College Field Club, and "Tuatara", from the Victoria University College Biological Society. "Tane" contained many interesting articles of an ecological nature written by the club members, while "Tuatara" included a number of useful keys to various groups of plants and animals.

The following is a list of the exhibits which were on display:—

1. Animal food chains associated with a lupin bush, Prof. B. J. Marples
2. Intertidal communities, G. A. Knox.
3. Invertebrates of a saltmarsh, Miss K. Paviour-Smith.
4. Vegetation of the Burma Road, Westport District, Miss R. Mason and N. T. Moar.
5. Map of Rabbit Distribution, Dr. K. A. Wodzicki.
6. Rabbit Parasite Distribution, P. C. Bull.
7. Methods of marking Rabbits, J. S. Watson.
8. Species of Rats found in N.Z., J. S. Watson.
9. Erosion studies of Horokiwi Stream, B. T. Cunningham.
10. Peat Bogs in Raumati Area, W. F. Harris and N. T. Moar.
11. "Yellow leaf" of *Phormium,* W. R. Boyce.
12. Light integrator made by Dominion Physical Laboratory, Miss L. B. Moore.
13. Vegetation changes at Molesworth, Miss L. B. Moore.
14. Vegetation of Rangitoto Island, Dr. L. H. Millener.
15. "Tane", A.U.C. Field Club.
16. "Tuatara", V.U.C. Biological Society.