DIVERSITY IN SOIL FUNGI AS INFLUENCED BY DDT

by

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ABSTRACT

The application of 1 and 2 ppm DDT to soil did not result in any consistent trends in fungal numbers through a 14 week period. However the amplitude of population fluctuations was markedly suppressed in treated soils during the early weeks of treatment.

A study of the effect of DDT on the population structure of the genus Penicillium indicated that it undergoes a reduction of diversity with treatment that persists at least through a 9 week survey period.

INTRODUCTION

Very low quantities of DDT have been detected in the forest soil ecosystem, (5,20). In the spruce budworm control programme in New Brunswick (9), residual quantities are often less than 1.0 ppm and seldom more than 5.0 ppm depending on the spray history (10).

Many studies, (for summaries see 2, 3, 11), have indicated that at concentrations considerably higher than this, DDT has not suppressed numbers of bacteria, fungi and actinomycetes in soil, nor the varied physiological processes carried out by them. However, in vitro studies have suggested that the compound, while not lethal, is deleterious to the growth or activities of some microorganisms (4, 8, 18, 21), although at concentrations usually in excess of those reported here.

The growth retarding effects of a pesticide like DDT might be expected to exert a profound influence on the patterns of succession in soil, especially under conditions where a "biological vacuum" had been created by partial sterilization. Evidence for this is presented here.

METHODS

To a previously dried and sieved soil fraction (0.25 mm to 1.0 mm diameter) of Pontypool sand (6) from a red pine plantation, recrystallized technical grade DDT dissolved in hexane was applied

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to 500 g samples to yield concentrations of 1.0 ppm or 2.0 ppm oven dry soil when mixed 1 : 1 with untreated soil. Control samples were prepared in the same way but without DDT. Each partially sterile fraction was mixedc thoroughly with 1 portion of untreated soil after complete evaporation of the hexane, brought to 70 % of its water holding capacity and maintained in a controlled environmental chamber. A 16 hour 25 °C day temperature and 15 °C, 8 hour night was programmed for the duration of the experiment. Moisture balance was maintained by addition of distilled water.

Samples of approximately one gram oven dry weight, one cm in depth were lifted from the treatments aseptically with a corer and analysed by the dilution plate method using peptone dextrose agar with streptomycin and rose bengal (7). Counts were converted to numbers per gram oven dry weight of soil.

All species growing other than those belonging to the genus *Penicillium* were identified after transfer to plates of malt agar.

All *Penicillium* colonies were transferred to Czapek agar and grouped on the basis of their morphological characteristics and growth rate during subsequent transfers. Pertinent data were placed on punch cards. Many minor differences observed on initial isolation disappeared on further transfer and thirty-two species or species groups were eventually recognized based on the classification of Raper & Thom (16). All isolations have been photographed and catalogued and representative forms maintained in culture.

### Results

The effect of DDT on the total numbers of soil fungi as ascertained by the plate count was not indicative of a pronounced suppression or enhancement (Fig. 1). The graphs indicate that when control and treated samples are compared, contrasting increases or decreases in microbial numbers are dependent upon the time at which the assay is made (Fig. 1). During the fifth week for instance, both the 1.0 ppm and 2.0 ppm treatment exceeded the control counts by a statistically significant quantity at the 1 per cent level. During the seventh week the effect was reversed although the differences were not significant. The amplitude of the fluctuations is sufficient in treated samples to suggest that the treatments do not alter the periodicity at least during the early stages. However the fluctuations are very clearly "dampened" following application of DDT.

The genera of fungi with the number of species comprising the total counts in these surveys were; *Penicillium* (32) *Mortierella* (5) *Mucor* (3) *Fusarium* (2) *Aspergillus* (2) *Trichoderma* (2) *Actinomucor* (1) *Zygorhynchus* (1) *Paecilomyces* (1) *Absidia* (1). None of these was restricted to a single treatment. If the distribution in time of individual species was examined it was readily apparent that most species do not fluctuate in unison but exhibit apparent patterns of succession which were difficult to interpret in a meaning-