GERMINATION OF CONIDIA OF *VERTICILLIUM DAHLIAE* IN SOIL

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SUMMARY

A study was made of the effect of soil fungistasis on the germination of conidia of *Verticillium dahliae* Kleb. Conidia germinated on steam or propylene oxide sterilized soil, but not on unsterilized soil of six types tested. Peptone (0.5 per cent) nullified fungistasis. Glucose (0.5 per cent) had no effect on fungistasis. Wheat straw or lignin amended to unsterilized soil had no effect on spore germination after sterilization. Fungistasis was restored to sterilized soil by incorporating natural soil at various ratios or by lowering the soil pH. Fungistasis was also restored by incubating various microorganisms in sterile soil. The fungistasis so obtained was nullified by incorporation of nutrients or by sterilization. The results suggest that nutrient deficiency as well as inhibitory substances of microbial origin might play a role in soil fungistasis.

INTRODUCTION

Soil fungistasis, the inhibitory effect of soil on the germination of fungal spores, has received considerable attention by research workers. Lockwood 15 reviewed the literature on this phenomenon and expressed the opinion that some form of biological activity is responsible for fungistasis. Various workers attempted to extract inhibitory substances from the soil, but the results obtained were either negative or inconclusive. Various soil amendments and root exudates nullify soil fungistasis and Lockwood 15 considered the direct effect of nutrients on the spores themselves as of major importance. In subsequent work, Lockwood and his coworkers 10 20 offered evidence that fungistasis could be ascribed primarily to nutrient short-
age in the soil. On the other hand, Jackson and Warcup, while recognizing the importance of nutrients, are of the opinion that other fungistatic principles should not be summarily rejected. Other factors which also received attention as possible causes of fungistasis were reviewed by Lockwood.

In this study the effect of soil fungistasis on the germination of conidia of Verticillium dahliae, was investigated. Some of the factors ruled out as possible causes, were included, since relatively little has been done on the effect of soil fungistasis on Verticillium. Green and Papavizas studied the effects of various carbon sources, C:N ratios, and organic amendments on the behaviour and survival of propagules of V. albo-atrum in the soil. They found that the microsclerotia germinated and produced viable secondary propagules after the addition of certain amendments. However, population increases were transitory and were followed by rather rapid decreases in the number of viable propagules, so that the final count was much lower than the initial population. Schreiber and Green demonstrated that the fungistatic effect of soil was overcome to varying degrees by plant root exudates and they suggested that amino acids or other nitrogen-containing compounds were responsible for overcoming fungistasis.

In this study soil types, nutrients, soil pH, lignin compounds, natural: sterilized soil ratios, and the incorporation of soil microorganisms were investigated for their possible influence on the germination of conidia of V. dahliae in soil.

MATERIALS AND METHODS

Six soil samples were collected from various localities: Two (VSC-1 and VSC-2) were sandy soils with pH 5.3 and pH 5.7 respectively. GS1C soil (pH 6.2) was a sandy loam and UL soil (pH 6.2) was a loam soil, while GK and GKC soils (both pH 7.8) were heavy clay soils. Cotton had previously been grown on VSC-1, VSC-2, GS1C, and GKC soil, but had never been grown on the other soils. Verticillium wilt occurred only on the GKC soil which was used in most of the experiments. The soil was sifted through a 16-mesh sieve in an air-dry condition. It was heat sterilized at 121°C for 1 hour for 3 consecutive days and tested for sterility by plating out on potato dextrose agar (PDA). Propylene oxide was used for cold sterilization of soil. Slightly moist soil was placed in a desiccator with propylene oxide. A slight vacuum was drawn and the propylene oxide allowed to evaporate. After 24 hours the propy-