BIOLOGICAL CONTROL OF WHITE ROT OF ONION

1. INTERACTIONS OF SOIL MICRO-ORGANISMS WITH SCLEROTIUM CEPIVORUM BERK.

by

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(with 14 figs.)

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INTRODUCTION

*Sclerotium cepivorum* BERK., the cause of white rot, is known to produce serious losses of onion (*Allium cepa* L.) in different parts of the world (24). Although control of the disease is obtained with calomel (4, 9), the observations of SCOTT (17) that mycelium of the fungus cannot grow saprophytically in unsterile soil suggested that antibiosis might be of some significance in the control of white rot disease. There are many references to the control of plant diseases by the use of antagonistic microorganisms (2, 10, 11, 22, 27). The present investigation was therefore carried out to study in some detail the interactions of soil microorganisms with *S. cepivorum* and the possibility of its biological control.

The bunching salad onion, var. 'white lisbon', commonly grown in market gardens and extremely susceptible to white rot (9), was used throughout the experiments. The isolate of *S. cepivorum* used was No. 388 in the culture collection of the Botany Department of Birmingham University.

EXPERIMENTAL

Isolation of microorganisms from the soil

The microbial population of the soil was sampled to obtain isolates of the most prevalent group of organisms for the study of their effects on the growth of *S. cepivorum*. The soil used in this investiga-

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tion was garden loam, pH 6.9—7.6, from a piece of land then under onions at the Botanical Garden of Birmingham University. At various intervals 26 soil samples were collected in small sterilized glass tubes by pushing them horizontally along the surface of the soil after removing about an inch of the surface layer. Soil dilution plate technique (21) was used for the isolation of microorganisms. One ml of the soil suspension in sterile tap water (1 : 1000 for fungi and 1 : 100,000 for bacteria and actinomycetes) was placed in sterilized Petri dishes and adequately dispersed with about 10 ml of melted cooled agar. Czapek Dox agar with 0.2 % yeast extract acidified to pH 4.4 by the addition of N/10 phosphoric acid was used for the isolation of fungi (25). For bacteria and actinomycetes, the medium was adjusted to pH 7.2 with N/10 NaOH. All the plates were incubated at 25° C. Microorganisms growing in isolated colonies on the dilution plates were transferred on Czapek Dox yeast agar slants. Amongst these 34 different genera of fungi, 4 genera of bacteria and the genus Streptomyces were identified (3, 8, 14, 16, 19).

Interaction in agar culture

With Fungi

The effect of fungi isolated from the soil, as described above, on the growth of S. cepivorum was studied on Czapek Dox yeast agar, pH 4.4. Petri dishes containing about 10 ml of Czapek Dox yeast agar were inoculated at opposite sides, 60—65 mm apart with 5 mm diameter disks of inoculum from actively growing edges of 4—5 day old colonies of S. cepivorum and a test fungus, respectively. All experiments were replicated twice. The dishes were incubated at 22° C, found to be optimum for the growth of the fungus in culture. Radial growth of the organisms towards one another were recorded daily.

When S. cepivorum is growing in a pure culture on Czapek Dox yeast agar, the hyphae at the edge of the colony are of uniform shape and the fungus fills the plate in 5 days time. It behaves differently, however, when it is growing with some other organism depending on the organism with which it is associated. The effects observed were classified into 4 different types of reactions explained as follows:

A. The hyphae of the two colonies intermingle but remain clearly distinguishable because of morphological differences between two sets of hyphae, (Fig. 2).

B. The growing margins of the two colonies meet, one of which (S. cepivorum) is inhibited and becomes overgrown by the other test fungus, (Fig. 3).

C. The hyphae of the two organisms approach one another and stop growing, (Fig. 4).

D. The growth of one of the organisms is inhibited at a distance leaving a clear zone of inhibition in between, (Fig. 5).