STUDIES ON THE FUNGUS SCLEROTIUM CEPIVORUM BERK. CAUSING WHITE ROT OF ONION

By

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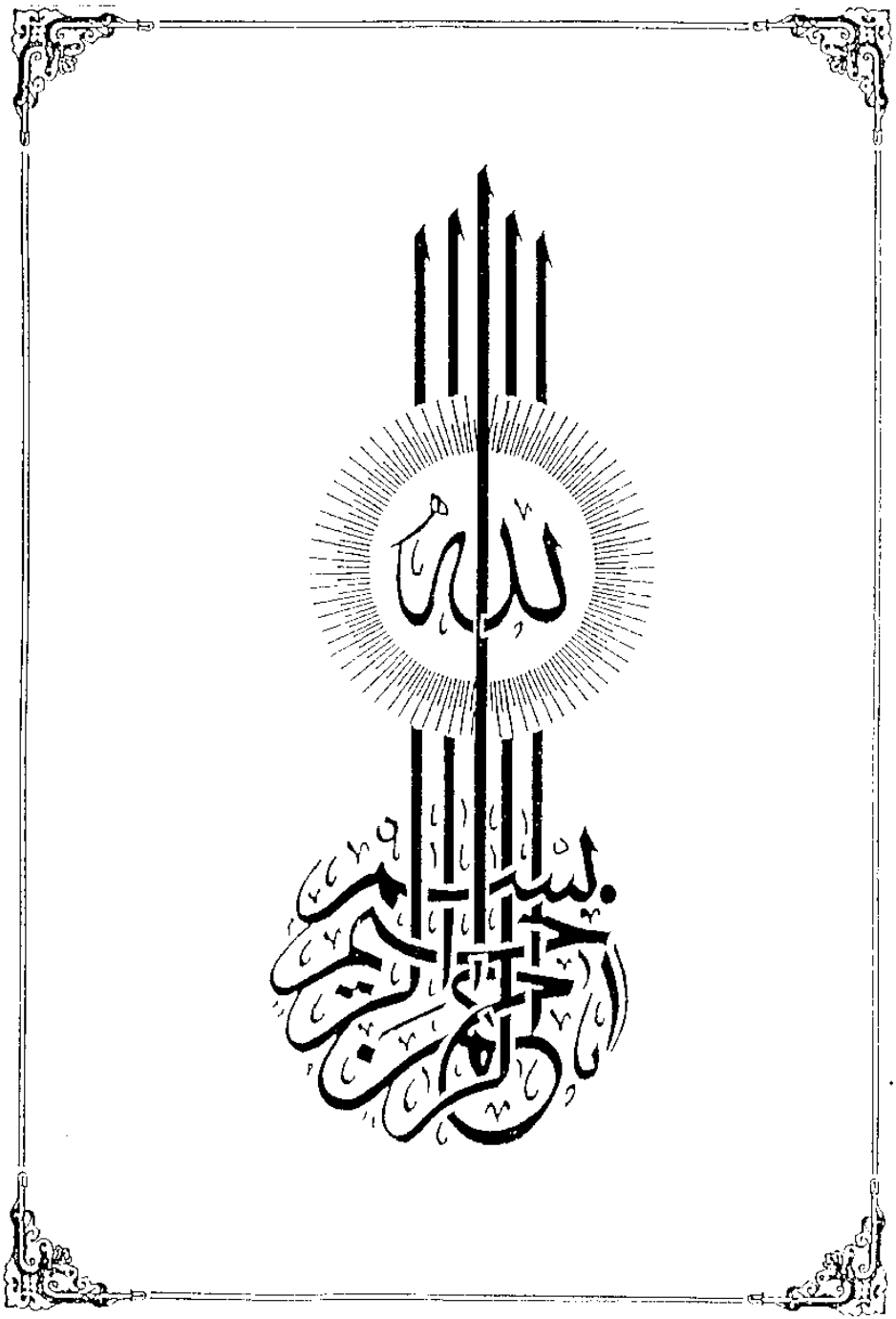

A C K N O W L E D G M E N T

This work was carried out under the supervision of Dr. A.R. Sirry, Professor of Plant Pathology and Dr. M.F. Hegazy, Lecturer of Plant Pathology, Faculty of Agric., Ain Shams University.

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C O N T E N T S

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I N T R O D U C T I O N

White rot of onion is considered one of the serious problems interferring with the production of this important exportation crop in U.A.R.

Owing to the heavy infestation of lands with white rot fungus, the farmers in whole villages in Minia and Beni-Swif provinces ceased to grow onion.

The survey of infested lands in 1964 showed that 5,575 feddans were found to be contaminated with the fungus in U.A.R. (Wilkinson, 1965).

Different aspects of the biology of white rot fungus are not completely explained, although extensive work was done in this field. As more data are obtained on the behaviour of the fungus alone, in soil with biological associations and in the diseased plants, a better illustration will be obtained for the weak points in the life history of the fungus to be used for its control.

The present investigation was planned to study the following items :

1) The effect of some environmental factors on the causal

organism in the laboratory.

2) The effect of plant nutrition, number of irrigations and fungicides on disease severity.

3) The effect of fertilisers on the mineral content of onion plant in relation to the disease.

4) The interaction between soil bacteria and Sclerotium cepivorum in the presence and absence of Allium juice.

REVIEW OF LITERATURE

Causal Organism :

Sclerotium cepivorum Berk. is one of the most important pathogens which cause great damage to onion(*Allium cepa* L.) all over the world.

Berkeley (1841) was the first who established that the fungus *S. cepivorum* is the causal pathogen of white rot disease of onion.

The disease has been recorded in U.S.A. (Walker, 1924), Holland, France, Spain and Italy (Walker, 1924), U.A.R. (Nattrass, 1931), South Africa (Du Plessis,1934), Australia (Anonymous, 1948), Brazil (Brando, 1942)and in Tasmania (Geard, 1959) (c.f. Tims, 1943).

Effect of Media :

Tims (1948) stated that *S. cepivorum* grew well and produced numerous sclerotia on Czapek's liquid medium and its growth was definitely limited on Richard's liquid medium.

Ashour and Khadr (1963) found that the fungus

gave its best rate of growth on potato-dextrose agar and onion extract agar media. They also observed that the slowest growth was on Richard's agar medium. The fungus gave its highest amount of growth, expressed in the mycelial dry weight, on onion extract medium and the lowest amount was obtained on Czapek's liquid medium.

Ragab et al. (1965) stated that S. cepivorum grew well on potato dextrose agar. The fungus gave moderate growth on Czapek's medium and poor growth on oatmeal medium.

Sirry et al. (1970) reported that the fungus S. cepivorum gave its best rate of growth on onion extract medium, while the lowest growth was on Richard's medium.

Effect of Temperature :

A. In culture :

Walker (1924) found that S. cepivorum grew rapidly on potato agar at 20° to 23° with a maximum about 28°C.

Nattrass (1931) made a comperative study on the Egyptian and the Dutch strains of S. cepivorum. He found that the optimum temperature for the growth of both strains was 22° to 24°C, the minimum 16° and the maximum 35°C.

Da Piessis (1932) reported that S. cepivorum was

favoured by low temperatures (10 - 20°C).

Asthana (1948) stated that S. cepivorum had an optimum range of temperature near 20°C.

Ashour and Khadr (1963) reported that the optimum temperature for the growth of S. cepivorum was 22°C. They added that germination of sclerotia occurred at a wide range of temperatures from 10 to 21°C, with an optimum between 16 and 21°C. The sclerotia were killed by heating at 90°C for ten minutes in water bath, while exposure to 85°C. for the same period reduced the percentage of germination

Ragab et al. (1965) found that 20°C was the most favourable for the fungal growth, whereas the lowest was at 10°C. They also reported that early production of sclerotia was at 20°C. There was no sclerotial production at 10°C.

Sirry et al. (1970) stated that the highest rate of growth was at 20°C, and the lowest was at 10°C. The fungus fail to grow at 35°C.

B. In soil :

It was reported that white rot disease developed most rapidly at soil temperature of 15°C to 21°C, while at

soil temperature over 24°C, the development of the disease was entirely inhibited (Anon 1943).

Asthana (1948) found that the optimum temperature for the development of the symptoms of white rot ranged from 13° to 18°C.

Effect of Moisture :

Walker (1924) found that white rot disease of onion was most destructive in soil having a medium moisture content. He also stated in 1926 that the amount of infection was much diminished at 60 and 80 per cent water holding capacity.

Du Plessis (1932) found that the best rate of fungal growth was at medium moisture content.

Asthana (1948) found that white rot disease of onion reached its maximum between 40 and 60 per cent of soil moisture.

Ashour and Khadr (1963) stated that the fungal growth of S. cepivorum on potato dextrose agar medium occurred at a wide range of relative humidity with an optimum near 74%. In pots, damping off of seedlings occurred at a wide range of soil moisture. They also stated that the

sclerotia germinate at a high percentage (95 - 100%) of R.H.

Sirry et al. (1970) found that the highest rate of growth was at 84.5% relative humidity. No growth was found at 14.5% relative humidity.

Effect of pH :

Time (1943) found that the fungus S. cepivorum grew very poorly on certain liquid culture media at pH over 7.0. No infection was found in fields with pH below 7.0. He also reported in 1948 that S. cepivorum grew well over a rather wide pH range on media such as Bacto bean agar and Czapek's solution. However, in Richard's solution growth was sharply limited between pH 2 and 7.0.

Asthana (1948) mentioned that the development of S. cepivorum was favoured by acidity.

Ashour and Khadr (1963) reported that the fungus S. cepivorum grew well at a wide range of pH with an optimum between 3.4 and 6.3.

Ragab et al. (1965) reported that the greatest mycelial dry weight was found at pH 6.0. There was a decline in the growth with decreasing the pH values to 2.4

or increasing them to 8.8. No growth of mycelium was noticed at pH 1.1 or 9.4.

Control of the disease :

It was found that crop rotation, using uncontaminated manure, obtaining seedlings from non-infected areas, and burning infested refuse, are necessary means for the disease control (Anon 1930).

Nattrass (1933) recorded that seedlings selected from disease free-areas and crop rotation for eight to ten years are necessary for the control of white rot disease.

Bremer (1934) stated that white rot of onion should be combated chiefly by well regulated rotation, in which onions are excluded from infested fields for at least eight to ten years.

Ogilive and Hickman (1937) stated that soil application of organic mercury compounds before sowing white Libson onion - at the rate of one oz. per square yard of soil surface, gave good control of white rot of onion.

It was suggested that the fungus S. cepivorum could be readily controlled in the seed beds by soil sterilization with formalin (Anon 1943) .