STUDIES ON BASAL ROT DISEASE OF ONION

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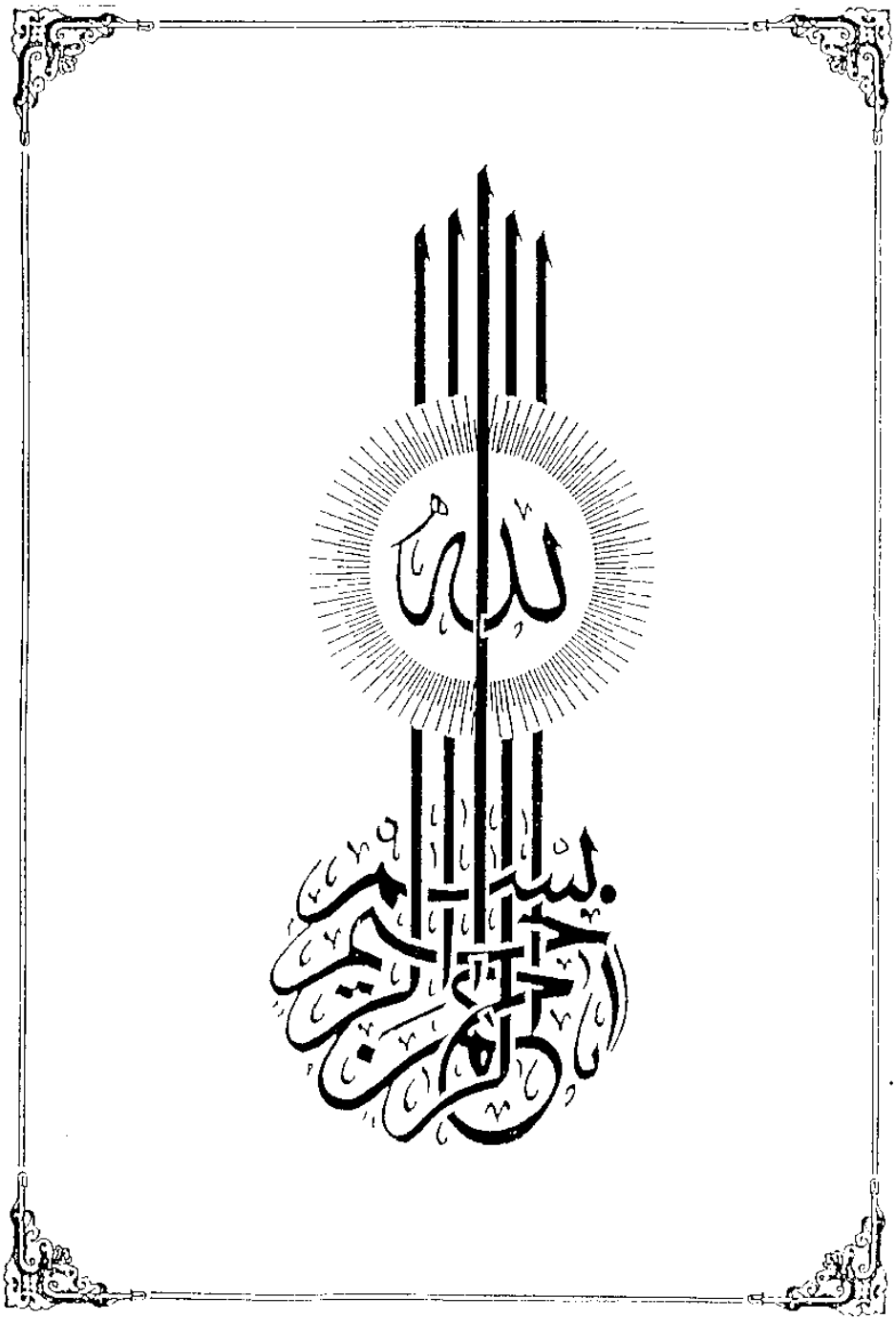

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INTRODUCTION

Egyptian onions are exported to many countries of the world for its superior quality. Thus intensive onion cultivations are distributed at Middle Egypt and Upper Egypt. The higher percentage of the exported bulbs is obtained from the Upper Egypt.

Egyptian onions are attacked by numerous diseases at almost all stages of growth, and along storage period or transit causing considerable losses in yield of bulbs.

Wherever onions are grown intensively, Fusarium basal rot can be present and causes severe losses (Geard 1959). The decay occurs both in the field and in storage. The disease is stated to make hard-sorting of the crop essentially ,thus greatly increasing the cost of production. Owing to the destruction of the roots, the diseased plants are easily pulled up and the tops may turn yellow prematurely. On harvesting, the extent of damage may not be easily noticed, but upon closer examination, a soft rot of the basal plate and the lower portions of the bulb scales can be detected, and in many cases whitish fungal hyphae are visible (Mathur & Sankhla 1963). In storage, the rot extends upwards, eventually, destroying all the contents and leaving only the dry shell.

Latham, Watson(1966) reported that onion seedlings were infected and bulbs rotted by Fusarium oxysporum according to the soil residue they were grown on. In soil amended with alfalfa residue, seedling growth was greatest and bulb rotting was lowest. However, on onion residue, seedling growth was inhibited and bulb rotting was severe.

The present investigation was planned to study some items on the disease and its pathogen and the effect of fungicidal and fertilization treatment on the disease severity. In addition, the relation between rhizosphere micro-organisms and the pathogen was studied. The histo-pathological study was planned here also to look for the mode of infection and the anatomical response of different onion varieties to Fusarium oxysporum f. cepae

REVIEW OF LITERATURE

Causal organism :

Walker and Tims (1925) reported that the causal organism of basal bulb rot of onion was Fusarium cepae Hanzawa. They added that this fungus most resemble to Fusarium hyper oxysporum, F. rodelens and F. oxysporum. The pathogenicity of Fusarium cepae was succeeded after artificial inoculation of the bulbs which were kept under moist conditions.

Link and Bailey (1926) and Palo (1928) reported that several species of Fusarium caused bulb rot of onions. They demonstrated that the pathogenic species were Fusarium zonatum sherb. and F. cepae.

Wooliams (1928) and Mclarty (1930) reported that the maximum infection of Fusarium bulb rot of onion occurred at harvest time. Needle prick inoculations of field and cured bulbs with a species of Fusarium isolated from diseased plants gave positive results.

Anon. (1953) reported that onions were susceptible to attack by F. oxysporum F. cepae, Marlatt (1958); Anon. (1958), and Dingley (1961) came to the same finding that this organism caused basal rot of onions.

Briant (1956) reported that some strains of Fusarium oxysporum f. sp. cepae were able to attack onions without prior damage by pink root rot (Pyrenochaeta terrestris)

Marlatt (1958) proved that F. oxysporum f. cepae is a wound parasite, that caused basal rot of onion bulbs in pots after the roots had been injured mechanically.

Mathur & Sankhla (1963) described the symptoms of basal rot of onion and reported that it is attributed to Fusarium oxysporum f. sp. cepae.

Szatala (1964) found that the infection with F. oxysporum f. cepae occurred almost exclusively through wounds. In storage, nearly all onions inoculated at 25-30°C were killed.

Abawi and Lorbeer (1965) isolated three hundred isolates of F. oxysporum f. sp. cepae from field infected onion (mostly stem plates and also roots). Ninety seven per cent of the original isolates produced sporodochia and abundant floccose mycelia, most produced sclerotia.

Lorbeer and Stone (1965); and Shalaby & Struckmeyer (1966), found that Fusarium oxysporum f. cepae invaded the basal plate of bulbs and older leaves causing the pre-harvest infection of plants in the field.

Ashour et al. (1973) reported that Fusarium oxysparum f. cepae is the causal organism of onion basal rot in A.R.E.

Inoculum potential:

French (1965) reported that increasing the spore concentration of F. oxysporum f. sp batatus resulted in an initial linear increases in the disease incidence. The differences among isolates increased as the resistance of host clones was high. The susceptibility rank of the four clones of sweet potato tested was the same for most isolates at a given concentration, but differed with changes in the inoculum potential.

Abawi and Lorbeer (1971) reported that it did not always follow that soils with high population of Fusarium oxysporum f. cepae had a history of high incidence of basal rot even when susceptible varieties of onions were grown. The incidence of other factors in addition to the inoculum density of the fungus influences the disease potential of naturally infested field soils. They found also in (1972) that the disease was observed when onion seedlings were grown in artificially organic soil(under controlled conditions),containing at least $5x10^{5}$ propagules/g oven dry soil.

Variatal resistance :

Walker and Lindegren (1925) gave an account of experiments to test the effect of soluble toxic substances existing in the outer scales of coloured varieties of onion which play an important part in the resistance. In the case of the onion rotting species of Fusarium, which enter through insect wounds and the stem plates, they have a little chance of their coming into contact with the soluble toxic substances existing in the outer scales.

Link and Bailey (1926) reported that Fusarium causing a bulb rot of onions is specialized to attack only species of Allium of which red, yellow, and white varieties are equally susceptible.

Woolliams (1932) tested the susceptibility of 86 onion varieties to Fusarium which cause bulb rot. He found that nine varieties showed no or 1 per cent infection and twenty three varieties showed 1 to 4 per cent infection. Of all the varieties tested, yellow, white, and red Bermuda onions appeared to be consistently resistant. Leeks (Allium porrum) and Chives (A.schoenoprasum) were apparently immune, white or English Welsh onion (A. fistulosum) remained unaffected but Red or French Welsh onion showed about 7.5 per cent infection.

Davis and Henderson (1937) reported that the Fusarium rot of onion is controlled by means of selection and inbreeding of five strains of Red and Yellow Globe onions which sustained less than 5 per cent loss from bulb rot in the field and in storage during 1935, when the damage amounted to 90 per cent.

Jones and Mann (1963) gave a study on breeding concerns of onion disease with notes on resistance to Fusarium oxysporum f. sp. cepae and other fungi.

Lorbeer and Stone (1965) reported that Fusarium basal rot of onion caused by Fusarium oxysporum Schlecht. emend. Snyd. & Hans. f. sp. cepae, generally occurs at low levels in organic soils in New York cropped by onion because of the avoidance in use of the more susceptible varieties.

Abawi and Lorbeer (1971) reported that in field tests with natural inoculum, the time of initial root infection of onion by Fusarium oxysporum f. cepae and the level of root infection at intervals later in the growing season were similar in the four selected varieties which have been tested. Differences in the percentage of bulb decay among varieties occurred after several months of storage. In green house and growth chamber tests in

soil with different levels of artificial infection with F. oxysporum f. cepae, seedlings of the four varieties generally were equally susceptible to infection as measured by emergence and stand.

Rhizosphere and Antagonistic organisms :

Evanari (1945) listed more than 100 plants which contain germination inhibitors, among them were Allium cepae. The inhibitors were produced by all parts of the plant, i.e. fruit pulp, fruit coat, endosperm, seed coats, embryo, leaves, and roots.

Timonin and Thexton (1950) investigating the effect of Allium spp. on soil organisms, and reported that onion and garlic juices reduced or completely inhibited the activity of certain fungi.

Wood and Tveit (1955) summarized the importance of antagonistic micro-organisms in reducing disease severity in connection with plant root diseases.

Brian, P.W. (1957) reported that antibiotic production by rhizosphere organisms may be effective in limiting the activity of soil-borne pathogens, but this is difficult to prove under natural conditions. Opinions vary regarding the importance of antibiotic production in the soil.

Park (1959) stated that Fusarium oxysporum colonized plant materials in soil only in the early stages in ecological successions.

Coley-Smith (1960) reported on the rhizosphere effect involving specific plant pathogens and their hosts. He demonstrated that sclerotia of Sclerotium cepivorum Berk. will germinate only in the presence of roots or extracts of roots of plants of the genus Allium is apparently unique in the fungi. The nature of the active factor in this case was not determined.

Schroth & Snyder (1961) reported that chlamydo spores of Fusarium solani f. phaseoli (Burk) Snyd & Hns. germinated in the vicinity of roots of phaseelus vulgaris L., but not in soil away from plant. The factor was not identified, but certain sugars and amino acids caused a similar stimulation.

Reyes and Mitchell (1962) reported that the average of the populations in the rhizosphere of 8 varieties of susceptible peas was significantly higher than in unplanted soil. They also mentioned that growth response of Fusarium solani f. pisi, Fusarium oxysporum f. lycopersici, and Fusarium solani was greater in rhizosphere of host than

of non host plants. Stimulation around the roots was evident at 4 days after planting. The young portion of the roots appeared most active in stimulation of fungus growth.

Richard (1962) demonstrated that colonies of Fusarium oxysporum f. niveum differed in their ability to grow saprophytically in non sterile soil, indicating differences in their ability to compete with other soil micro-organisms. He added that soil dilution plate studies demonstrated that 90% of the micro-conidia introduced on the surface of non sterile soil were unrecoverable after short periods of incubation.

Smith and Peterson (1965) explained the interaction between clover roots and such fungi as Fusarium oxysporum f. roseum, and F. solani. They reported that root exudates may play a significant role on the population changes of these organisms.

Latham and Watson (1967) reported that the complex of organisms associated with root rot in onion field soils consisted of F. oxysporum, Pyrenochaeta terrestris, Rhizoctonia sp, pythium sp., and bacteria. They added