

STUDIES ON THE BIOLOGICAL CONTROL OF MACROPHOMINA PHASEOLINA (TASSI)GOLD.

INTRODUCTION:

Biological control, in recent past, has gained considerable stature as a possible practical agricultural method for the control of soil-borne plant pathogens (Farrar & Lumsden, 1980). This includes, manipulation of the environment or the host whereby the activity or survival of a pathogen is reduced through the agency of any other living organism (Garrett, 1965). In the present studies, the biological control of Macrophomina phaseolina has been investigated.

M. Phaseolina (Tassi)Gold, causes seedling blight, charcoal rot, root rot, stem rot, pod rot of over 400 species of plants (Dhingra & Sinclair, 1978). The fungus is widely distributed in tropical and subtropical countries of the world (Reichert & Hellinger, 1947; Young, 1949) of which at least 40 hosts have been recorded from Pakistan alone (Ghaffar et al, 1964). In the Indo-Pakistan subcontinent, root rot of cotton is considered as a serious problem in cotton cultivation (Ghaffar et al, 1969) where the cotton crop is a complete failure in root rot infested patches (Fig.1). Cook et al (1973) have reported the incidence of charcoal rot in certain individual fields of Nebraska to be as high as 70% in corn and 80% in sorghum.

M. phaseolina in its mycelial state does not survive for more than 7 days in soil (Ghaffar, 1968; Ghaffar & Akhtar, 1968; Kavoor, 1954; Meyer et al, 1973). The fungus persists in the form of small, black sclerotia (60-100 x 56-80 μ m) which are produced in large numbers on infected host tissues (Fig.2) and subsequently dispersed in soil during tillage operation (Cook et al, 1973; Ghaffar & Akhtar, 1968; Smith, 1969 a).



Fig. 1. Cotton plants showing wilting in a root rot infested patch.



Fig. 2. Sclerotia of *M. phaseolina* studded on the inside of the bark of cotton root.

Populations as high as 1000 sclerotial propagules g^{-1} soil have been reported (Papavizas & Klay, 1975) and the importance of these sclerotia in the development of root rot has been stressed (Smith, 1969a; Watanabe et al, 1967; Ilyas & Sinclair, 1974).

Survival of the sclerotia of M. phaseolina has been reported for upto 10 months under dry storage condition in soil (Ghaffar & Akhtar, 1968; Jolly-Smith & Cook, 1971) and for 12 to 16 months in corn and sorghum stalk residues in soil (Cook et al, 1973). Most of the studies on survival of M. phaseolina have been made on recoveries of sclerotia made from infected host pieces in soil like soybean (Dhingra & Sinclair, 1974) corn and sorghum (Cook et al, 1973), cucumber (Ghaffar & Akhtar, 1968). This approach is logical since pathogens are primarily associated with host crop residue but they are also released in soil during tillage. Ghaffar (1968) used sclerotia of M. phaseolina on fiber glass cloth pieces. It is not known as to the percentage of reduction in numbers of viable sclerotia in nylon or host pieces.

In recent studies where tissue or soil formed sclerotia were used viability of sclerotia gradually declined in soil but some sclerotia were still viable after 4 yrs of soil exposure (Watanabe, 1973). Freezing and thawing of moist soil reduced sclerotial germinability (Bristow & Lyllie, 1975). Dhingra & Sinclair (1975) showed that sclerotial populations declined 96-99% in soil at 60-100% MHC as compared with populations in dry soil, no reduction was observed at 0% MHC. In contrast, the biggest drop occurred in air dried soil (2-3% MHC) at 26 C and at least 75% of sclerotia of M. phaseolina survived at 50-55% MHC (Papavizas, 1973). Similarly, of the organic amendments like alfalfa hay, chitin and pine needles, only

alfalfa hay at 0.8% w/w reduced survivability of sclerotia in soil by 75% in a year (Papavizas, 1977a). Amendment of soil with alfalfa meal reduced Macrophoma infection on cotton which was related to an increase in population of actinomycete and bacteria antagonistic to M. phaseolina (Ghaffar et al, 1969).

A basidiomycete hyperparasite has been reported to bring about biological control of Macrophoma on slash pine seedlings Pinus elliotii (Groz et al, 1975). Antagonistic activity of fungi like Arachniotus, Aspergillus aculeatus, Cephalosporium humicola, Trichoderma lignorum, (Ohingra & Khare, 1973), T. viride, (Ghaffar, 1968) and actinomycetes like Streptomyces albus, S. griseus and S. noursei (Ghaffar, 1971) have been reported. During studies on biological control of M. phaseolina, experiments have been carried out on the hypothesis whereby the existing soil microbial community is changed towards suppressiveness of the sclerotial propagules by addition of certain organic materials, or by the inoculation of selected saprophytic antagonistic micro-organism into soil and/ or by alteration of chemical or physical environment.