Pak. J. Bot., 20(2): 245–250, 1988.

# INACTIVATION OF SCLEROTIA OF *MACROPHOMINA PHASEOLINA* UNDER PADDY CULTIVATION

MOHAMMAD JAVED ZAKI AND ABDUL GHAFFAR

*Department of Botany,*
*University of Karachi, Karachi-75270, Pakistan.*

**Abstract**

Viability of sclerotia of *Macrophomina phaseolina* was examined in field under paddy cultivation for two consecutive years. After 12 weeks sampling, number of sclerotia were eliminated from surface and 20 cm depth at Rice Research Experimental Station, Kalashah Kaku, Lahore and declined by upto 60-83% at the University Experimental Station, Karachi. Whereas sclerotia survived under dry fallow treatment, soil flooding significantly reduced number of sclerotia by 95% in fields without paddy and 81% with paddy cultivation after 12 weeks as compared to 15% reduction in fields without paddy and 7% with paddy cultivation in plots irrigated daily. *Macrophomina* infection on cotton seedlings declined by 100% in flooded field without paddy and 80% with paddy crop as compared to 25% reduction in daily irrigated treatment without paddy cultivation and 38% with paddy. Soil flooding with or without paddy cultivation holds promise in the inactivation of sclerotia of *Macrophomina* from infested field.

## Introduction

*Macrophomina phaseolina* (Tassi) Goid., produces charcoal rot, damping off, root rot, stem rot or pod rot of over 500 plant species in tropical and subtropical countries of the world (Sinclair, 1982). The fungus survives as small black sclerotia (60 x 100 µm x 56-80 µm) which are formed in host tissues and released into the soil as tissue decays (Cook *et al.*, 1973). Population as high as 1000 sclerotial propagules/g soil have been reported (Papavizas & Klag, 1975). The inoculum density of *M. phaseolina* can be reduced by organic amendments (Ghaffar *et al.*, 1969), herbicides (Filho & Dhingra, 1980), fungicides (Ilyas *et al.*, 1975), fumigants (Smith & Bega, 1966), biological antagonists (Cruz & Hubbel, 1975) and by soil solarization (Sheikh & Ghaffar, 1984). We present the results on the reduction of sclerotia of *M. phaseolina* from flooded field with or without paddy cultivation. A portion of this study was previously reported (Zaki & Ghaffar, 1988).

## Material and Methods

*Macrophomina phaseolina* isolated from diseased roots of okra obtained from University Experimenal farm Karachi (KU Cult. No. 333) was used. Two month old sclerotia produced on cornmeal sand (5% w/w) separated after sieving (120 µm) were mixed with soil. Nylon bags containing soil artificially infested with sclerotia of *M. phaseolina* 200g each, were buried at 5 and 20 cm depth in the field under paddy cultivation (cv IR-6) at

two different field locations viz, University Experimental Station, Karachi (sandy loam, pH 7.5) and at Rice Research Experimental Station, Lahore (clay loam, pH 7.2). The experiments were carried out during 1986 and 1987 at the two sites.

In a separate experiment cemented rings, 40cm diam., and 15cm height, were placed in the field at the University Experimental Station, Karachi. Soil was artificially infested with sclerotia which gave an average population of 30 scl. $g^{-1}$ soil. A plastic sheet was placed in each ring at 30 cm depth to prevent water seepage and simulate flooded soil conditions. In a seperate treatment no plastic sheet was used and the soil was irrigated daily. Rice cv. 370 was transplanted. In flooded treatment water level was maintained at 2-4 cm above the soil. Dry fallow treatment was kept as control. There were three replicates of each treatment. Soil samples were collectd at 0 time and after 1, 2, 3, 4, 8 and 12 weeks interval to determine the population of sclerotia using wet sieving and dilution technique (Papavizas & Klag, 1975). Soil was also transferred into 12 cm diam., pots in which cotton was sown and *Macrophomina* infection on cotton roots was determined after 15 days growth of the seedlings.

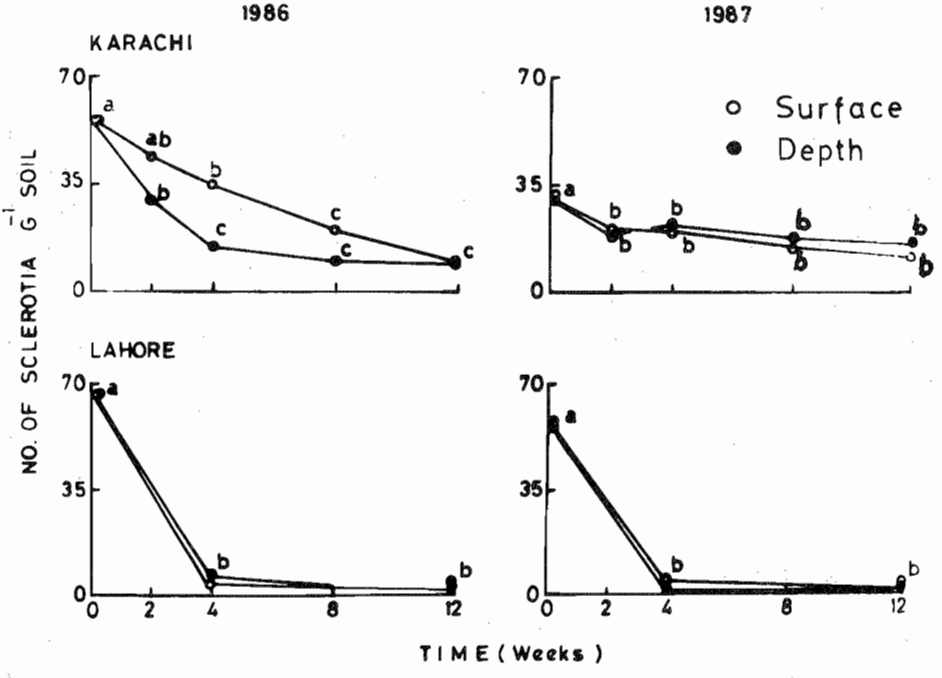


Fig. 1. Reduction in number of sclerotia of *Macrophomina phaseolina* under paddy field at 2 different locations. Means followed by different letters are significantly different at $P < 0.05$ using Duncan's Multiple Range Test.

Microbial population of soil was analysed using soil dilution technique on Czapek Dox Agar, pH 7 for actinomycetes and bacteria and pH 5, supplemented with penicillin and streptomycin each @ 100 ppm for fungi. *In vitro* antibiotic activity of fungi, actinomycetes and bacteria was examined by inoculating random isolates on Potato Dextrose Agar, 5 in each Petri dish and 1 cm from the edge of the plate. After incubation for 24 h and at 30°C *M. phaseolina* was inoculated in the centre by placing 5 mm diam., disc and potential antagonists around which *M. phaseolina* was inhibited were counted.

## Results and Discussion

Sclerotia of *M. phaseolina* were eliminated both at the soil surface and at 20 cm depth after 12 weeks in paddy field at the Rice Research Experimental Station, Kalashah Kaku, Lahore, in two consecutive years of experimental trial. Number of sclerotia declined by 83% in 1986 and by 60% in 1987 trial at the University Experimental Station, Karachi (Fig. 1). The difference between the results of two experimental sites may be due to soil type, clay loam retaining flooded soil conditions as compared to sandy loam. Scle-

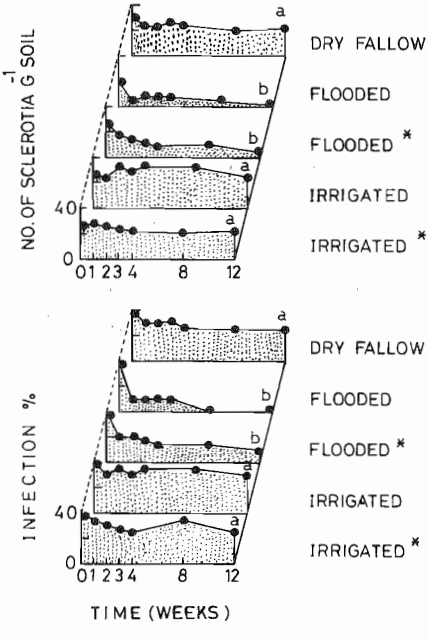


Fig. 2. Effect of flooded or irrigated condition on the reduction in number of sclerotia of *Macrophomina phaseolina* and its infection on cotton used as test plant. Means followed by different letters are significantly different at $P < 0.05$ using Duncan's Multiple Range Test.
*Rice cultivation.

rotia which survived in dry fallow treatment were reduced by 95% in field without paddy cultivation and 81% with paddy cultivation after 12 weeks under simulated flooded soil conditions. In soil irrigated daily upto 15% reduction in population of sclerotia was observed in field without paddy and 7% with paddy cultivation. *Macrophomina* infection on roots of cotton showed 100% control in flooded soil without paddy and 80% with paddy crop as compared to 25% reduction in daily irrigated treatments without paddy and 38% with paddy crop (Fig. 2).

Flooded soil undergo physcial, chemical and biological transformation that greatly alter their microbial population which include decrease in aerobic micro-organisms and increase in anaerobic bacteria (Anon., 1964). In the present study, a pronounced decrease in the population of fungi with no significient difference in actinomycetes and bacteria was noticed in flooded soil as compared to dry soil (Fig. 3). This was associated with an increase in population of antagonistic actinomycetes and bacteria which may be attributed to significant reduction of sclerotia of *M. phaseolina* in flooded soil.

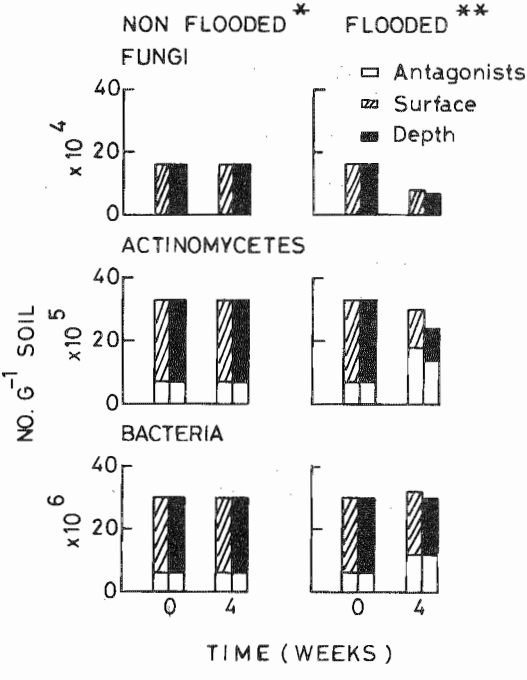


Fig. 3. Changes in microbial population of soil under flooded or non-flooded condition showing proportion of organisms antagonistic to *Macrophomina phaseolina*. Data is for 1987 at Rice Research Station, Lahore.

*Without rice cultivation, kept dry.

**With rice cultivation.

High soil moisture has been found to decrease the population of sclerotia of *M. phaseolina* (Dhingra & Sinclair, 1975; Sheikh & Ghaffar, 1980). Whereas high soil moisture adversely affects the survival of *Fusarium roseum* (Cook & Papendick, 1970) and *Theilaviopsis basicola* (Papavizas & Lewis, 1971), soil flooding showed a loss in viability and pathogenicity of sclerotia of *Rhizoctonia tuliparum* (Muller *et al.*, 1988). Decomposition of sclerotia of *Sclerotinia sclerotiorum* within 20 days under paddy field has been reported (Moore, 1949). Similarly soil flooding and paddy cultivation was found to affect the survival of *Verticillium dahliae* (Pullman & DeVay, 1981). The results of the present study would therefore suggest that soil flooding with or without paddy cultivation holds promise for the inactivation of sclerotia from soil which during the next cropping season may result in control of *Macrophomina* root rot of crop plants.

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(Received for publication 2 March 1988)