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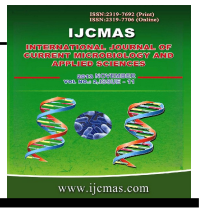

Original Research Article

Biochemical control of charcoal rot of Sorghum bicolor (L.) Moench

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Keywords

Sorghum bicolor (L.); Poaceae; *Macrophomina phaseolina*; *Trichoderma viride*.

A B S T R A C T

Sorghum bicolor (L.) Moench commonly known as "Jowar" is the most important rabi and Kharif crop of India belonging to the family "Poaceae". Sorghum crop suffers from biotic and abiotic stresses. Charcoal rot is one of the most important disease dining post rainy season caused by "*Macrophomina phaseolina* (Tassi) Goid". An attempt was made to determine suitable integrated control measures including biological control for increasing and stabilizing the production of sorghum. Several fungi isolated from soil were subjected to preliminary invitro screening for antagonistic nature against *Macrophomina phaseolina*. The result clearly showed that *Trichoderma viride* proved as potential antagonist against *Macrophomina phaseolina*. In Vivo data also revealed that the introduction of T. Viridi reduced the disease incidence to an appropriate level.

Introduction

Sorghum (L) MOench commonly known as **"**Jowar" is the most important rabi & kharif crop of India belonging to the family poccur. It is among one of the four major cereal crop of the world. The other three being wheat, rice and maize. It rank fifth among the cereal grains in extent of production after wheat, rice, maize & Barley. Current 'fao' data shows a world wide production of 260, 906 tones of Sorghum grain, cultivated 388, 166 million hectares of land. The five largest sorghum grain, producing countries in the world are the united states (25%) India (21.5%) Mexico (11%) China (9%) and Nigeria (7%). These countries account for 73% of world production.

With the current area under sorghum India is the largest grower in the world with USA ranking second. It is mainly cultivated in the states Maharashtra, Karnataka, Andhra Pradesh, Gujarat, Chennai, Rajasthan & Utter Pradesh. More than 90% of India's production is accounted by these states. (Anahousur, 1982). In Rajasthan Sorghum is grown in an area of about 556000 hectares. It is being cultivated as rainy season crop (Kharif, June to October).

Sorghum crop suffers from biotic and a biotic stresses. Among biotic stresses diseases play and important role. Many diseases caused by various micro organism

like bacteria, viruses, mytoplasma, and fungal pathogens. Among fungal diseases charcoal rot (M. Phaseolina) are quite common in India. Several of which have an adverse effect on yield. Stalk rot is one of the most important disease during post rainy season. Due to charcoal rot 15.5% and 35% of seed weight loss was observed in Dharwad of Karnataka (An ahosur & Patil, 1983). Charcoal rot diseases reduced grain yield by 38% in CSH-1 & 31% in CSH-6 (Choudhari *et al* 1987).

In Rajasthan State there is no published report about the control of this disease. So looking to the paucity of information on the control of the disease in Rajasthan State an immediate attention from the research side is needed. Hence the present investigation was aimed to undertake a thorough study on biological control of the disease for increasing & stabilizing the production of sorghum, results of which are incorporated here in.

Materials and Methods

The inoculums of biological antagonist Trichoderma Viride was prepared by multiplying the fungus on wheat husk bran saw dust medium having the composition 75 g wheat husk, 25 g saw dust mixed with water.

Fifty grams of medium was taken in each 250 ml conical flask and sterilized at 20 lbs presence for 30 minutes. The flasks were inoculated with small blocks containing young growing sclerotia of *T. viride* and then incubate at 29°C ± 1°C for 10 days.

In-vitro

Experiments were carried out to know possible existence of antagonism between *T. viride* and M. Phaseolina. The antagonistic nature of *T. viride* against *M. phaseolina* was studied by following method.

Dual Agar Culture

Method PDA was poured in 90 mm. petri plates (20 ml. per plate) and was allowed to solidify then these plates were inoculated with 5 mm mycilial disc of *T. viride* and *M. phaseolina* obtained from three days old cultures of the fungus were inoculated at a distance of 20 mm of facing with in from the centre same petriplates (Morton *et al*. 1955).

In -Vivo

In pot experiment, the inoculums of *M. phaseolina* grown on sand maize meal medium was added to the sterilized soil of each pot having a diameter of 15cm. at the rate of 1:10 i.e. 100g of inoculums was added per kg. of soil. The inoculated organism was allowed to grow for one week and then the antagmistic fungus, *T. viride* grown on wheat husk bran – saw dust medium was added to soil at the rate of 50 gm/pot which was previously inoculated with *M. phaseolina* and was allowed to grow for about one week. In each pot seeds were sown. Each treatment was replicated 8 times watering was done with sterile distilled water as and when required. Observation on incidence of seed and seedling rot were recorded, after one week and 3 weeks of sowing.

Result and Discussion

This study was carried out on possible existence of antagonism between *Trichoderma viride* and *Macrophomina phaseolina*.

Preliminary screening & selection of biocontrol agent

Several fungi isolate from soil were subjected to preliminary screening for antagonism against *Macrophomina phaseolina* by dual culture method.

Two genera screened viz *Aspergillus* spp and *Trichoderma* spp. Only *Trichoderma* Spp has exhibited antagonism against the pathogen. Out of two species *Trichoderma, Trichoderma harzianam* exhibited mild antagonism nehile *Trichoderma viride* exhibited moderate antagonism against *Macrophomina phaseolina*.

Hence species of *Trichoderma viride* was further screened for its antagonistic behavior against *Macrophomina phaseolina* of the 6 different isolated of *Trichoderma viride* tested only four of them showed some antagonism against the pathogen. However, no prominent exhibitory zone was observed against the pathogen by these isolates. From preliminary experiments, it is concluded that *Trichoderma viride* (Tr) was the most effective isolate against *Macrophomina phaseolina* there it is selected as a bicontrol agent for further study (*in-vitro* & *in-vivo*).

The antagonistic nature of *Trichodrma viride* against *Macrophomina phaseolina* was studied by dual agar culture method. In this method *Trichoderma viride* showed its antagonistic nature against *M. phaseolina.* In this the fungal disc of *T.viride* was also enoculated at a distance of 20 mm from the disc of *M. phaseolina* in 90 mm petriplate. After 48 hours of enucubation, a brown coloured line started appearing wherever the hyphal of both fungi came in contact with each other. The dark brown line measured 3mm in width and become very clear by 72 hours of incubation. The results clearly showed that the *T. viride* proved as a potential antagonist *M. phaseolina*.

In- vivo

In pot experiment *T. viride* was applied to soil as wheat husk bran saw dust culture. The soil inoculated with *T. viride* caused 25% of seed rot and 45% seedling rot, total 70% where the % of disease control was observed as 45% while in soil, when inoculated only with *M. phaseolina* caused 45% of seed rot, 55% of seedling rot, total 100%. The % of disease control observed is '0' (zero). While healthy or uninoculated observed no disease. The results obtained were present in table 1 & 2 and fig. 1. The data revealed that the introduction of *Trichoderma viride* reduced the disease to a appreciate level in comparism and it checked with *T. viride*. The % of disease control was 70%

Antagonism between *T. viride* and *M. phaseolina*

The antagonistic nature of Trichoderma species against *M. phaseolina* was reported by various workers both in-vitro and in-vivo experiments. Ferrera (1976) observed that *T. viride* parasitized 14 to 16 strains of pathogen like *R. solanki* and *M. phaseolina*. Alagarswamy *et al.,* (1987) studied the efficiency of Trichoderma species in the control of root rot of cotton caused by seed planting method. Inhibition by *T. viride* was well documented in various studies under laboratory conditions (Lowis and papavizas, 1989; Manibhushan Rao 1989; Khan and Hussain 1991; Kheri and Chandra 1991; Maramara & Panningbaten, 1993 & Vijayan *et al.,* 1994).

Table.1 Preliminary screening of soil for antagonism against *M. phaseolina*

S.No.	Fungus	Growth of test fungus (in cms)	Growth of *M. phaseolina* (in cms)
01.	*As per gillus flavus*	1.43	5.62
02.	*As per gillus niger*	1.91	5.24
03.	*Trichoderma harzianum*	3.2	4.5
04.	*Trichoderma viride*	5.7	3.05

Table.2 Percentage of disease control with *T. viride* against *M. phaseolina*

S. No.	Organism inoculated with soil	Disease incidence			% disease Control
		Seed Rot	Seedling rot (%)	Total	
01.	*Trichoderma viride*	25	45	70	45
02.	*M. phaseolina*	45	55	100	00
Healthy or Uninoculated plants		0.90	10.20	11.10	--

Thus, several workers reported that *T.viride* was found to be superior in inhibiting the growth of *M. phaseolina* (Weindling 1934, Ferrera – Cerrato 1976, Khan and Hussen; 1991 and Vijayan 1994, gaikwat *et al*. 2002).In the present work, biological control of an important soil borne disease of sorghum i.e. charcoal rot caused by *M. phaseolina* by employing *T. viride* was studied. The biological control agent (Tr_1) was selected from soil of sorghum against charcoal rot disease.

In the present study *T. viride* was allowed to germinate with the microscterolia of *M. phaseolina* in dual agar culture. It is worth while to mention the utilization of species of trichoderma in the control of many soil borne plant pathogen (Weinding 1934; Thomas 1938; Nortan 1954; gaffer 1968, ferrara 1976; Shekunova & Volkora 1977)

Further the formation of a light brown zone was observed around the mycelia growth of germinated microsclerotia in dual agar culture. The brown zone was clear only at later hours of incubation (72 hours). This clearly indicates the lysis of the cell of *M. phaseolina*. In dual agar culture brown line appeared at 48 hours of incubation and became very prominent at 86 hours of incubation. The formation of brown zone in dual agar culture gives evidence of lysis of the cell of *M. phaseolina* when they come in contact with the cells of *T. viride.*

The present results are closely collaborate with the above findings. Therefore, it can be concluded the *T. viride* is an effective antagonist against *M. phaseolina* and the antagonistic nature may be explained at field scale to combat the disease problem for which further studied at field level should be carried out.

The interaction studies between *T. viride* and *M. phaseolina* confirmed that *T. viride* is a strong antagonist to *M. phaseolina*. The antagonist completely inhibited the growth of test organism by dual agar culture method. The introduction to *T. viride* to soil as wheat bran saw dust culture markedly reduce the seen & seeding rot.

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