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In vitro Effect of different Bioagents against *Colletotrichum graminicola* causing Anthracnose of sorghum

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Abstract: *Colletotrichum graminicolais the most common species recorded on sorghum. It cause losses in grain up to 70%. Five fungal antagonists viz., Trichoderma viride, T. harzianum, T. longibrachiatum, T. hamatum, A. niger, and two bacterial antagonist Bacillus subtilis and Pseudomonas fluorescens were evaluated in vitro against Colletotrichum graminicola , applying dual culture technique T. viride was found most effective and test pathogen recorded least linear mycelial growth (18.33 mm) with highest mycelial inhibition (79.62%) of the test pathogen. The second and third best antagonists found were T. harzianumand T. longibrachiatum, which recorded mycelial growth of 25.33 mm and 29.00 mm, of the test pathogen respectively and inhibition of 71.85 and 67.77 per cent, respectively. This was followed by T. koningii (col. dia.: 34.33 mm and inhibition: 61.85%) and A. niger (col. dia.: 41.00mm and inhibition: 54.44%). The bacterial antagonist's P. fluorescens and B. subtilis were found least effective with 45.00 mm and 48.33 mm linear mycelial growth and 49.99 and 46.29 per cent mycelial inhibition, respectively.*

Key words: *Colletotrichum graminicola, Trichoderma viride, Pseudomonas fluorescens, dual culture.*

INTRODUCTION

Sorghum is important feed and food in the world and used as fodder to feed millions of animals providing milk and meal for man. It is also used as industrial raw material in various industries. In India, flour of the grain is used for preparing 'Bhakri'. To some extent it is also eaten as parched and popped grain. Sorghum grain contains 10 to 12 per cent protein, 3 per cent fat and 70 percent carbohydrate.The major sorghum producing countries of the world are India, USA China, Nigeria, Sudan and Argentina. In the world, USA is the largest producer of sorghum occupying 20.03 per cent of area with 16.41 per cent production. Anthracnose is the most common and probably important disease which causes qualitative and quantitative losses.Varieties of symptoms are associated with anthracnose *viz.*, stem, leaf, peduncle, inflorescence and grain. Leaf anthracnose is the most common form of the disease.Most survive when cloudy,warm and humid weather occurs with abundant rainfall in July and August. Infected seed are also potential source of infection in field. The disease cycle is initiated by spores (conidia) that are disseminated by wind, splashing rain and irrigation water.Free moisture is essential for conidia to germinate and infect plant.

MATERIALS AND METHODS

Five fungal antagonists' *viz.*, *Trichoderma viride*, *T. harzianum*, *T. longibrachiatum* and *T. koningii*, *Aspergillus niger* and two bacterial antagonists *viz.*, *Pseudomonas fluorescens* and *Bacillus subtilis* were evaluated *in vitro* against *C. graminicola*, applying Dual culture technique (Dennis and Webster, 1971). Seven days old cultures of the test bioagents and the test pathogen (*C. graminicola*,) grown on agar media were used for the study. The culture disc (5

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mm) of the test pathogen and bioagent were cut out with sterilized cork borer, from a week old culture. Then two culture discs, one each of the test pathogen and bioagent were placed aseptically at equidistance and exactly opposite with each other on solidified PDA medium in petri plates and plates were incubated at 28±2^{0}C. Three plates/ treatment/ replication were maintained. PDA plates inoculated only with culture disc of the test pathogen were maintained as untreated control.

Experimental details

Design : CRD

Replications : Three

Treatments : seven (7)

Fungal antagonist

T_1 : *Trichodermaviride*

T_2 : *T.harzianum*

T_3 : *T. longibrachiatum*

T_4 : *T. koningii*

T_5 : *Aspergillusniger*

Bacterial antagonist

T_6 : *Bacillussubtilis*

T_7 : *P. fluorescens*

T_8 : Control (Untreated)

Observations on linear mycelial growth of the test pathogen and bioagent were recorded at an interval of 24 hours and continued till untreated control plate was fully covered with mycelial growth of the test pathogen. Per cent inhibition of the test pathogen over untreated control was calculated by applying the following formula (Arora and Updhyay, 1978).

$$\text{Percent growth Inhibition} = \frac{\text{Colony growth in Control plate} - \text{Colony growth in intersecting plate}}{\text{Colony growth in control plate}} \times 100$$

RESULTS AND DISCUSSION

The results obtained on mycelial growth and inhibition of *C. graminicola* with five fungal and two bacterial antagonists are presented in (Table 1, PLATE-I and Fig. 1). Results (Table 1 and Fig. 1) revealed that all the bioagents evaluated exhibited fungistatic/antifungal activity against *C. graminicola* and significantly inhibited its growth over untreated control (PLATE-I).

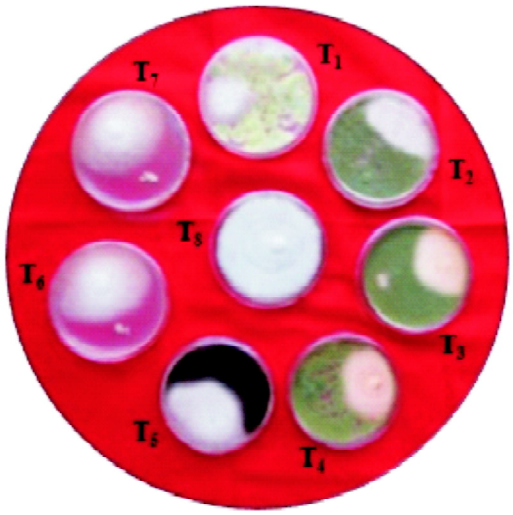
Of the five fungal antagonists tested, *T. viride* was found most effective and test pathogen recorded least linear mycelial growth (18.33 mm) with highest mycelial inhibition (79.62%) of the test pathogen. The second and third best antagonists found were *T. harzianum*and *T. longibrachiatum*, which recorded mycelial growth of 25.33 mm and 29.00 mm, of the test pathogen respectively and inhibition of 71.85 and 67.77 per cent, respectively. This was followed by *T. koningii*(col. dia.: 34.33 mm and inhibition: 61.85%) and *A. niger*(col. dia.: 41.00mm and inhibition: 54.44%). The bacterial antagonist's *P. fluorescens*and *B. subtilis*were found least effective with 45.00 mm and 48.33 mm linear mycelial growth and 49.99 and 46.29 per cent mycelial inhibition, respectively.

Table 1
In vitro* bioefficacy of bioagents against *C. graminicola

Tr. No.	Treatments	Colony diameter* (mm)	% Inhibition
T_1	***Trichodermaviride***	18.33	79.62 (52.77)
T_2	***T.harzianum***	25.33	71.85 (45.92)
T_3	***T. longibrachiatum***	29.00	67.77 (42.66)
T_4	***T. koningii***	34.33	61.85 (38.20)
T_5	***Aspergillusniger***	41.00	54.44 (32.98)
T_6	***Bacillus subtilis***	48.33	46.29 (57.57)
T_7	***P. fluorescens***	45.00	49.99 (29.99)
T_8	**Control**	90.00	00.00 (00.00)
	S.E. ±	**0.32**	**0.40**
	C.D. (P=0.01)	**0.97**	**1.21**

*-Mean of three replications, Dia.: Diameter

Figures in Parentheses are angular transformed values.



In vitro efficacy of the bioagents against mycelial growth and inhibition of *C. graminicola*

T_1 : *Trichoderma viride*
T_2 : *T. harzianum*
T_3 : *T. longibrachiatum*
T_4 : *T. koningii*
T_5 : *Aspergillus niger*
T_6 : *Bacillus subtilis*
T_7 : *Pseudomonas fluorescens*
T_{8} : Control

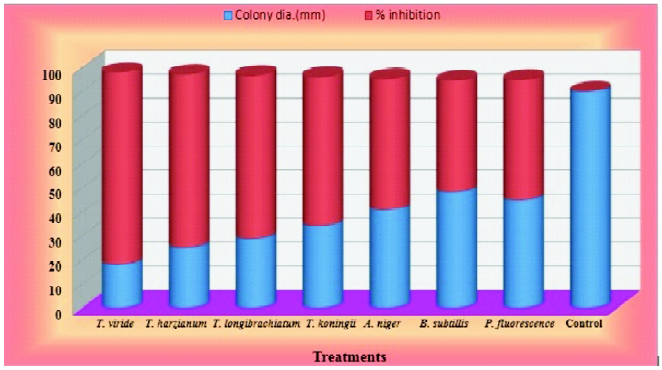


Figure 1: *In vitro* efficacy of different bioagents on mycelial growth and inhibition of *C. graminicola*

CONCLUSIONS

Anthracnose of sorghum has been reported as a serious threat to bean production in a major sorghum growing region of India and there four serve as a guide for further field testing in the future. *In vitro* all the five fungal and two bacterial antagonists tested, exhibited significant mycelial growth inhibition of *C. graminicola* However, *T. viride* recorded significantly highest mycelial growth inhibition (79.62%), followed by *T. harzianum* (71.85%) and *T. longibrachiatum* (67.77%). Rest of the bioagents tested also caused significant mycelial inhibition of the test pathogen.

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