J. Indian bot. Soc. (2023) Vol. 103 (3): 218-220

e-ISSN: 2455-7218, ISSN: 0019-4468

https://doi: 10.5958/2455-7218.2023.00010.4

www.indianbotsoc.org

RESEARCH ARTICLE

Phytotoxicity of culture filtrate of *Aspergillus terreus* on paddy seed germination and seedling growth

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Abstract

The effect of 7 days old culture filtrate of mycotoxigenic *Aspergillus terreus* was tested on paddy seed germination and seedling growth was studied. The culture filtrates of *A. terreus* were toxic to seed germination of all the three varieties of paddy. However, the toxicity varied significantly with the age of culture filtrate and the variety of paddy seed.

The Variety comparatively more resistant to *A. terreus*, while vijayamashuri variety was highly susceptible. The Phytotoxicity could be attributed to territrem B.

Keywords: paddy seeds, seed germination, culture filtrate, *Aspergillus terreus,* territrem B.

Introduction

Mycotoxigenic fungi live as saprophytes and sporulate heavily on variety of agricultural commendities including foods, feeds and fodders at different stages of harvest, storage and consumption. These moulds not only cause huge loss due to their deterioration activity but also convert those substrates toxic due to elaboration of variety of mycotoxins. It is to widely agreed that approximately 25% world foods are affected each year close variable levels of mycotoxin contamination economic consequences for the crop and livestock producers, grain handlers, processors, consumers and indeed national economics (Muller *et al.,* 1998).

The moulds associated with seeds are reported to reduce the seed germination and seedling growth (Kim & Mathur, 2006; Haikal, 2008). The inhibitory effect of the seed-borne fungi on seed germination, root elongation and shoot elongation has been attributed to the production of certain toxins (Haikal, 2008, Rajendra and Ashok, 2010, Gachande & Jadhav, 2010, Bhat & Fazal, 2011, Patil *et al.,* 2012). Kritzinger *et al.* (2006) have reported that fumonisins inhibited the seed germination, root and shoot elongation. They further observed that FB_1 treated embryonic tissues showed compaction in the protoplasm and separation of plasmalemma from the cell.

Some fungi associated with seed cause impairment of cell membrane permeability which ultimately lead to cell death (Green & Kroemer, 2004). Still some one reported to cause seedling diseases (Wang *et al.,* 2003). The above facts tempted the author to investigate the role of *Aspergillus terreus* which is constantly associated with the paddy seeds on seed health and seedling health was investigated and discussed in this paper.

Materials And Methods

For testing the phytotoxicity of *A. terreus* water agar method (Surekha, 1990) was employed. Two percent sterilized water agar slants were inoculated with *A. terreus* along with surface sterilized seed of paddy. Tubes thus inoculated were incubated at 27 ± 2°C for two weeks. Surface disinfected seeds without fungal inoculum placed on agar slants severed as control. The seed germination, root length and shoot length were recorded along with control. From these percentage of seed germination, root elongation

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How to cite this article: Kiran S, Surekha M, Reddy SM. 2023. Phytotoxicity of culture filtrate of *A. terreus* on paddy seed germination and seedling growth. *J. Indian bot. Soc.*, **103**(3):218-220. Doi: 10.5958/2455-7218.2023.00010.4

Source of support: Nil

Conflict of interest: None.

Received: 01/12/2022 **Accepted:** 05/01/2023 **Published online**: 18/05/2023

Table 1: Effect of culture filtrates of *A. terreus* on seed germination, seedling growth on cultivars of paddy

Age of culture filtrates	*MTU-1001*					*MTU-1010*					*Vijayamashuri*				
(in days)	*% of S.G*	*R. E*	*% of inhibition*	*S.E*	*% of inhibition*	*% of S.G*	*R. E*	*% of inhibition*	*S.E*	*% of inhibition*	*% of S.G*	*R. E*	*% of inhibition*	*S.E*	*% of inhibition*
5	70	14.3	24.3	15.5	22.8	60	13.7	18.4	12.6	31.1	66	14.1	27.6	15.9	25.3
10	58	13.6	28.0	14.8	26.3	55	13.1	22.0	11.3	38.2	60	13.3	31.7	14.1	33.8
15	50	11.4	35.3	13.0	35.3	48	11.5	31.5	10.1	44.8	55	10.7	45.1	13.2	38.0
20	60	12.6	33.3	13.4	33.3	60	12.3	26.7	12.8	30.0	65	12.5	35.8	14.8	30.5
Control	90	18.9	-	20.1	-	90	16.8	-	18.3	-	95	19.5	-	21.3	-

% of S.G = Percentage of seed germination, R.E = Root elongation, S.E = Shoot elongation.

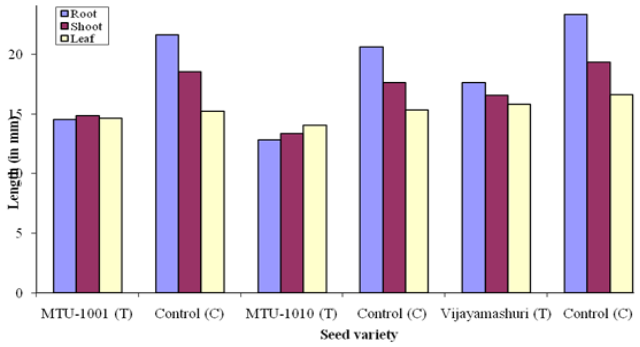

Figure 1: Phytotoxicity of *A. terreus* on three cultivars of paddy (Water agar method).

inhibition and shoot elongation inhibition over the control was calculated.

Effect of *A. terreus* on seed viability was assessed by treating the healthy seeds with 7 days old culture filtrate of *A. terreus*. *A. terreus* was grown in 250 ml Erlenmeyer conical flasks containing 25 mL of Czapek's broth for 20 days at 27 ± 2°C. At the end of 5, 10, 15 and 20 days incubation, a set of flasks were harvested and culture filtrates were employed for their phytotoxicity.

The seed viability was determined as suggested by Vidyasekaran *et al.* (1970). Hundred healthy seeds of paddy were soaked in 20 ml of culture filtrate for 24 hours and then spread on blotter paper moistened with same culture filtrate. Seeds soaked in uninoculated medium served as control. At the end of three days, seed germination was recorded. The percentage of inhibition of seed germination was calculated, with the formula.

$$\text{Percentage of seed germination inhibition} = 100 - \frac{\text{No. of seeds germinated}}{\text{Total no. of seeds observed}} \times 100$$

The filter paper was moistened with 5 mL of culture filtrate and fifty healthy seedlings each with 5 mm long roots were placed on moistened filter paper. The root length and shoot length was recorded at 3 days interval and percentage of inhibition of root and shoot elongation over the control was calculated.

Table 2: Analysis of variance (ANOVA)

Sources of variation	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*	*Inference*
Between Groups	338.917	3	112.972	8.526	.007	
Within Groups	106.000	8	13.250			S
Total	444.917	11				

$p > 0.05$= Not significant (NS)
$p < 0.05$=Significant (S).

$$\text{Percentage of root elongation inhibition} = 100 - \frac{\text{Root elongation inhibition in treated}}{\text{Root elongation inhibition in control}} \times 100$$

$$\text{Percentage of shoot elongation inhibition} = 100 - \frac{\text{Shoot elongation inhibition in treated}}{\text{Shoot elongation inhibition in control}} \times 100$$

Results and Discussion

The phytotoxicity of culture filtrate was almost uniform on three varieties of paddy (Figure 1). Phytotoxicity was comparatively more to MTU-1010 variety followed by MTU-1001 variety. Vijayamashuri variety was comparatively more resistant. The toxicity of fungus increased with the age of the fungus. Twenty days old culture filtrate caused nearly 55 percentage seed germination inhibition in MTU-1010, while other two varieties of paddy MTU-1001 and Vijayamashuri were comparatively more resistant to this toxin. Utobo *et al.,* (2011) and Islam & Borthakur (2012) have also recorded the maximum reduction in seed germination by 21 day old culture filtrates of seed-borne fungi associated with rice.

The culture filtrate of *A. terreus* was responsible for reduction in root, shoot and leaf elongation, which increased with increase in the age of the fungus. Twenty days old culture filtrate was responsible for maximum reduction in root, shoot and leaf length in MTU-1010 variety, while MTU-1001 variety showed only marginal effect (Table 1). Shaik *et al.,* 2008 and Jalander & Gachande (2011) have also reported toxicity of culture filtrate of *A. flavus* and *F. oxysporum* for on reduction of root and shoot length of soybean and pigeon pea respectively.

Statistical Analysis

The results obtained in the present investigations were subjected to statistical analysis using SPSS package 12.0 version. We conclude that there is significant effect of culture filtrate on the growth and territrem B production by *A. terreus* (Table 2).

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