

Effect of *Aspergillus flavus* Metabolites on Wheat Seed Germination and Seedlings GrowthMohd. Yaqub Bhat¹ and Munawar Fazal²

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Abstract

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This work was carried out to study the effect of *Aspergillus flavus* metabolites on wheat seed germination and seedling development. The higher concentration of culture filtrate obtained from *Aspergillus flavus* reduced the seed germination and root and shoot lengths of both cultivars Sonalika and Kalyansona. However, the inhibitory effect of culture filtrate on seed germination was more severe on Sonalika compared to Kalyansona. The reduction in mean root and shoot length was directly proportional to concentration of culture filtrate. Wilting symptoms started within 24 hours of incubation, with different degrees of wilting according to filtrate concentrations and time of incubation.

Keywords: *Aspergillus flavus*, germination, wilting, culture filtrate

Introduction

Aspergillus flavus is one of the most important storage fungi associated with wheat seeds. It produces toxic metabolites especially aflatoxin B₁ which alters seeds and seedlings physiology. Here an attempt has been made to study the effect of toxic metabolites of *A. flavus* on the wheat seeds germination and seedlings root and shoot development of wheat cultivars Sonalika and Kalyansona.

Materials and Methods

Toxigenic *A. flavus* isolate was identified and maintained on potato dextrose agar plate (PDA). Conical flasks with 50ml Czapek's dox casein thiamine medium (CDCTM) were inoculated with a mycelial discs of 2mm diameter obtained from 10 day old culture maintained on PDA. The flasks were incubated for 10 days at 25±2°C in the dark. The culture filtrate was obtained by filtering through Whatman filter paper No.1 and then centrifuged at 5000 r.p.m. for 30 minutes to obtain spore-free filtrate. Four hundred seeds of cvs. Sonalika and Kalyansona were surface disinfected with 1% sodium hypochlorite solution for 2-3 minutes, then soaked in culture filtrates of 25, 50, 75 and 100% concentration of metabolites, for 24 hrs. The soaked seeds were subjected to germination test by using Rolled Paper Towel Method (5). Seven days after seed incubation, 100 seedlings were picked randomly (from each conc.), and measured for mean root and shoot length (cm) for both cultivars.

To study the effect of culture filtrate on seedlings, 7 days old seedlings were removed from sand bed and kept on different dilutions of the filtrate for 24 hrs, then transferred to distilled water. The seedlings were observed for four days for any symptoms produced.

Results and Discussions

The culture filtrate obtained from *A. flavus* reduced the seed germination and root and shoot length of the seedlings in both wheat cultivars. The high concentrations (100 and 75%) of filtrate were more inhibitory to seed germination than lower concentrations (25 and 50%). However, reduction in germination rate over control was more clear in Sonalika (53% at 100% conc.) as compared to Kalyansona (46%) (Table 1). The most common abnormalities in both cultivars were deformation and decay.

The mean root and shoot length was also appreciably reduced in both cultivars. This reduction was also more clear in Sonalika compared to Kalyansona. The overall reduction in seed germination, mean shoot and root length was found directly proportional to the concentration of culture filtrate (Table 2).

Table 1. Percent inhibition of germination over control and abnormality of seedlings falling under different categories as a result of treatment with *A. flavus* culture filtrate. Germination in control was 100 per cent in both cvs.

Conc. of culture filtrate %	Inhibition over control %	Abnormality of seedlings falling under different categories*				Normal seedlings
		1	2	3	4	
Sonalika						
25	18.0	1.3	5.3	7.4	4.0	82.0
50	29.4	4.1	9.1	11.2	5.0	70.6
75	42.1	7.1	11.3	19.3	4.7	57.9
100	53.0	5.2	16.6	23.1	8.1	47.2
Kalyansona						
25	12.8	2.3	3.9	5.5	1.1	87.2
50	31.2	1.7	10.9	13.7	4.9	68.8
75	41.7	2.8	13.9	22.4	2.6	58.3
100	46.8	4.9	14.6	21.8	5.5	53.2

* 1= Damaged, 2= Deformed, 3= Decayed, 4= Un-germinated

Table 2. Effect of *A. flavus* culture filtrate on root and shoot length of wheat cvs. Sonalika and Kalyansona (after 7 days of treatment). Data are mean (in cm) of 100 seedlings.

Concentration (%) of culture filtrate	Sonalika		Kalyansona	
	Mean root length	Mean shoot length	Mean root length	Mean shoot length
25	1.98	4.86	2.05	5.00
50	1.92	4.29	1.96	4.15
75	1.80	3.07	1.78	3.89
100	1.04	2.91	1.29	3.05
Control	2.19	5.23	2.30	5.45

Seedlings of both cultivars, kept in culture filtrates of *A. flavus* showed wilting at different intervals and at various concentrations. The wilting started within twenty four hours and ultimately seedling collapsed following the fourth day

of treatment. Wilt symptoms started at the foliage tips and progressed gradually downwards.

The higher concentrations of aflatoxin B₁ present in the culture filtrate of *A. flavus*, might have resulted in an inhibitory effect on seed germination and root and shoot growth of seedlings. This effect increased along with increases in metabolites concentration. Loss in germination could be indicative of severe damage caused by aflatoxin B₁ to cell membrane (1, 2) or due to production of cell wall degrading enzymes (3) as well as reduction in seedling amylase activity (4).

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المخلص

يعقوب بهات، م. و م. أفضل. 2011. تأثير عضيات الفطر *Aspergillus flavus* في إنبات بذور القمح ونمو بادراته. مجلة وقاية النباتات العربية، 140-139: 29

نفذ هذا العمل لدراسة تأثير عضيات الفطر *Aspergillus flavus* في إنبات بذور القمح ونمو بادراته . خفض التركيز الأعلى من رشاحة مزرعة الفطر *Aspergillus flavus* من إنبات البذور وأطوال الجذور والإشطاءات لصففي سونالیکا وكاليانسونا. على أن التأثير المثبط لرشاحة الفطر في إنبات البذور كان أشد في الصنف سونالیکا مقارنة مع الصنف كاليانسونا كان الإنخفاض في متوسط طول الجذور والإشطاءات متناسب طردا مع تركيز رشاحة المزرعة. بدأت أعراض الذبول خلال 24 ساعة من التحضين مع درجات مختلفة من الذبول تبعا لتراكيز الرشاحة وزمن التحضين.

كلمات مفتاحية: *Aspergillus flavus*، إنبات، ذبول، رشاحة الفطر

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References

1. Banerjee, A., M.J. Reddy and H.S. Shetty. 1990. Effect of *Aspergillus flavus* metabolites and aflatoxin B₁ on seed germination of sunflower and maize. Proceedings, National Seminar on Advances in Seed Science and Technology : December 14-16, 1989, Department of Studies in Applied Botany & Biotechnology, University of Mysore: 353-355.
2. Crisan, E.V. 1973. Effects of aflatoxin on germination and growth of lettuce. Applied Microbiology, 25: 342-345.
3. Fawole, B.O., O. Ahmed and O.S. Balogun. 2006. Pathogenicity and cell wall-degrading enzyme activities of some fungal isolates from cowpea (*Vigna unguiculata* [L] Walp). Biokemistri, 18: (1): 45-51
4. Hasan, H.A.H.. 1999. Phytotoxicity of pathogenic fungi and their mycotoxins to cereal seedling viability. Mycopathologia, 148:149-155.
5. ISTA. 1985. International rules for Seed Testing. Seed Science and Technology, 13: 299-573.

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