STUDIES ON SEED BORNE MYCOFLORA AND EFFECT OF BIOAGENTS AND FUNGICIDES ON WHEAT SEED HEALTH

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INTRODUCTION

Wheat (Triticum aestivum L.) family Poaceae is one of the major widely cultivated cereal food crops in India and world. It is one of the most important staple foods of man and is grown in almost all the temperate and sub-tropical region of the world.

Primary source of the infection for some of the diseases is the grain itself (Ali and Fakir, 1982). Seed borne pathogen may cause seed abortion, seed rot, seed necrosis or reduction in germination as well as seedling damage by systemic or local infection resulting in the development of disease at later stages of plant growth (Khanzada et al., 2002).

Seed health play an important role for successful cultivation and yield exploitation of a crop species and seed borne pathogens of wheat are responsible to cause variation in plant morphology and reducing yield up to 15-19 per cent if untreated seeds are grown in the field (Wiese, 1984).

Seed borne mycoflora of wheat reported recently included Alternaria alternata, Drechslera sorokiniana, Fusarium moniliforme, Fusarium avenacearum, Fusarium gramineanum, Fusarium nivale, Fusarium culmorum, Fusarium equiseti, Fusarium sporotrichoids, Cladosporium herbarum, Stemphylium botryosum (Glazek, 1997 and Mirza and Qureshi, 1978).

The presence of the mycelium in seed indicating that disease is internally seed borne (Kumar and Arya, 1973). Alternaria triticina Prasada and Prabhu causing leaf blight of wheat is externally as well as internally seed borne (Shabana and Kumar, 2001).

The severities of infection of individual seed fungus differ depending upon the varieties and the location (Singh et al., 1977). The severity of infection by seed borne fungus differs with varieties and locations. Many scientists made attempts to minimize the several pathogens on wheat seed to increase the economic yield (Lodhi et al., 2002; Basak et al., 1987; Ravi et al., 1999; Sudhir Kumar and S. C. Jain, 2004).

Present investigation were undertaken for detection of seed borne mycoflora and efficacy of bioagents and fungicides with storage study.

MATERIALS AND METHODS

Seed samples of twenty four wheat cultivars were collected from four different locations viz. Akola, Washim, Niphad and Wellington. These seed samples were soaked in 0.1 % HgCl2 solution for one minute followed by three times washing with sterile distilled water (Bharti, 2000).

The seeds were soaked in distilled water as a control treatment. These seed samples were used for detection of seed borne mycoflora by using standard blotter paper method with some modifications (ISTA, 1985 and Goulart, 1998).

The study revealed that, untreated and pre-treated seed samples exhibited association of eight fungi Viz Alternaria alternata; Alternaria triticina; Aspergillus flavus; Aspergillus niger; Bipolaris sorokiniana; Curvularia lunata; Drechslera tetramera and Fusarium semitectum belonging to six genera. Less association of seed borne fungi was exhibited by pre-treated seed samples over untreated ones. For arresting the mycelia growth fungicidal seed treatments Viz. Thiram (0.3%), Carbendazim (0.1%), Thirum + Carbendazim (2:1) and Carboxin (0.2%) were found significantly superior over rest of the treatments. Increased seed germination, shoot and root length and seedling vigor index was observed in Thirum + Carbendazim (2:1) and Carboxin (0.2%) seed treatments followed by Tricoderma harzianum Rifai seed treatment.

KEYWORDS

Seed germination
Seedling vigour
Fungicides
Wheat

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ABSTRACT

The study revealed that, untreated and pre-treated seed samples exhibited association of eight fungi Viz Alternaria alternata; Alternaria triticina; Aspergillus flavus; Aspergillus niger; Bipolaris sorokiniana; Curvularia lunata; Drechslera tetramera and Fusarium semitectum belonging to six genera. Less association of seed borne fungi was exhibited by pre-treated seed samples over untreated ones. For arresting the mycelia growth fungicidal seed treatments Viz. Thiram (0.3%), Carbendazim (0.1%), Thirum + Carbendazim (2:1) and Carboxin (0.2%) were found significantly superior over rest of the treatments. Increased seed germination, shoot and root length and seedling vigor index was observed in Thirum + Carbendazim (2:1) and Carboxin (0.2%) seed treatments followed by Tricoderma harzianum Rifai seed treatment.

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**RESULTS AND DISCUSSION**

Eight fungal species namely, *Alternaria alternata*, *A. triticina*, *Bipolaris sorokiniana*, *Curvularia lunata*, *Drechslera tetramera*, *Aspergillus flavus*, *A. niger* and *Fusarium semitectum* were detected from twenty four wheat cultivars seeds by standard blotter paper methods and result were given in Table 1. It was observed that when seeds were pre treated with 0.1% of HgCl\(_2\) showed drastic decline in the incidence of seed borne mycoflora as compared to untreated seeds.

Incidence of *Alternaria alternata* (41.5%) was dominant followed by *A. triticina* (38.5%) on seeds of cultivars collected from Wheat Research Unit, Akola. While highest incidence of *Aspergillus flavus* (37%) followed by *A. niger* (31.75%) were observed on seed of cultivars collected from ARS, Niphad and *A. alternata* (31.5%) followed by *A. niger* (21.25%) on ARS, Niphad. Among the six cultivars received from IARI Regional Station, Wellington, highest incidence of *Aspergillus flavus* (24.5%) followed by *A. niger* (23%) were observed.

The highest frequency of seed mycoflora was observed on wheat cultivar AKAW-3722 (Vimal) followed by WSM-1472 and lowest fungal frequency was observed on cultivars from South region of Pakistan and Singh et al. (1977) from seven states of India.

The effect of bioagents and fungicides on the incidence of seed borne mycoflora after one month of storage was tested by blotter paper test and data obtained is given in Table 2. The treatments of Thiram+ Carbendazim (2:1) and Carboxin (0.2%) were most effective in reducing the incidence of seed born mycoflora (100 %) followed by *T. harzianum* (70.58 %). Whereas seeds was kept for storage study at one month storage, highest seed germination (78.33%) was observed in treatment of thiram+carbendazim (2:1) followed by *Pseudomonas fluorescens* (70.5%).

<table>
<thead>
<tr>
<th>Location</th>
<th>Total Fungi (Species-wise)</th>
<th>Alternaria alternata</th>
<th>Alternaria triticina</th>
<th>Bipolaris sorokiniana</th>
<th>Curvularia lunata</th>
<th>Drechslera tetramera</th>
<th>Fusarium semitectum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>143</td>
<td>46.25</td>
<td>13.5</td>
<td>26.5</td>
<td>16.8</td>
<td>10.8</td>
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</tr>
</tbody>
</table>

Table 1: Incidence of seed-borne fungi with untreated and pretreated (0.1 per cent HgCl\(_2\)) wheat seeds tested by blotter paper method
### Table 1: Effect of Bioagents and Fungicides on Longevity of Seed Borne Fungi and Seed Health of Wheat (One Month after Storage)

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Dose (g/kg seed)</th>
<th>Percent fungi associated with seed</th>
<th>Total Fungi (%)</th>
<th>Reduction of fungi over control (%)</th>
<th>Germination (%)</th>
<th>Shoot length (cm)</th>
<th>Root length (cm)</th>
<th>Seedling vigour index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aa</td>
<td>At</td>
<td>Af</td>
<td>An</td>
<td>Bs</td>
<td>Cl</td>
<td>Dt</td>
<td>Fs</td>
</tr>
<tr>
<td>T. harzianum</td>
<td>4.0</td>
<td>1.5</td>
<td>2.0</td>
<td>2.0</td>
<td>1.5</td>
<td>-</td>
<td>-</td>
<td>0.5</td>
</tr>
<tr>
<td>P. fluorescens</td>
<td>100</td>
<td>1.25</td>
<td>1.0</td>
<td>2.0</td>
<td>2.0</td>
<td>1.0</td>
<td>0.75</td>
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<tr>
<td>B. subtilis</td>
<td>100</td>
<td>1.5</td>
<td>0.75</td>
<td>1.0</td>
<td>2.0</td>
<td>-</td>
<td>1.0</td>
<td>10</td>
</tr>
<tr>
<td>P. fluorescens + B. subtilis (1:1)</td>
<td>100</td>
<td>1.75</td>
<td>1.25</td>
<td>1.5</td>
<td>1.75</td>
<td>1.0</td>
<td>1.0</td>
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</tr>
<tr>
<td>Thrion</td>
<td>3.0</td>
<td>1.25</td>
<td>1.0</td>
<td>1.25</td>
<td>1.25</td>
<td>-</td>
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</tr>
<tr>
<td>Carbendazim</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.25</td>
<td>2.0</td>
<td>-</td>
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<td>-</td>
</tr>
<tr>
<td>Thrion + Carbendazim (2:1)</td>
<td>3.0</td>
<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
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<tr>
<td>Carbion</td>
<td>2.0</td>
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<tr>
<td>Champion</td>
<td>3.0</td>
<td>1.0</td>
<td>1.75</td>
<td>1.25</td>
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<td>Curitote MiFl</td>
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<td>1.75</td>
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<td>-</td>
<td>-</td>
<td>12.5</td>
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<tr>
<td>Benomy</td>
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<td>1.0</td>
<td>1.25</td>
<td>1.25</td>
<td>1.0</td>
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<td>-</td>
</tr>
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<td>Chlorophenanil</td>
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<td>1.5</td>
<td>2.0</td>
<td>1.5</td>
<td>1.0</td>
<td>20</td>
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<tr>
<td>Control</td>
<td>-</td>
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</tbody>
</table>

## Table 3: Effect of Bioagents and Fungicides on longevity of seed borne fungi and seed health of wheat (two month after storage)

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Dose (g/kg seed)</th>
<th>Percent fungi associated with seed</th>
<th>Total Fungi (%)</th>
<th>Reduction in fungicide over control (%)</th>
<th>Germination (%)</th>
<th>Shoot length (cm)</th>
<th>Root length (cm)</th>
<th>Seedling vigour index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aa</td>
<td>At</td>
<td>Af</td>
<td>An</td>
<td>Bs</td>
<td>Cl</td>
<td>Ds</td>
<td>Fs</td>
</tr>
<tr>
<td><strong>Trichoderma harzianum</strong></td>
<td>4.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.5</td>
<td>1.25</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Pseudomonas fluorescens</strong></td>
<td>10.0</td>
<td>2.5</td>
<td>0.75</td>
<td>2.25</td>
<td>1.25</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Bacillus subtilis</strong></td>
<td>10.0</td>
<td>1.0</td>
<td>1.5</td>
<td>1.5</td>
<td>0.5</td>
<td>0.5</td>
<td>1.25</td>
<td>6.0</td>
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<tr>
<td><strong>P. fluorescens + B. subtilis</strong></td>
<td>10.0</td>
<td>1.5</td>
<td>1.5</td>
<td>1.0</td>
<td>0.75</td>
<td>0.75</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Thiram</strong></td>
<td>3.0</td>
<td>0.5</td>
<td>0.5</td>
<td>1.0</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Carbendazim</strong></td>
<td>1.0</td>
<td>0.5</td>
<td>0.5</td>
<td>0.75</td>
<td>1.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Thiram + Carbendazim (2:1)</strong></td>
<td>3.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td><strong>Carboxin</strong></td>
<td>2.0</td>
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<td>-</td>
<td>-</td>
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<td>-</td>
</tr>
<tr>
<td><strong>Champion</strong></td>
<td>3.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.5</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Curzate M-8</strong></td>
<td>2.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.5</td>
<td>0.75</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td><strong>Benzylol</strong></td>
<td>1.0</td>
<td>0.75</td>
<td>1.0</td>
<td>0.75</td>
<td>0.75</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>P. fluorescens + B. subtilis</strong></td>
<td>10.0</td>
<td>1.25</td>
<td>0.5</td>
<td>1.0</td>
<td>1.25</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Thiram + Carbendazim (2:1)</strong></td>
<td>3.0</td>
<td>2.75</td>
<td>4.0</td>
<td>3.25</td>
<td>1.5</td>
<td>1.5</td>
<td>3.25</td>
<td>19.75</td>
</tr>
</tbody>
</table>

*F test Sig. Sig. Sig. Sig. SE(m) 1.21 0.25 0.18 34.45 CD (P=0.01) 4.79 0.76 0.54 137.8

**Arc sine values**; Aa- Alternaria alternata, At- Alternaria triticina, Af- Aspergillus flavus, An-Aspergillus niger, Bs- Bipolaris sorokiniana, Cl- Curvularia lunata, Dt- Drechslera tetramera, Fs- Fusarium semitectum.

## Table 4: Effect of Bioagents and Fungicides on longevity of seed borne fungi and seed health of wheat (three month after storage)

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Dose (g/kg seed)</th>
<th>Percent fungi associated with seed</th>
<th>Total Fungi (%)</th>
<th>Reduction in fungicide over control (%)</th>
<th>Germination (%)</th>
<th>Shoot length (cm)</th>
<th>Root length (cm)</th>
<th>Seedling vigour index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aa</td>
<td>At</td>
<td>Af</td>
<td>An</td>
<td>Bs</td>
<td>Cl</td>
<td>Ds</td>
<td>Fs</td>
</tr>
<tr>
<td><strong>Trichoderma harzianum</strong></td>
<td>4.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.5</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Pseudomonas fluorescens</strong></td>
<td>10.0</td>
<td>0.75</td>
<td>0.75</td>
<td>1.75</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Bacillus subtilis</strong></td>
<td>12.0</td>
<td>0.5</td>
<td>0.5</td>
<td>1.5</td>
<td>1.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>P. fluorescens + B. subtilis</strong></td>
<td>12.0</td>
<td>1.0</td>
<td>1.5</td>
<td>0.75</td>
<td>0.75</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Thiram</strong></td>
<td>4.0</td>
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<td>0.5</td>
<td>1.0</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td><strong>Carbendazim</strong></td>
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<td>0.5</td>
<td>1.0</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Thiram + Carbendazim (2:1)</strong></td>
<td>4.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td><strong>Carboxin</strong></td>
<td>2.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Champion</strong></td>
<td>3.0</td>
<td>1.0</td>
<td>0.75</td>
<td>1.0</td>
<td>0.5</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>Curzate M-8</strong></td>
<td>2.0</td>
<td>1.0</td>
<td>0.75</td>
<td>1.0</td>
<td>0.5</td>
<td>-</td>
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<tr>
<td><strong>Benzylol</strong></td>
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<td>0.75</td>
<td>0.75</td>
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<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>P. fluorescens + B. subtilis</strong></td>
<td>12.0</td>
<td>1.25</td>
<td>0.5</td>
<td>1.0</td>
<td>1.25</td>
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<tr>
<td><strong>Thiram + Carbendazim (2:1)</strong></td>
<td>3.0</td>
<td>2.75</td>
<td>4.0</td>
<td>3.25</td>
<td>1.5</td>
<td>1.5</td>
<td>3.25</td>
<td>19.75</td>
</tr>
</tbody>
</table>

*F test Sig. Sig. Sig. Sig. SE(m) 1.22 0.15 0.16 29.34 CD (P=0.01) 4.80 0.47 0.49 117.36

**Arc sine values**; Aa- Alternaria alternata, At- Alternaria triticina, Af- Aspergillus flavus, An-Aspergillus niger, Bs- Bipolaris sorokiniana, Cl- Curvularia lunata, Dt- Drechslera tetramera, Fs- Fusarium semitectum.
(75.66%). Kamble et al. (1999) also reported similar results of fungicides seed treatment while working of vegetable seeds. Data presented in the Table 3 revealed that when treated and untreated seed were tested by blotter method with two month after storage the fungicides reduced the incidence of seed borne fungi. No association of fungi were found in the treatment of thiram + carbendazim (2:1) and carboxin (100%) followed by T. harzianum (73.41%). Whereas seeds was kept for storage study at two month storage, highest seed germination (77.66%) was observed in treatment of thiram + carbendazim (2:1) followed by Pseudomonas fluorescens (73.66%).

Data presented in the Table 4 revealed that when treated and untreated seed were tested by blotter method with three months after storage the fungicides reduced the incidence of seed borne fungi. No association of fungi were found in the treatment of thiram + carbendazim (2:1) and carboxin (100%) followed by B. subtilis (77.77 %). Whereas seeds was kept for storage study at three months storage, highest seed germination was observed in treatment of carboxin (76%) followed by Pseudomonas fluorescens (73.66%). Srinivas et al. (2005) also reported increase in seed germination and seedling vigour index following seed treatment with bioagents and fungicides in brinjal.

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Kotigere, G. S., Patel, S. T. and Gitte, V. V. 2012. Management of grain infecting fungi of sorghum through spray on earhead by chemical and non chemical methods. The Bioscan. 7(4): 597-599.


