Management of Alternaria alternata of blond Psyllium (Plantago ovata L.) through fungicides in vitro and natural condition

Sajjan Choudhary, RP Ghasolia, AL Yadav, GL Kakraliya and R Nasanwa

Abstract

The experiments were conducted at Department of Plant Pathology, S.K.N. College of Agriculture, Jobner (Rajasthan). Alternaria alternata was isolated from leaves of isabgol and observed to be pathogenic under artificial conditions. An attempt was more find out the efficacy of different fungicides were against in Alternaria alternata in vitro and in vivo condition. Among five fungicides mancozeb + carbendazim was found most effective against Alternaria alternata in vitro conditions followed by mancozeb and carbendazim. In potted plant minimum disease intensity were obtained in mancozeb + carbenxazim and mancozeb followed by carbendazim + difencozole. All treatments as foliar sprays were able to reduce disease severity over untreated control of 0.2% followed by 0.25% concentration. Carbendazim + mancozeb, and mancozeb were found effective in management of leaf blight of isabgol by Alternaria alternata in vitro and in vivo conditions.

Keywords: Alternaria alternata, fungicide, leaf blight and plantago ovate, isabgol

1. Introduction

Blond psyllium (Plantago ovata Forsk.) commonly known as isabgol, is an annual herb with narrow linear rosette like leaves belonging to the family Plantaginaceae. Isabgol is an important cash crop cultivated for its export and being of important medicinal value is reported to have larger demands and is traded in major medicinal markets of the world. Isabgol has pharmaceutical importance to treat dysentery, chronic constipation and chronic diarrhoea and as laxative demulcents, emollients and diuretics. India commands nearly monopoly in the production and export of blond psyllium products to countries like USA, Germany, France, England, Spain and Belgium [1]. In India, the isabgol crop is mainly grown as commercial crop in Gujarat, Rajasthan and Madhya Pradesh. However, the crop is spreading to other non-traditional parts of the country such as Haryana, Uttar Pradesh and Karnataka. In Rajasthan, it is being cultivated in 190081 hectares area with a total production of 99950 tonnes of seeds with an average productivity of 525 kg/ha [2]. In Rajasthan, isabgol mainly cultivated in Barmer, Jalore, Nagaur, Jodhpur and Jaisalmer districts. Presently, Rajasthan is on the top in productivity in India. [3] reported a number of pathogens viz., Fusarium wilt (Fusarium oxysporum), damping off (Pythium ultimum trow), leaf blight (Alternaria alternata (Fr.) Keissler), downy mildews (Peronospora plantaginis) and powdery mildew (Erysiphe cichoracearum D.C.) affecting this crop. Alternaria blight has become a serious problem in recent years. It has been found that downy mildew affected crop is more prone to be attacked by A. alternata. It causes considerable damage every year and sometimes become very severe which results in total loss of yield [4]. Hence, present investigations were carried out to test the efficacy of plant extracts and fungicides against leaf blight of isabgol incited by A. alternata.

2. Material and methods

Efficacy of different fungicides were evaluated against Alternaria alternata.

Efficacy of fungicides against Alternaria alternata (in vitro and in vivo)

The efficacy of five systemic and non-systemic fungicides against mycelial growth of Alternaria alternata was tested by Poisoned Food Technique (PFT) suggested by [5].
Four different concentrations viz., 100, 300, 500 and 700 ppm of each fungicide were tested in vitro. Required quantities of each fungicide were added separately in to molten and cooled PDA so as to get the desired concentration of the fungicides later on 20 ml of poisoned medium was poured sterile petri plates mycelial rises of 5 mm size from gets very growing culture of the fungus were cut by a sterile cork borer and one such rise was placed at the centre of each agar plate then such plates were incubated 25 ± 1 °C for 7 days and radial growth was measured. The mycelial growth of the test fungus was recorded and per cent growth inhibition was calculated by formula given below. The experiment was conducted in completely randomized design with three replications.

C-T

\[ \text{Per cent growth inhibition} = \frac{\text{C-T}}{\text{C}} \times 100 \]

Where,

C=Diameter of colony in check (Average of both diagonals)

T=Diameter of colony in treatment (Average of both diagonals)

**Efficacy of fungicides (in vivo):**

The field experiments of the fungicides was conducted during 2013-14 in mini plots (1x1 m) of Department of Plant Pathology, SKN COA, Jobner, Jaipur in RBD manner with four replication plots during rabi season to know the efficacy of fungicide against leaf blight of isabgol under natural condition. All the recommended agronomic practices were followed to raise the crop. The fungicides viz., thiophanate methyl (0.2%), carbendazim *0.1%, mancozeb (0.25%), carbendazim + mancozeb (0.2%) and difenoconazole (0.2%) were tested by applying as foliar spray (40 DAS). The middle two rows of each plot were rated for disease incidence (the presence or absence of one or more lesions) at 60 DAS by examining five leaves from five adjacent plants at 5 random sites within each plot for a total of 25 leaves per plot. The per cent disease intensity (PDI) was assessed for each plot on a disease rating scale of 1-9 [7] based on the percentage of leaf area symptomatic (1= 0% tissue symptomatic, 2= up to 1%, 3= 2-5%, 4= 6-10%, 5= 11-20%, 6= 21-30%, 7= 31-40%, 8= 41-50%, and 9= over 50%). The intensity was calculated by using the formula of [8].

\[ \text{PDI} = \frac{\text{Sum of individual ratings}}{\text{Number of leaves observed}} \times 100 \]

The per cent disease control was calculated by using the following formula:

\[ \text{PDC} = \frac{\text{Disease in control} - \text{Disease in treatment}}{\text{Disease in control}} \times 100 \]

**3. Result and discussion**

**Efficacy of fungicides in vitro**

The data (table 1) suggested that increase in concentrations of the fungicides caused increased inhibition of mycelial growth of the fungus. Among five fungicides tested, carbendazim+mancozeb (Companion) was found most effective which was showing 66.66, 79.99, 87.77 and 94.44 per cent inhibition of mycelial growth of Alternaria alternata at 100, 300, 500 and 700 ppm concentrations, respectively followed by mancozeb (48.88, 71.11, 83.33 and 87.77, respectively). Thiophanate methyl was found to be least effective in inhibiting mycelial growth. This experiment shows that carbendazim+mancozeb is highly effective in inhibiting the mycelial growth of Alternaria alternata in vitro. Similar observations were observed by earlier worker [9].

**Efficacy of fungicides in reducing disease intensity (in vivo)**

On the basis of performance of fungicide in vitro all five fungicides viz. mancozeb, carbendim+mancozeb, thiophanate methyl and difenoconazole each of 0.25, 0.2 and 0.2 per cent were evaluated in field conditions through foliar sprays against blight disease of isabgol. The results (Table 2) revealed that there was clear reduction disease in intensity when fungicides were applied as foliar spray maximum per cent efficacy of disease control was observed at 0.2 % (31.07 per cent) foliar spray of carbendim + mancozeb) which was followed by foliar spray of mancozeb 0.25% (20.71 per cent) carbenxazim 0.1% (19.93 per cent) difenoconazole 0.25% (13.94 per cent) and thiophenate 0.1% (11.95 per cent) efficacy of disease control respectively. These studies will be helpful in controlling the blicht incidence in the field effectively. Present results are in accordance with [10, 11, 9, 12].

Similar results were obtained by [12, 9, 13].

**Table 1**: Comparative efficacy of different fungicides on mycelial growth of Alternaria alternata in vitro after 7 days of incubation at 25 ± 1 °C

<table>
<thead>
<tr>
<th>Fungicides</th>
<th>100</th>
<th>300</th>
<th>500</th>
<th>700</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mancozeb</td>
<td>48.88 (44.36)</td>
<td>71.11 (57.49)</td>
<td>83.33 (65.90)</td>
<td>87.77 (69.53)</td>
</tr>
<tr>
<td>Carbendazim</td>
<td>42.22 (40.52)</td>
<td>48.88 (44.36)</td>
<td>54.44 (47.55)</td>
<td>60.00 (50.77)</td>
</tr>
<tr>
<td>Thiophanate methyl</td>
<td>19.00 (25.84)</td>
<td>42.22 (40.52)</td>
<td>51.11 (45.64)</td>
<td>65.00 (53.73)</td>
</tr>
<tr>
<td>Carbendazim+mancozeb</td>
<td>66.66 (54.73)</td>
<td>79.99 (63.43)</td>
<td>87.77 (69.53)</td>
<td>94.44 (76.36)</td>
</tr>
<tr>
<td>Difenoconazole</td>
<td>40.00 (39.23)</td>
<td>44.44 (41.81)</td>
<td>51.11 (45.64)</td>
<td>70.00 (56.79)</td>
</tr>
<tr>
<td>Check</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>0.60</td>
<td>1.72</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>0.49</td>
<td>1.40</td>
<td></td>
</tr>
<tr>
<td></td>
<td>FxC</td>
<td>1.21</td>
<td>3.44</td>
<td></td>
</tr>
</tbody>
</table>

*Average of 4 replications

Figures given in parentheses are angular transformed values
Table 2: Effect of fungicidal foliar spray on disease intensity (in vivo)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Fungicides</th>
<th>Dose (%)</th>
<th>Per cent disease intensity*</th>
<th>Per cent disease intensity reduction over control</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Carbendazim + mancozeb</td>
<td>0.2</td>
<td>43.25 (41.12)</td>
<td>31.07</td>
</tr>
<tr>
<td>2</td>
<td>Mancozeb</td>
<td>0.25</td>
<td>49.75 (44.86)</td>
<td>20.71</td>
</tr>
<tr>
<td>3</td>
<td>Carbendazim</td>
<td>0.1</td>
<td>52.75 (46.58)</td>
<td>19.93</td>
</tr>
<tr>
<td>4</td>
<td>Thiophanate methyl</td>
<td>0.2</td>
<td>55.25 (47.29)</td>
<td>11.95</td>
</tr>
<tr>
<td>5</td>
<td>Difenoconazole</td>
<td>0.2</td>
<td>54.25 (47.44)</td>
<td>13.94</td>
</tr>
<tr>
<td>6</td>
<td>Control</td>
<td>-</td>
<td>62.75 (52.39)</td>
<td>-</td>
</tr>
</tbody>
</table>

SE\(\text{m}^+\) 1.44

CD (\(p=0.05\)) 4.21

Figures given in parentheses are angular transformed values

* Average of four replications

Fig. 6 Effect of fungicidal foliar spray of disease intensity (in vivo)

Fig. 7 Comparative efficacy of different fungicides on mycelial growth of *Alternaria alternata* in vitro after 7 days of incubation at 25 ± 1 °C
4. Reference


8. Mandal K. Diseases of some important medicinal crops and their management. In: Microbial Diversity and Plant Disease Management, VDM Verlag, Dr. Muller, Germany, 2010, 509.


