GENETIC RESPONSE OF SOME POTATO VARIETIES AGAINST BLACKLEG DISEASE

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ABSTRACT

Fifteen potato cultivars were evaluated during year 2007 and in 2008 for resistance against Erwinia sp. associated with blackleg of potato out of which one variety Cardinal was found immune while Faisalabad white was found highly susceptible. The varieties like Faisalabad Red, Hermes and Orla resistant, Lady Rosette, Ascent and Harmony were susceptible while Paramount, Melody, Atlantic and Fontane were found moderately resistant and three other varieties, Desiree, SH-70 and Vales Everest, were found moderately susceptible.

Keywords: Blackleg, Erwinia carotovora subsp. Atroseptic, resistance, susceptibility.

INTRODUCTION

Potato (Solanum tuberosum L.) occupies a prominent place among the vegetable crops grown all over the world as well as in Pakistan. The total area under potato production during the year 2008-09 in Pakistan was 249.3 thousand hectare with a total production of 2542 thousand tons (Anonymous, 2009).

In Pakistan, Punjab, NWFP, Sindh and Balochistan contribute 83, nine, one, and seven per cent respectively to the total potato production. Exports of potato either chilled or fresh during the year 2005-06 were 15.39 million kg earning a foreign exchange worth Rs173.2 million which was lower than the previous year’s export of 20.76 million kg earning a foreign exchange equal to Rs. 183.99 million. Sri Lanka, Afghanistan and Malaysia are the major markets of Pakistani potato (Anonymous, 2006-07). The major potato growing districts in Pakistan are Kalat, Pishin and Killa in Balochistan; Sialkot, Okara, Sahiwal, Jhang, Kasur and Gujranwala in Punjab; and Dir, Nowshehra and Mansehra in NWFP.

Jones (1901) isolated and described for the first time the soft rot bacterium as Bacillus carotovorus. Hingorani and Addy (1953) investigated the blackleg disease of potato in India with special reference to the properties of the causal organisms. El-Goorani and El-Kazzaz (1975) have reported decrease in germination of potato tubers in soil infested with soft rot causing bacterium.

When the incidence of this disease increases, the yield decline linearly with blackleg incidence, there is 0.8% reduction in yield for every 1% blackleg at 13 weeks after planting (Bain et al., 1990). The economic importance of this disease is two folds; first it reduces yield when incidence exceeds 5-10%, second it causes downgrading/rejection of seed potato in the process of certification.

The specific objectives of the study are as under:
1. Isolation identification and purification of Erwinia associated with blackleg disease of potato.
11. Establishment of disease screening nursery to look for genetically resistant germplasm against Erwinia.
111. Comparison of responses of different varieties against Erwinia.

MATERIALS AND METHODS

1: Isolation Of The Pathogen: The infected potato parts (stem, tubers) showing typical symptoms of

<table>
<thead>
<tr>
<th>Media for E. carotovora isolation</th>
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<tbody>
<tr>
<td>Beef Extract</td>
<td>3.0 gm</td>
</tr>
<tr>
<td>Peptone</td>
<td>5.0 gm</td>
</tr>
<tr>
<td>Glucose</td>
<td>2.5 gm</td>
</tr>
<tr>
<td>Agar</td>
<td>15.0 gm</td>
</tr>
</tbody>
</table>
The parts of potato tubers affected with blackleg were disinfected with 0.5% Mercuric Chloride (HgCl₂) and then three washings were given with sterilized water to reduce the injurious effects of HgCl₂. Then these pieces were placed on petri plates and incubated at 30°C (Khan et al., 1999). The grayish-white, circular and smooth colonies appeared after 96 hours of incubation. Among the isolated colonies of the bacterium a single colony was picked and transferred to slant and incubated at 30°C for further use. Slides were of the bacterial culture were examined under the microscope to determine the morphological characteristics of Erwinia carotovora.

2: Purification of pathogen: The pathogen was purified by using streaking method, for this purpose sterile streaking loop was touched on bacterial growth and then streaked in the petri plate containing Nutrient Glucose Agar (NGA) media in criss cross manner and loop was sterilized after every streaking on four sides. Petri plates incubated at 30°C for 24 hours, grayish white, circular and smooth bacterial colonies appeared. Isolated colonies of bacterium were picked and single colony transferred to slants and incubated at 30°C for further use.

3: Gram staining for the bacteria: A drop of sterilized distilled water was placed in the middle of a clear slide. Then a loop of bacterial suspension (Young culture) was transferred to the sterilized drop of water and a very thin film was prepared on the slide by spreading uniformly. The film was fixed by passing it over the gentle flame for two or three time. The slide was flooded with crystal violet solution and allowed to stand for 30 second and then washed thoroughly with gentle stream of tape water. The slide was then immersed in the iodine solution for 1 minute and washed thoroughly with 95% alcohol for 10 second. The alcohol was drained off and washed thoroughly with gentle stream of tape water. The slide was the covered with safranin for 1 minute. After washing with the tape water, blotted it and examined under the microscope.

4: Pathogenicity of Erwinia. Pathogenicity of Erwinia carotovora was tested by:
I: injecting the 4.2x 10⁸ cfu/ml solution of pathogen into shoot of the potato variety; desiree’ plants by syringe.
II: soaking tuber/slices of potato in suspension of Erwinia and
III: mixing the pathogen in soil and then planting potato seed in soil.

The soil was sterilized by drenching the 5% formalin then the bacteria were mixed into this soil and potato tuber was planted in the pots. All the three methods were completed and pathogen was reisolated and morphological characteristics were compared with the culture of Erwinia. The bacteria showing similar colony characters as that of original culture were considered to be pathogenic.

5: Screening of varieties: The experiment for screening of potato cultivars was conducted in the experimental area of department of Plant Pathology University of Agriculture Faisalabad during the 2006-07 and 2007-08. Fifteen varieties Cardinal, Desiree, Faisalabad white Fontane, Hermes, Everest, Atlantic, Melody, Orla, Paramount, Lady Rosetta, Harmony, Accent, SH-70 and Faisalabad red were grown for the sources of resistance against blackleg. These plant were inoculated with the solution of Erwinia 4.2x 10⁸ cfu/ml after the 20 days of germination, the disease appeared on the plants and data were recorded according to the scale as given by James (1969).

Disease incidence = ............................... X100
Total no. of plants/unit area

Disease severity was assessed by visual rating scale (0-5) based on parent plant, tuber surface showing symptoms (Ahmad et al., 1995).

1 = No or few symptoms
2 = 1-10 % plant/leaf area affected
3 = 11-20% plant/leaf area affected
4 = 21-30% plant/leaf area affected
5 = 31-40% plant/leaf area affected
6 = 41-50% plant/leaf area affected
7 = 51% or more area affected
RESULTS AND DISCUSSION

Fifteen varieties namely, Cardinal, Faisalabad white, Faisalabad red, Accent, Harmony, Lady Rosette, Desiree, SH70, Everest, Hermes, Paramount, Fontane, Atlantic, Melody and Orla were grown during the year 2006-07 and 2007-08 in the experimental area of Department of Plant Pathology University of Agriculture Faisalabad for the screening purposes. Cardinal was found immune while Faisalabad white was highly susceptible. The varieties like Faisalabad Red, Hermes and Orla resistant, Lady Rosette, Ascent and Harmony, susceptible while Paramount, Melody, Atlantic and Fontane were found moderately resistant and three other varieties Desiree, SH-70 and Vales Everest were found moderately susceptible. (Table 1) and (Fig. 1). All the varieties showed different response to the disease. The results of this study are in accordance with the results of Mairaj (2004)

Table 1. Disease incidence, level of resistance/susceptibility of 15 potato varieties against blackleg disease in 2006-07 and 2007-08

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Variety</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Disease incidence mean</td>
<td>Rating</td>
<td>Response</td>
</tr>
<tr>
<td>1</td>
<td>Cardinal</td>
<td>0.093g</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Harmony</td>
<td>41.657c</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>Lady Rosetta</td>
<td>46.632b</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>Paramount</td>
<td>28.087c</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Orla</td>
<td>18.687e</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Melody</td>
<td>28.120e</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Atlantic</td>
<td>29.433e</td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Vales Everest</td>
<td>38.780d</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>Hermes</td>
<td>9.377f</td>
<td>3</td>
</tr>
<tr>
<td>10</td>
<td>Fontane</td>
<td>28.617e</td>
<td>4</td>
</tr>
<tr>
<td>11</td>
<td>Accent</td>
<td>47.417b</td>
<td>6</td>
</tr>
<tr>
<td>12</td>
<td>Faisalabad White</td>
<td>63.887a</td>
<td>7</td>
</tr>
<tr>
<td>13</td>
<td>Faisalabad Red</td>
<td>19.657f</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>SH70</td>
<td>37.357</td>
<td>5</td>
</tr>
<tr>
<td>15</td>
<td>Desiree</td>
<td>38.663d</td>
<td>5</td>
</tr>
</tbody>
</table>

LSD = 2.3233

Fig. 1: Response of 15 potato varieties during 2006 and 2007
who reported Faisalabad white and Desiree as the susceptible and Cardinal as immune varieties to the blackleg. Similarly Desiree was also reported as moderately to slightly susceptible by Rabot et al., (1994) and a little susceptibility of this cultivar was reported by Hossain and Logan (1983) although there are some contradictory results reported for Desiree by Bourne et al., (1981) and Lapwood et al., (1984) but this may be due to environmental differences, however, these are the results of two year experiments. Pasco et al., (2006) reported some varieties as resistant and some as susceptible and during present studies the varieties like Orla, Hermes and Faisalabad Red were found resistant while Lady Rosette, Harmony and Accent as susceptible.

REFERENCES


