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VARIETAL SCREENING OF POTATO AGAINST *RHIZOCTONIA SOLANI*

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ABSTRACT

Management of black scurf disease through determining levels of susceptibility in 12 germplasm lines and varieties of potato was investigated by using *Rhizoctonia solani* AG 3 isolate SL-41, previously characterized according to anastomosis group and pathogenicity against eight disease producing symptoms (parameters) of black scurf disease viz., eyes germination, number of sprouts, sprouts killed, stem girdling, stem canker, stolon canker, black scurf incidence and severity. Overall, statistically non-significant differences between inoculated and non-inoculated treatments were found in varieties SH-5, SH-20 and germplasm line CIP-9605 except black scurf incidence (37.33%) in var. SH-20, black scurf severity of 1.86 in var. SH-5 on rating scale of 0-5 and number of sprouts in line CIP-9605, where significant differences were found between inoculated and non inoculated treatments. Varieties SH-5, SH-20 and line CIP- 9605 were found resistant to the disease causing fungus when compared with the remaining lines and varieties. Faisalabad white was found to be the most susceptible variety as statistically, significant differences for eyes germination, number of sprouts, sprouts killed, black scurf incidence and severity were found. As it is susceptible to black scurf disease pathogen, therefore, it could not be grown as a resistant variety against *R. solani* particularly in agro-ecological zone 2 comprising of Sahiwal, Pakpatan, Okara, Sialkot, Narowal, Jhang and Faisalabad districts, where the disease is already a problem.

Key words: Potato, *Solanum tuberosum* L., *Rhizoctonia solani,* black scurf, resistance.

INTRODUCTION

Rhizoctonia stem and stolon canker, commonly called black scurf is found in all the potato production areas of the world (Frank, 1986) and has a wide host range (Mordue, 1974). In Pakistan, this disease was first mentioned by the name stem and black spot of tubers (Hafiz, 1955). Later, disease was reported from Swat (Khan *et al.*, 1995; Turkensteen, 1986). It is cultivated in eight different potato production agro-ecological zones on an area of 109.7 thousand hectares with an annual production of 1938.1 thousand tonnes with an average yield of 17.7 tonnes per hectare. It affects potato development from emergence to harvest. Black scurf can seriously limit marketable yield by producing high percentage of tubers which are mishapen, knobby, cracked and adversely affect size distribution. The development of sclerotia causing the black scurf or "dirt that won't wash off" stage of the disease occurs after vine desiccation. This disease is among the commonly occurring potato diseases in Pakistan (Ahmad, 1998).

The most economical way of controlling this disease is the use of resistant crop varieties. Resistance to fungal diseases such as *Rhizoctonia* canker, *Fusarium* wilt and *Fusarium* dry rot, *Verticillium* wilt, gangrene (*Phoma* rot), *Cercospora* leaf blotch have traditionally been scarcely considered in potato breeding programmes. Reliable sources of resistance to *Rhizoctonia* have not been reported, although some resistance may exist in the non-tuberiferrous species of *Solanum tuberosum* and *S, suaveolens* (Focke, 1955; Frandsen, 1958). However, differences in disease expression of cultivated varieties have been reported, which has encouraged some screening for varietal differences in susceptibility (Frank *et al.*, 1976; Richter and Schneider, 1954). Although, many seed-borne diseases including black scurf have been reported on potato in Pakistan but their quantitative role in seedling mortality and field performance has not been investigated.

MATERIALS AND METHODS

Screening of potato germplasm and varieties.

Twelve potato germplasm lines and varieties were screened against *R, solani* AG 3 isolate SL-4l during this study. Seed material was obtained from Punjab Seed Corporation, Sahiwal, and Potato Programme, National Agricultural Research Centre, Islamabad. Trial was conducted in earthen pots (8 x 11 inch) in greenhouse. Fifteen to twenty days old culture of *R. solani* AG 3 isolate SL-41 @ 20 g was added in each pot of each treatment. Non-inoculated pots served as control. There were two sets with three replications of the trial. The data regarding eyes germination, number of spouts and sprouts killed were taken after 30 days of sowing by harvesting first set of experiment, whereas, the data on stem girdling, stem canker, stolon canker, black scurf incidence and severity were

taken after 90 days of sowing by harvesting second set of experiment by the following methods /scales.

Eyes germination, number of sprouts and sprouts killed

Number of eyes, sprouts and sprouts killed in each replication of a treatment were counted and the means were calculated.

Stem girdling

The data on stem girdling was recorded on the basis of scale (Rauf, 2002) where, 0 = no girdling (avirulent), 1= Slight girdling (Slightly virulent), 2 = Moderate girdling (moderately virulent), 3 = Severe girdling (Virulent) and 4 = Very severe stem girdling (highly virulent).

Stem canker

Stem canker was recorded on the basis of scale where, 0 = No canker (avirulent), 1 = upto 25% canker (slightly virulent), 2 = 26-50% canker (moderately virulent), 3 = 51-75% canker (virulent) and 4 = 76-100% stem canker (highly virulent).

Stolon canker

The data on stolon canker was recorded on the basis of scale where 0 = No stolon canker (Avirulent), 1 = Slight stolon canker (Slightly virulent), 2 = Moderate stolon canker (moderately virulent), 3 = Severe stolon canker (Virulent) and 4 = Very severe stolon canker (highly virulent).

Black scurf disease incidence and severity

For the assessment of black scurf, two parameters, disease incidence and disease severity were taken into account. The incidence was based on percentage of tubers infected and severity was assessed on a visual disease rating scale based on percent tuber surface showing disease symptoms using the following scale (Ahmad *et al.*, 1995). Where

0 = No symptoms on potato tubers
1 = Less than 1 % tuber area affected
2 = 1-10% tuber area affected.
3 = 11-20% tuber area affected
4 = 21-51% tuber area affected and
5 = 51 % or more of tuber area affected

RESULTS AND DISCUSSION

Management of black scurf disease based on host plant resistance revealed that *R. solani* isolate SL-41 significantly reduced the number of eyes in varieties Faisalabad white, Faisalabad red, Atlantic and Red Norland as compared to non-inoculated control (Table 1). The effect of inoculated treatments in the remaining lines and varieties were non-significant. Significant reduction in number of sprouts in Faisalabad white, Faisalabad red, Miris piper, Atlantic and germplasm lines CIP-9605, 2031 and 2001-2002 occurred. In the remaining treatments the difference was non-significant. However, the number of sprouts killed as a result of inoculation of isolate SL-41 was non-significant in most of the treatments except in varieties Faisalabad white and Red Norland where the difference was significant. Stem girdling and stolon canker symptoms of black scurf disease could not be induced by the test isolate in all the germplasm lines and varieties evaluated (Table 1). Although, stem canker was induced in half of the germplasm lines and varieties but it was non-significant as compared to control. Significant differences in majority of the lines and varieties were found for black scurf incidence (BSI) and black scurf severity (BSS).

Overall, statistically, non-significant differences between inoculated and non-inoculated treatments were found in varieties SH-5, SH-20 and germplasm line. CIP-9605 except BSS in SH-5, BSI in SH-20 and number of sprouts in line CIP-9605 where significant differences were found between inoculated and non-inoculated treatments (Table 1). Varieties SH-5, SH-20 and germplasm line CIP-9605 were found resistant to the fungus when compared with the remaining germplasm lines and varieties. Stem girdling and stolon canker symptoms could not be induced by the test isolate. Faisalabad white was found to be the most susceptible variety as statistically, significant differences for eyes germination, number of sprouts, sprouts killed, BSI and BSS were found. This variety of potato has been recently evolved at Ayub Agricultural Research Institute (AARI), Faisalabad. As it is susceptible to black scurf disease pathogen, therefore, it could not be grown as a resistant variety against black scurf particularly in agro-ecological zone 2 comprising of Sahiwal, Okara, Pakpattan, Depalpur, Pasrur, Sialkot, Jhang and Faisalabad district

areas where the disease is already a problem (Farooq, 2004, personal communication).

Table 1. Reaction of twelve potato germplasm lines and varieties for black scurf symptoms expression inoculated with *Rhizoctonia solani* AG 3 isolate SL-41.

Variety/ Line	germin-ated(Number)	Eyes sprouts (Number).	Number of killed 4 rating)	Sprouts girdling(0- 4 rating	Stem canker(0- 4 rating)	Stem canker(0- (%)	Stolon incidence (0-5 rating)	Black scurf severity	Black scurf
Faisalabad white	0.0080*	0.0205*	0.0181 *	-	-	-		0.0101 *	0.0070*
Faisalabad red	0.0037*	0.0361*	0.0580^{NS}	-	-	-		0.0021*	0.0580^{NS}
Miris piper	0.0580^{NS}	0.0039*	0.0658^{NS}	-	-	-		0.0198*	0.0175*
Atlantic	0.0505*	0.0275*	$0.1548^{N\,S}$	-	0.1869^{NS}	-		0.0438*	0.0146*
Red Norland	0.0505*	0.2073^{NS}	0.0271*	-	-	-		0.0580^{NS}	0.0714^{NS}
SH-5	0.5000^{NS}	0.3838^{NS}	0.1908^{NS}	-	-	-		0.0612^{NS}	0.0529*
SH-20	0.1869^{NS}	0.3884^{NS}	0.1652^{NS}	-	0.1869^{NS}	-		0.0062*	0.0613^{NS}
Coroda	0.1869^{NS}	0.4620^{NS}	0.237^{NS}	-	0.1869^{NS}	-		0.0000**	0.0000**
CIP-9605	0.1869^{NS}	0.0083*	0.3057^{NS}	-	0.1869^{NS}	-		0.0687^{NS}	0.1385^{NS}
CIP-2030	0.3216^{NS}	0.2014^{NS}	0.453NS	-	0.0580^{NS}	-		0.0032*	0.0239*
CIP-2031	0.0580^{NS}	0.0728*	0.0237^{NS}	-	0.1869^{NS}	-		0.0001**	0.0060*
CIP-2001-2002	0.0580^{NS}	0.0320*	0.1869^{NS}	-	-	-		0.0472*	0.0584^{NS}

Mean separation by T-test at 5% level of significance
** Highly significant
* Significant
NS Non-significant

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