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Screening of Pea Accessions for Resistance against White Rot of Pea Caused by *Sclerotinia sclerotiorum* (Lib.) de Bary

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A B S T R A C T

In this study, 48 pea accessions collected from Indian institute of pulse research, Kanpur, were screened for resistance to *Sclerotinia sclerotiorum* by two different method *viz.*, cut stem and detached leaf method. The observations of result in cut stem method showed that 15 out of 48 accessions found resistant to white rot, resulted 0-2.5 cm lesion length, however 26 accessions found tolerant against the pathogen, resulted 2.5-6 cm lesion length. In this study, 7 accessions out of 48 were found susceptible to *Sclerotinia sclerotiorum*, resulted 7-14 cm lesion length. However in detached leaf method, four accessions (EC- 329569, EC-296176, P-107-2-1 and) of the 48 accessions screened showed resistant against the pathogen which produce lesion length on leaf between 0.4-0.8 cm, whereas 40 pea accessions were reported to moderately resistant, produced 0.8-3.5 cm lesion length. Of all the accessions screened, three accessions (PM-9, EC- 329554 and EC-329572) were found susceptible which produce 3.5-4.3 cm lesion length of pathogen infection All the accession screened, EC-329569, ET-45189 and IPF-5-19 were found resistant, while PM- 9, EC- 329554 and EC- 329558 were found susceptible in this study.

Introduction

Field pea (*Pisum sativum* L.) is an important pulse crop grown throughout the world including India. The crop plays an important role in human diet providing higher amount of proteins, minerals and essential amino acids particularly lysine (Nawab, *et al.*, 2008) and improving soil health in terms of fertility and sustainability of the cropping patterns. India is one of the largest field pea producers in the world, stands at the fifth place next to France (Javed, *et al.*, 2002) and contributing of area (0.76 m ha), production (0.84 m t) with productivity (1.1 t/ha), respectively (Gowda 2015). The pea cultivation is ravaged by several fungal diseases including ascochyta blight (*Ascochyta pisi*), powdery mildew (*Eryisphe pisi*), downy mildew (*Peronospora viciae f. sp. pisi*), septoria blight (*Septoria pisi*), and white mold (*Sclerotinia sclerotiorum*), common seed rot (*Rhizoctonia solani*), seedling damping-off diseases (*Pythium spp.)* and Common root rots include Fusarium root rot (*Fusarium solani f. sp. pisi*), Aphanomyces root rot (*Aphanomyces euteiches*), and Fusarium wilt (*Fusarium oxysporum f. sp. pisi*) (Kraft and Pfleger, 2001; McGee, 2012). Among all fungal pathogen, *Sclerotinia sclerotiorum*, causing white mould of pea known to be most devastating, cosmopolitan and necrotrophic

pathogen, attack over 650 species of plants worldwide (Farr and Rossman 2011) and responsible to cause yield losses upto 100% in favourable condition (Purdy, 1979). The disease is more prevail and damaging in cool and wet seasons of temperate and subtropical regions (Purdy, 1979; Willets and Wong, 1980; Saharan and Mehta, 2008). Initially the symptoms appear as elongated water-soaked lesions on the stem that expand rapidly and also found in leaf and pod. Later the lesions become bleached and necrotic and subsequently develop fluffy white mycelium, which is the most characteristic sign of mycelial infection (Bolton *et al.,* 2006). The affected stem then shred and several grayish-white to black, spherical and irregular sclerotia appear either in the pith of the affected stem or on the stem surface.

The pathogen is difficult to manage with a single management practise because their survival in soil is too longer and has a wide host range, however, cultural and chemical management tools are either expensive or less effective. Therefore, development of host resistant is one of the most advantageous, sustainable and economical method for effectively managing of this disease (Zhao *et al.,* 2004; Li *et al.,* 2006 and Porter, 2009). The main objective of this experiment was to identify the sources of partial resistance to *S. sclerotiorum* in pea accessions collections that would be help to pea breeders for developing resistance pea cultivars against this pathogen.

Materials and Methods

A field trial was conducted at Department of Plant Protection, Aligarh Muslim University, Aligarh during *rabi* seasons 2016-2017 in a sick plot condition.

Inoculum and field experiments

Forty eight promising entries of pea collected from Indian Institute of Pulse Research, Kanpur, were screened against Sclerotinia rot. All these accessions were grown in a single row of 3 m length in augmented design in 3 replications with row to row spacing 30 cm keeping 10 cm plant to plant distance. *Sclerotinia sclerotiorum* isolate (Scl 01) isolated in 2016 from Department of Plant Protection, Aligarh Muslim University, Aligarh and pathogenic to pea, was used for inoculations. Sclerotia of the isolate were transferred to Petri dishes containing potato dextrose agar (PDA) and incubated in the dark at 22±2 °C until the fungus colonized the agar. Agar plugs containing fungal mycelia were then removed from the leading edge of the expanding colony and transferred again to PDA and incubated in the dark at 22±2 °C for 2 days.

Cut stem method

Mini-agar plugs colonized with mycelia measuring 3 mm^2 were cut from the margin of actively growing mycelial colonies and used to inoculate plants. For inoculation, 5 week old plants were selected and main stem of plant horizontally severed with a sterile razor blade 0.5 cm above either the fourth or fifth node. A single mycelial plug (mycelial-side down) was placed on the cut stem.

Detached leaf method

The youngest fully expanded trifoliolate leaves of 5-week-old pea plants were cut at the stem, and place into Petri dishes labelled with four layered towel paper at the bottom. Mycelial plugs were placed centred with fungus-side down on one side of the middle trifoliolate leaf between the leaf edge and main leaf vein and slowly pressed to ascertain good contact with the leaf surface. To each Petri dishes, 20 ml of tap water was added, and each plate was wrapped with plastic wrap to maintain humidity. Petri dishes containing inoculated leaves were incubated at 20 ± 2°C. The observations of experiment were

calculated on basis of lesion length (cm) (Kull, 2003) which was developing after the inoculation of pathogen.

Results and Discussion

The pea accessions screened shown resistant to infection but varied in response to lesion expansion in both methods (Cut stem and detached leaf method). In cut stem-inoculated plants typical water-soaked symptoms of white rot showed 3 days after inoculation. The observations of host response in relation to resistant and susceptibility thus recorded in difference in lesion length of pathogen infection. Fifteen of the 48 accessions screened demonstrated white mould resistance based on mean lesion length which was 2·5 cm or less, however, 26 pea accessions were considered to be moderately resistant to *S. Sclerotiorum* produced 2.5-6 cm lesion length. Only six accessions (PM-9, EC- 329554, EC-329572, EC-329566, HUP-8 and IPFD-6-3) were found susceptible to *Sclerotinia sclerotiorum* resulted 7-14 cm lesion length of pathogen infection (Table 1).

In detached leaf method, visible water soaking and leaf necrosis symptoms appear under the plug after 24 h. At 48 h, the water-soaking and necrotic regions reached the leaf margin in some leaves. Four accessions (EC-329569, EC-296176, P-107-2-1 and ET-45189) of the 48 accessions screened showed resistant against the pathogen which produces lesion length on leaf between 0.4-0.8 cm, whereas 40 pea accessions were reported to moderately resistant, produced 0.8-3.5 cm lesion length. Of all the accessions screened, three accessions (PM-9, EC- 329554 and EC-329572) were found susceptible which produce 3.5–4.3 cm lesion length of pathogen infection (Table 2).

Fig.1 Reaction of different genotype of pea against white rot caused by *Sclerotinia sclerotiorum*

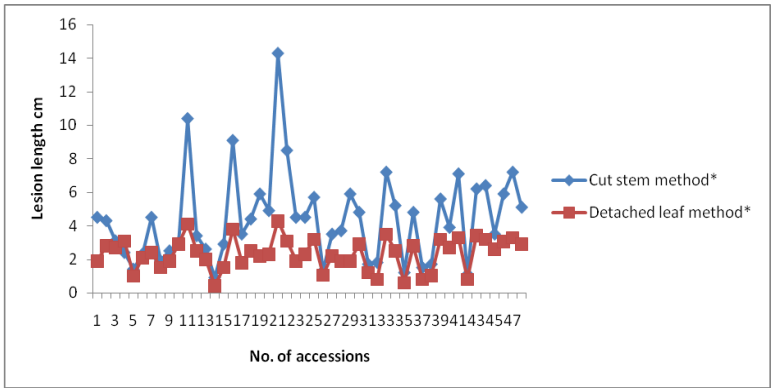

Table.1 Response of pea accessions against *Sclerotinia sclerotiorum*

Reaction of host plant	Lesion length (cm)	
	Cut stem method	Detached leaf method
Resistant	Less than 2.5 cm	0.4-0.8 cm
Moderately resistant	2.5-6 cm	0.8-3.5 cm
Susceptible	7-14 cm	3.5-4.3 cm

Table.2 Reaction of different accessions of pea against white rot caused by *Sclerotinia sclerotiorum*

S. No.	**Name of accessions**	**Lesion length (cm)**	
		Cut stem method*	Detached leaf method*
1	NIC-11183	4.5	1.9
2	EC-1408	4.3	2.8
3	NIC-18895	3.1	2.7
4	NIC-18905	2.4	3.1
5	EC-18909	1.4	1.0
6	DMR-11	2.3	2.1
7	EC-11208	4.5	2.4
8	NIC-11184	1.9	1.5
9	NIC-57473	2.5	1.9
10	EC-292161	3.0	2.9
11	PM-9	10.4	4.1
12	ET-5122	3.4	2.5
13	EC-329551	2.6	2.0
14	EC-329569	**0.9**	**0.4**
15	EC-329571	2.9	1.5
16	EC-329554	9.1	3.8
17	EC-320778	3.5	1.8
18	EC-325280	4.4	2.5
19	EC-329550	5.9	2.2
20	EC-329558	4.9	2.3
21	EC-329572	14.3	4.3
22	EC-329566	8.5	3.1
23	EC-329552	4.5	1.9
24	EC-324129	4.5	2.3
25	P-1541-1	5.7	3.2
26	EC-292167	1.3	1.06
27	EC-292171	3.5	2.2
28	EC41487	3.7	1.9
29	EC-292160	5.9	1.9
30	EC-341787	4.8	2.9
31	P-1-3	1.7	1.2
32	EC-296176	1.8	0.8
33	HUP-8	7.2	3.5
34	KSP-22	5.2	2.5
35	ET-45189	1.2	0.6
36	KSP-21	4.8	2.8
37	P-107-2-1	1.5	0.8
38	EC-584815	1.7	1.03
39	KSP-15	5.6	3.2
40	P-1297-77-1	3.9	2.7
41	IPF-99-25	7.1	3.3
42	IPF-5-19	**1.1**	**0.8**
43	IPFD-1-10	6.2	3.43
44	IPFD-99-13	6.4	3.2
45	IPFD-11-5	3.5	2.6
46	IPFD-10-12	5.9	3.06
47	IPFD-6-3	7.2	3.3
48	IPFD-4-9	5.1	2.9
CD at 5%	**---**	**1.09**	**0.54**
CV %	**---**	**15.12**	**14.25**

*Each value is an average of 3 replicates

Thus it was cleared from the study that all the accession screened, EC-329569, IPF-5-19 and ET-45189 were found highly resistant, while PM- 9, EC- 329554 and EC-329572 were found highly susceptible against the *Sclerotinia sclerotiorum* (Table 2 and Fig. 1). The development of resistance to S. sclerotiorum in pea is a challenge. Presently breeders are facing the absence of pea genotypes with complete resistance to this pathogen (Blanchette and Auld, 1978; Porter *et al.*, 2009; Porter, 2012). Based on stem lesion advancement data, the following genotypes would be recommended to breeders to improve partial resistance to white mould disease of pea.

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