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SCREENING OF PEA VARIETIES / GERMPLASM AGAINST *ASCOCHYTA PISI* CAUSING ASCOCHYTA BLIGHT

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ABSTRACT

Pea (*Pisum sativum* L.) possesses a position of utmost significance as edible leguminous crop grown throughout the world. One of the most important disease of pea is Ascochyta blight. Since the disease is complex and caused by more than one pathogen Viz. *Ascochyta pisi, Ascochyta pinodes* and *Ascochyta pinodella*. In the present investigation, sixteen varieties/germplasm of pea were screened under field conditions against Ascochyta disease. The observations were taken at peak disease occurrence and per cent disease intensity of each entry was calculated based on the rating scale 0-5 and were categorized accordingly. It is evident from the screening data that minimum disease intensity was shown by Pant-P-498 with percent intensity of 6.30 and is categorized as moderately resistant. It was followed by HFP-9907B with per cent intensity of 6.90 and categorized as moderately resistant. HFP-9907B (6.90) IPF-20-17 (7.20%), HUPT1709 (7.30%), RFP-2010-1 (7.60%), HFP-1607 (8.90%), IPF-20-21 (9.30%), RFPG-181 (13.86%), HFP-1702 (15.53%), RFPG-280 (18,93%), Pant P-497 (21.28%), VL-72 (35.1%), Pant P-501 (36.26%), IFP-20-11 (48.90%), Pant-P-42 (49.80%) and local check (43.93%). Reaction of pea varieties/germplasm against Ascochyta blight (according to rating scale (Sindhsn *et al*., 1999)

***Keywords*:** Pisum sativum, Ascochyta blight, *Ascochyta pisi*, cultivars/germplasm, moderately resistant

Introduction

Pea (*Pisum sativum* L.) is an annual, self-pollinated cool-season legume native to north-west to south-west Asia (Skoglund *et al*. 2011). It is one of the most important legume crop in the temperate climate of the world and was originally cultivated in the Mediterranean basin (Sardana *et al*. 2007). The crop belonging to family *leguminosae* and sub- family *Papilionaceae*. It is the fourth largest legume in terms of global consumption and an important field and vegetable crop in India. Peas are of four types *i.e*., Field pea (*Pisum sativum* spp. *arvense* (L.) Poir.), Garden pea (*P. sativum* spp. *hortense* (Asch. & graebn.), Early dwarf pea (*P. sativum* var. *humile*) and Edible podded peas (*P. sativum* spp. *macrocarpon*) (Duke 1981). Generally, two types of peas are cultivated in India. One is the field pea (*Pisum sativum* var. (L.) *arvense*) or called dry pea and other is garden pea (*Pisum sativum* var. (L.) *hortens*) called table pea. Field pea is generally used as a pulse crop and garden pea as vegetable crop. Dry peas are used as split pea dal and bean for various preparations whereas vegetable peas are used as fresh, frozen or canned and also as dry peas like the split pea (Boros and Wawer, 2009). The crop occupies a position of considerable importance in the agriculture economy and being a leguminous crop, it plays a significant role in the eco-buildup of agriculture as it enriches the soil by fixing the atmospheric nitrogen (Goswami and Pareek1976).

It is highly nutritive, containing high percentage of digestible protein, carbohydrate, vitamins and very rich in minerals. Its fresh pod contains 7.2 per cent protein, 19.8 per cent carbohydrate, 0.8 per cent mineral matter while dried pea grain contains 19.7 per

cent protein, 56.6 per cent carbohydrate, 2.1 per cent mineral matter and 4.4 per cent iron, besides being a rich source of vitamins A, B and C (Choudhary, 1987). Pea protein is a useful nutritional complement to cereal because it contains a comparatively high level of lysine despite lacking sulphur-containing amino acid such as cysteine and methionine (McPhee, 2003). Globally China having first position in production of pea. In india ranks fourth position in the area (10.53%) and 5th position in production (6.96%) of pea in the word (FAO Stat.2021-2022). It is grown in Uttar Pradesh, Madhya Pradesh, Himachal Pradesh, Punjab, Haryana, Rajasthan, Maharashtra, Bihar and Karnataka. providing 67 per cent of the total production. In India the total cultivation of pea is 582 thousand ha area and 6700 million tons' production of pea (Anon.2021-2022). In Rajasthan pea is grown on an area of 12687 hectares with an annual production of 25385 tons. It is mainly cultivated in Jaipur, Kota, Bundi, Alwar, Sikar, Ajmer, Chittorgarh, Bharatpur and Udaipur regions. The district of Jaipur alone covers an area of 78801 hectares with a total production of 7335 tons (Anon.2021-22).

Pea crop is susceptible to a number of diseases *viz.* root rot (*Fusarium oxysporum* f.sp pisi), powdery mildew (*Erysiphe pisi*), rust (*Uromyces pisi*), white rot (*Sclerotinia sclerotium*), downy mildew (*Peronospora pisi*), stem rot (*Sclerotium rolfsii*), leaf spot (*Alternaria alternata*), grey mould (*Botrytis cinerea*) seed rot and damping off *(Pythium spp., Rhizoctonia solani*), collar rot (*Fusarium solani* f.sp. pisi), foot rot (*Phoma medicaginis* var. pinodella), ascochyta blight (*Ascochyta spp.*), bacterial blight (*Pseudomonas syringae* pv. syringae) and pea seed borne mosaic virus. Among these, Ascochyta blight caused by Ascochyta pisi is a highly destructive disease of pea throughout the major pea growing areas of the world (Khan *et al*., 2013). Ascochyta blight is a polycyclic disease that can progress rapidly during periods of wet weather and moderate temperatures. The temperature between 20-25 with high relative humidity is ideal for disease development. Major source of initial inoculum in the field is the ascospore that are released from matured pseudothecia that develops on infected stubble from the previous season (Salam *et al*., 2011). Secondary inoculum involves of pycnidiospores that develop in pycnidia molded in lesions on leaves, stems and pods. According to Peever *et al*. (2007).

Ascochyta blight is complex diseased that is caused by more than one pathogen *viz. Ascochyta pisi, Ascochyta pinodes* and *Ascochyta pinodella*. This blight complex causes a range of different symptoms, including ascochyta blight, foot rot, black stem and leaf and pod spot. Seed quality may also be reduced through seed discoloration or retardation of seed development. *A. pinodes* can infect seedlings and all aerial parts of pea plants, causing necrotic leaf spots, stem lesions, shrinkage and dark-brown discoloration of seeds, blackening of the base of the stem, and foot rot in seedling. The disease symptoms caused by *P. pinodella* are similar to those observed with *A. pinodes*. However, *P. pinodella* infection can result in more severe foot rot symptoms that can extend below ground, while causing less damage to the leaves, stems and pods. *A. pisi* causes slightly sunken, circular, tan-colored lesions with dark brown margins that occur on the leaves, pods, and stems (Chilvers *et al*., 2009). Ascochyta is the anamorph of Didymella (Pleosporaceae) and Conidia are bi-celled obovoid, hyaline to pale- brown.

Material and Methods

Screening of pea varieties/ germplasm against Ascochyta blight disease.

Sixteen varieties (Pant-P-498, IPF-20-17, IPF-20-21, HFP-1607, HFP-9907B RFP-2010-1, HUPT-1709, Pant P-497, RFPG-181, HFP- 1702, RFPG-180, Pant-P-42, VL-72, Pant P-501, IFP-20-11, Local Check) were evaluated under natural condition in mini plots (1.5 x 1.5m) with three replications. The observations were taken at peak disease occurrence and per cent disease intensity of each entry was calculated based on the rating scale 0-5 and were categorized accordingly.

The germplasm was categorized on the basis of an established scale (Sindhan *et al.,* 1999) with some modification as follows:

S.No.	Reaction	Disease (%)
1.	Resistant (R)	0-5.0
2.	Moderately resistant (MR)	5.1-10.0
3.	Moderately susceptible (MS)	10.1-25.0
4.	Susceptible (S)	25.1-50.0
5.	Highly susceptible (HS)	> 50.0

$$\text{PDI} = \frac{\text{Sum of individual ratings}}{\text{Number of leaves observed}} \times 100 \times \text{Maximum disease rating}$$

Results and Discussion

Screening of pea varieties/germplasm against Ascochyta blight disease under natural conditions

Sixteen varieties/germplasm of pea were screened under field conditions against *Ascochyta* disease. The observations were taken at peak disease occurrence and per cent disease intensity of each entry was calculated based on the rating scale 0-5 and were categorized

accordingly. It is evident from the screening data (Table 1) that minimum disease intensity was shown by Pant-P-498 with percent intensity of 6.30 and is categorized as moderately resistant. It was followed by HFP-9907B with per cent intensity of 6.90, IPF-20-17 (7.20%), HUPT- 1709 (7.30%), RFP-2010-1 (7.60%), HFP-1607 (8.90%), IPF-20-21 (9.30%) and moderately susceptible is RFPG-181 (13.86%), HFP-1702 (15.53%), RFPG-180 (18,93%), Pant P-497 (21.28%) and susceptible is VL-72 (35.1%), Pant P-501 (36.26%), IFP-20-11 (48.90%), Pant-P-42 (49.80%) and local check (43.93%).

Table 1 : Screening of pea varieties/germplasm Ascochyta blight disease under natural conditions.

S.No.	Varieties	PDI (%)
1	Pant-P-498	6.30 (14.54)
2	IPF-20-17	7.20 (15.56)
3	IPF-20-21	9.30 (17.76)
4	HFP-1607	8.90 (17.36)
5	HFP-9907B	6.90 (15.23)
6	RFP-2010-1	7.60 (16.00)
7	HUPT-1709	7.30 (15.68)
8	Pant P-497	21.28 (27.47)
9	RFPG-181	13.86 (21.86)
10	HFP-1702	15.53 (23.21)
11	RFPG-180	18.93 (25.79)
12	Pant- P-42	49.8 (44.89)
13	VL-72	35.1 (36.33)
14	PANT P-501	36.26 (37.02)
15	IFP-20-11	48.9 (44.37)
16	Local Check	43.93 (41.51)
	SEm±	0.74
	CD (p=0.05)	2.27

Average of three replications

Figures given in parentheses are angular transformed values

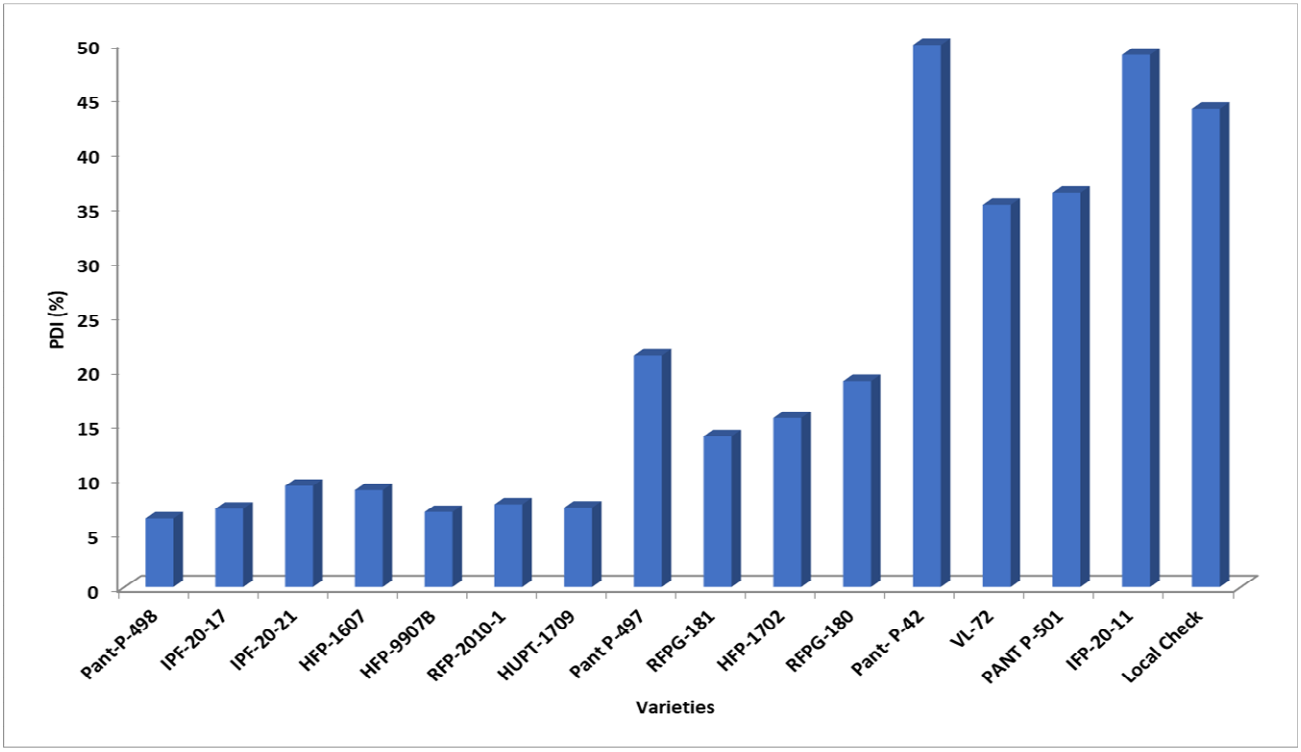

Fig. 1 : Screening of different varieties/ germplasm lines of pea against *Ascochyta spp.*

Discussion

Similarly, our results are parallel to the results of some other findings, among 48 genotypes, 16, 8, 3, 10, 11 were found highly susceptible, susceptible, moderately susceptible, resistant and moderately resistant, respectively. The lines showed highly susceptible reaction were: K-97006, K-97007, K-98009, K-94002, K-98014, K-98012, K-52721, K-60028, K-93001, K-92030, K-96022, D- CM98, D-CAM68, D-91013, D-97074, D-96022 and Punjab-1(check), while, genotypes showed susceptible reaction were viz: K-95058, K-60016, K-60034, K-60048, D-91224, D-03019, D-05028 and D-03006. There were only 3 lines (K-98007, K-50076 and K-95041) displayed moderately susceptible response. Whereas,

K-96033, K-89169, K-90395, D-91017, D-89044, D-05006, D-96018, D-86030, D-96032, D-1CC-5127 and D-03009 exhibited moderately resistant response against chickpea blight. While lines, K-60013, K-98008, D-97092, K-96001, K-96022, D-91055, D-90272, D- 96050, D-Pb2008 and D-Pu502-362 showed resistant reaction. Results clearly mentioning that most of the genotypes collected from ARRI were susceptible against Ascochyta blight (Ahmad *et al*., 2013). evalutated 15 chickpea germplasm assessions for resistance to Ascochyta blight under artificially inoculated environments. Five chickpea germplasm (ILC72, ILC182, ILC187, ILC 200 and ILC 202) exhibited highly resistant response, 2 susceptible namely, ILC 484, ILC 2506, ILC 3856, ILC 4421, ILC 5902, ILC 5921, ILC 6043 and ILC 6090 exhibited tolerant reactions (Benzohra *et al*., 2015). evaluated 54 advanced breeding lines of chickpea against Ascochyta blight and found that 23 were resistant and 16 were moderately resistant to disease (Shah *et al*., 2015). Out of the total 54 genotypes tested 23 were resistant, K0010-09, K0021-09, K0025-09, K0030-09, K0051-09, K0054-09, K0057-09, K0058-09, K0062-09, K0066-09, BKK17124, BKK07151, D080-09, D084-09, D089-09, D090-09, D094-09, D095-09, BK07A005, BK96A2055, BK05A015, BK04A013 & FG-0908, 16 were moderately resistant K009-09, K0026-09, K0034-09, K0035-09, K0063-09, K0065-09, K0068-09, K0070-09, BKK17115, BKK02213, BKK07124, D075-09, FG-0904, D098-09, D0100-09 & D096-09, 8 were tolerant K0031-09, K0039-09, K0069-09, BKK17106, BKK02174, BKK02231, CH 65/02 & D085-09, 5 were moderately susceptible CH82/02, CH 38/03, CH 47/04, FG0902 & FG090, 1 was susceptible and one was highly susceptible to Ascochyta blight disease (Shah *et al*., 2015). evaluated the existing chickpea germplasm diversity conserved in Indian National Gene Bank against the *Ascochyta rabiei* under artificial epiphytotic conditions. During the last five winter seasons from 2014–15 to 2018–19, a total of 1,970 accessions have been screened against the disease and promising accessions were identified and validated. Screening has resulted in identification of some promising chickpea accessions such as IC275447, IC117744, EC267301, IC248147 and EC220109 which have shown the disease resistance (disease severity score 3) in multiple seasons and locations (Gayacharan *et al*., 2020). 63 Pea genotypes under artificially inoculated conditions. it was found that none of the genotypes were resistant or moderately resistance due to lack of diversity in resistant genes. The majority of genotypes, including most cultivated cultivar Rachna were found Susceptible to the incident of Ascochyta blight and 40 genotypes were found susceptible while, thirteen genotypes were moderately susceptible and ten genotypes were highly susceptible The highest disease intensity was recorded in genotype SHM – 59 (53.99%) and lowest was in KDP – 47 (13.23%). (Chasti *et al*, 2022). Use of total 11 genotypes; 2 genotypes (EH 012022-1 and EH 012020-7) were moderately resistant, 3genotypes (Burkitu, Adi and EH 012019-1) were susceptible and the remaining 7 genotypes were highly susceptible to ascochyta blight disease. Genotypes EH 012020-7 and EH 012019-1were relatively high yielder and moderately resistant. (Tadesse, 2021).

Conclusion

Sixteen germplasm of pea were screened under artificial condition; no germplasm was found to show resistant against *Ascochyta pisi.* Six germplasm were found moderately resistant, four germplasm were found moderately susceptible and six germplasm were found susceptible.

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