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Screening of chickpea kabuli (*Cicer arietinum* L.) germpalsm against *Ascochyta* blight (*Ascochyta rabiei*)

Muhammad Imran Khan*[1], Waheed Arshad[1], Muhammad Zeeshan[1], Shiraz Ali[1], Ali Nawaz[1], Amina Batool[1], Muhammad Fayyaz[2]

[1]*Barani Agricultural Research Station, Fatehjang, Attock, Pakistan*

[2]*Crop Diseases Research Institute, National Agricultural Research Centre, Islamabad, Pakistan*

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Abstract

Chickpea blight caused by *Ascochyta rabiei* is a devastating disease of chickpea crop in Pakistan which causes low yield. The present study was designed to identify the resistant sources by evaluating the chickpea material at Barani Agricultural Research Station, Fatehjang under rainfed condition during two consecutive years 2013-2015. A total of 85 chickpea genotypes were screened for *Ascochyta* blight. Observations on disease were recorded by using international disease rating scale 1-9. Disease data was recorded at reproductive stage and considerable variation was observed at this stage. Out of these 85 lines, 9 were found resistant, 11 were moderately resistant/ susceptible, while 65 entries were found highly susceptible. None of the genotypes were found highly resistant under rainfed condition. These tolerant type genotypes will be useful for developing resistant sources against chickpea blight in germplasm for rainfed areas of Pakistan.

***Corresponding Author:** Muhammad Imran Khan ✉ imran.arid1984@gmail.com

Introduction

Chickpea (*Cicer arietinum* L.) is one of the most important legume food crop and ranked third among legume crops being cultivated in almost all over the world (Hirich *et al.,* 2014). The crop is successfully planted in more than fifty countries of the world and is third most important legume crop in Asia after bean and peas. Chickpea is considered an important source of protein not only for human food (Malik *et al.,* 2011) but also animal feed. It also fixes the nitrogen, which helps in the management of soil fertility especially in the dry areas (Islam *et al.,* 2011).

In Pakistan the crop is being cultivated on more than 960 thousand hectares with an annual production of 484 thousand tones (Anonymous, 2015). Unfortunately crop is being affected by many biotic and abiotic stresses and ultimately reduced the yield as compare to other countries of the world. Although the disease can be controlled to some extent by treating seed with some available fungicides (Bhatti *et al.,* 1984) but it is not economical. As chickpea crop is mainly grown in rainfed areas under low input applications, seed treatments with fungicides are not feasible (Chaudhry *et al.,* 2006 and Sarwar *et al.,* 2012). Blight severity can be minimized to some extent by adopting some cultural practices like crop rotation, late sowing and sowing of healthy seed. Host resistance, an however does not persist as varieties presumed to be blight resistant failed, either excellent approach not possible due to f genetic breakdown or a change in the virulence pattern of the pathogen (Jamil *et al.,* 2010 and Sarwar *et al.,* 2012).

The host plant resistance is the best way to identify the resistant sources against this disease but not present in this type of disease. This can be done by using a reliable screening method to screen under field condition. Although conventional evaluation by applying diseased plant debris or even spore suspension of mixture of isolates is not a reliable source (Ilyas *et al.,* 2007). The present study was designed to evaluate the chickpea advance lines against Ascochyta blight to identify resistance sources for future utilization under natural rainfed condition.

Material and methods

Materials

A total of eighty five (85) chickpea genotypes obtained from different research institutes of Pakistan actively involved for developing the resistant chickpea varieties. Nursey was evaluated two consecutive years i.e. 2013-14 and 2014-15 at Barani Agricultural Research Station, considered a natural hot spot for diseases development. Two rows of 4 meter of each genotypes were planted with 45cm row spacing.

To create the disease pressure in the nursery, a highly susceptible chickpea variety Punjab-1 (PB-1) was planted as a spreader after every two lines. Similarly, the nursery was also covered by the check variety to create the maximum disease pressure. As this is the natural hot spots hence no inoculation was done and allows the nursery for natural infection. Nursery was just sprayed with simple water to maintain the relative humidity for maximum disease development.

Data recorded

Severity of blight disease was recorded on the vegetative stage by using the 1-9 rating scale as described by Reddy and Nene 1979. The genotypes rated 1-3 were considered to be resistant, 4 moderately resistant, 5-6 susceptible and 7-9 were observed highly susceptible. The check variety PB-1 was rated 9 in all cases. The detail of rating scale for *Ascochyta* blight is given in Table 1.

Table 1. Disease Rating Scale for *Ascochyta* Blight (1-9).

Rating	Symptoms	Resistance Class
1	No symptoms	Resistant
2	Minute lesions prominent on the apical stem	Resistant
3	Lesions up to 5 mm in size and slight drooping of the apical stem	Resistant
4	Lesions obvious on all plant parts and clear drooping of apical stem	Moderately Resistant
5	Lesions obvious on all plant parts; defoliation initiated ; breaking and drying of branches slight to moderate	Moderately Susceptible
6	Lesions as in 56; defoliation; broken, dry branches common; some	Susceptible

Rating	Symptoms	Resistance Class
	plants killed	
7	Lesions as in 5; defoliation; broken, dry branches very common; up to 25% of the plants killed	Highly Susceptible
8	Symptoms as in 7 but up to 50% of the plants killed	Highly Susceptible
9	Symptoms as in 7 but up to 100% of the plants killed	Highly Susceptible

Result and discussion

Ascochyta blight contains a wide range of resistance from various sources and has different genes for blight resistance (Collard *et al.,* 2003). In our study 85 chickpea (kabuli) genotypes were screened against *Ascochyta* blight under field conditions during consecutive years 2013-2015. All these genotypes were categorized according to disease rating scale (1-9) and summarized in table 2. The data revealed that among 85 lines, only 9 genotypes i.e BKK17115, BKK17124, CH4/06, CM1381/05, K003/10, K006/10, 09AK053, K005/10, K0039/10 were found resistant (1-3), 6 lines (CH65/02, CM1399/05, ICC1381/06, K001/10, Noor-2009, 11KCC-112) were found moderately resistant and was rated 4, 2 moderately susceptible CH47/04, CM-2000 and was rated 5. Similarly, 3 lines i.e. CH44/00, FG0902, CM-2008 were found susceptible by showing defoliation; broken and dry branches and rest of the maximum 65 genotypes were observed highly susceptible (7-9). However, none of these chickpea genotypes was found highly resistant against blight and it might be due to the presence of high disease pressure in the environment (Akhtar *et al.,* 2009).

Table 2. Reaction of Chickpea (Kabuli) Genotypes against *Ascochyta* Blight.

Sr. No.	Disease Reaction (1-9)	Name of Genotypes	No. of Genotypes
1	Resistant (1-3)	BKK17115, BKK17124, CH4/06, CM1381/05, K003/10, K006/10, 09AK053, K005/10, K0039/10	9
2	Moderately Resistant (4)	CH65/02, CM1399/05, ICC1381/06, K001/10, Noor-2009, 11KCC-112	6
3	Moderately Susceptible (5)	CH47/04, CM-2000	2
4	Susceptible (6)	CH44/00, FG0902, CM-2008	3
5	Highly Susceptible (7-9)	BKK07124, BKK02174, CC98/09, CH114/06, CH47/06, CM1333/05, CM770/06, CM843/06, CM958/06, EM-06, EM-07, K009/09, K010/10, K012/10, K015/10, K017/10, K025/10, K026/10, K027/10, K031/10, K036/10, K037/10, K039/10, K040/10, K055/10, K057/10, K058/10, K068/10, PB-1, K020/11, K045/11, K048/11, K051/11, K054/11, K064/11, K070/11, 09AK054, 09AK061, 001887, 001888, 2174, 002182, 002193, 99010, CM1012/06, CM1004/06, CH82/02, CH38/03, CH63/08, CH71/08, CH80/08, CH3/06, K009/10, K002/10, K013/10, K024/10, 11KCC-103, 11KCC-108, 11KCC-109, 11KCC115, 09AK053, 09AK055, K0027/10, K0068/10, ICC-13816	65
Total			85

Cultural practices also somewhat helpful for controlling the disease. Since *A. rebiei* is specific for chickpea, crop rotation with non-host crops will help to also reduce its inoculum in soils. Tilling and burial of infected residue will speed up decomposition and ultimately reduce inoculum by eliminating the source for pathogen to endure in the soils. Disease can also be controlled by using different available fungicide i.e. Metalaxyl and Thiabendazole. These fungicides not only control the disease, but also enhanced the regrowth and flowering of infested plants (Robert M. Harveson 2013).

The utilization of the fungicide not environment friendly and increase the cost of production which is not suitable on the landholder have low inputs. Moreover, the spray should be done at particular stage and time.

The percentage of the resistant material in our material is very low and it is just 10.58% which is not a good sign. The utilization of the resistance chickpea lines is the best way to control the disease for better yield. It is assumed that most of the material presents in the fields have low resistance level against *A. blight* when tested world germplasm (Reddy & Singh, 1984).

The evaluation of the chickpea material under hot spots and inoculated condition provide the somewhat extent best way to identify the resistant sources for developing the resistant chickpea varieties. Different researcher identifies the resistant sources by evaluating the germpalsm against blight under field condition (Bashir *et al.,* 2006; Iqbal *et al.,* 2010 and Sarwar *et al.,* 2012).

The lines with indifference reaction are should be selected for developing the resistant material. The different reaction on the final stage indicates the resistance level involved by the different genes (Reddy and Singh, 1993). Different genes conferring different levels of resistance could be introduced into commercial varieties through gene pyramiding to facilitate increased level and durability of resistance in commercial cultivars (Tekeoglu *et al.,* 2000).

Based on this study, chickpea resistant and moderately resistant genotypes obtained from screening will be useful in future breeding programs to develop high yielding and blight resistant chickpea cultivars. The lines having resistance but not yield should be selected and crossed with high yielding susceptible varieties.

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