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SOURCES OF RESISTANCE IN CHICKPEA GERMPLASM AGAINST *ASCOCHYTA* BLIGHT

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Abstract

One hundred and seventy three germplasm lines/varieties of chickpea received from various research organizations were screened for the sources of resistance against chickpea blight disease (*Ascochyta rabiei* (Pass) Lab) by artificially inoculating the germplasm under a plastic tunnel where temperature, ranged from 8-24^{0}C and humidity was maintained above 80% by sprinkling fresh water. Out of 61 lines received form Pulses Research Institute, Faisalabad 3 lines viz., 03039, 03041 and 03053 exhibited highly resistant response while 11 lines viz., 03001, 03002, 03011, 03016, 03020, 03023, 03024, 03035, 03040, 03044 and 03045 displayed resistant reaction. The rest of the lines displayed moderately susceptible to susceptible reaction. Out of 80 lines received from Nuclear Institute of Agriculture and Biology, Faisalabad 5 test lines i.e. 03115, 03131, 03133, 03143 and 03159 were found to be highly resistant while 16 test lines viz., 03108, 03126, 03127, 03153, 03156, 03157, 03161, 03162, 03169, 03170, 03172, 03173, 03174, 03177, 03178 and 03180 were found resistant against *A. rabiei* infection. Similarly out of 90 test germplasm lines/ cultivars received from Arid Zone Research Institute, Bukhar 3 lines viz., 93A-086, 93A-111 and 93A-3354 exhibited highly resistant response while 5 lines viz., 91A-016, 92A-792, 92A-117, 96A-4504 and NES-98K4, displayed resistance response against *A. rabiei* infection. These resistant sources can further be exploited in breeding programe for the development of disease resistant commercial cultivars.

Introduction

In Pakistan chickpea (*Cicer arietinum* L.) is grown as a rabi pulse crop on an area of 1028.9 thousands hectares with an annual production of 479.5 thousand tones , an average yield being 466 Kg/ha (Anon., 2006). This is an extremely low yield as compared to potential yield of commercial chickpea cultivars sown in the country. Several biotic and abiotic factors affect the yield of this crop in Pakistan. One of the biotic factors is the chickpea blight disease caused by a fungus *Ascochyta rabiei* (Pass.) Lab. (Ilyas & Bashir , 1983a, b). *Ascochtya blight* is a devastating disease in areas where and when cool, cloudy humid weather (15-25^{o}C and >150 mm rainfall) persists during the crop season (Pande *et al.*, 2005). The disease causes serious grain yield and quality losses (Kaiser & Hannan, 1988; Guar & Singh, 1996) and may result in complete failure of the crop (Malik & Bashir, 1984). The disease perpetuates through infected seed and crop debris (Maiden, 1987). Infection during the pod formation stage often results in shriveled and infected seeds (Nene, 1982; Singh & Sharma, 1998; Akeem, 1999). The pathogen is highly variable and consists of several virulences, pathotypes or races (Vir & Grewal, 1974; Reddy & Kababeh, 1985; Jamil *et al*., 1995; Porta Puglia *et al*., 1996; Sarwar *et al.*, 2000). Chickpea blight can be effectively controlled by cultivating disease tolerant or resistant varieties of chickpea (Nene & Reddy, 1987) but the existing commercial cultivars with desirable agronomic traits are vulnerable to disease, probably

due to the existence of new physiological virulences or pathotypes (Reddy & Kababeh, 1985; Jamil *et al*., 1995; Sarwer *et al*., 2000). Under the present situation, there is a dire need for identification of durable resistant sources and incorporation of their resistance genes into commercial cult4ivars with desirable traits. Sources of resistance against *Ascochyta* blight disease, through screening of chickpea germplasm originating from Pulses Research Institute Faisalabad, NIAB Faisalabad and Arid Zone Research Institute Bhakhar is reported herein.

Materials and Methods

One hundred and seventy three germplasm lines / varieties of chickpea received from 3 research organizations were screened in the research area of Pulses Research Institute, Faisalabad for the sources of resistance against *Asochyta* blight disease by artificially inoculating the germplasm under a plastic tunnel where day and night temperature ranged from 8-24^{o}C and humidity was maintained above 80% by sprinkling fresh water. Each of the germplasm lines was sown in a single row subplot of two meter length with 30 cm row to row distance and 15 cm plant to plant distance. A highly susceptible check line (Pb-1) was planted after every two test germplasm lines. At adult plant stage i.e., at flowering and early pod formation, the test lines were sprayed every day with the spore suspension of *A. rabiei* (1x 10^{-5} spores /ml) until the appearance of disease on the susceptible check lines of Pb-1and their death. The inoculum was prepared by the mass culturing technique described by Ilyas & Khan (1986). The development of the disease was aided by the continuous spray of fresh tap water every day. The data for disease severity were recorded to assess the level of resistance or susceptibility of each test line, using 0-9 grades disease rating scale (Reddy & Singh, 1984), where I is no visible disease symptoms on any plant and 9 is profuse lesions on all plants, stem girdling on more than 50% of the plants and many plants killed.

Results and Discussion

The screening of 61 test lines originating from Pulses Research Institute, Faisalabad revealed 3, 11, 37 and 10 lines to be highly resistant, resistant, moderately resistant (or moderately susceptibility) and susceptible. The highly resistant lines were 03039, 03041, 03053, while the resistant lines were 03001, 03002, 03011, 03016, 03020, 03023, 03024, 03035, 03040, 03044 and 03045 (Table 1). Out of 82 lines originating as chickpea mutants from Nuclear Institute of Agriculture and Biology, Faisalabad 5, 17, 35 and 25 mutants exhibited highly resistant, resistant, moderately resistant, (or moderately susceptible) and susceptible response respectively. The high resistant chickpea mutants were 03115, 03131, 03133, 03143 and 03159 while the resistant mutants were 03108, 03126, 03127, 03153, 03156, 03157, 03161, 03162, 03169, 03170, 03172, 03173, 03174, 03177, 03178 and 03180 (Table 1). Similarly, out of 30 test germplasm lines / cultivars originating from Arid Zone Research Institute Bhakhar, 3, 5, 19 and 3 lines were found to give highly resistant, resistant, moderately resistant, (or moderately susceptible) and susceptible response respectively. The highly resistant lines were 93A-086, 93A-111, 96A-3354, while resistant lines were 91A-016, 92A-792, 92A-117, 96A-4504 and NES-98K4. Thus out of 173 test liens, 11 lines displayed highly resistant while 34 lines exhibited resistant response. These sources of resistance can further be exploited in breeding programmes for the development of disease resistant commercial cultivars after determining their genetics.

A thorough study on the number of genes conferring resistance against *Asochyta* blight, their nature and diversity is essential for exploiting a particular resistance source in resistance breeding programme. Genetic studies revealed that resistance of chickpea against *Ascochyta blight* disease is due to either a single dominant gene or recessive gene (Singh & Reddy, 1983, 1991). Allelic studies by Tewari & Pandy (1986) have revealed the presence of 3 independently segregating dominant genes for resistance in chickpea cultivar P. 1215-1, EC 26446 and PG 82-1 and a recessive gene in BRG 8. Interallelic interaction, additive gene effects and dominance influencing resistance has also been reported (Dey & Singh, 1993). Recent studies on inheritance of *Ascochyta* blight resistance indicate that several quantitative trait loci (QTL) also control resistance (Tekeoglu *et al*., 2000; Collard *et al*., 2003, Fleandez Galvez *et al*., 2003). Thus *Ascochyta* blight resistance is a complex endeavor suggesting that there is a range of different resistant sources with different genes of resistance. Pyramiding of different résistance genes into commercial cultivars may facilitate building up the level of resistance and increasing the durability of resistance in the commercial cultivars.

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