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RESPONSE OF CHICKPEA LINES AT DIFFERENT GROWTH STAGES OF PLANT TO FUSARIUM WILT (*FUSARIUM OXYSPORUM* F.SP. *CICERI*)

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A B S T R A C T

Fifty lines of chickpea were tested against Fusarium Wilt (*F. oxysporum* f.sp*. ciceri)* in diseased plot, which was developed at Pulses Research Institute (PRI), Faisalabad. None of the advance lines was highly susceptible to *Fusarium oxysporum* f.sp. *ciceri* at seedling stage or at flowering stage. The level of resistance and susceptibility varied at both the growth stages. At seedling stage, out of fifty test lines, twenty five lines were found highly resistant. Eighteen lines were resistant and six lines were moderately resistant at seedling stage. At flowering stage only seven lines were highly resistant and sixteen lines were resistant. Fifteen lines exhibited a moderately resistance response and twelve lines fell into the susceptible category. Lines 09013, 09021, 09023, 09044, 09045, 08006, 08010 were highly resistant at both the growth stages, while only a single line 08029 was susceptible at seedling as well as flowering stage.

Keywords: Chick pea varieties, *Fusarium oxysporum,* growth stages.

INTRODUCTION

Chickpea (*Cicer arietinum* L.) is the world's third most important pulse crop after dry beans (*Phaseolus vulgaris* L.) and dry pea (*Pisum sativum* L.). It is considered as an alternate to meat because it contains 38-59 % protein 3% carbohydrate, 4.8-5.5% ash fiber, 3% oil, 0.3% phosphorus crude lipid 6.29-6.99% and also contains amino acids and poly phenol contents with some sort of minerals (Iqbal *et al.*, 2006; Amjad *et al.,* 2006. Pakistan is the third major chickpea producer in the world after India and Turkey (Dusunceli *et al.,* 2007). In Pakistan it is cultivated over an area of 985 thousand hectares with 543 kg/hectare average yield and 673 thousand tones total production (Anonymous, 2013). The pathogen that causes the Fusarium wilt is both seed and soil borne (Pande *et al*., 2007). The prevalence of Fusarium wilt of chickpea has also been reported from many countries of the world (Iqbal *et al*., 2005). In Pakistan, Fusarium wilt disease may induce 10-50% crop loss every year (Khan *et al*., 2002). It is a serious disease in Pakistan, Burma, Nepal, India, Spain, Tunisia and has been reported from Mexico, Syria, Peru, Bangladesh, Ethiopia and the USA as well (Nene *et al*., 1984). Nema and Khare (1973) reported damage caused by wilt of up to 61 % if the attack takes place at the seedling stage and of 43% at the flowering stage. The crop yield losses due to chickpea wilt may vary from 10-90% (Jimenez-Diaz *et al.*, 1989; Ratnaparkhe *et al*., 1998; Akhtar *et al*., 2008). In Pakistan, disease may induce 10-50 percent loss every year (Khan *et al.*, 2002).

MATERIALS AND METHODS

Roots of diseased chickpea plants showing characteristic symptoms of wilt disease were collected from a naturally infested chickpea field of Pulses Research Institute (PRI), Ayyub Agricultural Research Institute, Faisalabad for the isolation of *Fusarium oxysporum* f.sp. *ciceri.* The roots of chickpea plants were cut into 8-10 mm long segments which were washed with tap water and their surface was disinfected by dipping in 0.1 % mercuric chloride solution for 30-60 seconds. These pieces were given three washing in sterilized distilled water and put on the sterilized filter paper sheets for drying. These segments were then plated on autoclaved potato

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dextrose agar (PDA) in Petri plates and incubated at 25 ±2 ^{0}C for more than one week. The colonies of *Fusarium oxysporum* along with some other colonies i.e. air borne fungi were observed. *Fusarium oxysporum* was purified by single spore method and was identified with the help of relevant literature of the Synder and Hansan (1946). Pb 2000 was used as spreader variety and was sown periodically after every two test entries for the monitoring of the disease pressure. Different advance lines (09010, 09013, 09014, 09015, 09018, 09021, 09022, 09023, 09024, 09027, 09028, 09029, 09036, 09037, 09039, 09041, 09042, 09043, 09044, 09045, 08006, 08010, 08016, 08017, 08018, 08020, 08025, 08026, 08029, 08030, 08041, 08052, 07007, 07008, 07009, 07012, 07020, 07021, 07041, 07045, 07057, 07058, 03019, 05006, 05007, 06004, 06024, 03009, 04004 and 05015) were tested, in already infected plot, against wilt in an augmented design. The wilt symptoms were visible on 23rd day from the sowing date. The disease incidence data were recorded at two growth stages of the plant i.e., at seedling stage and at flowering. The per cent wilt incidence was calculated by using the given formula.

$$Disease\ incidence = \frac{No.\ of\ plants\ affected}{Total\ no.\ of\ plants} \times 100$$

The level of resistance and susceptibility of each germplasm was determined by using 1-9 rating scale given by (Iqbal *et al*., 2005).

Table 1. Disease Rating Scale.

Index	Disease Incidence	Response
1	0-10 per cent	HR (Highly Resistant)
3	11-20 per cent	R (Resistant)
5	21-30 per cent	MR (Moderately Resistant)
7	31-50 per cent	S (Susceptible)
9	More than 50 per cent	HS (Highly Susceptible)

RESULTS

The data on wilt incidence at seedling stage of 50 test lines are given in Table 2 and the data on wilt incidence at flowering stage of each of 50 test lines of chickpea are given in Table 3. Out of 50 test lines twenty five lines were found to be highly resistant, eighteen resistant and six moderately resistant. On the other hand, only one line had exhibited susceptible response while none was found to be highly susceptible at seedling stage.

At flowering stage out of fifty test lines only seven lines were highly resistant, sixteen resistant, fifteen moderately resistant and twelve were susceptible. None of the screened line was highly susceptible at flowering stage also.

Table 2. Chickpea germplasm exhibiting various levels of resistance/susceptibility during their field screening against the wilt disease at seedling stage.

Highly resistant (0-10%) infection	Resistant (11-20%) infection	Moderately resistant (21-30%) infection	Susceptible (31-50%) infection	Highly susceptible (above 50%) infection
09010, 09014, 09018, 09022, 09041, 09042, 09043, 09045, 05006, 05007, 03009, 04004, 03019, 06004, 09023, 09044, 09028, 09013, 09015, 09039, 06024, 08006, 08010, 09036, 09021.	09024, 09027, 08018, 07041, 09029, 08041, 07058, 08026, 09037, 07007, 07008, 07057, 07009, 05015, 08020, 07021, 07045, 07012.	07020, 08017, 08016, 08052, 08025, 08030	08029.	None

Table 3. Chickpea germplasm exhibiting various levels of resistance/susceptibility during their field screening against the wilt disease at flowering stage.

Highly resistant (0-10%) infection	Resistant (11-20%) infection	Moderately resistant (21-30%) infection	Susceptible (31-50%) infection	Highly susceptible (above 50%) infection
09023, 09044, 09045, 09013, 08006, 08010, 09021.	08018, 07041, 06024, 09018, 09022, 05007, 09036, 03019, 03009, 09041, 09028, 09010, 09042, 09027, 09039, 05006.	07057, 09015 09043, 05015 06004, 09014 08020, 07045 07058, 09037 07007, 04004 09024, 07020 09029.	07009, 07012 07008, 08030 08041, 07021 08026, 08016 08017, 08025 08029, 08052	None

DISCUSSION

Grewal (1969) observed two phases of chickpea wilt i.e. early and later phase. The early stage was seedling stage and the later one was the flowering stage. Affected seedlings exhibit drooping of the leaves and were paler in color than healthy ones. Seedling may collapse and lie flat on the ground. Such seedlings, when removed from the soil show shrinkage of the stem. (Saxena and Singh, 1987). The infection of *Cicer arietinum* L. by *F. oxysporum* f.sp. ciceri resulted in a reduction in chlorophyll and increase in organic acids, polyphenols and carbohydrates (Murumkar and Chavan 1985). The cheapest, most economic and ideal way of controlling this pathogen/ disease, like all other diseases, is the use of cultivars possessing durable resistance. However, host resistance in the available germplasm for commercial cultivars of cultivated crops is generally scarce or absent altogether (Ilyas *et at.,* 1982) or is not incorporated with all other desirable agronomic characters.

Our results also indicates that the source of resistance to Fusarium wilt in chickpea germplasm are not uncommon and a number of other workers have also reported the occurrence of high level of resistance to Fusarium wilt (Pathak *et al.,* 1982, Zote *et al.,* 1983, Ahmad and Sharma 1990, Kaushal and Singh, 1990, Reddy *et al.,* 1990. Iqbal *et al.,* 1993 Ahmad and Sharma, 1990, Iftikhar *et al.,* 1997, Yu and Su, 1997). It was obvious from our study that at seedling stage majority of the genotypes were resistant whereas at reproductive stage majority of the genotypes appeared to be susceptible. Various workers have already reported variation in response of genotypes at two stages (Haware, 1992). They also reported that some of the sources were resistant against more than one race. However, these workers used different isolates and the genotypes from those used in the current study.

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