

**EVALUATION OF NATIONAL AND INTERNATIONAL CHICK PEA GERmplasm FOR  
RESISTANCE AGAINST FUSARIUM WILT (*FUSARIUM OXYSPORUM* F. SP. *CICERIS*)  
IN PAKISTAN**

**M. A. Nazir<sup>1\*</sup>, M. A. Khan<sup>1</sup>, S. Ali<sup>1</sup>.**

<sup>1</sup>Department of Plant Pathology, University of Agriculture, Faisalabad-38000, Pakistan

\*Corresponding author: asim.nazir.uaf@gmail.com

**ABSTRACT**

One hundred and seventy eight chickpea germplasm lines/cultivars were screened for resistance to disease caused by *Fusarium oxysporum* f. sp. *ciceris* (Padwick) Matuo & K. Sato in a wilt sick plot. None of the test lines were found immune and resistant. 14 lines obtained from NIAB, Faisalabad (Pakistan), were found to be moderately resistant while 20 lines were moderately susceptible. Five lines from ICARDA (Aleppo, Syria) were moderately resistant, while 12 lines were moderately susceptible. Out of 26 lines obtained from PRI (ARRI) only four lines displayed moderately resistance against with disease. Ten were found moderately susceptible. Genotypes showed steady resistance may be exploited for the development of resistant cultivars against wilt.

**Key words:** chick pea, *Fusarium oxysporum* f. sp. *ciceris*, resistant, wilt.

**INTRODUCTION**

Chickpea (*Cicer arietinum* L.) is an important pulse crop in Pakistan and cultivated on an area of 1028.9 thousand hectares giving 479.5 thousand tones of production with an average yield of 446 Kg/ha (Anonymous 2007). The average yield of chickpea in Pakistan is very low as compared to the other countries of the world e.g., 1,767 kg/ha in Egypt, 1,093 kg/ha in Morocco, 1,049 kg/ha in Iran, 1,818 kg/ha in Lebanon and 1,256 kg/ha in Turkey (Saxena and Singh, 1987). Chickpea produced in Pakistan accounts for ten percent world production (Auckland and Maeson, 1980).

The most important limiting factor in the chickpea production in Pakistan is the frequent occurrence of wilt and blight diseases. Chickpea wilt caused by *Fusarium oxysporum* f. sp. *ciceris* (Padwick) Matuo & K. Sato is responsible for wilting, flagging and consequently loss of the yield of the affected plants (Haqqani *et al.*, 2000). *Fusarium* wilt of chickpea has also been reported from Syria, Ethiopia, Iran, India and Australia (Shakoor, 1991), Nepal, Burma, Spain, Tunisia, Bangladesh, Malawi, Mexico, Peru and USA (Iqbal *et al.*, 2005). The pathogen of the disease is both seed and soil borne and can survive in soil, even in the absent of its host, for six years (Haware *et al.*, 1996). In Pakistan this disease may cause 10-50 percent crop loss every year (Khan *et al.*, 2002). The most ideal way of controlling the gram wilt disease is the use of host resistance, which is either scanty or breeders have not genetically exploited commercial cultivars. The biological and chemical control of this disease is not feasible, because large scale application of antagonistic and soil fungicides is highly expensive.

**MATERIALS AND METHODS**

One hundred and seventy eight germplasm lines of chickpea obtained from NIAB (Faisalabad, Pakistan), PRI-ARRI (Faisalabad, Pakistan) and ICARDA (Aleppo, Syria) centers were screened for the sources of resistance against *Fusarium* wilt. These germplasm lines/cultivars were sown for evaluation of their level of resistance/susceptibility in the field in wilt sick plot that is naturally and/or artificially infected with the fungus in the field of the Department of Plant Pathology, University of Agriculture, Faisalabad. Each of the 178 test lines was sown in rows 4 meter in length, with plant to plant distance of 15 cm and row to row distance of 30 cm. The cultivar k 850 served as a susceptible repeated check. The data on the number of wilted seedlings in each row for each test line were recorded weekly and wilt incidence was calculated for the each test line by using the formula:

$$\text{Wilt incidence} = \frac{\text{No of wilted plants}}{\text{Total no. of the plants}} \times 100$$

The level of resistance and susceptibility of each test line was determined by using 1-9 rating scale given by Iqbal *et al.*, (2005) where 1=highly resistant (0-10% plants wilted), 3=resistant (11-20% plants mortality), 5=moderately resistance (21-30% mortality), 7=susceptible (31-50% mortality) and 9=highly susceptible (more than 50% mortality).

One hundred and seventy eight chickpea germplasm lines/ cultivars were screened for resistance to wilt disease caused by *fusarium oxysporum* f. sp. *Ciceris* in a wilt sick plot. None of the test lines was found immune or highly resistance. Out of 90 lines belonging to NIAB

Table 1: Resistance / Susceptibility of Chickpea Cultivars/Lines against wilt disease caused by *Fusarium oxysporum* f. sp. *ciceris*

Disease Incidence %	Response	NIAB	ICARDA	PRI
0-10%	Resistance	None	None	None
11-20%	Moderately Resistant	07107, 07108, 07128, 07130, 07203, 07204, 07205, 07206, 07214, 07215, 07217, 07228, 07235, 07245,	25202, 25203, 25207, 25254, 25259,	L3, L7, L18, L24
21-30%	Moderately susceptible	07103, 07106, 07110, 07117, 07124, 07129, 07202, 07207, 07208, 07211, 07213, 07218, 07219, 07220, 07222, 07237, 07238, 07240, 07241, 07242,	25201, 25205, 25206, 25209, 25216, 25218, 25219, 25220, 25224, 25232, 25236, 25239,	L1, L2, L9, L11, L12, L19, L21, L22, L23, L25
31-50%	Susceptible	07101, 07105, 07109, 07111, 07112, 07113, 07114, 07115, 07116, 07120, 07121, 07122, 07123, 07127, 07131, 07132, 07134, 07135, 07137, 07141, 07143, 07144, 07201, 07209, 07212, 07216, 07224, 07225, 07226, 07227, 07230, 07232, 07233, 07234, 07236, 07244,	25204, 25208, 25214, 25215, 25217, 25221, 25222, 25223, 25229, 25230, 25231, 25233, 25234, 25235, 25237, 25238, 25240, 25241, 25242, 25245, 25252, 25253, 25255, 25257,	L4, L5, L6, L8, L10, L13, L14, L15, L16, L17, L20, L26.

Faisalabad, 14 lines displayed moderately resistant response (Table 1) while 20 lines were moderately susceptible (Table 1) while other displayed susceptible to highly susceptible response.

Out of 61 lines originated from ICARDA, five lines were found moderately resistant (Table 1). 12 lines were found moderately susceptible (Table 1) while all other displayed susceptible to highly susceptible response.

Out of 26 lines obtained from PRI (ARRI) none was found to be highly resistant or resistant, only four lines displayed moderate resistance against disease (Table 1). Ten were found moderately susceptible (Table 1).

Thus present screening revealed that the germplasm originating from NIAB had high number of moderately resistant and moderately susceptible lines as compared to other two research organizations. Resistance in chickpea wilt is either due to monogenes or oligogenes. Late wilting is due to individual genes of oligogenic resistance mechanism which delay onset of disease symptoms.

In a similar type of study, also 196 chickpea germplasm lines/cultivars were evaluated to check out their resistance to wilt disease caused by *Fusarium oxysporum* f.sp. *ciceris* in a wilt sick plot. None of the test lines were found immune or highly resistant (Chaudhry *et al.*, 2007). No

chickpea line immune to *Fusarium* wilt was found (Zote *et al.*, 1983). These results were supported when 240 chickpea varieties for wilt, *Colletotrichum* blight and *Alternaria* blight were evaluated and recorded 10-20% *Fusarium* wilt incidence in affected lines (Weeraratne and Chithral, 1997).

Out of the 178 cultivars test lines of chickpea in this study, no line exhibited resistant reaction which was in contrast with results that 35 lines were found resistant. Six promising lines of Pulses Research Institute, Faisalabad and four lines originated from AZRI, Bhakkar were found resistant (Chaudhry *et al.*, 2006).

In a similar type of conclusions seven lines obtained from Pulses Research Institute, Faisalabad, found to be resistant (Chaudhry *et al.*, 2007). Three test lines showed 16-17% wilt incidence and were considered resistant. Six chickpea lines were found resistant when screened against culture filtrate of the same isolate (Khan *et al.*, 2005). Thirteen lines behaved as resistant (Akhtar, 2001).

This study demonstrates that resistant genotypes exist in the world collection of chickpea germplasm against a virulent isolate of *F. oxysporum* f. sp. *ciceri*. These genotypes can be explored in hybridization programme for the development of

resistant cultivars against wilt for commercial cultivation in the country.

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