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ANTI-FUNGAL POTENTIAL OF CHILLI GERMPLASM AGAINST FUSARIUM WILT

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ABSTRACT

Fusarium wilt caused by *F. oxysporum* f.sp. *capsici* is a potential risk to successful production of chilli in Pakistan and causes huge yield loss. In present study, fifteen varieties/ lines were assessed against Fusarium wilt disease under Randomized Complete Block Design (RCBD) in the trial area of Department of Plant Pathology, University of Agriculture Faisalabad for a long time amid 2012-2013 and 2013-2014. Results showed that none of variety showed highly resistant response towards disease. Gola peshawari showed resistant response with 5.1% infection frequency while six varieties i.e. Talhari (10.30%), Harmal (13.26%), Neelum (14.46%), Burewala (20.13%), Sanam (15.10%) and FSD-1 (18.43%) showed moderately resistant response. Four varieties i.e. FSD-2 (28.10%), Ghotki (25.167%), KA-2 (23.133%), Tatapuri (22.15%), expressed moderately susceptible response with rating three and four varieties/lines i.e. Arunalu (40.33%), NARC-4 (35.66%), Sabazperi (32.13%) and Skyline (30.50%) expressed vulnerable response with score 4 to Fusarium wilt.

Keywords: *Capsicum annum*, *Fusarium oxysporum*, screening, resistance

INTRODUCTION

Chillies (*Capsicum annum*) are considered as one of the supreme crops in the tropics. It is grown worldwide because of its nutritive importance and as it is rich source of oils, carotenoids, vitamins, proteins, fiber and mineral component (Bosland and Votava, 2003). Fresh green chilli covers more vitamin C than citrus produces and fresh red chili has added vitamin A than carotenoids (Ossuna-Garcia *et al.*, 1998). The global region under farming is near 1700 thousand ha for producing fresh chili; and about 1,800 thousand ha for producing dried chilli (FAO, 2014). *Capsicum* contains roughly 20-27 species however 5 spp. like *C. annum*, *C. beccatum*, *C. chinense*, *C. frutescence* and *C. pubescent* are cultivated globally. Among these five species fusarium wilt is one of the record public cultivated crops (Tong and Bosland, 1999).

Chillies crop has to face biotic and abiotic stresses that lower its yield every year among these Fusarium wilt is

the greatest devastating malady. It is caused by the *Fusarium oxysporum* f. sp. *capsici* that has a place with the class hypomycetes and family tuberculariaceae. It is soil borne pathogen and can persist in earth and diseased plant for years (Pietro *et al.*, 2001). In developing countries, it causes 10-80 % yield loss (Poonpolgul and Kumphai, 2007). Initially symptoms appear as the water soaked area at the collar region of the young seedlings. Later they become the brown sunken lesion resulting in seedling collapse. On adult plant symptoms start from slight drooping of leaves that led to drying of leaves and root. Finally, plants exhibited wilting symptom (Ulloa *et al.*, 2006).

Different control measures like chemical, biological and use of resistance source have been adapted to control this disease. As the chemicals are not environment friendly and biological control is very slow and expensive mean to control the disease. Therefore, the paramount approach to accomplish the disease is the use of resistant varieties. High level of resistance against the Fusarium wilt is naturally found in some species of *Capsicum* (Poulos, 1992). In addition, use of resistant assortments is considered as cheap and sustainable control measure for this disease (Amini,

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2010). So, the breeders have advanced genetically resistance source in contrast to Fusarium wilt. The control of Fusarium wilt by the utilization of resistant varieties not merely removed biological and mechanical costs to manage this disease; but also reduced the yield losses (Agrios, 2005). Furthermore, resistant assortments have been considered as effective control of the plant disease (Tewari and Ramanujam, 1994). In this way, the present study was planned to screen out resistant source against Fusarium wilt.

MATERIALS AND METHODS

ESTABLISHMENT OF DISEASE SCREENING NURSERY:

Seeds of fifteen varieties/ lines (Arunalu, Burewala, FSD-1, FSD-2, Ghotki, Gola Peshawari, Harmal, KA-2, NARC-4, Neelum, Sabazperi, and Sanam were brought from Ayub Agricultural Research Institute (AARI), Faisalabad. Disease

free nursery was developed in experimental area of Department of Plant Pathology, University of Agriculture Faisalabad under Randomized Complete Block Design (RCBD) in the year 2012-2013 and 2013-2014 to find out source of resistance against Fusarium wilt of chillie. Nursery seedlings were developed on beds at a separation of 60 cm separated. The beds were divided 1.5 m from each other. All the agronomic works on including suggested manure measurements and water system plan was followed after to keep the crop in good conditions. Plots were exposed to natural epidemics in the course of the growing season. Susceptible cultivar was used in borders around the field as check. Fusarium wilt disease was scored by following Bayoumi and El-Bramawy scale (2007) (Table 1).

Table 1. Disease severity scale for Fusarium wilt of Chilli

Sr. #	Fusarium wilt disease incidence	Description	Response
1	0% wilting	Highly resistant	HR
2	1-10 % wilting	Resistant	R
3	11-20% wilting	Moderately Resistant	MR
4	21-30 % wilting	Moderately susceptible	MS
5	31-50 % wilting	Susceptible	S
6	>50% wilting	Highly Susceptible	HS

While Fusarium wilt disease incidence was calculated by using following formula

$$D. I. = \frac{\text{No. of Infected plants}}{\text{No. of Total plants}} \times 100$$

RESULTS

No even single variety shows high resistant reaction to disease with rating 1. One variety i.e. Gola peshawari exhibited effective reaction with (5.10%) infection rate while, six varieties/ lines i.e. Talhari (10.30%), Harmal (13.27%), Neelum (14.47%), Burewala (20.13%), Sanam

(15.10%) and FSD-1(18.433%) exhibited moderately resistant (MR) reaction to disease. Similarly four varieties/ lines i.e. FSD-2 (28.10%), Ghotki (25.17%), KA-2 (23.13%), Tatapuri (V%), showed moderately susceptible (MS) reaction type with rating 4 and four varieties/ lines i.e. Arunalu (40.33%), NARC-4 (35.67%), Sabazperi (32.13%) and Skyline(30.50%) demonstrated susceptible (S) type reaction with rating 5 to Fusarium wilt disease during 2012-2013 (Figure 1, Table 2).

Table 2. Evaluation of chilli germplasm against Fusarium wilt during 2012-2013

Sr.#	Varieties/ Lines	Disease incidence (%)	Disease rating	Response
1	Arunalu	40.333a	5	S
2	Burewala	20.133i	3	MR
3	FSD -2	28.100e	4	MS
4	FSD-1	18.433j	3	MR
5	Ghotki	25.167f	4	MS
6	GolaPeshawari	5.100o	2	R
7	Harmal	13.267m	3	MR
8	KA-2	23.133g	4	MS
9	NARC-4	35.667b	5	S
10	Neelum	14.467l	3	MR
11	Sabazpari	32.133c	5	S
12	Sanam	15.100k	3	MR
13	Skyline	30.500d	5	S
14	Talhari	10.300n	3	MR
15	Tatapuri	22.157h	4	MS

*Mean values in a column sharing similar letters do not differ significantly as determined by The LSD test (P ≤ 0.05). MR = Moderately resistant R= Resistant MS = Moderately susceptible S = Susceptible

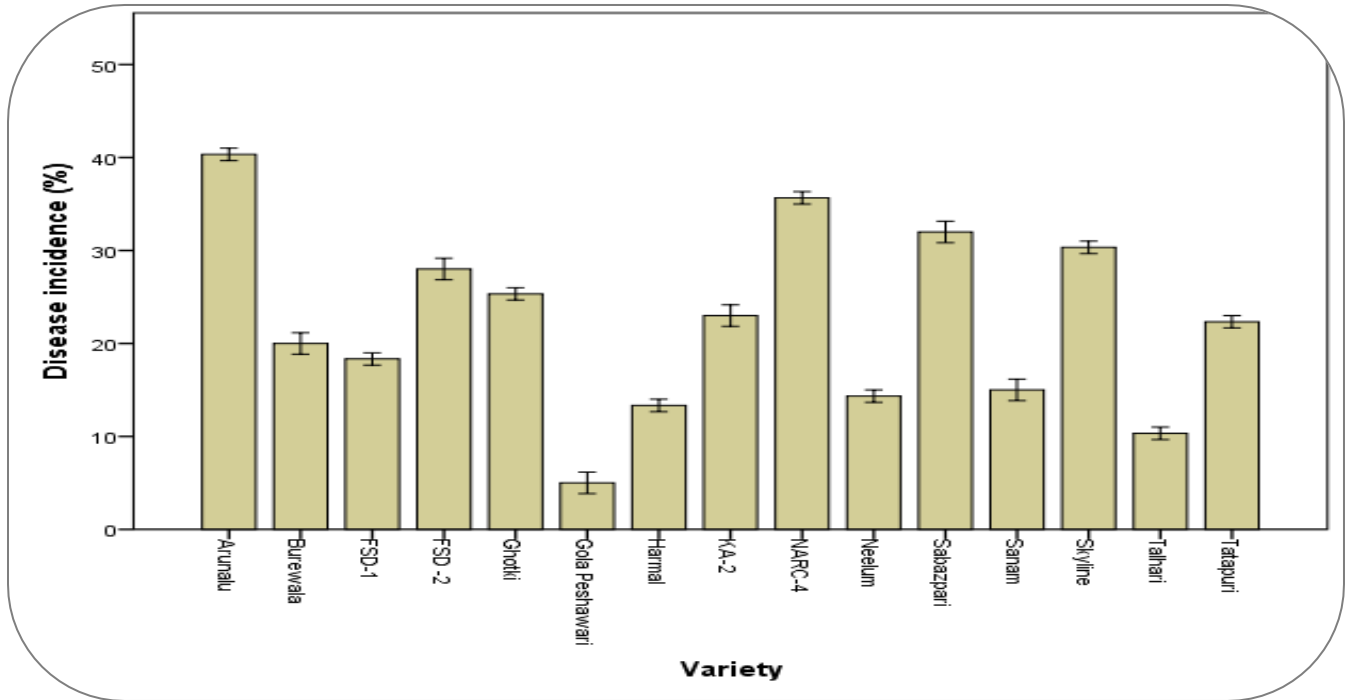


Figure 1. Response of Chilli germplasm against Fusarium wilt during 2012-2013

During second year 2013-2014, four varieties/ lines (Arunalu, NARC-4, Sabazpari, and Skyline) exhibited susceptible (S) reaction with disease incidence range (32.25 - 42.27%) while five varieties/ lines (FSD-2, Ghotki, KA-2, Burewala and Tatapuri) showed moderately susceptible (MS) reaction with disease incidence range

(21.55% - 29.42%). Similarly five assortments/ lines (Talhari, Harmal, Neelum, Sanam and FSD-1) showed moderately resistant (MR) response with disease incidence range (12.32 - 20.16%). Only single variety Gola Peshawari (5.50%) indicated resistant (R) reaction to Fusarium wilt disease (Figure 2, Table3).

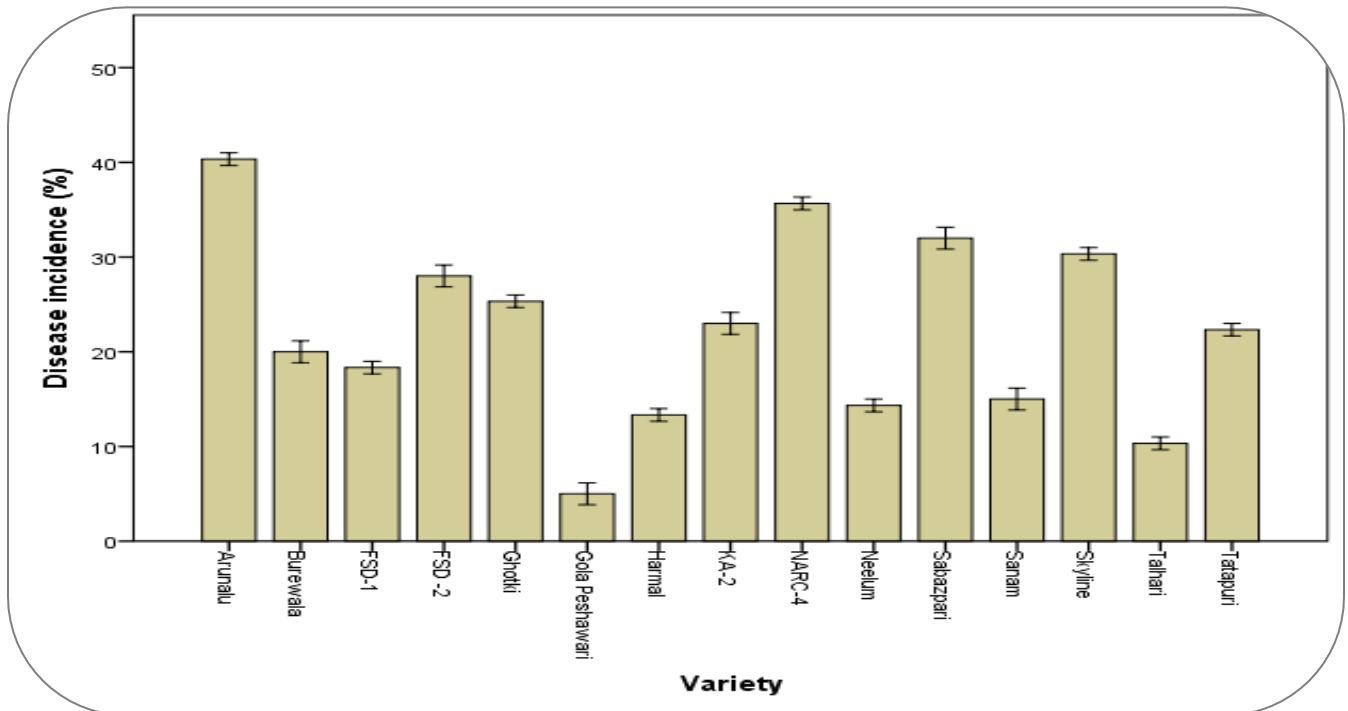


Figure 2. Response of Chilli germplasm against Fusarium wilt during 2013-2014

Table 3. Evaluation of Chilli germplasm against Fusarium wilt during 2013-2014

Sr.#	Varieties/ Lines	Disease incidence (%)	Disease rating	Response
1	Arunalu	42.277a	5	S
2	Burewala	23.347h	4	MS
3	FSD -2	29.417e	4	MS
4	FSD-1	20.160j	3	MR
5	Ghotki	26.253f	4	MS
6	GolaPeshawari	5.500o	2	R
7	Harmal	15.247m	3	MR
8	KA-2	24.530g	4	MS
9	NARC-4	37.493b	5	S
10	Neelum	16.190l	3	MR
11	Sabazpari	34.137c	5	S
12	Sanam	17.277k	3	MR
13	Skyline	32.250d	5	S
14	Talhari	12.313n	3	MR
15	Tatapuri	21.546i	4	MS

MR = Moderately resistant R= Resistant
MS = Moderately susceptible S = Susceptible

DISCUSSION

Now a days increasing population is a serious threat to food sector. So, it is need of hour to meet the requirement of food sector. But plant diseases are a major threat to edible crop. Selection of resistance variety is the most reliable method to control the disease. So, screening of accessible germplasm is the short time procedure when contrasted with developed resistance in plant via breeding techniques.

Current study is the active tool to control the Fusarium wilt of chilies. For this reason, the present research was focused to screen out fifteen varieties/ lines (Arunalu, Burewala, FSD-2, FSD-1, Ghotki, Gola Peshawari, Harmal, KA-2, NARC-4, Neelum, Sabazperi, Sanam, Skyline, Talhari, Tatapuri) of chilies. Golapeshawari exhibited resistant response with 5.10% disease incidence while six varieties/ lines i.e. Talhari (10.30%), Harmal (13.27%), Neelum (14.47%), Burewala (20.13%), Sanam (15.10%), and FSD-1 (18.43%) showed moderately resistant response towards disease. Similarly, four varieties/ lines i.e. FSD -2 (28.10%), Ghotki (25.17%), KA-2 (23.13%), Tatapuri (V%) expressed moderately susceptible response with rating 3 and four varieties/ lines i.e. Arunalu (40.33%), NARC-4(35.67%), Sabazperi (32.13%) and Skyline (30.50%) expressed susceptible response with rating 4 to this disease.

Joshi *et al.*, (2012) conducted a study to screen out wellspring of resistance against Fusarium wilt of bean stew. Among thirty assortments, two were found safe against this disease. Screening of two cultivars (Mae Ping-80 and Long Chili-455) of Chili at Thailand was

performed by Aphinya and Khemika in 2010 to check the resistance of these cultivars against Fusarium wilts. Among these two cultivars Mae Ping-80 was more resistant than Long Chili-455 against F. wilt disease. In another study ten chili germplasm were utilized as research materials to screen out resistant germplasms against Fusarium wilt. Only two chili germplasm showed resistance while other 8 germplasm are susceptible for *F. oxysporum* (Begum, 2007).

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