

## Original Research Article

<https://doi.org/10.20546/ijcmas.2018.709.024>

## Identification of Sources of Resistance in Chickpea (*Cicer arietinum*) against Wilt (*Fusarium oxysporum* f. sp. *ciceri*) under Temperate Agro-Climatic Conditions of Kashmir

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### ABSTRACT

Forty one chickpea genotypes in Chickpea international *Fusarium* wilt nursery 2018 (CIFWN-18), procured from ICARDA were evaluated against wilt caused by *Fusarium oxysporum* f. sp. *ciceri* during Rabi 2018 under temperate agro-climatic conditions of Kashmir. Two genotypes (FLIP10-382C and FLIP11-122C) were found highly resistant while six genotypes viz., FLIP11-23C, FLIP11-24C, FLIP11-77C, FLIP11-90C, FLIP11-150C and FLIP11-176C were Resistant. Twelve genotypes viz., FLIP10-354C FLIP11-69C, FLIP11-52C, FLIP11-115C, FLIP11-123C, FLIP11-121C, FLIP11-83C, FLIP11-124C, FLIP11-142C, FLIP11-149C, FLIP11-159C and FLIP11-172C were moderately resistant while thirteen genotypes viz., FLIP10-350C, FLIP10-357C, FLIP10-376, FLIP10-380C, FLIP11-48C, FLIP11-49C, FLIP11-68C, FLIP11-82C, FLIP11-143C, FLIP11-144C, FLIP11-152, FLIP11-116C and FLIP11-223C were moderately susceptible. Seven genotypes viz., FLIP10-358C, FLIP10-368C, FLIP11-35C, FLIP11-37C, FLIP11-186C, FLIP11-204C and FLIP11-227C were found susceptible and one genotype namely ILC482 was found highly susceptible.

#### Keywords

Chickpea, *Fusarium* wilt, Genotype screening, Kashmir, Temperate agro-climatic conditions

#### Article Info

##### Accepted:

04 August 2018

##### Available Online:

10 September 2018

### Introduction

Chickpea (*Cicer arietinum* L.) is one of the important pulse crop, which rank third after dry beans (*Phaseolus vulgaris* L.) and dry peas (*Pisum sativum* L.) (Dhar and Gurha, 1998).

India is largest producer of chickpea in the world contributing 65.49 per cent in

production and 65.25 per cent in area. In India chickpea is grown on 81.17 lakh hectare of land, producing 59.01 lakh tonnes with a productivity of 727 kg ha<sup>-1</sup> (Anonymous, 2015). Chickpea wilt caused by *Fusarium oxysporum* f. sp. *ciceri* (Foc, Padwick) is a serious soil borne disease (Hossain *et al.*, 2013) and was first reported in Indo-Pak sub-continent by Butler in 1918. It is one of the major constraints in chickpea cultivation

throughout the world especially in Indian sub-continent. Nema and Khare (1973) reported yield loss due to wilt up to 61 per cent if the infection occurs at seedling stage and 43 per cent if the infection occurs at flowering stage. In India, at National level, the yield loss due to wilt may vary between 5 to 10 per cent (Singh and Dahiya, 1973). However, under congenial weather conditions for disease, it may cause complete (100 %) yield loss (Pande *et al.*, 2010; Kumari and Khanna, 2014).

Though reports on different aspects of the disease are available from India and abroad, very scanty information is available on this disease from Jammu and Kashmir. Although various chemical management strategies are available for this disease but they incur high cost and cause environmental hazards and deleterious effects on human health. Identification of resistant genotypes is one of the most suitable, reliable, cheap and eco-friendly method of management of disease and improving the farmers returns. Keeping in view the importance of disease, socio-economic status of the crop and inadequate research work carried out, an attempt was made to identify sources of resistance to the disease in the genotypes procured from ICARDA.

### Materials and Methods

Forty one genotypes including one susceptible check (ILC482) in Chickpea International Elite Nursery 2018 (CIFWN-18) procured from ICARDA were screened against the wilt under natural epiphytotic conditions at FOA, Wadura during Rabi 2017-18. The genotypes were classified into Highly Resistant (HR), Resistant (R), Moderately Resistant (MR), Moderately Susceptible (MS), Susceptible (S) and Highly Susceptible (HS) groups on the basis of their response to disease under natural epiphytotic conditions. Two lines of each genotype were alternated with one line of

check and each entry was planted in two replications. Length of each row was 4 m and width was 0.45 m. The plot was flanked on both sides with double row of highly susceptible check (ILC482). The observation on wilt was recorded as percentage of disease incidence calculated by following formula:

$$\text{Disease incidence (\%)} = \frac{\text{No. of plants exhibiting wilt symptoms}}{\text{Total of total plants observed}} \times 100$$

A scale (0 – 5 point) was used for categorization of genotypes.

### Results and Discussion

The screening of the chickpea (Table 1 and 2) against wilt disease during rabi 2017-2018 indicated that the disease incidence ranged from 0.00 to 64.50 per cent. The highest disease incidence (64.50) was recorded in genotypes ILC482, used as Check while lowest disease incidence (0.00 %) was recorded in genotype FLIP10-382C and FLIP11-122C which were categorised as highly resistant genotypes. Six genotypes *viz.*, FLIP11-23C, FLIP11-24C, FLIP11-77C, FLIP11-90C, FLIP11-150C and FLIP11-176C were resistant where disease incidence varied from 2.75 per cent in genotype FLIP11-24C to 9.00 per cent in genotype FLIP11-176C. Twelve genotypes *viz.*, FLIP10-354C, FLIP11-69C, FLIP11-52C, FLIP11-115C, FLIP11-123C, FLIP11-121C, FLIP11-83C, FLIP11-124C, FLIP11-142C, FLIP11-149C, FLIP11-159C and FLIP11-172C were moderately resistant with disease incidence ranging from 12.00 per cent in genotypes FLIP10-354C to 19.00 per cent in genotype FLIP11-159C. Thirteen genotypes *viz.*, FLIP10-350C, FLIP10-357C, FLIP10-376, FLIP10-380C, FLIP11-48C, FLIP11-49C, FLIP11-68C, FLIP11-82C, FLIP11-143C, FLIP11-144C, FLIP11-152 and FLIP11-223C were moderately susceptible.

**Table.1** Reaction of genotypes to wilt in CIFWN-18

S. No	Genotype	Wilt incidence (%)
01	FLIP10-382C	0
02	FLIP11-122C	0
03	FLIP11-23C	3.00
04	FLIP11-24C	2.75
05	FLIP11-77C	8.00
06	FLIP11-90C	8.25
07	FLIP11-150C	6.75
08	FLIP11-176C	9.00
09	FLIP10-354C	12.00
10	FLIP11-69C	12.33
11	FLIP11-52C	15.75
12	FLIP11-115C	18.00
13	FLIP11-123C	12.50
14	FLIP11-121C	12.75
15	FLIP11-83C	15.50
16	FLIP11-124C	12.5
17	FLIP11-142C	15.50
18	FLIP11-149C	17.25
19	FLIP11-159C	19.00
20	FLIP11-172C	12.75
21	FLIP10-350C	24.75
22	FLIP10-357C	21.00
23	FLIP10-376C	23.50
24	FLIP10-380C	21.00
25	FLIP11-48C	24.00
26	FLIP11-49C	25.50
27	FLIP11-68C	27.75
28	FLIP11-82C	29.00
29	FLIP11-143C	29.00
30	FLIP11-144C	23.25
31	FLIP11-152C	21.75
32	FLIP11-116C	24.75
33	FLIP11-223C	23.00
34	FLIP10-358C	36.00
35	FLIP10-368C	34.25
36	FLIP11-35C	33.25
37	FLIP11-37C	38.00
38	FLIP11-186C	45.00
39	FLIP11-204C	42.90
40	FLIP11-227C	44.00
41	ILC482	64.50

**Table.2** Categorization of chickpea genotypes in CIFWN-18

Category	Reaction	Average wilt incidence	Genotypes/Lines
<b>0</b>	Highly resistant (2)	0	FLIP10-382C and FLIP11-122C
<b>1</b>	Resistant (6)	1-10	FLIP11-23C, FLIP11-24C, FLIP11-77C, FLIP11-90C, FLIP11-150C and FLIP11-176C
<b>2</b>	Moderately resistant (12)	10-20	FLIP10-354C, FLIP11-69C, FLIP11-52C, FLIP11-115C, FLIP11-123C, FLIP11-121C, FLIP11-83C, FLIP11-124C, FLIP11-142C, FLIP11-149C, FLIP11-159C and FLIP11-172C
<b>3</b>	Moderately susceptible (13)	20-30	FLIP10-350C, FLIP10-357C, FLIP10-376, FLIP10-380C, FLIP11-48C, FLIP11-49C, FLIP11-68C, FLIP11-82C, FLIP11-143C, FLIP11-144C, FLIP11-152, FLIP11-116C and FLIP11-223C
<b>4</b>	Susceptible (7)	30-50	FLIP10-358C, FLIP10-368C, FLIP11-35C, FLIP11-37C, FLIP11-186C, FLIP11-204C and FLIP11-227C
<b>5</b>	Highly susceptible (1)	50 & above	ILC482

**Disease categorization rating scale (0 – 5)**

Grade	Per cent mortality	Disease reactions
0	No disease	Highly resistant (HR)
1	1 to 10	Resistant(R)
2	10.1 to 20	Moderately Resistant (MR)
3	20.1 to 30	Moderately Susceptible (MS)
4	30.1 to 50	Susceptible (S)
5	50 and above	Highly Susceptible (HS)

(IIPR, 1999)

Among the moderately susceptible genotypes the disease incidence varied from 21.00 per cent in genotypes FLIP10-357C and FLIP10-380C to 29.00 per cent in genotypes and FLIP11-82C and FLIP11-143C. Seven genotypes viz., FLIP10-358C, FLIP10-368C, FLIP11-35C, FLIP11-37C, FLIP11-186C,

FLIP11-204C and FLIP11-227C were susceptible where disease incidence ranged from 33.25 per cent in genotype FLIP11-35C to 45.00 per cent in genotype FLIP11-186C. One genotype ILC482 was found highly susceptible with disease incidence of 64.50 per cent.

In the present investigation the selection for the resistance was based on the reaction of the genotypes to wilt pathogen, *Fusarium oxysporum* f. sp. *ciceri* under natural epiphytotic conditions and the result indicated that two genotypes were Highly Resistant (HR) and six genotypes were Resistant (R) which could be used as direct introduction or sources of resistance in hybridization programme. Korde, (2011), Mandhare *et al.*, (2011) and Kumar *et al.*, (2012) gave been screened number of chickpea genotypes and identified promising cultivars in India.

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### How to cite this article:

Shifa Showket, Sabiya Bashir, Mohammad Najeeb Mughal, Reyaz-ul-Raouf Mir, F.A. Bhat and Shah, T.A. 2018. Identification of Sources of Resistance in Chickpea (*Cicer arietinum*) against Wilt (*Fusarium oxysporum* f. sp. *ciceri*) under Temperate Agro-Climatic Conditions of Kashmir. *Int.J.Curr.Microbiol.App.Sci.* 7(09): 190-194. doi: <https://doi.org/10.20546/ijcmas.2018.709.024>