International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(3): 498-500

Received: 07-03-2020
Accepted: 09-04-2020

B Manasa
Acharya N.G. Ranga Agricultural University, Guntur, Andhra Pradesh, India

M Shanthi Priya
Acharya N.G. Ranga Agricultural University, Guntur, Andhra Pradesh, India

V Jayalakshmi
Acharya N.G. Ranga Agricultural University, Guntur, Andhra Pradesh, India

P Umamaheswari
Acharya N.G. Ranga Agricultural University, Guntur, Andhra Pradesh, India

Corresponding Author:
B Manasa
Acharya N.G. Ranga Agricultural University, Guntur, Andhra Pradesh, India

Screening of large and extra-large seeded kabuli chickpea genotypes for resistance to *fusarium* wilt under scarce rainfall zone

B Manasa, M Shanthi Priya, V Jayalakshmi and P Umamaheswari

DOI: https://doi.org/10.22271/chemi.2020.v8.i3f.9257

Abstract
30 genotypes were screened against *Fusarium* wilt at RARS, Nandyal in *Fusarium* wilt sick plot. The pathogen is both soil and seed borne and causes about 20-100 per cent losses in crop yield depending upon the stage of infection and incidence of wilt. The disease first appears in patches in the field which later spreads in the entire field. The most appropriate way to manage this disease is using the resistant varieties. For this purpose screening is conducted and the genotypes with resistant, moderately resistant and tolerant were found.

Keywords: Fusarium wilt, screening, resistant and *Kabuli*

Introduction
In *kabuli* chickpea, *Fusarium* wilt, caused by *Fusarium oxysporum* f. sp. *ciceri* is one of the most important diseases and major constraint to production (Nene and Reddy, 1987) [7]. The growing season of chickpea in Andhra Pradesh is characterized by short and warm winters. Keeping in view of the demand from farming community for large seeded *kabulis*, there is a need to initiate breeding and selection for large seeded *kabuli* chickpeas with more productivity, particularly suitable for rainfed as well as irrigated conditions of Andhra Pradesh. Most of the farmers in Andhra Pradesh are growing chickpeas during *rabi* continuously in the same field year after year. In such conditions, the crop gets proned to several soil borne diseases and globally *Fusarium* wilt (FW), caused by *Fusarium oxysporum f. sp ciceri*, is one of the most important and destructive vascular disease of chickpea (Dileep, 1999) [1].

The *Fusarium* wilt disease was first reported in India by Butler in 1918, but its etiology was determined by Padwick in 1940. According to Nene and Haware (1980) [6] and Halila and Strange (1996) [3], *Fusarium* wilt epidemics can be devastating to individual crops and cause up to 100% loss under favorable conditions. Yield losses attributable to *Fusarium* wilt were estimated to about 10% in India (Jamali *et al*., 2004) [2] but can result in total loss of the crop under specific condition (Nene and Haware, 1980; Halila and Strange, 1996) [6, 3].

Management of *Fusarium* wilt in chickpea is difficult, as no single control measure is fully effective. Solarization of soil, advanced sowing date, fungicide treatment and use of FOC-free seed are some of the measures usually employed to control *Fusarium* wilt in chickpea, but with limited success (Navas-Cortes *et al*., 1998) [5]. So the cheapest, cost-efficient and the most ideal way to manage *Fusarium* wilt is the use of resistant cultivars.

However, the high pathogenic variability in populations of F. *oxysporum* f. sp. *ciceri* present problems for the sustainability of resistant cultivars. Screening of the chickpea entries for the development of host plant resistance is best option to manage the disease. There are many sources with high resistance to *Fusarium* wilt available in *desi* type, while resistance sources in *kabuli* type are limited. Some *kabuli* accessions with high resistance to *Fusarium* wilt have been identified (Rubio *et al*., 2003) [8] and in some cases resistance has been introgressed from *desi* cultivars (Kumar *et al*., 1985) [4]. The resistant varieties become susceptible with the passage of time, hence there is a need for continuous screening of chickpea germplasm for resistance against *Fusarium* wilt.

Materials and Methods

All the 30 genotypes of chickpea were sown on 12th November during *rabi* 2018-19 in single row of 3m and spacing of 3cm x 10cm in wilt (*Fusarium oxysporum* f. sp. *ciceri*) sick plot. The genotypes were alternated with susceptible check JG 62 and resistant check WR 315.

The observations on wilt were recorded as percentage of disease incidence by using the following formula:

$$\text{Disease incidence (\%)} = \frac{\text{Number of diseased plants}}{\text{Total number of plants}} \text{ x } 100$$

Categorization of the wilt incidence was done using the disease resistance scale given by Nene *et al*. (1981) of ICRISAT.

Scale	Percent wilting (mortality)
Resistant	:No mortality
Moderately resistant	:10 % or less mortality
Tolerant	:11 % to 20 % mortality
Moderately susceptible	:20 % to 50 % mortality
Susceptible	:51% or more mortality

Results and Discussion

All the thirty genotypes of *kabuli* chickpea were screened in wilt (*Fusarium oxysporum* f. sp. *ciceri*) sick plot to identify the resistant/tolerant genotypes against *Fusarium* wilt. The genotypes were alternated with susceptible check JG 62 and resistant check WR 315. The data pertaining to disease incidence in wilt sick plot presented in Table 1 indicated that out of 30 genotypes, three genotypes *viz.*, NBeG 829, ICCV 171302 and RKGK 499 were moderately resistant (Plate: 1) as they showed a disease incidence of 5.26%, 5.55% and 10%, respectively. NBeG 440 was tolerant (Plate: 2) and showed a disease incidence of 14.28%. All the other 26 genotypes were resistant as they showed zero percentage of disease incidence.

Table 1: Disease incidence (%) of 30 *kabuli* chickpea genotypes and checks against wilt in sick plot

No. of Genotypes	Name of the genotypes	Disease incidence (%)	Categories
26	NBeG 399, NBeG 458, NBeG 719, NBeG 723, NBeG 724, NBeG 789, NBeG 805, NBeG 810, NBeG 833, NBeG 835, NBeG 837, NBeG 844, NBeG 1010, ICCV 171301, ICCV 171303, ICCV 171305, ICCV 171306, ICCV 171313, ICCV 177314, Phule G 15307, NBeG 119, MNK 1, JGK 5, Phule G 0517, KAK 2, Vihar	0	Resistant
3	NBeG 829,	5.26	Moderately resistant
	ICCV 171302,	5.55	
	RKGK 499	10.0	
1	NBeG 440	14.28	Tolerant
Checks			
1	JG 62	100	Susceptible
1	WR 315	0	Resistant

NBeG 829 ICCV 171302 RKGK 499

Plate 1: Resistant and susceptible plants of moderately resistant NBeG 829, ICCV 171302, RKGK 499 genotypes to *Fusarium* wilt.

NBeG 440

Plate 2: Resistant and susceptible plants of tolerant NBeG 440 genotype to *Fusarium* wilt.

Conclusion

Thus screening of genotypes for resistance showed that 26 genotypes *viz*., NBeG 399, NBeG 458, NBeG 719, NBeG 723, NBeG 724, NBeG 789, NBeG 805, NBeG 810, NBeG 833, NBeG 835, NBeG 837, NBeG 844, NBeG 1010, ICCV 171301, ICCV 171303, ICCV 171305, ICCV 171306, ICCV 171313, ICCV 177314, Phule G 15307, NBeG 119, MNK 1, JGK 5, Phule G 0517, KAK 2, Vihar were resistant; NBeG 829, ICCV 171302, RKGK 499 were moderately resistant and NBeG 440 was tolerant to *Fusarium* wilt. Hence, all the genotypes can be used for further breeding programme.

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