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Research Note

Study of fusarium wilt (*Fusarium oxysporum* f. sp. c*iceris)* resistance in recombinant inbred line population of chickpea

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Abstract:
Wilt caused by *Fusarium oxysporum* f. sp. c*iceris* is a devastating disease of chickpea in India. One hundred and 26 Recombinant Inbred Lines (RILs) derived from a cross ICCV-2 x JG 62 along with six checks were evaluated for wilt resistance under unprotected natural infestation to identify the genetic sources for resistance. The genotypes were classified as highly resistant, moderately resistant, intermediate, susceptible and highly susceptible based on per cent plants wilted. Some of genotypes showed high resistance to fusarium wilt. The per cent plants wilted in different lines ranged from O to 100 per cent. A total of 45, 31, 25, 11 and 20 genotypes fell into highly resistant, moderately resistant, intermediate, susceptible and highly susceptible classes respectively. Less proportion of highly resistant genotypes were observed and it may be due to the fact that the wilt resistance was governed by recessive alleles. The resistant genotypes may be exploited for the development of resistant cultivars against wilt.

Key Words:
Wheat, heterosis, heterobeltiosis, grain yield, yield components.

Among the important grain legumes, chickpea (Cicer arietinum L.) is unique because of the variety of food products that are prepared from it in different parts of the world. Chickpea forms an important dietary component in those countries in which it is a major crop. Although most of the world's chickpea production and consumption is in India (70%), the crop is also important in other countries of Asia, Africa, Europe and America (Anonymous, 2002). Although chickpea is premier legume crop of India, its productivity is low (400 kg/ha) due to many biotic factors; pest and diseases and abiotic factors; occurrence terminal drought, shorter period of crop growth, low soil fertility etc.

Of the many diseases that chickpea crop suffers, fusarium wilt is the most destructive, resulting in considerable crop loss every year (Singh and Reddy, 1991). The wilt caused by Fusarium oxysporum f. sp. ciceris is one of the major factors limiting production of this pulse crop. The affected plants exhibit drooping crown, xylem and stem discoloration and root rotting. The disease results in reduced plant population, reduced spear size and sub-optimal yields. It is difficult to successfully control this disease as it is soil borne; further, since most of the high-yielding varieties are susceptible to wilt, the pathogen has spread to all the chickpea-growing areas. Development of resistant varieties is thought to be the most viable strategy to overcome this problem (Yu and Su, 1997). Therefore, a total of 132 genotypes consisting of 126 Recombinant Inbred Lines (RILs) derived from a cross ICCV-2 x JG 62 along with six checks were studied for resistance to wilt under unprotected natural infestation. The *Desi* and *Kabuli* crosses have been widely used for enhancing fusarium wilt resistance in Chickpea. The same attempt was made to identify best performing RILs with resistance to fusarium wilt.

The experimental material for the present study comprised RILs of the cross ICCV2 x JG 62 in their F_{13} generation. ICCV-2 is a *kabuli* line with wilt resistance, bold seeds, early in maturity and with broader leaf size. JG-62 is a *desi* cultivar with wilt susceptible, small seed size, medium late in maturity

and smaller leaf size. The original cross was made at ICRISAT and material was supplied to department of genetics and plant Breeding, agricultural college, Dharwad. The experiment was conducted on conserved moisture in vertisol field in the post rainy season of 2002-2003 at University of Agricultural Sciences, Dharwad (latitude15.26' N, altitude 678 m above mean sea level) in India. 126 RIL's, parents and four checks were planted in an alfa design with three replications. Each plot consisted of two rows of 4 m length with a spacing of 30 cm between the rows and 10 cm between plants to study the reaction of wilt resistance under unprotected natural infestation. The number of plants showing wilt symptoms in each line was recorded in percentage and they are grouped into different classes of wilt resistance based on 1-5 scale. The per cent wilting for each RIL were used to study distribution pattern of RIL's for wilt reaction. The observations also recorded on yield traits viz; seed yield / plant (g) , plant height, number of branches /plant, number of pods / plant and 100 seed weight (g) to identify best performing RILs resistant to fusarium wilt.

All the RILs were screened for their field resistance to fusarium wilt disease under natural infestation during 2002-2003 and the experimental material showed ample variation for wilt reaction (Sidramappa, 2003). During the investigation, per cent wilt incidence in 132 genotypes ranged from 0 to 100 per cent. Based on per cent plant wilted, the genotypes were grouped into different classes as indicated in (Table 1). Among 42 genotypes 26 genotypes rated as highly resistant and had shown very negligible or no wilting and remaining 16 lines showed 10 to 20 per cent wilting. The highly susceptible genotypes showed nearly 100 per cent wilting i.e. no plant remained unwilted. The proportion of highly resistant i.e no wilting genotypes is very less (20%) and it may be due to the fact that the wilt resistance was governed by recessive alleles. Similar results were reported by Girase and Deshmukh (2002).

The frequency distribution of recombinant inbred lines for wilt reaction showed involvement of many minor genes along with major genes governing resistance (Fig.1). The disease reaction of RIL's showed continuous variation suggesting polygenic inheritance of wilt reaction along with major genes (Upadhyaya, 1983a,b). Recently a number of studies using molecular markers has indicated presence of quantitative loci influencing wilt resistance in chickpea (Gowda *et al.,* 2009). There should be genes with minor effects that modify the disease response.

The genotypes which perform better than check varieties with respect to yield and their attributing traits and resistant to wilt were identified (Table 2). Of these five potential RILs identified, some are *kabuli* type and some are *desi* type. Further, some are moderately resistant & highly resistant to fusarium wilt. From the resistance and productivity point of view, RIL number 23 (*desi*), 55 (*kabuli*) and 63 (*kabuli*) are desirable. The higher productivity with high resistance to wilt disease in these lines is due to better introgression of *desi* and *kabuli* germplasm as evident from higher mean performance (Katiyar, R. P., 1978). The potential RIL's identified in the present study may be subjected to large scale yield trails for confirming their potentiality. These lines can be further used to study the inheritance of wilt resistance and also can be used as source for wilt resistance.

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Table 1. Classification of chickpea RIL's based on per cent plants wilted

Class	Per cent plants wilted	No.of genotypes
Highly resistant	0 - 20	42
Moderately resistant	21 – 40	28
Intermediate	41 – 60	25
Susceptible	61 – 80	11
High susceptible	81 – 100	20

Table 2. Better performing recombinant inbred lines of chickpea with respect to seed yield and their related traits and resistance to wilt.

RIL N0.	Plant height (cm)	Days 50 per cent flowering	Days to physiological maturity	Duration of reproductive period	Number of pods	100 - seed weight (g)	Seed yield (g)	Reaction to wilt	Seed type
23	40.20	36.00	88.00	55.00	162.50	21.13	28.08	HR	D
24	43.00	37.00	89.00	55.00	109.50	22.21	30.30	MR	D
51	50.00	43.50	94.00	54.50	75.50	26.40	33.49	MR	K
55	49.20	47.00	99.00	56.00	119.00	25.70	29.03	HR	K
63	51.60	48.50	96.50	52.00	134.00	25.40	28.63	HR	K
Checks									
ICCV-2	40.60	37.00	82.50	47.50	48.00	24.28	12.90	HR	K
ICCV 10	32.50	59.00	96.00	41.50	49.00	18.40	13.68	HR	D

HR -Highly resistant; MR-Moderately resistant; INT-Intermediate; S- Susceptible; HS-Highly Susceptible
D-*Desi* type; K-*Kabuli* type