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Screening of Chickpea Genotypes for Dry Root Rot Resistance under Laboratory and Field Conditions

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ABSTRACT

A total of one hundred and forty seven chickpea genotypes were screened against dry root rot incidence caused by *Macrophomina phaseolina* under lab condition using blotter technique. None of the genotypes showed resistant reaction, while twenty three genotypes viz., BG 3055, GNG 2258, Phule G 12107, GJG 1202, GJG 1205, IPC 2010-112, DIBG 201, GJG 1207, Phule G 0611, BG 372, GJG 1208, IPC 2010-134, BG 3054, NDG 13-21, JGK 30, JGK 31, Phule G 12404, JGK 29, HK 4, GNG 1969, GNG 2207, BG 3044 and RSG 931 showed moderately resistance reaction. Out of two hundred and three genotypes screened under sick plot condition for dry root rot incidence, none of the genotypes showed resistance reaction. Whereas ten genotypes *viz*., ICCV05534, IPC 2010-72, IPC 2010-112, Phule G 0302, BG 3056, PG 071, BG 3059, ICCV 08412, ICCV08114 and IC 83325 showed moderate resistance**.**

Chickpea (*Cicer arietinum* L.), also known as Gram or Bengal gram, is the second most important pulse crop in the world, India accounting for 60 to 75% of the world's chickpea production. Chickpea seeds contain high quality easily digestible protein (25 per cent) and carbohydrates (20 per cent) making it an important source of protein. Thus it is also called as "Poor man's meat." In India it is grown in an area of about 9.51 millionha with a production of 8.83 million tonnes and a productivity of 929 kg/ ha. In Karnataka it is grown in 0.8 million ha with production of 0.38 million tonnes and productivity of 473 kg/ha (Singh, 2013).

The crop is vulnerable to a number of diseases, some of which may be devastating. Chickpea suffers from about 172 pathogens consisting of fungi, bacteria, viruses and nematodes.Dry root rot of chickpea caused by *M. phaseolina* is a major constraint in chickpea production as it is emerging as a potential threat to chickpea cultivation in semi-arid regions because the host plant is predisposed to infection by moisture stress and high temperatures during the flowering to pod filling stage. The annual yield loss due to this disease alone is 10–20 per cent (Vishwadhar and Chaudhary, 2001). Use of host plant resistance is the most economical approach for the management of dry root in chickpea. A few chickpea lines with field tolerance to dry root rot have been identified, but high levels of resistance are scarce in cultivated genotypes (Reddy *et al*., 1991). Keeping this in view the present investigations were undertaken to evaluate performance of chickpea genotypes against dry root rot by using blotter paper technique and field screening.

The culture of *M. Phaseolina* was inoculated to 250 ml Potato dextrose broth and incubated for seven days at room temperature. The mycelial mat from flask was removed and macerated by adding 100 ml of distilled water. Seven days old seedlings of different genotypes including susceptible checks (BG212 and L550) were uprooted, roots were immersed in the inoculum of *M. phaseolina* for a minute and placed in between blotter papers.Later, incubated at 35^0 C for eight days under 12h of light and dark condition, 80 per cent RH. The blotters were moistened with sterile water everyday. On the eighth day, the seedlings were examined for lesions on root and scored for the disease severity. Disease severity was scored by using 1-9 scale (Nene *et al.,* 1981). Based on the disease score the genotypes were grouped as mentioned below (Table I).

A total of two hundred and three chickpea genotypes were screened in *M. phaseolina* sick plot field at G.K.V.K., Bengaluru, during *rabi* season of 2014-2015. Each genotype was sown in five meter row length. After every five test entries one line of

TABLE I

Categorization of chickpea genotypes into different disease reactions

Rating	Category	Symptoms
1	Resistant	No infection on roots
3	Moderately resistant	Very few small lesions on roots
5	Moderately susceptible	Lesions on roots clear but small, new roots free from infection
7	Susceptible	Lesions on roots many, new roots generally free from lesions
9	highly susceptible	Roots infected and completely discoloured

susceptible check L550 was sown. At the time of sowing giant culture of *M. phaseolina* of Bangalore isolate was incorporated to the soil to improve sickness

$$\text{Per cent disease incidence} = \frac{\text{Number of plants infected}}{\text{Total number of plants observed}} \times 100$$

of the soil. Observations on per cent dry root rot incidence were recorded from pod formation to maturity stage. The following formula was used to calculate dry root rot disease incidence After estimating disease incidence, the entries were categorized into different disease reactions as given by Riyaz Ahmad Khan *et al*. (2013).

Among one hundred and forty seven chickpea genotypes screened for host plant resistance against dry root rot incidence under lab condition using blotter technique, none of the entries showed resistant reaction, while twenty three entries *viz.,* BG 3055, GNG 2258, Phule G 12107, GJG 1202, GJG 1205, IPC 2010-112, DIBG 201, GJG 1207, Phule G 0611, BG 372, GJG 1208, IPC 2010-134, BG 3054, NDG 13-21, JGK 30, JGK 31, Phule G 12404, JGK 29, HK 4, GNG 1969, GNG 2207, BG 3044 and RSG 931 showed moderately resistant reaction (Table II). The present findings are well supported by the field and blotter screening., Saifulla *et al*. (2011) screened chickpea entries for dry root rot under field condition and found that 21 entries *viz*., GNG 1861, Phule G 07112, BGD1056(R), RSG 931, Phule G 07101, Vijay, RSG 888 ,GJG 0825, PG064, GNG 1947, JG 1307, GBC 6 (AVT-1), GNG 2002, GNG 1936, CSJ 313, JG 18, HIR 60, JG 11, ICCV 07107 and ICCV 08323 were resistant and 36 entries were found moderately resistant to dry root rot out of 196 genotypes screened. Out of forty seven lines screened against dry root rot of chickpea, three genotypes were resistant, 22 were moderately resistant, 19 susceptible and three highly susceptible under blotter paper technique (Pande *et al*., 2004).

Out of two hundred and three genotypes screened under sick plot condition for dry root rot incidence, none of the genotypes showed resistance reaction. While, ten genotypes *viz*., ICCV05534, IPC 2010-72, IPC 2010-112, Phule G 0302, BG 3056, PG 071, BG 3059, ICCV 08412, ICCV08114 and IC 83325 showed moderately resistance reaction (Table III). Similarly Nagamma and Saifulla (2012) screened sixty four Kabuli genotypes against dry root rot and found six

TABLE II

Disease reaction of chickpea entries for dry root rot under blotter paper technique

No. of genotypes	Reaction	Genotypes
0	R	——
23	MR	BG 3055, GNG 2258, Phule G 12107, GJG 1202, GJG 1205, IPC 2010 -2012, DIBG 201, GJ 1207, Phule G 0611, BG 372, GJG1208, IPC 2010-134, BG 3054, NDG 13-21, JGK 30, JGK 31,m Phule G 12404,JGK 29, HK 4, GNG 1969, GNG 2207, BG 3044 and RSG 931
65	MS	——
45	S	——
14	HS	——
Total No. of genotypes		147

TABLE III

Disease reaction of chickpea genotypes for dry root rot under field condition

Disease incidence	Reaction	No. of genotypes	Genotype name
0-10%	Resistant	0	———
11-20%	Moderately Resistant	10	ICCV05534, IPC 2010-72, IPC 2010-112, Phule G 0302, BG 3056, PG 071, BG 3059, ICCV 08412, ICCV08114 and IC 83325
21-30%	Moderately Susceptible	20	——
31-50%	Susceptible	57	——
51-100%	Highly Susceptible	116	——
Total No. of genotypes		203	

genotypes *viz*., Phule G 04305, IPCK 07-62, RVSSG 12, HK 08-212, Phule G 09305 and AKG 2002-1K showed resistant reaction, nine genotypes *viz*., HK 94-134, GNG 1888, HK 06-152, GNG 2112, HK 06-171, Phule G 09316, CSJK 74, JGK 13 and CSJK 70 showed moderately resistant reaction. Cultivation of resistant varieties is an economical approach for the management of dry root rot of chickpea, but, only a few sources with low level of genetic resistance are available. Management can be made feasible and cost effective by identification of new resistant sources as this is the only alternative method so as to combat the disease, even though chemical control plays an important role in modern agriculture for disease management (Gupta *et al*., 1997).

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