

## Original Research Article

# Studies on Host Plant Resistant Sources of Soil Borne Diseases of Chickpea against Collar rot, Vascular Wilt and Dry root rot

Akhilesh Jagre\*, Girraj Prasad Nagar and Om Gupta

Department of plant pathology, JNKVV, Jabalpur, M.P.482004, India

\*Corresponding author

## ABSTRACT

Studies on host plant resistance source of soil borne diseases of chickpea against collar rot, vascular wilt and dry root rot under wilt sick field and different inoculation techniques employed revealed that among 159 entries (98 desi and kabuli 61) screened for locating the resistant sources 9 entries. viz. BDNG 2010-I, GNG-2064, IPC-08-11, H08-93, BG-3030, BG-D 1069, GNG-2002, GNG-2085, GNG-0921 of desi type and 2 kabuli type (HK-08-212, GLK 28-127) were found resistant to wilt. Fourteen entries of desi chickpea viz GJG 0809, GNG 1958, GL 27104, IPS 06127, PG 0105, GNG 2065, Phule G 0204, IPC 07-19, H-08-13, GNG 2068, IPC 07-09, GJG 0907, GL 27091, IPC 06-127, GNG 1581 and 15 Kabuli type entries namely CSJK 68, HK 06 -171, phuleG-09311, IPCK 08 120, IPCK 06-78, CSJK-54, GLK 26162, H K 06 152, Phul e G 09316, HK 08-212, CSJK 74, IPS-06-163, RVSSG 11, GNG 2112, IPS-06-143 were found resistant) were found resistant to collar rot. Four entries viz. GJG 09 809, CSJ 303, GJG-0910, IPCK 06-56 of desi type and 14 Kabuli type (IPCK 06-78, CSJK 4, IPCK06-56 HK08-231, BG3025, GLK 28127, GLK 26167, Vihar (phule G 95311) IPCK 08-120, JGK 19, CSJK 66, JGK 18, CSJK 72, CSJK 7) were found resistant to dry root rot. Besides resistance for individual disease genotype viz BDNG 2010-1, GNG 2064, BG 3004, RIPC 08-11, H 08-93, BGD 1069, GNG 2002, GNG 0921. (vascular wilt and dry root rot.) and BGD 1071 Phule G 09316 (Collar rot and Vascular wilt) were found dual resistant GLK 2 was found multiple disease resistance.

## Keywords

Chickpea,  
Collar rot,  
Vascular wilt,  
Dry root rot,  
Host resistance  
source

## Introduction

Chickpea (*Cicer arietinum* L.) is an important pulse crop, which belongs to Leguminosae family, ranking third after dry beans (*Phaseolus vulgaris* L.) and dry peas (*Pisum sativum* L.) (Dhar and Gurha, 1998). The Kabuli and Desi chickpea is grown throughout the world with different names i.e. Chickpea (UK), Garbanzo (Latin America), Bengal gram (India), Hommes, Hamaz (Arab world), Shimbra (Ethiopia) and Nohud and Loblebi (Turkey). Chickpea is self-pollinated rabi crop, upto 1% cross pollinated (Smithson *et al.*, 1985; Singh,

1987). The desi chickpea contribute to around 80 per cent of the total production.

India is the largest producer of chickpea contributing around 70 per cent (6.2 m. tones) of the world's total production. Chickpea is affected by several seed, soil and air borne diseases which is responsible for lowering its yield. Soil borne pathogens like *Sclerotium rolfsii* (Collar rot), *Fusarium oxysporium* f. sp. *ciceri* (Vascular wilt) and *Rhizoctonia bataticola* (Dry root rot) are responsible for causing diseases from

seedling to flowering and pod formation stage. Collar rot caused by *Sclerotium rolfsii* Sacc. is an important soil borne disease of chickpea causing seed rot and seedling mortality in the initial stage of crop growth up to 45 days. The mortality ranges from 54.7- 95 per cent in India (Kotasthane *et al.*, 1976) causing significant reduction in plant population. The first report of occurrence of root rot in chickpea along with wilt was made by Padwick (1948). The species *Rhizoctonia bataticola* responsible for serious diseases (Mukharji and Bhasin, 1986). Gupta *et al.*, (1983) reported incidence of root rot ranging 3.58 to 20.63 percent in 30 villages of Northern Madhya Pradesh. The disease is more severe at pod formation and grain filling stage especially under stress condition and causes forced maturity resulting reduced seed size. The present investigation were, therefore undertaken to know. The host plant resistance source of soil borne diseases of chickpea against collar rot, vascular wilt and dry root rot under wilt sick field and different inoculation techniques.

### **Materials and Methods**

Present investigations were undertaken to study the studies on host plant resistant sources against collar rot, vascular wilt and dry root rot. The experiment was conducted in multiple disease sick field under AICRP on chickpea at seed breeding farm, JNKVV Jabalpur during 2011-2012. Screening of chickpea genotypes against collar rot in Net house. The mass culturing of the pathogen was done on sterilized chickpea straw inoculated with culture of *S. rolfsii* and incubated at room temperature ( $25\pm 2^{\circ}\text{C}$ ) for 7 days to obtain the profuse and dense growth of fungal mycelium and sclerotia. The inoculum was thoroughly mixed in sterilized sand + soil (1:1) @ 100 g/ 2 kg soil. The inoculated soil was filled in trays

and incubated for 5 days in pot house. Ten chickpea seeds were sown for each genotype. The pots were watered from time to time and observations were recorded on emergence plant count, percent of seed rot and seedling mortality due to collar rot (up to 30 DAS).

Screening of chickpea genotypes against wilt and dry root rot resistance under multiple disease sick fields. In order to identify the sources of resistance the chickpea lines were screened in disease sick plot which was prepared by adding the culture of *F. oxysporum* f. sp. *ciceri* in chickpea straw and sand medium. The culture was mixed in the soil (1:9) then added in each row before sowing.

The experiment was conducted against *Fusarium* wilt resistance in randomized block design (RBD) in 2 replications under wilt sick field. For each test line, 40 seeds entry of different trials i.e.

Advanced varietal trial (Desi), Initial varietal trial (Desi), Advanced varietal trial (Late sown), Initial varietal trial (Late sown), Initial varietal trial (Rainfed), Advanced varietal trial (Kabuli), Initial varietal trial (Kabuli), Initial varietal trial for extra-large seeded Kabuli (EISK), National Nursery Wilt (NNW) were sown in 4 m. long row with seed to seed spacing of 10 cm and row to row spacing of 30 cm.

A susceptible check of JG 62 (early wilter) was maintained after every 2 rows of test entries for comparison (Nene *et al.*, 1981). Additionally a wilt resistant cultivar JG 315 was also sown in each trial for comparing the level of resistance in the test entries of the trials. Sowing was done on 20<sup>th</sup> Nov. 2011 after applying recommended dose of fertilizer. One come up irrigation was given to the crop. Observations on per cent

emergence were recorded after 20 days of sowing and mortality due to vascular wilt were recorded weekly up to podding stage. The crop was harvested in the maturity stage (April, 2012).

### **Percent mortality**

Percent mortality was calculated by using the following formula;

$$\text{Percent mortality} = \frac{\text{Number of diseased plants}}{\text{Total number of seedlings}} \times 100$$

### **Results and Discussion**

To identify the sources of host resistance against collar rot, vascular wilt and dry root rot pathogen, 159 lines comprising of 98 desi and 61 kabuli chickpea lines were screened along with resistant JG 315 and susceptible check JG 62 in artificially inoculated condition in Net house, Sick field and Blotter paper techniques, respectively. Each entry was sown in two replications. Observation on emergence count and plant mortality due to collar rot, vascular wilt and dry root rot were recorded after 20 days of sowing and at 7 days interval up to pod filling stage respectively. The lines exhibiting.

#### **Collar rot (desi genotype)**

Among the 98 entries desi type screened for collar rot, 15 entries namely GJG 0809, GNG 1958, GL 27104, IPS 06127, PG 0105, GNG 2065, Phule G 0204, IPC 07-19, H-08-13, GNG 2068, IPC 07-09, GJG 0907, GL 27091, IPC 06-127, GNG 1581. were found resistant and 16 entries as moderately resistant i.e. Phule G 07102, H 07163, GL 26054, GNG 1999, GJG 092, GNG-0921, JG 24, Phule G 02152, GJG 0907, GSJ 313, RVSSG 10, GJG 0809, GJG 0814, H 08 75,

CSJ 515 BG 3023 NDG 1105 to collar rot. Seedling mortality due to collar rot ranged from 0.0 to 89.9 per cent and seed rot ranged from 0 to 40 percent while in resistant check (JG 315) it was 12.5 per cent in susceptible check (JG 62) 78.4 per cent mortality was observed.

#### **Collar rot (kabuli genotypes)**

Among the 61 entries (kabuli) evaluated out of which 15 entries namely CSJK 68, HK 06 -171, phuleG-09311, IPCK 08 120, IPCK 06-78, CSJK-54, GLK 26162, H K 06 152, Phule G 09316, HK 08-212, CSJK 74, IPS-06-163, RVSSG 11, GNG 2112, IPS-06-143 were found resistant and 7 entries *i.e.* (HK 08-231, BG 3025, GNG 2104, Phule G 04305, CSJK 6, IPCK 06-56, GNG 1969) as moderately resistant.

The collar rot disease incidence ranged from 10.0 to 94.7, per cent and seed rot range from 0.0 to 30 per cent. Resistant check (JG 315) mortality 11.0 percent and susceptible check (JG 62) mortality 61.2 per cent were recorded.

#### **Vascular wilt (desi genotype)**

In this trial 98 desi entries were evaluated for wilt resistance among them 9 entries *viz*, BDNG 2010-1, GNG 2064, IPC 08-11, H 093, BGD 1069, GNG 2002, GNG 2085, BG-3030, H 08-13. were exhibited resistant and 12 entries namely *viz* JG 24, AKG 1001, BG 30040, JG 25, CSJ 513, H 08-71, BGD 1061, GJG 0922, IPC 07-56, GNG 0921, GNG 0910, BCP-60 were found to be moderately resistant.

The disease incidence ranged from 6.5 to 98.2 percent. Hundred percent wilting was observed in susceptible check JG 62 whereas in resistant check (7.5 %). (Table 6) Vascular.

**Disease reaction – collar rot, vascular wilt and dry root rot**

Rating	Category	Reaction type	Percent mortality (%)
1	R	Resistant	0-10
2	MR	Moderately resistant	10.1-20
3	TR	Tolerant	20.1-40
4	S	Susceptible	40.1-60
5	HS	Highly susceptible	60.0 and above

**Wilt (kabuli genotype)**

In this trial Out of the 61 (Kabuli) entries evaluated one HK 08-212, were found resistant and 4 entries i.e. CSJK 74, CSJK 72, JGK 16, CSJK 66, were found moderately resistant. The disease incidence ranged from 5.5 to 94.8 percent. The mortality was 11.5 per cent in resistant check JG 315 and 69.0 per cent susceptible check BG 212.

**Dry root rot (desi genotype)**

Out of 98 desi entries were screened for dry root rot, among them 48 entries showed resistant reaction and 28 entries as moderately resistant. The disease incidence ranged from 1.9 to 54.5 percentages. The percent mortality due to dry root rot in susceptible check BG 212 has been observed 66.3 percent. The least severity index (LSI) remained below 20 percent hence the entries exhibiting resistant and moderately resistant reaction to the disease were not consider to draw any conclusion on the basis of field data.

**Dry root rot (kabuli genotype)**

Among the 61 Kabuli entries 18 i.e. CSJK 54, GNG 2104, HK 08-212, CSJK 74, GNG 2047, IPC 06-143, GLK 26162, HK 06-152, CSJK 66, GNG 1969, GLK 26155, BG 3012, HK 08-206, JGK 13, IPCK 08-120, CSJK 70, JGK 19, BG 3027 were resistant and 23 entries namely (JGK 2005-301,

CSJK 6, JGK 2003-04, Phule G 09305, CSJK-1, GNG 2034, vihar (Phule G 95311), CSJK 68, RVSSG 11. GNG 2112, Kripa (Phule G 0517), HK 08-206, JGK 18, JGK 16, IPCK 08-136, Phule G 09316, HK 6-163, HK 07-234, Phule G 0027, CSJK 66, BG 3027) were moderately resistant. The disease incidence ranged from 4.1 to 69.4 percent. To find out the host resistance sources 98 chickpea (desi) entries and 61 kabuli entries were evaluated against dry root rot. Among them five (5 desi) entries viz GJG 0910, IPCK 06-78, CSJK-42, IPCK 06-56, GNG 1969 and 13 kabuli entries IPCK 06-78, CSJK 4, IPCK 06 -56, HK 08-231, BG 3025, GLK 28127, GLK 26167, Vihar (Phule G 95311), IPCK 08-120, JGK 19, CSJK 66, JGK18, CSJK 72 were found to be resistant. Prajapati *et al.*, (2003) also evaluated 45 chickpea cultivars for their resistance and recorded that to dry root rot among these, H 355, JG 315, Pusa 212, G 543, ICC 32, BG 244, Phule G 5, ICC 2644, 10384, 11224, 10630 and 11332, ICCV 10, ICC 12441 and 12263, 81010 and 81002, Avrodhi, ILC 702 and ILC 200 cultivars were resistant. Screening studies made by Gupta *et al.*, (2012) conducted that out of 170 accessions, 68 genotypes exhibited resistant reaction (<10% mortality), out of which 26 are the promising lines namely (JG1-14, 2-125, 2-4-110, 14-11, 14-10, 2001-13, 2001-13, 2001-18, 2001-80, 2001-115, 2002-20, 2003-95, 2003-14-16, 2004-110, 210, 9605, 1-9, 99-115, 2001-04, 2003-14-2, JG 2000-07, JSC 37, MPJG89-11551, MPJG 89-9023, CSJ

592. Similarly the entries evaluated against collar rot resulted that 15 of desi type (GJG 0809, GNG 1958, GL 27104, IPS 06127, PG 0105, GNG 2065, Phule G 0204, IPC 07-19, H-08-13, GNG 2068, IPC 07-09, GJG 0907, GL 27091, IPC 06-127, GNG 1581) and 13 in kabuli type which 15 entries namely CSJK 68, HK 06-171, phuleG-09311, IPCK 08 120, IPCK 06-78, CSJK-54, GLK 26162, H K 06 152, Phul e G 09316, HK 08-212, CSJK 74, IPS-06-163, RVSSG 11, GNG 2112, IPS-06-143 were found resistant) were found resistant.

Possible sources of resistance to collar rot has been reported by other workers from different places on the basis of pot inoculation and field screening techniques (Karat *et al.*, 1985, Chittle *et al.*, 1990 Sugha *et al.*, 1991, Gupta and Babbar, 2003 and Husain *et al.*, 2005. Gupta and Babbar (2006) have reported resistant lines for wilt and dry root rot in desi and kabuli chickpea. Studies on vascular wilt resistant exhibited nine entries desi and two entries kabuli entries were found resistant. Chaudhary *et al.*, (2007) screened 196 chickpea germplasm lines/cultivars for resistance to wilt disease in a wilt sick plot.

None of the test line was found immune or highly resistant. Gangwar *et al.*, (2002) screened 35 chickpea cultivars for resistance to dry root rot caused by *Rhizoctonia bataticola* in a field experiment. All the cultivars exhibited disease symptoms, only 10 cultivars (ICC 2644, 10384, 10630, 112244, 11332, ICCL 81002, 810810, ICC 12263, 12441 and ICCV 90254) were resistant whereas 5 genotypes (GCP 9504, Phule G 96020, 96105, 96313 and GL 91059) were moderately resistant to dry root rot. Dua *et al.*, (2008) have also reported identified promising chickpea lines had combined resistance against collar rot, wilt and dry root rot.

## References

- Chaudhary, MA, M.B. Ilyas, F. Muhammad and M.U. Ghazanfar 2007. Sources of resistance in chickpea germplasm against Fusarium wilt. *Mycopath* 5(1):17-21
- Chittle, Kalpna, R.N.S. Tyagi and R. D. Singh 1990. Reaction of Chickpea cultivars to Collar rot disease induced by *Sclerotium rolfsii*. *Indian J. Mycol. Pl.Patho*, 20 (3): 262 – 263.
- Dhar, V. and S.N. Gurha, 1998. Integrated Management of Chickipea Diseases. *Journal Phytopathology* 65:13-37
- Dua, R. P., H. L. Raiger, S. K. Mishra. S. K. Sharma and O. P. Dahiya, 2008. Sources for multipledisease resistance in chickpea (*Cicer arietinum*) germplasm. *I Indian Journal of Agricultural Sciences*. 78: 8, 684-689.
- Gangwar, R.K., R.K. Prajapati, S.S.L. Shrivastava, Kumud Kumar and K. Kumar, 2002. Resistance in chickpea germplasms against dry root rot. *Ann. of plant prot. sci.* 10(2): 393-394.
- Gupta, Om and Anita Babbar 2006. Identification of desi and kabuli chickpea genotypes for multiple disease resistance against soil bornediseases. *Indian Journal of Pulses Research*. 19 (1): 129 – 130.
- Gupta, R.N., J.S. Gupta and B.L. Sharma 1983. Studies on wilt and root rot incidence of *Cicer arietinum* of Madhya Pradesh. *Indian phytopathology*. 36(1): 82-84.
- Karat, K.P.R; R. Venugopal; J. V. Goud 1985. Identification of field resistance and symptomatology for collar rot of cowpea caused by *Sclerotium rolfsii* under natural conditions. *Plant Pathology – Newsletter*. 1985, 3: 1 – 2, 23.
- Kotasthane, S.R., P. S. Agrawal, L. K. Joshi and Laxman, Singh 1976. Studies on

- wilt complex in Bengal gram. *Research Journal*. 10: 257 – 258.
- Mukharji, K. G. and J. Bhasin 1986. Plant Disease in India. Today and Tomorrow Publisher, New Delhi. pp. 8-14.
- Prajapati, R.K, S.S.L. Shrivastava and R.K. Gangwar 2003. Resistant source of chickpea against dry root rot. *Farm Science J*. 12(1): 86.
- Sugha, S. K., B. K, Sharma and P. D, Tyagi 1991. A modified techniques for screening Chickpea (*Cicer arietinum*) varieties against collar rot caused by *Sclerotium rolfsii*. *Indian Journal of Agriculture Science*, 61: 4. 289- 290.