

Original Research Article

Screening of Chickpea (*Cicer arietinum* L.) Genotype against Dry Root Rot through Blotter Paper Technique *In-vitro* Condition

Akhilesh Jagre*, Girraj Prasad Nagar and Om Gupta

Department of Plant Pathology, Jawahar Lal Nehru Krishi Vishwa Vidyalaya,
Jabalpur – 482004, India

*Corresponding author

ABSTRACT

Chickpea (*Cicer arietinum* L.) is an important pulse crop, which belongs to family leguminosae, ranking third among pulse crops in India. Screening of chickpea genotypes against dry root rot through Blotter paper technique (*in vitro*) Blotter paper technique was employed. In order to find out the resistant genotype of chickpea, test lines were scored at the end of the incubation period by examining the seedlings for the extent of root damage and were scored for the disease. In order to find out the resistant genotype against dry root rot 98 chickpea (desi) entries were evaluated. In-vitro conditions among them 5 entries were found to be resistant. Exhibiting, less than 10 percent disease incidence whereas 42 entries were found to be moderately resistant. The disease incidence ranged from 10.1 to 20 percent. In this trial 61 (Kabuli) entries were evaluated, out of which 14 lines were found resistant whereas 25 entries were found moderately resistant showing 10.1-20 percent disease incidence.

Keywords

Chickpea, *In vitro*, Dry root rot, Blotter paper Technique

Introduction

Chickpea (*Cicer arietinum* L.) is an important pulse crop, which belongs to family fabaceae sub family leguminosae, ranking third after dry beans (*Phaseolus vulgaris* L.) and dry peas (*Pisum sativum* L.) (Dhar and Gurha, 1998). Chickpea is self-pollinated rabi crop, upto 1% cross pollinated (Smithson *et al.*, 1985; Singh, 1987).

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 oxysporum* f. sp. *ciceri* (Vascular wilt) and *Rhizoctonia bataticola* (Dry root rot) are responsible for causing diseases from seedling to flowering and pod formation

stage *Fusarium* wilt caused by *Fusarium oxysporum* f. sp. *ciceri* is the most important disease of chickpea throughout the world particularly in the Indian subcontinent, the Mediterranean basin and California (Haware 1990, Nene *et al.* 1987). *Fusarium* wilt caused by *Fusarium oxysporum* f. sp. *ciceri* is the most important disease of chickpea throughout the world particularly in the Indian subcontinent, the Mediterranean basin and California (Haware 1990, Nene *et al.*, 1987).

The disease causes annual yield losses up to 10 per cent in India (Singh and Dahiya, 1973). However, under favourable condition the pathogen may destroy the crop completely. The disease can occur at all the

stage of plant growth right from seedling to maturity and causes annual yield losses of 10-90 per cent annually (Jalali and Chand, 1992, Jimmez *et al.*, 1989). In susceptible genotypes, under favourable environmental conditions, wilt causes 100 per cent yield losses (Haware, 1990). The first report of the occurrence of root rot in chickpea along with wilt was made by Padwick (1948). The incidence of root rot ranging from 3.58 to 20.63 per cent in 30 villages of northern Madhya Pradesh was reported by Gupta *et al.*, (1983). Nene (1988) has developed three screening techniques *viz.* sick plot, pot culture and water culture. The pot and water culture techniques are usually adopted to supplement field screening test.

Keeping above evidences in our mind we assume that the suitable cultivar must be screen and get popularize to the farmers for fulfillment demand of pulses in India. This trail was design with aimed at study on screening of chickpea genotype against dry root rot through blotter paper technique *in-vitro* condition.

Materials and Methods

Samples were brought into the pathology laboratory running under 'AICRP on chickpea' in Department of Plant Breeding and Genetics for isolation and further studies at JNKVV Jabalpur 2012.

General Material

Borosil make glassware's were used throughout the investigation. These were cleaned with detergent powder followed by rinsing in tap and distilled water. Glassware's were then sterilized in hot air oven at 180°C for 2 hrs. The inoculation needle and other metallic instruments were sterilized by dipping them in alcohol and heating over flame. All precautionary

measures were applied to sterilized the inoculation chamber. The culture media were sterilized in an autoclave at 6.8 kg pressure per square centimeter (15 lbs psi) for 20 min at 121.6°C. The soil and sand were sterilized at 13.620 kg pressure per square centimeter (30 lbs psi) for two hours for two consecutive days. The roots of diseased plants were thoroughly washed with tap water and cut into pieces. Root pieces of samples were surface sterilized by dipping them in 1:1000 mercuric chloride solutions for 1-2 minutes followed by three washing in sterilized water. The petriplates containing the media were stored for 24 hrs before use to avoid the possibility of contamination. After isolation culture of isolates were maintained on PDA medium for further investigations.

Culture Media

The following media were used during the course of investigation and the compositions of media are given below.

Potato Dextrose Agar medium (PDA)

Potato (Peeled and sliced) - 200 g.
Dextrose - 20 g
Agar Agar - 20 g
Distilled water - 1000 ml

Potato Dextrose Broth

Peeled potato - 200 g
Dextrose - 20 g
Water - 1000 ml

Screening of chickpea genotypes against dry root rot through Blotter paper technique (*in vitro*) Blotter paper technique was employed (Nene *et al.*, 1981). For this purpose 5 mm disc of the culture was placed on PDA poured petriplates and incubated at 25°C for 4 days. Five mm disc was cut from the

above culture and transferred to 250 ml flasks each containing 100 ml P. D. broth. After 5 days of incubation at 25°C two mycelial mats were removed from the flask which were added to 100 ml sterilized distilled water in a beaker after its proper crushing for 1 minute in the blender. Surface sterilized seeds of different chickpea genotypes were sown on plastic trays containing sterilized soil + sand (1:1). Five days old seedlings of each genotype were uprooted in such a way so that root system is not disturbed. The root system of these seedlings was properly washed in running water followed by rinsing in sterilized distilled water. The roots of all genotypes (test lines) were dipped in the inoculum kept in a beaker with an up and down movement for about 30 seconds and the excess inoculum was removed by touching the roots to the edge of beaker.

Ten seedlings of the each test line were taken and 10 of these were kept separately on two blotter papers (size 45 cm x 25 cm with one fold). The blotter paper was moistened adequately and the seedlings were kept in such a way so that only cotyledons and roots are covered and the green tops of the seedlings remains outside the blotter paper. The seedlings of a susceptible check BG 212 were also inoculated with each batch of test seedlings.

The folded blotter papers were kept one on top of the other, in heaps of ten in a tray. A susceptible check was kept in each heap. These trays were placed into the incubator at 35°C for 8 days. Artificial light was provided for 12 hrs and the blotter papers were moistened adequately on alternate day.

Rating scale

In order to find out the resistant genotype of chickpea, test lines were scored at the end of

the incubation period by examining the seedlings for the extent of root damage and were scored for the disease on 1-9 point scale as mentioned below:

Results and Discussion

In order to find out the resistant genotype against dry root rot 98 chickpea (desi) entries were evaluated. In-vitro condition among them five entries *viz* GJG 0910, IPCK 06-78, CSJK-42, IPCK 06-56, GNG 1969 were found to be resistant.

Exhibiting, less than 10 percent disease incidence whereas 42 entries namely (GL 27091, H 07-163, GJG 0907, RVSSG 9, CSJ 313, RVSSG 10, GNG 2065, Phule G 0204, GNG 0906, CSJ 0564, GNG 2064, AKG 1001, H 08-131, H 08-18, JG 23, BG 032, Phule G 0204-16, BGD 107, H 08-25, GNG 0921, Phule G 06 102, IPC 06-127, JG 28, NDG 1105, GNG 2066, IPC 06-127, JG 28, NDG 1105, GNG 2066, IPC 2006-77, RSG 963, CSJ 753, BG 3031, GNG 2081, RSG 888, CSJ 515, RSG 931, BGD 1070, Vijay, BGM 572, BCP 60, JG 25, GJG 0814, CSJ 513, H 08-93, GNG 2068) were found to be moderately resistant.

In this trial 61 (Kabuli) entries were evaluated, out of which 14 lines *viz* GNG 1969, CSJK 68, Vihar (PhuleG95311), RVSSG 11, GNG 2112, HK 06-171, Kripa (Phule G 0517), IPCK 08-136, BG 3012, HK 08-206, JGK 13, AKG 2002-1K, IPCK 08-130, BG 3027 were found resistant whereas 25 entries IPCK 06-78, CSJK 42, IPCK 0656, GNG 1969 152, HK 08231, BG 3025, GLK 28127, GLK 26167, IPCK 08120, CSJK 72, CSJK 66, GJK 19, JGK 2005-301, vihar, CSJK-6, JGK-2003-304, CSJK-1, SC-RS-1, HK 94134, GNG 1888, JGK 1, HK 07-234, CSJK 6, CSJK 42, GNG 2034. were found moderately resistant showing 10.1-20 percent disease incidence.

Rating scale used for disease scoring

Rating	Category	Symptoms of DRR	DRR%
1	Resistant	No infection on roots	0.0-10
2-3	Moderately resistant	Very few small lesions on roots	10.1-20
4-5	Tolerant	Lesions on roots clear but small, new roots free from infection	20.1-30
6-7	Susceptible	Lesions on roots many, new roots generally free from lesions	30.1-40
8-9	Highly susceptible	Roots infected and completely discolored	40.1 and above

Pande *et al.*, (2004) evaluated twenty-nine chickpea germplasm accessions, 10 cultivars and 8 advanced breeding lines for resistance to dry root rot, caused by *Rhizoctonia bataticola* under *in vitro* conditions. They observed that one germplasm accession (ICC 14395), a cultivar (ICCV 2) and advanced breeding line were resistant to dry root rot. Of the remaining lines 22 were moderately resistant, 19 susceptible and 2 highly susceptible line (BG 212 and ICC 12267) used as the control. Gupta *et al.*, (2012) screened for resistance against *Rhizoctonia bataticola* causing dry root rot in chickpea. The susceptible cultivar BG 212 showed 100 per cent mortality *i.e.* rating 9 in 1-9 scale.

The studies led to conclusion 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 and Rajas) from JNKVV, Jabalpur. These lines further evaluated for their performance in sick field for three consecutive years and revealed six lines *viz.*, JG 2000-07, JSC 37, MPJG 89-11551, MPJG 89-9023, CSJ 592 and Rajas as resistant exhibiting <10 per cent mortality, however 14 lines showed moderately resistance reaction.

In order to find out the resistant genotype against dry root rot 98 chickpea (desi) entries were evaluated. In-vitro conditions among them 5 entries were found to be resistant. Exhibiting, less than 10 percent disease incidence whereas 42 entries were found to be moderately resistant. The disease incidence ranged from 10.1 to 20 percent. In this trial 61 (Kabuli) entries were evaluated, out of which 14 lines were found resistant whereas 25 entries were found moderately resistant showing 10.1-20 percent disease incidence.

Acknowledgement

Authors are very thankful to the Project coordinator 'AICRP on Chickpea' and Head, Department of Plant Pathology, Jawahar Lal Nehru Krishi Vishwa Vidyalaya, Jabalpur – 482004, India

References

- Dhar, V. and S.N. Gurha, 1998. Integrated Management of Chickpea Diseases. *Journal Phytopathology* 65:13-37
- Gupta Om, Manisha Rathi and Madhuri Mishra 2012. Screening for resistance against *Rhizoctonia bataticola* causing dry root rot in chickpea. *Journal of Food Legumes* 25(2).139-141
- 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.
- Haware, M.P. 1990. *Fusarium* wilt and other important diseases of Mediterranean area options mediterr ser. Semin, 9: 61-64.
- Jalali B.L. and H. Chand. 1992. Chickpea wilt. Prentice Hall, Englewood cliffs, NY. USA, 1: 429-44.
- Jimmez, Diaz R M, A. Trapero-casas, J. Cabreradela and Colina. 1989. Races of *Fusarium oxysporum* f. sp. *ciceri* infecting chickpea in southern Spain. Vascular wilt of plants (eds. Tjamos E.C. and Beekmanc) NATA ASI series, NATO, Berlin 228: 515-520.
- Nene, Y. L. 1988. Multiple disease resistance in grain legumes *Ann. Rev phytopatho*. 26: 203.
- Padwick, G.W. 1948. Plant protection and food crops of India, plant pest and disease at rice, wheat, sorghum and gram. *Imperial J. Exp. Agri*. 16: 55-64.
- Pandey, S., J.N. Rao and G.K. Kishore 2004. Evaluation of chickpea lines for resistance to dry root rot caused by *Rhizoctonia bataticola*. *International chickpea and pigeon pea newsletter*. 11: 37-38
- Singh, K. B. and B. S. Dahiya 1973. Breeding for wilt resistance in chickpea. Symposium on wilt resistance in Bengal gram. Sept. 1973 at *India Agr. Res. Int. New*. 13-14.
- Singh, K.B. 1987. Chickpea breeding. In: Saxena, MC, Singh, KB, eds. *The Chickpea*. Wallingford, UK: CAB Int., 127-62.
- Smithson, J.B., Thompson, J.A. and Summerfield, R.J. 1985. Chickpea (*Cicer arietinu* L.). In: R.J. Summerfield and E.H. Roberts (eds.), *Grain Legume Crops*. Collins, London, UK. p. 312-390.