Mysore J. Agric. Sci., 50 (2) : 369-371, 2016

Identification of Sources Resistant to Dry Root Rot Caused by *Macrophomina phaseolina* (Tassi) in Chickpea (*Cicer arietinum* L.)

A. Trivikrama Reddy, Jayarame Gowda and Muhammad Saifulla
Department of Genetics and Plant Breeding, College of Agriculture, UAS, GKVK, Bengaluru - 500 065

Abstract

Dry root rot is one of the most important and widespread soil borne diseases of chickpea grown between latitudes 20° N and 20° S, where, the climate is relatively dry and warm and is emerging as a serious biotic constraint for chickpea production. In this study, 815 germplasm accessions of chickpea collected from different research institutes representing significant diversity were screened for resistance against dry root rot (DRR) under a controlled environment using Blotter paper technique. In all, 7, 154, 436 and 218 accessions were moderately resistant, moderately susceptible, susceptible and highly susceptible to DRR, respectively. Seven chickpea germplasm accessions identified through this study possessing high levels of resistance to dry root rot disease *viz.*, ICCV-07305, ICCV-06304, K-007, GNG-1499, GNG-1958, ICC-14699 and BGM-572 would be useful in chickpea disease resistance breeding programs.

Chickpea (*Cicer arietinum* L.) is a self-pollinated, annual, diploid, cool season food legume originated in south-eastern Turkey and the adjoining northern region of Syria. Chickpea is the second most important legume globally, after common bean. It is valued as source of protein to the largely vegetarian population of India. India is the leading producer (68% share in global chickpea production) as well as consumer of chickpea. The global chickpea area, production and productivity is 13.54 million hectares,13.1 million tonnes and 967 kg / ha, respectively (FAO STAT, 2013). In India the area, production and productivity of chickpea is 10.74 million hectares, 9.88 million tonnes and 919 kg / ha respectively, whereas, in Karnataka it is grown in an area of 0.8 million hectares with a production of 0.38 million tonnes and productivity of 473 kg/ha.

More than two-third of the total chickpea area lies in central and southern India (Madhya Pradesh, Maharashtra, Andhra Pradesh and Karnataka). The yield potential of currently growing improved chickpea cultivars exceeds 3 t / ha. However, average onfarm yield is around 0.8 t / ha. The major portion of this yield gap is attributed to diseases and pests. Chickpea crop is prone to many diseases *viz.*, *Fusarium* wilt, Dry root rot, *Verticillium* wilt, Black root rot, Collar rot, *Phytophthora* root rot, Wet root rot, Foot rot, *Pythium* root and seed rot.

Dry root rot (DRR) of chickpea caused by necrotrophic fungus *Rhizoctonia bataticola* (Taub.) Butler [Pycnidial stage: *Macrophomina phaseolina* (Tassi) Goid] was not of much significance in chickpea earlier; however, it has become a major threat to chickpea production in recent years due to altered weather conditions, particularly on the account of longer drought spells. Higher temperatures and soil moisture depletion during crop growth period particularly at post flowering stage are predisposing chickpea to dry root rot (Sharma and Pande, 2013). Recent surveys conducted during 2010 to 2013 indicated wide spread and increased incidence of DRR in the central and the southern states of India (Ghosh *et al.* 2013). Disease was found irrespective of soil type and cropping system and cultivars used and incidence ranged from 5 to 50 per cent or more in badly infected soils. Dry root rot of chickpea causes a yield loss of 10-25 per cent in India (Masood Ali and Shivakumar, 2001). Identification of resistant sources and using them in development of cultivars resistant to dry root rot is the most economic and environmental friendly approach to mitigate losses caused by dry root rot.

In this study 815 germplasm accessions including advanced breeding lines and cultivars collected from

different research institutes were screened for resistance against DRR under controlled environment during 2014 at UAS, GKVK, Bangalore by Blotter paper technique. Obtained pure culture of *R. bataticola* from infected chickpeas. Sown 15 surface-sterilized (5 min in 2.5% sodium hypochlorite) seeds of each germplasm line in autoclaved riverbed sand placed in pots. Inoculated with fungus 100 ml of potato dextrose broth medium taken in 250 ml flask and was incubated for 7 days at 25°C. Added two mycelial mats to 100 ml sterilized distilled water and macerate these in a waring blender for 1 min (operated the blender intermittently) and placed this inoculum in a 250 ml beaker. Uprooted the 8 day old seedlings of the lines and washed the root system in running water and rinsed in sterilized distilled water. Roots of ten healthy seedlings of each line were dipped in the inoculum for about 30 seconds. Inoculated seedlings of each line were placed side by side on a blotter paper so that only the cotyledons and roots are covered and the green tops of the seedlings remain outside the blotter paper after it is folded. Seedlings of susceptible checks (BG-212 and L-550) were kept for each batch of ten blotter papers. The trays of blotter papers were placedin an incubator at 35°C for 8 days with provision of 12 hr artificial light. The blotters were adequately moistened every day. The seedlings were examined for the extent of root damage on the 8th day after inoculation and the severity was scored on a 1-9 rating scale (Nene *et al.*, 1981).

In all, seven lines found moderately resistant showing very few small lesions on roots *viz.*, ICCV-07305, ICCV-06304, K-007, GNG-1499, GNG-1958, ICC-14699 and BGM-572 and 154 lines with lesions on roots clear but small, new roots free from infection are categorised as moderately susceptible *viz.*, GNG-1969, JG-130, GNG-469, PG 06102, Phule-G-0215-2, Radhey, ICC-14051, ICC-14778, ICC-16181, ICC-1710 and ICCV-08110. Four hundred and thirty six lines were categorised as susceptible with many lesions on roots but new roots free from lesions *viz.*, IPC-02-248, RKG-155, WR-315, JG-210, JG-26, JG-322, JG-63, JG-14, A-1, DCP-92-3, GBC-6, GG-2, HC-5, WEG-97, JG-11 etc., and 218 lines were found to be highly susceptible having completely discolored roots *viz.*, JG-207, JG-37, JGK-18, BG-212, L-550, Pratapchena, RVSSG-9, IC-83307, ICCV-04101 etc. The moderately resistant lines are 0.85 per cent and MS lines are 18.9 per cent of total germplasm screened moderately susceptible whereas, resistant lines free of disease were not found necessitating screening of wild species. The susceptible and highly susceptible categories contributed 53.5 and 26.7 per cent, respectively showing that majority of the germplasm lines screened belong to these categories (Table I).

TABLE I

List of germplasm accessions in response to artificial screening for dry root rot

Disease scale	Response to Disease	Number of genotypes	Percentage of genotypes	Genotypes
1	Resistant	-	-	-
3	Moderately Resistant	7	0.85	ICCV-07305, ICCV-06304, K-007, GNG-1499, GNG-1958, ICC-14699 and BGM-572
5	Moderately Susceptible	154	18.9	GNG-1969, JG-130, GNG-469, PG 06102, Phule-G-0215-2, Radhey, ICC-14051, ICC-14778, ICC-16181, ICC-1710, ICCV-08110 etc.
7	Susceptible	436	53.5	IPC-02-248, RKG-155, WR-315, JG-210, JG-26, JG-322, JG-63, JG-14, A-1, DCP-92-3, GBC-6, GG-2, HC-5, WEG-97, JG-11 etc.
9	Highly Susceptible	218	26.7	JG-207, JG-37, JGK-18, BG-212, L-550, Pratapchena, RVSSG-9, IC-83307, ICCV-04101 etc.

Pande *et al.,* (2004), Jayalakshmi *et al*. (2008), Om Gupta *et al.* (2012) have also reported resistant sources for dry root rot in chickpea. The screened lines cover significant amount of diversity in chickpea and the accessions identified through this study possessing high levels of resistance to dry root rot disease would be useful in chickpea disease resistance breeding programs.

References

FAO Stat, 2013, Agriculture. Available from: http://www.faostat.fao.org.

Ghosh, R., Sharma, M., Telangre, R. and Pande, S., 2013, Occurence and distribution of Chickpea diseases in central and southern parts of India. *Am J Plant Sci.*, **4** : 940-944.

Jayalakshmi, S. K., Usharani, S., Benagi, V. I. and Mannur, D. M., 2008, Sources of resistance to dry root rot of chickpea caused by *Rhizoctonia bataticola*. *Agri. Sci. Digest*., **28**(2) : 147-148.

Masood Ali and Shivkumar, 2001, An overview of chickpea research in India. *Indian J. Pulse Res.,* **14**(2) : 81-89.

Nene, Y. L., Haware, M. P. and Reddy, M. V., 1981, Chickpea diseases : resistance-screening techniques. *ICRISAT Information Bulletin No. 10*, Patancheru, India, 10 pp.

Om Gupta, Rathi Manisha and Mishra Madhuri, 2012, Screening for resistance against *Rhizoctonia bataticola* causing dry root rot in chickpea. *J. Food Legumes.,* **25**(2) : 139-141.

Pande, S., Kishore, G. K. and Rao, J. N., 2004, Evaluation of chickpea lines for resistance to dry root rot caused by *Rhizoctonia botaticola*. *Inter. Chickpea Pigeonpea Newsl*.,**11** : 37-38.

Sharma, M. and Pande, S., 2013, Unravelling effects of temperature and soil moisture stress response on development of dry root rot [Rhizoctonia bataticola (Taub.)] butler in chickpea. *Am J. Plant Sci.*, **4** : 584-589.

(Received : May, 2016 **Accepted :** June, 2016**)**