RESEARCH ARTICLE Legume Research- An International Journal, Volume 47 Issue 3: 505-507 (March 2024)

Evaluation for the Resistance of Green Gram (*Vigna radiata* L.) Germplasm against *Macrophomina phaseolina*

Mohit Kumar[1], Data Ram Kumhar[1], Surbhi Garg[1], Mahendra Partap[1]

10.18805/LR-4501

ABSTRACT

Background: The green gram (*Vigna radiata* L.) is the major legume crop in India. Dry root rot (DRR) incited by *M. phaseolina* is a serious problem to the green gram production area in the world and India; Dry root rot has in recent years become a major obstacle to the successful and gainful growing of green gram, which can lead to significant losses in green gram production. The host plant resistance is the best alternative to management the DRR of the green gram, it is an economical and eco-friendly way to disease management. In the experiment, Twenty-five green gram germplasm has been tested for resistance to DRR, a serious disease caused by *Macrophomina phaseolina*.

Methods: *M. phaseolina* sand maize meal inoculum was applied to the field in sufficient amounts to maintain the sick plot before planting green gram germplasm, each germplasm was planted in three rows of 5 m in length, maintaining a distance between plants of 10 cm, the incidence of DRR was recorded using a disease rating scale. Based on disease reaction, green gram germplasm was grouped into different categories.

Result: From 25 green gram germplasm, four germplasm showed a resistant reaction to dry root rot, namely IPM-02-03, G-2, MH-2-15, MUM-2, while this has been observed. Susceptibility of green gram germplasm to dry root rot such as RMG-26.

Key words: Disease, Germplasm, Green gram, *Macrophomina phaseolina,* Resistance, Soil-borne.

INTRODUCTION

Green gram is one of the most important legumes; it is cultivated in almost all parts of the country, the green gram is susceptible to approximately 26 diseases worldwide, (Charles. 1978). Among them, dry root rot caused by *Macrophomina phaseolina* is of most importance in reducing crop yields, especially in the arid zone of the world (Hoes., 1985). Dry root rot poses a serious threat to green gram growing areas around the world, as well as in Pakistan, which can lead to crop loss of up to 100% in epidemic situations (Iqbal *et al.,* 2010). *Macrophomina phaseolina* a soil-borne pathogen causes severe disease in various crops in India, reducing crop yields (Pandey *et al.*, 2018). *Macrophomina phaseolina* is highly destructive that infects plants through the soil. The pathogenic fungus *Macrophomina phaseolina* causes dry root rot/charcoal rot in many plant species. Dry root rot/ *Macrophomina* blight has been a major restraint on the high production of green gram in recent years. The management of DRR is challenging as the pathogen is soil and seed-borne pathogen. Therefore, the use of chemicals is undesirable and even impractical as a long-term solution to crop health. Using host plant resistance can be a good alternative to disease management. Traditional methods of dealing with these diseases are difficult due to the predominantly subterranean habit and the strong competitiveness of the pathogen. Hence, the resistance of the host plant is one of the excellent ways to overcome dry rot root of green gram, it is a cost-effective and eco-friendly way of disease management.

[1]Department of Plant Pathology, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner-334 001, Rajasthan, India.

Corresponding Author: Mohit Kumar, Department of Plant Pathology, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner-334 001, Rajasthan, India.
Email: mohiiitgodala0001@gmail.com

How to cite this article: Kumar, M., Kumhar, D.R., Garg, S. and Partap, M. (2024). Evaluation for the Resistance of Green Gram (*Vigna radiata* L.) Germplasm against *Macrophomina phaseolina*. Legume Research. 47(3): 505-507. doi: 10.18805/LR-4501.

Submitted: 03-09-2020 **Accepted:** 07-05-2021 **Online:** 25-05-2021

MATERIALS AND METHODS

Location of experiments

The experiment was conducted during the 2017 *Kharif* season at the experimental field, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner.

Observations recorded

The crop was properly observed to record the first appearance of the disease after germination and the observation was taken at the time of maturity of a crop by randomly selecting 20 plants from each germplasm according to the method described (Anonymous, 2004). The incidence of the disease was recorded at maturity and the PDI was calculated as follows:

Layout and sowing

In this experiment, 25 germplasm of green gram, namely Samrat, Ganga-1, Ganga-8, V-7240, PM-106, RMG-10, V-3890, RMG-4, RMG-40, RMG-5, RMG -8, RMG-26, PM-116, PM-111, PM-105, OUM-112, OUM-7, OUM-115, BPMR-1, HUM-9, V-3219, V-1082, MH-2-15, IPM-02-03 and Pusa Vishal were collected from ARS, Sri Ganganagar and germplasm were screened in *Macrophomina phaseolina* sick plot during *Kharif*-2017, *Macrophomina phaseolina* sand maize meal inoculum was applied to the field in sufficient amounts to maintain the sick plot before planting green gram germplasm, each germplasm was planted in three rows of 5 m in length, maintaining a distance between plants of 10 cm, the incidence was recorded on a scale from 0 to 9 (Nene *et al*., 1981). The package of practices recommended for increasing yields was followed.

RESULTS AND DISCUSSION

Screening of germplasm of green gram against *M. phaseolina*

Twenty-five green gram germplasm against *Macrophomina phaseolina* was selected under artificial inoculation in the field, the incidence of DRR was recorded using a rating scale from 0 to 9 (Nene *et al*., 1981). Based on disease reaction, green gram germplasm was grouped into different categories, namely, highly resistant (HR), Resistant (R), Moderately resistant (MR), Moderately Susceptible (MS), Susceptible (S) and highly susceptible. (HS) (Table 1). None of the germplasm was recorded as highly resistant, *i.e.* four germplasms, IPM-02-03, G-2, MH-2-15 and MUM-2 were classified as resistant. Fifteen other germplasm, namely RMG-4, RMG-5, RMG-8, RMG-10, PM-105, PM-106, PM-111, PM-116, V-1082, V-3219, V-3940, V-7240, G-8, Pusa Vishal and Samrat were moderately resistant, five germplasm were moderately susceptible, *i.e.* BPMR-1, RMG-14, OUM-7, OUM -112, OUM-115 and the remaining germplasm RMG-26 was susceptible (Table 2).

Twenty-five green gram germplasm was tested against *M. phaseolina* under artificial inoculation in the field. The reaction to the disease was recorded according to a standard rating scale. None of the germplasm was highly resistant (HR), while four germplasm, namely MUM-2, MH-2-15, G-2 and IPM-02-03 were classified as resistant (R). Another fifteen germplasm were classified as moderately resistant. (MR), five germplasm were moderately susceptible and one remaining germplasm of RMG-26 was susceptible (S) (Table 3).

Choudhary *et al*. (2011), tested twenty-five of green gram germplasm to determine the source of *Macrophomina phaseolina* resistance to DRR in the field. The three germplasm MSJ-118, KM 4-44 and KM 4-59 were resistant to dry root rot. Similarly, Haseeb *et al*. (2013) tested twenty-

Table 1: The disease rating scale for dry root rot of green gram (Nene *et al*., 1981).

Rating scale	Disease incidence (%)	Category
0	0-10	Highly resistant (HR)
1	10.1-30	Resistant (R)
3	30.1-50	Moderately resistant (MR)
5	50.1-70	Moderately susceptible(MS)
7	70.1-90	Susceptible (S)
9	>90	Highly susceptible (HS)

Table 2: Disease incidence of green gram germplasm against *Macrophomina phaseolina*.

Germplasm	Disease incidence (%)	Disease reaction
MUM-2	16.72	R
MH-2-15	15.93	R
G-2	19.94	R
IPM-02-03	13.78	R
G-8	32.80	MR
RMG-14	60.81	MS
V-7240	36.92	MR
PM-106	46.75	MR
RMG-10	45.86	MR
V-3940	41.74	MR
RMG-4	43.17	MR
RMG-26	72.83	S
RMG-5	40.92	MR
Samrat	44.80	MR
PM-116	45.78	MR
OUM-115	52.79	MS
OUM-7	54.26	MS
PM-111	43.09	MR
PM-105	36.38	MR
Pusa Vishal	46.90	MR
V-3219	41.93	MR
V-1082	44.86	MR
OUM-112	51.73	MS
RMG-8	49.80	MR
BPMR-1	55.83	MS

Table 3: Evaluation of green gram germplasm against *Macrophomina phaseolina*.

Disease reaction	Disease incidence	Germplasm
Resistant	10.1-30	IPM -02-03, G-2, MH-2-15, MUM-2 (4)
Moderately resistant	30.1-50	RMG-4, RMG-5, RMG-8, RMG- 10, PM-105, PM-106, PM-111, PM-116, V-1082, V-3219, V-3940, V-7240, G-8, Pusa Vishal, Samrat (15)
Moderately susceptible	50.1-70	BPMR-1, RMG-14, OUM-7, OUM -112, OUM-115 (5)
Susceptible	70.1-90	RMG-26 (1)

seven green gram germplasm against *M. phaseolina* in the field under artificial inoculation, No one is immune from dry root rot, germplasm such as Azari 2006, NM 2006 and AUM 9 was found to be resistant.

Resistant germplasm can be used in a crop improvement program after further testing with a large number of virulent *M. phaseolina* strains. The IPM99-125 germplasm has higher plant survival can be beneficial in green gram breeding programs to create germplasm that is resistant to DRR (Pandey *et al*., 2020).

Among 26 genotypes, 2 (MNUYT-317 and NM-2011) were highly resistant, 10 were moderately resistant (Mung-12004, MNUYT-317, Mung-12007, MNUYT-201, MNUYT-219, AZRI-2006, Mung - 12002, MNUYT -318, MNUYT-207 and MNUYT-107, (Akhtar and Shoaib, 2018). Thombre and Kohire (2018) found that BPMR-145 was resistant and two more germplasm JL-781 and Kopargaon were susceptible.

Most workers collected germplasm against *Macrophomina phaseolina* and at the time of selection found resistant or moderately resistant germplasm. We also found germplasm to be resistant and moderately resistant to *Macrophomina phaseolina* and these can be used for crop improvement programs after further testing and these results are confirmed by the previous findings.

CONCLUSION

Out of 25 genotypes screened, four genotypes *viz.*, MUM-2, MH-2-15, G-2 and fifteen genotypes were moderately resistant against *M. phaseolina.* The resistant genotypes recognized in the present investigation could be utilized as potential donors for future resistance breeding programme for dry root rot in green gram.

ACKNOWLEDGMENT

Authors are grateful to the Agricultural Research Station, Sri Ganganagar for providing seed of germplasm and Department of Plant Pathology, Swami Keshwanand Rajasthan agricultural university, Bikaner for providing an experimental field for the studies.

Conflict of interest

All authors declared that there is no conflict of interest.

REFERENCES

Akhtar, S., Khan, K.A., Shoaib, A. (2018). Response of *Vigna radiata* (L.) Wilczek genotypes to charcoal rot disease. Mycopath. 14(1 and 2).

Anonymous (2004). Annual Report. Indian Institute of Pulse Research, Kanpur.

Charles, Y.Y. (1978). In: Mungbean Diseases and Control, the First International Mungbean Symposium. AVRDC, Taiwan.

Choudhary, S., Choudhary, A.K., Sharma, O.P. (2011). Screening of green gram (*Vigna radiata*) germplasm to identify the source of resistance to dry root rot. Journal of Food Legumes. 24(2): 117-119.

Haseeb, H.A., Sahi, S.T., Ali, S. and Fiaz, M. (2013). Response of different mung bean varieties against *Macrophomina phaseolina* (Tassi) goid and *in vitro* studies of plant extracts against the pathogen. Pakistan Journal of Phytopathology. 25(1): 78-83.

Hoes, J.A. (1985). Macrophomina phaseolina causal agent of charcoal rots of sunflower and other crops. Agricultural Canada Research Statistics, Modern Manitoba.

Iqbal, U., Mukhtar, T., Iqbal, S.M., Ul-Haque, I., Malik, S.R. (2010). Host plant resistance in black gram against charcoal rot [*Macrophomina phaseolina* (Tassi) Goid]. Pakistan Journal of Phytopathology. 22(1): 126-129.

Nene, Y.L., Haware, M.P., Reddy, M.V. (1981). Chickpea Diseases: Resistance-Screening Techniques. Information Bulletin No. 10, International Crops Research Institute for the Semi-Arid Tropics, ICRISAT, Patancheru P.O., Andhra Pradesh, India.

Pandey, A.K., Burlakoti, R.R., Kenyon, L. and Nair, R.M. (2018). Perspectives and challenges for sustainable management of fungal diseases of mungbean [*Vigna radiata* (L.) R. Wilczek var. radiata]: A review. Frontiers in Environmental Science. 6: 53.

Pandey, A.K., Burlakoti, R.R., Rathore, A., Nair, R.M (2020). Morphological and molecular characterization of *Macrophomina phaseolina* isolated from three legume crops and evaluation of green gram genotypes for resistance to dry root rot. Crop Protection. 127: 104962.

Thombre, B.B., Kohire, O.D (2018). Integrated management of Macrophomina blight of green gram (*Vigna radiata* L.) caused by *Macrophomina phaseolina* (Tassi) Goid. Indian Phytopathology. 71(3): 423-429.