www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(9): 1891-1894

www.thepharmajournal.com
Received: 02-06-2023
Accepted: 08-07-2023

Jitendra Pal
Banda University of Agriculture and Technology, Banda, Uttar Pradesh, India

Vivek Singh
Banda University of Agriculture and Technology, Banda, Uttar Pradesh, India

Hoshiyar Singh Negi
Banda University of Agriculture and Technology, Banda, Uttar Pradesh, India

Arvind Kumar
Banda University of Agriculture and Technology, Banda, Uttar Pradesh, India

Kamaluddin
Banda University of Agriculture and Technology, Banda, Uttar Pradesh, India

Corresponding Author:
Vivek Singh
Banda University of Agriculture and Technology, Banda, Uttar Pradesh, India

Evaluation of sources resistance against collar rot of lentil under artificially inoculated net-house and field conditions

Jitendra Pal, Vivek Singh, Hoshiyar Singh Negi, Arvind Kumar and Kamaluddin

Abstract
Among the many diseases causing threat to lentil production, collar rot caused by the ubiquitous soil-borne pathogen *Sclerotium rolfsii* is a most threatening disease. Collar rot is one of the fast spreading fungal diseases of lentil at seedling stage it causes heavy losses. Total During Rabi 2020–21, fifty genotypes of lentils were tested for resistance to collar rot under artificially inoculated net-house and field environments. Out of 50 genotypes five genotypes viz, IPL 5-09-38, ILL-9948, DPL-15, TAL-6 and DPL-62 were showed moderately resistant reaction in both pot and field conditions. Rest genotypes showed moderately susceptible to highly susceptible reaction.

Keywords: Lentil, collar rot, screening lentil genotypes, *Sclerotium rolfsii*

Introduction
Lentil is an important pulse pulse crop grown in India. It is a rich source of proteins, carbohydrates, minerals and fiber for resource poor people. The major lentil producing countries are Canada, India, Turkey, China and Syria. India stands at second position next to Canada with annual production of 1.61 million tons. It is grown on an estimated 1.47 million ha in India, with a productivity of 1017 kg per ha. The major lentil producing states in India are Madhya Pradesh, Uttar Pradesh, Bihar, Uttarakhand and West Bengal. In India Uttar Pradesh has first position in lentil area, production and productivity with 0.49 million ha area, 0.48 million tones production and 1014 kg/ha productivity (Anonymous, 2022) [2].

Lentil is the most important crop of Bundelkhand region of Uttar Pradesh. In general crop productivity is very low in this region. There are several factors for low productivity of lentil in the region such as lack of improved package and practice, water deficits and inadaptability of improved varieties low rate of seed replacement, pest and diseases. In India, the production of lentils has been reported to decrease by 20–25% due to biotic stresses. Among them diseases are the major impediments limiting the productivity of lentil in region. It suffers from various diseases caused by fungi, viruses, bacteria, phytoplasma and nematodes (Sarwar *et al*., 2014; Akhtar *et al*., 2016) [3, 1]. Among these, fungi-caused illnesses are of particular significance because they lower plant vigor, endanger its life, and eventually impair yields (Chen *et al.*, 2011) [4]. The main problem restricting lentil production is soil-borne ailments such color rot (*Sclerotium rolfsii*), wilt (*Fusarium oxysporum* f.sp. *lentis*), and dry root (*Rhizoctonia bataticola*). Due to the changing environment, one of the diseases, collar rot caused by *Sclerotium rolfsii*, has become a serious problem for lentils. *S. rolfsii* is an economically significant pathogen on many crops around the world. It causes yield losses of up to 50%.

Nearly every place where ever lentils are grown collar rot appeared, particularly in areas with high soil moisture and high temperatures during the seedling stage. The most frequent hosts are legumes, crucifers, and cucurbits, and it has a wide host range; at least 500 species in 100 families are vulnerable. It frequently occurs in the tropics, subtropics, and other warm temperate zones. The main factors which increase in disease prevalence include the rapid development of pathogen and propensity to produce abundant sclerotia that may survives in soil for several years. The disease causes huge yield losses many countries viz., Bangladesh, Ethiopia, India, and Pakistan. The emergence of white cottony mycelium growth on the collar region is the primary sign of collar rot illness.

To guarantee the region's lentil output remains constant, disease management is necessary. Application of fungicides is one option to address this problem, however due to the technical difficulties of applying chemicals in the soil, field application is not viable. The development of resistant cultivars is the best long-lasting, efficient, and ecofriendly substitute of chemical fungicides to solve this problem. Identification of resistant sources against this disease has been reported but stable resistance could not be achieved due to the prevalence of aggressive isolates of *S. rolfsii* (Sharma and Jodha, 1984) [5]. Moreover, these diseases are very difficult to control using chemicals or cultural practices. There are only few reports available on sources of resistance against lentil collar rot. The present study was conducted with the aim of evaluating lentil genotypes resistant to collar rot under arterially inoculated pot and field conditions, keeping in mind the aforementioned facts.

Materials and Methods

Isolation of pathogen *Sclerotium rolfsii* from diseased samples

Fresh diseased plant samples obtained from infected lentil at the seedling stage of the crop were used to isolate the disease. A sterilized blade was used to remove small portions of the infected components from the areas of the diseased plant that were exhibited symptoms of collar rot. To remove the surface infection, these plant parts were surface sterilized with 1% sodium hypochlorite solution for one minute, followed by three washes in sterilized distilled water. The fragments were then aseptically placed to Petri plates containing sterilized PDA, incubated at 27 °C for three to five days, and frequently checked to observe the fungus' growth as it emerged from various portions. When a fungus colony forms, it was transferred to a PDA slant for obtained the pure culture of pathogen.

Mass culturing of *S. rolfsii* on sorghum seeds

Sorghum grains were used to mass multiply the pathogen *Sclerotium rolfsii*. A 250 ml conical flask was used to hold fifty grams of sorghum grain while it was soaked overnight and repeatedly sterilized for two days at 15 psi for 15 minutes at 121.6 °C. These autoclaved flasks with sorghum grains allowed for cooling and were inoculated with the test fungus using three to four 5 mm mycelium discs from a pathogen culture that had previously been cultured on PDA plates. These inoculated flasks were incubated under aseptic conditions at 27+_1 °C for 10 days. The flasks were shaken on alternate days for uniform colonization on sorghum grains by incubated fungus. The sorghum grains completely covered with fungal growth were used as inoculums.

Screening of lentil genotypes against collar rot in Net house

A pot experiment was conducted under net house conditions during *Rabi* season in 2020-21. Fifty genotypes of lentil were evaluated for germination percentage and resistance line. Six seeds were sown in each pot. The pots were arranged in CRD (complete randomized design) with 2 replications. Lentil genotypes were categorized in to different group. The inoculum was thoroughly mixed in sterilized sand + soil (1:1) @ 20g/ kg soil. The infested soil was filled in 30 cm diameter plastic pots and incubated for 5 days in net house. Lentil seed (6 seed/pot) were sown for each genotype. The pots were watered from time to time and observations were recorded on emergence plant count and seedling mortality due to collar rot (up to 30 DAS). Based on PDI, the entries were categorized into different disease reactions using IIPR scale.

Evaluation of lentil germplasm for resistance to collar rot in field conditions

The experiment was conducted during *Rabi season* 2020-21 at the Crop research farm, BUAT, Banda under artificially inoculated field conditions. A total of fifty entries which were evaluated in the net house conditions against collar rot of lentil, these entries were also evaluated under artificially inoculated field conditions. Every test entry was planted twice in a plot with two rows of five meters each, spaced 30 cm apart, followed by one row of the susceptible check variety JL 3. At ten and twenty DAS, observations on emergence were recorded. The artificial inoculation with mass culture of *S. rolfsii* was done 15 days after sowing in the collar zone of plants followed the method given by Koshariya *et al*. (2020) [12] with slightly modification. Light irrigation was given just to activate the growth of fungus. Observations on per cent collar rot incidence were recorded at 10 days intervals and recorded up to maturity. Per cent seedling mortality was calculated by using the formula given below;

$$\text{Percent collar rot incidence} = \frac{\text{Infected Plants}}{\text{Total Plant}} \text{x}100$$

Indian Institute of Pulse Research rating scale

Sl. No.	Reaction	Collar rot incidence (%)
1	Resistant	0 – 10
2	Moderately resistant	11 – 20
3	Moderately susceptible	21 – 30
4	Susceptible	31-50
5	Highly susceptible	51-100

Results and Discussion

Evaluations of Lentil genotypes against collar rot of lentil in pots under net house condition and field conditions

Fifty lentil genotypes along with one susceptible check JL-3 were evaluated against collar rot in artificially inoculated pots as explained in “Material and methods” under greenhouse during *Rabi* season 2020-21. The results presented in table 1 revealed that out of the 50 genotypes five genotypes viz, IPL 5-09-38, ILL-9948, DPL-15, TAL-6 and DPL-62 were showed moderately resistant reaction with 11-20 % incidence. However one genotype L-112-19 was exhibited moderate susceptible reaction with 21-30 % incidence, five genotype viz., IPL 316, IG 4286, 27-KML-320, L 4076 and KL-09-5 were showed susceptible reaction with 31-50 % incidence and rest 39 entire were exhibited highly susceptible reaction with 51-100 % incidence. None of the genotype exhibited resistance reaction against collar rot.

Fifty lentil genotypes along with one susceptible check JL-3 were evaluated against collar rot in artificially inoculated field conditions as explained in “Material and methods” under greenhouse during Rabi season 2020-21. The results presented in table 2 revealed that out of the 50 genotypes five viz IPL 5-09-38, ILL-9948, DPL-15, TAL-6 and DPL-62 were exhibited moderately resistant reaction with 11-20 % incidence, six genotypes viz., IPL-5-09-27, CE-54-2186, 60-IPL-416, L-112-14, PL-639, LLS-18-142 were exhibited moderately susceptible reaction with 21-30 % incidence, 34 genotypes viz., K L 320, IPL-5-09 74, 37-KML-320, K L

1658, 87-LS5-18-149, KL-302, K LS1461, IPL 316, KL320, L-112-11, IG 4286, BLL-1, KL 127, 27-KML-320, KLB 1460, L 4076, PL-406, ILL-6829, 200-13-L, KL 320, L-112-8, 200-25L, IPL-406, Pant-L-639, KLS 1453, IPL-534, KLS 1455, IPL 313, L-112-19, IPL-526, KLB 1452 and KLS 1459 were exhibited susceptible reaction with 31-50 % incidence and five genotypes viz., 96-51 CB, WBL-58, ILL-8114, 43-RLS-218 and JL-3 were exhibited highly susceptible reaction with 51-100 % incidence. According to Gaurkhede *et al.* (2015), in field study of 284 lentil germplasm accessions against collar rot revealed that 29 had less than 10% mortality rate of collar rot while 9 were found disease-free. After screening 57 cultivars, Hussain *et al.* (2005) [8] reported that only one genotype was extremely resistant. In a three-year evaluation of 120 lentil germplasm lines in sick fields, thirty-two entries consistently displayed resistance to collar rot, according to Gupta and Mishra (2009) [9]. In the testing years with heavy disease pressure, twelve accessions were determined free from collar rot infection. In 1991 Sugha *et al.*, evaluated two hundred ten lentil genotypes from different sources, none of these were resistant or even moderately resistant to collar rot.

Table 1: Reaction of lentil genotypes to collar rot in artificially inoculated net house conditions during-2019-20.

S. No.	Reaction	Collar rot incidence (%)	No. of genotypes	Name of genotypes
1	Resistant	0-10	-	-
2	Moderately resistant	11-20	05	IPL 5-09-38, ILL-9948, DPL-15, TAL-6, DPL-62
3	Moderately susceptible	21-30	01	L-112-19
4	Susceptible	31-50	05	IPL 316, IG 4286, 27-KML-320, L 4076, KL-09-5
5	Highly susceptible	51-100	39	K L 320, IPL-5-09 74, 37-KML-320, KL 1658, 87-LS5-18-149, 96-51 CB, KL-302, KLS 1461, PL-15, L-112-11, WBL-58, BLL-1, KL 127, KLB 1460, CE-54-2186, IPL-5-09-27, PL-406, ILL-6829, 200-13-L, ILL-8114, L-112-14, IPL-321, 60-IPL-416, L-112-8, 43-RLS-218, 200-25L, IPL-406, Pant-L-639, KLS 1453, IPL-534, KLS 1455, IPL 313, PL-639, IPL-526, KLB 1452, KLS 1459, LEE-18-172, LLS-18-142, JL-3

Table 2: Reaction of lentil genotypes for collar rot in artificially inoculated field conditions

S. No.	Reaction	Collar rot incidence (%)	No. of genotypes	Name of genotypes
1	Resistant	0-10	-	-
2	Moderately resistant	11-20	05	IPL 5-09-38, ILL-9948, DPL-15, TAL-6, DPL-62
3	Moderately susceptible	21-30	06	IPL-5-09-27, CE-54-2186, 60-IPL-416, L-112-14, PL-639, LLS-18-142
4	Susceptible	31-50	34	K L 320, IPL-5-09 74, 37-KML-320, K L 1658, 87-LS5-18-149, KL-302, K LS 1461, IPL 316, PL-15, L-112-11, IG 4286, BLL-1, KL 127, 27-KML-320, KLB 1460, L 4076, PL-406, ILL-6829, 200-13-L, IPL-321, L-112-8, 200-25L, IPL-406, Pant-L-639, KLS 1453, IPL-534, KLS 1455, IPL 313, L-112-19, IPL-526, KLB 1452, KLS 1459, KL-09-5, LEE-18-172,
5	Highly susceptible	51-100	05	96-51 CB, WBL-58, ILL-8114, 43-RLS-218, JL-3

Germplasm lines showing moderately resistant reaction against lentil collar rot

Genotype evaluation in field conditions against lentil collar rot

Conclusion

Total fifty genotypes were evaluated to identify the resistant sources for collar rot of lentil caused by *S. rolfsii* in artificially inoculated net-house and field conditions. Out of 50 genotypes only five genotypes viz, IPL 5-09-38, ILL-9948, DPL-15, TAL-6 and DPL-62 were showed moderately resistant reaction in both net-house and field conditions. While rest genotypes were showed moderately susceptible to highly susceptible reaction. Identified moderately resistant genotypes can be used for future breeding programs.

Acknowledgement

Authors are highly thankful to Centre of Excellence on Dry-land Agriculture with focus on pulses and oilseed crops project for providing necessary facilities to carry out the research.

References

1. Akhtar KP, Dickinson M, Asghar MJ, Abbas G, Sarwar N. Association of 16 SrII-C phytoplasma with lentil phyllody disease in Pakistan Tropical Plant Pathology; c2016. p. 15.
2. Annonymous. Agriculture Statistics at a glance. Ministry of Agriculture, Government of India; c2022.
3. Sarwar G, Asghar MJ, Abbas G, Akhtar KP. Effect of Fusarium wilt disease on seed yield of advance lentil genotypes. Pakistan Journal of Agricultural Sciences. 2014;51:147-152.
4. Chen W, Sharma HC, Muehlbauer FJ. Compendium of Chickpea and Lentil Diseases and Pests. American Phytopathological Society, APS Press, St Paul; c2011, p. 165.
5. Sharma D, Jodha NS. Pulse production in Semi-arid region of India. Proceedings of Pulses Production, Constraints and Opportunities. Economic and Political Weekly. 1984;17(52):135-137.
6. Singh SP, Agarwal RK, Bhagawati R. Screening of chickpea germplasms, date of sowing and integrated management of collar rot caused by *Sclerotium rolfsii.* Annals of Plant Protection Sciences. 2012;20(2):397-399.
7. Gaurkhede J, Gupta O, Patil M. Management of collar rot of chickpea by *Pseudomonas fluorescens* and identification of sources of resistance. Journal of Food Legumes. 2015;28(2):51-54.
8. Hussain A, Iqbal SM, Ayub N. Screening of chickpea against collar rot caused by *Sclerotium rolfsii* Sacc. Pakistan Journal of Agriculture, Agricultural Engineering and Veterinary Sciences. 2005;21(1):32-34.
9. Gupta O, Mishra M. Screening of chickpea germplasm accessions for resistance to Collar rot. Journal of Food Legumes. 2009;22(2):140-141.
10. Sugha SK, Sharma BK, Tyagi PD. A modified technique for screening chickpea (Cicer arietinum) varieties against collar rot caused by *Scerotium rolfsii*. Indian Journal of Agricultural Science. 1991;61(4):289-290.
11. Tripathi BP, Khare N. Testing of fungicides against *Sclerotium rolfsii.* Journal of Mycology and Plant Pathology. 2006;36(2):347-348.
12. Koshariya AK, Khare N, Kotasthane AS. Survey and collection of lentil collar rot in Chhattisgarh. Journal of Pharmacognosy and Phytochemistry. 2020;9(4):3191-3196.