



ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(2): 1453-1456
© 2022 TPI

www.thepharmajournal.com

Received: 13-12-2021

Accepted: 24-01-2022

KK Saini

Ph.D., Scholar, Division of Plant Pathology, RARI, Durgapura, SKN Agriculture University, Jobner, Jaipur, Rajasthan, India

AC Mathur

Professor, Division of Plant Pathology, RARI, Durgapura, SKN Agriculture University, Jobner, Jaipur, Rajasthan, India

RS Sharma

Assistant Professor, Division of Plant Pathology, RARI, Durgapura, SKN Agriculture University, Jobner, Jaipur, Rajasthan, India

Virendra Kumar

Ph.D., Scholar, Division of Plant Pathology, RARI, Durgapura, SKN Agriculture University, Jobner, Jaipur, Rajasthan, India

RK Bagri

Associate Professor, Division of Plant Pathology, RARI, Durgapura, SKN Agriculture University, Jobner, Jaipur, Rajasthan, India

Yogesh Kumar Sharma

Assistant Professor, Division of Horticulture RARI, SKN Agriculture University, Jobner, Jaipur, Rajasthan, India

KC Gupta

Associate Professor, Division of Agronomy, RARI, Durgapura, SKN Agriculture University, Jobner, Jaipur, Rajasthan, India

Corresponding Author:

KK Saini

Ph.D., Scholar, Division of Plant Pathology, RARI, Durgapura, SKN Agriculture University, Jobner, Jaipur, Rajasthan, India

Screening of pearl millet (*Pennisetum glaucum*) genotypes against downy mildew caused by *Sclerospora graminicola* (Sacc.) Schoret

KK Saini, AC Mathur, RS Sharma, Virendra Kumar, RK Bagri, Yogesh Kumar Sharma and KC Gupta

Abstract

A total of 62 pearl millet entries were evaluated against downy mildew. Among sixty two entries, thirty six entries viz., BIB-7, BIB-19, BIB-20, RIB-192, RIB-15 076, RIB 525-2, J-2290, J-2340, RIB-16 5112, RIB-9215, RIB-16 5126, RIB-16 5134, RIB-16 5136, RIB-11133, RIB-11483, RIB-16 5162, RIB-16 5170, RIB-16 5186, RIB-12256, RIB-16 5196, RIB-16 5204, RIB-16 5212, RIB-16 5214, RIB-16 5216, RIB-16 5222, RIB-16 5226, RIB-16 5236, RIB-16 5240, RIB-16 5246, RIB-16 5252, RIB-16 5256, RIB-16 5258, RIB-16 5262, RIB-16 5264, RIB-16 5266, RIB-16 5152 were expressed highly resistant (PDI, 0-5%) reaction against downy mildew disease with the lowest per cent disease incidence; while, the seven entries showed resistant (PDI, 5.1-10%) reaction viz., ST-I-9, RIB-494, RIB-3135 18, RIB-13 5071, H-77 1833-2, RIB-16 5128, RIB-16 5270 Fourteen entries exhibited moderately resistant (PDI, 10.1-20%) reaction viz., BIB-3, BIB-5, BIB-8, BIB-14, BIB-16, RIB-15 076 (Tall), RIB-15 5147, RIB-15 0148, RIB-16 5114, RIB-11006, RIB-16 5146, RIB-16 5148, RIB-11487, RIB-16 5178. Five entries were recoded susceptible (PDI, 20.1-50%) to *Sclerospora graminicola* downy mildew viz., BIB-6, BIB-9, BIB-12, RIB-15 5137, RIB-16 5150. Most of the entries expressed downy mildew 0-5 per cent where the susceptible check (7042 S and Nokha Local) showed 100 per cent downy mildew incidence at the location. None of the entry was found highly susceptible.

Keywords: Germplasm, downy mildew severity, screening

Introduction

Pearl millet is a staple food for millions of poor people living in the semi-arid tropical regions of Africa and Asia (Rachie and Mujumdar, 1980) [5]. Pearl millet is grown for both fodder and grain where as in South America, U.S.A., Canada, South Africa, Italy, Japan, Australia etc., it is solely cultivated as a forage crop (Johnson *et al.*, 1976) [3]. Besides food for human consumption, the grain is also used for poultry feed and some industrial uses. However, pearl millet is attacked by a large number of diseases caused by fungal, bacterial, viral and nematode pathogens and diseases that are considered economically important and are major constraint in its production, are downy mildew, ergot, smut, blast and rust (Raj *et al.*, 2014) [6]. Among these, downy mildew is one of the most important diseases of pearl millet crop and cause considerable economic yield losses. Downy mildew of pearl millet sometimes referred to as 'green ear' disease, is caused by *Sclerospora graminicola* (Sacc.) Schoret. It is the most widespread and destructive disease of pearl millet in India and western Africa. The disease, first reported in India (Butler, 1907) [2], is present in more than 20 countries (Safeulla, 1976) [7], and is a major factor limiting the full exploitation of the high yield potential of hybrids in India. Downy mildew causes heavy loss in yield, which varies from place to place. Therefore, use of high yielding resistant/tolerant cultivars is the most viable, environmentally safe, economical sound and also less expensive technique for the management of disease. Hence, the identification of the resistance source is a basic need in breeding for disease resistance. So, the present investigation was undertaken to find out resistant sources against pearl millet downy mildew disease.

Materials and Methods

Screening for resistance to downy mildew a total of sixty two pearl millet entries were procured from All India Coordinated Research Project on pearl millet, Division of Plant Breeding and Genetics Rajasthan Agricultural Research Institute, Durgapura, Jaipur.

These entries were evaluated against downy mildew using field screening technique (William *et al.*, 1981)^[11] under sick experimental field at Rajasthan Agricultural Research Institute, Durgapura, Jaipur during *kharif* 2016 and 2017. For this purpose a highly susceptible cultivar 7042 S was used as infector row and sown three weeks before the test material. At the time of sowing, a fine powder of oosporic material was added to the furrows. Between every two infector rows five lines of five meter each, test entries were sown. Two replications were maintained for each test entry. The pearl millet downy mildew incidence was recorded twice *viz.*, first at 30 days and second at 60 days after sowing by formula mentioned below and the reaction of varieties were categorized as given in table-1.

$$\text{Per cent disease incidence} = \frac{\text{Number of infected plants}}{\text{Total number of plants observed}} \times 100$$

Table 1: Reaction of a entries were categorized for disease assessment as follows

Disease rating	PDI (%)	Disease reaction
1	0-5	Highly Resistant (HR)
2	5.1-10	Resistant (R)
3	10.1-20	Moderately Resistant (MR)
4	20.1-50	Susceptible (S)
5	>50	Highly Susceptible (HS)

Results and Discussion

A total of 62 pearl millet lines were evaluated in downy mildew sick field under infector rows systems to identify the downy mildew resistance lines. Pooled data on downy mildew incidence which presented in table 2 and 3 showed that among sixty two entries thirty six entries *viz.*, BIB- 7, BIB-19, BIB-20, RIB-192, RIB-15 076, RIB 525-2, J-2290, J-2340, RIB-16 5112, RIB-9215, RIB-16 5126, RIB-16 5134, RIB-16 5136, RIB-11133, RIB-11483, RIB-16 5162, RIB-16 5170, RIB-16 5186, RIB-12256, RIB-16 5196, RIB-16 5204, RIB-16 5212, RIB-16 5214, RIB-16 5216, RIB-16 5222, RIB-16

5226, RIB-16 5236, RIB-16 5240, RIB-16 5246, RIB-16 5252, RIB-16 5256, RIB-16 5258, RIB-16 5262, RIB-16 5264, RIB-16 5266, RIB-16 5152 were expressed highly resistant (PDI, 0-5%) reaction against *Sclerospora graminicola* downy mildew disease with the lowest per cent disease incidence 4.01, 2.94, 1.85, 0.0, 0.0, 4.08, 4.54, 3.73, 4.01, 4.76, 2.38, 3.58, 3.17, 0.0 4.05, 3.51, 1.67, 3.90, 0.32, 3.0, 0.0, 0.0, 0.0, 1.5, 0.0, 0.0, 0.0, 0.75, 2.91, 1.33, 1.10, 1.15, 2.08, 5.0, 4.01 and 4.34, respectively while, the seven entries showed resistant (PDI, >5.1-10%) reaction *viz.*, BIB-15, RIB-494, RIB-3135 18, RIB-13 5071, H-77 1833-2, RIB-16 5128, RIB-16 5270 with 8.51, 6.02, 8.84, 6.53, 7.56, 9.54 and 8.49 downy mildew incidence respectively. Fourteen entries exhibited moderately resistant (PDI, >10.1-20%) reaction *viz.*, BIB-3, BIB-5, BIB-8, BIB-14, BIB-16, RIB-15 076 (Tall), RIB-15 5147, RIB-15 0148, RIB-16 5114, RIB-11006, RIB-16 5146, RIB-16 5148, RIB-11487, RIB-16 5178 with 10.71, 17.33, 19.27, 15.84, 13.82, 16.62, 13.14, 10.82, 11.56, 17.09, 15.81, 12.22, 14.64 and 13.82 per cent downy mildew incidence respectively. Five entries were recorded susceptible (PDI, >20.1-50%) to *Sclerospora graminicola* downy mildew with 39.58, 30.94, 22.94, 21.81 and 28.93 per cent downy mildew incidence *viz.*, BIB-6, BIB-9, BIB-12, RIB-15 5137, RIB-16 5150. Among sixty two entries screened against *Sclerospora graminicola* downy mildew of pearl millet during *Kharif* 2016 and *Kharif* 2017, Most of the entries expressed *Sclerospora graminicola* downy mildew 0-5 per cent where the susceptible check (7042 S and Nokha Local) showed 100 per cent downy mildew incidence at the location. None of the entry was found highly susceptible. Similarly, Shivkumar *et al.* (2003)^[9], Thakur *et al.* (2004)^[10], Sharma *et al.* (2007)^[8], Latake *et al.* (2008)^[4] and Ati *et al.* (2013)^[11] evaluated 147 germplasm lines for their resistance and found that, 25 were highly resistant and amongst them, 10 lines were completely free from downy mildew, 32 were resistant, 52 were susceptible and 38 were highly susceptible to downy mildew infection at both 30 and 60 days after planting. Rajput *et al.* (2013) evaluated twenty two locally cultivated hybrids/varieties, among these seven entries were completely free from downy mildew at 30 days after sowing. Out of these seven, four entries remained free at 60 days after sowing also while four entries showed more than 10 per cent downy mildew incidence at 60 days after sowing.

Table 2: Evaluation of pearl millet entries against downy mildew under sick field conditions during *kharif* 2016 and 2017

S. No.	Entry	Average No. of plants	Average DM incidence (%) (<i>kharif</i> 2016)	Average DM incidence (%) (<i>kharif</i> 2017)	Pooled DM incidence
1.	BIB-3	4.0	21.42	0.0	10.71
2.	BIB-5	16.25	8.0	13.33	17.33
3.	BIB-6	12.0	29.16	25.0	39.58
4.	BIB-7	15.75	2.17	2.94	4.02
5.	BIB-8	18.25	5.22	16.66	19.27
6.	BIB-9	12.0	34.61	13.63	30.94
7.	BIB-12	18.25	10.16	17.85	22.94
8.	BIB-14	16.5	8.16	11.76	15.84
9.	BIB-15	26.75	7.93	4.54	8.51
10.	BIB-16	13.0	10.0	8.82	13.82
11.	BIB-19	12.5	0.0	2.94	2.94
12.	BIB-20	18.25	0.0	1.85	1.85
13.	RIB-192	26.0	0.0	0.0	0.0
14.	RIB-494	34.5	7.14	2.45	6.03
15.	RIB-3135-18	33.0	10.0	3.84	8.84
16.	RIB-13 5071	17.25	1.96	5.55	6.53
17.	RIB-15 076	25.75	0.0	0.0	0.0

18.	RIB-15 076 (Tall)	24.5	29.54	1.85	16.62
19.	RIB-15 5137	27.5	14.54	14.54	21.81
20.	RIB-15 5147	29.0	20.63	2.83	13.14
21.	RIB-15 0148	26.0	14.51	3.57	10.82
22.	RIB-525-2	26.75	2.89	2.63	4.08
23.	J-2290	19.0	9.09	0.0	4.54
24.	J-2340	23.25	7.46	0.0	3.73
25.	H-77 1833-2	25.25	15.13	0.0	7.56
26.	RIB-16 5112	17.50	8.03	0.0	4.01
27.	RIB-16 5114	20.75	11.36	5.88	11.56
28.	RIB-9215	25.25	0.0	4.76	4.76
29.	RIB-16 5126	20.50	4.76	0.0	2.38
30.	RIB-16 5128	34.25	7.14	5.97	9.54
31.	RIB-11006	24.50	10.38	11.90	17.09
32.	RIB-16 5134	28.75	4.66	1.25	3.58
33.	RIB-16 5136	21.00	1.58	2.38	3.17
34.	RIB-11133	17.75	0.0	0.0	0.0
35.	RIB-11483	21.75	8.10	0.0	4.05
36.	RIB-16 5146	26.00	21.62	5.0	15.81
37.	RIB-16 5148	23.75	15.07	4.68	12.22
38.	RIB-11487	26.50	14.58	7.35	14.64
39.	RIB-16 5162	26.75	4.16	1.42	3.51
40.	RIB-16 5170	31.75	1.26	1.04	1.67
41.	RIB-16 5178	30.25	9.86	8.88	13.82
42.	RIB-16 5186	21.25	7.81	0.0	3.90
43.	RIB-12256	25.00	0.64	0.0	0.32
44.	RIB-16 5196	30.25	0.0	3.0	3.0
45.	RIB-16 5204	26.00	0.0	0.0	0.0
46.	RIB-16 5212	27.25	0.0	0.0	0.0
47.	RIB-16 5214	25.75	0.0	0.0	0.0
48.	RIB-16 5216	19.50	3.0	0.0	1.5
49.	RIB-16 5222	19.75	0.0	0.0	0.0
50.	RIB-16 5226	28.50	0.0	0.0	0.0
51.	RIB-16 5236	28.50	0.0	0.0	0.0
52.	RIB-16 5240	27.50	1.51	0.0	0.75
53.	RIB-16 5246	23.00	5.83	0.0	2.91
54.	RIB-16 5252	24.75	2.66	0.0	1.33
55.	RIB-16 5256	23.50	2.20	0.0	1.10
56.	RIB-16 5258	25.50	2.30	0.0	1.15
57.	RIB-16 5262	22.50	0.0	2.08	2.08
58.	RIB-16 5264	25.25	10.0	0.0	5.0
59.	RIB-16 5266	23.00	8.03	0.0	4.01
60.	RIB-16 5270	27.75	0.0	8.49	8.49
61.	RIB-16 5150	24.25	11.19	23.33	28.93
62.	RIB-16 5152	26.25	4.03	2.32	4.34

*All data are means of two replications

Table 3: Reaction of pearl millet entries against downy mildew under sick field conditions

Disease rating	PDI	Disease reaction	Entries	Total
1	0-5%	Highly Resistant (HR)	BIB-7, BIB-19, BIB-20, RIB-192, RIB-15 076, RIB 525-2, J-2290, J-2340, RIB-16 5112, RIB-9215, RIB-16 5126, RIB-16 5134, RIB-16 5136, RIB-11133, RIB-11483, RIB-16 5162, RIB-16 5170, RIB-16 5186, RIB-12256, RIB-16 5196, RIB-16 5204, RIB-16 5212, RIB-16 5214, RIB-16 5216, RIB-16 5222, RIB-16 5226, RIB-16 5236, RIB-16 5240, RIB-16 5246, RIB-16 5252, RIB-16 5256, RIB-16 5258, RIB-16 5262, RIB-16 5264, RIB-16 5266, RIB-16 5152.	36
2	5.1-10%	Resistant (R)	BIB-15, RIB-494, RIB-3135 18, RIB-13 5071, H-77 1833-2, RIB-16 5128, RIB-16 5270	7
3	10.1-20%	Moderately Resistant (MR)	BIB-3, BIB-5, BIB-8, BIB-14, BIB-16, RIB-15 076 (Tall), RIB-15 5147, RIB-15 0148, RIB-16 5114, RIB-11006, RIB-16 5146, RIB-16 5148, RIB-11487, RIB-16 5178	14
4	20.1-50%	Susceptible (S)	BIB-6, BIB-9, BIB-12, RIB-15 5137, RIB-16 5150	5
5	>50%	Highly Susceptible (HS)	None	0

Conclusion

Out of 62 pearl millet lines, thirty-six entries were expressed highly resistant (PDI, 0-5%) reaction against downy mildew

while, the seven entries showed resistant (PDI, 5.1-10%) reaction. Fourteen entries exhibited moderately resistant (PDI, 10.1-20%) reaction. Five entries were recoded susceptible

(PDI, 20.1-50%) to downy mildew disease. None of the entry was found highly susceptible.

Acknowledgement

The authors are grateful to Director and Head, Division of Plant Pathology, Rajasthan Agricultural Research Institute, Durgapura and SKN Agriculture University- Jobner for providing necessary facilities to carry out the experiment.

References

1. Ati HM, Aba DA, Ishiyaku MF, Katung MD. Screen house evaluation of pearl millet genotypes for downy mildew incidence, Aust. J Basic & Appl. Sci. 2013;7(6):82-588.
2. Butler EJ. Some diseases of cereals caused by *Sclerospora graminicola*. Mem. Agric. Indian Bot. Ser. 1907;2:1-24.
3. Johnson JC, Monson WG, Burton GW, McCormick WC. Performance of dairy heifers grazing pastures of either Gahi 1, Gahi 3, or Tifleaf 1 millet. J Dairy Sci. 1976;59:19.
4. Latake SB, Bhosale DM, Chirame BB. Screening of pearl millet genotypes for their resistance to downy mildew. J. Maharashtra Agric. Univ. 2008;33(2):273-274.
5. Rachie KO, Majmudar YV. Pearl millet. University Park, Pennsylvania, USA: Pennsylvania State University Press, 1980, pp. 307.
6. Raj K, Arya RK, Kumar R. Pearl millet improvement for disease resistance, Forage Res. 2014;40:133-146.
7. Safeeulla KM. Biology and control of downy mildews of pearl millet, sorghum and finger millet. University of Mysore, Mysore, Karnataka, India, 1976, pp. 304.
8. Sharma YK, Yadav SK, Khairwal IS. Evaluation of pearl millet germplasm lines against downy mildew incited by *Sclerospora graminicola* in Western Rajasthan. J Sat. Agric. Res. 2007;3(1):1-2.
9. Shivkumar PD, Geeta HM, Shetty HS. Peroxidase activity and isozyme analysis of pearl millet seedling and their implications in downy mildew disease resistance. Plant Science. 2003;1:85-93.
10. Thakur RP, Rao VP, Wu BM, Subbarao KV, Shetty HS, Singh G, *et al.* Host resistance stability to downy mildew in pearl millet and pathogenic variability in *Sclerospora graminicola*. Crop Protec. 2004;23(10):901-908.
11. William RJ, Singh SD, Pawar MN. An improved field screening technique for downy mildew resistance in pearl millet. Plant Disease. 1981;65:239-241.