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REACTION OF PEARL MILLET VARIETIES/GENOTYPES AGAINST BLAST DISEASE CAUSED BY *PYRICULARIA GRISEA*

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ABSTRACT

In this study thirty-seven entries of pearl millet were screened under natural field condition against blast disease and found that the none of variety or germplasm was recorded free from disease and categorized as immune or resistant. Evaluation of genotypes for percent disease intensity (PDI) across 2023 and 2024 revealed significant variation in disease resistance. Six genotypes MPMH 42, MPMH 35, HHB 272, 86M84, RHB 234, and MPMH 21 were classified as Resistant, with PDI between 8.04 per cent and 10.05 per cent. Twenty genotypes, including PB 1756, GHB 719, and Kaveri Super Boss, showed Moderate Resistance (PDI 20.22%–30.88%). Eleven genotypes such as DHBH 1397, ICMV 221, and 86M01 were Moderately Susceptible, with PDI values above 40%, but no genotypes fell into Susceptible or Highly Susceptible categories. Statistical analysis confirmed significant differences among genotypes, with critical difference and low coefficient of variation values indicating reliable results. No genotypes were Highly Resistant. These findings provide important insights for breeding disease-resistant varieties.
***Keywords*:** Blast, Varieties/Genotypes, Screening, *Pyricularia,* Pearl millet, Disease intensity

Introduction

Pearl millet (*Pennisetum glaucum*), a vital cereal crop grown predominantly in arid and semi-arid regions, is of immense importance for food and nutritional security, particularly in Africa and South Asia. Ranked sixth among cereal crops globally following wheat, maize, rice, barley, and sorghum pearl millet accounts for 42% of the total global production (Jain *et al*., 2018). Owing to its drought tolerance, high nutritional value, and adaptability to marginal soils, pearl millet plays a critical role in sustaining smallholder farming systems. However, its productivity is often hampered by a range of biotic stresses, among which blast disease, caused by the fungal pathogen *Pyricularia grisea* (teleomorph: *Magnaporthe grisea*), poses a significant threat (Sharma *et al*., 2012). Blast disease in pearl millet has emerged as a major concern due to its potential to cause severe yield losses under favorable environmental conditions. Severe blast outbreaks in millets can lead to yield losses ranging from 30% to 90%, depending on the host and environmental conditions (Mgonja, 2023). The pathogen attacks various parts of the plant including leaves, nodes, and panicles, leading to characteristic lesions, stunted growth, and in severe cases, death of the plant (Kumar *et al*., 2023). The disease is known for its rapid spread and adaptability to diverse agro-ecological zones, which complicates its management. Although chemical control and agronomic practices can reduce the disease burden, they are not economically or environmentally sustainable in the long term, especially for resource-poor farmers. One of the most effective and environmentally sound strategies to manage blast disease is the development and deployment of resistant cultivars. Varietal resistance offers a cost-effective, durable, and farmer-friendly approach to disease management. However, the resistance in plants can vary widely among genotypes due to the genetic diversity of both the host and the pathogen (Brown, 2015). Therefore, the identification and screening of resistant pearl millet varieties is a crucial step in any integrated disease management program. Varietal screening involves the evaluation of different genotypes under natural or artificial inoculation conditions to determine their relative resistance or susceptibility to blast disease. This process helps plant breeders and pathologists to identify promising lines that can be used directly in cultivation or as donors in breeding programs. Moreover, the knowledge gained from screening can assist in understanding the genetic basis of resistance, facilitating the development of improved cultivars through conventional and molecular breeding approaches. In the context of increasing climate variability and emerging virulent races of *P. grisea*, continuous screening and characterization of pearl millet germplasm for blast resistance is essential (Sharma *et al*., 2013). This ensures that newly released varieties retain effective resistance in the field. It also contributes to a sustainable crop protection strategy that minimizes dependence on fungicides and supports eco-friendly agriculture.

Materials and Methods

Experimental site and materials

Total thirty-seven pearl millet local/hybrids (Table 1) were screened under natural conditions for their reactions (Table 2) against blast disease (*Pyricularia grisea* (Cooke) Sacc.) with three replications during *Kharif*, 2023 and 2024 at Agronomy farm, S.K.N College of Agriculture, Jobner, Jaipur. Susceptible check (NBH 4903) was planted on every 5th row alternately (45 cm x 10 cm row to row and plant to plant distance, respectively).

Disease assessment

Per cent disease intensity (PDI) and disease control in various experiments were calculated as follows:

$$\text{PDI} = \frac{\text{Sum of all the numerical ratings}}{\text{Number of leaves observed} \times \text{Max. score of scale}} \times 100$$

Table: Description of scale for blast disease scoring (0-9 grade, Prakash *et al*., 2016)

Rating Scale	Symptoms and Lesions	PDI*	Disease Reaction
0	No infection	0	Highly resistant (HR)
1	small brown specks of pinhead size	≤11	Resistant (R)
2-3	Large brown specks, Small, roundish to slightly elongated, necrotic gray spots, about 1–2 mm in diameter with a brown margin	12-33	Moderately Resistant (MR)
4-5	Typical blast lesions, usually confined to the area between main veins, covering <5% of the leaf area, typical blast lesions covering 6-10% of the leaf area	34-55	Moderately susceptible (MS)
6-7	Typical blast lesions covering 11-50% of the leaf area	56-77	susceptible (S)
8-9	Typical blast lesions covering 51–75% of the leaf area and all leaves dead	≥78	Highly susceptible(HS)

PDI: Percent disease intensity

Results and Discussion

Host plant resistance is an ultimate tool to keep away the diseases. A simple and low-cost method to know the source of resistance in varieties/germplasm is screening under natural field conditions at Agronomy Farm of SKNCOA Jobner. The evaluation of different varieties/genotypes for percent disease intensity (PDI) revealed significant variation across the two years, 2023 and 2024. Among the tested genotypes, MPMH 35, MPMH 42, HHB 272, 86M84, RHB 234, and MPMH 21 consistently recorded the lowest mean disease intensity, ranging from 8.04% to 10.05%, indicating a resistant reaction. These genotypes were followed by several others that exhibited moderate levels of resistance. For instance, PB 1756, GHB 719, GHB 538, HHB 67 Improved, PB 1852, RHB 173, GHB 732, GHB 744, MP 7878, Kaveri Super Boss, 86M86, AHB 1200, HHB 299, Dhanshakti, Pusa Composite 701, Pusa Composite 383, JBV 2, Raj 171, 86M38, and MPMH 17 showed mean PDI values ranging from 20.22% to 30.88%, categorizing them as moderately resistant to moderately susceptible depending on their individual values.

Equally, several genotypes demonstrated high disease susceptibility. Notably, RHB 223, 86M94, DHBH 1397, 86M01, GHB 905, 86M80, KBH 108, RHB 233, AHB 1269, ICMV 221, and NBH 4903 (check) exhibited high mean PDI values, ranging from 40.70% to 54.66%, indicating a moderately susceptible to highly susceptible response. The highest mean PDI was recorded by DHBH 1397 (54.66%), followed closely by ICMV 221 (54.45%) and 86M01 (53.56%), suggesting their vulnerability to disease under the tested conditions.

The analysis also highlighted significant differences between genotypes, as indicated by the critical difference (CD) at 5% level, which was 3.56% in 2023, 4.51% in 2024, and 3.00% for the mean. The coefficient of variation (CV) values was within acceptable limits, being 7.42% in 2023, 8.02% in 2024, and 5.73% for the mean, reflecting good experimental precision.

Table 1 : Evaluation of Disease Intensity Among Genotypes of Pearl Millet During 2023 and 2024

S. No.	Varieties/Genotypes	Percent Disease Intensity		
		2023	2024	Mean
1	MPMH 42	8.30 (16.73)	10.06 (18.43)	9.18 (17.63)
2	MPMH 35	6.82 (14.97)	9.26 (17.56)	8.04 (16.46)
3	RHB 223	38.36 (38.27)	43.03 (40.99)	40.70 (39.64)
4	PB 1756	14.50 (22.38)	28.69 (32.38)	21.60 (27.69)
5	HHB 272	9.26 (17.71)	10.84 (19.01)	10.05 (18.42)
6	GHB 719	18.41 (25.38)	32.60 (34.80)	25.51 (30.32)
7	GHB 538	20.25 (26.73)	31.50 (34.13)	25.88 (30.58)
8	HHB 67 Improved	21.55 (27.65)	29.84 (33.09)	25.69 (30.45)
9	86M94	50.04 (45.02)	54.78 (47.74)	52.41 (46.38)
10	DHBH 1397	52.03 (46.16)	57.29 (49.20)	54.66 (47.67)
11	PB 1852	17.63 (24.83)	32.22 (34.48)	24.92 (29.90)
12	86M01	51.32 (45.76)	55.48 (48.15)	53.56 (47.04)
13	GHB 905	46.23 (42.83)	51.40 (45.80)	48.81 (44.32)
14	RHB 173	16.92 (24.26)	29.64 (32.95)	23.28 (28.82)
15	GHB 732	18.26 (25.25)	32.01 (34.44)	25.13 (30.07)
16	GHB 744	14.62 (22.29)	31.46 (34.08)	23.04 (28.61)
17	86M80	37.06 (37.50)	54.88 (47.81)	45.97 (42.69)
18	MP 7878	15.48 (23.10)	30.51 (33.46)	22.99 (28.58)
19	86M84	10.02 (18.33)	8.14 (16.51)	9.08 (17.46)
20	KBH 108	38.59 (38.40)	49.43 (44.69)	44.01 (41.54)
21	Kaveri Super Boss	19.63 (26.29)	28.45 (32.12)	24.04 (29.33)
22	86M86	22.13 (28.03)	29.58 (32.88)	25.85 (30.51)
23	RHB 233	49.17 (44.53)	54.62 (47.65)	51.89 (46.08)
24	RHB 234	8.32 (16.68)	10.01 (18.38)	9.16 (17.60)
25	AHB 1269	51.22 (45.69)	54.21 (47.42)	52.71 (46.55)
26	AHB 1200	25.33 (30.15)	32.44 (34.66)	28.88 (32.44)
27	HHB 299	29.06 (32.58)	32.45 (34.71)	30.75 (33.67)
28	Dhanshakti	18.37 (25.34)	30.17 (33.29)	24.27 (29.51)
29	ICMV 221	53.86 (47.24)	55.05 (47.90)	54.45 (47.57)
30	Pusa Composite 701	15.29 (22.91)	30.59 (33.56)	22.94 (28.59)
31	Pusa Composite 383	13.47 (21.46)	29.40 (32.82)	21.44 (27.55)
32	JBV 2	16.21 (23.70)	24.23 (29.43)	20.22 (26.67)
33	Raj 171	19.03 (25.75)	27.36 (31.45)	23.20 (28.79)
34	MPMH 21	10.24 (18.56)	8.46 (16.79)	9.35 (17.71)
35	86M38	30.32 (33.41)	31.44 (34.08)	30.88 (33.75)
36	MPMH 17	17.27 (24.54)	23.59 (29.03)	20.43 (26.84)
37	NBH 4903 (CHECK)	43.53 (41.27)	47.31 (43.46)	45.42 (42.36)
	SE (m) ±	1.26	1.60	1.06
	CD (p=0.05)	3.56	4.51	3.00
	CV (%)	7.42	8.02	5.73

Reaction of pearl millet genotypes against blast

The screening of entries revealed that none of the genotypes fell under the Highly Resistant category. A total of six entries were categorized as Resistant, namely MPMH 42, MPMH 35, HHB 272, 86M84, RHB 234, and MPMH 21. The majority of the genotypes, twenty in number, were found to be Moderately Resistant. These include PB 1756, GHB 719, GHB 538, HHB 67 Improved, PB 1852, RHB 173, GHB 732, GHB 744, MP 7878, Kaveri Super Boss, 86M86, AHB 1200, HHB 299, Dhanshakti, Pusa Composite 701, Pusa Composite 383, JBV 2, Raj 171, 86M38, and MPMH 17. Eleven entries were identified as Moderately Susceptible, which were RHB 223, 86M94, DHBH 1397, 86M01, GHB 905, 86M80, KBH 108, RHB 233, AHB 1269, ICMV 221, and NBH 4903. No entries were found in either the Susceptible or Highly Susceptible categories. Similar finding was reported by Sankar *et al.* (2021) & Kumawat *et al.* (2021).

Table 2 : Reaction of pearl millet varieties/genotypes against blast disease

S. No.	Category	PDI*	No. of entries	Name of entries
1	Highly Resistant	0	-	-
2	Resistant	≤11	6	MPMH 42, MPMH 35, HHB 272, 86M84, RHB 234, MPMH 21
3	Moderately Resistant	12-33	20	PB 1756, GHB 719, GHB 538, HHB 67 Improved, PB 1852, RHB 173, GHB 732, GHB 744, MP 7878, Kaveri Super Boss, 86M86, AHB 1200, HHB 299, Dhanshakti, Pusa Composite 701, Pusa Composite 383, JBV 2, Raj 171, 86M38, MPMH 17
4	Moderately Susceptible	34-55	11	RHB 223, 86M94, DHBH 1397, 86M01, GHB 905, 86M80, KBH 108, RHB 233, AHB 1269, ICMV 221, NBH 4903
5	Susceptible	56-77	-	-
6	Highly Susceptible	≥78	-	-

PDI: Percent disease intensity

Conclusion

The comprehensive screening of thirty-seven Bajra genotypes under natural field conditions over two years has revealed a clear spectrum of resistance levels to bajra blast disease. Although none of the entries exhibited complete immunity or high resistance, six genotypes demonstrated notable resistance with low percent disease intensity (PDI), making them promising candidates for future breeding programs. The identification of moderately resistant and moderately susceptible genotypes further enhances our understanding of the genetic diversity in disease response. The statistically robust findings of this study highlight the urgency and potential for targeted breeding strategies aimed at improving disease resistance in Bajra, ultimately contributing to more resilient crop production systems.

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