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Study of Impact of Prominent Diseases in Hotspot on Pearl millet Genotypes (*Pennisetum glaucum* L.)

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ABSTRACT: The present study was conducted to identify impact of biotic stresses on pearl millet genotypes. It is one of the hardy crops adaptable to wide range of ecological conditions and water scarcity. Pearl millet crop is affected by number of diseases caused by fungus, bacteria, virus, nematodes, etc. The present investigation was carried out using 50 different genotypes with two replications. Observations on diseases *viz* Downey mildew (green ear head disease) and blast reaction (Leaf spot) were recorded. The genotypes S-21/05(1%) followed by S-21/06(1%), S-21/18 (1%), S-21/18 (1%), DHLB-27B, (2%), DHLB-36B (2%), S-21/13 (2%), S-21/15 (2%), S-21/07(2%), S-21/11 (2%), DHLB-37B(3%), S-21/04 (3%), S-21/08(3%), S-21/14 (4%), S-21/16 (4%), S-21/12 (5%), PBLN-2021-204 (5%) exhibited highest resistance to blast reaction. The genotype DHLB-31B (1%), followed by S-21/05 (1%), ICMB-9544 (1%), PBLN-2021-203 (1%), S-21/17 (2%), S-21/19 (2%), PBLN-2021-204 (2.38%), PBLN-2021-211 (2.38%), S-21/07 (2.54%), S-21/10 (2.54%), PBLN-2021-212 (4.39%) and S-21/20 (4.67%) were found highly resistant to Downey mildew incidence.

KEYWORDS: Pearl millet, Biotic stress, Downey mildew, Blast reaction.

INTRODUCTION

Pearl millet is a climate resilient crop and it protect itself from adverse effect of climate change. It has potential to increase income and food security of farmers in arid region while pearl millet is one of the hardy crops to wide range of ecological conditions and water scarcity. Pearl millet crop is affected by number of diseases caused by fungus, bacteria, virus, nematodes, etc. Blast is one of the important fungal diseases of pearl mill*et al*so called as leaf spot. It is caused by *Pyricularia grisea* (teleomorph: *Magnaporthe grisea*) and it is the serious disease affecting both forage and grain production (Nayaka *et al*.2017). Initially in 1953 pearl millet leaf blast was reported in India. Since 1970 pearl millet growing states of India facing extensive blast incidence and from year 2000 it became more serious. Recently in most pearl millet growing states like Gujarat, Madhya Pradesh, Uttar Pradesh, Delhi, Maharashtra, Rajasthan and Karnataka are also facing prevalent incidence of blast. (Fig. 2). The disease incidence data from 2002-2016 indicates that the disease is becoming more and more widespread (AICPMIP Annual Reports, 2002-2016). Over a decade AICRP - PM has been reported at Dhule, Jaipur, Jamnagar and Gwalior centres were hotspot of blast and was recorded on almost all the entries that have been evaluated under pathological trials. The map showed that Dhule, Aurangabad, Ahmednagar are the hotspot for blast in Maharashtra.

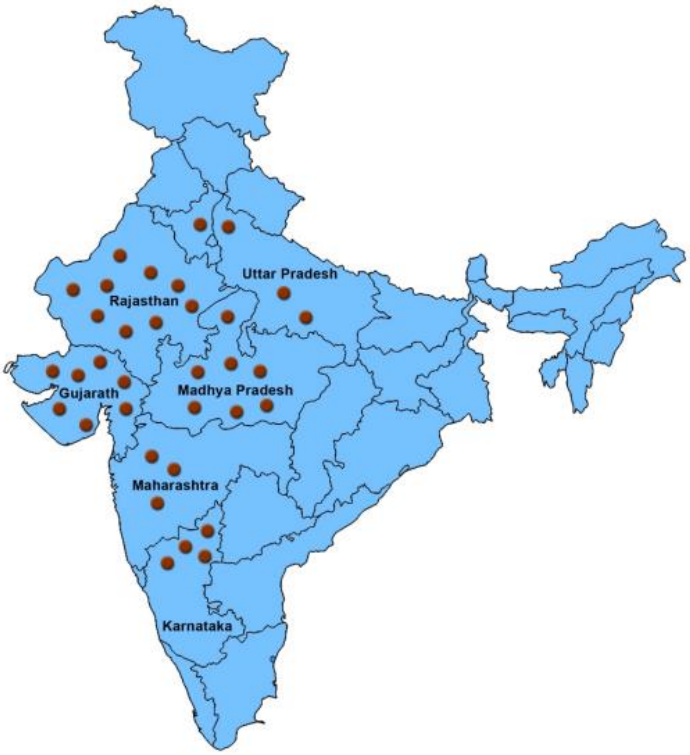

Figure 1. Hotspots of Magnaporthe blast of pearl millet in India

Pearl mill*et al*so has huge threat of disease downy mildew which is caused by oomycetes of fungal pathogen *Sclerospora graminicola*. The disease is popularly known as green ear head disease due to transformation of floral parts into leafy structure and unable to even grain filling. This is such a serious disease which may lead to 80% of yield losses. (M. Nandhini *et al.,*2019). The major epidemic in India occurred in 1971-72 since many contradictory opinions towards transmission of downy mildew. (Singh *et al.,*1993)

MATERIALS AND METHODS

The experimental materials used for present research consist of 50 genotypes of pearl millet [*Pennisetum glacum* L.] were received from Bajara Research Scheme, College of Agriculture, Dhule and the field experiment was conducted during the *Kharif* season of 2021. The experiment was carried out under randomized block design with two replications.

Blast Reaction (%)

Blast disease is caused by *Pyricularia grisea*. The disease severity is evaluated by visual appearance according to lesion area of spot of blast on leaf, stem and neck accordingly. Also, we observed size and shape of blast spot and colour changes in spot and categorized disease severity in percentage as per spot as follow; (plate no.3)

Table No. 1. Scale for Blast Severity 0 to 9

Sr. No.	Severity Index	Symptoms observed
1	0-leaf area free from infection	Nil
2	1-	Leaf area infected with Pin point small brown specks
3	2 -	Larger brown specks
4	3-	Up to 2 mm size small roundish to slightly elongated necrotic grey spots with brown specks
5	4-	Up to 2 mm size small roundish to slightly elongated necrotic grey spots with brown specks <5% leaf area
6	5-	Up to 2 mm size small roundish to slightly elongated necrotic grey spots with brown specks 6-10% leaf area
7	6-	Up to 2 mm size small roundish to slightly elongated necrotic grey spots with brown specks 11-25% leaf area

8	7-	Up to 2 mm size small roundish to slightly elongated necrotic grey spots with brown specks 26-50% leaf area
9	8-	Up to 2 mm size small roundish to slightly elongated necrotic grey spots with brown specks 51-75% leaf area
10	9-	Up to 2 mm size small roundish to slightly elongated necrotic grey spots with brown specks >75% leaf area

Downey Mildew

Downey mildew disease is one of the serious diseases also known as green ear disease caused by fungus *sclerospora graminicola*. We count total number of plants in each row and plant affected by Downey mildew and further calculated disease severity in percentage as per following formulae

Disease Severity (%) = Number of Infected Plant in Per Treatment x 100
Total

RESULT AND DISCUSSION

Blast Reaction on pearl millet genotypes (Table No.4.17)

Mean of blast severity

The general population mean of blast disease incidence in experimental plot was 17.40

Resistant to Reaction (1-5%)

The genotypes had found S-21/05(1%), S-21/06(1%), S-21/18 (1%), S-21/18 (1%), DHLB-27B, (2%), DHLB-36B (2%), S-21/13 (2%), S-21/15 (2%), S-21/07(2%), S-21/11 (2%), DHLB-37B(3%), S-21/04 (3%), S-21/08(3%), S-21/14 (4%), S-21/16 (4%), S-21/12 (5%) and PBLN-2021-204 (5%) resistant to blast severity.

Moderately Resistant (6-10%)

Most of the genotypes were moderately resistant which follows criteria blast severity percentage up to 10%. The genotype S-21/19(7%), followed by PBLN-2021-203 (7%), PBLN-2021-209 (7%), DHLB-14B (8%), DHLB-23B(8%), S-21/20 (8%), PBLN-2021-207 (8%), PBLN-2021-207 (8%), S-21/02 (9%), S-21/03 (9%), PBLN-2021-205 (9%), ICMB-13444 (10%), ICMB-10889 (10%), DHLB-28B (10%), DHLB-33B (10%), DHLB-35B (10%), S-21/09 (10%), S-21/10 (10%), PBLN-2021-206 (10%), PBLN-2021-211 (10%) and PBLN-2021-212 (10%) had found moderately resistance.

Susceptible (11-50%)

The genotype PBLN-2021-210 (11%) followed by S-21/01 (12%), S-21/17 (14%), DHLB-17B (14%), DHLB-31B (20%), DHLB-15B (25%), DHLB-32B(25%), DHLB-24B (28%), DHLB-21B (30%), PBLN-2021-208 (31%), and DHLB-16B (32%) had found susceptible.

Highly Susceptible (>50%)

The genotype ICMB-9544 (51%) was found highly susceptible to Blast Severity.

Table No. 2. Reaction of Blast severity on Pearl Millet Genotype in (*kharif* 2021)

Sr. No.	Genotype	Blast severity %	Blast Reaction
1	DHLB-10B	14	S
2	ICMB-13444	10	MR
3	ICMB-10889	10	MR
4	DHLB-8B	14	S
5	DHLB-14B	8	MR
6	DHLB-15B	25	S
7	DHLB-16B	32	S
8	DHLB-17B	14	S
9	DHLB-21B	30	S
10	DHLB-23B	8	MR
11	DHLB-24B	28	S
12	DHLB-27B	2	R
13	DHLB-28B	10	MR
14	DHLB-31B	20	S
15	DHLB-32B	25	S
16	DHLB-33B	10	MR

17	DHLB-35B	10	MR
18	DHLB-36B	2	R
19	DHLB-37B	3	R
20	S-21/01	12	S
21	S-21/02	9	MR
22	S-21/03	9	MR
23	S-21/04	3	R
24	S-21/05	1	R
25	S-21/06	1	R
26	S-21/07	2	R
27	S-21/08	3	R
28	S-21/09	10	MR
29	S-21/10	10	MR
30	S-21/11	2	R
31	S-21/12	5	R
32	S-21/13	2	R
33	S-21/14	4	R
34	S-21/15	2	R
35	S-21/16	4	R
36	S-21/17	14	S
37	S-21/18	1	R
38	S-21/19	7	MR
39	S-21/20	8	MR
40	ICMB-9544	51	HS
41	PBLN-2021-203	7	MR
42	PBLN-2021-204	5	R
43	PBLN-2021-205	9	MR
44	PBLN-2021-206	10	MR
45	PBLN-2021-207	8	MR
46	PBLN-2021-208	31	S
47	PBLN-2021-209	7	MR
48	PBLN-2021-210	11	S
49	PBLN-2021-211	10	MR
50	PBLN-2021-212	10	MR

Table No. 3. Scale for blast resistance (IARI, 2019; Singh *et al*., 2019)

Sr. No.	**Blast severity %**	**Blast Reaction**
1	1-5	R
2	6-10	MR
3	11-50	S
4	>50%	HS

Downey Mildew

Mean of Downey Mildew Incidence

The general population mean of Downey Mildew disease incidence in experimental plot was 23.74

Highly Resistant to Downey Mildew

Reaction of 50 genotypes of pearl millet revealed that, The genotype DHLB-31B(1%), followed by S-21/05 (1%), ICMB-9544 (1%), PBLN-2021-203 (1%), S-21/17 (2%), S-21/19 (2%), PBLN-2021-204 (2.38%), PBLN-2021-211 (2.38%), S-21/07 (2.54%), S-21/10 (2.54%), PBLN-2021-212 (4.39%) and S-21/20 (4.67%) were found highly resistant to Downey mildew incidence.

Resistant to Downey Mildew

The genotypes had found resistant to Downey Mildew incidence S-21/18 (6.63%) followed by PBLN-2021-205 (7.18%), PBLN-2021-208 (7.18%), DHLB-24B (7.61%) and S-21/09 (8.66%) etc.

Susceptible to Downey Mildew

The genotypes had found susceptible to Downey Mildew incidence ICMB-13444(11.5%), DHLB-23B (15.12%), DHLB-28B (18.11%), DHLB-32B (10.49%), DHLB-36B (13.57%), S-21/06 (15.35%), S-21/11(10.07%), S-21/16 (15.2%), PBLN-2021-209 (11.48%) etc.

Highly Susceptible to Downey Mildew

The genotypes had found highly susceptible to Downey Mildew incidence ICMB-10889 (39.4), DHLB-8B (39.4), DHLB-14B (31.7), DHLB-15B (48.7), DHLB-17B (26.49), DHLB-21B (26.14), DHLB-27B (37.99), DHLB-33B (44.49), DHLB-35B (26.48), DHLB-37B (41.87), S-20/01 (28.64), S-21/02 (28.15), S-21/03 (39.87), S-21/04 (37.99), S-21/08 (46.88), S-21/12 (35.68), S-21/13 (37.44), S-21/14 (34.16), S-21/15 (21.14), PBLN-2021-207 (25.1) and PBLN-2021-210 (37.05)

Table No.4. Reaction to Downey mildew Incidence on Pearl millet Genotypes

Sr. No.	Genotype	Downey mildew Incidence %	Downey mildew Reaction
1	DHLB-10B	38.88	HS
2	ICMB-13444	11.5	S
3	ICMB-10889	39.4	HS
4	DHLB-8B	39.4	HS
5	DHLB-14B	31.7	HS
6	DHLB-15B	48.7	HS
7	DHLB-16B	2.63	HR
8	DHLB-17B	26.49	HS
9	DHLB-21B	26.14	HS
10	DHLB-23B	15.12	S
11	DHLB-24B	7.61	R
12	DHLB-27B	37.99	HS
13	DHLB-28B	18.11	S
14	DHLB-31B	1	HR
15	DHLB-32B	10.49	S
16	DHLB-33B	44.49	HS
17	DHLB-35B	26.48	HS
18	DHLB-36B	13.57	S
19	DHLB-37B	41.87	HS
20	S-20/01	28.64	HS
21	S-21/02	28.15	HS
22	S-21/03	39.87	HS
23	S-21/04	37.99	HS
24	S-21/05	1	HR
25	S-21/06	15.35	S
26	S-21/07	2.54	HR
27	S-21/08	46.88	HS
28	S-21/09	8.66	R
29	S-21/10	2.54	HR
30	S-21/11	10.07	S
31	S-21/12	35.68	HS
32	S-21/13	37.44	HS
33	S-21/14	34.16	HS
34	S-21/15	21.14	HS
35	S-21/16	15.2	S
36	S-21/17	2	HR
37	S-21/18	6.63	R
38	S-21/19	2	HR
39	S-21/20	4.67	HR

40	ICMB-9544	1	HR
41	PBLN-2021-203	1	HR
42	PBLN-2021-204	2.38	HR
43	PBLN-2021-205	7.18	R
44	PBLN-2021-206	1	HR
45	PBLN-2021-207	25.1	HS
46	PBLN-2021-208	7.18	R
47	PBLN-2021-209	11.48	S
48	PBLN-2021-210	37.05	HS
49	PBLN-2021-211	2.38	HR
50	PBLN-2021-212	4.39	HR

Table No.5. Scale for Downey mildew Incidence

Sr. no.	Downey mildew Incidence (percentage)	Resistant Category
1	0-5%	HR
2	5.1-10%	R
3	10.1-20%	S
4	>25%	HS

CONCLUSION

Blast Severity

1. The genotypes found resistant to blast severity was S-21/05, S-21/06, S-21/18, DHLB-27B etc.
2. The yield performance by the blast resistant genotypes was S-21/05 (52.51), followed by S-21/06 (44.20), S-21/18 (55.66), DHLB-27B (25.64) recorded grain yield per plant in grams.

Downey Mildew Incidence

1. The genotypes DHLB-31B, S-21/05, ICMB-9544 and PBLN-2021-203 was found highly resistant.
2. The genotypes found resistant to Downey Mildew incidence was S-21/18, PBLN-2021-205 PBLN-2021-208, DHLB-24B and S-21/09 etc.
3. The yield performance by the genotypes highly resistant to Downey mildew was DHLB-31B (43.86), S-21/05 (52.51), and PBLN-2021-203(21.39)

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PLATES

Different Stages of Blast

Different stages of Downey mildew