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Screening of pearl millet promising hybrids and varieties against blast (*Pyricularia grisea*) by disease indexing

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Abstract
Pearl millet blast, caused by *Pyricularia grisea* (Cooke) Sacc, has emerged at an alarming rate in the recent past year in India, and causes severe losses in higher yield potential hybrids/ varieties particularly cultivated for fodder purpose. The disease can be best managed through host plant resistance. A total of thirty-two promising pearl millet hybrids and varieties were evaluated in two replications at Research Farm, College of Agriculture, Gwalior during *Kharif* 2019-20 and 2020-21 against blast under favorable condition. The tested entries showed a great variation in response to blast as their blast PDI varied significantly among different genotypes. None of the entry was investigated absolutely free from the disease. Ten hybrids *viz*., GHB 719, XMT 1497, GHB 744, GHB 905, KBH 108, 86M86, HHB 299, HHB 197, Pusa Composite 383 and RHB 173 were considered in the category of resistant as their blast severity PDI was investigated in the range of 11.11 to 33.33%. The maximum blast PDI (63.87%) was recorded in the ICMV 155. Resistant lines may be employed in breeding programme to develop blast resistant hybrids/cultivars.

Keywords: Pearl millet, blast, disease indexing, disease severity, resistant, susceptible

Introduction
Pearl millet [*Pennisetum glaucum* (L) R. Br.] is the most important millet species, accounting for approximately half the total worldwide production of millets (Nehra *et al*., 2017; Reddy *et al*., 2021) [9, 12]. It is mainly cultivated in India and Africa and is uniquely tolerant of hot and dry conditions. Pearl millet seems to be one of the important crops to resist/survive itself under erotic rainfall with high temperature (Choudhary *et al*., 2021a; Choudhary *et al*., 2021b) [1, 2]. It has been almost exclusively a subsistence crop but today is becoming widely employed in commercial small-scale food manufacture. It is one of cereal which has strong development of roots and tends to have effective adaptive mechanism to cope with drought (Choudhary *et al*., 2021c) [3]. It is an excellent forage crop because of its lower hydrocyanic acid content than sorghum. Its green fodder is rich in protein, calcium, phosphorous and other minerals with oxalic acid within safe limits (Makwana *et al*., 2021) [6].

The crop is affected by an array of diseases such as blast, downy mildew, smut, rust, and ergot *etc*. Among the several diseases, the blast caused by *Pyricularia grisea* (Cooke) Sacc. (Teleomorph: *Magnaporthe grisea*) Lately, it is turning into a genuine danger to pearl millet crop in India and around the world. In India, this disease has been inconsistently seen on high yielding cultivars from 1953 onwards in the pearl millet developing areas having a place with Northern pieces of India (Verma *et al*., 2021) [16]. The disease appears as grayish, water-soaked lesions on foliage that enlarge and become necrotic, resulting in extensive chlorosis and premature drying of young leaves. (Wilson *et al*., 1989). The most effective way of management of this pathogen is to use blast resistant cultivars. Due to the destructive nature of the disease, careful selection of pearl millet genotype is needed. Hence, there is lot of pressure on breeders to develop durably resistant pearl millet cultivars. Resistance varieties offer the most lucrative and environmentally safe option for the management of diseases (Pramanik *et al*., 2019; Mishra *et al*., 2020; Upadhyay *et al*., 2020; Pramanik *et al*., 2021) [10, 8, 17, 11]. The present investigation therefore was undertaken to evaluate elite pearl millet promising hybrids and varieties to identify resistance against blast disease by means of disease indexing under field conditions.

Materials and Methods

A total of thirty-two pearl millet promising hybrids and cultivars registered in India were used in this study with divergent reactions to blast disease *viz*., susceptible, tolerant and resistant. The seeds were obtained from All India Coordinated Research Project on pearl millet, College of Agriculture, Gwalior, RVSKVV, Gwalior, M.P., India. The field experiment was conducted at the experimental field, Department of Plant Pathology, College of Agriculture, Rajmata Vijayaraje Scindia Agricultural University, Gwalior, Madhya Pradesh, India Gwalior (M.P.) during Kharif 2019-20 and 2020-21.

The experimental material has been monitored in randomized block design (RBD) in 4-meter-long rows with spacing of 50cm from row-to row and 10cm from-plant-to-plant with two replications. Fertilizer was applied in the ratio of 60 N: 40 P_2O_5:20 K_2O $kgha^{-1}$. Screening for resistance to blast has been done under natural field epiphytotic conditions as per method suggested by Wilson *et al*. (1993) [19] which has been standardized at ICRISAT. In this method test lines have been grown in the central four rows and a highly susceptible line on the first row and every fifth rows as infector/indicator rows.

The blast severity was recorded on the 5 randomly selected and tagged plants of each line. Blast severity was recorded using 0 - 9 Scale of Mayee and Datar (1986) [7] as detailed below:

Score	Percent leaf area infected
0	No lesion
1	No lesion to small brown specks of pinhead size
2	No lesion to small brown specks of pinhead size
3	Small, roundish to slightly elongated, necrotic gray spots, about 1–2 mm in diameter with a brown margin
4	Typical blast lesions, elliptical, 1–2 cm long, usually confined to the area between main veins, covering <2% of the leaf area
5	Typical blast lesions covering <10% of the leaf area
6	Typical blast lesions covering 10–25% of the leaf area
7	Typical blast lesions covering 26–50% of the leaf area
8	Typical blast lesions covering 51–75% of the leaf area and many leaves dead
9	All leaves dead

Percent disease index (PDI) was worked out by using the formula given by Wheeler (1969).

$$\text{Percent Disease Index (PDI)} = \frac{\text{Sum of individual disease ratings}}{\text{No. of leaves assessed x Maximum grade}} \text{ x } 100$$

Results and discussion

A total of 32 promising hybrids and cultivars of pearl millet were evaluated against blast and the data are summarized in the table 1. None of the hybrids were completely free and highly resistant from blast (0.00). Ten genotypes were found in the resistant category because their blast PDI was in the range of more than 11.11% to 33.33%. Seventeen genotypes fall in the category of moderately resistant as their PDI was in the range of more than 33.33% to 55.55% and five genotypes were showed susceptible reaction of more than 55.55% to 77.77%.

During *kharif* 2019-20, none of the hybrid was completely free from blast. Genotype GHB 719 was found highly resistant (< 11.11%). Eight hybrids *viz.*, GHB 744, KBH 108, 86M86, HHB 197, GHB 538, XMT 1497, GHB 558, HHB 299 and Pusa composite 383 were found in the category of resistant because as their blast severity PDI was in the range of 11.11 to 33.33. Fourteen hybrids *namely*, RHB 177, PB 1705, MPMH 17, GHB 905, RHB 173, HHB 223, Dhanshakti, Pusa composite 701, JBV2, NBH 5767, Pratap, NBH 5061, ABV04 and Proagro 9444 were fall in the category of moderately resistant as their PDI was arrayed between 33.33 to 55.55. Six genotypes *viz.*, HHB 67, Improved, MP7792, GHB 732, Pusa composite 612, ICMV 155 and NBH 4903 were showed susceptible reaction (55.55-77.77) while none was found in the category of highly susceptible.

In *kharif* 2020-21, none of the hybrid was recognized completely free from blast and highly resistant (<11.11). Six hybrids including RHB 177, HHB 197, XMT 1497, GHB 905, RHB 173, HHB 223 were found in the category of resistant because as their blast severity PDI was in the range of 11.11 to 33.33. Sixteen hybrids *viz.*, HHB 67 Improved, PB 1705, MPMH 17, GHB 732, GHB 744, KBH 108, Kaveri Super Boss, 86M86, GHB 719, Proagro 9444, GHB 558, HHB 299, Pusa Composite 701, Pusa Composite 383, NBH 5767and ABV 04 were fall in the category of the moderately resistant as their PDI was in the range of 33.33 to 55.55. Nine hybrids *viz.*, GHB 538, Dhanshakti, JBV 2, Pratap, NBH 4903, NBH 5061, 86M64, Pusa Composite 612 and ICMV 155 were displayed susceptible reaction (55.55-77.77) while none was found in the category of highly susceptible.

The two years pooled data summarized in the table 2 reveals that none of the hybrid was free from blast and highly resistant. Ten hybrids *viz.*, GHB 719, XMT 1497, GHB 744, GHB 905, KBH 108, 86M86, HHB 299, HHB 197, Pusa Composite 383 and RHB 173 were found in the category of resistant because as their blast severity PDI was in the range of 11.11% to 33.33%. Seventeen hybrids *viz.*, RHB 177, Kaveri S Boss, HHB 223, MPMH 17, GHB 558, GHB 538, Proagro 9444, PB 1705, Pusa Composite 701, ABV 04, Dhanshakti, GHB 732, NBH 5767, MP-7792, JBV 2, NBH 5061 and Pratap were fall in the category of the moderately resistant since their PDI was found in the range of 33.33% to 55.55%. However, genotypes HHB 67, Improved, 86M64, ICMV 155, Pusa Comp. 612 and NBH 4903 were exhibited susceptible reaction while none was found in the category of susceptible. None of the hybrid or variety were under highly susceptible category. (>77%) as well. Minimum PDI of 23.33% was recorded in hybrid GHB 719 which was *at par* with genotypes XMT1497 (24.99%), Kaveri Super Boss (24.44%), GHB 744(26.11%) and GHB 905(27.77%).

Disease severity was documented at the hard-dough stage using a progressive 1-9 scale as developed for blast disease at International Rice Research Institute and screening techniques for pearl millet diseases described by Thakur *et al.* (2011) [15]. Likewise, Gupta *et al.* (2011) [5] recorded the disease severity using same 1–9 progressive scale as mentioned for field screening. Sharma *et al.* (2013) [14] surveyed in the four major pearl-millet growing states in India *viz*., Rajasthan, Haryana, Maharashtra and Uttar Pradesh for the prevalence of pearl millet blast. Blast severity was recorded using a 1 to 9 progressive scale and from the mini-core collection identified 32 germplasm accessions having resistance to at least one of the five pathotypes of *M. grisea* in India. Most of these accessions (21) originated in India; therefore, germplasm accessions collected from different locations of India seem to be potential sources of blast resistance and could be evaluated against different pathotypes of *M. grisea* to identify additional sources of blast resistance. Yadav *et al.* (2013) [20] also

evaluated twenty-five promising pearl millet hybrids and varieties against blast. The minimum severity of 7.5% was recorded in PB 106, GHB-744 and GHB-732, while its maximum severity (32.50%) was recorded in B-2301, PB 106, GHB 744 and GHB-732. One thirty-five pearl millet lines were also evaluated against blast at Gwalior by Devda (2009) [4] and reported blast severity in the range of 0 - 47.5%. The result reveals that only one entry MH 1541 remained completely free from blast while its maximum severity *i.e.*, 47.5% was recorded in MH 1513. Likewise, in recent study, Sharma *et al.* (2020) [13] identified possible diverse sources of blast and rust resistance in 305 accessions of *Pennisetum violaceum*, a wild relative of pearl millet, were screened against five pathotype-isolates of *M. grisea* and a local isolate of *P. substriata* var. *indica* collected from ICRISAT Farm, Patancheru, Hyderabad, India. Based on the mean blast score 1 to 9 scale, 17 accessions *viz*., IP 21525, 21531, 21536, 21540, 21594, 21610, 21640, 21706, 21711, 21716, 21719, 21720, 21721, 21724, 21987, 21988 and 22160 were found to be resistant (score ≤3.0) against all five pathotypes, and 24 accessions were resistant to four pathotypes of *M. grisea*.. In investigation of Verma *et al*. (2021) [16], out of 48 genotypes 5 were found highly resistance, 5 were resistance, 20 moderate resistance, 8 susceptible and 10 highly susceptible.

Table 1: Evaluation of promising pearl millet hybrids and varieties against blast during kharif 2019-20 and 2020-21

S. No.	Entries	2019	2020	Mean
1	RHB 177	38.89(38.52)	33.33(35.25)	36.11(36.88)
2	HHB 197	27.78(31.68)	30.00(33.19)	28.89(32.44)
3	HHB 67 Improved	66.66(54.71)	47.77(43.70)	57.22(49.21)
4	GHB 538	27.78(31.68)	61.11(51.40)	44.44(41.54)
5	PB 1705	41.11(39.85)	52.22(46.25)	46.66(43.05)
6	XMT 1497	16.67(23.79)	33.33(35.25)	25.00(29.52)
7	MPMH 17	38.85(38.50)	41.11(39.86)	39.98(39.18)
8	GHB 905	44.40(41.77)	11.11(19.46)	27.76(30.62)
9	RHB 173	44.42(41.78)	20.00(26.24)	32.21(34.01)
10	HHB 223	44.40(41.77)	32.22(34.57)	38.31(38.17)
11	GHB 732	66.60(54.67)	37.77(37.91)	52.19(46.29)
12	GHB 744	11.11(19.46)	41.11(39.86)	26.11(29.66)
13	KBH 108	11.11(19.46)	46.66(43.07)	28.88(31.26)
14	Kaveri S Boss	27.78(31.68)	46.66(43.04)	37.22(37.36)
15	86M86	11.11(19.46)	46.66(43.07)	28.88(31.26)
16	MP-7792	61.08(51.42)	46.66(43.07)	53.87(47.24)
17	GHB 719	5.56(9.88)	41.11(39.85)	23.33(24.86)
18	Proagro 9444	50.00(44.98)	42.22(40.50)	46.11(42.74)
19	GHB 558	27.78(31.68)	55.55(48.17)	41.66(39.93)
20	HHB 299	11.11(19.46)	46.66(43.07)	28.89(31.26)
21	Dhanshakti	38.89(38.52)	61.11(51.44)	50.00(44.98)
22	Pusa Composite 701	38.89(38.52)	55.55(48.18)	47.22(43.35)
23	Pusa Composite 383	11.11(19.46)	52.22(46.25)	31.67(32.86)
24	JBV 2	44.44(41.79)	64.44(53.38)	54.44(47.59)
25	NBH 5767	49.97(44.96)	55.55(48.25)	52.76(46.61)
26	Pratap	49.97(44.96)	61.11(51.40)	55.54(48.18)
27	NBH 4903	77.70(61.80)	67.77(55.54)	72.74(58.67)
28	NBH 5061	49.95(44.95)	61.11(51.40)	55.53(48.18)
29	86M64	66.60(54.67)	61.11(51.44)	63.85(53.06)
30	Pusa Comp. 612	66.60(54.67)	65.55(54.04)	66.08(54.36)
31	ABV 04	49.95(44.95)	50.00(44.98)	49.97(44.97)
32	ICMV 155	61.08(51.42)	66.66(55.01)	63.87(53.21)
S.Em		2.98	2.49	1.95
$CD_{0.05}$		8.99	7.49	5.89

Table 2: Reaction of pearl millet genotypes against blast disease severity (%)

S. N0.	Category	No. of entries	Name of entries
1	Highly Resistant (<11.11%)	-	-
2	Resistant (11.11-33.33%)	10	GHB 719, XMT 1497, GHB 744, GHB 905, KBH 108, 86M86, HHB 299, HHB 197, Pusa Composite 383, RHB 173. Kaveri Super Boss
3	Moderately Resistant (33.33-55.55%)	17	RHB 177, HHB 223, MPMH 17, GHB 558, GHB 538, Proagro 9444, PB 1705, Pusa Composite 701, ABV 04, Dhanshakti, GHB 732, NBH 5767, MP-7792, JBV 2, NBH 5061, Pratap.
4	Susceptible (55.55-77.77%)	05	HHB 67 Improved, 86M64, ICMV 155, Pusa Comp. 612, NBH 4903, Dhanshakti.
5	Highly Susceptible (>77.77%)	-	-

Conclusion

It can be concluded from present investigation that entries *viz.*, HHB197, XMT1497, GHB905, GHB744, 86M86, GHB719 and HHB299 were found resistant against leaf blast disease under field conditions. Consequently, these promising lines may be employed in breeding programme to develop blast resistant hybrids/cultivars.

References

1. Choudhary ML, Tripathi K, Tiwari S, Pandya RK, Gupta N, Tripathi N, *et al*. Screening of pearl millet [*Pennisetum glaucum* (L.) R. Br.] Germplam lines for drought tolerance based on morpho-physiological traits and SSR markers. Current Journal of Applied Science and Technology. 2021a; 40:46-63. Available: https://doi.org/10.9734/cjast/2021/v40i531303.
2. Choudhary ML, Tripathi MK, Gupta N, Tiwari, S, Tripathi, N, Parihar P, *et al*. Morpho-physiological and molecular characterization of pearl millet [*Pennisetum glaucum* (L.) R. Br.] Germplasm lines for drought tolerance. In book: New Visions in Science and Technology Vol. 5:39-60. Publisher: BP International; 2021b. DOI: 10.9734/bpi/nvst/v5/2541E
3. Choudhary ML, Tripathi MK, Gupta N, Tiwari S, Tripathi N, Parihar P, *et al*. RK Screening of pearl millet [*Pennisetum glaucum* [L] R Br] germplasm lines against drought tolerance based on biochemical traits. Current Journal of Applied Science & Technology. 2021c;40(23):1-12.
4. Devda BS. Studies on some aspects of Pearl millet caused by *Pyricularia setariae* ''Nisikado''. M.Sc. (Ag) Thesis, College of Agriculture, J.N.K.V.V. Gwalior (M.P), 2009.
5. Gupta SK, Sharma R, Rai KN, Thakur RP. Inheritance of foliar blast resistance in pearl millet (*Pennisetum glaucum*). Plant Breed. 2011;131(1):217-219.
6. Makwana K, Tiwari S, Tripathi MK, Sharma AK, Pandya RK, Singh AK. Morphological characterization and DNA finger printing of pearl millet (*Pennisetum Glaucum* (L.) germplasms. Range Management and Agroforestry. 2021 42(2):205-211
7. Mayee CD, Datar VV. Phytopathometry *Bulletin* -1. Marathwada Agric. Univ., Parabhani, 1986, 26-27.
8. Mishra N, Tripathi MK, Tiwari S, Tripathi N, Trivedi HK. Morphological and molecular screening of soybean genotypes against yellow mosaic virus disease. Leg Res.; 2020.DOI: 10.18805/LR4240.
9. Nehra M, Kumar Devvart KJ, Sharma RK. Molecular characterization of pearl millet [*Pennisetum glaucum* (L.) R. Br] inbreeds using microsatellite markers. J Appl Nat Sci. 2017; 9(1):357-363.
10. Pramanik A, Tiwari S, Tripathi MK, Tomar RS, Singh AK. Molecular characterization of groundnut (*Arachis hypogea* L.) germplasm lines for yield attributed traits. Indian J Genet. 2019;79(1):56-65
11. Pramanik A, Tiwari S, Tripathi MK, Mandloi S, Tomar RS. Identification of groundnut germplasm lines for foliar disease resistance and high oleic traits using SNP and gene-based markers and their morphological characterization. Legume Research; 2021.DOI: 10.18805/LR-4666
12. Reddy SP, Satyavathi CT, Khandelwal V, Patil HT, Gupta PC, Sharma LD, Mungra KD, Singh SP, Narasimhulu, R, Bhadarge HH, Iyanar, K, Tripathi MK, Yadav D, Bhardwaj R, Talwar AM, Tiwari VK, Kachole UG, Sravanti K, Shanthi Priya M, Athoni BK, Anuradha N, Govindaraj M, Napoleon T and Tonapi VA. Performance and stability of pearl millet varieties for grain yield and micronutrients in arid and semi-arid regions of India. Frontiers in Plant Sciences. 2021;12: 670201.DOI: 10.3389/fpls.2021.670201.
13. Sharma R, Sharma S, Gate VL. 2227 Tapping *Pennisetum violaceum*, a wild relative of pearl millet (*Pennisetum glaucum*), for resistance to blast (caused by *Magnaporthe grisea*) and rust (caused by *Puccinia substriata* var. indica). Plant Dis. 2020 May;104(5): 1487-1491.doi: 10.1094/PDIS-08-19-1602-RE. Epub 2020 Mar 9.
14. Sharma R, Upadhyaya HD, Manjunatha SV, Rai KN, Gupta SK, Thakur RP. Pathogenic variation in the pearl millet blast pathogen *Magnaporthe grisea* and identification of resistance to diverse pathotypes. Plant Dis. 2013;97:189-195.
15. Thakur RP, Sharma Rajan, Rao VP. Screening techniques for pearl millet diseases. Information Bulletin No. 89. Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics, 2011, 56 pp.
16. Verma R, Tripathi MK, Tiwari S, Pandya RK, Tripathi N, Parihar P. Screening of pearl millet [*Pennisetum glaucum* (L.) R. Br.] geno-types against blast disease on the basis of disease indexing and gene- specific SSR markers. Int J Curr Microbiol Appl Sci. 2021b;10(02):1108-1117.
17. Upadhyay S, Singh AK, Tripathi MK, Tiwari S, Tripathi N. Validation of simple sequence repeats markers for charcoal rot and *Rhizoctonia* root rot resistance in soybean genotypes. IJABR. 2020;10(2):137-144.
18. Wheeler BEJ. An Introduction to Plant Diseases. John Wiley and Sons. Ltd. London, 1969, 301pp.
19. Wilson JP, Gates RN. Forage Yield losses in hybrid pearl millet due to leaf blight caused primarily by *Pyricularia grisea*. Phytopatlogy, 1993;83:739-743.
20. Yadav R, Pandya RK, Kirar BS, Singh DP. Screening of released Pearl millet varieties against *Pyricularia setarie* nisikado. Society for sci. Dev.in Agric. And tech. Progre. Res. 2013;8(1):143-144.