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ASSESSMENT OF GENETIC VARIABILITY AMONG FINGER MILLET GENOTYPES FOR BLAST DISEASE TOLERANCE UNDER BASTAR PLATEAU CONDITIONS OF CHHATTISGARH INDIA

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ABSTRACT

Finger millet is an important *kharif* minor millet crop in Chhattisgarh and is widely consumed as a staple food among the tribal communities. *Magnaporthe grisea* is a fungal pathogen that causes leaf, neck, and finger blast diseases in finger millet, resulting in severe yield losses. Therefore, it is necessary to identify and develop finger millet varieties resistant to blast disease. In this context, the present study was undertaken with the objective of screening and identifying finger millet genotypes that exhibit resistance against blast disease. Evaluation of Eleven Advanced Varietal Trial (AVT) and twenty-five Initial Varietal Trial (IVT) genotypes of finger millet for their reaction to blast disease under natural field conditions during *Kharif* 2024. The results revealed that the Advanced Varietal Trial (AVT) genotypes exhibited leaf blast scores ranging from 1.87 to 2.80 (grade G), neck blast incidence from 9.70 to 24.19%, and finger blast incidence from 4.99 to 18.82%**.** All AVT entries showed moderate resistance to neck blast, while the genotype VL 402 was found resistant to finger blast. Similarly, the Initial Varietal Trial (IVT) genotypes showed leaf blast scores ranging from 1.53 to 4.20 (grade G), neck blast incidence from 9.42 to 28.59%, and finger blast incidence from 4.34 to 22.56%. Among these, the genotypes WN 593, TNEC 1349, IIMR FMR-23-3022, IIMR FMR-23-3016, and CMFV 2 exhibited resistance to neck blast, while RPCAU-FM 17, VR 1212, BR (Bastar Ragi)-16-28, KIFMG-22-13, IIMR FMR-23-3022, TNEC 1310, OEB 612, and IIMR FMR-23-3022 were found resistant to finger blast.
Keywords **:** Finger millet, Screening, genotype, resistant, blast and disease.

Introduction

Finger millet (*Eleusine coracana* L.) is one of the important minor millets cultivated in various agro-climatic zones of India, particularly in Karnataka, Tamil Nadu, Odisha, and Chhattisgarh. In India, finger millet ranks next to pearl millet and is cultivated on 2.6 m ha area with a production of about 3.0 mt and accounts for 81% of the minor millets produced (Shastri, 1989). In the Bastar Plateau agro-climatic zone of Chhattisgarh, finger millet serves as a vital subsistence crop for tribal communities due to its exceptional nutritional value, resilience to marginal soils, and ability to withstand drought stress (Rao *et al.,* 2017). Finger millet (*Eleusine coracana*) commonly known as ragi, bird foot in different part of India (Patro *et al.,* 2018). Small millets are the conventional crops, which are easily grown in less fertile soils. The most important small millet crops are finger millet, kodo millet, little millet, foxtail millet, barnyard millet and proso millets which are grown in India (Netam *et al.,* 2014). Finger millet (*Eleusine coracana*) is one of the major staple foods in tribal region of the rural community of Bastar, Chhattisgarh. It is commonly known as bird foot, mandia, ragi in different place of India. Finger millet is also known as ragi, African millet and bird's foot millet and an important staple food crop in part of eastern and central Africa and India (Sandhya *et al.,* 2017). Rich in

calcium, iron, dietary fiber, and essential amino acids, finger millet plays a significant role in ensuring nutritional security in rainfed farming systems (Chethan and Malleshi, 2007). A number of constraints limit finger millet production and productivity. Blast disease, caused by *Pyricularia grisea*, is a major constraint affecting both yield and grain quality of finger millet. In India, blast is one of the major diseases causing recurring yield losses in all the state (Seetharam, 1983). The average loss recorded due to finger blast was 28% and under the endemic areas its goes more than 80-9-% (Vishwanath, 1997). The present study was conducted to screen and evaluate different finger millet genotypes for their tolerance to blast disease under field conditions in the Bastar Plateau region. Blast is the most destructive disease of finger millet because of its aggressiveness. Finger millet blast is caused by the fungus *Magnaporthe grisea* (anamorph *Pyricularia grisea)*. The pathogen attacks all stages of crop development (vegetative and productive stages) (Mgonja *et al*., 2013).

Material and Methods

A total of 25 Initial Varietal Trial (IVT) and 11 Advanced Varietal Trial (AVT) genotypes, along with one susceptible check (KMR 301) and one resistant check (GE 4449), were obtained from the Project Coordinating Unit, All India Coordinated Research Project on Small Millets (AICRP-SM), ICAR, GKVK, Bengaluru. These genotypes were screened against *Magnaporthe grisea* (the causal organism of blast disease) under natural field conditions at the Zonal Agricultural Research Station (ZARS), Jagdalpur, during Kharif 2024. The experiment was conducted in a Randomized Block Design (RBD) with three replications, following the recommended package of practices. The same trial was simultaneously carried out at six other centres, namely Almora, Athiyandal, Bengaluru, Dindori, Vizianagaram, Mandya, and Ranchi. Based on the observations, significant variations were recorded among the genotypes in their response to blast infection. The study concludes that the identification of resistant genotypes is crucial for developing sustainable and location-specific blast management strategies, particularly for the Bastar region. These entries were sown in two rows of 3 meter length and 22.5 cm × 10 cm spacing with to find out resistant sources against blast disease of finger millet. The recommended agronomic practices were adopted at the time of crop growth. Infected plants were examined for lesion development and disease severity was assessed on the basis of lesion length by using 1 to 9 scale (Anon, 2020) (Table 1). Neck blast (%) and finger blast (%) incidence was calculated by using the following formula:

$$Neckblast(\%) = \frac{No.\ of infected panicles}{Total number of panicle} \times 100$$

$$Fingerblast(\%) = \frac{No.\ of infected finger}{Average no. of finger \times total number of panicle} \times 100$$

Result and Discussion

Symptoms of blast disease *viz.* leaf, neck and finger millet were observed and recorded the per cent disease incidence in different finger millet genotype.The results revealed that the Advanced Varietal Trial (AVT) genotypes exhibited leaf blast scores ranging from 1.87 to 2.80 (grade G), neck blast incidence from 9.70 to 24.19%, and finger blast incidence from 4.99 to 18.82%. All AVT entries showed moderate resistance to neck blast, while the genotype VL 402 was found resistant to finger blast. Similarly, the Initial Varietal Trial (IVT) genotypes showed leaf blast scores ranging from 1.53 to 4.20 (grade G), neck blast incidence from 9.42 to 28.59%, and finger blast incidence from 4.34 to 22.56%. Among these, the genotypes WN 593, TNEC 1349, IIMR FMR-23-3022, IIMR FMR-23-3016, and CMFV 2 exhibited resistance to neck blast, while RPCAU-FM 17, VR 1212, BR (Bastar Ragi)-16-28, KIFMG-22-13, IIMR FMR-23-3022, TNEC 1310, OEB 612, and IIMR FMR-23-3022 were found resistant to finger blast. Nagaraja *et al.* (2016) Screened 12 finger millets cultivars and reported that GE 4449 and GPU 28 found resistant for leaf blast and GE 4449 and GPU 28 was moderately resistant for neck and finger blast. Divya *et al*. (2017) evaluate 10 genotypes were evaluated of finger millets for blast disease and found all genotypes were free from blast disease incidence and recorded minimum percentage of neck blast severity in VL 379 (14.82%) and minimum finger blast severity in GPU 45 (19.70%). Patro *et al.* (2013) evaluated 16 pre released and released varieties of finger millets and reported that nine varieties were resistant to all three forks of blast diseases. Ramappa *et al.* recorded more than 50 per cent neck blast and 70 percent finger blast in Mandya and Mysore during *Kharif* 2000. Patro and Madhuri (2014) evaluated 32 genotypes of finger millet and two genotypes were found susceptible to neck blast and moderately resistant for finger blast, 14 were moderately resistant for neck and 13 were susceptible for neck and finger blast both. The experiment was conducted seven different ecological situations of India and the average mean of all center revealed that the average leaf blast score under AVT experiment from 2.76 to 5.53 (G) and genotype IIMR-

FM-R23-3011 were found resistant for both neck blast (9.77%) and finger blast (9.32%) and IIMR-FM-R23-3014 was resistant for finger blast (8.55%). In IVT experiment the range of leaf blast score from 3.13 to 4.67 (G), genotypes GPU 108 (8.71, 7.90%), WN-593 (9.09%, 9.79%), PRSW 43(8.32%, 10.18%), and CMFV2 (7.45%, 9.13%) were found resistant both for neck blast and finger blast; only KIFMG-22-13 (5.76) and IIMR-FM-R23-3022 (9.97%) was resistant for neck blast.

Table 1: Standard Evaluation System (SES) scale for leaf blast disease

Score	Description	Reaction
1	Small, brown, pinhead size specks without sporulating centre	Highly Resistant (HR)
2	Small (1-2mm) roundish to elongated, necrotic grey spots with a distinct brown margin covering up to 5% leaf area	Resistant (R)
3	Typical blast lesions (≥3mm) with sporulating center, covering 6-10% of the leaf area	Resistant (R)
4	Blast lesions covering 11-20% leaf area	Moderately Resistant (MR)
5	Blast lesions covering 21-30% leaf area	Moderately Resistant (MR)
6	Blast lesions covering 31-40% leaf area	Susceptible (S)
7	Blast lesions covering 41-50% leaf area	Susceptible (S)
8	Blast lesions covering 51-75% leaf area	Highly Susceptible (HS)
9	Blast lesions covering >75% leaf area & plant dead	Highly Susceptible (HS)

Table 2: Performance of finger millet advanced varietal trail genotypes against major diseases *(Kharif* 2024) : Leaf blast (Grade), Neck blast (%) and Finger Blast (%)

S. No.	Advanced varital trial (AVT) Genotype	Jagdalpur			Mean over seven centers		
		LB (G)	NB (%)	FB (%)	LB (G)	NB (%)	FB (%)
1	IIMR-FM-R23-3011	2.27	22.42	13.31	3.96	9.77	9.32
2	TNEC 1345	2.53	18.28	13.91	4.36	17.63	13.16
3	VL 402	2.07	14.06	4.99	3.37	13.48	11.79
4	VR 1192	2.8	18.79	14.27	4.45	17.46	18.04
5	BFM5-E	2.47	22.41	10.13	3.75	25.74	18.06
6	OEB605	2.73	21.06	11.08	4.52	20.38	22.53
7	WN 1585	2	20.56	10.62	3	22.3	18.76
8	IIMR-FM-R23-3014	2.13	24.09	12.81	4.37	15.03	8.55
9	VL 376	1.87	10.93	12.07	3.25	13.46	11.88
10	CMFV1	2.53	24.19	15.42	4.05	14.76	16.65
11	CMFV2	2.2	19.76	18.82	3.7	13.72	11.12
12	GE4449 (Resistant Check)	2.13	9.7	1.5	2.76	7.44	5.6
13	KMR 301 (Susceptible Check)	3.67	22.22	14.07	5.53	24.46	27.45
	Loc. Mean	2.42	19.11	11.77	3.93	16.59	14.84
	C.D. (5%)	0.46	5.94	3.69	0.84	8.6	9.64
	C.D. (1%)	0.62	8.05	5.01	1.11	11.39	12.77
	C.V. (%)	11.3	18.45	18.62	22.79	52.12	65.31

Table 3: Performance of finger millet Initial varietal trail genotypes against major diseases *(Kharif* 2024) : Leaf blast (Grade), Neck blast (%) and Finger Blast (%)

S.No.	Initial varietal trial (IVT) Genotypes	Jagdalpur Centre			Mean over seven centers		
		LB (G)	NB (%)	FB (%)	LB (G)	NB (%)	FB (%)
1	RPCAU-FM-18	4.20	28.59	21.78	4.67	23.69	33.73
2	RPCAU-FM-17	2.93	13.23	13.76	3.80	19.73	15.89
3	VR 1212	3.67	25.26	7.11	4.60	19.34	13.82
4	GPU 108	2.87	24.83	8.66	4.31	8.71	7.90
5	BR-16-28	2.73	10.07	5.28	3.82	20.88	19.08
6	KIFMG-22-13	2.53	10.74	5.16	4.07	5.76	11.77
7	KIFMG-22-17	3.07	11.86	16.06	4.43	19.42	21.03
8	WN-593	2.73	9.70	13.93	4.23	9.09	9.79
9	WN-660	2.60	11.43	14.22	4.54	16.11	14.91
10	BFM 8 E	2.07	22.41	22.56	3.45	20.32	24.28
11	TNEC1349	3.20	9.42	4.34	3.79	17.77	16.83

12	TNEC 1310	2.53	12.26	7.49	4.05	12.46	8.70
13	KMR 654	1.53	10.83	14.61	3.13	17.96	10.67
14	KMR 702	3.00	10.90	13.85	4.09	21.2	21.64
15	OEB 612	3.27	18.46	14.63	4.18	21.57	19.27
16	OEB 630	2.53	18.33	6.73	4.27	13.67	15.39
17	PRSW 43	2.60	10.87	10.87	3.97	8.32	10.18
18	IIMR-FM-R23-3023	2.47	12.22	11.82	3.85	10.04	8.60
19	IIMR-FM-R23-3022	2.40	9.70	3.60	4.19	9.97	14.05
20	IIMR-FM-R23-3016	2.20	9.70	13.43	3.48	12.12	9.85
21	VL 422	2.00	14.82	13.32	2.88	17.91	10.85
22	VL 423	1.53	16.43	12.21	2.67	18.68	14.18
23	VL 376	2.13	16.06	10.59	3.20	20.08	17.57
24	CMFV1	2.27	11.57	13.49	3.97	15.03	13.09
25	CMFV2	2.40	9.70	12.32	3.47	7.45	9.13
26	GE4449 (Resistant Check)	2.13	9.44	2.33	3.19	6.89	6.96
27	KMR 301 (Susceptible Check)	4.47	32.12	9.39	5.68	25.87	27.32
	Loc. Mean	**2.67**	**14.85**	**11.24**	**3.93**	**15.56**	**15.05**
	C.D. (5%)	**0.74**	**5.17**	**3.32**	**0.80**	**9.51**	**9.19**
	C.D. (1%)	**0.99**	**6.88**	**4.42**	**1.05**	**12.54**	**12.12**
	C.V. (%)	**16.96**	**21.23**	**18.01**	**23.09**	**61.94**	**65.70**

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