Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(3): 635-639
Received: 08-03-2020
Accepted: 12-04-2020

Sushri Sangita Bal
AICRP on MULLaRP, Centre for Pulses Research, Berhampur, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, India

S Kumar
AICRP on Medicinal & Aromatic Plants and Betelvine, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, India

IOP Mishra
AICRP on Small millets, Centre for Pulses Research, Berhampur, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, India

PM Mahapatra
AICRP on Pigeonpea, Centre for Pulses Research, Berhampur, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, India

RK Panigrahi
AICRP on MULLaRP, Centre for Pulses Research, Berhampur, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, India

PK Panda
AICRP on Pigeonpea, Centre for Pulses Research, Berhampur, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, India

Corresponding Author:
Sushri Sangita Bal
AICRP on MULLaRP, Centre for Pulses Research, Berhampur, Orissa University of Agriculture and Technology, Bhubaneswar, Odisha, India

Evaluation of finger millet genotypes against three major diseases in east and south eastern coastal plain zone of Odisha

Sushri Sangita Bal, S Kumar, IOP Mishra, PM Mahapatra, RK panigrahi and PK Panda

DOI: https://doi.org/10.22271/phyto.2020.v9.i3j.11342

Abstract
An experiment was conducted under natural epiphytotic conditions with an aim to evaluate eighteen genotypes against three major diseases of finger millet i.e. blast, foot rot and brown spot diseases at Centre For Pulses Research (CPR), Berhampur, Odisha during *Kharif* 2016. In case of blast disease, genotypes were screened for leaf blast at seedling stage where as at dough stage they were evaluated for neck and finger blast. Leaf blast infection was found to be less than 2% of leaf area in the genotype BR 14-3 and VL 352 and maximum infection to the extent of 25% in test entry TNEC 1281. Neck blast infection ranged from 9.29 to 66.60% while in case of finger blast the range of infection was 16.33 to 75.37%. Similarly the range of foot rot disease infection was from 0.00 to 23.64% and six genotypes namely GPU 67, VR 1094, BR 14-3, VL 352, KOPM 942 and PR 202 stand out to be immune and no resistance was noticed in any of the genotypes tested against brown spot disease.

Keywords: Finger millet, genotypes, blast disease, foot rot disease, brown spot diseases

Introduction
Finger millet (*Eleusine coracana* L.), is one of the oldest cereal crop known to humanity since time immemorial and it is grown and consumed in more than 95% of the regions of Africa and Asia. In India, it is cultivated in Karnataka, Tamil Nadu, Andhra Pradesh, Orissa, Bihar, Gujarat, and Maharashtra and in the hilly regions of Uttar Pradesh and Himachal Pradesh. In the scenario of extreme climate variability and dietary induced malnutrition the crop becomes more important because of its multipurpose use, adaptability to different kinds of stress and high nutritive value. (http://www.millets.res.in/vision/vision2050). Finger millet is a power house of health benefitting nutrients such as of calcium (0.38%), protein (6%–13%), dietary fiber (18%), carbohydrates (65%–75%), minerals (2.5%–3.5%), phytates (0.48%), tannins (0.61%), phenolic compounds (0.3–3%). Additionally, it is also rich in vitamins, essential amino acids and trypsin inhibitory factors. Because of these nutrients the crop has prominent health beneficial properties *viz.* anti-diabetic, anti-diarrheal, antiulcer, anti-inflammatory, antitumerogenic, atherosclerogenic effects, antimicrobial and antioxidant properties (Chandra *et al*. 2016) [2]. Because of these reasons, finger millet has got higher increasing demand in wider range of consumers of all classes i.e. rural to urban and poor to rich in the country. But its production is being checked by many abiotic and biotic stresses. Among biotic factors, fungal blast, foot rot, and brown spot are some major diseases affecting finger millet in India (Nagaraja *et al*., 2007) [9]. Blast, caused by *Pyricularia grisea* (Cooke) Sacc., is an economically important disease that appears at all stages of the crop infecting leaves, finger-necks and fingers blast causing more than 50% yield losses. In severe cases the yield losses in endemic areas could be as high as 80-90% (Rao, 1990; Esele, 2002) [12, 3]. In leaf blast, typical spindle shaped spots appears on leaf lamina and then these spots enlarge, coalesce showing blasted appearance from tip to the base in leaf. In neck blast, pathogen attacks the culms at nodal regions showing blackening and attack at neck region results in seed sterility, under developed seeds and frequently hanging down of the stalk from the neck. In finger blast, fingers get infected from apical portion towards the base and eventually results in shriveled and blackened seeds (Nagaraja *et al*., 2007) [9]. Foot rot disease in finger millet is caused by *Sclerotium rolfsii* Sacc. and because of soil borne nature of the disease, a considerable losses are being incurred to the crop. The disease occurs at seedling stage of the crop wherein the affected plants become pale, chlorotic and stunted.

Infected part of the stem gets softened and turns brown with concomitant shrinking and then the plants gets wilted and dried. White fan like mycelial growth can be observed between sheaths and basal portion of the stem. Subsequently, mustard seed like dark brown sclerotial bodies can also be noticed on the basal portion of the stem as well as near the collar region of infected plants (Kumar and Prasad, 2010). In severity, brown spot disease caused by *Drechslera nodulosum* Berk and Curt., is next to blast inducing damages of qualitative and quantitative nature (Nagaraja *et al*., 2007; Kiran Kumar, 2011) [9]. Almost all parts of an infected plant i.e. root, base, culms, leaf sheath, leaf blade, neck of the panicle and fingers get affected but leaf blade, leaf sheath and culms particularly the nodal joints are majorly affected. The oval shaped spots on leaves merge together to give blighted appearances particularly towards the tips of infected leaves. Dark brown discolouration can be seen at the junction of leaf sheath and leaf blade. In severe cases the infected plants under favourable conditions also exhibit foot rot symptoms (Nagaraja *et al*., 2007) [9]. Growing region specific resistant varieties is the most suitable, efficient and ecofriendly approach to manage these diseases and minimize the losses caused by them. There is very limited information available on sources of resistance against major diseases in the south eastern coastal plain zone of Odisha. Keeping these facts in mind, eighteen finger millet genotypes were screened to identify the source of resistance against blast, foot rot and brown spot diseases under natural epiphytotic conditions during *Kharif*, 2016.

Materials and Methods

Test entries of finger millet, received from Indian Institute of Millet Research, Hyderabad, India, were evaluated in the experimental farm of Center for Pulses Research, Odisha University of Agriculture and Technology (OUAT), Berhampur, Odisha during *Kharif* 2016. The experimental site comes under East & South East Coastal Plain zone and is situated at 19^0 18' N Latitude, $84^0$54' E Longitude and at an altitude of 34m above MSL. The seeds of test materials were sown in nursery to raise their seedlings. Similarly, seedlings of susceptible check and local check were also raised in nursery. GPU 28 was used as susceptible check whereas a highly susceptible variety Bhairabi was used as local check. The purpose of using susceptible check and local check was to impart maximum conducive environment for the disease to spread under natural field conditions. Seedlings of each test entry were transplanted in two rows of 3m length and both the rows of each entry were sandwiched with a susceptible check i.e. on either side of each test entry a row of susceptible check was transplanted. The experiment was laid in three replications with spacing of 22.5cm x 10cm. Seedlings of local check i.e. Bhairabi were transplanted in a row after every 10 test entries. All the recommended agronomic practices were followed except insecticidal and fungicidal spray. Five plants were randomly selected from each replication of every genotype for recording the observations of blasts, brown spot and foot rot disease, following Standard Evaluation System (SES) scale provided by AICRP (All India Coordinated Research Project) on Small Millets (Table 1 to 3). For blast disease, leaf blast recording was done at seedling stage (30-40 days old plant) and for neck & finger blast diseases observations were taken at dough stage (70-75 days old plants).

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

Score	Description for leaf blast
0	No lesions/symptoms on leaves
1	Small brown specks of pinhead size without sporulatingcentre
2	Small roundish to slightly elongated, necrotic grey spots, about 1-2 mm in diameter with a distinct brown margin and lesions are mostly found on the lower leaves.
3	Lesion type is the same as in scale 2, but significant numbers of lesions are on the upper leaves.
4	Typical sporulating blast lesions, 3mm or longer, infecting less than 2% of the leaf area.
5	Typical blast lesions infection 2-10% of the leaf area.
6	Blast lesions infecting 11-25% leaf area.
7	Blast lesions infecting 26-50% leaf area.
8	Blast lesions infecting 51-75% leaf area.
9	More than 75% leaf area affected.

$$\text{Neck blast (\%)} = \frac{\text{No. of infected panicles}}{\text{Total no. of panicles}} \times 100$$

$$\text{Finger blast (\%)} = \frac{\text{No. of infected fingers}}{\text{Average number of fingers} \times \text{Total Number of panicles}} \times 100$$

Table 2: Score chart for neck blast (NB) and finger blast (FB)

Score	Description	Reaction
0	No incidence	No disease/ HR
1	Less than 5%	R
3	5-10%	MR
5	11-25%	MS
7	26-50%	S
9	More than 50%	HS

Table 3: Standard Evaluation System (SES) scale for brown spot and foot rot disease

Brown spot disease	
Score	**Description**
0	No incidence
1	Less than 1% leaf area affected
2	1-3% leaf area affected
3	4-5% leaf area affected
4	6-10% leaf area affected
5	11-15% leaf area affected
6	16-25% leaf area affected
7	26-50% leaf area affected
8	51-75% leaf area affected
9	76-100% leaf area affected

Foot rot disease		
Score	**Description**	**Reaction**
1	0% (no disease)	Immune (I)
2	Up to 1%	HR
3	2-10%	R
4	11-20%	MR
5	21-50%	S
6	More than 50%	HS

Result and Discussion

The genotypes were screened and evaluated against three major diseases i.e. blast, brown spot and foot rot. The mean data of three replications has been presented in Table 4.

Blast disease: The minimum leaf area infection was found to be less than 25% in the genotypes BR 14-3 and VL 352 where as the maximum infection was noticed in an entry TNEC 1281 wherein the infection was up to 25%. Neck blast infection ranged from 9.29 to 66.60% and out of eighteen genotypes only one i.e. KRI 009-04 was found to be moderately resistant against neck blast disease. Five genotypes were observed to be moderately susceptible, nine as susceptible and three test entries as highly susceptible against neck blast. Finger blast infection ranged from 16.33 to 75.37%. None of the genotypes were found to be resistant or moderately resistant against neck blast. Four genotypes namely VR 1094, BR 14-3, DHFM 78-33 and PR 202 were found to be moderately susceptible where as other four entries such as VL 387, VR 936, GPU 67 and GPU 93 were observed to be susceptible. Ten genotypes i.e. GPU 94, TNEC 1281, VL 352, KOPM 942, KRI 009-04, VL 503, VR 708, PR 10-35, KMR 630 and GPU 45 were found to be highly susceptible against finger blast. Somasekahara *et al.* (1991) [13] screened twenty five finger millet cultivars for their resistance to blasts under natural conditions and reported none of the cultivar was resistant to leaf blast. Barnwal (2012) [1] screened 8 finger millet cultivars against blast disease and reported PR 202 to be moderately resistant against neck blast. Patro and Madhuri (2014) [10] evaluated 32 finger millet genotypes where they found two genotypes susceptible to neck blast and moderately resistant to finger blast, 14 were moderately resistant to both neck and finger blast whereas and 13 genotypes were susceptible to both neck and finger blast. Ganesha *et al* (2018) [4] screened 14 released and pre released varieties against blast disease and reported PR 202 to be moderately susceptible against neck blast and resistant against finger blast at Agricultural and Horticultural Research Station, Bavikere, Chikmagaluru district, Karnataka.

Foot rot disease: Foot rot infection was ranged from 0.00 to 23.64 percent. Out of eighteen genotypes, six genotypes (GPU 67, VR 1094, BR 14-3, VL 352, KOPM 942 and PR 202) exhibited immune reaction against foot root disease. Genotypes VR 936 and DHFM 78-33 were observed to be resistant where as eight genotypes namely GPU 94, VL 387, TNEC 1281, GPU 93, KRI 009-04, VL 503, VR 708, PR 10-35 were noticed to be moderately resistant against the disease. Out of eighteen genotypes only two genotypes namely KMR 630 and GPU 45 were found to be susceptible against foot root disease. Similar findings were reported by Prakash and Ravishankar (2007) wherein seven genotypes *viz.* GPU 28, RAU 8, L–49–1, MR 6, OEB 82, PR 202 and OEB 10 were observed to be highly resistant to foot rot disease. Madhukarrao (2013) [8] evaluated 14 genotypes of finger millet and recorded the lowest disease incidence in PR 202 (10.00%) at Navsari, Gujrat.

Brown spot disease: in case of brown spot disease, affected leaf areas ranged from 16 to 75% indicating that none of them were found to be resistant against brown spot disease. The maximum infection was noticed in case of KRI 009-04 which and it was at par with the infection in local check Bhairabi. Kumar *et al.* (2015) [6] tested 65 finger millet genotypes out of which 30 entries exhibited immune response, 24 genotypes showed highly resistance reaction, 6 test entries displayed resistance response and 5 genotypes showed moderately resistance response.

Table 4: Reaction of finger millet genotypes against major diseases during *Kharif* 2016

Sl. No.	Genotypes	Blast disease					Foot rot	Disease reaction	Brown spot (G)
		LB (G)	NB (%)	Disease reaction	FB (%)	Disease reaction			
1.	GPU 94	5	22.80	MS	58.74	HS	11.37	MR	7.00
2.	VL 387	4.6	30.38	S	25.23	S	14.09	MR	7.66
3.	VR 936	5	37.27	S	49.35	S	3.26	R	6.66
4.	TNEC 1281	6.6	34.23	S	69.13	HS	14.95	MR	7.66
5.	GPU 67	6	40.55	S	46.31	S	0.00	I	7.00
6.	VR 1094	4	35.44	S	21.06	MS	0.00	I	7.00
7.	BR 14-3	3.6	18.22	MS	16.33	MS	0.00	I	6.66
8.	VL 352	3.6	55.69	HS	68.89	HS	0.00	I	7.33
9.	GPU 93	4.6	16.74	MS	47.70	S	16.10	MR	7.33
10	DHFM 78-33	6	23.52	MS	24.10	MS	5.48	R	7.33
11.	KOPM 942	5	24.44	MS	59.98	HS	0.00	I	7.33
12.	KRI 009-04	5.3	9.29	MR	71.77	HS	10.15	MR	8.00
13.	PR 202	6	32.53	S	24.84	MS	0.00	I	6.66
14.	VL 503	4.6	50.99	HS	64.55	HS	12.98	MR	7.33
15.	VR 708	5	66.60	HS	75.37	HS	15.34	MR	6.33
16.	PR 10-35	5.6	29.89	S	74.66	HS	14.44	MR	6.66
17.	KMR 630	5.3	25.39	S	70.99	HS	23.64	S	7.33
18.	GPU 45	5	42.96	S	61.15	HS	22.22	S	7.00
NC	GPU 28	5.3	50.21	HS	63.58	HS	21.66	S	7.33
LC	Bhairabi	4.33	33.05	S	57.45	HS	26.72	S	8.00

LB-Leaf blast, NB-Neck blast, FB-Finger blast, NC -National check, LC- Local Check

Acknowledgements

Authors would like to acknowledge Centre for Pulses Research (OUAT) Berhampur, Odisha for providing facilities for conducting research and Project Coordinator, AICRP on Small Millets for all kinds of support.

References

1. Barnwal MK. Evaluation of finger millet varieties against blast (*Pyricularia grisea*) under rainfed conditions. J Mycol. Pl. Pathol. 2012; 42(2):222-224.
2. Chandra D, Chandra S, Pallavi, Sharma AK. Review of Fingermillet (*Eleusine coracana* (L.) Gaertn): A powerhouse of health benefiting nutrients. Food Science and Human Wellness, 2016, 149–155.
3. Esele JP. Diseases of finger millet. A global review. Sorghum and finger millet diseases edited by Leslie JF, 2002, 19-26.
4. Ganesha Naik R, Basavarajnaik T, Jayalakshmi K. Identification of resistant sources of finger millet varieties against neck and finger blast disease. International Journal of Chemical Studies. 2018; 6(5):1065-1068.
5. Kiran Kumar AC. Studies on brown leaf spot disease (*Helminthosporium* spp.) of finger millet and foxtail millet. M. Sc. (Agri.) Thesis. Dept. of Plant Pathology, Uniersity of Agricultural Science, Bengaluru, 2011.
6. Kumar CK, Nagaraja A. Raghavendra BT. Evaluation of genotypes of finger millet and foxtail millet against brown leaf spot disease. Environment and Ecology. 2015; 33(1):136-139.
7. Kumar B, Prasad D. A new record on foot rot or wilt disease of finger millet (*Eleusine coracana*) caused by *Sclerotium rolfsii* from mid hills of Uttarakhand. J Mycol. Pl. Pathol. 2010; 40(3):334-336
8. Madhukarrao PD. Management of foot rot (*Sclerotium rolfsii* Sacc.) of finger millet (*Eleusine coracana* L. Gaertn). M. Sc. (Agri.) Thesis.2013. Dept. of Plant Pathology, N.M. College of Agriculture, N.A.U., Navsari.
9. Nagaraja A, Jagadish PS, Ashok EG, Krishne Gowda KT. Avoidance of finger millet blast by ideal sowing time and assessment of varietal performance under rainfed production situations in Karnataka. Journal of Mycopathological Research. 2007; 45(2):237-240.
10. Patro TSSK, Madhuri J. Identification of resistant varieties of finger millet for leaf, neck and finger blast. International Journal of Food, Agriculture and Veterinary Sciences. 2014; 4(2):7-11.
11. Prakash P, Ravishankar CR. Reaction of finger millet genotypes to neck blast (*Pyricularia grisea*) incidence at different nitrogen levels. J Mycol. Pl. Pathol. 2007: 37:583.
12. Rao A. Estimates of losses in finger millet (*Eleusine coracana*) due to blast disease (*Pyricularia grisea*). Mysore J Agric. Sci. 1990; 24:57–60.
13. Somasekahara YM, Viswanath S, Anilkumar TB. Evaluation of finger millet [*Eleusinecoracana* (L.) Gaertn.] cultivars for their reactions to blast (*Pyriculariagrisea* Sacc.). Trop. Agric. (Trinidad). 1991; 68(3):231-234.