The Andhra Agric. J 70 (1): 103-107, 2023
10.61657/aaj.2023.15

Screening Barnyard Millet Genotypes under Natural Field Conditions against Sheath Blight Disease incited by *Rhizoctonia solani* Kuhn

T S S K Patro, N Anuradha, Y Sandhya Rani, U Triveni, D Sabina Mary, K B Palanna and I K Das
Agricultural Research Station, ANGRAU, Vizianagaram, Andhra Pradesh

ABSTRACT

Barnyard millet is the second most important small millet after finger millet in India. In the present study 18 barnyard millet entries including checks were evaluated for identification of a resistance source against banded blight disease at Agricultural Research Station, Vizianagaram during *kharif*, 2021 under natural field conditions. The screening revealed that none of the test lines or varieties were immune or highly resistant. However, LRB-13 (20.4%),LRB-14 (21.0%),VB-19-6 (22.6%), VB-19-5(22.8%),LRB-30 (25.8%), LRB-29(29.9%), VB-19-5(30.8%) and LRB-29 (30.7%) were recorded as resistant to banded blight. The disease intensity ranged from 20.4% (LRB-13) to 48.6% (VL 257), whereas it was 8.6% in resistant check (PRB 903) and 71.67% in susceptible check (LDR-1).

Keywords: *Barnyard millet, Banded blight, Resistant, Screening and Susceptible*

Small millets are warm-season cereals largely grown in the semi arid tropical regions of Asia and Africa, under rainfed farming systems (Rai *et al*., 2008). The most prominent small millets include finger millet (*Eleucine coracana*), kodo millet (*Paspalum scrobiculatum*), proso millet (*Panicum miliaceum*), foxtail millet (*Setaria italica*), little millet (*Panicum sumatrance*), barnyard millet (*Echinocloa frumentacea*) and browntop millet (*Brachiaria ramosa*). Small millets have been the staple food for millions of people residing in arid and semiarid regions of Asian and African countries and are currently restricted to certain traditional growing areas. Increased health problems, due to changes in lifestyle, have driven people to rethink their food habits and deliberately shift toward nutritional crops, such as small millets (Anuradha *et al*., 2022). Small millet grains are rich in dietary energy, vitamins, several minerals (especially micronutrients such as iron, calcium and zinc), insoluble dietary fiber and phyto chemicals with antioxidant properties (Bouis, 2000) and are considered as “Nutri-cereals”. Epidemiologically, a lower incidence of diabetes is reported in millet consuming populations (Saleh *et al*., 2013).

Barnyard millet (*Echinochloa frumentacaea*) is one of the hardiest millets, and is called by several names *viz*., Japanese barnyard millet, ooda, oadalu, sawan, sanwa, and sanwank. Nutritionally, Barnyard millet is an important crop. The most calcium-rich source among the small millets is barnyard millet. The grain of barnyard millet has a notable supply of micronutrients (iron and zinc) in comparison to other major cereals. It is also a rich source of protein, carbohydrates, and fibre (Renganathan *et al*., 2020). The carbohydrate content is low and slowly digestible (Veena *et al*., 2005), which makes the barnyard millet a natural designer food.

When compared to wheat, it contains six times more fibre and has a high fibre, calcium, and phosphorus content. Besides, barnyard is a fastest multipurpose crop, which yields food and forage in a short duration and at low inputs even under adverse climatic conditions. Barnyard millet is prone to many diseases and can be effectively controlled by application of fungicides and practicing suitable management practices. Screening of varieties within built genetic resistance is the best means for management of this disease, as the crop is predominantly grown by resource poor farmers who can hardly afford using chemicals for its control (Das *et al*., 2021). Different in *virto* Screening techniques like leaf disc method, pollen bioassay (Babu and

Ravikumar, 2010) were available for identifying resistance sources, However screening in hot spot is the best method in situ incorporation of legume green manure crops also increases the nutrient uptake, productivity of maize and reduces disease incidence (Sandhya Rani *et al.*, 2022). Similarly, in the ground nut crop simultaneous selection for stable disease resistant and high yielding groundnut genotypes was identified (Patro *et al.* 2022).

However, the poor farmers required only varieties with resistance to the disease. Hence, the study was undertaken to identify barnyard millet genotypes resistant to banded blight disease.

MATERIAL AND METHODS

A field experiment was conducted against sheath blight caused by *Rhizoctonia solani* during *kharif*, 2021 at Agricultural Research Station, Vizianagaram. The experiment was laid out on a plot in Randomized Block Design (RBD), with 18varietiesreplicated three times which was sown in two rows of 3 m length with a spacing of 22.5 x 10 m. The recommended agronomic practices and other standard packages of practices were adopted at the time of crop growth . Five randomly selected plants from each genotype/replication were selected for recording the observations. The genotypes of barnyard millet were screened under natural epiphytotic conditions and no artificial inoculation was made. Infected plants were examined for lesion development and disease severity was assessed on the basis of lesion length using a 0 to 5 scale (Anonymay, 1996).

RESULTS AND DISCUSSION

Eighteen barnyard millet varieties were screened for banded blight reaction. Among the screened entries, no variety was found to be immune to *R. solani, nor was it* found to be highly resistant. However, LRB-13 (20.4%), LRB-14 (21.0%), VB-19-6 (22.6%), VB-19-5(22.8%), LRB-30 (25.8%), LRB-29 (29.9%), VB-19-5(30.8%) and LRB-29 (30.7%)were recorded as resistant to banded blight. The disease intensity ranged from 23.13% (VMBC 333) to 59.27% (ACM 15-343), whereas it was 8.67% in resistant check (LDR 1) and 71.6% in susceptible check (PRB 903)(Table2).

Patro *et al*. (2021) evaluated 22 barnyard millet varieties and screened them for banded blight reactions. Among the screened entries, no variety was found to be immune to *R. solani* also none found to be highly resistant. However, VMBC 333 (23.13%), VL 254 (25.40%), ACM 15-353 (25.87%) TNEf 319 (25.40%) and DHBM 93-3 (26.20%) were recorded as resistant to banded blight. The disease intensity ranged from 23.13% (VMBC 333) to 59.27% (ACM 15-343)

Patro *et al*. (2017) evaluated ten varieties where the disease intensity ranged from 85.33%(VL207)to97.33% (DHBM 18-6, VL 249 and DHBM 99-6) while it was 98.67% in the local check. Divya *et al*. (2016) evaluated thirteen varieties and the percent disease intensity was ranged from 27.9% (ACM 10-082) to 92.5% (RBM 7-2) whereas it was 93.7% in susceptible check. Patro *et al* (2014) and Nagaraja *et al*.(2016) reported that all the small millet crops were found infected with *R. solani*. Similar research was also done in other small millet crops by Neeraja *et al*. (2016), Patro *et al*.(2013) and Patro *et al*. (2016). Patro *et al*. (2018) evaluated twentythree barnyard millet varieties and reported that no variety was found to be immune to *R. solani* also none found to be resistant. However, varieties VB- 16-7 (40.00), VB-16-8 (46.67), VB16-20 (49.33), LRB-9 (44.00) and LRB-19 (49.30) were found to be resistant. Varieties VB-15-3 (56.00), VB-15-6 (57.33), VB-16-31 (52.00), PRB 903 (54.67), LRB-1 (52.00) and LRB-26 (56.00) as moderately resistant to moderately susceptible. Whereas, VB-15-1 (80.00) and LRB-21 (81.33) were found to be as susceptible. Patro *et al*. (2018) evaluated 9genotypes and reported that TNEf 204 (49.33) and VL 172 (45.33) entries as moderately susceptible and DHBM 99-6, DHBM 19-7 and RBM 36 (73.33)were susceptible entries. Patro *et al*. (2019) evaluated 14genotypes and reported that disease intensity was ranged from 53.8 (DHBM 33) to 97.5 (TNEf 204) which were recorded as susceptible entries. Patro *et al*. (2020) screened 19 barnyard millet entries and revealed that none of the test lines or varieties were immune or highly resistant. However, LBT 1 (22.3%) and LRB 2 (25.3%) were recorded as resistant. The disease intensity was ranged from 22.3% (LBT 1) to 85.0% (LRB 15), whereas it was 21.7% in resistant check (PRB 903) and 97.1% in susceptible check (LDR-1).These genotypes would be of immense value to the breeders involved in developing high yielding resistant genotypes of barnyard millet.

Table 1: Standard Evaluation System (SES) scale for sheath blight disease

Score	Description	Reaction
0	No incidence	Immune
1	Vertical spread of the lesions upto 20% of the plant height	HR
2	Vertical spread of the lesions upto 21-30% of the plant height	R
3	Vertical spread of the lesions upto 31-45% of the plant height	MR/MS
4	Vertical spread of the lesions upto 46-65% of the plant height	S
5	Vertical spread of the lesions upto 66-100% of the plant height	HS

The Percent Disease Index (PDI) was calculated by using the formula

PDI for severity =

$$\frac{\text{Sum of all disease ratings}}{\text{Total no. of ratings} \times \text{Maximum disease grade}} \times 100$$

Table 2:Reaction of Barnyard millet entries against banded blight

S.No.	Entry	Banded blight (%)	Yield/ plot (g)
1	LRB-10	29.47	127.57
2	LRB-13	20.4	173.63
3	LRB-14	21	168
4	LRB-15	35.53	119.33
5	LRB-17	37.8	114
6	LRB-24	30.73	128.73
7	LRB-29	29.93	125.4
8	LRB-30	25.8	153.43
9	VB-19-3	45.47	69.27
10	VB-19-4	43	107.77
11	VB-19-5	22.87	155.03
12	VB-19-6	22.6	175.8
13	VB-19-7	30.8	142.83
14	VB-19-12	37.27	135.67
15	VL 257	48.6	85.87
16	VB-19-15	42.87	98.77
17	LDR 1**(R)**	8.67	215.67
18	PRB 903**(S)**	71.67	41.47
	Mean	**33.58**	**129.9**
	C.D. (5%)	**7**	**15.3**
	C.D. (1%)	**9.5**	**20.5**
	C.V. (%)	**12.6**	**7.1**

Eighteen genotypes of barnyard millet in national screening nursery (NSN) were screened with one resistant and one susceptible check. None of the genotype was found to be immune against banded blight. Genotypes LRB-13 (20.4%), LRB-14 (21.0%), VB-19-6 (22.6%), VB-19-5(22.8%),LRB-30 (25.8%), LRB-29 (29.9%), VB-19-5(30.8%) and LRB-29 (30.7%) were found to be promising entries for banded blight resistant during the one year experimentation.

Anonymous 1996. Standard evaluation system for rice. International Rice Testing programme. International Rice Research Institute Report, Philippines.

Anuradha N, Patro T S S K, Ashok Singamsetti, Sandhya Rani Y, Triveni U, Nirmala Kumari, Nagappa Govanakoppa, Lakshmi Pathy T and Vilas A Tonapi 2022. Comparative study of AMMI and BLUP based simultaneous selection for grain yield and stability of finger millet (*Eleusine coracana* (L.) Gaertn.) genotypes. *Frontiers in Plant Science section Plant Breeding*, Doi:10.3389/fpls.2021.786-839.

Babu D R and Ravikumar R L 2010. Parallel response between gametophyte and sporophyte of Fusarium wilt resistance in recombinant inbred lines of chickpea (Cicer airetinum L.) *Current Science*. 99(4): 513-518.

Bouis H E 2000. Enrichment of food staples through plant breeding: a new strategy for fighting micronutrient malnutrition. Nutrition. 16:701-4

Das I K, Palanna K B, Patro T S S K, Ganapathy K N, Kannababu N, Sunil Kumar and Tonapi V A 2021. A multilocational evaluation of blast resistance in a diverse panel of finger millet in India. Crop protection. 139:105401

Divya M, Patro T S S K and Ashok S 2016. Evaluation of resistant sources of Banyard millet varieties against banded blight (BB) disease incited by *Rhizoctonia solani* Kuhn. Frontiers in Crop Improvement. 4(2):99-100.

Nagaraja A, Bijendra Kumar, Jain A K, Patro T S S K and Nageswar Rao T G 2016. Diseases of small millets. Diseases of field crops and their management. Indian Phytopathological Society. New Delhi. 295-371.

Neeraja B, Patro T S S K, Rani Y S, Triveni U and Geethanjali K 2016. Studies on three forms of blast (leaf, neck and finger) in finger millet (*Eleusine coracana* Gaertn.) incited by *Magnaporthe grisea* [Hebert]. Barr. in vivo. 6th International Conference "Plant, Pathogens and People". February 23-27, 2016, New Delhi, India. 269.

Patro T S S K, Anuradha N, Ashok Singamsetti, Sandhya Rani Y and Triveni U 2022. Simultaneous selection for stable disease resistant high yielding groundnut genotypes. Current Science.28(2):85-92

Patro T S S K, Praveen B, Anuradha N, Sandhya Rani Y, Triveni U and Ashok S 2021. Resistant Source Identification in Barnyard Millet under Natural Field Conditions against Sheath Blight Disease Incited by *Rhizoctonia solani* Kuhn. *Frontiers in Crop Improvement.* 9: 3799-3801.

Patro T S S K, Meena A, Divya M and Anuradha N 2018. Identification of resistant sources in Donor Screening Nursery (DSN) of Barnyard millet against *Rhizoctonia solani*, the cause of sheath blight. International journal of chemical studies. 6(4):2514-2516.

Patro T S S K, Anuradha N, Madhuri J, Suma Y and Soujanya A 2013. Identification of resistant sources for blast disease in finger millet (*Eleusine coracana* Gaertn.). Varietal Improvement of Small Millets. National seminar on "Recent Advances of Varietal Improvement in Small Millets. 5-6.

Patro T S S K, Divya M, Sandhya Rani Y, Triveni U and Anuradha N 2017. Identification of resistant sources against *Rhizoctonia solani* Khun, the incitant of sheath blight of *Echinocloa frumentacea*. Progressive Research- An International Journal. 12(1) :125-126.

PatroT S S K, Georgia K E, Raj Kumar S, Anuradha N, Sandhya Rani Y, Triveni U and Jogarao P 2020. Evaluation of resistant sources of barnyard millet varieties against sheath blight caused by *Rhizoctonia solani* Kuhn.Journal of Pharmacognosy and Phytochemistry 9 (5): 1231-1233.

Patro T S S K, Neearja B, Rani S Y, Keerthi S, Jyothsna S 2014. Banded blight – An emerging malady in small millets. National conference on emerging challenges and opportunities in biotic and abiotic stress management. Society for scientific development in agriculture and technology, Meerut, India. 120.

Patro T S S K, Neeraja B, Sandhya Rani Y, Jyothsna S, Keerthi S and Bansal A 2016. Reaction of elite finger millet varieties against blast disease incited by *Magnaporthe griseain vivo*. 11(2):209-212.

Patro T S S K, Raj Kumar S, Meena A, Anuradha N, Triveni U and Joga Rao P 2019. Screening for identification of resistant sources of barnyard millet varieties against sheath blight caused by *Rhizoctonia solani* Kuhn. International Journal of Chemical Studies. 7(6): 957-959.

Rai K N, Gowda C L L, Reddy B V S and Sehgal S 2008. Adaptation and potential uses of sorghum and pearl millet in alternative and health foods. Comprehensive Reviews in Food Sciences. 7:340-352

Renganathan V G, Vanniarajan C, Karthikeyan A and Ramalingam J 2020. Barnyard Millet for Food and Nutritional Security: Current Status and Future Research Direction. *Front. Genetics*. 11:1-21

Saleh A S M, Zhang Q, Chen J and Shen Q 2013. Millet grains: nutritional quality and potential health benefits. Compr. Rev. Food Sci. Food Saf. 12: 281-295

Sandhya Rani Y, Jamuna P, Triveni U, Patro, T S S K and Anuradha N 2022. Effect of in situ incorporation of legume green manure crops on nutrient bioavailability, productivity and uptake of maize. *Journal ofPlant Nutrition*, 45 (7): 1004–1016.

Veena B, Chimmad B V, Naik R K and Shantakumar G 2005. Physico-chemical and nutritional studies in barnyard millet. *Karnataka J Agril Sci*.18:101-105

Received on 18.09.2022 and Accepted on 04.02.2023