Int.J.Curr.Microbiol.App.Sci (2019) *8*(3): 1796-1800

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 8 Number 03 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.803.210

Identification of Resistant Sources for Blast and Rust in Foxtail Millet Incited by *Pyricularia setariae* and *Uromyces setariae-Italica*

M. Rajesh*, A. Sudha, A. Nirmalakumari and P. Parasuraman

Centre of Excellence in Millets, Athiyandal, Tiruvannamalai District, India

**Corresponding author*

Keywords

Foxtail Millet, *Pyricularia setariae*, *Uromyces setariae-italica*

Article Info

Accepted:
15 February 2019
Available Online:
10 March 2019

A B S T R A C T

The present investigation was undertaken to identify the resistant genotypes amongst twelve genotypes of foxtail millet or Italian (*Setaria italica* L.) for evaluating blast and rust disease severity caused by *Pyricularia setariae* Nisikado. and *Uromyces setariae-italica* (Diet.) Yoshino. were studied during 2016-2017 at Centre of Excellence in Millets, Athiyandal, Tamil Nadu, India and this paper reports the result of this investigation. Blast disease caused by *Pyricularia setariae* and rust disease caused by *Uromyces setariae-italica* is a serious disease of foxtail millet and inflicts considerable reduction in grain yield. The disease has characteristic lesions and in severe cases, completely drying up of lesions. Among the twelve genotypes screened against blast and rust diseases, maximum grade of disease severity was recorded in SiA 3163 (4 and 7.67 grade respectively) and the minimum percentage of disease severity was recorded in SiA 3164 (1.00 and 0.67 grade respectively). Among the twelve genotypes, SiA 3205 and SiA 3164 were evaluated as resistant genotypes. These genotypes could be considered a potential source for disease resistance against the blast and rust of foxtail millet and could be used in breeding program for development of blast and rust resistant foxtail millet variety.

Introduction

Foxtail (*Setaria italica* L.) millet is cultivated as dry land crop under marginal and sub-marginal lands of tropical and sub tropical Asia and an important staple food for millions of people in southern Europe and Asia (Reddy *et al.*, 2006). The grain is widely used as livestock and poultry feed. The oil recovery from the bran ranges from 7-11 per cent which can be used in soap and paint industry. The oil can be easily refined and bleached to render it edible. In India, it is grown over an area of around 5 lakh ha in Andhra Pradesh, Karnataka, Tamil Nadu, Rajasthan, Uttar Pradesh, Gujarat and North Eastern states with an annual production of 2.9 lakh tonnes and productivity of around 600 kg/ha. It is grown in Tamil Nadu as rainfed crop during June-July and September - October covering the area of western zone of Tamil Nadu and occupies an area of 767 ha with a production of 349 tonnes and productivity of 468 kg/ha (Crop and Season report 2015–16). More

specifically it is grown in Coimbatore, Madurai, Dindigul, Erode, Salem, Namakkal and Tirunelveli districts.

Foxtail millet is attacked by many diseases like blast (*Pyricularia setariae*), rust (*Uromyces setariae*), brown spot (*Drechslera setariae*), downy mildew (*Sclerospora graminicola*) and smut (*Ustilago crameri*). Among them, blast and rust are the most destructive diseases. The blast in its severe form causes upto 30 - 40 per cent loss in grain yield (Nagaraja *et al.,* 2007). Although voluminous literature is available on the blast of rice owing to its worldwide cultivation, work on the foxtail millet blast is comparatively less. Kawakami (1902) first reported *P. oryzae* Cav. on *S. italica*, but the blast disease of foxtail millet was reported in Japan by Nishikado in 1917 and the causal pathogen was identified as *P. setariae* Nishikado. In India, it was first reported from Tamil Nadu in 1920 by McRae (1920). Application of pesticides is not common in small millets therefore each season crops suffer from serious losses, especially due to blast and rust in foxtail millet. Thus development of genotypes resistant to these diseases is essential considering the poor purchasing power of rainfed farmers and safer ecology. Therefore, an attempt has been made to identify the suitable foxtail millet genotypes, which can be exploited for developing resistant cultivars against important endemic diseases of the region.

Materials and Methods

In order to find out resistant sources against blast disease caused by *Pyricularia setariae* and rust disease caused by *Uromyces setariae-italica*, field experiment was conducted with twelve foxtail millet genotypes were grown in a sandwich method with three replications during *kharif* 2016 under natural epiphytotic conditions at research farm of Centre of Excellence in Millets, Athiyandal, where the severity of these diseases remain very high during the cropping season. The recommended agronomical practices were adopted for better crop growth. Each entry was sown in two rows of 3m length and plot size of 3 m x 2.25 m; keeping the 20 cm row to row and 10cm plant to plant distance. Every entry was sandwiched by a local variety [CO(Te)7] as check (Plate 3). Five randomly selected plants were selected from each genotype/replication for recording the observations. Observations were recorded at panicle emergence stage for leaf blast and rust symptoms on leaves. The resistance or otherwise of the test genotypes to blast and rust diseases was assessed using 1-9 rating scale (Proceedings of 27th Annual Group Meeting of AICRP on Small Millets, 2016) as follows,

SES for blast

Score	Description	Reaction
1	Small brown specks of pinhead size without sporulating centre.	R
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.	MR
3	Lesion type is the same as in scale 2, but significant numbers of lesions are on the upper leaves.	MR
4	Typical sporulating blast lesions, 3 mm or longer, infecting less than 2% o the leaf area.	MS
5	Typical blast lesions infection 2-10% of the leaf area.	MS
6	Blast lesions infecting 11-25% leaf area.	S
7	Blast lesions infecting 26-50% leaf area.	S
8	Blast lesions infecting 51-75% leaf area.	HS
9	More than 75% leaf area affected	HS

Incidence of rust: SES Scale

Score	Description	Reaction
0-1	Pinhead flecks with no sporulation	R
1.1-3	Small scattered erumpent pustules with little sporulation	MR
3.1-5	Clear many erumpent pustules containing numerous spores	MS
5.1-7	Many coalescing pustules covering < 50% leaves	S
7.1-9	Many coalescing pustules covering most (>50%) leaves	HS

Results and Discussion

Typical leaf blast symptoms were observed on the leaf lamina (Plate 1). Initially, small yellowish dot appeared that within 2-3 days turned circular to oval with a grayish centre surrounded by brown margin. In severe form, lesions coalesced with tearing off of infected portion. Under high relative humidity, central grayish region became brownish colour indicating sporulation of the causal fungus. Similar symptoms were reported by Ramakrishnan (1948) and Sharma *et al.*, (2014). The lower leaves were severely affected than top young leaves with no symptoms observed on leaf sheath, nodes, peduncle and panicle. Symptoms of blast and rust disease (Plate 2) were observed and grades of disease severity were recorded. The data present in the table 1 revealed that a total of twelve foxtail millet genotypes were evaluated against blast and rust diseases, out of which SiA 3205 and SiA 3164 genotype and Check CO (Te)7 could exhibit Highly resistant reaction. Among the twelve genotypes screened against blat and rust diseases, maximum grade of disease severity was recorded in SiA 3163 (4 and 7.67 grade respectively) and the minimum percentage of disease severity was recorded in SiA 3164 (1.00 and 0.67 grade respectively). Among the twelve genotypes, SiA 3164 and SiA 3205 were evaluated as resistant genotypes.

Table.1 Grades of blast and rust diseases of foxtail millet

S. No	Entry No	Leaf blast (G)				Rust (G)			
		Replications			**Mean**	**Replications**			Mean
		I	**II**	**III**		**I**	**II**	**III**	
1	SiA 3205	1.00	1.00	1.00	1.00	1.00	1.00	1.00	**1.00**
2	RFM-68	4.00	3.00	3.00	3.33	5.00	5.00	3.00	**4.33**
3	DHFTMV 2-5	3.00	2.00	2.00	2.33	5.00	3.00	3.00	**3.67**
4	SiA 3163	5.00	3.00	4.00	4.00	7.00	9.00	7.00	**7.67**
5	DHFT 5-6	1.00	3.00	3.00	2.33	1.00	3.00	3.00	**2.33**
6	SiA 326	2.00	3.00	2.00	2.33	1.00	1.00	1.00	**1.00**
7	H-46	2.00	3.00	2.00	2.33	1.00	1.00	1.00	**1.00**
8	SiA 3164	1.00	1.00	1.00	1.00	0.00	1.00	1.00	**0.67**
9	SiA 3159	2.00	2.00	3.00	2.33	5.00	5.00	7.00	**5.67**
10	SiA 3156	5.00	2.00	3.00	3.33	7.00	7.00	5.00	**6.33**
11	SiA 3179	3.00	3.00	1.00	2.33	3.00	3.00	3.00	**3.00**
12	DHFT 77-3	3.00	3.00	3.00	3.00	3.00	3.00	3.00	**3.00**
13	Check CO (Te) 7	**2.00**	**1.00**	**2.00**	**1.67**	**1.00**	**1.00**	**1.00**	**1.00**

Plate.1 Typical leaf blast symptoms on the leaf lamina

Plate.2&3 Typical rust symptoms on the leaf lamina & Field view of screening trial at Centre of Excellence in Millets, Athiyandal

These genotypes could be considered a potential source for disease resistance against the blast and rust of foxtail millet and could be used in breeding program for development of blast and rust resistant foxtail millet variety. Jain (2000) also found three resistant foxtail millet cultivars out of thirteen cultivars screened for resistance against *P. setariae*. Likewise, Sharma *et al.*, (2014) also found that out of 154 accessions of foxtail millet screened for blast resistance under field conditions, 34 were resistant and 96 were moderately resistant during 2009; whereas, in 2010, number of accessions in the resistant and moderately resistant categories was 46 and 65 respectively.

References

Anonymous, Proceedings of 27th Annual Group Meeting of AICRP on Small Millets, 2016. Held at Regional Agricultural Research Station, Tirupati, April 17-19, 2016.

Crop and Season report 2015–16. Published by Department of Economics and Statistics, Chennai, Government of Tamil Nadu. pp125.

Jain, A. K. 2000. Multiple disease resistance in foxtail millet. *Ann. Pl. Prot. Sci.*,8(2):pp268-270.

Kawakami, T. 1902. On the blast disease of rice. *J. Sapporo Agric. Soc.*,3: pp1-3.

MCRae, W. 1920. Detailed administration report of the Government Mycologist for the year 1919-20.

Nagaraja, A., J. Kumar, A.K. Jain, Y. Narasimhadu, T. Raghuchander, B. Kumar and B.H. Gowda. 2007. Compendium of small millets diseases. Project Coordinator Cell, All India Coordinated Small Millets Improvement Project, UAS, GKVK Campus, Bengaluru. pp80.

Ramakrishnan. 1948. Studies on the morphology, physiology and parasitism of the genus *Pyricularia* in Madras, *Proceedings of the Indian Academy of Sciences Section B*, 27(6): pp174-193.

Reddy, V.G., H.D. Upadhyaya and C.L.L. Gowda. 2006. Characterization of world's foxtail millet germplasm collections for morphological traits. Internet Resource:http://www.icrisat.org/journal/cropimprovement/v2i1/v2i1characterization.pdf.

Sharma, R., A. G. Girish, H. D. Upadhyaya, P. Humayun, T. K. Babu, V. P. Rao and R. P. Thakur. 2014. Identification of blast resistance in a core collection of foxtail millet germplasm. *Plant Disease*, 98:pp519-524.

How to cite this article:

Rajesh, M., A. Sudha, A. Nirmalakumari and Parasuraman, P. 2019. Identification of Resistant Sources for Blast and Rust in Foxtail Millet Incited by *Pyricularia setariae* and *Uromyces setariae-Italica*. *Int.J.Curr.Microbiol.App.Sci.* 8(03): 1796-1800.
doi: https://doi.org/10.20546/ijcmas.2019.803.210