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RICE BLAST PATHOGENICI TY AND ITS EFFECT ON SOME RICE CULTIVARS IN NIGERIA.

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Abstract

Screen house experiment to compare the virulence of blast inoculum collected at various locations in Nigeria and its effects on some rice cultivars were determined at Badeggi Central Nigeria. The blast inoculum was collected from some locations in North West, North East. North Central, South East and South West of Nigeria. The experiment was laid out in a factorial design fitted into a split plot. There were 60 treatment combinations. The rice cultivars serve as the main plot while the inoculum serves as the subplot. The experiment was replicated three times. Inoculation was done at two weeks after sowing with a control plot that was not inoculated. Leaf, neck and panicle blast were scored on all the buckets. Also grain weight at harvest was scored. Result indicated that blast pathogen from South west was most virulent. Blast pathogen from South East was the second most virulent on all the varieties of rice tested. Blast pathogens from North East and North Central were almost the same in terms of pathogenicity on all the varieties of rice tested. Blast pathogen from North West was the least virulent on all the varieties of rice tested. There was a progressive increase in pathogenicity from the day of inoculation to 4 weeks after inoculation across all the treatments. The result showed that the local varieties used in the trial holds promise for blast control and for breeding for blast resistant varieties.

Key words: *Blast Pathogen, inoculum, Rice, Variety.*

INTRODUCTION

Rice is a grass plant which belongs to the genus *Oryza* of the family *poaceae* (Vaughan, 1994). Two species *(Oryza sativa* and *Oryza glaberrima)* are cultivated (Crawford and Lee, 2003). Rice is the world's most important food crop based on the cultivated area and serves as a major source of calories for 40% of the world population (Heinrichs, 1992a). Most of the world rice production occurs in tropical Asia in irrigated and rainfed lowland fields (Heinrichs, 1992a). In Nigeria rice is produced in all agro-ecological zones from Sahel to coastal swamps of the country (Singh *et al.*, 1997). Nigeria produces about three million metric tons of rice annually, with harvested area of about 1.7 million hectares. Rice per capital consumption is put at 21.2kg annually (WARDA, 1996).

Rice blast caused by *Pyricularia oryzae* is now the most destructive fungal disease of rice in the West African Subregion (Fomba and Taylor, 1994). The fungus produces spot or lesions on leaves, nodes and different parts of the panicles and the grains (Ou, 1985). The leaf spots are typically elliptical with more or less pointed ends. The centre of the spots is usually gray or whitish and the margin is usually brown or reddish brown. Fully developed lesions reach 1-1.5cm long, 0.3-0.5cm broad and usually develop a brown margin. On resistant cultivars only minute brown specks of pinhead size may be observed. Numerous spots may occur on the leaf, which may soon be killed. This is followed by the drying up of the leaf sheath. Seedling or plant at the tillering stage is often completely killed in the field.

MATERIALS AND METHOD

The experiment was conducted in the screen house of National Cereals Research Institute (NCRI) Badeggi in 2011. Badegi is located in North Central Nigeria. The blast innoculum were sourced from five locations across the agro ecology of Nigeria. North West (Wurno), North East (Damarmari), North Central (National Cereals Research Institute Badeggi) South East (Abakaliki,) and South West (Ogbomoso,). The local varieties of rice used were collected from various locations in Niger state. Also five rice blast differentials were collected form

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African Rice Center. The Experiment was laid out in factorial arrangement fitted into a split plot design. The experiment consists of 60 treatment combinations and replicated three times. Each of the fungus (*Magnaporthe grisea*) collected from five different rice growing regions in Nigeria, was Isolated from lesions on leaves of infected rice by conidial isolation technique (Shanta, 2000 and Awoderu, 1990). Conidial suspensions (25×10^3 spores/ml) of monoconidial culture of blast fungus, were used to inoculate the seedlings of 10 varieties of rice. Inoculation was done 2 weeks after planting (by spraying the conidial suspensions (25×10^3 spores/ml) on rice seedling). Blast scoring was done at 2, 3 and 4 weeks after inoculation for leaf blast, and at 3 weeks after heading for neck and panicle blast. Degree of infection was measured using a visual scale of 0-9 (0 = no infection, 1 = mild infection, 3 = moderate infection, 5 = high infection, 7 = severe infection and 9 = very severe infection) IRRI disease evaluation scale (1996). Disease progression was measured using the differences between the intervals of record taken (i.e, 2WKS – 4WKS). To determine the stage (s) of rice growth in which the pathogens are more virulent. Scoring was based on the number of plants and leaves infected, lesions and sizes of lesion on the leaves, necks and panicles infested (WARDA, 1999). Also data on plant height at maturity, grain weight at harvest were also taken

RESULT

Result from Table 1 shows the mean score for blast at 2, 3 and 4 weeks after inoculation. The location result showed that South West had the highest value and was significantly different from other locations at 2 WAI. The same trend was expressed at 3 and 4 WAI. Result at 3 WAI showed the highest value of 6.0. Blast collected from North East and North Central were significantly similar. They were higher that than the collection from North west and the control. At 4 WAI significant differences were observed among the treatments. The control had the lowest value of 1.60. The highest value was from the South west, followed closely by value obtained from the South east. All the locations showed significant difference from each other. Reaction of the varieties at 2 WAI showed that RAM 28 had the highest value but was not significantly different from RAM 114 and OS6, it was however different from others. At 3 WAI, RAM 28 had the highest value but it was not significantly different from TOG 80711, OS 6 and Jina. Result at 4 WAI also showed that RAM 28 had the highest value and was significantly different from others. The interaction between location and variety were not significantly different.

Table 1: Blast mean score at 2, 3, 4 weeks after inoculation (WAI) for both location and variety

Treatment	**2WAI**	**3WAI**	**4WAI**
Blast Isolate From			
North West	1.17b	2.40d	3.33e
North East	1.10b	3.07c	3.80d
North Central	1.27b	3.47c	4.33c
South East	1.77b	4.67b	5.07b
South West	2.67a	6.00a	6.13a
Control	0.13c	0.93e	1.60f
S E±	**0.23**	**0.20**	**0.16**
Variety			
RAM 114	2.22ab	3.72cb	4.22bc
RAM 28	2.72a	4.67a	5.44a
TOG6711	0.61d	3.06cd	3.06e
TOG 80711	1.06cd	3.89ab	3.89dc
OS 6	2.11ab	4.33ab	5.22bc
Maitudunkurshi	0.56d	3.00cd	3.67edc

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Jina	1.72cb	4.67a	4.78b
Yarkuma	0.44d	2.72d	3.78dc
Majalisa	1.06cd	2.44d	3.44ed
Zokwandami	1.00cd	1.72e	3.28f
S E ±	**0.30**	**0.26**	**0.21**
Interaction			
Blast Isolates x Varieties	**NS**	**NS**	**NS**

NS=Not significant at 5%.

Means with the same letter (s) in a column are not significantly different by Duncan Multiple range test

The result from table 2 indicates the mean values for neck and panicle blasts and the grain yield. Neck blast result showed that South east had the highest value and was significantly different from other locations. The control had the lowest value. The same trend showed also for the panicle blast. The varieties showed a susceptible value for South west but resistant reaction for the control. North West, North East and North central showed moderately resistant to moderately susceptible reaction. The grain yield result showed that the control had the highest value and was significantly different from others. Varietal reaction showed that RAM 28 had the highest value for neck blast and was significantly different from others. The same variety had the highest value for panicle blast also. The yield result were generally the same. However there were interaction between blast isolates and the varieties for neck blast. The interaction result is as shown in table 3. Result from North West showed that RAM 28 had the highest value and was significantly different from others. This trend was repeated in all the locations. However RAM 114 was significantly the same with RAM 28 the North east and North central. Control result showed lowest values in all the locations and the varieties.

Table 2: Mean Score of Neck and Panicle Blast 3 Weeks after Heading (WAH) and Grain Weight (Kg/Ha)

Treatment	**Neck Blast 3 WAH**	**Panicle Blast 3WAH**	**Grains Weight at Harvest (Kg/Ha)**
Blast Isolate From			
North West	2.47d	3.67d	266.69b
North East	3.53c	4.67c	210.54c
North Central	4.03c	5.33c	183.63cd
South East	5.07b	6.20b	153.75d
South West	5.87a	7.45a	100.18e
Control	1.10e	1.43e	539.31a
S E±	**0.20**	**0.27**	**16.23**
Varity			
RAM 114	5.56b	4.89bc	235.21ab
RAM 28	6.56a	6.89a	130.70d
TOG6711	2.61d	4.22dc	296.59a
TOG 80711	4.22c	4.78bc	267.36ab

OS 6	2.72d	4.39c	279.84ab
Maitudunkurshi	4.11c	5.67b	165.41cd
Jina	5.00b	5.56b	215.02cb
Yarkuma	1.78e	4.44c	281.48a
Majalisa	2.56d	3.22d	285.93a
Zokwandami	1.67e	3.89d	265.96ab
S E ±	**0.26**	**0.34**	**20.93**
Interaction			
Blast Isolates x Varieties	*****	**NS**	**NS**

* = Significant at 5%.

Means with the same letter (s) in a column are not significantly different by Duncan Multiple range test

The result of the interaction between variety and sources of innoculum is presented in table 3. Across the variety RAM 28 had the highest value and was significantly different from others in the North West. The same variety gave similar result across the locations but was significantly similar to RAM 114 with innoculum collected at North East and North Central. Result of the individual varieties across the innoculum sources showed that North West had the highest value across the varieties and was significantly different from others except for Zokwandami at South East. The overall highest value was obtained with RAM 28 (8.33), this gave a highly susceptible value. This was significantly different from all the other values in the interaction. The control had the lowest value across the varieties. Majilisa and Zokwandami (control treatment) had the lowest value of 0.33 for all the treatment combinations. However it was significantly not different from Yarkuma under the North West innoculum.

Table 3: Interaction of blast isolates and Variety on Neck Blast at 3WAH.

Variety	RAM 114	RAM 28	TOG 6711	TOG 80711	OS 6	Maitudunkurshi
Isolate						
North West	3.00ij	6.33d	1.67mn	3.00ij	1.33no	2.67jk
North East	7.00c	7.00c	1.00op	3.00ij	2.00lm	3.67h
North Central	7.00c	7.00c	3.6h	3.00ij	3.33no	5.00f
South East	7.00c	7.67b	3.67h	3.76h	4.33g	5.67e
South West	7.67b	8.33a	5.00f	7.00c	5.00f	6.33d
Control	1.67mn	3.00ij	0.67pq	7.67b	0.33q	1.33no
SE			**0.64**			

* = Significant at 5%.

Means with the same letter (s) in a column are not significantly different by Duncan Multiple range test

Table 3 continue: Interaction of blast isolates and Variety on Neck Blast at 3WAH

Variety	Jina	Yarkuma	Majelisa	Zogwandami

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Isolate				
North West	3.67h	0.67pq	1.00op	1.33no
North East	4.33g	2.33kl	3.67h	1.33no
North Central	5.67e	1.00op	3.00ij	1.00p
South East	7.00c	2.33kl	3.00ij	3.00ij
South West	7.67b	3.67h	4.33g	3.00ij
Control	1.67mn	0.67pq	0.33q	0.33q
SE		**0.64**		

* = Significant at 5%.

Means with the same letter (s) in a column are not significantly different by Duncan Multiple range test

DISCUSSION

The effect of blast pathogens on the ten varieties of rice confirmed the detrimental effect of this disease to the rice production in Nigeria (Maji, 2000). The disease cycle is short and most damage is caused by secondary infections (Jahn *et al*., 2007). The mark difference between the control revealed the inability of these varieties to confer resistance to blast races across the locations in the country

Several blasts resistant cultivars have been developed and traditional landraces including ROK 16, 63-83, Moroberakan, Lac 23 and OS6 which possess high level of stable resistance to blast (Alluri *et al.,* 1987). These traditional varieties are often cross with Asian semi dwarf to improve yields. In a study on upland rice cultivars in Senegal, Mbodj *et al.,* (1989b) observed high level of quantitative resistance to blast in IRAT 10, IRAT 112 and IRAT 133 while Dj 8-14 and Dill-509 were moderately resistant. Among the lowland rice cultivars studied TOX 103, ITA 123, BKN 6986-38-1 and BR 51-46-5 showed high degree of partial or incomplete resistance, which was stable in time and with rice cultivars (Mbodj *et al.,* 1989b). In this study blast innoculum collected from South west was more virulent. The control had better resistant reaction to blast. The varieties showed a susceptible value for South west but resistant reaction for the control. North West, North East and North central showed moderately resistant to moderately susceptible reactions. The grain yield result showed that the control had the highest value and was significantly different from others. Varietal reaction showed that RAM 28 had the highest value for neck blast and was significantly different from others. The same variety had the highest value for panicle blast also.

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