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Review Article

To evaluate the resistance of aromatic rice entries against yellow rice stem borer under field conditions

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Abstract

To study the evaluation the resistance of aromatic rice entries against yellow rice stem borer under field condition was conducted at Rice Research Institute Dokri, Larkana, Sindh, Pakistan. During the study of dead hearts from the aromatic rice entries under field conditions, least dead heart percentage against yellow rice stem borer from Lateefy and highest from Basmati-307 was recorded while; minimum average white head percentage was noted from Basmati-520 and maximum from Basmati-370. Premium yield was achieved from Lateefy, followed by PAV-30, Basmati-370, PNR-75704-30 and Basmati-520. Statistically no significant difference was observed between Basmati-370 and PNR-75704-30 during the study of yield.

Keywords: Yellow rice stem borer, Aromatic rice, resistance, Field conditions

INTRODUCTION

The world population is increasing rapidly hence; rice production is also increasing rapidly in recent years to fulfill the food requirements. Anonymous (2002-2003) according to economic survey of Pakistan 2002-2003, the area, production and yield of this crop were 2226 thousand hectares, 4478 thousand tones and 2012 kg per hectares respectively. Khush and Virk (2000) rice production has to increase by 50 percent by 2025. Vinod *et al*. (2004) rice consumers are increasing at the rate of 1.8 percent every year, but the rate growth to rice production has slowed down. In the comparison of other rice growing countries, the yield in Pakistan is very low mostly due to the attacking of stem borers. Among stem borers, *Scirpophaga incertulas* (Walker) commonly called as yellow rice stem borer is responsible for heavy loss. Young caterpillars after hatching feed inside the stem at early stage (vegetative or tillering stage) and the central shoot dries up to cause “dead hearts” and when attack is at later stage (heading or milky stage) the panicle do not produces and the condition is called as “ white heads”. Amuwitagama (2002) in Asia, yield losses due to the two most important species, the yellow and striped stem borers range from 1-20% however; during outbreak conditions, yield losses may range from 30-100**%.** Indrani and Hikim (2006) rice stem borer is the serious pests of the rice in hot and humid area. Rehman (2002a) yellow rice stem borer is an important pest of rice in temperate and tropical areas. The same favor was reported by Akram, and Rehman (2008), Anayatullah and Rehman (2002a, b) and Salim (2006).

MATERIALS AND METHODS

Status of rice varieties against yellow rice stem was evaluated at experimental area of Rice Research Institute Dokri. Aromatic rice entries viz. Lateefy, Basmati-520, Basmati-370, PAV-30 and PNR-75704-30 were tested against yellow rice stem borer. Basmati-370 was used as a standard check. Experiment was conducted during 2009 and repeated during 2010. Experiment was Randomize Complete Block Design (RCBD) with three replications of six treatments. Nursery was sown on 5th July 2009 and 8th July 2010 and line transplanting was done in the field on 1^{ist} August 2009 and 4th August 2010. The space between plant to plant and row to row was maintained at 20cm. The sub-plot size was maintained 63 m^2 (9x6). 10 hills per treatment and replication were selected at random to observe infestation percentage. After harvesting and threshing of the crop, paddy yield was recorded. No chemical was used in experimental area to observe only varietal resistance of entries against yellow rice stem borers. The recommended dose of fertilizer application was made at the rate of 135-67: N-P kg/ ha. All P and half of the N was applied at the time of transplanting and rest of N was applied at the time of panicle initiation stage of crop.The data were statistically analyzed and LSD range test was applied to compare mean infestation differences. Steel and Torrie (1984) data were subjected to analysis of variance using Fisher’s analysis of variance technique and treatment means were compared with standard (control) by Least Significant Difference (LSD) test. Dead heart and white head percentage were calculated by Abbott’s formula (1925).

RESULTS

Dead hearts study

Dead heart percentage from the aromatic (scented) rice entries was noted during 2009 as 9.88, 11.39, 12.42, 11.36 and 11.17; during 2010 as 10.23, 11.84, 12.98, 12.10 and 11.87; average of both years was 10.06, 11.62, 12.70, 11.73 and 11.52 from Lateefy, Basmati-520, Basmati-370, PAV-30 and PNR-75704-30 respectively **(**Table 1**).**

Table 1. Dead heart percentage from the aromatic rice entries during 2009 and 2010

Name of entries	Dead heart% 2009	Dead heart% 2010	Average
Lateefy	9.88 C	10.23 B	10.06
Basmati-520	11.39 B	11.84 AB	11.62
Basmati-370	12.42 A	12.98 A	12.70
PAV-30	11.36 B	12.10 AB	11.73
PNR-75704-30	11.17 B	11.87 AB	11.52

The same letters are not significant different.

Statistical analysis

The analysis of variance of dead heart percentage among aromatic rice entries was during 2009 (P>0.074) and during 2010 (P>0.083). Coefficient of variation, Grand Mean and Grand Sum during 2009 were 7.77%, 11.244 and 168.660 (Table 2); during 2010 were 8.35%, 11.804 and 170.060 (Table 3) respectively.

Table 2 Analysis of variance of dead heart percentage from the aromatic rice entries during 2009

Source	DF	SS	MS	F Value	Prob.
Replication	2	0.885	0.442	0.580	
Factor A	4	9.851	2.463	3.227	>0.074
Error	8	6.104	0.763		
Total	14	16.840			
Coefficient of variation	7.77%				
Grand Mean	11.244				
Grand Sum	168.660				
Total Count	15				

Table 3. Analysis of variance of dead heart percentage from the aromatic rice entries during 2010

Source	DF	SS	MS	F Value	Prob.
Replication	2	2.992	1.496	1.541	>0.271
Factor A	4	11.861	2.965	3.054	>0.083
Error	8	7.765	0.971		
Total	14	22.621			
Coefficient of variation	8.35%				
Grand Mean	11.804				
Grand Sum	177.060				
Total Count	15				

White heads study

From the aromatic rice entries, white head percentage was recorded during 2009 as 11.62, 11.39, 13.04, 11.93 and 11.17; during 2010 was 11.83, 11.90, 13.75, 12.10 and 12.67; average of both years was 11.73, 11.65, 13.40, 12.02 and 11.92 from Lateefy, Basmati-520, Basmati-370, PAV-30 and PNR-75704-30 respectively (Table 4). Comparison between the averages of dead heart percentage and white head percentage of both years are included in **(**Figure 1).

Table 4. White head percentage from the aromatic rice entries during 2009 and 2010

Name of entries	White head % 2009	White head % 2010	Average
Lateefy	11.62 B	11.83 B	11.73
Basmati-520	11.39 B	11.90 B	11.65
Basmati-370	13.04 A	13.75 A	13.40
PAV-30	11.93 B	12.10 B	12.02
PNR-75704-30	11.17 B	12.67 AB	11.92

The same letters are not significant different.

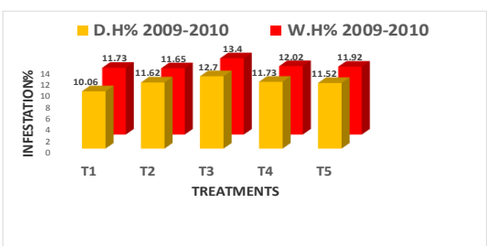

Figure 1. Comparison between the averages of dead heart percentage and white head percentage from the aromatic rice entries during 2009 and 2010

Statistical analysis

Statistical analysis of white head percentage from the aromatic rice entries during 2005 and 2006 is shown in (Table 5) (Table 6).

Table 5. Analysis of variance of white head percentage from the aromatic rice entries during 2009

Source	DF	SS	MS	F Value	Prob.
Replication	2	0.733	0.366	0.425	
Factor A	4	6.442	1.611	1.867	>0.210 ns
Error	8	6.901	0.863		
Total	14	14.078			
Coefficient of variation	7.85%				
Grand Mean	11.830				
Grand Sum	177.450				
Total Count	15				

Table 6. Analysis of variance of white head percentage from the aromatic rice entries during 2010

Source	DF	SS	MS	F Value	Prob.
Replication	2	4.130	2.065	2.281	>0.165 ns
Factor A	4	7.648	1.912	2.112	>0.171 ns
Error	8	7.242	0.905		
Total	14	19.020			
Coefficient of variation	7.64%				
Grand Mean	12.451				
Grand Sum	186.760				
Total Count	15				

Yield study

During 2009, yield was recorded 25.76, 18.90, 18.78, 20.68 and 18.94; during 2010 was 24.44, 17.34, 17.86, 20.04 and 17.46; average of both years was 25.10, 18.12, 18.32, 20.36 and 18.20 from aromatic rice entries (Lateefy, Basmati-520, Basmati-370, PAV-30 and PNR_75704-30 respectively (Table 7).

Table 7. Yield (kg/plot) from the aromatic rice entries during 2009 and 2010

Name of entries	Yield 2009	Yield 2010	Average
Lateefy	25.76 A	24.44 A	25.10
Basmati-520	18.90 C	17.34 C	18.12
Basmati-370	18.78 C	17.86 C	18.32
PAV-30	20.68 B	20.04 B	20.36
PNR-75704-30	18.94 C	17.46 C	18.20

The same letters are not significant different

DISCUSSION

During the study of dead hearts from aromatic rice entries under field conditions, least dead heart percentage (10.06) was recorded from Lateefy, followed PNR-75704-30 (11.52), Basmati-520 (11.62), PAV-30 (11.73) and Basmati-370 (12.70). Basmati-520 and PNR-75704-30 were statistically positioned in akin rank. (Table1). Rehman *et al*.(2007) conducts experiments on Basmati-370 against yellow rice stem borer and found to be insect resistance. Sarwar *et al*.(2010) infestation of 10.4% dead hearts and 19.3% white heads observed in aromatic rice, due to stem borers under natural field conditions. Average white head percentage decline in Basmati-520 (11.65), this followed by Lateefy (11.73), PNR-75704-30 (11.92), PAV-30 (12.02) and Basmati-370 (13.40). Statistically no significant difference was observed between Lateefy and Basmati-520 during the study of white heads (Table 4). Maqbool *et al*., (1998) evaluated Indica Basmati-370 against yellow rice stem borer. Sarwar (2012) Basmati-20-1/93 showed the least dead hearts and white heads causing maximum yield as compared to the remaining genotypes identified for tolerance. Rashid and Khan (2005) Basmati 370 showed maximum infestation. Among tested aromatic rice entries premium yield (25.10 kg/63m^2) was achieved from Lateefy, followed by PAV-30 (20.36), Basmati-370 (18.32), PNR-75704-30 (18.20) and Basmati-520 (18.12). Statistically Basmati-370 and PNR-75704-30 were significantly comparable to each other (Table 7). Ahmad *et al*., (2006), Khan *et al* (1991) basmati rice varieties of Indo-Pak are economical important due to high quality, distinguished long grain and aroma however; its production is lower than other varietal groups, as it is more susceptible to insect damage. Safdar et al. (2008) paddy yield varied among various basmati strains. Rashid *et al*. (2003) the fine grain basmati rice varieties are considered high quality rice and fetch a high price in national and international trade. However, yield per unit area of basmati rice is very low due to tall plant habit and late maturity.

CONCLUSIONS

Aromatic rice entries were more prone to yellow rice stem borer than the early and medium maturing coarse rice entries.

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