Pakistan Journal of Applied Sciences 2(8): 831-834, 2002

Oviposition Preference and Infestation of Yellow Stem Borer in Rice Varieties

Maqsood A.Rustamani , Muzaffar A.Talpur, Rab Dino Khuhro and Hussain Bux Baloch
Faculty of Crop Protection, Sindh Agriculture University
Tandojam-70060, Pakistan

Abstract: Five coarse grain rice varieties (IR-6, IR-6-18, IR-8, Shadab, Shua-92) and five fine grain varieties (Basmati-370, Jajai-33, Jajai-77, Sonahri Sugdasi, Sonahri Sugdasi-5) were examined to determine the oviposition preference and infestation of yellow stem borer in the experimental field of Nuclear Institute of Agriculture (NIA) at Tandojam during (Kharif) 2001. A differential response of varieties was observed towards the oviposition preference by borer. Shua-92 variety was least preferred and Sonahri Sugdasi as most preferred for oviposition. Two oviposition peaks were recorded, the first one during vegetative growth period and other during reproduction period. The population infestation trend showed that amongst the coarse grain varieties Shadab was comparatively less susceptible and IR-6 susceptible to borer attack, whereas, amongst the varieties of fine grain, Basmati-370 and Sonahri Sugdasi suffered less damage of borer. The oviposition had positive significant correlation with dead hearts and white heads whereas, borer infestation had negative significant correlation with yield.

Key Words: Oviposition, Preference, Population, *Scirpophaga Incertulas*

Introduction

Scirpophaga Incertulas Walk., commonly known as yellow stem borer of rice and is distributed widely, covering almost all Asian countries. It is reported to be responsible for an annual damage of 20% of rice crop with local catastrophic outbreaks of upto 60% damage (Hattori, 1971; Jepson, 1954; Cattingh and Islam, 1981). The present studies were therefore conducted to study on the oviposition preference and population build-up of yellow stem borer in different rice varieties to assess their level of resistance to this insect pest under field conditions.

Materials and Methods

In order to assess the oviposition preference and infestation of yellow stem borer in rice varieties, an experiment was conducted in the experimental field of Nuclear Institute of Agriculture (NIA) at Tandojam. The seed of five coarse rice varieties (IR-6, IR-6-18, IR-8, Shadab, Shua-92) and five fine grain varieties (Basmati-370, Jajai-33, Jajai-77, Sonahri Sugdasi and Sonahri Sugdasi-5) were sown to raise nursery during 2nd week of April 2001. Forty days old nursery was transplanted in a randomized complete block design with four replicates. Each replicate had 10 sub plots (5 x 2m 2) for respective variety.

Oviposition Observation: The observations on the oviposition preference were recorded at weekly intervals after the establishment of rice plants. For this purpose $1m^2$ area in each sub plot was scanned thoroughly for the presence of egg masses of borer. This procedure was repeated at three sites in each sub plot.

Borer Infestation and Paddy Yield: The percentage borer infestation (dead hearts) was recorded during vegetative growth stage and white heads at the time of maturity by counting total number of dead hearts/m^2 and white heads/m^2 in each sub plot of a replication for the respective variety. The paddy yield was also recorded while selecting $1m^2$ of a variety in each replicate and threshing was done to weigh the grains. The data thus obtained was subjected to statistical analysis and DMR test was applied. The correlation coefficient of oviposition, population build-up and yield also computed (Steel and Torrie, 1980).

Results and Discussion

Oviposition Preference: The results on the oviposition preference in Table1. indicated that oviposition was invariable recorded during 1st week of June on all varieties, however, egg masses/m^2 of respective varieties varied significantly. The mean number of egg masses/m^2 increased with the plant phenology and reached to its peak during 4th week of July, thereafter, the egg masses decreased gradually, again increased second peak was recorded during 4th week of August. It is evident from the results that 1st oviposition peak was recorded during vegetative growth stage (dead hearts) whereas, the 2nd one was recorded before the panicle initiation stage (white heads). The data revealed that mean number of egg masses/m^2 was statistically higher on fine varieties Sunahri Sugdasi (0.232) fine grain variety and followed by Sunhari Sugdasi-5 (0.158), Jajai-33 (0.154), Jajai-77 (0.145) and Basmati-370 (0.089), respectively. Amongst the coarse varieties significantly higher number of egg masses/m^2 was recorded on IR-8 (0.151) and it was followed by IR-6-18 (0.118), IR-6 (0.094), Shadab (0.092) and Shua-92 (0.078), respectively. The overall mean values for egg masses/m^2 for different rice varieties also revealed that Shua-92 was least preferred and Sunhari Sugdasi was most preferred variety for oviposition of yellow stem borer.

Table 1: Mean Number of Egg Masses/M^2 of Different Rice Varieties as Influenced by Plant Phenology

Varieties	June	July			August				September			Mean
	W1	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	
IR-6	0.01	0.03	0.06	0.14	0.16	0.09	0.06	0.13	0.19	0.14	0.08	0.02	0.094
IR-6-18	0.02	0.04	0.09	0.16	0.21	0.12	0.09	0.16	0.22	0.15	0.12	0.03	0.118
IR-8	0.05	0.06	0.13	0.18	0.21	0.14	0.11	0.20	0.26	0.19	0.16	0.02	0.151
Shadab	0.03	0.05	0.10	0.15	0.19	0.08	0.07	0.12	0.15	0.09	0.06	0.01	0.092
Shua-92	0.05	0.06	0.09	0.13	0.16	0.08	0.04	0.09	0.12	0.06	0.02	0.03	0.078
Basmati-370	0.03	0.06	0.10	0.15	0.21	0.06	0.06	0.07	0.15	0.08	0.06	0.04	0.089
Jajai-33	0.09	0.13	0.22	0.32	0.36	0.07	0.07	0.14	0.20	0.12	0.09	0.04	0.154
Jajai-77	0.06	0.10	0.14	0.20	0.26	0.11	0.08	0.16	0.26	0.19	0.11	0.07	0.145
Sonahri Sugdasi	0.08	0.17	0.26	0.43	0.52	0.16	0.12	0.22	0.34	0.23	0.16	0.09	0.232
Sonahri Sugdasi-5	0.09	0.12	0.24	0.35	0.38	0.10	0.07	0.12	0.18	0.12	0.08	0.05	0.158

Table 2: Mean Percent Dead Hearts, White Heads and Paddy Yield of Rice Varieties

Varieties	Dead hearts/m^2	White heads/ m^2	Paddy yield (g/ m^2)
Coarse Grain			
IR-6	10.91a	14.49a	651.4ab
IR-6-18	8.17c	12.80b	640.6b
IR-8	9.98b	11.41c	615.7c
Shadab	6.95c	9.00d	674.2c
Shua-92	8.95c	12.55b	672.4a
CD1	0.38	0.77	24.40
CD2	0.53	1.08	34.22
Fine Grain			
Basmati-370	11.52d	15.38d	317.2a
Jajai-33	17.28a	21.08a	172.7c
Jajai-77	16.88a	20.55b	177.7c
Sunhari Sugdasi	15.20a	21.83a	177.1c
Sunhari Sugdasi-5	12.84c	17.05c	289.5c
CD1	0.84	0.77	20.94
CD2	1.18	1.08	29.36

Mean sharing same letter are statistically non-significant (P=0.05)

Table 3: Correlation Coefficient and Regression Equation for Ovipostion, Dead Hearts, White Heads and Paddy Yield in Different Rice Varieties

Parameters	Correlation Coefficient	Regression Equation
Oviposition v/s Dead heart	0.6398*	5.548 + 48.62
Oviposition v/s White head	0.6924*	7.053 + 65295
Oviposition v/s Paddy yield	-0.6604*	862.673 - 3232.814
Oviposition v/s White head	0.9632**	1.364 + 1.195
Oviposition v/s Paddy yield	-0.9199**	1145.313 - 59.257
White head v/s Paddy yield	-0.9222**	1186.275 - 47.872

** Significant at 1%

* Significant at 5%

Borer Infestation: A perusal of the data in Table2. showed that the results on percent dead hearts/m^2 in different rice varieties the coarse grain variety IR-6 harboured significantly maximum borer infestation (10.91) and minimum borer infestation was recorded on Shadab (6.95). The analysis of variance revealed significantly variation amongst coarse varieties, however, comparison of mean values through DMR test indicated that difference between IR-6-18 (8.71) and Shua-92 (8.95) was statistically non-significant (P=0.05). Whereas, fine grain rice varieties indicated that Jajai-33 (17.28) and Jajai-77 (16.88) harboured significantly higher borer infestation than rest of the varieties. The differences between these two varieties were statistically non-significant (P=0.05).

The result presented in Table2. Showed that white heads/m^2 percent during flowering and maturity stage were statistically higher in IR-6 (14.49), whereas, Shadab harboured significantly the least (9.0) borer infestation. The variation between IR-6-18 (12.80) and Shua-92 (12.55) were statistically non-significant. The CD values to the mean percent white heads/m^2 revealed non-significant differences between Sunhari Sugdasi (21.83) and Jajai-33 (21.8) at both 5% and 1% level of infestation. The borer infestation was significantly least in Basmati-370 (15.38) and it was followed in ascending order by Sunhari Sugdasi-5 (17.05), Jajai-77 (20.55), Jajai-33 (21.08) and Sunhari Sugdasi (21.83), respectively.

Paddy Yield: The results obtained on paddy yield are shown in Table2. of coarse grain varieties , Shadab was comparatively higher (674.2 g/m^2) than rest of the varieties. This was followed by Shua-92 (672.4 g/m^2), IR-6 (651.4 g/m^2), IR-6-18 (640.6 g/m^2) and IR-8 (615.7 g/m^2), respectively. The analysis of variance showed significant differences amongst all the coarse varieties, however, CD values to mean yield indicated non-significant variation amongst Shadab, Shua-92, IR-6, and IR-6-18. The mean yield of fine grain varieties also varied significantly with the varieties. Basmati-370 (317.2g/m^2) yielded significantly higher grains than rest of the varieties. This was followed by Sunhari Sugdasi-5 (289.5 g/m^2), Jajai-77 (177.7 g/m^2), Sunhari Sugdasi (177.1 g/m^2), and Jajai-33 (172.7 g/m^2), respectively. The difference amongst Jajai-77, Sunhari Sugdasi and Jajai-33 were statistically non-significant.

Data in Table3. depict that the positive and significant correlation between oviposition and dead hearts in all varieties, similarly, oviposition had negative significant (P=0.05) correlation with the borer infestation. The dead hearts had positive significant correlation with white heads irrespective of the varieties. The dead heart had negative significant correlation with the yield as well as indicated by regression equation. Corresponding regression equation depicted in Table-3 also supported the correlation coefficients of the other parameters listed in the table.

The results on the oviposition preference indicated that the females preferred the foliage (ventral surface of leaves) for oviposition. Maximum eggs were laid during the vegetative growth stage of the plant and significant higher number of egg masses were recorded on Sunhari Sugdasi and Jajai-33, however, buildup was comparatively less on Sunhari Sugdasi-5. (Balasubramanian *et al.*, 1982) reported that an increase of minimum temperature of 1°C would result in a 0.4% decrease in damage by yellow stem borer in rice. The damage of rice plants is usually caused by the larval stage which feed inside the stalk of plants. (Chen *et al.*, 1982) reported that 3rd and 5th instar larvae of yellow stem borer cause damage at various stages of development in rice. (Saroja, 1982) and (Rao, 1983) also reported that larvae caused dead hearts and white heads in rice. The results on first oviposition peak during 4th week of July are in agreement to those reported by (Hussain and Begum 1985) from Bangladesh.

The results on the larval infestation in rice varieties revealed differential response of rice varieties to the attack of yellow stem borer. Many research workers (Dhaliwal and Singh, 1982; Mehar and Bhatti, 1985; Marwat *et al.*, 1985; Pandhi *et al.*, 1985; Uthamasamy & Sadanda, 1985; Rao *et al.*, 1990; Rustamani *et al.*, 1995a) had also reported that the larval infestation of yellow stem borer varied with the rice varieties. Furthermore, the paddy yield had negative significant correlation with larval infestation in the present studies. (Rustamani *et al.*, 1995bc) reported that dead hearts and white heads had negative significant correlation with paddy yield. (Viajante and Heinrich 1987) and (Viajante and Sexena 1988) also correlated the paddy yield with the larval infestation of yellow borer. However, (Inayatullah *et al.*, 1980) the larval infestation with the adult moths captured on light trap. It could therefore, be inferred that egg masses should be collected and destroyed physically before the establishment of the pest attack. Furthermore, the resistant varieties should be multiplies and more available to the farmers for general cultivation to reduce the use of pesticides.

References

Balasubramanian, G., M.Gopalan, M.Balssuramanin and A.kulansaivelu, 1982. Influence of Weather Factors of the Incidence of Stem Borer in Rice. Indian J. Plant Prot., 9:82-87

Cattingh, A. and Z.Islam, 1981. Stem Borer Incidence in Bangladesh Water Rice Crop. Rice. Deep Water Rice Workshop. Inst. Los. Banos, Philippines., 215-225

Chen, G. Q., R. S.Feng and Z. B.Fue, 1982. A Preliminary Investigation on Damage of Rice Plants By Yellow Stem Borer . Fujian Nongye Keiji., 3:25-27

Dhaliwal, G. S. and J.Singh, 1982. Yellow Stem Borer Damage to Rice Varieties in Punjab India. Inst. Rice Res. Newsl., 7:9-10

Hattori, I., 1971. Stem Borers of Graminaceous Crop is in South Asia. Trop.Agric. Res., 5:145-153

Hussain, M. and N.Begum, 1985. Seasonal Stem Borer Population Fluctuation in Mymensigh, Bangladesh. Inst.Rice Res.Newsl.,10:22

Inayatullah, C., A.Majid and M. Moughal, 1980. Fluctuation in Rice Stem Borer Density in Punjab, Pakistan. Inst.Rice.Res.Newsl., 15:24

Jepson, W. E., 1954. A Critical Review of the World Literature on the Lepidopterous Stalk Borer of Tropical Gramineous Crops. Common Wealth Inst. Ento. London

Mehar. M. M. and I. M.Bhatti, 1985. Evaluation of Rice Cultivars for Yellow Stem Borer Resistance. Inst. Rice Res. Newsl.. 10:9

Marwat, N. K., U. K.Baloch and A.Latif, 1985. Resistance of Some New Rice Cultivars Against Attack of Stem Borers. Pak. J. Zool., 17:357-361

Pandhi, G., S. M.Chatterji and S. K.Nayek, 1985. Effect of Stem Borer Infestation on Photosynthetic Activity of Rice Cultivars. J.Ento.Res., 9: 112-114

Rao, P.S., 1983. Ecology of Yellow Rice Borers Effect of Climate and Season. Insect Ecology and Resource Management. J. Agric. Sci. India., 37:850-852

Rao, N. V., K. M.Rao, V.P.Rao and P.S.Reddy, 1990. Economic Injury Levels for Rice Gall Midge and Yellow Stem Borer. Indian J.Ento.,52:445-451

Rustamani, M.A., M.M.Khan, M.A.Talpur and H.B.Baloch, 1995a. Effect of Transplanting Dates on The Incidence of Stem Borers Infestation in Rice. Pak. J. Zool., 27:341-343

Rustamani, M. A., M. H.Solangi, M. A.Talpur, M M.Khan and T.Hussain, 1995b. Screening of Ric Genotypes For Relative Resistance to Yellow Sten Borer. Pak. J.Zool., 27:345-348

Rustamani, M. A., M. A.Talpur and T.Hussain, 1995c Relative Resistance of Rice Genotypes to Yellow Stem Borer. 1st Int. Cong. Ento. Faisalabad Pakistan 155-161

Saroja, A., 1982. Occurrence of Rice Stem Borers and Gall Midges at India. Inst. Rice Res. Newsl., 7:14-15

Steel, R.G.D. and J. H.Torrie, 1980. Principles and Procedures of Statistics. McGraw Hill Book Co. Inc New York., 473

Uthamasamy, S. and A.R.Sadanda, 1985. Evaluation of Rice Cultivars for Resistance at Handing Stage toYellow Stem Borer. *Oryza*., 22: 238-239

Viajante,V. D. and E. A.Heinrich, 1987. Plant Age of Rice Cultivars IR-6 on Susceptibility to Yellow Stem Borer (Lepidoptera:Pyralidae). Crop Protection., 6:33-37

Viajante, V. D. and R. C.Sexena, 1988. Effect of Plant Age on Rice Susceptibility to Yellow Stem Borer. Inst. Rice Res. Newsl., 13:37