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PERFORMANCE OF DIFFERENT RICE CULTIVARS AND INSECTICIDES AGAINST *Tryporyza incertulas* (WALKER) AND *Cnaphalocrocis medinalis* (GUENEE)

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Studies were conducted to determine the toxicity of Roll Up (7.2% G), Furadan (3G), Solomon (300-0-Teq), Belt (48% SC), Karuz (4% GR) and Shark Super (6% G) and relative resistance of rice varieties IRRI-6, KSK-282, DR-83, Basmati-370, Basmati-385 and Super Basmati against rice stem borer and rice leaf folder and their effect on yield ha^{-1}. Roll Up and Shark Super ranked first in their efficacy against rice stem borer; as 0.64% and 0.63% dead hearts and 0.32 and 0.33% white heads were recorded, respectively, and which were significantly ($P < 0.05$) lower than control. Solomon with 0.73% infestation was the most effective insecticide against rice leaf folder. Rice varieties IRRI-6 and KSK-282 were the most resistant varieties against rice stem borer; as 14.73% and 18.34% dead hearts, and 4.33% and 4.77% white heads were significantly ($P < 0.05$) lower than the other tested varieties. Similarly IRRI-6, KSK-282 and DR-83 also showed resistance to rice leaf folder. Basmati-385 was the most susceptible variety against rice leaf folder. KSK-282 with 5656 kg ha^{-1} yield ranked first. Plots treated with shark super resulted in to highest (7014 kg ha^{-1}) yield whereas; plots treated with Karuz resulted into lowest (5984 kg ha^{-1}) yield.

Keywords: Rice varieties, rice stem borer, rice leaf folder, *Tryporyza incertulas, Cnaphalocrocis medinalis*

INTRODUCTION

Rice is the second most important cereal crop of Pakistan after wheat and plays multifarious role in its economy. Total area under rice cultivation in Pakistan is 2515 thousand hectares with an average yield of 2211 kg ha^{-1} (Anonymous, 2007, 2008) which is significantly low as compared to other rice growing countries of world. This low yield is ascribed to many factors such as limited adoption of scientific cultivation, improper management of pest insects and diseases (Iram *et al*., 2003). Rice crop is attacked by several insect species right from nursery to harvest. Among these pest insects, rice stem borer (*Tryporyza incertulas)* and rice leaf-folder (*Cnaphalocrocis medinalis*) are of prime importance. Rice plants result into dead hearts and white heads, when attacked by rice stem borers at early age and panicle initiation stage respectively. Rehman *et al.* (2002) reported that rice stem borer *Scirpophaga incertulas* and *S. innotata* are serious insect pests of rice in south and south-east Asia resulting into huge crop losses. Rice leaf folder damages the crop in its larval stage by scraping the open as well as rolled leaves and a single larva can damage a number of leaves (Bashir *et al*., 2004). This activity disturbs the photosynthetic activities of the plant resulting into drastic yield losses (Alvi *et al*., 2003). Second instar larvae of rice *C. medinalis* glues the growing paddy leaves longitudinally and feeds voraciously on green leaves (Khan *et al*., 1989). The leaves of rice plants infested by Rice leaf folder are predisposed to bacterial and fungal infection (Bashir *et al.*, 2004).

In Pakistan these insect pests are mainly controlled by granular and sprayable formulations of the synthetic insecticides (Mustafa and Razzaq, 1991). Afzal *et al.* (2003) found that Furadan 3G (Carbofuran) significantly reduced dead hearts and white heads in Super Basmati and thus increased rice yield. Dash and Mukherjee (2003) found that Fipronil at 0.075 kg a.i.ha^{-1} gave maximum protection to rice crop against gall midge and stem borer. They also reported that granular insecticides resulted into higher yield than the emulsifiable concentrated formulations.

Natural resistance in plants against insect pests is one of the important components of IPM. Knowledge of resistance level of a certain variety is also very important for planning good management practices. Atwal (1994) stated that certain varieties of crops are less attacked by insect pests of that crop than others because of their natural resistance. Akram *et al*. (1994) reported that rice variety Phakal was resistant to *Chilo supressalis* and *Cnaphalocrosis medinalis*. Khan *et al.* (2003) found that variety KSK-282 was resistant while Gomal-6 and Gomal-7 were moderately resistance against

rice stem borer. Basmati-385 and Swat-2 were moderately susceptible whereas; Swat-1, JP-5 and Dilrosh-97 were the susceptible varieties under the agro ecological conditions of Dera Ismail Khan. Khan *et al.* (2005) noted that rice stem borer infestation varied significantly among different Basmati varieties under different chemical, biological and natural environmental conditions. Keeping in view the economic importance of rice crop in the economy of Pakistan and pest status of rice stem borer and rice leaf folder a study was undertaken with the following objectives:

- To determine the most effective insecticide against rice stem borer and rice leaf folder.
- To evaluate the performance of different rice varieties against rice stem borer and rice leaf folder.

MATERIALS AND METHODS

***Experiment No. 1*:** An experiment was conducted at the research farm of Agriculture Research Institute Dera Ismail Khan during 2010-11 to evaluate the efficacy of Roll Up (7.2% G), Furadan (3 G), Solomon (300-0-Teq), Belt (48% SC), Karuz (4% GR) and Shark Super (6% G) against rice stem borer and rice leaf folder. The seeds of Rice variety IRRI-6 used in this experiment was obtained from the local market and planted in mid-May. The experiment included seven treatments with each treatment replicated four times. The experiment was laid out in Randomized Complete Block Design (RCBD). A sound nursery was sown and transplanted at the age of 30 days with a standard plant to plant and row to row distance of 22 cm. For each treatment the plot size was 3×5 m^2. All the other standard agronomic practices were applied uniformly to each plot. The insecticides were applied 25 days after transplanting as per their recommended doses and directions. The data regarding stem borer and leaf folder infestation were recorded ten days after insecticides application. In the case of stem borer damage, seven randomly selected plants in each treatment were counted for their total tillers and damaged tillers, whereas, for rice leaf folder data in terms of total and infested leaves were recorded. The data recorded were statistically analyzed using the analysis of variance (ANOVA) and means were compared using least significant difference (LSD) test.

Table 1. Recommended doses of insecticides

Common Name	Active ingredient	Dose
Roll Up 7.2% G	Carbosulfan3% + Monomehypo4.2%	6 kg $acre^{-1}$
Furadan 3G	Carbofuran	10 kg $acre^{-1}$
Soloman 300-O-Teq	Imidacloprid + betacyhlothrin 300 OD	50 ml $Acre^{-1}$
Belt 48% SC	Flubendiamide	200 ml $acre^{-1}$
Karuz 4% G	Cartap hydrochloride 4% G	9 kg $acre^{-1}$
Shark Super 6% G	Permethrine + Monomehypo	7 kg $acre^{-1}$

***Experiment No. 2*:** A study was conducted to investigate the relative resistance of different rice varieties against rice stem borer and rice leaf folder. In this study six varieties of rice namely, IRRI- 6, KSK- 282, DR- 83, Basmati- 370, Basmati-385 and Super Basmati were evaluated under unsprayed conditions for their resistance/tolerance against the above mentioned pest insects. The experiment was laid out in RCBD with six treatments having 4 replicates. Sound nursery was sown and transplanted at the age of 30 days with a standard plant to plant and row to row distance of 22 cm. For each treatment the plot size was 3×5 m^2. All the other standard agronomic practices were applied uniformly to each plot. Infestation data (dead hearts and white heads) was taken at booting and panicle formation stage. The data obtained thus were converted into percent dead heart using the following formula:

$$\% \text{ Dead hearts} = \frac{\text{Infested tillers} \times 100}{\text{Total tillers}}$$

The data regarding white heads was recorded by counting total No. of healthy and white panicles produced by a randomly selected hill. A total of seven plants per treatment were observed. The data obtained were converted into percent white heads as:

$$\% \text{ White Heads} = \frac{\text{No. of White panicles} \times 100}{\text{Total Number of panicles}}$$

The final data was statistically analyzed with analysis of variance (ANOVA) and means compared using least significant difference (LSD) test.

RESULTS

***Effect of insecticides on the percent Infestation of T. incertulas*:** The percent infestation of rice stem borer is expressed in terms of dead hearts and white heads. All the tested insecticides when used at their recommended doses showed significantly lower percentage of dead hearts as compared to control. Shark Super and Roll up with 0.63% and 0.64% dead hearts, respectively ranked 1st in their efficacy followed by Karuz, Solomon, Furadan and Belt (Table 2). The later insecticides were statistically similar with each other in terms of percent dead hearts formation; however, were significantly ($P \leq 0.05$) better in reducing dead hearts formation compared to the control.

Data on percent white head infestation revealed that Rollup and Shark Super gave statistically better results with only 0.32% and 0.33% white heads, respectively followed by Karuz, Belt, Furdan and Solomon. The later four insecticides were statistically at par with each other against rice stem borer. Maximum number of (15.70%) white heads were found in the control plots (Table 2).

***Effect of insecticides on the percent infestation of C. medinalis*:** Results showed that mean percent infestation by leaf folder in plots treated with insecticides was significantly lower than that in the control (Table 3). Solomon with

0.73% infestation ranked 1st followed by Belt, Shark Super and Roll up. These insecticides were statistically similar in their efficacy with each other but were significantly better than the other tested insecticides & the control. Plots treated with Karuz 4G and Furadan 3G recorded 4.02% and 4.73% infestation which were statistically at par with each other, and were significantly less than the infestation in the control.

Table 2. Toxic effect of insecticides on the percent Infestation of rice stem borer

Treatments	% Dead hearts	% White heads
Roll Up 7.2% G	0.64 b	0.326 c
Furadan 3G	2.08 b	3.357 b
Soloman 300-O-Teq	1.81 b	3.390 b
Belt 48% SC	2.77 b	3.123 b
Karuz 4% G	1.28 b	2.987 b
Shark Super 6% G	0.63 b	0.330 c
Check	47.42 a	15.700 a
LSD	5.341	2.439

Means followed by same letters are not significantly different from each other at $P \leq 0.05$.

Table 3. Effect of insecticides on the percent infestation of rice leaf folder

Treatment	Mean % infestation
Roll Up 7.2% G	1.77 c
Furadan 3G	4.73 b
Soloman 300-O-Teq	0.73 c
Belt 48% SC	1.26 c
Karuz 4% G	4.02 b
Shark Super 6% G	1.60 c
Check	13.38 a
LSD	1.591

Means followed by same letters are not significantly different from each other at $P \leq 0.05$.

***Effect of different insecticides on yield of rice*:** It is evident from the results in Table 4 that maximum yield (7014 kg ha^{-1}) of rice was obtained in the plots treated with Shark Super (6% G) followed by Roll Up (7.2% G) with 6918 kg ha^{-1} yield . These were statistically at par with each other. Lowest yield (5984 kg ha^{-1}) among the treatments was obtained from the plots treated with Karuz (4% G). Overall, all the treatments gave significantly ($P \leq 0.05$) higher yield than the Control i.e. 2727 kg ha^{-1}.

***Comparative resistance of different rice varieties against T. incertulas*:** Results showed that super Basmati, Basmati-385 and Basmati-370 were the most susceptible varieties to *T. incertulas* with 52.75%, and 51.42% and 43.54% DH respectively (Table 5). Results also showed that variety IRRI-6, KSK-282 and DR-83 were resistant against rice stem borer. Similarly in terms of white heads formation, IRRI-6 and KSK-282 were at par to each other but had significantly ($P \leq 0.05$) fewer white heads as compared to other tested varieties. Basmati-85, Basmati-370, Super Basmati and DR-83 had 12.81%, 12.02%, 11.63% and 9.71% white heads respectively and were statistically at par with each other.

Table 4. Effect of different insecticides on per hectare yield of rice

Treatment	Yield (kg ha^{-1})
Roll Up 7.2% G	6918 ab
Furadan 3G	6500 bc
Soloman 300-O-Teq	6391 cd
Belt 48% SC	6277 cd
Karuz 4% G	5984 d
Shark Super 6% G	7014 a
Check	2727 e

Means followed by same letters are not significantly different from each other at $P \leq 0.05$.

Table 5. Comparative resistance of different rice varieties against rice stem borer

Treatments	% Dead Hearts	% White Heads
IRRI-6	14.73 c	4.32 b
KSK-282	18.34 c	4.77 b
DR-83	19.49 c	9.71 a
Basmati-370	43.54 b	12.02 a
Basmati-385	51.42 a	12.81 a
Super Basmati.	52.75 a	11.63 a
LSD	6.62	3.51

Means followed by same letters are not significantly different from each other at $P \leq 0.05$.

***Comparative resistance of different rice varieties against C. medinalis*:** It is evident from the results (Table 6) that among the tested varieties, IRRI-6 with 14.50% infestation showed maximum resistance against rice leaf folder. This was followed by KSK-282 and DR-83. These three varieties were statistically at par to each other with regard to percent rice leaf folder infestation (Table 5). Similarly Basmati-370, Basmati-385 and Super Basmati showed their susceptibility to rice leaf folder as compared to the other tested varieties. However, they were statistically at par with each other.

***Yield of different varieties hectare^{-1}*:** Result (Table 7) showed that per hectare yield of KSK-282 and IRRI-6 was significantly higher than other tested varieties. These two varieties, however, were statistically at par with each other but were significantly better than Basmati-370, Basmati-385 and super Basmati. Variety DR-83 with 5311 kg ha^{-1} yield, although, statistically similar in its yield kg ha^{-1} with IRRI-6, was significantly better than the last three varieties.

Table 6. Comparative resistance of different rice varieties against rice leaf folder

Varieties	% Infestation
IRRI-6	14.50 b
KSK-282	15.99 b
DR-83	19.12 b
Basmati-370	27.65 a
Basmati-385	28.08 a
Super Basmati.	27.23 a
LSD	5.59

Means followed by same letters are not significantly different from each other at $P \leq 0.05$.

Table 7. Comparison of yield of different rice varieties

Varieties	Yield (kg ha^{-1})
IRRI-6	5620.0 ab
KSK-282	5656.0 a
DR-83	5311.0 b
Basmati-370	620.0 c
Basmati-385	773.3 c
Super Basmati.	488.9 c

Means followed by same letters are not significantly different from each other at $P \leq 0.05$

DISCUSSION

Different granular and spray-able insecticides are used for the management of rice stem borer, *T. incertulas* and rice leaf folder *C. medinalis* on rice crop for their quick knockdown effect to prevent yield losses. Results of the present study indicated that Roll up (7.2% G) and shark super (6% G) significantly reduced the mean percent dead hearts and white heads caused by rice stem borer. Similarly, plots treated with Karuz (4% GR) and Furadan (3G) resulted into minimum infestation of rice leaf folder. These results are in agreement with Chakraborty and Deb (2011) who reported that all the synthetic insecticides significantly reduced the population of rice leaf folder than the control.

Shark super 6% G gave highest rice yield per hectare. These results are different from those of Ahmad *et al*. (2004) who tested Monomehypo 5G and chloropyriphos 40EC against rice insect pests . They reported that the effect of chloropyriphos 40 EC was more evident in than that of monomehypo at 24, 46, 72 hr and one week after the application while in the present study, Roll up (Carbosulfan & Monomehypo) gave best results because the combination of carbosulfan and monomehypo was more effective than monomehypo alone.

Resistant varieties also play important role in the management of these insect pests. Results of the present studies showed that the rice varieties Basmati-385, Basmati-370 and Super Basmati (all fine varieties) were susceptible to rice stem borer and rice leaf folder and had maximum infestation. IRRI-6 and KSK-282 (coarse varieties) proved moderately resistant with minimum infestation of rice stem borer and rice leaf folder**.** Shah *et al.* (2008) also reported that Basmati-385 and KSK-282 were susceptible to leaf folder, with damage rating score of 7 while IRRI-6 was moderately susceptible with damage rating score of 5. The change in results may be due to the changes in the environmental conditions of the area. Khan *et al.* (2003) found that variety KSK-282 was resistant while Basmati-385 was susceptible to rice stem borer under the agro ecological conditions of Dera Ismail Khan. Rajput *et al*. (2004) reported that non-aromatic genotypes of rice were resistant to rice stem borer and resulted into high yield as compared to the aromatic rice genotypes. Abdullah and Shah (1996) found significantly more unfilled grains in fine variety Basmati-283 followed by IRRI-6 and KSK-282. With respect to yield, KSK-282 and IRRI-6 gave highest yield compared to other tested varieties. The results are supported by Shafique *et al.* (2000) who reported that among the coarse rice varieties IR8-151, IR6-20, B/94, IR6-25-1 and IR6-25 B/94 were comparatively resistant to borer attack and produced high yield ha^{-1}. The results of our experiments suggest that Solomon, Roll Up and Shark Super can be used for the better management of rice leaf folder and rice stem borer. Similarly, KSK-282 is the high yielding variety of rice crop.

REFERENCES

Abdullah, K. and G.S. Shah. 1996. Effect of different sowing dates and rice cultivars on the incidence and damage by rice stem borers. 2nd Int. Cong. Entomol. Sci. pp.18-19.

Afzal, M., S.S. Hasnain and S.M. Sherawat. 2003. Toxicity of different insecticides against rice stem borers *Scirpophaga incertulas* and *Scirpophaga innotata*. Pak. Entomol. 25:207-210.

Ahmad, S., M. Kashif and S. Nisar. 2004. Efficacy of Monomehypo 5G and Chlorpyrifos 40EC against insect pests and their effect on natural enemies in rice eco-system. Pak. Entomol. 26:87-94.

Akram, M., M. Ashraf, F.M. Abbasi and M.A. Sagar. 1994. 'Phakal', a high yielding short duration rice variety for Hazara division in Pakistan. Int. Rice Res. Note. pp.18-19.

Alvi, S.M., M.A. Ali, S.U. Chaudhary and S. Iqbal. 2003. Population trends and chemical control of rice leaf folder *(Cnaphalocrocis medinalis)* on rice crop. Int. J. Agric. Biol. 5:615-617.

Anonymous. 2007-08. Economic survey. Economic Survey of Pakistan 2007-08. Finance and Economic Affairs Division, Ministry of Finance, Govt. of Pakistan, Islamabad, Pakistan.

Atwal, A.S. 1994. Agricultural pests of India and South-east Asia, Kalyani Publishers. pp. 69-70.

Bashir, K., H. Tayyab, F. Tahira, L. Zakia, S.A. Mehdi and R. Sheikh. 2004. Field evaluation and risk assessment of transgenic indica basmati rice. Molec. Breed. 13:301-312.

Chakraborty, K. and D.C. Deb. 2011. Extent of suppression of leaf folder, *Cnaphalocrocis medinalis*, Guen. Population by some selected insecticides in the field of scented local paddy cultivar Tulaipanji at Raiganj, Uttar Dinajpur, West Bengal, India. Int. J. Plant Anim. Environ. Sci. 1:142-149.

Dash, A.N. and S.K. Mukherjee. 2003. Insecticidal control of major insect pests of rice. Pest Manag. Econ. Zool. 11:147-151.

Iram, S., I. Ahmad and M. Ashraf. 2003. A study on fungi and soil born diseases associated with rice-wheat cropping system of Punjab province of Pakistan. Pak J. Biol. Sci. 6:1-6.

Khan, M., A.U.R. Saljoqi, A. Latif and K. Abdullah. 2003. Evaluation of some rice varieties against rice stem borer. Asian J. Plant. Sci. 2:498-500.

Khan, M.R., M. Ahmad and S. Ahmad. 1989. Some studies on biology, chemical control and varietal preference of rice leaf folder, *Cnaphalocrocis medinalis*. Pak. J. Agric. Sci. 26:253-63.

Khan, R.A., J.A. Khan, M. Hamed and F.F. Jamil. 2005. Resistance of different basmati rice varieties to stem borers under different control tactics of IPM and evaluation of yield. Pak. J. Bot. 37:319-324.

Mustafa, G. and M.A. Razzaq. 1991. Efficacy of different doses of granular insecticides against rice borers. Ann. Rept. Ayub Agri. Res. Inst., Faisalabad, Pakistan. pp. 42-43.

Rajput, A.A., M. Sarwar and M. Toufiq. 2004. Varietal screening of different rice genotypes against infestation of rice stem borer. National Conf. Agri. Animal Sci. Sind Agri. Uni. Tandojam. p.61.

Rehman, A., E.U. Haq and C. Inayatullah. 2002. Impact of tillage practices and cropping systems on the survival of over-wintering rice stem borer larvae. Pak. J. Agri. Res. 17:163-169.

Shafique, M., M. Ashraf, M. Bux and M. Tofique. 2000. Screening of rice genotypes for resistance to stem borers. Pak. J. Zool. 32:135-137.

Shah, S.M.A., H. Rahman, A. Rahman, F.M. Abbassi, I.H. Khalil and A. Ali. 2008. Characterization of wild rice species in response to leaf folder. Sarhad J. Agric. 24:69-74.