MS.NO. 7767-GQ

ADVANCED WHEAT GENOTYPES RESPONDED DIFFERENTLY TO *HELICOVERPA ARMIGERA* HUBNER INFESTATION

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ABSTRACT

A field experiment was conducted to evaluate the response of 20 wheat genotypes in terms of spike and grain damage caused by *Helicoverpa armigera* Hubner at Regional Agricultural Research Institute, Bahawalpur. Wheat cultivars were sown in a randomized complete block design with three replications. A significant genotypic variability existed among the wheat genotypes for all the traits studies. Grain yield ranged from 2931 (DN-10) to 4333 (AUP-9701) kg ha^{-1}. Spike and grain damage ranged from 19.95 to 80.47 and 3.90 to 22.16 % in various wheat genotypes, respectively. The results suggested that studies on *Helicoverpa armigera* Hubner occurrence and identification of resistant/tolerant cultivars should be encouraged and area sown to wheat cultivars with low levels of resistance should be decreased.

KEY WORDS: *Triticum aestivum, Helicoverpa armigera,* variety, grain yield, losses

INTRODUCTION

Pakistan, with a population of 160.9 million in mid 2008, is the 6th most populous country in the world. The country's population is estimated to double in the year 2045 if it continues to grow at 1.8 percent (Anonymous, 2008). In this scenario, the government is facing the challenge of feeding the ever increasing population. Wheat is the most widely grown crop in the world. In Pakistan, wheat being the staple diet is the most important crop and is cultivated on the largest acreage of 8.459 million hectares with a production of 22.5 million tons during 2006-07 in almost every part of the country. It contributes 13.7 percent to the value added in agriculture and 3.0 percent to GDP (Anonymous, 2008). Dhaliwal and Arora (2004) reported that about 42% of attainable production is lost as a result of attack of pests in spite of control measures. Losses in wheat are estimated @ 9.3, 12.4 and 12.3 % due to animal pests, pathogens and weeds, respectively.

Wheat suffers from various biotic and abiotic stresses like rusts and smut diseases, aphids, *Helicoverpa armigera,* termites, salinity, drought, etc. Out of several other pests, *H. armigera,* which is the most destructive pest of agricultural crops and causes economic damage to the wheat crop (Dhaliwal and Arora, 1993; Patankar *et al*., 2001). Saleem and Rashid (2000) reported a loss of 13.98 % in grain yield in wheat caused by a single caterpillar of *H. armigera* per tiller. He *et al*. (1996) and Xia *et al*. (1997) have reported that Ist generation cotton bollworm larvae mainly injure winter wheat in the late stage growth with 90% of the eggs of the 1st generation oviposited on wheat ears. The larvae mainly feed on wheat ears. Wang *et al*. (1997) found that one larva could destroy approximately 47.7 grains. He *et al*. (1996) and Wang *et al*. (1997) further pointed out that the cotton bollworm infestations of wheat are an important source of pests which infest cotton and other crops after the wheat is harvested.

Seed quality is an important parameter that determines the acceptability of a commodity among the consumers (Bhatty, 1988). The grain quality of wheat is deteriorated due to the *H. armigera* infestation resulting in reduced market value. Thus, causing a significant economic loss to the wheat growers. It is, therefore, imperative to resolve this serious issue. The two possible solutions of the problem are:

1. Chemical control of the pest to ensure the good quality and quantity of wheat
2. Cultivation of resistant/tolerant wheat cultivars.

The first solution is not feasible because wheat is the staple food and is consumed directly after harvesting. In this way the residual effects may be hazardous to human health. The only solution to the problem is the screening and development of genotypes with inbuilt resistance/tolerance to *H. armigera*. Keeping in view the significance of the pest, various genotypes of wheat were screened for their resistance/tolerance to *H. armigera* in this study.

MATERIALS AND METHODS

A field experiment was conducted to evaluate the response of wheat genotypes in terms of spike and grain damage caused by *Helicoverpa armigera* Hubner during the Rabi season 1998-99 at Regional Agricultural Research Institute, Bahawalpur (29°23' 60N; 71°40' 60E; 112 m asl). Experiment consisted of 20 advance strains of wheat including two checks (V-95219, 94B-3047, WS-94194, V-94105, PR-68, D-94654, SD-4, 92T001, V-95153, AUP-

9701, V-94091, 93B2707, PR-67, V-95069, DN-10, V-8120, 91BT010-1, V-94045, Inqlab-91 and Local check). The experiment was laid out in a randomized complete block design with three replications and plot size of 12 m^2. The experiment was sown on 30 November. N and P_2O_5 fertilizers were applied at the rate of 160 and 110 kg ha^{-1}, respectively. Four irrigations were applied to the crop. Weeds were controlled chemically with Bromoxynil @ 1250 ml ha^{-1}. Observations of spike damage were recorded at the time of harvest by counting the total number of spikes and the number of spikes damaged by the pest from three randomly selected spots of 1 ft^2 from each plot. Grain-damage data were recorded by counting the total number of grains and number of grains damaged by the pest from five randomly selected spikes from each plot after the harvest. The percentage of damaged spikes/grains was calculated as described by Saleem and Rashid (2000) as under:

$$\text{Spike/grain damage (\%)} = \frac{\text{No. of damaged spikes/grains}}{\text{No. of total spikes/grains}} \times 100$$

Data were subjected to statistical analysis using a computer package MSTATC. Correlations were computed using the Correlation subprogram of MSTATC. Means were compared by Duncan's New Multiple Range Test (Steel and Torrie 1980).

RESULTS AND DISCUSSION

Highly significant differences were found among the wheat genotypes with respect to grain yield and spike and grain damage percentage ($P<0.01$) (Table 1). Grain yield ranged from 2931 (DN-10) to 4333 (AUP-9701) kg ha^{-1}. Spike and grain damage ranged from 19.95 to 80.47 and 3.90 to 22.16 % in various wheat genotypes, respectively (Table 2). The most susceptible genotypes in terms of spike damage were D-94654 (80.47 %), PR-68 (76.00 %), WS-94194 (59.53 %), and V-94091 (58.28 %). The genotype 92T001 was found to have the least spike damage (19.95 %). The wheat genotype SD-4 had the maximum grain damage (22.16 %) and V-8120 had the lowest (3.90 %) (Table 2). A significant positive correlation (r^2=0.422) was found between spike and grain damage percentages. The present results support the findings of Saleem and Rashid (2000) who found 13.98 % loss in grain yield of wheat by a single caterpillar of *H. armigera* per tiller. He *et al*. (1996) and Xia *et al*. (1997) have reported that Ist generation cotton bollworm larvae mainly injure winter wheat in the late stage growth with 90% of the eggs of the 1st generation oviposited on wheat ears. The larvae mainly feed on wheat ears. Wang *et al*. (1997) found that one larva could destroy approximately 47.7 grains. He *et al*. (1996) and Wang *et al*. (1997) further pointed out that the cotton bollworm infestations of wheat are an important source of pests which infest cotton and other crops after the wheat is harvested. Seed quality is an important parameter that determines the acceptability of a commodity among the consumers (Bhatty, 1988). The grain quality of wheat is deteriorated due to the *H. armigera* infestation resulting in reduced market value. Thus, causing a significant economic loss to the wheat growers.

CONCLUSIONS

Wheat genotypes responded differently to infestation of *Helicoverpa armigera* Hubner. The infestation by *H. armigera* Hubner caused significant damage to spikes and grains. It is, therefore, suggested that the studies on *H. armigera* Hubner occurrence in the area and identification of resistant/tolerant cultivars should be encouraged. The genotypes identified to be resistant/tolerant to *H. armigera* should be released for general cultivation. Efforts are on the way to develop wheat genotypes resistant/tolerant to *H. armigera* at the institute.

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Table 1 Analysis of variance of data with regard to Yield, spike and grain damage of various wheat genotypes after damage by *Helicoverpa armigera*

Parameters	Damaged spikes (%)	Damaged grains (%)	Yield (kg ha^{-1})
Means squares	65392	96.35	953680
Probability	0.000	0.000	0.000
CV (%)	3.54 %	7.32 %	9.65
LSD (5 %)	2.728	1.558	358
LSD (1 %)	3.654	2.086	425

Table 2 Yield and % damage in spike and grains in wheat genotypes due to infestation of *Helicoverpa armigera* at the Regional Agricultural Research Institute, Bahawalpur

Genotypes	Damaged spikes (%)	Damaged grains (%)	Yield (kg ha^{-1})
AUP-9701	34.58	06.12	4,333
V-95219	41.01	11.48	4,062
92T001	19.95	04.09	4,035
V-95153	45.75	20.52	4,021
91BT010-1	45.33	04.00	3,986
V-94105	52.37	09.58	3,861
94B-3047	39.34	14.19	3,861
Local check	41.31	19.12	3,771
WS-94194	59.53	15.18	3,674
Inqlab-91	52.37	19.78	3,674
93B2707	37.85	14.32	3,674
V-95069	36.22	12.29	3,604
V-94091	58.28	11.44	3,597
PR-67	46.72	09.01	3,507
V-8120	24.23	03.90	3,382
V-94045	52.42	18.24	3,326
D-94654	80.47	18.09	3,292
PR-68	76.00	14.94	3,243

SD-4	39.04	22.16	3,049
DN-10	50.48	09.96	2,931
LSD (5%)	**2.73**	**1.56**	**358**