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Comparative Resistance of Maize Cultivars/lines to Maize Stem Borer, *Chilo partellus* (Swinhoe)

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Abstract: The research was conducted to investigate the comparative resistance of nine maize cultivars/lines i.e. W-2, FRY-4, EV-9808, FRY-1, EV-9806, W-19, Ghori, Pahari and Babar, to maize stem borer, *Chilo partellus* (Swinhoe). The lowest significant infestation was recorded on EV-9806 (5.29%), EV-9808 (6.21%) and FRY-1 (6.32%), while the lowest number of dead hearts were observed on FRY-1 (4.10%), EV-9808 (5.40%), Pahari (5.47%) and W-2 (5.51%), throughout the growing season. The result based on these parameters revealed that line FRY-1 was comparatively the most resistant followed by EV-9808, Pahari and W-2. Overall result can be summed up for maize cultivars/lines resistance to maize stem borer FRY-1 > EV-9808 > Pahari > W-2 > W-19.

Key words: Maize stem borer, *Chilo partellus* (swinhoe), infestation dead heats, resistance

Introduction

Maize (*Zea mays* L.) is perhaps the most completely domesticated of all cereal crops. The most likely center of origin of corn is Mexico or Central America (Martin *et al.*, 1990). The precise date and route of the introduction of maize into Pakistan still remains a mystery. Maize is second to wheat in world economy. In Pakistan it is the third most important cereal after wheat and rice (Anonymous, 1980). Maize is a cereal crop and has high yielding potential under a wide range of adaptations. Therefore, it is grown on millions of hectares in every country. The total area under maize cultivation in NWFP during 1997-98 was 536.6.

Thousands hectare, with a total production of 814.0 thousands tones, while the average yield of maize in NWFP was 1525 kg ha^{-1} (Anonymous, 1997-98). The average yield of maize in Pakistan (1367Kg ha^{-1}) is very low as compared to other countries of the world (Rehman *et al.*, 1986). Several factors are responsible for this, among them insect pests are very important. Of all the cereal crops maize crop is most severely damaged by a wide array of insect pests. Maize stem borer, *Chilo partellus* (Swinhoe), ranks amongst the most destructive pests of maize in Pakistan. The conservative estimate of loss in yield of about 10% would lead to an annual loss of over Rs.100 million. This is one of the limiting factors in the intensification of maize cultivation in Pakistan (Chaudhry, 1983).

Tiwari *et al.* (1986) reported 50 maize germ plasm were screened for resistance to *Chilo partellus*. On the basis of leaf injury indexing following artificial infestation, germ plasm K1-159 was the most susceptible, while K1 Nos. 176, 163, 272 and 267 were least susceptible. Kumar (1993) evaluated two parental maize lines, susceptible Inbred A and resistant inbred Mp704, along with their reciprocal F1 hybrids for resistance to *Chilo partellus* and *Busseola fusca* in a screen house. The resistant parent and the F1 hybrids showed significantly lower foliage damage ratings as well as stem damage than the susceptible parent against both stem borers under artificial infestation. Larval survival on the F1 hybrids was as low as on Mp704.

Kumar (1994) evaluated the Kenyan maize varieties for resistance to *Chilo partellus*. The artificial infestation by 1st-generation *C. partellus* on maize during the early whorl stage revealed that leaf feeding damage, dead heart formation and stem damage on the Kenyan hybrids and populations were significantly greater than on the MIRT varieties.

Sharma and Sharma (1992) evaluate 10 maize cultivars against *Chilo partellus*. The variety arun was the most resistant to attack, having the lowest percentage infestation and the lowest percentage leaf damage and leaf injury at 40 and 70 days after sowing. The new hybrid ganga 11 was highly susceptible.

The study was conducted to determine the comparative resistance of maize cultivars/lines to the attack of maize stem borer and the extent of hibernation of maize stem borer.

Materials and Methods

To locate comparatively resistant maize cultivar/line to the attack of maize stem borer, *Chilo Partellus* (Swinhoe), an experiment was conducted at Cereal Crop Research Institute (CCRI), Pirsabak, Nowshera during July, 1999. Nine maize cultivars/lines namely, W-2, FRY-4, EV9808, FRY-1, EV9806, W-19, Ghori, Pahari and Babar. The experiment was laid out in randomized complete block design. Uniform cultural practices were followed in all plots. The experiment was left for natural infestation.

Comparative resistance of maize cultivars/lines to maize stem borer: The comparative resistance was determined by counting infested plants and dead hearts at 10 days interval from August to September 1999.

Extent of maize stem borer infestation: For recording the extent of infestation, leaf scratches, leaf holes and larval excreta were used as criteria for infested plants. In each observation the number of infested plants, in each plot, were recorded for calculating the extent of infestation, which was then converted into percent infestation by following formula:

$$\text{Percent infestation} = \frac{\text{Total no. of infested plants}}{\text{Total no. of plants}} \times 100$$

The average percent calculated data on monthly basis were finally subjected to statistical analysis.

Extent of dead hearts by maize stem borer: The boring of larvae into the stem through central whorl of maize plant was used as criteria for calculating the extent of dead hearts. The number of dead hearts in each observation in each plot, were counted. The percent dead hearts were calculated from the number of dead hearts in each plot.

Extent of maize stem borer hibernation and stubble infestation: To record the extent of hibernation, first, all the infested stubbles were counted and converted into percent. Second, all the infested stubbles were checked for the presence or absence of hibernating larvae in December 1999. Presence of hibernating larvae was considered as hibernation.

Results and Discussion

Comparative resistance of maize cultivars/lines to maize stem borer Maize stem borer infestation during August: The percent borer infestation during August 1999 on all cultivars/lines varied from 3.87 to 29.57 with an average range of 6.82 to 16.97 (Table 1). The data show that highest infestation was recorded on

Table 1: Averages seasonal infestation by maize stem borer

	August		September		Seasonal	
Treatments	Range	Average	Range	Average	Range	Average
W-2	3.87-15.83	9.49abc	8.89–19.38	14.14abc	3.8719.3	11.82ab
FRY4	15.10-23.98	16.97a	12.5-17.3	4.79ab	12.5-23.98	15.88a
EV9808	4.31-8.79	6.98c	4.99-5.8	5.42cd	4.31-8.79	6.21b
FRY-1	3.99-10.82	6.82c	3.45-8.14	5.81bcd	3.45-10.82	6.32b
EV9806	5.62-14.77	9.03abc	1.03–2.07	1.55d	1.03-14.77	5.29b
W-19	6.29-12.20	8.48bc	8.87–15.60	12.25abc	6.29-15.60	10.37ab
Ghori	6.60-29.57	16.24ab	13.12–21.08	17.13a	6.60-29.57	16.68a
Pahari	10.27-18.76	13.44abc	05.82–15.20	10.53abc	5.82-18.76	11.99a
Babar	9.17-25.63	16.91a	8.91-18.81	3.88abc	8.91-25.63	15.41a
Means		11.59		10.61		11.10

Means sharing different letters are significantly different at P≤0.05

Table 2: Average percent seasonal dead hearts by maize stem borer

	August		September		Seasonal	
Treatments	Range	Average	Range	Average	Range	Average
W-2	0.00-3.12	1.96	7.66-10.14	9.05	0.00-10.44	5.51
FRI-4	1.53-13.46	6.91	15.33-21.91	18.62	1.53-21.91	12.80
EV9806	0.00-3.38	1.86	8.54-9.38	8.69	0.00-9.38	5.40
FRI-1	0.49-5.03	2.66	3.17-7.76	5.47	0.49-7.76	4.10
EV9806	3.59-16.42	8.85	11.03-12.00	11.52	3.59-16.42	10.21
W-19	0.87-8.01	5.07	9.55-11.68	10.62	0.87-11.68	7.85
Ghori	0.37-12.35	5.81	9.43-13.39	11.44	0.37-13.39	8.61
Pahari	0.39-5.44	2.62	7.35-10.07	8.34	0.39-12.13	5.47
Babar	1.52-11.08	4.68	5.58-11.43	8.52	1.52-11.43	6.61
Means		4.49		10.28		7.41

line FRY-4 (16.97%) followed by hybrid Babar (16.91%) and Ghori (16.24%) in the descending order. The lowest infestation was recorded on line FRY-1 (6.82%) followed by EV9808 (6.98%) and W-19 (8.48%) in the ascending order, while the intermediate infested lines were Pahari (13.44%), EV-9808 (9.03%) and W-2 (9.49%). The statistical analysis of the percent maize stem borer infestation during August 1999 showed that difference among maize cultivars/lines under trial are significant to each other (Table 1).

Percent infestation in September 1999: The percent borer infestation during September 1999 of all the cultivars/lines varied from 1.03 to 21.08 with an average range of 1.55 to 17.13 (Table 1). The highest infestation was recorded on maize cultivar Ghori (17.13%) followed by FRY-4 (14.79%). While the lowest infestation was recorded on EV-9806 (1.55%) followed by EV-9808 (5.42%) and FRY-1 (5.81%). The intermediate infested cultivars/lines were Pahari (10.53%), W-19 (12.25%) and W-2 (14.14%).

The statistical analysis of the maize stem borer infestation during the month of September 1999 showed that highest infestation was recorded on Ghori which is significantly different from EV-9808, FRY-1 and EV-9806 (Table 1). Similarly line FRY-4 is next to Ghori in infestation and significantly similar to Ghori and other cultivars/lines but different from EV-9808 and EV-9806. The line EV-9806 showed significant resistance to maize stem borer than all other cultivars/lines, except EV-9808 and FRY-1.

Percent seasonal infestation by maize stem borer: Overall the percent infestation on all cultivars/lines varied from 5.29 to 16.68 with a total seasonal average of 11.10. According to the data (Table 1) highest infestation was recorded on Ghori (16.68%) followed by FRY-4 (15.88%), Babar (15.41%) and Pahari (11.99%). The lowest infestation was recorded on line EV-9806 (5.29%) followed by EV-9808 (6.21%) and FRY-1 (6.32%), while the intermediate infestation was recorded on W-19 (10.37%) and W-2 (11.82%).

The statistical analysis of seasonal infestation showed, that difference among maize cultivars/lines under trial are significant to each other. The data (Table 1) further revealed that highest infestation was recorded on Ghori, line FRY-4 and Babar which is significantly different from EV-9806, EV-9808 and FRY-1. The intermediate infested lines/cultivars were W-2 and W-19 which are non-significant to all other maize cultivars/lines.

Extent of dead hearts by maize stem borer

Percent dead hearts in August 1999: The percent dead hearts in all maize cultivars/lines varied from 0.00 to 16.42 with an average range of 1.86 to 8.85. The highest number of percent dead hearts were recorded in EV-9806 (8.85) followed by FRY-4 (6.91), Ghori (5.81) and W-19 (5.07), Babar (4.68), FRY-1 (2.66), Pahari (2.61), W-2 (1.96) and EV-9808 (1.86) in the descending order (Table 2).

Percent dead hearts in September 1999: The highest number of dead hearts were recorded in line FRY-4 (18.62%) followed by EV-9806 (11.52%), Ghori (11.44%), W-19 (10.62%), W-2 (9.05%), EV-9808 (8.96%), Babar (8.52%), Pahari (8.34%) and FRY-1 (5.47%) in the descending order (Table 2). The percent dead hearts ranges form 5.47 to 18.62 with an average of 10.28.

Percent seasonal dead hearts by maize stem borer: Over all the percent dead hearts varied from 4.10 to 12.80 with a total average of 7.41 throughout the growing season. According to the statistical analysis none of the maize cultivar/line dead hearts means were significantly different from one another. However, FRY-1 had lowest number of dead hearts throughout the growing season (Table 2).

Pant and Lal (1980) screened maize variety Antigua-Gr-1 and Sorghum 24 for resistance of *Chilo Partellus* on the basis of dead hearts, percent damaged leaves and percent tunneled stems. Tiwari *et al.* (1986) screened germ plasm K1-159 most susceptible and K1 Nos: 176, 163, 272 and 267 least susceptible on the basis of leaf injury indexing. Pathak and Othieno (1992), used 10 parent diallel analysis to evaluate the potential for genetic improvement

of resistance to *Chilo partellus* on the basis of leaf injury, dead hearts, stem tunneling and number of entry and exit holes.

Extent of maize stem borer hibernation and stubble infestation: The percent infested stubbles ranged from 14.68 to 24.44 with an average of 19.07. Statistical analysis (Table 3) showed that infested stubble means did not differ significantly from each other. However FRY-1 had lowest number of infested stubbles.

The data also indicates number of hibernating larvae of each maize cultivar/line in stubbles. The highest number of hibernating larvae (7) were observed in Ghori, followed by Babar (6), Pahari (3), W-19 (2), EV806 (2), FRY-1 (2) EV9806 (2), W-19 (1) and FRY-4 (0) in the descending order.

Table 3: Average percent infested stubbles by maize stem borer

Treatments	Percent infested stubbles	No. of hibernating larvae
W-2	20.84	1
FRY-4	18.31	0
EV9808	14.91	2
FRY-1	14.68	2
EV9806	18.25	2
W-19	21.37	2
Ghori	23.37	7
Pahari	15.48	3
Babar	24.44	6
	19.07	

Kafir (1988) observed 45 percent hibernating larvae inside the dry stalks in the lower third and 50 percent in the middle third location of grain sorghum.

The result based on maize stem borer infestation and dead hearts revealed that FRY-1 was comparatively the most resistant line followed by EV-9808, Pahari and W-2. The most susceptible cultivars/lines were EV-9806, FRY-4 and Ghori.

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