

**Varietal Response of Sugarcane Cultivars against the *Chilo infuscatellus* (Pyralidae, Lepidoptera)**

Shahbaz Ahmad

Institute of Agricultural Sciences, University of the Punjab, 59540

Corresponding Address: [Shahbaz.iags@pu.edu.pk](mailto:Shahbaz.iags@pu.edu.pk)

**Abstract:** Study was conducted to screen out the fifteen sugarcane cultivars with an objective to assess the varietal response against the *Chilo infuscatellus*. The experiment was designed in a randomized complete block designed (RCBD) with three replication. It is evident from the results that the US-394 showed maximum pest infestation (21.90%) while NSG-555 and (21.60%) showed significantly different from other varieties BL-4, US-162, US-394, L-116 and CP-77-400. The variety US-718 showed minimum infestation (15.49%) after US-133 and US-676 with (15.59) and (16.46%). The variety CPF-237 showed (17.81%) which significantly different from US-312, US-1491, US-824 and CPF-246 respectively. The Host Plant Susceptible indices (HPSIs) showed that CPF-237 showed maximum HPSIs (13%) and proved susceptible whereas all the other varieties showed equal response each with 11% HPSIs. The variety US-718 showed minimum HPSIs (10%). It concluded that most of the varieties of sugarcane showed equal response towards population of *Chilo infuscatellus* except CPF-237 that showed maximum HPSIs (13%).

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**Introduction:**

Sugarcane (*Saccharum officinarum* L.) is important cash crop of Pakistan. It plays key role in Agriculture and world fifth in production as compared to other countries of the world. The raw material like white and brown sugar, Shaker, Gur and ethanol etc are obtained (Hussain *et al.*, 2007). Sugarcane crop facing lot problems both in sugar industry and farmer community. There are many challenges like financial issues, low per acre yield, pitiable varieties, poor irrigation systems, lack of communication among the farmers and researchers but the most important is the insect pests. Instead of lack of infrastructure and facilities average production is 49.00 tons/ha and its yield is between 150-250 tons/ ha (Arian *et al.*, 2011). There are numbers of sucking and chewing pests that attack on the sugarcane crop but the most damaging pest is the sugarcane stem borer (*Chilo infuscatellus*). The losses cause by the insect pests of sugarcane crop upto 20% in every year. (Ahmed *et al.*, 2011) reported that losses cause by *Chilo infuscatellus* are 36.51%. It is also reported that third and fourth brood of *C. infuscatellus* reduce the weight upto 25% The plant damaged by stem borer produce internodes from growing season to formation of cane. The severe attack of the stem borer reduces the crop yield from 30-70% (Shahid *et al.*, 2007; Sajid and Hamid, 2011). The population of the *Chilo infuscatellus* depends on the growing season, control methods and varietal resistance. It is important that there should be resistant varieties to overcome the losses cause by *C. infuscatellus*. In the present work, we will try to find

out resistant and high yielding varieties against the the *Chilo infuscatellus*.

**Materials and Methods:**

The experiment was conducted in Southern Punjab highly affected sugarcane area, at Akram abad (Distt, Rahim Yar Khan) and University of Agriculture Faisalabad. The climate is very hot in summer up to 50°C while winter is cold up to 22°C. The average rainfall is very low as compared to other areas of Punjab.

**Preliminary screening of varieties against *Chilo infuscatellus*:**

The experiment was conducted to screen out the resistant and susceptible varieties of sugarcane on the basis of stem borer infestation. Fifteen early and late maturing varieties of sugarcane Viz., US-676, US-133, US-312, SPF-234, US-1491, US-824, CPF-246, US-718, CPF-237, CP-77-400, US-162, NSG-555, BL-4, L-116 and US-394 were screen out during spring. Experiment was laid out in a Randomized Complete Block Design (RCBD) with three replication in each block. The plot size was kept 5×10 m<sup>2</sup> and the experiment was repeated thrice. There were five rows in each plot for each variety. Middle three rows were selected for recording the data during preliminary screening. All the recommended agronomic practices (Hoeing, Earthing up, balance use of fertilizer and irrigations) were applied during the experimentation. The infestation was calculated on the basis of infested tillers from the preliminary screening. The observations were taken at weekly intervals. The number of total internodes and infested internodes

were counted separately from each cane and the borer infestation percentage on the basis of internodes damage was calculated by the following formula.

$$\text{Borer infestation (\% age)} = \frac{\text{Number of infested internodes}}{\text{Number of total internodes}} \times 100$$

The data were analyzed by following analysis of variance (ANOVA) and means were compared by the Tukey HSD test ( $P \leq 5\%$ ) by using the software Statistix 8.1.

#### Final screening of varieties against *Chilo infuscatellus*:

After preliminary screening, base on the infestation nine varieties of sugarcane Viz., US-676, US-133, US-312, SPF-234, US-1491, US-824, CPF-246, US-718 and CPF-237 were selected during 2012. The Data was collected after 15 days interval in both years on the basis of infestation.

#### Host Plant Susceptibility Indices (HPSI's):

The Plant Susceptibility indices were determined on the basis of percentage infestation of *Chilo infuscatellus*, on the selected varieties by using IBM compatible computer having a Microsoft Chart Package. It was also calculated by following formula:

$$\text{HPSI (\%)} = \frac{B - A}{B} \times 100$$

Where

A= Infestation of *C. infuscatellus* on individual varieties; and

B = Infestation of *C. infuscatellus* on all varieties, on an average basis.

#### Results:

The data regarding base on the pest infestation on the various varieties of sugarcane against the stem borer infestation at various dates of observations are given in Table-1. The analysis of variance of data regarding infestation caused by sugarcane stem borer showed significant difference among the varieties as the dates of observation. The means are compared by the Tukey HSD test ( $P=0.05$ ). It is evident from the results that the variety US-394 showed maximum pest infestation 21.90% and was at par with NSG-555 and 21.60% which significantly different from other varieties BL-4, US-162, US-394, L-116 and CP-77-400 with infestation 20.73%, 20.38%, 19.64%, and 19.51%. The variety US-718 showed minimum infestation 15.49% after US-133 and US-676 with 15.59 and 16.46%. The variety CPF-237 showed 17.81% which significantly different from US-312,

US-1491, US-824 and CPF-246 with 17.15, 17.12, 17.08 and 16.95% respectively.

#### Analysis of variance table for infestation

Source of variation	Degrees of freedom		Mean squares		F-value	
	2011	2012	2011	2012	2011	2012
Replication	2	2	8.337	2.627	8.72	3.6266
Date	13	13	2373.554	1033.951	2483.38**	1427.3197**
Variety	14	8	192.141	13.461	201.03**	18.5826**
Date x Variety	182	104	3.931	1.767	4.11**	2.4391**
Error	418	250	0.956	0.724	8.72	3.6266

\*\* = Highly significant ( $P < 0.01$ )

**Table-01. The mean comparison of data regarding leaf infestation percentage caused by sugarcane stem borer on different varieties of sugarcane at different dates of observation during 2011**

Variety	Mean
US-676	16.46 F
US-133	15.59 G
US-312	17.15 E
SPF-234	16.94 E
US-1491	17.12 E
US-824	17.08 E
CPF-246	16.95 E
US-718	15.49 G
CPF-237	17.81 D
CP-77-400	19.51 C
US-162	20.38 B
NSG-555	21.60 A
BL-4	20.73 B
L-116	19.64 C
US-394	21.90 A

The analysis of variance showed significance differences among the dates of observation. The means were compared with Tukey HSD test ( $P=0.05$ ). The maximum infestation was recorded on August 30 during 2011 but the tremendous decrease was observed on September 15. The minimum infestation was recorded on April 15 during 2011.

#### Final Screening of Varieties of Sugarcane:

Base on the data of stem borer infestation during 2011, in preliminary screening three varieties (US-718, US-312 and CPF-246) showed resistant and three moderate resistant (US-133, US-676 and US-1491) and three susceptible varieties (CPF-237, US-824 and SPF-234) were selected for final screening during 2012. The Bio-chemical plant factors of these varieties were also study to determine the role in mechanism of resistance in these varieties against sugarcane stem borer. The effect of various qualitative and abiotic factors on sugarcane was also investigated for final screening during 2012.

**Table-02. The mean comparison of data regarding leaf infestation percentage caused by sugarcane stem borer on different dates of observation during 2011**

Date	Mean
15-04-2011	07.79 M
30-04-2011	09.97 L
15-05-2011	12.25 K
30-05-2011	14.62 I
15-06-2011	17.20 H
30-06-2011	19.95 F
15-07-2011	23.28 E
30-07-2011	25.87 C
15-08-2011	28.24 B
30-08-2011	30.25 A
15-09-2011	23.81 D
30-09-2011	19.47 G
15-10-2011	13.74 J
30-10-2011	09.61 L

**Screening of Varieties on the Basis of Infestation (%)**

The data regarding to infestation of selected varieties of sugarcane stem borer during 2012 are given in Table-2a. The results showed significant difference and the means were compared with Tukey HSD test at (P=0.05). The minimum infestation was recorded in US-718 with 14.44%. The maximum infestation was recorded in CPF-237 with 15.95% followed by SPF-234 and US-824 with 15.87 and 15.78%. The varieties US-133, US-676 and US-1491 showed intermediate response with 15.69, 15/35 and 15%. The variety CPF-246 and US-312 showed significantly different response from other with 14.82 and 14.69%.

**Infestation Fluctuation at Various Dates of Observation During 2012****Table-03. The mean comparison of data regarding leaf infestation percentage caused by sugarcane stem borer on different varieties of sugarcane at different dates of observation during 2012**

Variety	Mean
US-676	15.35 BC
US-133	15.69 AB
US-312	14.69 DE
SPF-234	15.87 A
US-1491	15.00 CD
US-824	15.78 A
CPF-246	14.82 D
US-718	14.44 E
CPF-237	15.95 A

The analysis of variance showed significance differences among the dates of observation. The means were compared with Tukey HSD test (P=0.05).

The maximum infestation was recorded on May 30 during 2012 but the tremendous decrease was observed on June 15. The minimum infestation was recorded on August 30 during 2012.

**Table-04. The mean comparison of data regarding leaf infestation percentage caused by sugarcane stem borer on different dates of observation during 2012**

Date	Mean
15-4-2012	14.18 F
30-4-2012	19.45 D
15-5-2012	20.08 C
30-5-2012	22.65 A
15-6-2012	21.16 B
30-6-2012	20.89 B
15-7-2012	16.76 E
30-7-2012	12.77 G
15-8-2012	10.36 H
30-8-2012	5.62 L
15-9-2012	6.67 K
30-9-2012	8.55 J
15-10-2012	9.45 I
30-10-2012	14.57 F

**Host Plant Susceptibility Indices (HPSIs):**

HPSIs were calculated among varieties based on the infestation of sugarcane stem borer with the objective to find the role of individual varieties towards susceptibility among the varieties under study for the years 2011-09 and on cumulative basis. The results are described as under;

**Host Plant Susceptibility Indices (HPSIs) During 2011:**

The HPSIs, base on the infestation of different varieties of sugarcane during 2011 are shown in Fig-1. The results revealed that varieties CPF-237 showed maximum HPSIs (13%) followed by US-676 with HPSIs 12%. The minimum HPSIs were determined by varieties US-718 and US-133 with 10%. The other varieties each had 11% HPSIs and proved to be intermediate.

**Host Plant Susceptibility Indices (HPSIs) During 2012:**

The HPSIs, base on the infestation on different varieties of sugarcane during 2012 are shown in Fig-2. The results revealed that variety SPF-234 and CPF-237 showed maximum HPSIs (12%). The minimum HPSIs were observed in variety US-718 (10%). The other varieties showed intermediate HPSIs with (11%).

**Host Plant Susceptibility Indices on Cumulatively During 2011-12:**

The results pertaining to HPSIs on cumulative basis for both the study years based on infestation on different varieties of sugarcane are presented in Fig-3.

It is evident from the results that CPF-237 showed maximum HPSI i.e. 13% and proved susceptible whereas all the other varieties showed equal response each with 11% HPSIs. The variety US-718 showed minimum HPSIs (10%). From these results it was concluded that most of the varieties of sugarcane under study showed equal response towards population stem borer except CPF-237 which had maximum HPSI i.e. 13%.

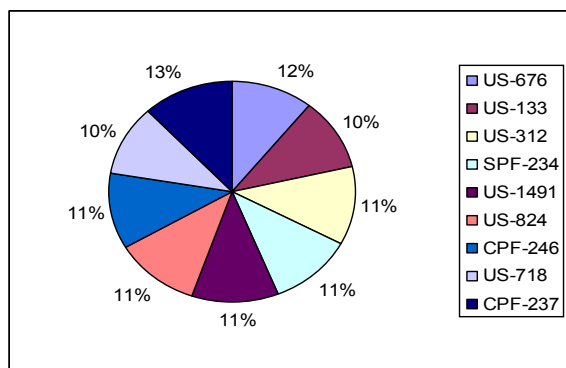


Fig-01. HPSIs % during 2011

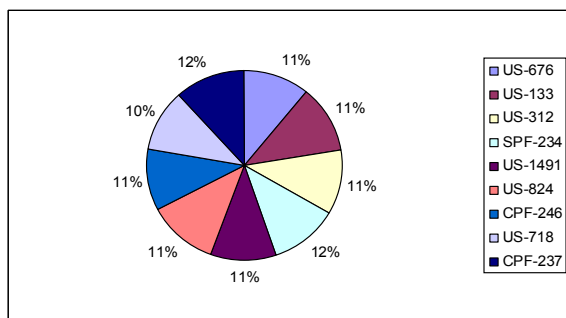


Fig-02. HPSIs (%) during 2012

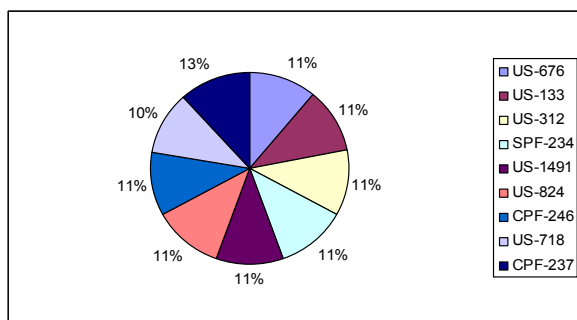


Fig-03. HPSIs (%) during 2011-12

**Discussion:**

**Varietal Resistance:**

The results revealed that there were significant variations among the varieties. US-718 showed comparatively resistant with minimum infestation (15.49%) and US-394 found susceptible and showing maximum infestation (21.90%). The infestation of

other varieties was given under descending order towards the susceptibility during 2011 are as, NSG-555 > BL-4 > US-162 > L-116 > CP-77-400 > CPF-237 > US-312 > US-1491 > US-824 > CPF-246 > SPF-234 > US-676 > US-133. In present study NSG-555 showed susceptible against sugarcane stem borer. The present results cannot compare with those of Baloach *et al.* (2005) and Rafiq *et al.* (2007) who found that NSG-555 showed least resistance against the stem borer. It is also concluded that BL-4 showed moderately resistant against stem borer, these findings are partially compared with those of Memon *et al.* (2003), Keerio *et al.* (2003) who reported that the BL-4 showed minimum infestation. It is also conformity by Mushtaq *et al.* (1989) who found that BL-4 showed least infestation against the stem borer. Our findings are contradict with Sohu *et al.* (2011) who recorded that L-116 showed very good results against sugarcane borer. The present findings showed that results contradict with those of Zafar *et al.* (2005) who's reported that CP-77-400 showed poor growth against the stem borer.

In the present experiment nine varieties were selected from fifteen varieties as mention which showed resistant, susceptible and intermediate responses. The level of infestation was low during 2012 as compared to the 2011. US-718 showed infestation 14.44% and CPF-237 showed 15.95% while it was 17.81% during 2011. The descending order of the varieties towards the susceptibility, CPF > 237 > SPF-234 > US-824 > US-133 > US-676 > US-1491 > CPF-246 > US-312 > US-718. The present finding cannot compared with those of Bahadar *et al.* (2007); Sarwar *et al.* (2002); Ali *et al.* (2002) and Shah *et al.* (2005) who found that CPF-237 showed least resistance against borer.

The results showed that the period of infestation was variable during both the years. There was maximum infestation 30.25% during 4<sup>th</sup> week of the August. This was the most favorable period for the pest fluctuation during 2011. The trend was quite different during 2012. The 4<sup>th</sup> week of May was most favorable and increased the pest infestation 22.65% followed by the infestation 21.16% during the second week of the July. The infestation decreased suddenly during both of the years. From the result it was concluded that borer population was high during 2011 as compared to 2012. The present findings are confirmatory with Aheer *et al.* (1994) who reported that borer population was maximum during the month of July and August. The Rana *et al.* (1992) who reported that highest population of stem borer was recorded during 4<sup>th</sup> week of May, 4<sup>th</sup> week of August and 2nd week of September. These findings partially comparable with those of Bhati *et al.* (2011) whose

reported that maximum damage done by the stem borer during the month from April to July.

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