

**ALL INDIA CO-ORDINATED RESEARCH PROJECT  
ON  
SUGARCANE**



**ANNUAL REPORT  
SUGARCANE ENTOMOLOGY  
2013-14**

**PUNJAB AGRICULTURAL UNIVERSITY, REGIONAL RESEARCH  
STATION, KAPURTHALA - 144 601**

**ANNUAL REPORT [ENTOMOLOGY]**  
**ALL INDIA CO-ORDINATED RESEARCH PROJECT ON SUGARCANE**  
**PUNJAB AGRICULTURAL UNIVERSITY, REGIONAL RESEARCH STATION,**  
**KAPURTHALA (2013-14)**

**1. Evaluation of varieties for their reaction against major insect pests.**

<b>Project No.</b>	<b>E. 4.1</b>
Location	Punjab Agricultural University, Regional Research Station, Kapurthala.
Title	Evaluation of zonal varieties for their reaction against major insect pests.
Objectives	To grade the entries in the zonal varietal trials for their behavior towards damage by key pests in the area.
Year of start	1985-86
Technical program	Early and mid-late genotypes/varieties to be evaluated against major insect pests without any insecticidal application. Observations to be recorded on the incidence of shoot borer in April to July, top borer in July to September and stalk borer at harvest.
Technical program	To continue with the new entries.
<b>Technical Report:</b>	
Genotypes	Zonal Varietal Trials, 37 entries
Design	RBD
Replications	Three
Plot size	27 sq. m.
Date of planting	22-3-2013

Thirty seven genotypes comprising of thirteen early maturing (three under IVT E, five under AVT E I plant and three under AVT E II plant) and twenty four late maturing (ten under IVT ML, five under AVT ML I plant and six under AVT ML II plant) with respective group standards were evaluated against early shoot borer, (*Chilo infuscatellus* Snellen), top borer

(*Scirpophaga excerptalis* Walker) and stalk borer (*Chilo auricilius* Dudgeon) of sugarcane at Punjab Agricultural University, Regional Research Station, Kapurthala.

Early shoot borer incidence was found to be low in all the tested genotypes (except one genotype viz. CoS 09246 showed moderately susceptible) ranged from 0.00 to 5.00 (CoPb 09263 and Co 09022). The other genotypes showed early shoot borer incidence ranged from 5.68 to 10.00 (CoPb 10181, Co 10035, CoH 10261, CoS 10231, CoJ 64, CoPant 84211, CoH 09262, CoLk 09202, CoPb 09181, CoPb 08211, CoPb 08212, CoS 08233, Co 10036, Co 10037, Co 10039, CoH 10262, CoH 10263, CoPant 10221, CoPb 10182, CoPb 10183, CoPb 10211, CoS 767, CoS 8436, CoPant 97222, CoH 09264, CoLk 09204, CoPb 09214, CoS 09232, CoH 08262, CoH 08263, CoH 08264, CoPb 08217, CoS 08234 and CoS 08235). Only one genotype viz. CoS 09246 (IVT E I) showed moderately susceptible to early shoot borer incidence was above fifteen percent (Table1). The cumulative incidence of top borer was recorded less susceptible to moderate susceptible. However, it ranged from 4.44 per cent in CoH 09262 (IVT E I) to 10.71 per cent in CoPant 10221 (AVT ML) in all the genotypes evaluated which exhibited low to moderately susceptible reaction against top borer. The per cent incidence of stalk borer ranged from 2.67 per cent in CoS 08235 (AVT ML II) to 12.00 per cent in CoPant 084211 (AVT E I). However, the genotypes under six different group showed less susceptible reaction to stalk borer (0.01-0.16 infestation index) (Table1).

**Summary:** Early shoot borer incidence was found to be less to moderately susceptible in all the tested genotypes under six different groups. The cumulative incidence of top borer was recorded as less to moderate ranging from 4.44 to 10.71 per cent. The genotypes tested also showed less than two per cent infestation index reaction to the stalk borer.

## 2. Survey and Surveillance of insect pests of Sugarcane

<b>Project No.</b>	<b>E. 28</b>
Location	Sugarcane fields nearby sugar factories of Punjab
Title	Survey and surveillance of insect pests of Sugarcane
Objectives	To identify key insect pests of sugarcane in the area
Year of start	2003-04
Technical program	Roving survey of sugarcane fields at 5-8 Km distance be recorded
Technical program	To continue for the next year

Sugarcane fields nearby sugar factories of Punjab were surveyed for insect pests in the area. Incidence of termite ranged between 1-2 per cent in popular varieties of sugarcane viz., CoJ 85, Co 238 and CoH 89003 around sugar factories at Nawansahar, Budhewal and Dhuri. The incidence of early shoot borer, top borer and stalk borer ranged between 5-8, 7-10 and 7-9 per cent, respectively, in different varieties of sugarcane viz., CoJ 85, CoJ 83, CoJ 88, Co 238, CoH 119, CoH 89003 and CoS 8436 in different cane growing areas of Punjab. The incidence of pyrilla, whitefly, mite, mealy bug and black bug were found in traces (Table 2).

**Summary:** Most of the sugar mill areas surveyed exhibited low insect pest incidence. Early shoot borer, top borer, stalk borer and termite were recorded as major insects in sugarcane. The per cent incidence of early shoot borer, top borer, stalk borer and termite varied from low to moderate range. The incidence of pyrilla, whitefly, mite, mealy bug and black bug were found in traces.

### 3. Monitoring of insect pests and bioagents in sugarcane agro-ecosystem

<b>Project No.</b>	<b>E. 30</b>
Location	Punjab Agricultural University, Regional Research Station, Kapurthala
Title	Monitoring of insect pests and bioagents in sugarcane agro-ecosystem
Objectives	To monitor key insect pests and natural enemies in the area
Year of start	2006-07
Technical program	1. Planting of sugarcane variety recommended for the region in 0.2 ha area. 2. All recommended practices to be followed except application of insecticide.
Technical program	To continue for the next year
Date of planting	20.03.13
Variety	CoJ 88
Area	0.2 ha

Sugarcane variety CoJ 88 was planted in 0.2 ha area and the incidence of insect pests and their natural enemies was recorded. The early shoot borer incidence started from 2<sup>nd</sup> week of May and reached its peak level of 9.0 per cent in 2<sup>nd</sup> week of July which thereafter, declined

to 3.0 per cent in the 2<sup>nd</sup> week of August. The activity of predator *Cheilomenes sexmaculata* (1-2 predator/plant) was observed against early shoot borer in 2<sup>nd</sup> week of June to July. The top borer incidence started from month of July and reached to its peak level of 10.2 per cent in 2<sup>nd</sup> week of September. Thereafter, top borer incidence decreased to 5.6 per cent in the 2<sup>nd</sup> fortnight of October. The bio-agents viz., *Isotima javensis* and *Stenobracon* sp. were recorded as 1.2 and 2.0 per cent in the month of July, respectively and 2.5 and 1.0 per cent in the month of August, respectively. The stalk borer incidence started from last week of August and reached to its peak level of 8.8 per cent in the month of October and thereafter, stalk borer incidence declined. Parasitization by bio-agents viz., *Sturmiopsis inference* and *Cotesia flavipes* were observed 1.0 and 2.0 percent in the month of September, respectively and again *Cotesia flavipes* 1 per cent was observed in the month of October. The activity of pyrilla on sugarcane initiated from first 1<sup>st</sup> week of August and continued up to last week of October. Activity of bio-agent viz., *Epiricania melanoleuca* 2 per cent parasitization was observed in the month of September and 1 per cent observed in month of October (Table 3).

**Summary:** The incidence of early shoot borer ranged from 3 to 9.0 per cent from 2<sup>nd</sup> week of May to August. The activity of predator *Cheilomenes sexmaculata* (1-2 predator/plant) was observed against early shoot borer in 2<sup>nd</sup> week of June to July. Top borer incidence was 5.6 and 10.2 per cent in the month of July to 2<sup>nd</sup> fortnight of October. Stalk borer incidence varied from 2.0 to 8.8 per cent from last week August to December. The bio-agents viz., *Isotima javensis* and *Stenobracon* sp. were recorded as 1.2 and 2.0 per cent in the month of July, respectively and 2.5 and 1.0 per cent in the month of August, respectively. The stalk borer incidence started from last week of August and reached to its peak level of 8.8 per cent in the month of October Parasitization by bio-agents viz., *Sturmiopsis inference* and *Cotesia flavipes* were observed 1.0 and 2.0 percent in the month of September, respectively and again *Cotesia flavipes* 1 per cent was observed in the month of October. The activity of Pyrilla on sugarcane initiated from first 1<sup>st</sup> week of August and continued up to last week of October. Activity of its bio-agent viz., *Epiricania melanoleuca* 2 per cent parasitization was observed in the month of September and 1 per cent observed in month of October.

#### 4. Management of borer complex of sugarcane through lures

<b>Project:</b>	<b>E.36</b>
<b>Location:</b>	Punjab Agricultural University, Regional Research Station, Kapurthala.
<b>Title:</b>	Management of borer complex of sugarcane through lures.
<b>Objective:</b>	To manage sugarcane borers (early shoot borer, top borer and stalk borer) through pheromone traps
<b>Year of start:</b>	2008-09
<b>Variety:</b>	CoJ 88
<b>Date of planting:</b>	22.03.2013
<b>Area:</b>	1 acre

The management of borer complex (early shoot borer, top borer and stalk borer) of sugarcane through lures was conducted at Punjab Agricultural University, Regional Research Station, Kapurthala. For the purpose, three pheromone traps for each borer were installed during first week of April till the harvest of crop. Observation on number of moth catches was recorded at weekly intervals. The activity of early shoot borer started from 18<sup>th</sup> MW (Monthly Week) (first week of May) to 38<sup>th</sup> MW (Third week of September). Thereafter, it was found to be nil up to 8<sup>th</sup> MW (3<sup>rd</sup> week of February 2014). The highest number of early shoot borer catches (9 moths/trap) trapped in 25<sup>th</sup> MW (third week of June) when maximum and minimum temperature was 41.3 and 27.9 °C. The early shoot borer moth catches were positively ( $r = 0.52$  and  $0.42$ ) correlated with maximum and minimum temperature, respectively, while it was negatively correlated with morning relative humidity ( $r = -0.35$ ), evening relative humidity ( $r = -0.12$ ) and rainfall ( $r = -0.13$ ) (Table 4 and 5). Incidence of early shoot borer in treatment and control plots was 5.67 and 7.87 per cent, respectively, Thus there was reduction of 27.95 per cent in the incidence of early shoot borer by lure alone (Table 6).

Activity of top borer started from 23<sup>rd</sup> MW (first week of June) to 43<sup>rd</sup> MW (last week of October) and thereafter, it was found to be nil up to the harvest of crop. The highest number of top borer catches (6 moths/trap) trapped during 31<sup>th</sup> MW (first week of August) when maximum and minimum temperature was 35.9 and 26.4 °C. The top borer moth catches were positively ( $r = 0.32$  and  $0.39$ ) correlated with maximum and minimum temperature,

respectively, and also positively correlated with morning and evening relative humidity ( $r = 0.04$  and  $0.17$ ), while it was negatively correlated with rain fall ( $r = -0.08$ ). Incidence of top borer in treatment and control plots was 6.87 and 8.91 per cent, respectively, Thus there was reduction of 22.89 per cent in the incidence of top borer by lure.

The activity of stalk borer started from 36<sup>th</sup> MW (first week of September) to 1<sup>st</sup> MW (first week of January), thereafter, it was found to be nil up to the harvest of crop. The highest number of stalk borer catches (4 moths/trap) were trapped in 40<sup>th</sup> MW (first week of October) when maximum and minimum temperature were 35.9 and 18.1 °C. The stalk borer moth catches were positively correlated with ( $r = 0.06$ ) with maximum temperature, morning relative humidity ( $r = 0.25$ ) while it was negatively correlated with ( $r = -0.15$ ) with minimum temperature and evening relative humidity ( $r = -0.02$ ) and rainfall ( $r = -0.11$ ) (Table 4 and 5). Incidence of stalk borer in treatment and control plots was 8.21 and 9.23 per cent, respectively, Thus there was reduction of 11.05 per cent in the incidence of stalk borer by pheromone (Table 6).

**Summary :** The activity of early shoot borer started from first week of May to third week of September. The highest numbers of early shoot borer were trapped in third week of June Incidence of early shoot borer in treatment and control plots was 5.67 and 7.87 per cent, respectively, Thus there was reduction of 27.95 per cent by lure alone. The activity of top borer was started from first week of June to last week of October. The highest numbers of top borer were trapped in first week of August. Incidence of top borer in treatment and control plots was 6.87 and 8.91 per cent, respectively, Thus there was reduction of 22.89 per cent in the incidence of top borer by lure. The activity of stalk borer started from first week of September to first week of January. The highest numbers of stalk were trapped in first week of October. Incidence of stalk borer in treatment and control plots was 8.21 and 9.23 per cent, respectively, Thus there was reduction of 11.05 per cent in the incidence of stalk borer.

## **5. Bioefficacy of new insecticides for the control of sugarcane early shoot borer**

**Project:** E.37.

**Location:** Punjab Agricultural University, Regional Research Station, Kapurthala.

<b>Title:</b>	Bioefficacy of new insecticides for the control of sugarcane early shoot borer.
<b>Objective:</b>	To find out effective strategy for the management of sugarcane early shoot borer
<b>Year of start:</b>	2013-14
<b>Variety:</b>	CoJ 88
<b>Date of planting:</b>	28.03.2013
<b>Area:</b>	800 sq m

An experiment was conducted to test the efficacy of different insecticidal treatments against sugarcane early shoot borer (*Chilo infuscatellus* Snellen) at Punjab Agricultural University, Regional Research Station, Kapurthala during spring 2013-14. The cumulative percent incidence of early shoot borer was observed at 30, 60, 90 and 120 days after planting. Different treatments were given viz. Fipronil 0.3 G @ 25 kg/ha, Chlorantraniliprole 0.4 G @ 22.5 kg/ha, Phorate 10 G @ 15 kg/ha, Carbofuron 3 G @ 33 kg/ha as a soil application at 60 days after planting and Chlorantraniliprole 18.5 SC @ 375 ml/ha, Spinosad 45 SC @ 90 ml/ha, Flubendiamide 24 SC @ 250 ml/ha, spray at 30 and 60 days after planting and control plot. Analysis of variance revealed significant differences for the control of early shoot borer (Table 7). Out of the insecticides tested Chlorantraniliprole 18.5 SC @ 375 ml/ha was found to be significantly superior and recorded minimum percent incidence of early shoot borer (1.63%). Its application also resulted in significant increase for germination percentage (33.7%), cane yield (89.67t/ha), total cane height (281.33 cm), sucrose percent in juice (17.91%) and Commercial Cane Sugar (CCS) (12.77%). This was followed by Chlorantraniliprole 0.4G @ 22.5 kg/ha treatment having percent incidence of early shoot borer (2.28%) and thereby increased other parameters significantly viz. germination percentage (31.97%), cane yield (88.23t/ha), total cane height (279.67 cm), sucrose percent in juice (17.85%) and CCS (12.75%) (Table 7). The corresponding values for incidence of ESB and other parameters in control treatment were percent incidence of early shoot borer highest (8.74%) and minimum germination percentage (21.89%), cane yield (76.33t/ha), total cane height (266.33 cm), sucrose percent in juice (16.78%) and CCS (11.94%), respectively. The rest of the treatments were also comparable to control with varying levels.



**Summary:** The efficacy of different insecticidal treatments tested against sugarcane early shoot borer revealed that cumulative percent incidence of early shoot borer observed at 30, 60, 90 and 120 days after planting was least for the treatment Chlorantraniliprole 18.5 SC @ 375 ml/ha thereby resulting in increase in other economic parameters like germination percentage, cane yield, total cane height, sucrose (% in juice) and CCS (%) closely followed by the insecticides, Chlorantraniliprole 0.4G @ 22.5 kg, Flubendiamide 24 SC @ 250 ml/ha, Spinosad 45SC @ 90 ml/ha, Fipronil 0.3 G@ 25 kg, Carbofuron 3G @ 33 kg/ha and Phorate 10 G @ 15 kg/ha as compared to control for management of early shoot borer in sugarcane.

## HIGHLIGHTS

1. Early shoot borer incidence was found to be less to moderately susceptible in all the tested genotypes under six different groups. The cumulative incidence of top borer was recorded as less to moderate ranging from 4.44 to 10.71 per cent. The genotypes tested also showed less than two per cent infestation index reaction to the stalk borer.
2. Most of the sugar mill areas surveyed exhibited low insect pest incidence. Early shoot borer, top borer, stalk borer and termite were recorded as major insects in sugarcane. The per cent incidence of early shoot borer, top borer, stalk borer and termite varied from low to moderate range. The incidence of pyrilla, whitefly, mite, mealy bug and black bug were found in traces.
3. The incidence of early shoot borer ranged from 3 to 9.0 per cent from 2<sup>nd</sup> week of May to August. The activity of predator *Cheilomenes sexmaculata* (1-2 predator/plant) was observed against early shoot borer in 2<sup>nd</sup> week of June to July. Top borer incidence was 5.6 and 10.2 per cent in the month of July to 2<sup>nd</sup> fortnight of October. Stalk borer incidence varied from 2.0 to 8.8 per cent from last week August to December. The bio-agents viz., *Isotima javensis* and *Stenobracon* sp. were recorded as 1.2 and 2.0 per cent in the month of July, respectively and 2.5 and 1.0 per cent in the month of August, respectively. The stalk borer incidence started from last week of August and reached to its peak level of 8.8 per cent in the month of October Parasitization by bio-agents viz., *Sturmiopsis inference* and *Cotesia flavipes* were observed 1.0 and 2.0 percent in the month of September, respectively and again *Cotesia flavipes* 1 per cent was observed in the month of October. The activity of Pyrilla on sugarcane initiated from first 1<sup>st</sup> week of August and continued up to last week of October. Activity of its bio-agent viz., *Epiricania melanoleuca* 2 per cent parasitization was observed in the month of September and 1 per cent observed in month of October.
4. The activity of early shoot borer started from first week of May to third week of September. The highest numbers of early shoot borer were trapped in third week of June Incidence of early shoot borer in treatment and control plots was 5.67 and 7.87 per cent, respectively, Thus there was reduction of 27.95 per cent by lure alone. The activity of top borer was started from first week of June to last week of October. The highest numbers of top borer were trapped in first week of August. Incidence of top borer in treatment and

control plots was 6.87 and 8.91 per cent, respectively, Thus there was reduction of 22.89 per cent in the incidence of top borer by lure. The activity of stalk borer started from first week of September to first week of January. The highest numbers of stalk were trapped in first week of October. Incidence of stalk borer in treatment and control plots was 8.21 and 9.23 per cent, respectively, Thus there was reduction of 11.05 per cent in the incidence of stalk borer.

5. The efficacy of different insecticidal treatments tested against sugarcane early shoot borer revealed that cumulative percent incidence of early shoot borer observed at 30, 60, 90 and 120 days after planting was least for the treatment Chlorantraniliprole 18.5 SC @ 375 ml/ha thereby resulting in increase in other economic parameters like germination percentage, cane yield, total cane height, sucrose (% in juice) and CCS (%) closely followed by the insecticides, Chlorantraniliprole 0.4G @ 22.5 kg, Flubendiamide 24 SC @ 250 ml/ha, Spinosad 45SC @ 90 ml/ha, Fipronil 0.3 G@ 25 kg, Carbofuron 3G @ 33 kg/ha and Phorate 10 G @ 15 kg/ha as compared to control for management of early shoot borer in sugarcane.

**Table 1. Screening of varieties for resistance to insect pests**

Sr. No	Genotype	Shoot borer	Top borer incidence (%)			Stalk borer		Infestation index
		Cumulative percent Incidence	III Brood	IV Brood	Cumulative	Incidence (%)	Intensity (%)	
<b>IVT Varietal Trial (Early)</b>								
1	Co 10035	6.82	5.56	1.05	6.61	8.00	0.75	0.06
2	CoH 10261	6.32	6.93	0.99	7.92	5.33	0.67	0.04
3	CoS 10231	7.61	4.35	2.17	6.52	6.67	1.00	0.07
CK	CoJ 64	8.24	7.06	2.35	9.41	9.33	1.00	0.09
	CoPant 84211	7.23	6.02	2.41	8.43	10.67	1.17	0.12
CD (0.05)		0.23	0.46	0.08	0.54	0.90	0.19	0.01
<b>AVT Varietal Trial (Early I plant )</b>								
1	CoH 09262	7.78	2.22	2.22	4.44	5.33	0.58	0.03
2	CoPb 09263	4.94	3.70	2.47	6.17	5.33	0.67	0.04
3	CoLk 09202	8.14	5.81	1.16	6.98	9.33	0.58	0.05
4	CoPb 09181	6.98	6.17	2.47	8.64	5.33	0.75	0.04
5	CoS 09246	15.12	3.49	1.16	4.65	6.67	0.42	0.03
CK	CoJ 64	7.61	8.14	2.17	10.31	10.67	1.17	0.12
	CoPant 84211	9.57	5.32	3.19	8.51	12.00	1.33	0.16
CD (0.05)		1.35	1.07	0.54	0.86	1.07	0.25	0.04
<b>AVT Varietal Trial (Early II plant )</b>								
1	CoPb 08211	7.37	5.26	4.21	9.47	8.00	0.83	0.07
2	CoPb 08212	6.67	3.33	2.22	5.56	5.33	0.58	0.03
3	CoS08233	8.75	5.00	3.75	8.75	8.00	0.83	0.07
CK	CoJ 64	9.76	7.32	2.50	9.82	9.33	1.08	0.10
	CoPant 84211	10.00	5.00	3.85	8.85	10.67	1.00	0.11
CD (0.05)		0.78	0.54	0.35	0.42	1.14	0.18	0.03
<b>IVT Varietal Trail (Mid late)</b>								
1	Co 10036	6.52	4.35	3.26	7.61	6.67	0.83	0.06
2	Co 10037	7.32	6.10	3.66	9.76	5.33	0.67	0.04
3	Co 10039	10.00	7.50	2.50	10.00	6.67	0.75	0.05
4	CoH 10262	9.20	4.44	2.22	6.67	5.33	0.67	0.04
5	CoH 10263	8.05	5.75	3.45	9.20	8.00	0.83	0.07
6	CoPant 10221	7.79	8.33	2.38	10.71	6.67	0.92	0.06
7	CoPb 10181	5.68	5.00	2.50	7.50	8.00	0.83	0.07
8	CoPb 10182	6.90	4.60	3.45	8.05	6.67	0.75	0.05
9	CoPb 10183	8.05	6.25	2.47	8.72	8.00	0.83	0.07
10	CoPb 10211	6.90	5.75	3.49	9.24	6.67	0.67	0.04
CK	CoS 767	8.54	7.23	2.41	9.64	10.67	1.00	0.11
	CoS 8436	8.86	7.59	1.27	8.86	10.67	1.33	0.14
	CoPant 97222	9.41	5.88	3.53	9.41	9.33	1.00	0.09
CD (0.05)		0.62	0.64	0.35	0.56	0.87	0.09	0.01
<b>AVT Varietal Trial (Mid late I plant)</b>								
1	Co 09022	4.88	4.88	1.22	6.10	6.67	0.75	0.05

2	CoH 09264	6.82	5.68	3.41	9.09	9.33	0.83	0.08
3	CoLk 09204	6.67	4.44	2.22	6.67	8.00	0.92	0.07
4	CoPb 09214	7.23	6.02	2.41	8.43	8.00	1.17	0.09
5	CoS 09232	6.67	5.56	1.11	6.67	6.67	0.83	0.06
CK	CoS 767	8.24	7.37	1.05	8.42	10.67	1.17	0.12
	CoS 8436	7.95	5.68	2.27	7.95	10.67	1.08	0.12
	CoPant 97222	7.41	8.64	1.23	9.88	9.33	0.92	0.09
CD (0.05)		0.69	0.91	0.57	0.88	1.07	0.11	0.02
<b>AVT Varietal Trial (Mid late II plant)</b>								
1	CoH 08262	6.90	5.75	2.30	8.05	8.00	0.58	0.05
2	CoH 08263	6.67	6.67	1.11	7.78	5.33	0.50	0.03
3	CoH 08264	7.78	5.56	3.33	8.89	5.33	0.75	0.04
4	CoPb 08217	7.14	4.76	2.38	7.14	8.00	0.83	0.07
5	CoS 08234	7.45	6.38	1.06	7.45	6.67	0.67	0.04
6	CoS 08235	7.29	6.25	3.13	9.38	2.67	0.50	0.01
CK	CoS 767	8.33	7.45	2.13	9.57	10.67	0.92	0.10
	CoS 8436	7.95	6.82	1.14	7.95	9.33	1.00	0.09
	CoPant 97222	9.09	6.49	2.60	9.09	10.67	1.17	0.12
CD (0.05)		0.47	0.49	0.53	0.55	1.66	0.14	0.02

### Grade

Pest	LS	MS	HS
Early shoot borer (%)	Below 15.0	15.1-30.0	Above 30.0
Top borer (%)	Below 10.0	10.1-20.0	Above 20.0
Root borer	Below 15.0	15.1-30.0	Above 30.0
Stalk borer (infestation index)	Below 2.0	2.1-5.0	Above 5.0
Pyrilla (nymph + adult per leaf)	Below 5.0	5.1-20.0	Above 20.0
Whitefly (per square inch)	Below 2.0	2.1-5.0	Above 5.0

**Table 2. Survey and surveillance of insect pest of sugarcane in Punjab during 2013-14**

S. No.	Varieties	Location	Name of Pest	Per cent incidence	Remark
1.	CoJ 85 Co 238 CoH 89003	Nawanshahar Budhewal Dhuri	Termite	1-2	Termite damage was more in sandy soil
2.	CoJ 85 CoJ 83 CoJ 88 Co 238 CoH 119 CoH 89003	Nawanshahar Phagwara Ajnala Gurdaspur Dhuri Budhewal Bhogpur	Early shoot borer	5-8	Late planting of sugarcane showed more incidence of early shoot borer
3.	Co 238	Budhewal Bhogpur Phagwara Ajnala Gurdaspur Mukerian Dhuri Morinda	Top borer	13-16	Top borer incidence was higher in variety Co 238
	CoJ 85 CoJ 88 CoH 119 CoS 8436	Budhewal Bhogpur Phagwara Ajnala Gurdaspur Mukerian Dhuri Morinda	Top borer	7-10	-
4.	CoJ 85 CoJ 88 Co 238 CoH 119 CoS 8436	Gurdaspur Phagwara Ajnala Mukerian Dhuri Nawanshahar Budhewal	Pyrilla	Traces	-
5.	CoJ 85 CoJ 88 Co 238	Mukerian Nawanshahar Budhewal	Whitefly	Traces	-
6.	CoJ 85 Co 238	Faridkot Abohar	Mite	Traces	-

7.	Co 238 CoH 119 CoS 8436	Phagwara Gurdaspur Mukerian	Mealy bug	Traces	-
8.	CoJ 85 Co 238 CoH 119 CoS 8436	Ludhiana Gurdaspur Phagwara Gurdaspur Mukerian	Black bug	Traces	-
9.	CoJ 85 CoJ 83 CoJ 88 Co 238 CoS 8436	Nawanshahar Phagwara Ajnala Gurdaspur Mukerian Budhewal Morinda	Stalk borer	7-9	Stalk borer incidence was declined with recommendation of new insecticide in the state

**Table 3. Incidence of insect pests and bioagents in sugarcane (2013-14)**

Month	Percent incidence of early shoot borer	Predator (ESB)/ per plant	Percent incidence of Top borer	Percent parasitism (Tb)		Percent incidence of Stalk borer	Percent parasitism (Stb)		Percent incidence of Pyrilla	Percent parasitism (Pyrilla)
		<i>Cheilomenes sexmaculata</i>		<i>Isotima javensis</i>	<i>Stenobraccon</i> sp.		<i>Sturmiopsis inference</i>	<i>Cotesia flavipes</i>		<i>Epiricania melanoleuca</i>
April, 12	-	-	-	-	-	-	-	-	-	-
May, 12	4.5	-	-	-	-	-	-	-	-	-
June, 12	5.8	1.0	-	-	-	-	-	-	-	-
July, 12	9.0	2.0	6.4	1.2	2.0	-	-	-	-	-
August, 12	3.0	-	9.8	2.5	1.0	Traces	-	Traces	Traces	Traces
September, 12	-	-	10.2	-	-	6.8	1.0	2.0	2.0	2.0
October, 12	-	-	5.6	-	-	8.8	-	1.0	1.0	1.0
November, 12	-	-	-	-	-	6.0	Traces	-	-	-
December, 12	-	-	-	-	-	2.0	-	-	-	-
January, 12	-	-	-	-	-	-	-	-	-	-

ESB (Early Shoot Borer), Tb (Top Borer) and Stb (Stalk Borer)



**Table 4. Number of Early shoot borer, Top borer and Stalk borer moth trapped at weekly interval with weather parameters (2013-14)**

Standard Week	Date	Early shoot borer	Top borer	Stalk borer	Average Temperature °C		Average Relative Humidity %		Total Rain fall (mm)
					Max	Min	Morning	Evening	
12	22.03.13	0.00	0.00	0.00	27.5	15.0	92.3	50.7	30.2
13	29.03.13	0.00	0.00	0.00	33.0	15.8	87.0	36.1	0.0
14	5.04.13	0.00	0.00	0.00	36.9	16.8	75.7	23.4	10.6
15	12.04.13	0.00	0.00	0.00	32.3	15.8	64.9	18.3	11.8
16	19.04.13	0.00	0.00	0.00	36.4	16.9	48.1	24.4	9.8
17	26.04.13	0.00	0.00	0.00	35.4	15.1	54.1	23.6	14.0
18	3.05.13	1.00	0.00	0.00	38.3	18.3	44.3	18.3	0.0
19	10.05.13	3.00	0.00	0.00	41.4	22.1	59.9	34.1	0.0
20	17.05.13	1.00	0.00	0.00	41.8	24.1	46.0	21.7	0.0
21	24.05.13	4.00	0.00	0.00	42.9	23.1	51.9	34.6	0.0
22	31.05.13	8.00	0.00	0.00	44.0	25.0	69.6	42.0	0.0
23	7.06.13	4.00	1.00	0.00	41.9	24.2	76.4	52.4	0.0
24	14.06.13	5.00	3.00	0.00	43.2	26.4	79.7	58.7	0.0
25	21.06.13	9.00	1.00	0.00	41.3	27.9	77.0	50.6	0.0
26	28.06.13	2.00	1.00	0.00	40.6	28.4	81.4	58.1	0.0
27	5.07.13	1.00	0.00	0.00	37.3	26.9	83.9	70.3	7.2
28	12.07.13	0.00	0.00	0.00	36.1	26.9	80.6	60.0	29.0
29	19.07.13	0.00	0.00	0.00	37.9	26.1	84.3	69.3	7.6
30	26.07.13	0.00	2.00	0.00	36.1	26.9	83.3	60.9	6.2
31	2.08.13	1.00	6.00	0.00	35.9	26.4	87.1	76.9	8.4
32	9.08.13	0.00	1.00	0.00	34.4	25.6	88.9	71.9	6.6
33	16.08.13	0.00	0.00	0.00	35.1	26.5	91.1	71.1	31.3
34	23.08.13	0.00	0.00	0.00	33.8	25.6	88.6	62.3	12.4
35	30.08.13	0.00	0.00	0.00	36.3	25.6	86.1	57.6	9.4
36	6.09.13	0.00	3.00	2.00	34.5	25.1	85.6	66.3	21.4
37	13.09.13	0.00	0.00	0.00	32.1	23.7	85.9	53.1	212.2
38	20.09.13	1.00	0.00	1.00	34.1	21.0	90.1	63.6	0.0
39	27.09.13	0.00	2.00	3.00	35.9	19.7	86.4	60.0	0.0
40	4.10.13	0.00	0.00	4.00	35.9	18.1	92.7	65.9	0.0
41	11.10.13	0.00	3.00	1.00	33.7	15.2	93.3	53.4	0.2
42	18.10.13	0.00	0.00	2.00	32.7	13.6	89.3	35.4	3.4
43	25.10.13	0.00	1.00	0.00	30.3	11.9	89.6	37.0	0.0
44	1.11.13	0.00	0.00	1.00	32.1	12.9	88.7	41.1	0.0
45	8.11.13	0.00	0.00	0.00	28.9	10.2	93.4	36.9	0.0
46	15.11.13	0.00	0.00	3.00	27.6	7.9	90.7	32.1	0.0
47	22.11.13	0.00	0.00	1.00	26.8	6.4	93.7	38.4	0.0
48	29.11.13	0.00	0.00	3.00	24.1	5.0	92.1	43.9	0.0
49	6.12.13	0.00	0.00	0.00	25.1	4.9	93.0	46.1	0.0
50	13.12.13	0.00	0.00	0.00	20.6	6.2	94.1	66.7	13.0
51	20.12.13	0.00	0.00	0.00	17.5	4.9	95.4	64.9	0.0
52	27.12.13	0.00	0.00	0.00	13.1	6.6	92.4	53.3	0.0
1	3.01.14	0.00	0.00	1.00	11.4	3.6	94.1	72.4	0.0
2	10.01.14	0.00	0.00	0.00	20.9	2.2	93.1	77.1	0.0
3	17.01.14	0.00	0.00	0.00	18.8	3.9	97.7	85.4	9.6
4	24.01.14	0.00	0.00	0.00	21.6	1.5	97.4	80.0	0.0
5	31.01.14	0.00	0.00	0.00	21.1	6.1	95.6	83.6	0.0
6	7.02.14	0.00	0.00	0.00	23.0	3.3	94.3	76.0	0.0
7	14.02.14	0.00	0.00	0.00	20.5	7.9	92.6	77.4	24.8
8	21.02.14	0.00	0.00	0.00	20.7	9.2	92.9	76.4	63.0

**Table 5. Correlation of weather parameters with moth catches (2013-14)**

<b>Correlation coefficient</b>	<b>Early shoot borer</b>	<b>Top borer</b>	<b>Stalk borer</b>
Maximum Temperature	0.52	0.32	0.06
Minimum Temperature	0.42	0.39	-0.15
Relative Humidity % (Morning)	-0.35	0.04	0.25
Relative Humidity % (Evening)	-0.12	0.17	-0.02
Rain fall	-0.13	-0.08	-0.11

**Table 6. Incidence of borer complex in treatment and control plot**

<b>Treatment</b>	<b>Percent incidence of Early shoot borer</b>	<b>Percent incidence of Top borer</b>	<b>Percent incidence of Stalk borer</b>
Pheromone (treatment)	5.67	6.87	8.21
Control	7.87	8.91	9.23
Percent reduction	27.95	22.89	11.05

**Table 7. Bioefficacy of new insecticides for the control of sugarcane early shoot borer during 2013-14**

Treatment	Cumulative percent incidence of early shoot borer (ESB)	Germination (%)	Tillering percent at 120 (000/ha)	Number of millable cane (t/ha)	Cane yield (t/ha)	Growth Parameter				Quality parameter			
						Total cane height (cm)	Millable cane height (cm)	Number of internodes	Girth of cane (cm)	Brix (%)	Sucrose (%) in Juice	Purity (%)	CCS (%)
Fipronil 0.3 G@ 25 kg	3.34	27.78	116	73.67	83.67	274.00	221.33	19.00	2.17	18.71	17.76	94.92	12.69
Chlorantraniliprole 0.4G @ 22.5 kg	2.28	31.97	125	78.33	88.23	279.67	225.30	21.00	2.21	18.82	17.85	94.86	12.75
Chlorantraniliprole 18.5 SC @ 375 ml/ha	1.63	33.37	128	81.10	89.67	281.33	226.23	21.67	2.22	18.95	17.91	94.51	12.77
Spinosad 45SC @ 90 ml/ha	3.05	29.21	118	75.09	85.16	276.00	223.33	20.00	2.18	18.71	17.81	95.21	12.74
Flubendiamide 24 SC @ 250 ml/ha	2.85	30.59	121	76.38	86.23	277.67	224.13	20.67	2.19	18.72	17.82	95.23	12.75
Phorate 10 G @ 15 kg/ha	4.31	25.00	113	72.34	81.65	272.33	217.24	18.00	2.13	18.69	17.73	94.85	12.66
Carbofuron 3 G @ 33 kg/ha	4.09	26.43	115	73.760	82.67	273.67	219.08	19.00	2.15	18.65	17.76	95.23	12.70
Control	8.74	21.89	109	66.67	76.33	266.33	212.33	17.00	2.07	17.84	16.78	94.07	11.94
CD (0.05)	0.084	0.057	0.066	3.35	2.41	6.11	4.66	1.56	0.050	0.094	0.17	NS	0.19

NS – Non Significant