

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



**ANNUAL REPORT
SUGARCANE ENTOMOLOGY
2014-15**

**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 (2014-15)

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

Project No.	E. 4.1
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.
Technical Report:	
Genotypes	Zonal Varietal Trials, 38 entries
Design	RBD
Replications	Three
Plot size	27 sq. m.
Date of planting	21-3-2014

Thirty eight genotypes comprising of fifteen early maturing (seven under IVT E, three under AVT E I plant and five under AVT E II plant) and twenty three mid-late maturing (thirteen under IVT ML, five under AVT ML I plant and five 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 two genotype viz. CoH 11261 and CoLk 11205 showed moderately susceptible) ranged from 0.00 to 15.00 per cent viz. CoH 11262, CoLk 11201, CoLk 11202, CoLk 11203, CoPb 11211, CoPb 11212, Co 10035, CoH 10261, CoS 10231, CoH 09262, CoH 09263, CoLk 09202, CoPb 09181, CoS 09246, Co 11026, Co 11027, CoH 11263, CoH 11264, CoLk 11204, CoLk 11206, CoPb 11181, CoPb 11182, CoPb 11213, CoPb 11214, CoS 11231, CoS 11232, Co 10036, CoH 10262, CoPant 10221, CoPb 10181, CoPb 10182, Co 09022, CoH 09264, CoLk 09204, CoPb 09214 and CoS 9232). Only two genotype viz. CoH 11261 (IVT E) and CoLk 11205 (IVT ML) showed moderately susceptible to early shoot borer and its incidence were above fifteen percent (Table1). The cumulative incidence of top borer was recorded less susceptible to moderate susceptible. However, it ranged from 7.15 per cent in CoS 09232 (AVT ML II) to 10.21 per cent in CoH 10262 (AVT ML I) in all the genotypes evaluated which exhibited low to moderately susceptible reaction against top borer. The per cent incidence of stalk borer ranged from 8.00 per cent in CoH 11262 (IVT E) to 16.00 per cent in CoLk 0904 (AVT ML II). However, the genotypes under six different group showed less susceptible reaction to stalk borer (0.07- 0.21 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 7.15 to 10.21 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

Project No.	E. 28
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 2-3 per cent in popular varieties of sugarcane viz., Co 238, CoH 89003 and CoJ 64 around sugar factories at Morinda, Dhuri and Fazilka. The incidence of early shoot borer, top borer and stalk borer ranged between 8-9, 8-9 and 7-8 per cent, respectively, in different varieties of sugarcane viz., CoJ 85, CoJ 88, Co 238, CoS 8436 and CoH 89003 in different cane growing areas of Punjab. The top borer incidence was higher on variety Co 238 (13-14%) in the most of districts of Punjab. The incidence of whitefly and mealy 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 and stalk borer were recorded as major insects and root borer, termite pyrilla, mite and black bug were recorded as minor insect in sugarcane. The per cent incidence of early shoot borer, top borer, stalk borer, root borer, termite, pyrilla, mite and black bug varied from low to moderate range. The incidence of whitefly and mealy bug were found in traces.

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

Project No.	E. 30
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	21.03.14
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 2nd week of April and reached its peak level of 9.8 per cent in 2nd week of June which thereafter, declined to 1.0 per cent in the 2nd week of August. The activity of predator *Cheilomenes sexmaculata* (1-2 predator/plant) was observed against early shoot borer in 2nd week of May to July. The top borer incidence started from month of June and reached to its peak level of 8.5 per cent in 2nd week of August. Thereafter, top borer incidence decreased to 3.2 per cent in the 1st fortnight of October. The bio-agents viz., *Rhaconotus* sp., *Isotima javensis* and *Stenobracon* sp. were recorded as 2.3, 3.1 and 2.0 per cent in the month of August, respectively and 1.6, 1.2 and 1.0 per cent in the month of September, respectively. The stalk borer incidence started from second week of August and reached to its peak level of 9.4 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 1.2 percent in the month of September, respectively and again *Sturmiopsis inference* and *Cotesia flavipes* were observed 1.0 and 1.1 percent in the month of November. The activity of pyrilla on sugarcane initiated from first Second week of August and continued up to last week of October. Activity of bio-agent viz., *Epiricania melanoleuca* 2.1 per cent parasitization was observed in the month of August, 2.6 per cent was observed in the month of September and 1.6 per cent observed in month of October (Table 3).

Summary: The incidence of early shoot borer incidence varied from April to August. The activity of predator *Cheilomenes sexmaculata* (1-2 predator/plant) was observed against early shoot borer in 2nd week of May to July. The top borer incidence started from month of June October. The bio-agents viz., *Rhaconotus* sp., *Isotima javensis* and *Stenobracon* sp. were recorded as 2.3, 3.1 and 2.0 per cent in the month of August, respectively and 1.6, 1.2 and 1.0 per cent in the month of September, respectively. The stalk borer incidence started from second week of August to January. Parasitization by bio-agents viz., *Sturmiopsis inference* and *Cotesia flavipes* were observed September, October and November. The activity of pyrilla on sugarcane initiated from Second week of August and continued up to last week of October. Activity of bio-agent viz., *Epiricania melanoleuca* parasitization was observed in the month of August, September and October.

4. Management of borer complex of sugarcane through lures

Project:	E.36
Location:	Punjab Agricultural University, Regional Research Station, Kapurthala.
Title:	Management of borer complex of sugarcane through lures.
Objective:	To manage sugarcane borers (early shoot borer, top borer and stalk borer) through pheromone traps
Year of start:	2008-09
Variety:	CoJ 88
Date of planting:	23.03.2014
Area:	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 17th MW (Monthly Week) (Last week of April) to 28th MW (Second week of July). Thereafter, it was found to be nil up to 8th MW (3rd week of February 2015). The highest number of early shoot borer catches (8 moths/trap) trapped in 24th MW (Second week of June) when maximum and minimum temperature was 41.0 and 28.7 °C. The early shoot borer moth catches were positively ($r = 0.57$ and 0.46) correlated with maximum and minimum temperature, respectively, while it was negatively correlated with morning relative humidity ($r = -0.81$), evening relative humidity ($r = -0.53$) and rainfall ($r = -0.16$) (Table 4 and 5). Incidence of early shoot borer in treatment and control plots was 7.60 and 8.21 per cent, respectively, Thus there was reduction of 7.43 per cent in the incidence of early shoot borer by lure alone (Table 6).

Activity of top borer started from 24th MW (Second week of June) to 43rd 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 33th MW (Third week of August) when maximum and minimum temperature was 34.2 and 26.5 °C. The top borer moth catches were positively ($r = 0.30$ and 0.43) correlated with maximum and minimum temperature,

respectively, and also positively correlated with morning and evening relative humidity ($r = 0.03$ and 0.07), while it was negatively correlated with rain fall ($r = -0.18$). Incidence of top borer in treatment and control plots was 8.95 and 10.11 per cent, respectively, Thus there was reduction of 11.48 per cent in the incidence of top borer by lure.

The activity of stalk borer started from 37th MW (Second week of September) to 50th MW (Second week of December), thereafter, it was found to be nil up to the harvest of crop. The highest number of stalk borer catches (5 moths/trap) were trapped in 42th MW (Third week of October) when maximum and minimum temperature were 31.0 and 16.2 °C. The stalk borer moth catches were positively correlated with ($r = 0.08$) with maximum temperature and morning relative humidity ($r = 0.33$) while it was negatively correlated with ($r = -0.24$) with minimum temperature and evening relative humidity ($r = -0.20$) and rainfall ($r = -0.26$) (Table 4 and 5). Incidence of stalk borer in treatment and control plots was 7.05 and 7.87 per cent, respectively, Thus there was reduction of 10.42 per cent in the incidence of stalk borer by pheromone (Table 6).

Summary : The activity of early shoot borer started from last week of April to second week of July. The highest numbers of early shoot borer were trapped in second week of June. Incidence of early shoot borer in treatment and control plots was 7.60 and 8.21 per cent, respectively, Thus there was reduction of 7.43 per cent by lure alone. The activity of top borer was started from second week of June to last week of October. The highest numbers of top borer were trapped in third week of August. Incidence of top borer in treatment and control plots was 8.95 and 10.11 per cent, respectively, Thus there was reduction of 11.48 per cent in the incidence of top borer by lure. The activity of stalk borer started from second week of September to second week of December. The highest numbers of stalk were trapped in third week of October. Incidence of stalk borer in treatment and control plots was 7.05 and 7.87 per cent, respectively, Thus there was reduction of 10.42 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.

Title:	Bioefficacy of new insecticides for the control of sugarcane early shoot borer.
Objective:	To find out effective strategy for the management of sugarcane early shoot borer
Year of start:	2013-14
Variety:	CoJ 88
Date of planting:	25.03.2014
Area:	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 2014-15. 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 240 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 (0.84%). Its application also resulted in significant increase for cane yield (90.29t/ha), total cane height (283.00 cm), sucrose percent in juice (17.98%) and Commercial Cane Sugar (CCS) (12.56%). This was followed by Chlorantraniliprole 0.4G @ 22.5 kg/ha treatment having percent incidence of early shoot borer (2.01%) and thereby increased other parameters significantly viz. cane yield (88.67t/ha), total cane height (280.67 cm), sucrose percent in juice (17.80%) and CCS (12.45%) (Table7). The corresponding values for incidence of ESB and other parameters in control treatment were percent incidence of early shoot borer highest (10.31%) and cane yield (66.90t/ha), total cane height (259.33 cm), sucrose percent in juice (16.11%) and CCS (10.68%), 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 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 7.15 to 10.21 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 and stalk borer were recorded as major insects and root borer, termite pyrilla, mite and black bug were recorded as minor insect in sugarcane. The per cent incidence of early shoot borer, top borer, stalk borer, root borer, termite, pyrilla, mite and black bug varied from low to moderate range. The incidence of whitefly and mealy bug were found in traces.
3. The incidence of early shoot borer incidence varied from April to August. The activity of predator *Cheilomenes sexmaculata* (1-2 predator/plant) was observed against early shoot borer in 2nd week of May to July. The top borer incidence started from month of June October. The bio-agents viz., *Rhaconotus* sp., *Isotima javensis* and *Stenobracon* sp. were recorded as 2.3, 3.1 and 2.0 per cent in the month of August, respectively and 1.6, 1.2 and 1.0 per cent in the month of September, respectively. The stalk borer incidence started from second week of August to January. Parasitization by bio-agents viz., *Sturmiopsis inference* and *Cotesia flavipes* were observed September, October and November. The activity of pyrilla on sugarcane initiated from Second week of August and continued up to last week of October. Activity of bio-agent viz., *Epiricania melanoleuca* parasitization was observed in the month of August, September and October.
4. The activity of early shoot borer started from last week of April to second week of July. The highest numbers of early shoot borer were trapped in second week of June. Incidence of early shoot borer in treatment and control plots was 7.60 and 8.21 per cent, respectively, Thus there was reduction of 7.43 per cent by lure alone. The activity of top borer was started from second week of June to last week of October. The highest numbers of top borer were trapped in third week of August. Incidence of top borer in treatment and control plots was 8.95 and 10.11 per cent, respectively, Thus there was reduction of 11.48 per cent in the incidence of top borer by lure. The activity of stalk borer started from second week of September to second week of December. The highest numbers of stalk were trapped in

third week of October. Incidence of stalk borer in treatment and control plots was 7.05 and 7.87 per cent, respectively, Thus there was reduction of 10.42 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 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 (2014-15)

Sr. No	Genotype	Shoot borer	Top borer incidence (%)			Stalk borer		
		Cumulative percent Incidence	III Brood	IV Brood	Cumulative	Incidence (%)	Intensity (%)	Infestation index
IVT Varietal Trial (Early)								
1	CoH 11261	17.53	3.16	4.85	8.01	10.67	0.81	0.09
2	CoH 11262	8.01	6.42	2.35	8.77	8.00	0.98	0.08
3	CoLk 11201	6.96	4.35	3.26	7.61	12.00	1.11	0.13
4	CoLk 11202	8.12	6.25	2.35	8.60	13.33	1.33	0.18
5	CoLk 11203	7.67	6.02	2.41	8.43	10.67	1.08	0.12
6	CoPb 11211	9.43	4.44	5.26	9.71	9.33	1.50	0.14
7	CoPb 11212	10.03	7.41	3.30	10.70	10.67	1.00	0.11
CK	Co 238	9.76	8.14	5.81	13.95	12.00	0.92	0.11
	CoPant 84211	11.34	6.17	3.70	9.88	12.00	0.83	0.10
	CoJ 64	9.71	5.00	3.75	8.75	13.33	1.08	0.14
CD (0.05)		2.34	1.44	1.19	1.75	1.61	0.21	0.02
AVT Varietal Trial (Early I plant)								
1	Co 10035	7.47	6.25	3.26	9.51	12.00	0.83	0.10
2	CoH 10261	7.69	5.10	3.16	8.26	9.33	0.92	0.09
3	CoS 10231	7.81	5.26	4.21	9.47	10.67	1.42	0.15
CK	Co 238	9.46	8.54	5.62	14.15	8.00	1.08	0.09
	CoPant 84211	12.24	6.41	3.70	10.11	14.67	1.17	0.17
	CoJ 64	9.12	3.75	5.26	9.01	12.00	1.00	0.12
CD (0.05)		1.72	1.54	0.99	1.99	2.23	0.20	0.03
AVT Varietal Trial (Early II plant)								
1	CoH 09262	9.09	5.00	4.49	9.49	12.00	1.00	0.12
2	CoH 09263	7.96	4.90	3.09	7.99	8.00	1.42	0.11
3	CoLk 09202	8.62	3.66	4.88	8.54	8.00	1.58	0.13
4	CoPb 09181	8.89	6.90	2.11	9.00	14.67	1.25	0.18
5	CoS 09246	8.91	4.44	4.44	8.89	9.33	0.92	0.09
CK	Co 238	10.07	6.90	5.75	12.64	12.00	1.00	0.12
	CoPant 84211	10.75	7.78	1.19	8.97	14.67	1.42	0.21
	CoJ 64	9.77	4.60	4.44	9.04	9.33	0.83	0.08
CD (0.05)		0.85	1.40	1.46	1.35	2.61	0.26	0.04
IVT Varietal Trail (Mid late)								
1	Co 11026	8.45	4.60	3.75	8.35	10.67	0.67	0.07
2	Co 11027	9.09	6.25	2.47	8.72	8.00	1.42	0.11
3	CoH 11263	9.63	5.75	3.49	9.24	10.67	1.58	0.17
4	CoH 11264	7.76	6.02	1.20	7.23	9.33	1.08	0.10
5	CoLk 11204	9.24	7.59	2.25	9.84	8.00	1.17	0.09
6	CoLk 11205	15.05	5.26	4.71	9.97	12.00	1.00	0.12
7	CoLk 11206	9.56	6.76	2.78	9.53	13.33	1.75	0.23
8	CoPb 11181	9.52	5.68	3.66	9.34	9.33	0.83	0.08
9	CoPb 11182	8.39	5.88	3.19	9.07	14.67	1.17	0.17

10	CoPb 11213	7.80	6.02	2.41	8.43	10.67	1.17	0.12
11	CoPb 11214	7.95	6.67	2.22	8.89	9.33	1.50	0.14
12	CoS 11231	8.16	7.37	1.05	8.42	9.33	1.17	0.11
13	CoS 11232	8.77	7.06	2.27	9.33	14.67	1.08	0.16
CK	CoS 767	10.54	8.33	2.11	10.44	16.00	1.17	0.19
	CoS 8436	9.84	5.75	4.08	9.83	12.50	1.08	0.13
	CoPant 97222	10.06	7.78	1.11	8.89	13.33	0.83	0.11
CD (0.05)		1.66	0.96	1.03	0.75	2.37	0.27	0.04
AVT Varietal Trial (Mid late I plant)								
1	Co 10036	8.41	4.44	3.33	7.78	9.33	0.75	0.07
2	CoH 10262	9.97	6.10	4.11	10.21	10.67	0.83	0.09
3	CoPant 10221	7.96	6.38	1.19	7.57	8.00	0.67	0.05
4	CoPb 10181	8.61	5.21	3.13	8.33	10.67	0.83	0.09
5	CoPb 10182	9.59	6.38	2.38	8.76	13.33	1.17	0.16
CK	CoS 767	10.37	6.82	2.27	9.09	9.33	1.27	0.11
	CoS 8436	10.75	6.49	2.60	9.09	12.00	1.16	0.14
	CoPant 97222	9.45	6.67	4.94	11.60	13.43	1.25	0.17
CD (0.05)		0.94	0.78	1.11	1.26	1.86	0.22	0.03
AVT Varietal Trial (Mid late II plant)								
1	Co 09022	10.07	5.56	3.49	9.04	8.00	0.83	0.07
2	CoH 09264	9.43	5.95	3.61	9.57	9.33	1.25	0.12
3	CoLk 09204	8.94	6.38	1.27	7.65	16.00	1.17	0.19
4	CoPb 09214	9.46	5.21	3.53	8.74	12.00	1.33	0.16
5	CoS 9232	8.80	6.06	1.09	7.15	13.33	1.58	0.21
CK	CoS 767	10.14	6.82	3.41	10.23	6.67	1.42	0.09
	CoS 8436	9.42	6.49	2.22	8.72	12.00	1.33	0.16
	CoPant 97222	9.77	6.86	3.23	10.09	10.67	1.17	0.12
CD (0.05)		0.46	0.56	1.01	1.04	2.87	0.21	0.05

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 2014-15

S. No.	Varieties	Location	Name of Pest	Per cent incidence	Remark
1.	Co 238 CoH 89003 CoJ 64	Morinda Dhuri Fazilka	Termite	2-3	Termite damage was more in sandy soil
2.	CoJ 85 CoJ 88 Co 238 CoH 89003	Kapurthala Phagwara Ajnala Morinda Dhuri Fazilka Gurdaspur Dasuya Mukerian	Early shoot borer	8-9	Late planting of sugarcane showed more incidence of early shoot borer
3.	Co 238	Phagwara Dhuri Nakodar Morinda Budhewal Bhogpur Ajnala Gurdaspur Mukerian	Top borer	13-14	Top borer incidence was higher in variety Co 238
	CoJ 85 CoJ 88 CoS 8436 Co 89003	Phagwara Dhuri Nakodar Morinda Budhewal Bhogpur Ajnala Gurdaspur Mukerian	Top borer	8-9	-
4.	CoJ 85 CoJ 88 Co 238 CoS 8436	Phagwara Gurdaspur Ajnala Mukerian Dhuri Nawanshahar Budhewal Nakodar	Pyrrilla	2-3	-

5.	CoJ 85 CoJ 88 Co 238	Nakodar Mukerian Nawanshahar Budhewal	Whitefly	Traces	-
6.	CoJ 85 Co 238 Co 89003	Kapurthala Faridkot Abohar Dhuri	Mite	1-2	-
7.	CoJ 85 Co 238 CoS 8436	Budhewal Gurdaspur Mukerian	Mealy bug	Traces	-
8.	CoJ 85 Co 238 CoS 8436 Co 89003	Faridkot Phagwara Gurdaspur Ajnala Mukerian Dhuri Nawanshahar Budhewal Nakodar	Black bug	1-2	-
9	Co 238 CoS 8436 Co 89003	Phagwara Kaputhala Gurdaspur Batala	Root borer	2-3	-
10.	CoJ 85 CoJ 88 Co 238 CoS 8436 Co 89003	Morinda Phagwara Gurdaspur Ajnala Mukerian Dasuya Dhuri Nawanshahar Budhewal Nakodar	Stalk borer	7-8	-

Table 3. Incidence of insect pests and bioagents in sugarcane (2014-15)

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>Rhaconotus sp.</i>	<i>Isotima javensis</i>	<i>Stenobraccon sp.</i>		<i>Sturmiopsis inference</i>	<i>Cotesia flavipes</i>		<i>Epiricania melanoleuca</i>
April, 11	2.0	-	-	-	-	-	-	-	-	-	-
May, 11	6.5	1.0	-	-	-	-	-	-	-	-	-
June, 11	9.8	2.0	2.4	-	-	-	-	-	-	-	-
July, 11	3.0	1.0	3.8	-	-	1.0	-	-	-	-	-
August, 11	1.0	-	8.5	2.3	3.1	2.0	Traces	-	-	3.3	2.1
September, 11	-	-	5.8	1.6	1.2	1.0	3.5	1.0	1.2	4.4	2.6
October, 11	-	-	3.2	-	-	-	9.4	2.0	2.0	2.2	1.6
November, 11	-	-	-	-	-	-	7.4	1.0	1.1	-	-
December, 11	-	-	-	-	-	-	4.2	-	-	-	-
January, 11	-	-	-	-	-	-	2.0	-	-	-	-

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 (2014-15)

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	21.03.14	0.00	0.00	0.00	26.5	14.8	89.0	55.3	20.6
13	28.03.14	0.00	0.00	0.00	28.0	14.1	87.6	39.6	0.0
14	04.04.14	0.00	0.00	0.00	30.0	14.7	85.0	39.0	0.0
15	11.04.14	0.00	0.00	0.00	32.3	16.2	78.0	37.3	14.4
16	18.04.14	0.00	0.00	0.00	32.4	17.2	74.0	37.1	76.0
17	25.04.14	1.00	0.00	0.00	39.1	20.5	67.0	33.4	0.0
18	02.05.14	2.00	0.00	0.00	38.3	23.9	62.4	24.9	22.6
19	09.05.14	2.00	0.00	0.00	34.1	20.2	68.3	41.7	10.4
20	16.05.14	3.00	0.00	0.00	36.8	21.9	64.6	29.7	0.0
21	23.05.14	5.00	0.00	0.00	39.7	24.5	45.3	27.3	0.0
22	30.05.14	7.00	0.00	0.00	41.3	25.9	47.4	22.7	0.0
23	06.06.14	6.00	0.00	0.00	44.2	26.1	40.0	13.9	0.0
24	13.06.14	8.00	1.00	0.00	41.0	28.7	65.4	34.9	0.0
25	20.06.14	7.00	2.00	0.00	37.8	27.2	63.3	41.1	5.0
26	27.06.14	3.00	1.00	0.00	35.6	26.4	76.3	49.9	40.7
27	04.07.14	2.00	3.00	0.00	38.2	28.4	67.6	43.9	0.0
28	11.07.14	1.00	2.00	0.00	36.3	29.4	75.6	56.7	0.0
29	18.07.14	0.00	0.00	0.00	34.7	27.8	76.4	58.0	31.0
30	25.07.14	0.00	0.00	0.00	33.6	27.3	84.0	69.3	52.0
31	01.08.14	0.00	2.00	0.00	34.2	27.2	85.7	66.4	11.7
32	08.08.14	0.00	4.00	0.00	34.3	27.7	83.3	67.1	0.2
33	15.08.14	0.00	6.00	0.00	34.2	26.5	81.3	54.3	1.0
34	22.08.14	0.00	3.00	0.00	35.0	26.4	79.7	53.6	9.6
35	29.08.14	0.00	1.00	0.00	31.7	25.1	84.6	70.3	62.8
36	05.09.14	0.00	0.00	0.00	31.4	24.8	93.9	74.6	71.4
37	12.09.14	0.00	0.00	1.00	32.4	23.9	90.3	74.1	39.6
38	19.09.14	1.00	3.00	1.00	33.3	24.3	89.6	64.9	10.6
39	26.09.14	0.00	5.00	3.00	33.6	24.0	86.7	55.7	0.0
40	03.10.14	0.00	4.00	2.00	33.5	23.0	89.0	53.3	10.6
41	10.10.14	0.00	5.00	3.00	30.3	17.0	92.1	46.4	2.8
42	17.10.14	0.00	4.00	5.00	31.0	16.2	87.7	39.6	0.0
43	24.10.14	0.00	1.00	4.00	29.9	17.3	86.7	51.9	2.2
44	31.11.14	0.00	0.00	3.00	28.5	13.8	92.1	42.4	0.0
45	07.11.14	0.00	0.00	2.00	28.0	13.2	88.4	34.1	0.0
46	14.11.14	0.00	0.00	3.00	26.1	8.5	91.6	32.3	0.0
47	21.11.14	0.00	0.00	4.00	24.7	8.2	94.3	35.4	0.0
48	28.11.14	0.00	0.00	3.00	26.6	9.7	91.3	38.1	0.0
49	05.12.14	0.00	0.00	1.00	23.6	6.6	94.6	43.6	0.0
50	12.12.14	0.00	0.00	1.00	16.2	8.1	91.9	74.0	4.8
51	19.12.14	0.00	0.00	0.00	12.5	6.3	95.0	79.3	0.0
52	26.12.14	0.00	0.00	0.00	14.8	5.3	96.6	77.4	0.0
1	02.01.15	0.00	0.00	0.00	14.8	7.9	97.9	78.6	0.0
2	09.01.15	0.00	0.00	0.00	14.1	7.4	94.1	76.6	10.0
3	16.01.15	0.00	0.00	0.00	16.4	6.6	96.1	73.0	8.8
4	23.01.15	0.00	0.00	0.00	15.3	7.0	97.9	72.6	0.0
5	30.01.15	0.00	0.00	0.00	19.1	7.4	92.4	61.1	16.6
6	06.02.15	0.00	0.00	0.00	21.3	7.2	94.6	59.3	0.0
7	13.02.15	0.00	0.00	0.00	24.0	12.7	90.4	65.0	15.6
8	20.02.15	0.00	0.00	0.00	23.2	13.5	95.9	72.9	56.5

Table 5. Correlation of weather parameters with moth catches (2014-15)

Correlation coefficient	Early shoot borer	Top borer	Stalk borer
Maximum Temperature	0.57	0.30	0.08
Minimum Temperature	0.46	0.43	-0.24
Relative Humidity % (Morning)	-0.81	0.03	0.33
Relative Humidity % (Evening)	-0.53	0.07	-0.20
Rain fall	-0.16	-0.18	-0.26

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

Treatment	Percent incidence of Early shoot borer	Percent incidence of Top borer	Percent incidence of Stalk borer
Pheromone (treatment)	7.60	8.95	7.05
Control	8.21	10.11	7.87
Percent reduction	7.43	11.48	10.42

Table 7. Bioefficacy of new insecticides for the control of sugarcane early shoot borer during 2014-15

Treatment	Cumulative percent incidence of early shoot borer (ESB)	Germination (%)	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	4.15	59.82	78.33	80.56	275.00	219.00	18.67	2.18	19.51	17.56	90.00	12.25
Chlorantraniliprole 0.4G @ 22.5 kg	2.01	63.82	82.00	88.67	280.67	231.00	22.00	2.22	19.65	17.80	90.56	12.45
Chlorantraniliprole 18.5 SC @ 375 ml/ha	0.84	61.30	85.00	90.29	283.00	234.67	22.67	2.23	19.91	17.98	90.31	12.56
Spinosad 45SC @ 90 ml/ha	3.30	64.33	79.67	83.25	277.00	222.00	19.67	2.19	19.63	17.73	90.32	12.39
Flubendiamide 240 SC @ 250 ml/ha	2.54	61.45	80.33	87.15	278.33	228.33	21.00	2.20	19.63	17.78	90.58	12.44
Phorate 10 G @ 15 kg/ha	4.68	63.37	75.00	79.04	269.67	214.00	18.00	2.14	19.38	17.49	90.25	12.22
Carbofuron 3 G @ 33 kg/ha	4.20	58.33	76.00	79.78	272.67	215.33	19.00	2.14	19.46	17.53	90.09	12.23
Control	10.31	61.33	63.00	66.90	259.33	204.67	17.33	2.04	19.81	16.11	81.35	10.68
CD (0.05)	0.57	NS	1.85	3.11	6.73	4.70	1.35	0.30	0.28	0.31	1.74	0.30