स्वच्छ भारत

एक कदम स्वच्छता की ओर

ALL INDIA COORDINATED RESEARCH PROJECT ON SUGARCANE

TECHNICAL REPORT 2017-2018

Entomology





Compiled by

Dr. M.R. Singh, Principal Scientist,
Head, Division of Crop Protection
&
Principal Investigator

ICAR-Indian Institute of Sugarcane Research,
Lucknow 226002 (U.P.)

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Contents

Project E. 4.1		
Title of Project	**:**	**Evaluation of zonal varieties/genotypes for the reaction against major insect pests.**
Objective	:	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 (Continuing)
Duration	:	Long term
Location	:	As hereunder
North Western Zone	:	Kapurthala (Ludhiana), Uchani, Karnal (SBI), Shahjahanpur and Lucknow`
North Central Zone and Eastern Zone	:	Pusa and Seorahi
Peninsular Zone	:	Akola, Kolhapur, Padegaon, Pune, Powarkheda, Navsari, Mandya, Coimbatore
East Coast Zone	:	Anakapalle, Vuyyuru (Voluntary centre since 2013-14)
No. of replication	:	03 (Three)
Plot size	:	A minimum of 3 (three), six metre row/ variety per replication
Project E. 28		
Title of Project	**:**	**Survey and surveillance of sugarcane insect pests**
Objective	:	To identify key insect pests of sugarcane in the area
Year of Start	:	2003-04
Duration	:	Long term
Location	:	All centres where entomologist are available
Project E. 30		
Title of Project	**:**	**Monitoring of insect pests and bioagents in sugarcane agro-ecosystem**
Objective	:	To monitor the key insect pests and natural enemies in the area.
Year of Start	:	2006-07
Duration	:	Long term
Location	:	Kapurthala, Uchani, Karnal (SBI), Shahajhanpur Lucknow, Pusa, Seorahi, Akola, Padegaon, Pune, Powwarkheda, Navsari, Mandya, Kolhapur, Coimbatore and Anakapalle
Plot size	:	Planting of sugarcane variety recommended for the region in 0.2 ha area
Project E. 34		
Title of Project	**:**	**Standardization of simple and cost effective techniques for mass multiplication of sugarcane bio-agent.**
Objective	**:**	To develop simple and cost effective mass multiplication techniques of promising bio-agents of the area.
Year of Start	**:**	2012-2013
Modified year	**:**	2015-16 [In 31st Biennial Workshop of AICRP on Sugarcane held at VSI, Pune (MS) on November16-17,2016

Duration	**:**	Three years
Location	**:**	Locations and bio-agents to be multiplied.
Ankapalle	**:**	*Beauveria Bassiana*
Uchani	**:**	*Trichogramma spp., Epiricania melanoleuca*
Lucknow	**:**	*Metarhizium anisopliae, Beauveria bassiana, Chrysoperla carnae and E. melanoleuca*
Padegown	**:**	*Chrysoperla zastrowi sillemi*
Coimbatore	**:**	*Cotesia flazvipes*
Pune		*Trichogramma sp.*
Project E. 38		
Title of Project	**:**	**Formulation and validation of IPM Module of sugarcane insect pests**
Objective	:	To evaluate IPM Module in current
Year of Start	:	2017-2018
Duration	:	
Location	:	Under here
North Western Zone	:	Kapurthala (Ludhiana), Uchani,
North Central Zone and Eastern Zone	:	Seorahi
Peninsular Zone	:	Padegaon, Pune, Powarkheda, Navsari, Mandya,
East Coast Zone	:	Anakapalle,
No. of replication	:	-
Plot size	:	A minimum of 3 (three), six metre row/ variety per replication

Treatment details :

T1: IPM Block

Stage of the cultivation/Period	**Target pest**	**Activities carried out***
Seed selection	Borer, Mealy bug, scale insect, woolly aphid	➢ Selection from uninfested field. ➢ Rejecting infested pieces.
Pre-planting	Borer, Mealy bug, Scale insect, white grub, termite	➢ Dipping the setts for 2 minutes in the solution of chlorpyriphos 20 EC @ 40 ml in 10 litre of water. ➢ Ploughing for exposure of stages of white grub for predation.
At planting	Borer, Scale insect, white grub, Termite	➢ Soil application of chlorantraniliprole 0.4 G @ 22.5 kg/ha at the time of planting. ➢ Trash mulching @ 3/ha
At 45 day	Borer	➢ Collection and destruction of egg masses and damaged shoots. ➢ Setting up of sex pheromone traps two weeks after planting @ 27/ha (Lure change at an interval of 45 days).
At 60 day	Borer, *Pyrilla*, scale insect, mealy bug	➢ Spraying of chlorantraniliprole 18.5 SC @ 375 ml/ha at 60 DAP
At 90 day	Borer, *Pyrill*a, scale insect, mealy bug	➢ Detrash the lower leaves, remove egg masses and infested canes.
At 150 day	INB, Mealy bug, Scale insect, whitefly, *Pyrilla*	➢ Release of *Epiricania (=Fulgoreica) melanoleuca* @ 2000 cocoons and 250 egg mass/ha for the management of pyrilla. ➢ Detrash the lower leaves after 150 days of planting
At 180 day	INB	➢ Removal of water shoots of the crop.
At 210 day	INB	➢ Removal of water shoots of the crop.
At 240 day	INB	➢ Removal of water shoots of the crop.
June-July	*Pyrilla*, whitefly, scale insect, mealy bug	➢ Installation of 'Biological-cum-Mechanical' traps @ 20/ha during first fortnight of June for management of whitefly. ➢ Spray clothionidin 50 WDG @ 250 g/ha after detrash lower leaves.
*** Need based application of insecticides, if insect pest cross the ETL.**		

T2 : Zonal recommendation in Andhra Pradesh

- Soil application of carbofuran 3G@ 33kg/ha at planting
- Trash mulching @ 3t/ha at 3 days after planting
- Scheduled spraying of monocrotophos @ 1.6ml/lt at 4th, 6th & 9th week after planting and at 120 days after planting
- Field release of *T.chilonis* @ 50,000/ha at 130 days after planting for 2 times at 7-10 days interval
- Detrashing at 150 days after planting

7. Methodology : adopted

- Pheromone traps @ 27/ha were installed in the month of April for mass trapping of ESB & INB moths in T1- IPM module.
- The pheromone lure changes were done at 21 days interval for ESB upto 120 days and 45 days interval for INB after 120 days.
- All the activities were carried for the management of major insect pests in this zone

Observations recorded :

a. Per cent germination

b. Incidence of early shoot borer was recorded at 30, 60, 90 and 120 days after planting.

c. Incidence and intensity of scale insect was recorded.

d. Internode borer damage was assessed at harvest from 100 cane samples.

e. Yield, growth and quality parameters:

i. Tiller population at 120 DAP

ii. Number of millable cane [‘000/ha] at harvest

iii. Cane yield (kg/ha) at harvest

iv. Growth parameters [total cane height (cm), millable cane height (cm), number of internodes and girth of cane at harvest.

v. Juice sucrose (%)s at harvest

E. 4.1: Evaluation of varieties for their reaction against major insect pests.

North Western Zone

PAU Regional Resaerch Station, Kapurthala

Thirty eight genotypes comprising of foruteen early maturing (seven under IVT E, three under AVT E I plant and four under AVT E II plant) and twenty four mid-late maturing (thirteen 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. Early shoot borer incidence was found to be low in all the tested genotypes (except seven genotype) viz. Co 14034, CoLk 14201, CoPant 14222, CoPb 14181, CoPb 14182, CoPb 14211Co 13034, CoPb 13181, CoS 13231, Co 12026, Co 12027, CoLk 12203, Co 14035, CoH 14261, CoLk 14203, CoLk 14204, CoLk 14205, CoPb 14183, CoPb 14184. CoPb 14185, CoPb 14212, CoS 14231, CoS 14232, Co 13035, CoPant 13224, CoPb 13182, CoLk 13204, Co 12029, CoH 12263, CoLk 12205, CoPb 12211 and CoS 12232. Only six genotypes viz. CoLk 14202 (IVT E), CoPant 12221(IVT E-II), CoH 14262, CoS 14233(IVT ML), CoH 13263(IVT ML-I) and CoPant 12226(IVT ML-II) showed MS reaction 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 5.76 per cent in Co 14035 (IVT ML) to 16.24 per cent in CoLk 14205 (IVT E) in all the genotypes evaluated which exhibited low to moderately susceptible reaction against top borer. The per cent incidence of stalk borer ranged from 6.67 per cent in Co 14035 (IVT ML) to 17.33 per cent in CoS 14233 (IVT ML). However, the genotypes under six different group showed LS reaction to stalk borer (0.08- 0.28 infestation index) (Table1).

Table 1. Screening of varieties for resistance to insect pests, PAU Regional Resaerch Station, Kapurthala

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	Co 14034	6.87	4.21	1.94	6.15	12.00	1.30	0.16
2	CoLk 14201	11.42	3.67	5.88	9.55	10.67	1.24	0.13
3	CoLk 14202	16.05	7.61	6.52	14.13	16.00	1.35	0.22
4	CoPant 14222	14.46	10.00	4.71	14.71	13.33	1.50	0.20
5	CoPb 14181	8.88	8.43	1.20	9.64	9.33	1.25	0.12
6	CoPb 14182	10.60	4.44	3.16	7.60	12.00	1.50	0.18
7	CoPb 14211	7.84	7.41	4.40	11.80	13.33	1.25	0.17
CK	Co 05009	8.53	5.00	3.26	8.26	10.67	1.00	0.11
	Co 0238	9.15	10.20	8.42	18.63	13.33	1.33	0.18
	CoJ 64	11.43	7.37	5.26	12.63	16.00	1.33	0.21
CD (0.05)		**1.69**	**1.38**	**1.26**	**2.21**	**1.27**	**0.08**	**0.02**
AVT Varietal Trial (Early I Plant)								
1	Co 13034	10.16	3.66	4.49	8.15	14.67	1.17	0.17
2	CoPb 13181	9.46	6.41	2.47	8.88	13.33	1.25	0.17
3	CoS 13231	8.39	6.25	6.58	12.83	12.00	1.08	0.13

CK	Co 05009	9.49	4.90	4.12	9.03	10.67	1.17	0.12
	Co 0238	10.73	10.98	4.88	15.85	13.33	1.25	0.17
	CoJ 64	12.54	6.90	4.21	11.11	17.33	1.25	0.22
CD (0.05)		**4.75**	**3.48**	**2.09**	**5.39**	**7.04**	**0.61**	**0.08**
AVT Varietal Trial (Early II Plant)								
1	Co 12026	11.22	4.44	3.33	7.78	10.67	1.33	0.14
2	Co 12027	7.12	3.45	3.45	6.90	10.67	1.25	0.13
3	CoLk 12203	12.94	8.89	4.76	13.65	16.00	1.42	0.23
4	CoPant 12221	15.19	7.78	4.76	12.54	12.00	1.17	0.14
CK	Co 05009	10.67	4.60	3.33	7.93	8.00	1.25	0.10
	Co 0238	11.90	10.34	7.50	17.84	14.67	1.08	0.16
	CoJ 64	12.97	6.25	6.17	12.42	17.33	1.17	0.20
CD (0.05)		**4.45**	**2.85**	**2.03**	**4.80**	**4.55**	**0.39**	**0.06**
IVT Varietal Trail (Midlate)								
1	Co 14035	7.83	4.60	1.16	5.76	6.67	1.17	0.08
2	CoH 14261	9.44	4.82	2.41	7.23	10.67	1.08	0.12
3	CoH 14262	15.19	8.86	5.62	14.48	16.00	1.33	0.21
4	CoLk 14203	8.64	4.21	3.53	7.74	10.67	1.00	0.11
5	CoLk 14204	8.36	5.41	1.39	6.79	9.33	1.08	0.10
6	CoLk 14205	14.90	11.36	4.88	16.24	13.33	1.33	0.18
7	CoPb 14183	11.72	7.06	3.19	10.25	12.00	1.25	0.15
8	CoPb 14184	10.97	4.82	3.61	8.43	12.00	1.08	0.13
9	CoPb 14185	8.71	5.56	2.22	7.78	10.67	1.00	0.11
10	CoPb 14212	10.96	5.26	4.21	9.47	9.33	1.25	0.12
11	CoS 14231	11.69	7.06	3.41	10.47	14.67	1.25	0.18
12	CoS 14232	14.10	8.33	5.26	13.60	16.00	1.33	0.21
13	CoS 14233	16.88	8.05	6.12	14.17	20.00	1.42	0.28
CK	Co 05011	9.31	4.88	2.74	7.62	10.67	1.08	0.12
	CoPant 97222	9.59	7.45	2.38	9.83	13.33	1.08	0.14
	CoS 8436	10.41	5.32	4.76	10.08	14.67	1.17	0.17
	CoS 8436	12.89	6.25	6.25	12.50	16.00	1.33	0.21
CD (0.05)		**1.05**	**0.56**	**0.62**	**0.98**	**1.35**	**0.06**	**0.02**
AVT Varietal Trial (Midlate I Plant)								
1	Co 13035	6.69	5.32	2.38	7.70	9.33	0.83	0.08
2	CoH 13263	16.40	6.82	4.76	11.58	14.67	1.17	0.17
3	CoPant 13224	13.73	9.09	5.95	15.04	17.33	1.33	0.23
4	CoPb 13182	8.67	6.67	3.57	10.24	9.33	1.00	0.09
5	CoLk 13204	12.96	4.44	3.57	8.02	10.67	1.17	0.12
CK	Co 05011	8.84	4.76	3.57	8.33	12.00	1.08	0.13
	CoPant 97222	10.37	5.32	3.80	9.12	12.00	1.25	0.15
	CoS 8436	12.18	6.25	3.53	9.78	13.33	1.33	0.18
	CoS 8436	13.40	8.08	3.26	11.34	13.33	1.25	0.17
CD (0.05)		**3.91**	**2.08**	**1.24**	**3.23**	**3.82**	**0.34**	**0.05**
AVT Varietal Trial (Midlate II Plant)								
1	Co 12029	8.87	5.68	2.27	7.95	12.00	1.50	0.18
2	CoH 12263	14.42	6.49	2.22	8.72	14.67	1.58	0.23
3	CoLk 12205	11.97	7.84	4.30	12.14	10.67	1.33	0.14

4	CoPant 12226	15.77	6.82	5.68	12.50	13.33	1.33	0.18
5	CoPb 12211	8.80	6.49	3.90	10.39	9.33	0.92	0.09
6	CoS 12232	7.17	5.19	1.30	6.49	8.00	1.00	0.08
CK	Co 05011	8.59	3.92	2.47	6.39	10.67	1.08	0.12
	CoPant 97222	11.33	6.82	5.81	12.63	13.33	1.17	0.16
	CoS 8436	10.30	6.49	4.82	11.31	10.67	1.42	0.15
	CoS 8436	10.93	6.49	3.61	10.11	16.00	1.25	0.20
CD (0.05)		**1.56**	**0.62**	**0.90**	**1.37**	**1.43**	**0.13**	**0.03**

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

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In AVT (Early) I Plant trial, four sugarcane genotypes, CoS 13231, CoPb 13181, Co13034, Co 05009 and two standard checks viz., CoJ 64 and Co 0238 were evaluated against major insect pests. CoS 13231 (5.61%), CoPb13181, Co13034, Co05009 and Co0238 were LS while CoJ64 was MS to early shoot borer. Sugarcane genotypes, CoS13231, CoPb13181 and Co13034 showed LS reaction while Co05009 both two standard checks showed MS reaction to top borer. CoS13231, CoPb13181, Co13034 and Co05009 and CoJ64 showed LS reaction while Co0238 MS reaction to stalk borer.

In AVT (Early) II Plant trial, four sugarcane genotypes, CoPant 12221, CoLk 12203, Co 12026 and Co 12027 and two standard checks as taken in I plant were evaluated against major insect pests. CoPant12221, CoLk12203, Co12026 and Co12027 and both of the checks showed less susceptible reaction to shoot borer. At harvest, the varieties CoLk12203, Co12026 and Co12027 and CoJ 64 (6.67%) showed LS reaction while the CoPant12221 and Co0238 showed MS reaction to top borer. Co12026 and Co12027 and CoJ64 showed LS while CoPant12221, CoLk12203 and Co0238 showed MS reaction to stalk borer.

In AVT (Mid Late) I Plant Trial, five genotypes and three standard checks were evaluated against major insect pests. Based on cumulative incidence of early shoot borer, CoPb13182, CoH13263, Co13035, CoLk13204, and four standards checks, CoS767, CoPant97222, CoS8436 and Co05011 were LS while CoPant13224 was MS to early shoot borer. CoPb13182,, CoPant13224, CoH13263, CoLk13204 and three standards checks swere LS while the Co13035 and one standard CoS8436 were MS to top borer. CoPb13182, CoH13263, Co13035 and two standards CoS767, CoPant97222 were LS while CoPant13224 and two standard checks CoS8436 and Co05011 were MS to stalk borer. CoLk13204 was HS.

In AVT (Midlate) II Plant, six genotypes CoPant12226, CoLk12205, CoH12263, Co12029, CoPb12211, CoS12232 and three same standard checks as taken in I plant were evaluated against major insect pests. CoPant12226, CoLk12205, CoH12263, CoPb12211 and CoS12232 and all three standards checks were LS while Co12029 was MS to shoot borer.

CoPant12226, CoPb12211, and CoS12232 and all three standard checks were LS while CoLk12205, CoH12263, and Co12029 wre MS to top borer. SAgainst stalk borer, CoPant12226, Co12029 and CoS12232 two standard checks CoS767 and CoS8436 showed LS reaction while CoLk12205, CoH 12263 and CoPb12211 and a standard check, CoPant 97222 showed MS.

AVT (Early) Ratoon

Under AVT (early) ratoon, total 4 varieties viz., CoPant 12221,CoLk 12203, Co 12026 and Co 12027 alongwith two standards (checks), CoJ 64 and Co 0238 were evaluated against major insect pest of the area.

Based on cummulative incidence of shoot borer all the varieties CoPant 12221 (6.08%), CoLk 12203 (7.27%), Co 12026 (5.09%) and Co 12027 (6.35%) alongwith standards CoJ 64 (11.29%) and Co 0238 (6.72%) showed less susceptible reaction to shoot borer.

At harvest, the varieties CoPant 12221 (5.33%), CoLk 12203 (6.67%), Co 12026 (9.33%) and Co 12027 (4.00%) alongwith two standards CoJ 64 (9.33%) and Co 0238 (5.33%) showed less susceptible to top borer. Regarding stalk borer infestation the varieties CoPant 12221 (3.89), CoLk 12203 (2.68) alongwith standard Co 0238 (3.14) showed moderate susceptible while the varieties Co 12026 (1.50) and Co 12027 (2.00) alongwith standard CoJ 64 (0.87) showed less susceptible reaction to stalk borer infestation (Table 1 k, l).

Project E. 4-1

Table 1a: Evaluation of zonal varieties /genotypes for their reaction against major insect pests of sugarcane, (UPCSR, Shahjahanpur)

AVT (Midlate) I Plant

SN	Varieties/genotypes	Early shoot borer (% incidence)					No. of bored plants/ha
		30 DAP	60 DAP	90 DAP	120 DAP	Cummu.	
1	CoPb 13182	5.23	3.53	3.79	2.58	5.76	3704
2	Co Pant13224	5.76	7.41	4.96	6.35	15.70	7818
3	CoH 13263	2.61	5.40	2.22	1.37	6.99	3498
4	Co 13035	7.39	8.21	4.47	3.55	12.12	4938
5	CoLk 13204	3.58	6.42	6.16	2.26	9.59	5761
CK	Co 05011	3.69	4.17	4.10	1.25	8.91	4527
	CoS 767	3.16	4.05	3.44	0.72	6.96	3909
	CoS 8436	4.08	3.76	5.90	3.20	10.85	4732
	CoPant 97222	4.23	5.38	3.94	2.48	9.30	4115
	SE	2.77	2.06	0.71	1.38		
	CD	NS	NS	1.49	2.92		

Table 1b: Evaluation of zonal varieties /genotypes for their reaction against major insect pests of sugarcane, (UPCSR, Shahjahanpur)

AVT (Midlate) I Plant

S.No.	Varieties/ genotypes	Top borer (% incidence)			Stalk borer		
		IIIrd brood	IVth brood	At harvest	% incidence	% intensity	Infestation index
		5th month	7th month				
1	CoPb13182	2.29	3.79	5.33	24.00	5.05	1.24

2	CoPant 13224	2.99	4.26	5.33	34.67	7.09	2.42
3	CoH 13263	2.36	3.37	4.00	25.33	6.97	1.75
4	Co 13035	2.93	3.24	12.00	18.67	5.74	1.16
5	CoLk 13204	2.29	2.94	5.33	42.67	15.12	6.57
Ck	Co 05011	1.85	2.43	6.67	29.33	7.98	2.40
	CoS 767	2.12	2.03	4.00	28.00	5.20	1.46
	CoS 8436	3.85	3.27	10.67	33.33	8.03	2.67
	CoPant 97222	2.22	2.81	6.67	22.67	8.03	1.89
	SE	1.03	1.41	2.28	7.80	1.66	
	CD	NS	NS	4.82	16.53	3.51	

Table 1c: Evaluation of zonal varieties/genotypes for their reaction against major insect pests of sugarcane, (UPCSR, Shahjahanpur)

AVT (midlate) II Plant

SN	Varieties/genotypes	Early shoot borer (% incidence)					No. of bored plants/ha
		30 DAP	60 DAP	90 DAP	120 DAP	Cummu.	
01	CoPant12226	2.09	3.85	5.34	3.14	8.82	4321
02	CoLk 12205	1.75	2.95	5.72	0.85	7.94	4115
03	CoH 12263	2.56	4.12	4.33	2.16	9.95	4115
04	Co 12029	5.46	7.44	8.04	5.49	15.89	7818
05	CoPb 12211	5.50	7.32	6.54	1.43	11.49	5556
06	CoS 12232	4.32	5.89	7.47	1.20	13.12	5556
Ck	CoS 8436	4.47	6.62	3.86	1.01	11.76	4938
	CoS 767	0.65	2.82	3.03	2.80	8.23	3909
	CoPant 97222	2.55	4.03	6.30	0.98	9.38	4321
	SE	1.76	2.46	1.94	1.35		
	CD	NS	NS	NS	NS		

Table 1d: Evaluation of zonal varieties/genotypes for their reaction against major insect pests of sugarcane, (UPCSR, Shahjahanpur)

AVT (midlate) II Plant

S.No.	Varieties/ genotypes	Top borer (% incidence)			Stalk borer		
		IIIrd brood 5th month	IVth brood 7th month	At harvest	% incidence	% intensity	Infestation index
01	CoPant 12226	2.41	2.99	4.00	21.33	6.44	1.52
02	CoLk 12205	2.96	7.07	12.00	41.33	5.80	2.67
03	CoH 12263	3.72	6.53	13.33	48.00	8.19	4.07
04	Co 12029	2.77	5.56	12.00	22.67	7.02	1.70
05	CoPb 12211	4.03	5.53	4.00	29.33	7.76	2.29
06	CoS 12232	4.15	3.07	8.00	25.33	6.11	1.51
Ck	CoS 8436	2.93	4.01	9.33	20.00	5.78	1.14
	CoS 767	3.63	3.21	2.67	25.33	6.40	1.44
	CoPant 97222	2.90	1.99	6.67	20.00	7.36	4.85
	SE	0.84	1.80	2.40	11.11	2.09	1.76
	CD	NS	NS	5.09	NS	NS	NS

Table 1e: Evaluation of zonal varieties/genotypes for their reaction against major insect pests of sugarcane, (UPCSR, Shahjahanpur)

AVT (Early) I Plant

S.No.	Varieties/genotypes	Early shoot borer (% incidence)					No. of bored plants/ha
		45 DAP	60 DAP	90 DAP	120 DAP	Cummu.	
01	CoS 13231	0.00	3.58	2.88	1.44	5.61	2469
02	CoPb 13181	0.83	3.38	3.40	0.00	4.01	2469
03	Co 13034	0.00	4.74	3.99	1.09	6.37	2675
04	Co 05009	1.57	3.44	5.49	1.57	7.87	4321
Ck	CoJ 64	2.66	7.62	11.13	3.75	15.74	6996
	Co 0238	2.52	4.20	4.11	1.82	7.39	3498
	SE	0.76	1.41	1.28	0.45		
	CD	1.69	NS	2.84	0.99		

Table 1f : Evaluation of zonal varieties/genotypes for their reaction against major insect pests of sugarcane, (UPCSR, Shahjahanpur)

AVT (Early) I Plant

SN	Varieties/genotypes	Top borer (% incidence)			Stalk borer		
		IIIrd brood 5th month	IVth brood 7th month	At harvest	% incidence	% intensity	Infestation index
01	CoS 13231	1.83	3.33	2.67	26.67	5.84	1.66
02	CoPb 13181	3.20	2.58	5.33	28.00	7.93	1.80
03	Co 13034	1.44	3.67	2.67	12.00	10.11	1.16
04	Co 05009	2.47	5.34	13.33	29.33	6.22	1.89
Ck	CoJ 64	3.05	5.71	10.67	21.33	5.67	1.10
	Co 0238	3.92	5.39	13.33	46.67	7.99	4.08
	SE	1.20	1.16	1.98	11.79	1.90	1.08
	CD	NS	NS	4.40	NS	NS	NS

Table 1g: Evaluation of zonal varieties/genotypes for their reaction against major insect pests of sugarcane, (UPCSR, Shahjahanpur)

AVT (Early) II Plant

S.No.	Varieties/genotypes	Early shoot borer (% incidence)					No. of bored plants/ha
		30 DAP	60 DAP	90 DAP	120 DAP	Cummu.	
01	CoPant 12221	3.07	9.96	4.57	1.12	14.23	7407
02	CoLk 12203	1.67	2.99	3.53	1.68	7.29	3704
03	Co 12027	2.57	4.64	4.19	1.73	8.47	3292
04	Co12026	4.89	4.86	4.16	1.17	8.11	3086
Ck	CoJ 64	5.67	6.58	7.31	1.63	9.50	3909
	Co 0238	2.29	2.48	5.10	1.87	8.20	3086
	SE	0.91	2.04	1.24	0.35		
	CD	2.02	4.55	NS	0.77		

Table 1h: Evaluation of zonal varieties/genotypes for their reaction against major insect pests of sugarcane, (UPCSR, Shahjahanpur)

AVT (Early) II Plant

SN	Varieties/genotypes	Top borer (% incidence)			Stalk borer		
		IIIrd brood 5th month	IVth brood 7th month	At harvest	% incidence	% intensity	Infestation index
01	CoPant 12221	2.12	1.74	12.00	40.00	7.42	3.33
02	CoLk 12203	3.06	1.67	6.67	25.33	8.75	2.40
03	Co 12027	3.35	1.97	4.00	25.33	7.59	2.00
04	Co12026	2.93	1.93	5.33	26.67	6.97	1.40
Ck	CoJ 64	1.99	2.01	6.67	16.00	5.43	0.90
	Co 0238	2.81	1.92	10.67	26.67	6.82	2.05
	SE	1.01	0.68	1.98	9.14	1.87	1.26
	CD	NS	NS	4.41	NS	NS	NS

Table 1i: Evaluation of zonal varieties/genotypes for their reaction against major insect pests of sugarcane, (UPCSR, Shahjahanpur)

AVT (Mid late) Ratoon

SN	Varieties/genotypes	Early shoot borer (% incidence)					No. of borer plants/ha
		30 DAP	60 DAP	90 DAP	120 DAP	Cummu.	
01	Co 12029	2.48	1.78	1.55	1.69	5.39	2263
02	CoH 12263	2.08	2.21	2.60	2.52	7.61	3086
03	CoLk 12205	2.10	1.93	3.40	2.49	8.13	4732
04	CoPant 12226	3.78	5.96	7.75	3.19	14.29	7819
05	CoPb 12211	3.30	5.71	7.00	2.02	10.15	5761
06	CoS 12232	4.67	4.05	5.40	2.71	11.39	5556
Ck	CoS 8436	3.19	1.54	3.34	1.44	6.07	3086
	CoS 767	2.19	1.09	0.98	1.96	4.62	2469
	Co Pant 97222	3.04	2.73	4.02	1.26	7.93	4732
	SE	0.92	2.00	1.50	0.76		
	CD	NS	NS	3.18	NS		

Table 1j: Evaluation of zonal varieties/genotypes for their reaction against major insect pests of sugarcane, (UPCSR, Shahjahanpur)

AVT (Mid late) Ratoon

SN	Varieties/genotypes	Top borer (% incidence)			Stalk borer		
		IIIrd brood 5th month	IVth brood 7th month	At harvest	% incidence	% intensity	Infestation index
01	Co 12029	0.51	1.90	6.67	28.00	5.29	1.42
02	CoH 12263	0.90	1.27	10.67	40.33	5.89	2.42
03	CoLk 12205	1.54	1.42	9.33	36.00	5.81	2.10
04	CoPant 12226	1.38	0.88	1.33	22.67	8.82	1.95
05	CoPb 12211	1.02	1.71	8.00	30.67	6.33	2.03
06	CoS 12232	1.00	0.89	2.67	26.67	8.62	2.30

Ck	CoS 8436	0.00	0.94	9.33	34.67	6.44	2.22
	CoS 767	1.39	1.49	5.33	25.33	7.30	1.83
	Co Pant 97222	2.13	1.23	2.67	34.67	6.58	2.29
	SE	1.11	0.32	2.49	9.65	1.10	0.71
	CD	NS	NS	5.28	NS	NS	NS

Table 1k: Evaluation of zonal varieties /genotypes for their reaction against borer pests of sugarcane , (UPCSR, Shahjahanpur)

AVT (Early) Ratoon

SN	Varieties/genotypes	Early shoot borer (% incidence)					No. of borer plants/ha
		30 DAP	60 DAP	90 DAP	120 DAP	Cummu.	
1	Co 12026	3.05	1.21	1.94	1.30	5.09	2675
2	Co 12027	3.69	1.74	2.12	1.64	6.35	3292
3	CoLk 12203	2.06	1.96	3.08	1.99	7.27	4938
4	CoPant 12221	2.16	1.42	2.16	1.54	6.08	4115
Ck	CoJ 64	5.19	3.37	4.16	2.41	11.29	7201
	Co 0238	2.88	1.64	2.76	2.03	6.72	3498
	SE	1.01	0.63	0.66	0.89		
	CD	NS	1.39	NS	NS		

Table 1l: Evaluation of zonal varieties /genotypes for their reaction against major insect pests of sugarcane , (UPCSR, Shahjahanpur)

AVT (Early) II Plant Ratoon

SN	Varieties/genotypes	Top borer (% incidence)			Stalk borer		
		3rd brood 5th month	4th brood 7th month	At harvest	% incidence	% intensity	Infestation index
1	Co 12026	1.84	1.04	9.33	22.67	6.54	1.50
2	Co 12027	10.5	1.99	4.00	36.00	5.60	2.00
3	CoLk 12203	1.19	3.36	6.67	30.67	10.02	2.68
4	CoPant 12221	0.80	2.38	5.33	26.67	7.76	3.89
Ck	CoJ 64	1.19	2.14	9.33	9.33	8.48	0.87
	Co 0238	0.48	1.57	5.33	48.00	6.67	3.14
	SE	0.44	0.60	2.60	9.65	1.48	1.05
	CD	NS	1.33	NS	21.49	NS	NS

ICAR-IISR, Lucknow Uttar Pradesh

In Advanced Varietal Trial (AVT):

In early maturing group, 4+2 sugarcane genotypesviz., **Co12027**, **CoS13231, CoLk12203, CoPant12221** and two standard (Co0230 and CoJ64) and in mid late maturing group 13+2genotypes viz., Co05011, Co13035, Co12263, Co12029, CoH13263, CoPb12211, CoPb13181, CoLk12205, CoLk13204, CoS12232, CoPant12226, CoPant13224, and two standards (CoS767 and CoPant97222, CoS8436)

In early group, incidence of top borer II, III and IV brood was ranged 15.67 to 40.33, 11.29 to 26.37 and 14.35 to 33.33 per cent, respectively. Incidence and intensity of stalk borer borer ranged 3.02 to 9.03 and 0.73 to 4.23 percent, respectively. Incidence and intensity of internode borer ranged 5.08 to 16.74 and 1.19 to 5.52 percent, respectively. Infestation index of stalk borer and internode borer ranged from 0.007 to 0.074 and 0.117 to 0.925, respectively. (Table 2).

CoLk12203 MS reaction and rest of the genotypes showed HS (Highly Susceptible) reaction to 2nd brood of top borer. Co12027 genotype showed HS reaction and rests of the genotypes showed MS reaction to Top borer 3rd brood. Two genotypes viz., Co12027 and standard Co0238 were HS and rests were MS to Top Borer 4th brood. All the genotypes showed LS reaction to internode borer. CoPant12227 and CoJ64 were MS and rests were HS to stalk borer (Table-3).

In mid late group, incidence of top borer II, III and IV brood was ranged 12.05 to 34.44, 6.06 to 22.06 and 9.85to 46.09 per cent, respectively. Incidence and intensity of internode borer ranged 6.87 to 16.68 percent and 1.28 to 5.93, respectively. Incidence and intensity of stalk borer ranged 4.14 to 17.14 and 0.65 to 6.62, percent, respectively.

Seven genotypes viz., CoLk12205, CoS12232, Co13035, CoLk13204, Co05011, Co12263, CoS8436 were MS and rests of the genotypes were HS to top borer 2nd brood. CoS12232 was LS and rests of the genotypes were MS to Top Borer 3rd brood. Co05011 was LS to Top Borer IV brood and MS to 2nd and 3rd brood. CoS767, Five genotypes viz., CoLk12205, CoS12232, CoPb12211, Co12263 were MS and rests of the genotypes were HS to top borer 4th brood.

Table-1: List of genotypes evaluated (AVT), (ICAR-IISR, Lucknow)

S.N.	**Early maturing**	**S.N.**	**Mid late maturing**
First Plant		**First Plant**	
1	CoLk 12203	1	CoS 767
2	Co 12027	2	CoLk 12205
3	CoS 13231	3	CoPant 12226
4	Co 0238	4	CoS 12232
5	CoPant 12227	5	Co 13035
6	CoJ 64	6	CoLk 13204
		7	CoPant 13224
		8	CoPb 13182
		9	CoS 8436
		10	CoLk 13263
		11	Co 05011
		12	Co Pb 12211
		13	CoPant 97222
		14	Co12263
		15	Co12029

Table-2: Incidence of insect pests in early maturing genotypes (AVT), (ICAR-IISR, Lucknow)

S. N.	Variety	Incidence of top borer			Stalk borer			Internode Borer		
		II Brood	III brood	IV brood	Incidence (%)	Intensity (%)	Infestation index	Incidence (%)	Intensity (%)	Infestation index
1	CoLk 12203	15.66	12.16	15.48	5.34	0.95	0.051	8.61	2.61	0.224
2	Co 12027	40.33	26.37	28.9	5.01	1.41	0.071	9.59	2.96	0.283
3	CoS 13231	37.87	11.29	16.11	5.16	0.24	0.012	3.32	1.19	0.395
4	Co 0238	28.63	15.78	33.33	9.03	0.82	0.074	16.74	5.52	0.924

5	Co PANT 12227	20.8	11.32	14.35	4.82	0.38	0.018	6.86	2.22	0.152
6	CoJ 64	25.13	13.24	17.89	3.02	0.25	0.007	5.08	2.31	0.117

Table:3. Reaction of sugarcane genotypes (Early maturing) against top borer and internode borer (AVT), (ICAR-IISR, Lucknow)

Insect pests	Scale (% incidence)	Reaction	No. of genotype	*Genotype*
To Borer II Brood	<10.0	LS	-	-
	10.1-20.0	MS	1	CoLk12203
	>20.0	HS	5	Co 12027, CoS 13231, Co 0238, CoPant12227 , CoJ 64
Top borer III Brood	<10.0	LS	-	-
	10.1-20.0	MS	5	CoLk12203, CoS 13231, Co 0238, CoPant 12227 , CoJ 64
	>20.0	HS	1	CO 12027,
Top borer IV Brood	<10.0	LS	-	-
	10.1-20.0	MS	4	CoLk12203, CoS13231, CoPant12227, CoJ64
	>20.0	HS	2	Co12027, Co0238
Internode borer	<20.0	LS	6	CoLk12203, Co 12027, CoS 13231, Co 0238, CoPant 12227 , CoJ 64
	20.1-40.0	MS	-	-
	>40.0	HS	-	-
Stalk borer	<2.0	LS	-	-
	2.1-5.0	MS	2	CoPant12227, CoJ64
	>5.0	HS	4	CoLk12203, Co 12027, CoS 13231, Co 0238

Table-4: Quality parameters and cane yield in early maturing group, (ICAR-IISR, Lucknow)

S.N	Variety	Quality parameters		
		Corrected Brix	Sucrose (%)	Purity Coefficient
1	COLK 12203	18.11	15.72	86.79
2	CO 12027	17.54	14.26	81.31
3	COS 13231	20.61	17.49	84.90
4	CO 0238	19.55	16.83	86.09
5	CO PANT 12221	17.6	14.83	84.29
6	COJ 64	20.85	17.97	86.24

Table-5: Incidence of insect pests in mid late maturing genotypes (AVT), (ICAR-IISR, Lucknow)

S.N	Variety		Incidence of top borer		Stalk borer			Internode Borer		
		II Brood	III brood	IV brood	Incidence (%)	Intensity (%)	Infestation index	Incidence (%)	Intensity (%)	Infestation index
1	CoS 767	23.39	11.95	14.9	9.18	1.75	0.161	11.6	1.97	0.229
2	CoLk 12205	19.83	14.87	17.57	11.6	2.68	0.311	9.48	2.16	0.205
3	CoPant	34.44	19.26	30.56	15.15	2.16	0.327	12.67	2.75	0.348

	12226									
4	CoS 12232	16.77	6.45	11.11	8.64	1.17	0.101	6.87	2.17	0.149
5	Co 13035	17.53	13.74	23.4	7.34	4.55	0.334	12.96	3.73	0.483
6	CoLk 13204	15.32	10.73	20.57	17.65	6.62	1.168	13.84	5.93	0.821
7	CoPant 13224	21.16	10.32	46.09	8.11	0.93	0.075	9.93	2.82	0.280
8	CoPb 13182	25.35	15.76	30.97	9.79	1.81	0.177	16.68	3.3	0.550
9	CoS 8436	19.3	10.05	21.37	8.69	0.63	0.055	7.68	3.18	0.244
10	CoLk 13263	28.53	12.04	32.85	6.95	4.07	0.283	10.37	2.65	0.275
11	Co05011	12.05	11.09	9.85	7.88	2.44	0.192	8.51	4.36	0.371
12	CoPb 12211	26.65	10.94	17.83	7.64	2.34	0.179	8.32	1.28	0.106
13	CoPant 97222	23.39	11.95	24.55	7.53	0.81	0.061	8.18	2.63	0.215
14	Co 12263	19.83	14.87	13.86	10.65	1.21	0.129	9.62	1.71	0.165
15	Co 12029	34.44	19.26	20.64	8.32	1.34	0.111	9.39	1.93	0.181

Table:6. Reaction of sugarcane genotypes (Mid-late maturing) against top borer and internode borer (AVT), (ICAR-IISR, Lucknow)

Insect pests	Scale (% incidence)	Reaction	Genotype
Top borer II brood	<10.0%	LS	-
	10.1-20.0	MS	CoLk12205, CoS12232, Co13035, CoLk13204, Co05011, Co12263, CoS8436
	>20.0	HS	CoS767, CoPant12226, CoPant13224, CoPb13182, CoLk13263, CoPb12211, CoPant97222, Co12029
Top borer III Brood	<10.0%	LS	CoS12232
	10.1-20.0	MS	CoLk12205, Co13035, CoLk13204, Co5011, Co12265, Co8436, CoS767, CoPant12226, CoPant13224, CoPb13182, CoLk13263, CoPb12211, CoPant97222, Co12029
	>20.0	HS	-
Top borer IV Brood	<10.0%	LS	Co05011
	10.1-20.0	MS	CoS767, CoLk12205, CoS12232, CoPb12211, Co12263,
	>20.0	HS	CoPant12226, Co13035, CoLk13204, CoPant13224, CoPb13182, Co8436, CoLk13263, CoPant97222, Co12029
Internode borer	<20.0	LS	CoLk12205, Co13035, CoLk13204, Co5011, Co12265, Co8436, CoS767, CoPant12226, CoPant13224, CoPb13182, CoLk13263, CoPb12211, CoPant97222, Co12029, CoS12232
	20.1-40.0	MS	
	>40.0	HS	
Stalk borer	<2.0	LS	-
	2.1-5.0	MS	-
	>5.0	HS	CoLk12205, Co13035, CoLk13204, Co5011, Co12265, Co8436, CoS767, CoPant12226, CoPant13224, CoPb13182, CoLk13263, CoPb12211, CoPant97222, Co12029, CoS12232

Table-7: Quality parameters and cane yield in mid late group , (ICAR-IISR, Lucknow)

S.N	Variety	Quality parameters		
		Corrected rix	Sucrose (%)	Purity Coefficient
1	CoS 767	18.56	17.50	89.13
2	CoLk 12205	18.74	16.84	89.88
3	CoPant 12226	19.58	17.50	89.32
4	CoS 12232	19.76	17.95	90.85
5	Co 13035	19.71	17.85	90.60
6	CoLk 13204	16.51	14.35	86.91
7	CoPant 13224	19.29	17.36	89.95
9	CoPb 13182	19.64	17.69	90.11
10	CoS 8436	19.12	17.13	89.61
11	CoLk 13263	19.02	16.97	89.24
12	Co05011	18.64	16.72	89.66
13	CoPb 12211	18.32	16.40	89.50
14	CoPant 97222	19.24	17.52	91.07
15	Co 12263	18.00	16.36	85.81
16	Co 12029	19.57	17.36	88.87

SBI-RC, Karnal

In AVT Early 1st plant trial, four genotypes and one standard check were evaluated against early shoot borer, top borer, root borer and stalk borer. All the genotypes including standard check were LS to early shoot borer and top borer and HS to stalk borer. Co0238 was MS and rests of the genotypes were HS to root borer. In AVT Early 2ndPlant trial, three genotypes and one standard check were evaluated against early shoot borer, top borer, root borer and stalk borer. All the genotypes including standard check were LS to early shoot borer and top borer and HS to stalk borer. Co0238 and CoPant12221 were MS and rests of the genotypes were HS to root borer. In AVT Mid late I Plant trial, six genotypes and one standard check were evaluated against early shoot borer, top borer, root borer and stalk borer. All the genotypes including standard check were LS to early shoot borer and top borer and HS to stalk borer. CoLk13204, Copant13224 and standard check Co5011 were MS and rests of the genotypes were HS to root borer. In AVT Mid late II Plant trial, six genotypes and one standard check were evaluated against early shoot borer, top borer, root borer and stalk borer. All the genotypes including standard check were LS to early shoot borer and top borer and HS to stalk borer. Copant13224 HS and rests of the genotypes were MS to root borer.

Table-1. Reaction of sugarcane genotypes against major insect pests in ratoon, (SBI-RC, Karnal)

Sl. No.	Variety/ Genotypes	Popn./ 20 leaves	% Incidence			Stalk borer		
		Black Bug	ESB	Top borer	Root borer	Incidence (%)	Intensity (%)	Infestation Index
1	CoH 11262	1.6	2.0	4.2	15.8	5.3	6.9	0.5
2	CoLk 11201	0.8	1.7	5.3	13.2	6.5	6.9	0.4
3	CoLk 11202	1.3	1.9	1.1	27.1	8.8	8.8	0.9
4	CoLk 11203	1.6	1.8	4.7	27.2	6.3	8.0	0.5
5	Co 0238	2.0	2.0	6.8	31.1	9.4	7.5	1.1
6	Co 11027	1.2	1.9	1.1	25.9	2.4	5.1	0.2
7	CoH 11263	1.8	1.7	5.5	29.1	6.0	10.0	0.6

8	CoLk 11204	1.9	1.9	0.0	15.0	1.3	2.8	0.1
9	CoLk 11206	1.3	1.9	4.3	42.9	1.4	2.8	0.1
10	CoPb 11214	1.0	1.9	2.5	28.1	18.4	10.6	1.7
11	CoS 11232	2.3	1.7	0.0	41.7	5.2	8.8	0.4
12	Co 05011	2.1	1.7	2.2	25.2	7.3	8.9	0.6

Table-2. Reaction of sugarcane genotypes against major insect pests in AVT 1st plant, (SBI-RC, Karnal)

Sl. No.	Variety/Genotypes	Incidence (%)			Stalk borer		
		Early shoot borer	Top borer	Root borer	Incidence (%)	Intensity (%)	Infestation Index
1	CoPb 13181	0.9	0.5	42.3	13.9	13.0	1.7
2	Co 0238	0.6	1.6	20.0	18.3	11.1	2.0
3	CoS 13231	0.4	0.7	41.1	22.9	7.0	1.7
4	Co 13034	2.3	2.0	58.7	45.3	8.9	3.9
5	CoLk 13204	1.9	0.4	23.3	36.4	7.1	2.6
6	CoPb 13182	5.0	1.5	33.1	43.2	8.1	3.5
7	CoH 13263	2.0	1.5	33.7	35.1	10.0	3.5
8	CoPant 13224	2.1	2.9	19.0	43.9	8.2	3.6
9	Co 13035	1.9	0.6	51.2	44.6	7.2	3.0
10	Co 05011	0.6	0.9	17.9	12.5	10.1	1.3

Table-3. Reaction of sugarcane genotypes against major insect pests in AVT 2nd Plant, (SBI-RC, Karnal)

Sl. No.	Variety/Genotypes	Incidence (%)			Stalk borer		
		Early shoot borer	Top borer	Root borer	% Incidence	Intensity (%)	Infestation Index
1	CoPant 12221	1.5	0.0	25.9	35.7	6.6	2.6
2	Co 12027	3.1	0.6	40.0	22.2	7.5	2.5
3	Co 12026	8.2	2.5	31.7	28.2	6.7	3.0
4	CoLk 12203	1.2	2.5	34.6	31.6	8.0	2.8
5	Co 0238	0.8	2.3	22.1	26.58	7.6	2.0
6	CoS 12232	2.3	0.8	22.5	25.5	9.1	2.2
7	Co 12029	0.4	5.1	15.6	40.1	7.9	3.3
8	CoH 12263	0.3	0.9	29.8	44.5	10.8	5.1
9	CoLk 12205	2.3	0.0	19.9	11.4	3.4	0.6
10	CoPant 12226	1.2	0.9	31.4	30.1	6.0	2.3
11	Co 05011	0.6	0.9	16.7	17.86	8.9	1.6
12	CoPb 12211	1.1	0.8	20.3	17.4	9.1	1.9

CCSHAU, RRS, UCHANI, KARNAL

A total of thirty-eight genotypes of sugarcane comprising seven under IVT (Early), three under AVT (Early)-I Plant, four under AVT (Early)-II Plant, thirteen under IVT-Midlate, five under AVT (Midlate)-I Plant and six under AVT (Midlate)-II Plant with three standards for early and four for midlate were screened against major insect pests of sugarcane.

In IVT- early all genotypes and standard checks were LS to early shoot borer.

Two genotypes, CoLk 14201 and CoPant 14222, five genotypes, Co 14034, CoLk 14202, CoPb 14181, CoPb 14182 and CoPb 14211 and one genotype, Co 05009 were LS, MS and

HS to top borer. Out of seven two genotypes (CoLk 14202 and CoPb 14182) were MS and rests were LS to stalk borer. In the case of root borer, only CoLk 14201 and CoPb 14182 sowed MS reaction and rests of the genotypes were showed LS reaction.

In AVT (early) –I Plant, all entries were LS to early shoot borer. Co 13034 and Co 05009 were LS and HS to top borer, respectively and rests of genotypes were MS. All the genotypes including standards were LS to stalk borer. Against root borer, CoJ 64, Co 0238 and Co 05009 were MS and rests of the genotypes were LS.

In AVT (early) - II Plant, all genotypes including standard checks were LS to early shoot borer, stalk borer, root borer and MS to top borer.

In IVT midlate trial, thirteen genotypes were evaluated for their reaction against major insect pests of sugarcane and CoS 767, CoS 8436, CoPant 97222 and Co 05011were also kept as standard checks. All the genotypes and standard checks were LS to early shoot and variable reaction of these genotypes were recorded against top borer. Three genotypes, Co 14035, CoLk 14203 and CoPb 14185 were HS to top borer. CoPb 14185, COS 8436 and Co 05011 were MS and rests of the genotypes were moderately susceptible (MS) to stalk borer. Genotypes, Co 14035, CoPb 14212, CoS 14233 and Co 05011 were MS and rests of the genotypes were LS to root borer.

In AVT (Midlate)- I Plant, five entries were evaluated. All genotypes were reported LS to early shoot borer. Top borer incidence ranged from 5.1 to 21.1 in all tested genotypes.
Four genotypes, CoPb 13182, CoLk 13204, CoPant 97222, Co 05011, three genotypes, CoH 13263, CoPant 13224, CoS 767 and two genotypes, CoS 8436, Co 13035 showed LS, MS and HS reactions, respectively. All entries were found least susceptible against stalk borer except CoPant 13224,Co 8436 and Co 05011. All tested genotypes were found least susceptible against root borer except CoPant 13224 and Co 05011(check).
All genotypes evaluated in AVT midlate –II Plant against early shoot borer were found least susceptible. CoPant 97222 LS and CoLk 12205, CoPant 12226 was HS and rests of the genotypes rated as MS to top borer. In case of stalk borer, infestation ranged from 1.3 to 2.8 infestation index and all the genotypes except CoPb 12111 and CoS 8436 (check) were rated LS. All genotypes were LS to root borer.
All genotypes in IVT Early and mid late , AVT Early I &II Plant and AVT Mid late I & II plant were LS to sucking pests.

Table 1.1a: Reaction of sugarcane genotypes in Initial Varietal Trial (early) against major borers, (CCSHAU, RRS, Uchani, Karnal)

Sr. No.	Variety/Genotype	Borer (% infestation)				Grade of infestation			
		Shoot Borer	Top Borer	Stalk borer*	Root borer	Shoot Borer	Top Borer	Stalk borer*	Root borer
1	Co 14034	5.6	18.0	1.9	9.3	LS	MS	LS	LS
2	CoLk 14201	6.7	7.3	1.1	16.0	LS	LS	LS	MS
3	CoLk 14202	6.7	17.6	2.3	5.3	LS	MS	MS	LS
4	CoPant 14222	8.0	7.5	0.8	5.3	LS	LS	LS	LS
5	CoPb 14181	6.6	12.9	1.3	12.0	LS	MS	LS	LS
6	CoPb 14182	8.1	13.7	2.6	15.3	LS	MS	MS	MS
7	CoPb 14211	5.2	15.3	0.9	8.0	LS	MS	LS	LS
CK	CoJ 64	7.1	14.1	1.3	13.3	LS	MS	LS	LS
	Co 0238	6.5	16.5	0.9	14.7	LS	MS	LS	LS
	Co 05009	8.4	30.9	1.1	10.7	LS	HS	LS	LS

*Infestation Index

Table 1.1b: Reaction of sugarcane genotypes in Initial Varietal Trial (early) against major sucking pests, (CCSHAU, RRS, Uchani, Karnal)

Sr. No	Variety/ Genotype	Sucking pests infestation				Grade of infestation			
		Pyrilla	White fly	Black bug	Webbing mite	Pyrilla	White fly	Black bug	Webbing mite
1	Co 14034	4.3	1.5	3.2	8.2	LS	LS	LS	LS
2	CoLk 14201	2.5	1.6	3.4	6.1	LS	LS	LS	LS
3	CoLk 14202	3.0	1.1	3.3	4.3	LS	LS	LS	LS
4	CoPant 14222	2.3	1.3	4.5	5.6	LS	LS	LS	LS
5	CoPb 14181	5.4	2.1	3.8	4.2	LS	MS	LS	LS
6	CoPb 14182	1.8	1.4	3.6	2.8	LS	LS	LS	LS
7	CoPb 14211	2.8	1.6	6.4	4.9	LS	LS	LS	LS
CK	CoJ 64	3.7	2.4	5.2	8.7	LS	MS	LS	LS
	Co 0238	3.4	1.7	6.2	7.4	LS	LS	LS	LS
	Co 05009	3.5	2.2	4.6	3.7	LS	MS	LS	LS

Table 1.2a: Reaction of sugarcane genotypes in Advance Varietal Trial (early) - I Plant against major borers, (CCSHAU, RRS, Uchani, Karnal)

Sr No.	Variety/Genotype	Borer (% infestation)				Grade of infestation			
		Shoot Borer	Top Borer	Stalk borer*	Root borer	Shoot Borer	Top Borer	Stalk borer*	Root borer
1	Co 13034	6.3	8.4	1.1	16.0	LS	LS	LS	MS
2	CoPb 13181	5.5	11.5	0.6	10.7	LS	MS	LS	LS
3	CoS 13231	5.2	14.4	1.9	16.0	LS	MS	LS	MS
CK	CoJ 64	7.3	17.6	1.7	14.7	LS	MS	LS	LS
	Co 0238	6.9	19.5	1.9	13.3	LS	MS	LS	LS
	Co 05009	7.4	34.4	1.0	12.0	LS	HS	LS	LS

*Infestation Index

Table 1.2b: Reaction of sugarcane genotypes in Advance Varietal Trial (early)- I Plant against major sucking pests, (CCSHAU, RRS, Uchani, Karnal)

Sr No.	Variety/ Genotype	Sucking pests infestation				Grade of infestation			
		Pyrilla	White fly	Black bug	Webbing mite	Pyrilla	White fly	Black bug	Webbing mite
1	Co 13034	2.6	1.2	2.1	5.4	LS	LS	LS	LS
2	CoPb 13181	2.9	1.6	3.4	4.2	LS	LS	LS	LS
3	CoS 13231	1.4	1.4	3.7	4.9	LS	LS	LS	LS
CK	CoJ 64	1.6	2.2	3.1	6.4	LS	MS	LS	LS
	Co 0238	2.5	1.6	3.1	4.2	LS	LS	LS	LS
	Co 05009	2.9	2.4	5.7	4.8	LS	MS	LS	LS

Table 1.3a: Reaction of sugarcane genotypes in Advance Varietal Trial (early) - II Plant against major borers, (CCSHAU, RRS, Uchani, Karnal)

Sr No.	Variety/Genotype	Borer (% infestation)				Grade of infestation			
		Shoot Borer	Top Borer	Stalk borer*	Root borer	Shoot Borer	Top Borer	Stalk borer*	Root borer
1	Co 12026	5.9	14.5	1.7	14.7	LS	MS	LS	LS

2	Co 12027	7.3	12.0	2.2	13.3	LS	MS	MS	LS
3	CoLk 12203	6.3	13.2	0.7	14.7	LS	MS	LS	LS
4	CoPant 12221	7.5	14.2	1.8	12.0	**LS**	MS	LS	LS
CK	CoJ 64	7.0	11.3	1.0	12.0	LS	MS	LS	LS
	Co 0238	7.1	15.2	0.9	13.3	LS	MS	LS	LS

*Infestation Index

Table 1.3b: Reaction of sugarcane genotypes in Advance Varietal Trial (early)- II Plant against major sucking pests, (CCSHAU, RRS, Uchani, Karnal)

Sr No.	Variety/ Genotype	Sucking pests infestation				Grade of infestation			
		Pyrilla	White fly	Black bug	Webbing mite	Pyrilla	White fly	Black bug	Webbing mite
1	Co 12026	2.3	1.1	3.4	5.4	LS	LS	LS	LS
2	Co 12027	2.1	1.6	3.1	4.6	LS	LS	LS	LS
3	CoLk 12203	2.7	1.5	5.3	4.8	LS	LS	LS	LS
4	CoPant 12221	2.5	1.2	3.4	5.1	LS	LS	LS	LS
CK	CoJ 64	2.1	2.5	2.2	5.4	LS	MS	LS	LS
	Co 0238	2.6	1.4	4.2	6.4	LS	LS	LS	LS

Table 1.4a: Reaction of sugarcane genotypes in Initial Varietal Trial -midlate against major borers, (CCSHAU, RRS, Uchani, Karnal)

Sr No.	Variety/Genotype	Borer (% infestation)				Grade of infestation			
		Shoot Borer	Top Borer	Stalk borer*	Root borer	Shoot Borer	Top Borer	Stalk borer*	Root borer
1	**Co 14035**	6.5	30.8	1.5	16.0	LS	HS	LS	MS
2	CoH 14261	5.1	14.8	1.6	6.7	LS	MS	LS	LS
3	CoH 14262	7.5	9.6	1.1	10.7	LS	LS	LS	LS
4	CoLk 14203	7.0	20.9	1.3	12.0	LS	HS	LS	LS
5	CoLk 14204	6.7	8.5	0.6	12.0	LS	LS	LS	LS
6	CoLk 14205	7.6	14.1	0.5	8.0	LS	MS	LS	LS
7	CoPb 14183	5.6	13.4	1.3	9.3	LS	MS	LS	LS
8	CoPb 14184	6.4	12.2	1.7	8.0	LS	MS	LS	LS
9	CoPb 14185	7.7	24.8	2.3	6.7	LS	HS	MS	LS
10	CoPb 14212	4.6	5.9	1.0	17.3	LS	LS	LS	MS
11	CoS 14231	5.7	14.5	1.4	8.0	LS	MS	LS	LS
12	CoS 14232	7.5	12.1	1.3	5.3	LS	MS	LS	LS
13	CoS 14233	6.2	11.6	0.8	16.0	LS	MS	LS	MS
CK	CoS 767	6.4	11.1	1.7	10.7	LS	MS	LS	LS
	CoS 8436	11.1	16.1	2.4	14.7	LS	MS	MS	LS
	CoPant 97222	4.9	9.0	1.1	13.3	LS	LS	LS	LS
	Co 05011	8.6	6.9	2.8	19.3	LS	LS	MS	MS

*Infestation Index

Table 1.4b: Reaction of sugarcane genotypes in Initial Varietal Trial -midlate against major sucking pests, (CCSHAU, RRS, Uchani, Karnal)

Sr No.	Variety/ Genotype	Sucking pests infestation				Grade of infestation			
		Pyrilla	White fly	Black bug	Webbing mite	Pyrilla	White fly	Black bug	Webbing mite
1	**Co 14035**	4.1	1.1	2.2	6.2	LS	LS	LS	LS
2	CoH 14261	4.5	1.3	3.0	4.3	LS	LS	LS	LS

3	CoH 14262	3.8	0.9	2.3	6.8	LS	LS	LS	LS
4	CoLk 14203	4.3	1.2	4.1	7.2	LS	LS	LS	LS
5	CoLk 14204	2.4	1.1	1.8	5.3	LS	LS	LS	LS
6	CoLk 14205	1.6	1.3	3.4	4.8	LS	LS	LS	LS
7	CoPb 14183	4.8	1.4	2.4	5.7	LS	LS	LS	LS
8	CoPb 14184	2.7	1.6	3.2	5.3	LS	LS	LS	LS
9	CoPb 14185	3.1	2.5	2.2	4.2	LS	MS	LS	LS
10	CoPb 14212	3.2	2.3	3.4	7.6	LS	MS	LS	LS
11	CoS 14231	4.6	1.1	3.2	6.2	LS	LS	LS	LS
12	CoS 14232	2.8	0.7	2.6	6.5	LS	LS	LS	LS
13	CoS 14233	4.1	2.2	3.1	5.2	LS	MS	LS	LS
CK	CoS 767	4.2	1.4	2.8	5.2	LS	LS	LS	LS
	CoS 8436	2.4	1.1	3.1	4.3	LS	LS	LS	LS
	CoPant 97222	4.6	1.3	2.2	5.2	LS	LS	LS	LS
	Co 05011	4.2	1.6	2.2	4.3	LS	LS	LS	LS

Table 1.5a: Reaction of sugarcane genotypes in Advanced Varietal Trial (midlate)-I Plant against major borers, (CCSHAU, RRS, Uchani, Karnal)

Sr No.	Variety/Genotype	Borer (% infestation)				Grade of infestation			
		Shoot Borer	Top Borer	Stalk borer*	Root borer	Shoot Borer	Top Borer	Stalk borer*	Root borer
1	**Co 13035**	6.6	20.5	1.4	10.7	LS	HS	LS	LS
2	CoH 13263	7.6	18.1	1.6	13.3	LS	MS	LS	LS
3	CoPant 13224	6.0	18.2	3.0	16.0	LS	MS	LS	MS
4	CoPb 13182	5.8	7.2	1.5	14.7	LS	MS	LS	LS
5	CoLk 13204	5.9	7.7	1.3	12.0	LS	LS	LS	LS
CK	CoS 767	6.7	11.7	0.8	9.3	LS	MS	LS	LS
	CoS 8436	12.5	21.1	2.7	13.3	LS	HS	MS	LS
	CoPant 97222	5.6	6.8	1.7	10.7	LS	LS	LS	LS
	Co 05011	8.4	5.1	3.4	16.0	LS	LS	MS	MS

*Infestation Index

Table 1.5b: Reaction of sugarcane genotypes in Advanced Varietal Trial (midlate) – I Plant against major sucking pests, (CCSHAU, RRS, Uchani, Karnal)

Sr No	Variety/ Genotype	Sucking pests infestation				Grade of infestation			
		Pyrilla	White fly	Black bug	Webbing mite	Pyrilla	White fly	Black bug	Webbing mite
1	Co 13035	2.8	1.2	4.0	7.2	LS	LS	LS	LS
2	CoH 13263	3.7	1.1	2.3	2.4	LS	LS	LS	LS
3	CoPant 13224	2.6	0.9	3.1	5.6	LS	LS	LS	LS
4	CoPb 13182	2.4	1.3	4.5	6.3	LS	LS	LS	LS
5	CoLk 13204	3.7	1.8	3.3	5.2	LS	LS	LS	LS
CK	CoS 767	3.8	1.2	2.4	5.0	LS	LS	LS	LS
	CoS 8436	2.7	1.4	2.5	4.2	LS	LS	LS	LS
	CoPant 97222	4.1	1.2	2.4	4.0	LS	LS	LS	LS
	Co 05011	3.6	1.5	2.8	3.6	LS	LS	LS	LS

Table 1.6a: Reaction of sugarcane genotypes in Advanced Varietal Trial (midlate) - II Plant against major borers, (CCSHAU, RRS, Uchani, Karnal)

Sr No.	Variety/Genotype	Borer (% infestation)				Grade of infestation			
		Shoot Borer	Top Borer	Stalk borer*	Root borer	Shoot Borer	Top Borer	Stalk borer*	Root borer
1	Co 12029	9.2	14.2	1.9	13.3	LS	MS	LS	LS
2	CoH 12263	7.7	18.1	1.6	10.7	LS	MS	LS	LS
3	CoLk 12205	6.1	21.0	1.7	13.3	LS	MS	LS	LS
4	CoPant 12226	6.4	21.4	1.8	13.3	LS	HS	LS	LS
5	CoPb 12211	5.9	16.6	2.2	14.7	LS	MS	MS	LS
6	CoS 12232	8.4	11.3	1.3	12.0	LS	MS	LS	LS
CK	CoS 767	7.9	12.5	1.6	10.7	LS	MS	LS	LS
	CoS 8436	10.5	12.2	2.8	12.0	LS	MS	MS	LS
	CoPant 97222	5.6	9.6	1.8	12.0	LS	LS	LS	LS

*Infestation Index

Table 1.6b: Reaction of sugarcane genotypes in Advanced Varietal Trial (midlate- II Plant) against major sucking pests, (CCSHAU, RRS, Uchani, Karnal)

Sr No.	Variety/ Genotype	Sucking pests (% infestation)				Grade of infestation			
		Pyrilla	White fly	Black bug	Webbing mite	Pyrilla	White fly	Black bug	Webbing mite
1	Co 12029	1.6	1.4	3.2	7.5	LS	LS	LS	LS
2	CoH 12263	2.4	1.6	3.1	6.4	LS	LS	LS	LS
3	CoLk 12205	3.4	1.5	2.8	8.2	LS	LS	LS	LS
4	CoPant 12226	1.7	0.7	4.3	6.5	LS	LS	LS	LS
5	CoPb 12211	2.2	1.7	2.9	5.2	LS	LS	LS	LS
6	CoS 12232	2.8	1.4	3.6	5.5	LS	LS	LS	LS
CK	CoS 767	2.6	1.0	2.0	3.4	LS	LS	LS	LS
	CoS 8436	2.2	1.1	3.1	3.8	LS	LS	LS	LS
	CoPant 97222	3.1	0.9	2.2	2.9	LS	LS	LS	LS

E. 28: Survey and Surveillance of insect pests of Sugarcane

PAU Regional Resaerch Station, Kapurthala

Sugarcane fields nearby sugar factories of Punjab were surveyed for insect pests in the area. Incidence of termite was low in Faridkot, Fazilka, Ajnala and Nawanshahr. The incidence of early shoot borer, top borer, stalk borer and root borer ranged between 5-6, 4-5, 5-6 and 2-3 per cent respectively, in different varieties of sugarcane *viz.,* Co 0238, CoJ 88, CoJ 85, Co 89003, Co 0118 and CoJ 64 at different cane growing areas of Punjab. The incidence of pyrilla, mite and black bug were found 5-6, 3-4 and 5-6 per cent respectively, on different varieties in Dasuya, Mukerian, Batala, Gurdaspur, Budhewal, Fazilka, Dhuri, Mukatsar, Faridkot, Phagwara, Morinda, Kapurthala, Nakodar and Ajnala. The incidence of whitefly was found in traces. (Table 2).

Table 2. Survey and surveillance of insect pest of sugarcane in Punjab during, (PAU, Kapurthala)

S. No.	Varieties	Location	Name of Pest	Per cent incidence	Remark
1.	Co 0238 Co 89003 CoJ 85 CoJ 64 Co 0118	Faridkot Fazilka Ajnala Nawanshahr	Termite (*Odontotermes obesus*)	2-3	In sandy soil termite attack was more
2.	Co 0238 CoJ 88 CoJ 85 Co 89003	Gurdaspur Faridkot Bhogpur Dasuya Dhuri Morinda	Early shoot borer (*Chilo infuscatellus)*	5-6	
3.	Co 0238 CoJ 85 Co 89003 CoJ 88 Co 0118	Batala Gurdaspur Ajnala Nawanshahr Dasuya Bhogpur Mukerian	Top borer (*Scirpophaga excerptalis*)	4-5	-
4.	Co 0238 CoJ 85 CoJ 88	Dasuya Mukerian Batala Gurdaspur	Pyrilla (*Pyrilla perpusilla*)	4-5/leaf (5-6%)	-
5.	Co 0238 CoJ 85 CoJ 64	Budhewal Fazilka	Whitefly (*Aleurolobus barodensis*)	Traces	-
6.	Co 0238 Co 89003 CoJ 64	Fazilka Dhuri Mukatsar Faridkot	Mite (*Oligonychus indicus*)	7-8/cm square (3-4%)	-
7.	Co 0238 CoPb 91 CoJ 85 CoJ 88 Co 89003	Dasuya Budhewal Phagwara Mukerian Gurdaspur Morinda	Black bug (*Cavelerious excavatus*)	3-4/Plant (5-6%)	Black bug incidence more in sugarcane ratoon crop
8	Co 0238 CoJ 85 Co 89003	Dhuri Kapurthala Gurdaspur	Root borer (*Emmalocera depressella*)	2-3	-
9.	Co 0238 Co 89003 CoJ 85 CoJ 64 Co 0118	Nakodar Phagwara Ajnala Gurdaspur Budhewal Nawanshahar Morinda	Stalk borer (*Chilo auricilius*)	5-6	-

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Sugarcane fields around sugar factory viz.; Gola (Kheri), Hargaon (Sitapur), Kumbhi (Kheri), Rosa (Shahjahanpur), Khambarkhera (Kheri), Maqsudapur (Shahjahanpur), Nigohi (Shahjahanpur), Gularia (Kheri), Aira (Kheri), Pallia (Kheri) and Azabapur (Kheri) were surveyed. During summer months, the incidence of early shoot borer was low and ranged from 2.50% (Pallia and Azabapur factory zone) to 4.50% (Rosa factory zone). The percent incidence of top borer was also recorded low in all surveyed factory zones. The infestation of stalk borer was recorded low in all surveyed factory zones. Incidence of thrips was recorded in some of the factory zones and it was 7.50% in Kumbhi, 25.00%, 32.50% in around Rosa and Aira factory zones. Sporadic occurrence of termite, mealy bug, white fly and root borer was found in some factory zones. The infestation of mite was recorded low to high (7.50%-65%) around Kumbhi, and Aira factory zones. The low incidence of occurrence of Gurdaspur borer was recorded around Rosa, Khambarkhera, Gularia, and Pallia (Table 2).

Table 2: Survey and surveillance of sugarcane insect pests in the area (UPCSR, Shahjahanpur)

SN	Varieties	Location	Name of pest	% incidence/population			Remark
				Minimum	Maximum	Average	
1	Co 0238, CoS 8432	Gola (Lkahimpur kheri)	Early shoot borer (% incidence)	3	5	4.00	
			Top shoot borer (% incidence)	2	4	3.00	
			Thrips	5	15	10.00	
			Mealy bug	0	5	2.50	
2	Co 0238, Co 98014, CoPant 03220 CoS 08272, CoLk 94184 CoJ 85	Hargaon (Sitapur)	Early shoot borer (% incidence)	2	6	4.00	
			Top shoot borer (% incidence)	3	7	5.00	
			Mealy bug	2	4	3.00	
3	Co 0238 CoJ 88 CoS 08279 Co 0118	Kumbhi (Kheri)	Early shoot borer (% incidence)	3	5	4.00	
			Top shoot borer (% incidence)	2	4	3.00	
			Thrips	5	10	7.50	
			Mealy bug	1	5	3.00	
			Mite	5	10	7.50	

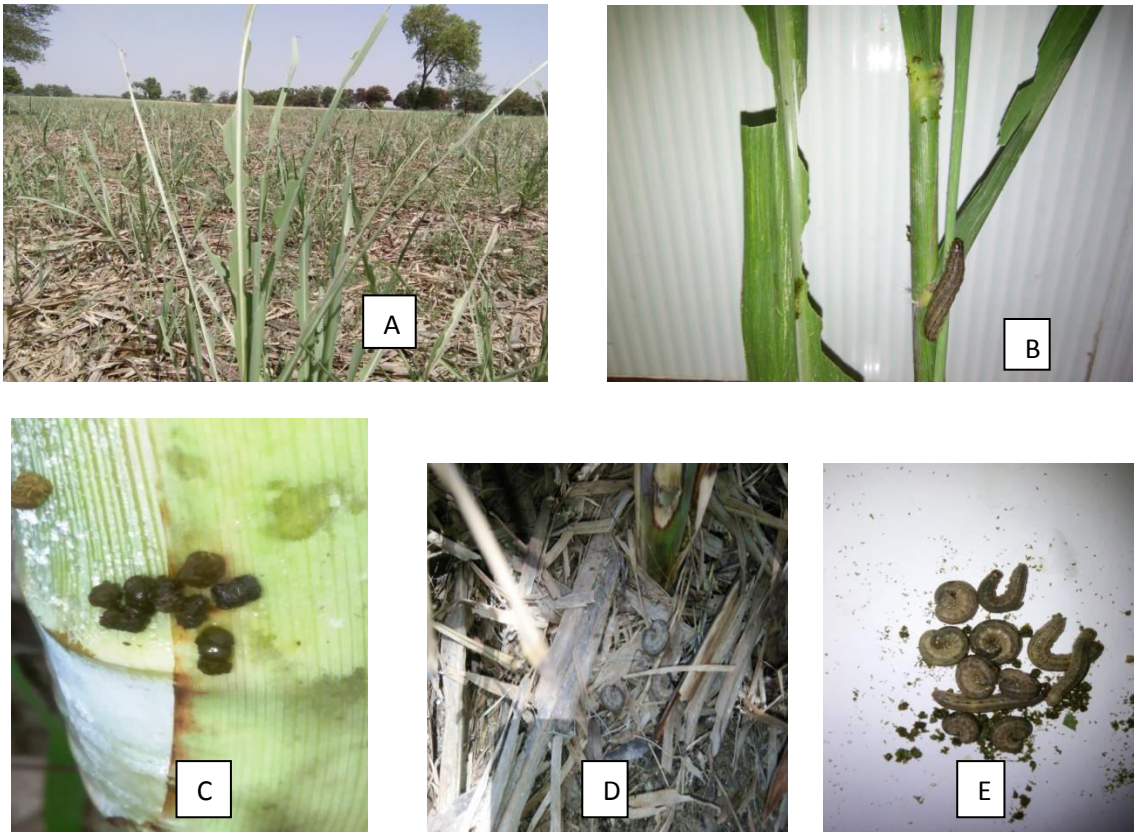
4	Co 0238 CoS 07250 CoSe 01434, Co 98014	Rosa (Shahjah anpur)	Early shoot borer (% incidence) Top shoot borer (% incidence) Gurdaspur borer Termite Thrips Whitefly	3 2 1 8 10 10	8 5 3 10 40 45	5.50 3.50 2.00 9.00 25.00 27.50	
5	Co 0238	Khambar khera (Kheri)	Early shoot borer (% incidence) Top shoot borer (% incidence) Stalk borer(% incidence) Gurdaspur borer Mite	2 3 9 1 20	5 4 13 2 45	3.50 3.50 11.00 1.50 32.50	
6	Co 0238, CoS 08276 CoLk 94184	Maqsuda pur (Shahjah anpur)	Early shoot borer (% incidence) Top shoot borer (% incidence) Stalk borer(% incidence)	3 2 6	5 5 11	4.00 3.50 8.50	
7	Co 0238, CoLk 98184	Nihoghi(Shahjaha npur)	Early shoot borer (% incidence) Top shoot borer (% incidence) Stalk borer(% incidence)	2 2 8	5 4 14	3.50 3.00 11.00	

8	Co 0238, CoS 08279 Co 98014 CoS 08272	Gularia (Kheri)	Early shoot borer (% incidence)	2	5	3.50	
			Top shoot borer (% incidence)	4	6	5.00	
			Stalk borer(% incidence)	7	10	8.50	
			Gurdaspur borer	1	5	6.00	
			Termite	20	25	22.50	
9	Co 0238, CoLk 94184, CoSe 01434, Co 98014	Aira (Kheri)	Early shoot borer(% incidence)	3	4	3.50	
			Top shoot bore (% incidence)	2	6	4.00	
			Stalk bore (% incidence)	7	9	8.00	
			Root borer	0	5	2.50	
			Thrips	15	50	32.50	
			Mite	60	70	65.00	
10	Co 0238, Co 98014	Pallia (Kheri)	Early shoot borer(% incidence)	2	3	2.50	
			Top shoot bore (% incidence)	3	6	4.50	
			Stalk borer(% incidence)	5	10	7.50	
			Gurdaspur borer	3	15	9.00	
11	Co 0238, Co 05011	Ajabapur (Kheri)	Early shoot borer(% incidence)	2	3	2.50	
			Top shoot bore (% incidence)	3	5	4.00	
			Stalk borer(% incidence)	5	10	7.50	
			Mealy bug	1	10	5.50	

ICAR-IISR, Lucknow Uttar Pradesh

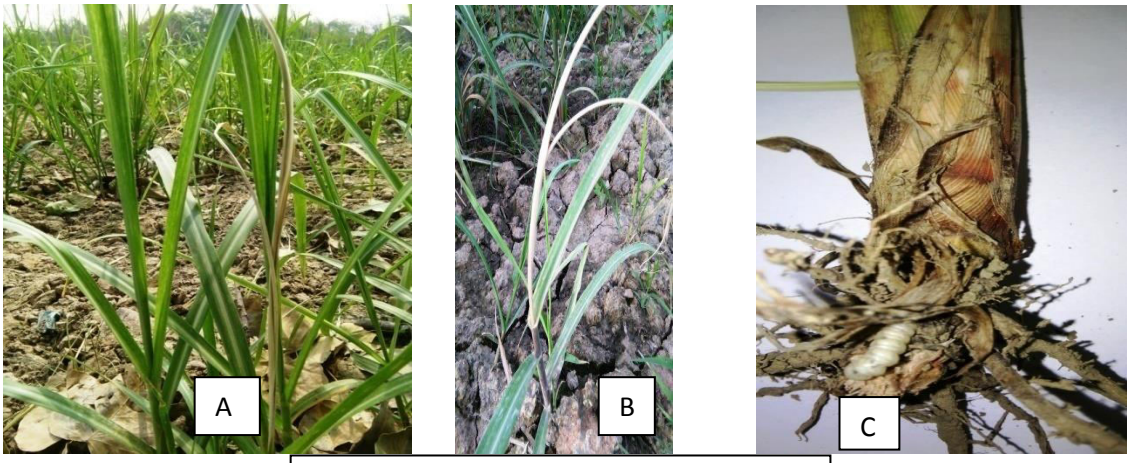
The survey was conducted in Command area of Chilbaria Sugar Mill, Nanpara Sugar Mill, Bahraich and Hata Sugar Mill, Deoria, U.P. The incidence of root borer and army worm is increasing and incidence was around 5% and 5-10%, respectively with one location a heavy patch incidence of root borer (20%) and army worm (60%) was observed. Incidence of ESB was 5-15%. A black beetle (*Heteronychus* sp.) was observed gnawing the basal portion

of young shoots and causing dead heart. Its occurrence was wide spread. During 2017-18, insect survey was conducted in command areas of USDM, Ltd. Shamli, DSCL Sugar-Hariawan&Loni, The Simbhaoli Sugar Ltd., Chilwaria in U.P. The incidence of top borer (II brood), ESB, web mite, white grub and was observed as 2-8%,2-3%,3-6% ,10-20% and 1-4%,respectively in variety Co 0238 in different villages of USDM, Shamli. White grub (8-10%) was observed in varieties Co 89003, Co 05011 and Co 95422 in DSCL-Hariawan&Loni. The incidence of root borer is increasing and incidence was around 5% in Chilwaria areas with one location a heavy patch of root borer incidence (20%) was observed. Low incidence of top borer and stalk borer in Shahjahanpur area was noticed.



Army worm infestation in sugarcane

A. Typical symptoms of army worm damage
B. Caterpillar of army worm
C. Excreta of Army Worm
D. Caterpillars of Army worm hiding in leaf traces
E. Caterpillars of Army worm



Root Borer infestation in sugarcane
A & B Dead heart formation in plant crop
C Root borer larvae

White grub damage

SBI-RC, Karnal

Insect pests survey was carried out under the reserved areas of 07 Co-operative sugar mills of Haryana namely; Karnal, Shahabad, Panipat, Rohtak, Palwal, Jind and Meham and 03 sugar mills of Uttar Pradesh viz., Mawana sugar works Mawana, district Meerut, Triveni engineering works, Deoband, district Saharanpur and Triveni engineering works, Khatauli, district Muzaffarnagar (UP). Pink borer, Internode borer and Blister mite were identified as new pests of sugarcane in Haryana and western Uttar Pradesh. Blister mite incidence was 78.2 and 62.0 per cent in U.P. and Haryana, respectively.

Table- 4: current status of major insect pests of sugarcane North Western Zone

Surveyed area	Key insect pests	Occasional insect pests	New pest
Uttar Pradesh	WG, ESB, PB, INB,TB,RB, SB, Pyrilla, BM,BB and Termites	AW, GH,WF, YM ,Thrips	PB (T-30%) BM (T-78.2%) INB (T-5 %)
Haryana	ESB, TB,RB, SB,PB, Pyrilla, BB,BM, WM and Termites	AW,GH,WF, , WG MB,YM, Thrips	PB (T-40%) INB (T-8 %) BM (T-62.0%)

ESB= Early shoot borer, TB =top borer, RB= root borer, SB= stalk borer, BB= black bug, BM=Blister mites, WG=white grubs, AM=Army worm, GH=grass hopper, WF=white fly, YM=Yellow mite MB=mealy bug, PB=Pink borer, BM=Blister mite, INB=Internode borer

CCSHAU, RRS, UCHANI, KARNAL

A survey owas carried out in Mills zones of Cooperative sugar factories viz. Karnal, Yamuna Nagar, Shahabad, Rohtak, Assandh, Panipat, Sonepat and Jind was carried out for insect- pests of sugarcane crop. In pre-monsoon season 3.5-18.6 % dead heart formation was observed tha may be dueto incidence of pink stem borer, *Sesamia inferens.* A moderate incidence of thrips (4.2- 8.5 %), low to high incidence of early shoot borer (3.4-45.6 %) and low incidence of top borer (3-6 %) was observed in plant and ratoon crop. Moderate to high incidence of black bug (23-38 bugs/whorl) was observed in ratoon and plant crops. Round the year low to high and low to moderate incidence of early shoot, pink borer, top borer, stalk borer, root borer was recoded. Incidence of sucking pests such as black bug, web mites, white fly, *Pyrilla perpusilla* was low to moderate and in some pockets it was moderate to high. Preseence of *Epiricania melanoleuca* was noticed in the area.

Table 2: Incidence of sugarcane insect- pests in mill zones of Haryana during (CCSHAU, RRS, Uchani, Karnal)

Sugar Mills Zone	Season	Varieties	**Insect-pests**	**Per cent incidence (%)**	**Remarks**
Karnal	Pre-monsoon	CoH 160, Co 0238, Co J 85, Co 89003, Co 0118, Co 05011 & CoP 84212	Pink stem borer	3.5-18.6	More damage during March
			Thrips	4.2-8.5	Infestation under drought conditions
			Shoot borer	3.4-45.6	Severe damage even after insecticide application
			Black bug	23-38 bugs/whorl	Infestation in ratoon crop
			Top borer	3-6	-
	Monsoon	Co 0238, Co 89003, CoH160 and Co05011	Top borer	5.6-42.8	More infestation in Co 0238
			Stalk borer	8.0-11.5	-
			Black bug	5.0-25.4 bugs/whorl	Infestation in plant & ratoon crop
			Webbing mite	5-65 % leaves infested	-
			Root borer	2.4-20.6	-
			Pyrilla	0-1.5 nymphs/ adults/leaf	-
			White grub	1-2 grub/m^2	Grub damage more in sandy soils

	Post monsoon	Co 89003, Co 0238, CoH 160, Co 0118 Co 05011, CoP 84212 & Co J 85	Stalk borer	4.0-12.8	More infestation in mismanaged fields
			Root borer	4.3-14.1	-
			White grub	1-2 grubs/m^2	Grub damage more in sandy soils
			Pyrilla	0.2-1.1 nymphs/ adults/leaf	-
			Epiricania melanoleuca	1.2cocoons/leaf	-
			Black bug	4.0-11.2 bugs/whorl	Infestation in plant & ratoon crop.
			Top borer	4.3-39.5	-
Yamuna Nagar	Pre-monsoon	Co 89003, Co 0238 & CoH 160	Thrips	2.0-13.5 % infested leaves	Infestation under drought conditions
			Shoot borer	2.5-20.8	-
			Black bug	4.0-12.5bugs/whorl	Infestation in ratoon crop
	Monsoon	Co 89003, Co 0238, CoH 160, Co 05011 & Co 0118	White grub	1-4 grubs/m^2	Grub damage more in sandy soils
			Webbing mite	20-67 % leaves infested	Heavy damage in border of field
			Whitefly	4-11 nymphs & puparia/2.5 cm^2	-
			Black bug	3.5-16.7 bugs/whorl	Infestation in plant & ratoon crop
			Top borer	5-35 % infestation	-
Shahbad	**Pre-monsoon**	**Co 89003, Co 05011, Co 0238 & CoH 160**	Shoot borer	3.5-24. 5 infested shoots	-
			Black bug	2.0-15 bugs/whorl	-

			Top borer	1.0-5.0 % infestation	-
	Monsoon	**Co 0238, CoH 160, Co 05011 & Co 89003**	Top borer	7.5-20.0% infestation	Severe damage in Co 0238
			Webbing mite	8-55 % leaves infested	-
			Whitefly	2-15 nymphs & puparia/2.5 cm^2	Heavy damage in water logged fields
			Pyrilla	1-2 nymphs & adults/leaf	-
			Epiricania melanoleuca	2-4 cocoons/ leaf	-
Sonepat	Pre-monsoon	Co 89003, Co 0118, Co 0238 & CoH 160	Black bug	3.2-9.4 bugs/whorl	-
			Shoot borer	2.0-23.5 %	-
Panipat	**Monsoon**	**Co 89003, CoH 160 & Co 0238**	Black bug	2-8 bugs/whorl	Infestation in ratoon crop
			Top borer	4.0-26.5 infested plants	Heavy damage in Co 0238
Rohtak	**Monsoon**	**Co 89003, Co 0118, CoH 160 ,CoH 119 & Co 0238**	Black bug	2-12 bugs/whorl	Infestation in ratoon crop
			Top borer	5.0-42 5 infested plants	Heavy damage in Co 0238
			Whitefly	5.5-18.5 nymphs & puparia/2.5 cm^2	Heavy damage in water logged conditions
Assandh	Monsoon	Co 89003, Co 0238, CoS 88230 & CoH 160	Top borer	5.0-60.0 infested plants	Heavy damage in Co 0238
			Webbing mite	4.0-42 % leaves infested	-
			Whitefly	3.0-12.9nymphs & puparia/2.5 cm^2	More damage in water logged conditions
			Root borer	10.5-15.6	-
	Post monsoon	**Co 89003, Co 0238, CoH 160 & CoS 88230**	**Stalk borer**	6-17 5 infestation	**-**
			Pyrilla	1.5 nymphs & adults/leaf	-
			Epiricania melanoleuca	1-4 cocoons/ leaf (3.4 % parasitisation)	-

Jind	**Post monsoon**	CoH 119, Co 89003, CoH 160 & Co 05011	Stalk borer	**5-20 % infestation**	-
			Pyrilla	**1-3 nymphs & adults/leaf**	-
			Epiricania melanoleuca	**1-4 cocoons/leaf**	-

E. 30: Monitoring of insect pests and bioagents in sugarcane agro-ecosystem

PAU Regional Resaerch Station, Kapurthala

Sugarcane variety CoJ 88 was planted in 0.2 ha area and the incidence of insect pests and their natural enemies were recorded. The early shoot borer incidence started from 3rd week of April and reached its peak level of 10.5 per cent in 3rd week of May which thereafter, declined to 1.0 per cent in the 3rd week of July. The parasitoid *viz., Trichogramma* sp. and *Stenobracon* sp. were recorded as 2.0 and 2.1 per cent, respectively in the month of April and parasitoid *Stenobracon* sp. 3.5 and 2.0 per cent were recorded in the month of May and June, respectively. The top borer incidence reached to its peak level of 11.8 per cent in 3rd week of July. The bio-agents *viz., Rhaconotus* sp., *Isotima javensis* and *Stenobracon* sp. were recorded as 2.7, 2.5 and 3.5 per cent in the month of June, respectively, 4.8, 4.0 and 5.2 per cent in the month of July, respectively and 1.0, 2.0 and 2.6 per cent in the month of August, respectively. The stalk borer incidence started from 3rd week of September and reached to its peak level of 10.9 per cent in the month of November. Parasitization by bio-agents *viz.*, *Sturmiopsis inference* and *Cotesia flavipes* were observed 4.5 and 2.0 percent in the month of October, respectively and again *Sturmiopsis inference* and *Cotesia flavipes* were observed 2.6 and 2.8 percent in the month of November and 1.2 and 1.0 per cent in the month of December, respectively. The activity of pyrilla on sugarcane initiated from 3rd week of July and continued up to second fortnight of October. Activity of bio-agent *viz., Epiricania melanoleuca* 2.6, 5.4, 2.8 and 0.5 per cent parasitization were observed in the month of July, August, September and October, respectively (Table 3).

Table 3. Incidence of insect pests and bioagents in sugarcane (PAU, Kapurthala)

Month	**ercent incidence of early shoot borer**	Percent parasitism (ESB)		**Percent incidence of Top borer**	Percent parasitism (Tb)			**Percent incidence of Stalk borer**	Percent parasitism (Stb)		**Percent incidence of Pyrilla (Nymph/adult per leaf)**	Percent parasitism on Pyrilla nymph
		Trichogramma chilonis	*Stenobracon* sp.		*Rhaconotus sp.*	*Isotima javensis*	*Stenobracon* sp.		*Sturmiopsis inference*	*Cotesia flavipes*		*Epiricania melanoleuca*
15 April, 2017	3.6	2.0	2.1	-	-	-	-	-	-	-	-	-
15 May, 2017	10.5	-	3.5	1.5	-	1.2	-	-	-	-	-	-

15 June, 2017	5.2	-	2.0	8.6	2.7	2.5	3.5	-	-	-	-	-
15 July, 2017	1.0	-	-	11.8	4.8	4.0	5.2	-	-	-	4.8	2.6
15 August, 2017	-	-	-	2.3	1.0	2.0	2.6	-	-	-	8.0	5.4
15 Septem ber, 2017	-	-	-	-	-	-	1.0	2.1	1.0	-	3.5	2.8
15 October , 2017	-	-		-	-	-	-	8.3	4.5	2.0	1.0	0.5
15 Novem ber, 2017	-	-	-	-	-	-	-	10.9	2.6	2.8	-	-
15 Decemb er, 2017	-	-	-	-	-	-	-	2.6	1.2	1.0	-	-
15 January, 2018	-	-	-	-	-	-	-	1.0	-	-	-	-

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

UP COUNCIL OF SUGARCANE RESEARCH, SHAHJAHNAPUR

An experiment was conducted on sugarcane crop planted in 0.2 ha area with UP 05125 cultivars. The incidence of early shoot borer was recorded maximum 5.10% during 24th SMW followed by 4.50%, 3.10% and 2.50% during 20th, 16th and 29th SMW, respectively. The incidence of top borer was recorded maximum 5.00% during 35th SMW followed by 3.50%, 3.10%, 2.00% and 1.00% during 31st , 26th, 22nd and 38th SMW, respectively. The percent incidence of stalk borer (on cane basis) was observed to be maximum 19.50% during 43rd followed by 12.25% during 38th SMW, respectively.

The bio-agents viz., *Telenomus beneficiens, Isotima javensis, Rhaconotus scirpophagae* and *Stenbracon deesae* were recorded as major parasitoids of top borer. *Cotesia flavipes*, a larval parasitoid of stalk borer was also recorded from fields. A parasitisation of stalk borer larvae was low to modrerate . (Table 3a, b).

Table 3a: Monitoring of insect pest and natural enemies of sugarcane, (UPCSR, Shahajahanpur)

Period of observation Dates + SMW	**% incidence early shoot borer**	**% Paraitism (ESB)**		**% incidence stalk borer**	**% Parasitism (stalk borer)**
		T. chilonis	***E. annulipes***		***Cotesia flavipes***
1	**2**	**3**	**4**	**5**	**6**
18-04-17 16th SMW	3.10	-	-	-	-
19-05-17 20th SMW	4.50	-	-	-	-
16-06-17 24th SMW	5.10	-	-	-	-

21-07-17 29th SMW	2.50	-	-	-	-
23-08-17 34th SMW	-	-	-	-	-
24-09-17 38th SMW	-	-	-	-	-
27-10-17 43rd SMW	-	-	-	12.25	6.00
22-11-17 47th SMW	-	-	-	19.50	10.00

Table 3b: Monitoring of insect pest and natural enemies of sugarcane (0.2 ha area) 2017-18

Period of observation Dates & SMW	**% incidence top shoot borer**	**% Parasitism (top shoot borer)**						
		T. beneficiens	***I. javensis***	***A. flavipes***	***Rhanconotus scripophagae***	***Elasmus zehntneri***	***S. deesae***	***B. bassi ana***
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
16-04-17 16th SMW	-	-	-	-	-	-	-	-
31-05-17 22nd SMW	2.00	1.20	-	-	-	-	-	-
30-06-17 26th SMW	3.10	4.00	-	-	1.35	-	-	-
31-07-17 31st SMW	3.50	11.00	-	-	2.25	-	1.65	-
28-08-17 35th SMW	5.00	3.00	-	-	3.50	-	2.25	-
20-09-17 38th SMW	1.00	-	-	-	2.00	-	3.50	-
25-10-17 43rd SMW	-	-	-	-	-	-	-	-

ICAR-IISR, Lucknow Uttar Pradesh

Experiment on monitoring of insect pests of sugarcane was carried out with CoLk 94184. Due to termites, bud damage ranged from 8.33 to 33.33 per cent. Per cent cut end damage of sett was high but in most of the cases buds were intact. Complete sett damage was 0.5 to 1.5 % and live workers were also seen (5 to 50 per sett).

Incidence of top borer II, III and IV brood was 9.01 to 18.85, 10.20 to 19.62 and14.03to 23.16 percent, respectively. Incidence of root borer was 18.18 to 48.00 per cent in July and in the month of September it was 35.71 to 62.96 per cent.

Incidence of internode borer was low while the incidence of stalk borer is on increasing trend. The incidence of *Pyrilla perpusilla* was low and its adult and nymph parasitoid, *Fulgoraesia* (*Epiricania) melanoleuca* was active. Mealy bug and black bugs were present in every clump. Parasites like *Telenomus beneficiens* (80.0 % on egg mass basis). Total parasitisation of top borer was 41.43 %. due to *Stenobracon* sp. (5.76%), *Rhaconotus* sp. (8.81%) and *Isotima javensis* (26.86%) and predatory fauna comprising of Coccinellids, spiders and ants were noticed active in the field at different stages of the crop.

Table 1: Incidence of different insect pests of sugarcane, (ICAR-IISR, Lucknow)

Top borer

Period of Observation	Incidence of top borer (%)	% parasitisation (Top borer)								
		T. japonicum	*T. chilonis*	*T. beneficiens*	*I. Javensis*	*Cotesia flavipes*	*Rhaconotusscirpophagae*	*Elasmus zehntneri*	*S. desae*	*B. bassiana*
1	2	3	4	5	6	7	8	9	10	11
II brood 10-05-17(19th week)	9.01-18.85	-	-	40.0 on egg mass basis	-	-	-	-	0.0	-
III brood 10-06-17 (23rd week)	10.20-19.62	-	-	36.67 On egg mass basis	26.86 (Range 15.38-40.0)	-	8.81 (Range 3.85-19.23)	-	5.76 (Range3.85-12.0)	-
IV brood 17-09-2017(38th week)	8.87-23.17	-	-	11.11 On egg mass basis	8.88 (Range 4.16 - 15.38)	-	36.50 (Range 25.10-53.33)		2.93 (Range 3.86.67)	-

Internode and root borer

Period of Observation	Incidence of internode borer	**% parasitisation**				Period of Observation	Incidence of Root borer	% parasitisation		
		T. chilonis	*T. japonicum*	*Cotesiaflavipes*	*B. bassiana*			*T. chilonis*	*Cotesiaflavipes*	*B. bassiana*
1	2	3	4	5	6	1	2	3	4	5
19-08-17(33rd week)	8.01	-	-	Traces	-	7-7-17	33.86	-	-	-
-	-	-	-	-	-	7-9-17 (I Week)	47.57	-	-	-

Stalk borer and Mealy bug

Period of Observation	Incidence of stalk borer	**% parasitisation**				Period of Observation	Incidence of Mealy bug	% parasitisation		
		T. chilonis	*T. japonicum*	*Cotesiaflavipes*	*B. bassiana*			*T. chilonis*	*Cotesiaflavipes*	*B. bassiana*
1	2	3	4	5	6	1	2	3	4	5
18-08-17(33rd week)	11.43	-	-	-	-	10-10-17	100.0 on cane basis	-	-	-

Pyrillaperpusilla

Period of Observation	Incidence of P. perpusilla			% Parsitisation				
	No. of adults/leaf	No. 0f nymphs /leaf	No. of egg mass/leaf	*Epiricaniamelanoleuca*			Tetrastichuspyrillae	Lestrodryinuspyrillae
				Cocoon	Egg mass	Adults	% parasitisation On egg mass basis	% parasitisation On egg mass basis
1	2	3	4	5	6	7	-	-
20-07-2017 (29th Week	0-1	-	-	-	-	-	-	-
22-08-2017 (34th Week)	0-2	1-2	0-1	1-2	0-1	1	-	-
10-10-17 (41Week)	traces	2-3	-	2-3	-	2	-	-

Termite

Period of Observation	Incidence of termites			
	Bud Damage (%)	Cut End Damage (%)	Sett damage (%)	Live termites (No./ha)
1	2	3	4	5
11-04-2017 (18th Week	27.16	35.09	14.58	40000

SBI-RC, Karnal

An experiment with sugarcane variety, Co 0238 was carried out and monitored the incidences of major insect pests and their bio agents of sugarcane at regular interval. Pink borer emerged a new insect pest of sugarcane.

The cumulative incidence of pink borer right from shoot stage to harvest of the crop was 45.0 per cent. Root borer and termite incidence was 26.6 and 7.0%, respectively. Stalk borer incidence, intensity and infestation index were 39.6%, 8.5% and 3.4, respectively. The Pyrilla population was 2.0 individual/20 leaf. Among bio agents, About 22.3 per cent parasitization of *Pyrilla perpusilla* was obsercved dueto *Epiricania melanoleuca*. *Tetrasticus pyrillae,* an egg parasitoid of pyrilla, parasitized 28.3 per cent egg masses. Parasitisation dueto larval parsitoides was low.

Prevalence of Insect pests of sugarcane and their bio- agents, (SBI-RC, Karnal)

S.No.	Insect-pests	Incidence / Population	Bio- agents	Parasitisation (%)
1.	Early shoot borer	3.3 %	-	-
2.	Top borer	2.6%	*Isotima javensis*	1.2 (Larvae)
			Stenobracon deesae	0.6(Larvae)
3.	Stalk borer	incidence - 39.6 % intensity - 8.5 % Infestation index - 3.4	*Cotesia flavipes*	9.3(Larvae)
4.	Root borer	26.6%	-	-
5.	Pink borer	45.0%	-	-
6.	Pyrilla	(2.0 individual/20leaves).	*Epiricania*	22.3 (Nymph and

			melanoleuca	adults)
			Tetrasticus pyrillae.	28.3 (eggs)
7.	Termite	7.0	-	-
8.	Black bug	1.7(Nymph &Adult)/leaf	-	-

CCSHAU, RRS, UCHANI, KARNAL

Experiment was laid out with Co 0238 is spring season. Incidence of pink borer was observed in April (6.4%), May (4.6%) and June (6.6%). Incidence o top borer II, III and IV brood was 26.2, 34.3 and 34.6 per cent, respectively. Incidence of stalk borer was low The incidence of root borer was noticed during month of July (7.2 %). During October its population reached 10.5 per cent and there after population of root borer increased gradually and reached to a maximum of 14.2 per cent during month of March.

Incidence of thrips, black bugwas low during premonsoon period. Leaf hopper, *Pyrilla perpusilla* was noticed to begin in May and remained in the crop till December. Whitefly appeared in end of July and its population was recorded 1.8 nymphs and puparia/2.5 sq. cm^2 and reached to a maximum of 2.1 nymphs and puparia/2.5 sq. cm^2 during August, 2017. Similarly, webbing mite also appeared during monsoon season in July with incidence (3.2 % infested leaves) and increased slowly to a mean per cent webbing leaves of 6.5 during month of August and subsequently declined to 0.3 per cent in November.

A natural parasitism (2.7 %) of whitefly was also recorded by *Encarsia* sp. The leaf hopper infested sugarcane field received about 1.8 per cent parasitism by *Epiricania melanoleuca.* The parasitism build up by *Tetrastichus pyrillae* was also observed during first fortnight of July (1.6 per cent). Parasitisation of top borer, stalk borer larvae was observed dueto *Isotima javensis, Cotesia flavipes and Beauveria bassiana*

Table 3.1: Incidence of insect-pests during, (RRS, Uchani, Karnal)

Period of observation	**Mean incidence (%)**					**Mean number**		**Mean leaf incidence (%)**		**Mean number/ 2.5 sq.cm**
	Pink stem borer	**Shoot borer (cumulative)**	**Top borer**	**Stalk* borer**	**Root borer**	**Black bug/ central whorl**	**Pyrilla / leaf**	**Webbing mite**	**Thrips**	**White fly**
March,2017	-	-	-							
April, 2017	6.4	1.2	-	-	-	-	-	-	-	-
May, 2017	-	4.6	4.8	-	-	1.0	0.6	-	3.4	-
June, 2017	-	6.6	7.4	-	-	1.8	-	-	3.8	-
July, 2017	-	3.2	26.2	0.4	7.2	2.0	1.0	3.2	-	1.8
August, 2017	-	-	34.3	0.5	8.3	2.3	1.2	6.5	-	2.1
September, 2017	-	-	34.6	0.6	9.6	1.5	1.4	6.1	-	1.6
October,2017	-	-	-	0.8	10.5	1.3	1.1	2.1	-	1.0
November, 2017	-	-	-	0.9	11.6	0.4	0.9	0.3	-	0.5
December,2017	-	-	-	0.9	12.8	-	1.0	-	-	0.2
January,2018	-	-	-	1.0	13.2	-	-	-	-	-
February,2018	-	-	-	1.3	13.9	-	-	-	-	-
March,2018	-	-	-	1.3	14.2	-	-	-	-	-

*Infestation Index

Table 3.2: Natural enemy complex of *Pyrilla perpusilla,* (RRS, Uchani, Karnal)

	Per cent parasitisation			
Period of observation	***Cheiloneurus pyrillae***	***Tetrastichus pyrillae***	***Epiricania melanoleuca***	**Total parasitism**
1-15 May,2017	-	-	-	-
16-31 May, 2017	-	-	1.8	1.8
1-15 June,2017	-	-	-	-
16-30 June, 2017	-	-	-	-
1-15 July, 2017	-	1.6	1.1	2.7
16-31 July, 2017	-	12.4	1.2	13.6
1-7 August, 2017	1.2	8.7	3.8	13.7
8-15August, 2017	2.3	11.3	9.4	23.0
16-23 August, 2017	5.6	12.5	6.4	24.5
24- 31August, 2017	8.4	17.4	9.6	35.4
1-7 Sept, 2017	12.6	10.7	13.5	36.8
8-15 Sept, 2017	12.7	13.4	22.4	48.5
16-23 Sept, 2017	15.5	5.7	40.2	61.4
24-30 Sept, 2017	9.8	7.3	29.2	46.3
1-7 October, 2017	5.1	2.1	34.2	41.4
8-15 Oct, 2017	1.9	-	39.3	41.2
16-23 Oct, 2017	-	-	45.3	45.3
24-31 Oct, 2017	-	-	55.4	55.4
1-7 November, 2017	-	-	46.8	46.8
8-15 November, 2017	-	-	21.2	21.2
16-23 Nov, 2017	-	-	10.4	10.4
24 Nov-01 Dec, 2017	-	-	5.3	5.3
02 Dec -09 Dec, 2017	-	-	-	-

Table 3.3: Natural enemy complex of sugarcane pests, (RRS, Uchani, Karnal)

Insect-pest	**Stage**	**Natural enemies**	**Parasitism (%)**
Top borer, *Scirpophaga excerptalis*	Egg	*Trichogramma chilonis*	1.7
Stalk borer, *Chilo auricilius*	Egg	*Trichogramma chilonis*	3.2
Top borer, *Scirpophaga excerptalis*	Larva	*Isotima javensis* *Cotesia flavipes* *Beauveria bassiana*	3.4 6.4 4.2
Stalk borer, *Chilo auricilius*	Larva	*Sturmiopsis inferens* *Cotesia flavipes* *Beauveria bassiana*	3.2 5.1 3.2
Root borer, *Polychola (Emmalocera) depressella*	Larva	*Beauveria bassiana*	2.4
Whitefly,*Aleurolobus* sp.	Nymph	*Encarsia sp.*	2.7

E. 34 : Standardisation of simple and cost effective techniques for mass multiplication of sugarcane bio-agents

ICAR-IISR, Lucknow Uttar Pradesh

Eumicrosoma spp. (Hymenoptera : Scelionidae) is a potential egg parasitoid of black bugs of sugarcane, *Cavelerioussweeti* Myamoto and *Dimorphopterusgibbus* and other Hemipteran insect pests of loan grass. *Eumicrosoma* spp. is mass multiplied inth laboratory on laboratory reared black bugs of sugarcane.

Rearing of black bug, *Dimorphopterusgibbus* (Fabricius) and *CaveleriusSweeti*Myamoto

Rearing of black bug completes in to two steps.

Muslin bag for oviposition: A muslin bag measuring 20.0 x 8.0 cm was developed. Three to four cut topes of sugarcane with 5 cm leaf portion are kept in a muslin bag and field

collected male & female (1:1) are released into the bag. In one bag 50 pairs of insect can be accommodated and begs are kept in tray for egg laying. Eggs are collected daily and stored in homoeopathic vials.

Paper cone for nymph development: Paper cone was developed from a sterilized paper of 25 cm^2 size and cut cane (8-10) with leaf sheath. One such cut piece of sugarcane stalk was placed at the lower left corner of the paper and rolled in a manner that it takes the shape of cone without touching the upper end of cut stalk. Narrow end of the paper cone was tightened with the help of rubber bands.

Mature egg (orange in colour) or freshly hatched nymphs are released to the paper cone and its upper broader end is closed by folding twice and inserting the rear corner of the second fold into the first one. Incubation, nymphal and total period of lifecycle varied from 7.0 to 10, 24 to 36, 31 to 60 days, respectively (Table-1).

Table -1: Duration of different life stages of *Dimorphopterus gibuus* on natural food, ICAR-IISR, Lucknow

Duration	Incubation period (days)	Nymphal period (Days)	Total period (days
February-March	7-8	25-27	32-35
April-May	8-9	25-27	33-36
June -July	7-8	25-29	32-37
August- September	7-8	24-28	31-36
October -November	8-9	27-30	35-39
December-January	9-10	45-50	54-60

Mass multiplication of *Eumicrosoma*sp (Hymenoptera: Sceilionidae) an egg parasitoid of Lygaeid bugs of sugarcane

Fresh eggs (fresh or 24 hour old) are offered to the gravid female in homoeopathic vials for parasitization. Parasitized eggs became blackish in colour from one end and in few days turned completely black to shiny black just before hatching. No superparasitism was observed Parasitization ranged from 38.00 to 80.00 percent. Single gravid female could parasitize on an average of 15.67 eggs with a range of 5-22 eggs. Development period of prasitoid varies from 7-11 days. Parsitisation and longevity of adults varies from 62.5 to 91.50 per cent and 1-3 days, respectively (Table-2).

Table-2: Parasitisation by *Eumicrosoma* spp. and its development ICAR-IISR, Lucknow

Duration	Parasitisation (%)	Development period (Days)	Adult emergence (%)	Longevity of Adults (Days)
February	38-41	10-11	75.00	2-3
March	43-53	8-9	75.00	2-3
April	49-55	8-9	62.8	2-3
May	39-45	8-9	65.5	1-2
June	45-53	8-9	62.5	1-2
July	55-67	8-9	71.00	2-2.5
August	55-60	7-8	80.5	2-3
September	74-80	7-8	82.50	2-3.5
October	71-75	7-9	75.50	2-2.5
November	49-53	8-9	62.89	2.2.5
December	38-45	9-11	91.50	1.5-2
January	Low	9-11	80.75	1-1.5

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***Trichigramma chilonis* for top borer *(Scirpophaga excerptalis)* and stalk borer *(Chilo auricilius)* management:**

Mass multiplication of egg parasitoid, *Trichogramma chilonis* on eggs of *Corcyra cephalonica that reared on* coarsely milled maize grains. About 821 *Tricho* cards (*Trichogramma chilonis*) were prepared and supplied to 94 cane growers for use of against stalk borer *(Chilo auricilius)* management (Table 4.1).

Table 4.1: Production of bio-agents, (RRS Uchani,Karnal)

Month	*T. chilonis* cards supplied (no.)	No. of farmers	cocoons of *E. melanoleuca* produced(no.)	No egg masses	No. of farmers
June,2017	2	1	0	0	0
July,2017	138	22	0	0	0
August,2017	284	34	0	0	0
Sept,2017	385	32	2026	122	37
Oct,2017	12	5	2274	237	29
Nov,2017	0	0	48	16	2
Dec,2017	0	0	0	0	0
Total	821	94	4348	375	68

***Epiricania melanoleuca* for sugarcane leaf hopper, *Pyrilla perpusilla* management**

Nymphal and adult parasitoid, *Epiricania melanoleuca* of sugarcane leaf hopper, *Pyrilla perpusilla* was also mass multiplied in laboratory and supplied to cane growers for release in sugarcane fields. (Table 4.1).

E.38: Formulation and validation of IPM module of sugarcane insect pests

PAU, Regional Resaerch, Station, Kapurthala

An experiment was conducted in 0.4 ha of sugarcane (0.2 ha for IPM block and 0.2 ha farmer's practice block with isolation distance of 100 meter) for formulation and validation of IPM module for the management of sugarcane insect pests. Major insect pest of sugarcane along with yield, growth (Germination %, number of tillers, number of millable cane, total cane height, millable cane height, girth of cane and number of internode) and quality (brix%, sucrose%, purity%, CCS%) parameters were recorded (Table 4 and 4.1). The incidence of insect pests was low (Table 4).

Overall result indicated that insect pests attack was less in IPM block as compared to farmer practices block due to cane growth, quality parameters and yield was more in IPM block as compared to farmer practices block.

Table 4. Formulation and validation of IPM Module of sugarcane inset-pests (PAU, Kapurthala)

Insect	T1: IPM Block	TII: Farmers practice block
Borer infestation (%)		
Early shoot borer	2.58	6.30
Top borer	1.15	8.90
Stalk borer (infestation	0.08	0.18

index)		
Sucking pests*		
Black bug	0.21	0.35
Whitefly	0.35	2.20
Mite	3.10	6.78
Pyrilla	1.16	2.10

*Black bug : Nymph&adult/whorl; Whitefly : Nymph & puparia/2.5 sq. cm.; Webbing mite : infested leaves(%); Pyrilla : Nymphs & adults/leaf.

Table 4.1 Data of cane growth, yield and quality parameters in IPM block and farmers' practice block during 2017-18

Parameters	**T1: IPM Block**	**TII: Farmer practices block**
Growth parameters		
Germination (%) at 45 DAP	54.82	53.29
Number of tillers (000/ha) 120 DAP	89.64	83.24
Number of millable cane ('000/ha)	82.80	78.58
Total cane height (cm)	263.50	260.30
Millable cane height (cm)	240.21	235.61
Girth of cane (cm)	2.20	2.17
Number of internodes	20.23	19.98
Quality parameters		
Brix (%)	19.97	19.40
Sucrose (%)	17.82	17.35
Purity (%)	89.26	89.43
CCS (%)	12.38	12.07
Cane yield		
Cane yield (t/ha)	80.33	71.45

UP COUNCIL OF SUGARCANE RESEARCH, SHAHJAHNAPUR

The experiment was conducted on half acre plot size with UP 05125 as a treated and half acre plot as untreated both the plots were separated by keeping 100 meter distance. All the IPM module of sugarcane insect pests was adopted in treated plot. The IPM treatments included deep ploughing for exposure of white grub predation, planting of healthy cane setts treated for 2 minutes in the solution of chlorpyriphos 25% EC @ 40 ml in 10 liter of water, soil application of chlorantraniliprole 0.4G @ 22.5 kg/ha at the time of planting, collection and destruction of egg masses and damaged shoots, setting up of sex pheromone traps two week of planting @ 27/ha (lure changed at on interval of 45 days), spraying of chlorantraniliprole 18.5 SC @ 375 ml/ha at 60 DAP, detrashing of lower leaves, removal of egg masses of pyrilla and infested canes at 90 days, detrashing of lower leaves after 150 days & spraying of clothianidin 50 WDG @ 250 gm/ha after detrashing lower leaves. The untreated block was raised under farmer's practice.

The IPM block recorded 64.11 percent germination against 52.00 percent in untreated block. Incidence of shoot borer, top borer and stalk borer weas low. The IPM block recorded higher number of tillers (129000/ha), millable canes (109000/ha) and cane yield (71.8 MT/ha) against 109000, 97000/ha and 63.6 MT/ha, respectively in the untreated block.

The increase in cane yield in IPM was 23.88 percent higher over untreated block. Regarding the growth attributes the IPM block recorded higher total cane height (2.79 m) millable cane height (1.94 m), number of internodes (24) and cane girth (1.58 mm) against 2.78, 1.87 and 23 in untreated block respectively. In IPM block the sucrose percent in juice was recorded 17.89 against 17.43 in untreated block. Table 4 (1 a,b,c,d)

Table4(a): Formulation and validation of IPM module sugarcane insect-pests (UPCSR, Shahjahanpur).

S.N.	Treatments	%Ger.	Tillers/ha (000)	NMC/ha (000)	Yield MT/ha
1	I P M Block	64.11	129	109	718
2	Farmer Practice	52.00	109	97	636

Table4(b): Moth catches of borer complex of Sugarcane through lure at Shahjanpur (UPCSR, Shahjahanpur).

	Moth trapped		
Month	**Shoot borer**	**Top borer**	**Stalk borer**
March 2017	01	05	04
April 2017	10	07	06
May 2017	15	10	08
June 2017	08	07	12
July 2017	05	13	14
August 2017	02	03	15
September 2017	_	02	18
October 2017	_	_	02

Table4(c): Formulation and validation of IPM module sugarcane insect-pests (UPCSR, Shahjahanpur)

S.N.	Treatments	. Growth parameter				Quality parameter
		Total cane height (m)	Millable cane height(m)	Number of inter nodes	Cane girth (mm)	Sucrose (%) in juice
1	I P M BLOCK	2.79	1.94	24	1.58	17.89
2	Farmer Practice	2.78	1.87	23	1.55	17.43

Table4(d) Title: Formulation and validation of IPM module sugarcane insect-pests

Insect-pest	% Incidence of Insect-Pest	
	I P M Block	Farmer Practice
Shoot bore r (Cumulative)	2.03	6.21
Top borer (3nd brood)	2.00	2.88
Top borer (4th brood)	2.55	4.48
Top borer (At harvest)	4.67	7.33
Stalk borer (Infestation index)	0.90	1.04

CCSHAU, RRS, UCHANI, KARNAL

A field experiment was conducted with variety CoH 167during 2017-18 crop season in 0.4 ha. of sugarcane (each for IPM and farmers' practice) for formulation and validation of IPM module for management of sugarcane insect-pests. All recommended package of practices were followed in both plots except pest management practices. Insect-pest management was done as per protocol of AICRP. Observations on insect-pests was recorded as per AICRP protocol.

Table 5.1: Incidence of insect-pests in IPM block and farmers' practice fields in sugarcane during, (RRS, Uchani, Haryana)

Insect	**T1: IPM Block**	**TII: Farmers practice of the Zone**
Borer infestation (%)		
Pink stem borer	1.02	1.74
Early shoot borer	3.38	8.85
Top borer	1.62	16.78
Root borer	4.53	9.26
Stalk borer (infestation index)	0.41	1.34
Sucking pests*		
Black bug	0.44	0.61
Thrips	0.53	0.75
Whitefly	0.45	5.34
Webbing mite	4.29	26.47
Pyrilla	0.20	1.64
Epiricania melanoleuca	1.54	0.87

***Black bug :Nymph&adult/whorl; Thrips : infested leaves(%); Whitefly : Nymph & puparia/2.5 sq. cm.; Webbing mite : infested leaves(%); Pyrilla : Nymphs & adults/leaf; *Epiricania melanoleuca :* cocoons/leaf.**

Table 5.2: Observations on growth, yield and quality parameters in IPM block and farmers' practice fields in sugarcane, (RRS, Uchani, Haryana)

Parameters	**T1: IPM Block**	**TII: Farmer practices of the Zone**
Growth and yield parameters		
Germination (%) at 40 DAP	57.5	56.4
Number of tillers(000/ha) 120 DAP	126.4	123.2
Number of millable cane ('000/ha) 360 DAP	114.4	108.5
Quality parameters at 360 DAP		
Brix(%)	20.72	19.84
Purity(%)	90.64	87.78
CCS(%)	12.81	12.48
Sucrose (%)	19.43	18.52
Cane yield		
Cane yield (t/ha)	92.6	81.2

Incidence of pink borer, early shoot borer and root borer was low. Top borer infestation (II brood) was.62 per cent in IPM block as against 16.78 per cent in farmers' practice field. Infestation by sucking insect-pests was reported comparatively low in IPM

block as compared to farmers practice. Whitefly infestation was reported 0.45 nymph & puparia/2.5 sq. cm in IPM block as compared to high population of 5.34 nymph & puparia/2.5 sq. **cm** in farmers' practice block. Similarly leaf infestation by webbing mite was recorded 4.29 per cent in IPM block as compared to 26.47 per cent in farmers' practice block. Results indicate that there was no significant difference in germination both of the blocks. Number of tillers recorded at 120 DAP indicate that 126.4 (000/ha) tillers were recorded in IPM block as compared to 123.2 (000/ha) tillers in farmers' practice block. Observations on number of millable canes at 360 DAP indicate that 114.4 (000/ha) canes were recorded in IPM block as compared to 108.5 (000/ha) canes in farmers' practice block. Cane yield was 92.6 t/ha in IPM block and 81.2 t/ha in farmers' practice block.

North Central East Zone

E. 4.1: Evaluation of varieties for their reaction against major insect pests.

SUGARCANE RESEARCH INSTITUTE, PUSA

Forty varieties/genotypes compressing of 11 IVT. E, 6 AVT E 1P, 12 IV T M, 6 AVT M IIP, and 5 AVT, E, IIP including standard check were evaluated against root, shoot, top and stalk borer at SRI, Pusa (Table 1-1d).

The cumulative incidence of early shoot borer was recorded as lowest (6.60%) in variety CoSe 01421 AVT E IP and highest (16.50%) in variety CoLK 12209 AVT M IIP . The genotypes tested under different maturity groups are graded under less to moderately susceptible reaction against early shoot borer. While, incidence of root borer was found minimum (6.80%) in variety CoSe 14451 IVT E and maximum (9.75%) in variety CoLK 94184 AVT E IP graded as less susceptible reaction. The incidence of top borer was recorded as less to moderate being 7.00% in variety CoP 06436 IVT M and 12.00% in variety CoP 14436 IVT E against 4^{th} brood of top borer. All the genotypes evaluated under different maturity groups exhibited less to moderately susceptible reaction against top borer based on 4^{th} brood incidence. The stalk borer infestation index was varied from untraceable to 1.00 per cent and showed less susceptible reaction for all tested gentoypes.

Table .1: E. 4.1 Evaluation of zonal variety/genotypes of reaction against borer pest of sugarcane (SRI, PUSA)

S. N.	Varieties/ genotypes	Early shoot borer (% incidence)						Top borer (% incidence)			Stalk borer				Root borer % incidence	Reaction
		30 DAP	60 DAP	90 DAP	120 DAP	Cumm	Reaction	III brood 5th month	IV Brood 7th month	*Reaction	% incidence	% intensity	Infestation index	Reaction		
IVT (Early) 8+3																
1	CoP 14436	1.50	11.5	10.20	4.85	12.30	LS	8.75	12.00	MS	0.00	0.00	0.00	LS	7.15	LS
2	CoP 14437	0.00	9.00	6.70	5.00	10.10	LS	8.10	9.10	LS	3.00	2.15	0.80	LS	7.60	LS
3	CoSe 14451	11.25	8.85	6.35	7.00	14.00	LS	8.40	7.80	LS	0.80	0.70	0.10	LS	6.80	LS
4	CoSe 14453	7.35	9.50	8.00	5.60	15.70	MS	8.65	9.50	LS	1.80	1.20	0.12	LS	7.90	LS
5	CoSe 14454	6.00	7.00	6.95	5.85	10.25	LS	7.90	11.00	MS	1.00	1.00	1.00	LS	6.95	LS
6	CoLK 14206	8.10	9.50	8.15	6.75	15.90	MS	8.10	9.25	LS	2.90	1.35	1.00	LS	7.60	LS
7	CoLK 14207	7.20	7.25	6.95	7.00	10.30	LS	7.80	9.00	LS	1.70	1.65	0.80	LS	8.10	LS
8	CoBLN14501	6.95	5.70	6.20	7.80	11.20	LS	8.10	8.50	LS	1.95	2.60	1.0	LS	9.00	LS
9	CoSe 01421(Std.)	6.50	8.00	7.85	6.65	11.35	LS	8.10	7.90	LS	0.12	0.90	0.00	LS	6.70	LS
10	CoLK 94184 (Std.)	7.20	7.50	5.10	5.10	14.50	LS	6.00	8.25	LS	0.04	0.44	0.02	LS	7.15	LS
11	CoSe 95422 (Std.)	6.50	8.00	8.00	7.20	15.80	MS	7.85	10.70	MS	0.12	0.80	0.00	LS	8.20	LS

***Reaction based on 4th brood percent incidence**

Table .1a: E. 4.1 Evaluation of Zonal variety/genotypes of reaction against borer pest of sugarcane, (SRI, PUSA)

S.N.	Varieties/genotypes	Early shoot borer (% incidence)						Top borer (% incidence)			Stalk borer				Root borer % incidence	Reaction
		30 DAP	60 DAP	90 DAP	120 DAP	Cumm	Reaction	III brood 5th month	IV Brood 7th month	*Reaction	% incidence	% intensity	Infestation index	Reaction		
AVT (Early) 1st plant 3+3																
1	CoSe 13452	0.00	6.70	6.40	2.10	6.65	LS	6.85	8.10	LS	0.00	0.00	0.00	LS	7.40	LS
2	CoP 13437	5.20	6.85	6.25	4.35	15.90	MS	7.50	11.15	MS	2.50	2.35	0.15	LS	7.30	LS
3	CoSe 13451	0.10	7.60	6.90	1.80	8.50	LS	7.20	9.80	LS	0.70	2.85	0.10	LS	7.75	LS
4	CoLk 94184 (Std.)	0.00	8.90	8.30	2.80	14.30	LS	7.35	7.80	LS	0.10	4.15	0.10	LS	9.75	LS
5	CoSe 95422 (Std.)	11.90	13.25	7.00	1.90	15.90	MS	8.20	9.80	LS	4.90	7.70	0.15	LS	9.70	LS
6	CoSe 01421(Std.)	3.20	4.80	6.00	3.95	6.60	LS	7.80	9.00	LS	3.90	3.00	0.00	LS	8.70	LS

***Reaction based on 4th brood percent incidence**

Table .1b: E. 4.1 Evaluation of zonal variety/genotypes of reaction against borer pest of sugarcane, (SRI, PUSA)

S. N.	Varieties/genotypes	Early shoot borer (% incidence)						Top borer (% incidence)			Stalk borer				Root borer % incidence	Reaction
		30 DAP	60 DAP	90 DAP	120 DAP	Cumm	Reaction	III brood 5th month	IV Brood 7th month	*Reaction	% incidence	% intensity	Infestation index	Reaction		
IVT (Midlate) 9+3																
1	CoP 14438	9.70	10.25	8.10	1.50	12.75	LS	6.90	7.60	LS	0.80	1.10	0.01	LS	7.50	LS
2	CoP 14439	8.90	8.00	7.20	2.95	11.50	LS	8.90	9.10	LS	0.75	1.25	0.01	LS	8.90	LS
3	CoSe 14452	1.35	10.15	7.50	2.50	9.60	LS	8.35	9.00	LS	4.50	7.10	0.38	LS	8.30	LS
4	CoSe 14455	2.75	11.70	11.30	5.80	15.10	MS	8.50	9.10	LS	3.20	1.50	0.45	LS	7.95	LS
5	CoSe 14456	10.15	9.50	10.00	2.50	10.60	LS	7.00	7.60	LS	0.75	1.10	0.01	LS	7.30	LS
6	COBLN 14502	6.60	8.60	9.00	2.80	15.35	MS	8.10	10.50	MS	2.35	2.00	0.15	LS	8.70	LS
7	COLK 14208	5.00	7.30	8.10	3.10	11.20	LS	7.30	8.10	LS	3.00	2.85	0.90	LS	7.60	LS
8	COLK 14209	6.75	7.00	9.10	2.15	7.80	LS	6.20	6.85	LS	2.00	3.15	1.00	LS	8.70	LS
9	COLK 14210	8.90	9.00	8.35	3.10	9.00	LS	6.35	7.10	LS	3.00	2.35	0.85	LS	9.00	LS
10	CoP 06436 (Std.)	7.70	8.10	8.00	2.00	7.35	LS	8.10	7.00	LS	2.00	1.85	1.00	LS	8.70	LS
11	BO 91 (Std.)	1.08	8.20	7.00	2.50	12.60	LS	7.50	10.00	LS	1.90	2.50	0.10	LS	9.50	LS
12	CoP 9301 (Std.)	9.30	6.70	6.90	5.00	13.50	LS	8.10	11.10	MS	3.25	2.50	0.15	LS	9.30	LS

***Reaction based on 4th brood percent incidence**

Table .1c: E. 4.1 Evaluation of zonal variety/genotypes of reaction against borer pest of sugarcane, (SRI, PUSA)

S.N.	Varieties/genotypes	Early shoot borer (% incidence)						Top borer (% incidence)			Stalk borer				Root borer % incidence	Reaction
		30 DAP	60 DAP	90 DAP	120 DAP	Cumm	Reaction	III brood 5th month	IV Brood 7th month	*Reaction	% incidence	% intensity	Infestation index	Reaction		
IVT (Midlate) 4+2																
1	CoP 12438	6.00	6.10	5.80	1.50	10.10	LS	7.20	9.10	LS	1.60	3.40	0.50	LS	9.50	LS
2	CoSe 12453	7.00	8.20	7.00	1.35	9.50	LS	7.30	10.70	MS	2.10	0.15	0.02	LS	9.80	LS
3	COLK 12209	10.20	9.80	8.70	3.00	16.50	MS	8.70	8.35	LS	0.10	1.05	0.00	LS	9.90	LS
4	COLK 09204	1.00	8.10	7.10	2.10	9.00	LS	7.30	11.00	MS	0.10	0.75	0.05	LS	9.95	LS
5	BO 91 (Std.)	1.10	9.20	7.20	1.95	11.95	LS	8.25	9.80	LS	0.25	0.20	0.05	LS	9.80	LS
6	CoP 9301 (Std.)	10.20	7.50	6.90	4.25	14.00	LS	6.70	9.80	LS	2.95	3.10	0.15	LS	9.50	LS

***Reaction based on 4th brood percent incidence**

Table .1d: E. 4.1 Evaluation of zonal variety/genotypes of reaction against borer pest of sugarcane, (SRI, PUSA)

S. N.	Varieties/genotypes	Early shoot borer (% incidence)						Top borer (% incidence)			Stalk borer				Root borer % incidence	Reaction
		30 DAP	60 DAP	90 DAP	120 DAP	Cumm	Reaction	III brood 5th month	IV Brood 7th month	*Reaction	% incidence	% intensity	Infestation index	Reaction		
IVT (Early)-II Plant- 3+2																
1	CoP 12436	1.05	8.15	6.50	5.40	9.50	LS	6.20	7.50	LS	0.10	1.05	0.00	LS	7.60	LS
2	COLK 12207	2.01	8.70	7.30	6.75	11.85	LS	8.30	10.20	MS	1.10	0.80	0.00	LS	9.30	LS
3	CoSe 12451	11.50	10.50	7.30	9.00	15.30	MS	8.35	8.75	LS	3.30	1.20	0.10	LS	9.10	LS
4	BO 130(Std.)	6.10	6.85	4.50	4.25	14.50	LS	8.90	8.10	LS	2.80	4.20	0.15	LS	8.70	LS
5	CoSe 95422(Std.)	6.20	7.00	6.70	5.35	15.90	MS	7.00	8.00	LS	1.80	2.10	0.25	LS	8.50	LS

***Reaction based on 4th brood percent incidence**

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AVT (MID-LATE) 2nd PLANT

Under AVT (Mid-late) 1st plant total four varieties were evaluated viz., CoLk 09204, CoLk 12209, CoP 12438 and CoSe 12453 along with two standards (checks) BO91 and CoP 9301 against shoot, top, stalk and root borer.

All the varieties including standard showed less susceptible reaction to shoot borer. The cumulative incidence of shoot borer was recorded minimum (8.82%) in BO 91 and maximum (12.20%) in Colk 09204. At harvest, all the varieties including standard showed less susceptible to top borer. Maximum incidence (9.21%) was recorded in CoLk 09204 while it was minimum (6.72%) in CoSe 12453 respectively. Regarding the stalk borer infestation, the infestation index was recorded very low. It ranged from 0.10 in CoSe 12453 to 0.22 in CoP 9301. All the genotypes including standards showed less susceptible behaviour to stalk borer. Similarly the root borer incidence was also recorded low, which showed less susceptible to root borer (Table- 1 a, b, c).

AVT (EARLY) 1st PLANT

Under AVT (Early) 1st plant three varieties were evaluated viz., CoP 13437, Cose 13451, CoSe 13452 alongwith three standard varieties CoLk 94184, CoSe 01421 and CoSe 95422 against shoot, top, root and stalk borer.

All the varieties including standard showed less susceptible reaction to shoot borer. The cumulative incidence of shoot borer was recorded minimum (9.25%) in CoSe 13451 and maximum (11.60%) in CoSe 95422 (standard), respectively. At harvest, only two varieties viz., CoP 13437 (10.12%) and CoSe 95422 (standard) (11.28%) showed less susceptible reaction to top borer. Regarding the stalk borer infestation all the varieties including standard showed less susceptible reaction to stalk borer. It's infestation index ranged from 0.15 in CoP 13437 & CoLk 94184 (Standard) to 0.25 in CoSe 95422 (standard), respectively. All the genotypes including standards showed less susceptible behaviour to stalk borer. Similarly, the root borer incidence was also recorded low, which showed less susceptible to root borer (Table 1d, e, f,).

AVT (EARLY) 2nd PLANT

Under AVT (Early) 2nd plant three varieties were evaluated viz., CoLk 12207, CoP 12436 and CoSe 12451 alongwith two standard varieties BO130 and CoSe 95422 against shoot, top, stalk and root borer.

All the varities including standard showed less susceptible reaction to shoot borer. The cumulative incidence of shoot borer was recorded minimum (7.25%) in CoP 12436 and maximum (12.94%) in CoLk 12207. At harvest, all the varieties including standard showed moderate susceptible reaction to top borer. The incidence of top borer was recorded minimum (10.19%), in BO 130 (standard) and maximum (12.76%), in CoP 12436. Regarding stalk borer infestation, all the genotypes including standard showed less susceptible reaction. It's infestation index was recorded minimum 0.12 in CoSe 12451 to 0.25 in BO 130 (standard). Similarly all the varieties showed less susceptible behaviour to root borer also. The minimum and maximum incidence was found (3.07%) in CoLk 12207 and 4.41% in BO 130 (standard) respectively. (Table-1g, h, i).

Table- 1a. AVT (Mid-late) 2nd plant, (G.S. S B and Research Institute, Seorahi)

Sr. No.	Genotype	% incidence of ESB					No. of bored plants/ ha (on the basis of Cumulative%incidence)
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative % incidence	
1	Co lk 09204	0.00	6.57	8.14	3.20	12.20	5185.18
2	Colk 12209	0.00	7.14	9.60	3.84	13.71	5925.92
3	CoP12438	0.00	6.97	10.40	3.10	13.33	5925.92
4	CoSe 12453	0.00	3.37	6.52	2.45	9.14	3950.61
5	BO91	0.00	4.93	7.54	1.89	8.82	3703.70
6	CoP9301	0.00	6.02	10.48	2.54	12.15	5432.09
	SE	-	0.85	0.99	0.53	-	-
	CD	-	2.69	3.12	1.68	-	-

Table- 1b. AVT (Mid-late) 2nd Plant , (G.S. S B and Research Institute, Seorahi)

Sr. No.	Genotype	% incidence of top borer		
		III brood/5th month	IV brood/7th month	At harvest
1	Co lk 09204	2.33	4.63	9.21
2	Colk 12209	2.79	4.34	7.92
3	CoP12438	3.26	4.95	7.62
4	CoSe 12453	2.43	4.46	6.72
5	BO91	2.33	4.08	8.52
6	CoP9301	2.06	3.89	8.58
	SE	0.24	0.43	0.61
	CD	0.78	1.38	1.93

Table- 1c. AVT (Mid-late) 2nd Plant , (G.S. S B and Research Institute, Seorahi)

Sr. No.	Genotype	Stalk borer			Root borer
		% incidence	% intensity	Infestation index	% incidence
1	Co lk 09204	14.66	1.20	0.17	2.47
2	Colk 12209	14.66	1.26	0.18	2.15
3	CoP12438	13.33	1.09	0.14	2.24
4	CoSe 12453	10.66	0.98	0.10	2.03
5	BO91	13.33	1.21	0.16	3.02
6	CoP9301	17.33	1.29	0.22	3.47
	SE	1.40	0.14	0.03	0.64
	CD	4.41	0.44	0.08	2.03

Table- 1d. AVT (Early) 1st Plant , (G.S. S B and Research Institute, Seorahi)

Sr. No.	Genotype	% incidence of ESB					No. of bored plants/ha (on the basis of Cumulative % incidence)
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative % incidence	
1	CoP 13437	0.00	8.06	6.76	2.70	11.11	4444.44
2	CoSe 13451	0.00	5.88	5.14	2.64	9.25	3703.70
3	CoSe13452	0.00	7.04	6.32	2.97	10.92	4938.27
4	CoSe 01421	0.00	5.82	7.82	2.56	10.05	4197.53
5	Colk94184	0.00	7.24	5.59	2.40	9.49	4197.53

6	CoSe 95422	0.00	6.17	8.21	2.43	11.60	5185.18
	SE	-	1.06	1.08	0.26	-	-
	CD	-	3.36	3.43	0.81	-	-

Table- 1e. AVT (Early) 1st Plant, (G.S. S B and Research Institute, Seorahi)

Sr. No.	Genotype	**% incidence of top borer**		
		III brood/5th month	IV brood/7th month	At harvest
1	CoP 13437	3.13	5.30	10.12
2	CoSe 13451	3.12	5.55	9.47
3	CoSe13452	2.76	5.26	8.26
4	CoSe 01421	3.15	4.91	8.33
5	Colk94184	1.86	4.31	8.33
6	CoSe 95422	4.38	5.57	11.28
	SE	0.37	0.52	1.02
	CD	1.16	1.65	3.21

Table- 1f. AVT (Early) 1st Plant, (G.S. S B and Research Institute, Seorahi)

Sr. No.	Genotype	**Stalk borer**			**Root borer**
		% incidence	% intensity	Infestation index	% incidence
1	CoP 13437	14.66	1.07	0.15	4.19
2	CoSe 13451	14.66	1.26	0.18	3.07
3	CoSe13452	14.66	1.07	0.16	3.13
4	CoSe 01421	16.00	1.26	0.20	2.85
5	Colk94184	13.33	1.16	0.15	3.11
6	CoSe 95422	17.33	1.47	0.25	4.32
	SE	1.44	0.10	0.03	0.32
	CD	4.53	0.33	0.09	1.00

Table -1g. AVT (Early) 2nd plant, (G.S. S B and Research Institute, Seorahi)

Sr. No.	Genotype	**% incidence of ESB**					No. of bored plants/ ha (on the basis of Cumulative%incidence)
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative % incidence	
1	CoLk 12207	0.00	7.57	11.21	3.26	12.94	5432.09
2	CoP 12436	0.00	8.82	6.36	2.23	7.25	4938.27
3	CoSe 12451	0.00	7.46	6.71	5.26	10.52	4444.44
4	BO130	0.00	5.68	8.59	2.64	11.90	5438.27
5	CoSe 95422	0.00	7.40	6.49	2.39	10.92	4938.27
	SE	-	0.95	0.51	0.36	-	-
	CD	-	3.11	1.67	1.17	-	-

Table -1h. AVT (Early) 2nd Plant , (G.S. S B and Research Institute, Seorahi)

Sr. No.	Genotype	**% incidence of top borer**		
		III brood/5th month	IV brood/7th month	At harvest
1	CoLk 12207	2.89	5.32	11.32
2	CoP 12436	2.94	5.13	12.76
3	CoSe 12451	2.16	5.00	10.56
4	BO130	2.57	4.95	10.19

5	CoSe 95422	3.01	5.66	11.33
	SE	0.38	0.64	0.91
	CD	0.20	2.09	2.95

Table- 1i. AVT (Early) 2nd Plant , (G.S. S B and Research Institute, Seorahi)

Sr. No.	Genotype	**Stalk borer**			**Root borer**
		% incidence	% intensity	Infestation index	% incidence
1	CoLk 12207	16.00	1.38	0.22	3.07
2	CoP 12436	16.00	1.27	0.20	4.09
3	CoSe 12451	12.00	1.01	0.12	3.59
4	BO130	17.33	1.45	0.25	4.41
5	CoSe 95422	16.00	1.33	0.21	4.16
	SE	2.38	0.01	0.58	0.57
	CD	7.78	0.33	0.19	1.75

E. 28: Survey and Surveillance of insect pests of Sugarcane

SUGARCANE RESEARCH INSTITUTE, PUSA

A survey was conducted (Table -2) on the insect pests of sugarcane under different village of reserved area of Majhaulia and Hasanpur sugar factory during cropping season of 2017-18. The per cent incidence of early shoot borer (5.0 to 11.0%), root borer (2.5 to 4.5%), top borer (10.5 to 15.0 %), stalk borer below 5%, army worm (5.0 to 6.0 %) and pyrilla (8.0 to 12.0) per leaf were observed as the key pests of sugar factory reserved area of sugarcane. The incidence of other pests like Mealy bug, Termite, Grass hopper, Scale insect, White fly, etc. were also recorded in traces. Beside, sugar mills reserved areas, a roving survey was also conducted at sugarcane field in and around Pusa and SRI Museum at monthly interval. The per cent incidence of early shoot borer, root borer, top borer plassy borer and stalk borer were varied from 2.0 to 9.0%, 2.0 to 8.0 % and 5.0 to 16.0 % 9.0 to 19.0% and 1.0 to 7.0%, respectively. While, Pyrilla was observed 5-12 per leaf at Pusa Farm.

Table. 2: Survey and surveillance of sugarcane insect pests, (SRI, PUSA)

Sl No.	**Variety**	**Location**	**Name of pest**	**% Incidence**		
				Min.	**Max.**	**Average**
1	BO 130, CoSe 95422, CoP 2061, BO 153	Kalyanpur	Root borer	02	03	2.50
			Pyrilla/leaves	05	15	10.00
			Shoot borer	08	11	9.50
			Top borer	10	20	15.00
2	CoP 9301, BO 153, CoSe 95422, CoSe 14454	Madhopur	Pyrilla	08	20	14.00
			Shoot borer	08	14	11.00
			Root borer	02	09	4.50
3	BO 130, CoSe 13452	Bandra	Pyrilla	05	11	8.00
			Army warm	03	09	6.00
4	BO 91, BO 146, BO 130, CoP 2061, CoP 9301, CoSe 95422	SRI, Museum	Pyrilla	03	07	5.00
			Top borer	12.0	18.0	15.00
			Plassy borer	10.0	19.0	14.50
			Army warm	03	07	5.00
			Shoot borer	06	11.0	8.50

			Stalk borer	01	03	2.00
			Root borer	02	05	3.50
5	BO 91, BO 130, CoP 12436, CoP 14438	Jatmalpur	Army warm	05	10	7.50
			Top borer	08	16	12.0
			Shoot borer	04	10	7.00
6	CoP 2061, COLK 94184, BO 154, CoP 2061	Pusa Farm	Pyrilla	04	12	8.00
			Root borer	02	7.0	4.50
			Scale insect	02	04	3.00
			Shoot borer	02	08	5.00
			Top borer	06	15	10.50
			Stalk borer	02	07	4.50
			Plassy borer	4.0	12.0	8.00

G.S. Sugarcane Breeding and Research Institute, Seorahi – Kushinagar. U.P.-India

Survey was made in 14 different sugar factory zones viz., Seorahi, Manakapur, Balrampur, Babhanan, Sathiyaon, Dhadha, Ramkola, Goshi, Siswabajar, Khadda, Utrola, Rudhauli Tulshipur, and Partapur for key insect–pests of sugarcane. During hot weather, the incidence of early Shoot borer was low and ranged from 3.00% in Mankapur factory zone & Dhadha to 7.00% in Seorahi factory zone. The percent incidence of top borer, stalk borer and root borer was low in all surveyed factory zones. (Table-2).

E-28. Survey and Surveillance of sugarcane insect-pests in the area, (GSSBand RI, Seorahi)

Variety	**Name of Pest**	**% incidence/population**			**Remark**
		Min.	**Max.**	**Average**	
(1) Seorahi					
Co 0238, 0118, CoS 08272,08279 ,CoSe 01434,08452	Early Shoot Borer at hot weather	2	10	6.00	
	Top Borer at harvest	2	12	7.00	
	Stalk Borer at harvest	2	6	4.00	
	Root Borer at harvest	-	-	-	
	Thrips/plant	4	22	13.00	
(2) Mankapur					
Co 0238, 0118,5011,UP 05125	Early Shoot Borer at hot weather	1	5	3.00	
	Top Borer at harvest	2	6	3.00	
	Stalk Borer at harvest	3	4	3.50	
	Root Borer at harvest	-	-	-	
	Thrips/plant	5	25	15.00	
(3) Balrampur					
Co 0238, 0239, 0118,98014 CoS 88230, 91269, 97261, 767, 8436, CoSe 92423, 01434, CoLk 94184 ,UP 039	Early Shoot Borer at hot weather	2	5	3.50	
	Top Borer at harvest	1	5	3.00	
	Stalk Borer at harvest	3	8	5.50	

	Root Borer at harvest	-	-	-	
	Thrips/plant	4	18	11.00	
(4) Bhabhnan					
Co 0238, 98014, CoSe 08279, 8432, CoLk 94184, CoJ 88	Early Shoot Borer at hot weather	2	8	5.00	
	Top Borer at harvest	3	9	6.00	
	Stalk Borer at harvest	2	6	4.00	
	Root Borer at harvest	3	12	7.50	
	Thrips/plant	5	22	13.50	
(5)Sathiyav					
Co 0238, 0118, 98014 CoS 08436, 08279,CoSe 01434	Early Shoot Borer at hot weather	3	10	6.50	
	Top Borer at harvest	2	11	6.50	
	Stalk Borer at harvest	2	8	4.00	
	Root Borer at harvest	3	10	6.50	
	Thrips/plant	5	22	13.50	
(6)Dhada					
Co 0238, 0118, 98014 CoS 08436,08279, CoSe 01434	Early Shoot Borer at hot weather	1	5	3.00	
	Top Borer at harvest	2	6	4.00	
	Stalk Borer at harvest	3	8	5.50	
	Root Borer at harvest	1	5	3.00	
	Thrips/plant	4	18	11.00	
(7)Ramkola					
Co 0238,0118, 98014 CoS 08272, CoP 9301.	Early Shoot Borer at hot weather	2	12	7.00	
	Top Borer at harvest	3	14	8.50	
	Stalk Borer at harvest	2	10	6.00	
	Root Borer at harvest	-	-	-	
	Thrips/plant	5	28	11.50	
(8)Goshi					
Co 0238, 98014 CoS 97261, CoSe 01434	Early Shoot Borer at hot weather	2	8	5.00	
	Top Borer at harvest	2	10	6.00	
	Stalk Borer at harvest	1	5	3.00	
	Root Borer at harvest	2	15	8.50	
	Thrips/plant	5	28	11.50	
(9)Siswabajar					
Co 0238, 0118, 98014,CoLk 94184	Early Shoot Borer at hot weather	2	5	3.50	
	Top Borer at harvest	3	8	5.50	

	Stalk Borer at harvest	2	6	4.00	
	Root Borer at harvest	-	-	-	
	Thrips/plant	3	18	10.50	
(10)Khadda					
Co 0238,CoS 8436, 08279, CoSe 01434 ,08452, 92423, 98231 CoLk 94184.	Early Shoot Borer at hot weather	2	6	4.00	
	Top Borer at harvest	3	7	5.00	
	Stalk Borer at harvest	2	5	3.50	
	Root Borer at harvest	3	18	10.50	
	Thrips/plant	2	20	11.00	
(11)Utrola					
Co 0238 .0118 , CoLk 94184	Early Shoot Borer at hot weather	2	6	4.00	
	Top Borer at harvest	2	8	5.00	
	Stalk Borer at harvest	2	5	3.50	
	Root Borer at harvest	-	-	-	
	Thrips/plant	3	20	11.5	
(12)Rudhawli					
Co 0238, 0118,98014 CoS 08436, 08279, CoSe 01434	Early Shoot Borer at hot weather	2	7	3.50	
	Top Borer at harvest	3	13	8.00	
	Stalk Borer at harvest	2	12	7.00	
	Root Borer at harvest	3	18	10.50	
	Thrips/plant	2	12	7.00	
(13) Tulsipur					
Co 0238, 98014 CoS 97261, CoSe 01434	Early Shoot Borer at hot weather	2	6	4.00	
	Top Borer at harvest	2	5	3.50	
	Stalk Borer at harvest	2	7	3.50	
	Root Borer at harvest	2	12	7.00	
	Thrips/plant	3	18	10.50	
(14)Prtappur					
CoLk 94184, Co 0238, CoSe 92423, CoS 767& Co 0118 CoS07250, CoSe 01434& CoSe98231	Early Shoot Borer at hot weather	2	6	4.00	
	Top Borer at harvest	2	10	5.00	
	Stalk Borer at harvest	2	8	4.00	
	Root Borer at harvest	-	-	-	
	Thrips/plant	3	15	9.00	

E. 30: Monitoring of insect pests and bioagents in sugarcane agro-ecosystem

SUGARCANE RESEARCH INSTITUTE, PUSA

Sugarcane variety BO 154 was planted in 0.2 hectare area. The data on monitoring of insect pests and their bio-agents revealed that the mean per cent incidence of Root borer, Shoot borer, Top borer and Stalk borer were varied from 1.5 to 9.5 %, 2.2 to 14.8%, 0.80 to 17.0% and 1.8 to 4.2% respectively. Whereas, the incidence of sugarcane Pyrilla was 0.25 to 11.30 leaf.

Activity of *Cotesia flavipes, Rhanconotus scirpophagae* and *Stenobracon deesae* was recorded. The data presented in table 3 to 4a revealed that population of *S. deesae* varied from 2.0 to 10.20 during May to November. The activity of *R. scirpophagae* was recorded from July to November with its peak (8.2%) in month of September. The parasitization of *T. pyrillae* and *E. melanoleuca* were recorded from July to November and May to November, respectively. Their peaks were noticed in the month of November (30.15%) and September (20.20%), respectively. In case of Stalk borer, the parasitizastion of *Apantalis flavipes* was recorded from 6.20 to 14.2% during August to November.

Table. 3: Meteorological data during cropping season, (SRI, PUSA)

Month /year		Temperature (^{0}C)		Humidity (%)		Rainfall (mm)	Sunshine (Hrs.)
		Maximum	Minimum	07 hrs.	14 hrs.		
January, 17	I	20.83	8.49	93.0	59.87	0	3.33
	II	23.93	8.88	92.87	64.31	0	6.7
February, 17	I	24.05	10.2	92.14	61.21	0	6.38
	II	27.94	11.5	87.43	54.57	0	7.68
March, 17	I	29.04	13.0	84.37	47.44	9.6	8.57
	II	30.47	18.23	87.6	61.47	0	5.91
April, 17	I	34.71	20.83	75.6	54.00	0	6.95
	II	33.61	22.78	76.33	53.53	63.6	5.46
May, 17	I	33.39	23.43	82.00	65.40	47.25	8.30
	II	34.96	24.31	84.25	64.50	72.00	8.60
June, 17	I	35.00	26.43	86.13	67.26	19.60	6.40
	II	35.11	27.02	853.66	63.80	44.55	7.20
July, 17	I	31.78	25.84	92.13	80.06	398.00	2.50
	II	33.23	26.63	85.37	71.12	44.16	5.90
August, 17	I	32.27	26.06	92.93	79.73	301.50	3.60
	II	32.81	26.65	88.62	73.62	85.76	5.80
September, 17	I	33.66	26.46	89.80	69.60	13.95	4.70
	II	33.99	26.06	88.13	66.06	30.00	5.40
October, 17	I	33.20	24.75	88.13	68.20	3.45	5.70
	II	31.94	21.36	89.00	64.87	0.00	6.30
November, 17	I	29.83	17.58	85.93	56.80	0.00	4.60
	II	27.64	12.95	87.53	61.26	0.00	7.10
December, 17	I	26.64	11.22	93.16	64.33	0.00	5.10
	II	22.44	10.68	93.84	71.63	0.00	3.90

Table. 4: E.30 Monitoring of insect pests and their natural enemies in Sugarcane, (SRI, PUSA)

Period of observation	% incidence top borer	% parastitism (Top borer)			% incidence of Shoot borer	% incidence of root borer	% Parssities (root and shoot borer) if any
		A. Flavipes	*R. Scripophagae*	*S. Deesae*			
January, 17	-	-	-	-	-	-	-
February, 17	-	-	-	-	-	-	-
March, 17	-	-	-	-	6.5	2.50	-
April, 17	8.20	-	-		12.2	5.80	-
May, 17	13.75	3.50	-	2.0	14.8	9.50	Not observed
June, 17	17.00	8.50	-	6.0	9.80	4.75	-
July, 17	15.00	11.20	1.255	7.90	2.20	1.50	-
August, 17	9.50	10.50	3.95	9.50	-	-	-
September, 17	6.70	13.5	8.20	10.20	-	-	-
October, 17	1.50	9.25	2.80	8.0	-	-	-
November, 17	0.80	3.50	1.50	2.85	-	-	-
December, 17	Trace	-	-	-	-	-	-

Table. 4a: E.30 Monitoring of insect pests and their natural enemies in Sugarcane, (SRI, PUSA)

Period of observation	Pyrillae/leaf	% Parastitism (Pyrilla)		% incidence of stalk borer	% Parasitism (Stalk borer) *A. flavipes*
		T. Pyrillae	*E. melanoleuc*		
January, 17	-	-	-	-	-
February, 17	-	-	-	-	-
March, 17	3.00	-	-	-	-
April, 17	5.00	-	-	-	-
May, 17	10.20	-	3.80	-	-
June, 17	11.30	-	9.75	-	-
July, 17	10.20	9.50	11.70	2.00	
August, 17	9.80	11.20	20.10	3.80	10.50
September, 17	5.60	17.25	21.00	4.20	14.20
October, 17	1.80	20.20	14.80	2.75	13.80
November, 17	0.25	30.15	2.8	1.80	6.20
December, 17	-	-	-	-	-

G.S. Sugarcane Breeding and Research Institute, Seorahi – Kushinagar. U.P.-India

The Experiment was conducted on 0.2 ha area with CoS 08272 cultivar. The incidence of early shoot borer was recorded maximum 8.26% during 24th SMW. The incidence of Top borer was recorded maximum 6.68% during 31st SMW followed by 4.29%, 3.29%, 1.83% and 1.50% during 35th, 26th, 22nd and 38th SMW, respectively. The percent incidence of stalk borer was to be maximum 11.20% during 43rd SMW. The bio-agents viz. *Isotima javensis, Stenobracon sp., Elasmus zehnteri* and *Rhaconotus scirpophagae* were recorded major parasitoid of Top borer and *Cotesia flavipes* , a larval parasitoid of stalk borer was also recorded from the field . (Table -3).

Table-3 Monitoring of insect pest and natural enemies of Sugarcane (G.S. S. B. and Research Institute, Seorahi)

(1) Early shoot borer							
Period of observation Dates + SMW	% incidence	% parasitism (ESB), if any					
		T. chilonis		*E. annulipes*		*S. inferens*	
16-04-2017 16th SMW	3.72	-		-		-	
18-05-2017 20th SMW	6.04	-		-		-	
17-06-2017 24th SMW	8.26	-		-		-	
20-07-2017 29th SMW	2.21	-		-		-	
20-08-2017 34th SMW	-	-		-		-	
22-09-2017 38th SMW	-	-		-		-	
25-10-2017 43rd SMW	-	-		-		-	
19-11-201 47th SMW	-	-		-		-	
(2) Stalk borer							
Period of observation Dates + SMW	% incidence	% Parasitism (Stalk borer)					
		Cotesia flavipes	*Apanteles flavipes*	*Apanteles pyralophagus*	*S. inference*	*Nosema sp.*	*B. bassiana*
16-04-2017 16th SMW	-	-	-	-	-	-	-
18-05-201 20th SMW	-	-	-	-	-	-	-
17-06-2017 24th SMW	-	-	-	-	-	-	-
20-07-2017 29th SMW	-	-	-	-	-	-	-
20-08-2017 34th SMW	-	-	-	-	-	-	-
22-09-2017 38th SMW	7.20	10.00	-	-	-	-	-
25-10-2017 43rd SMW	11.20	14.81	-	-	-	-	-

(3) Top borer							
Period of observation Dates + SMW	% incidence	% Parasitism (Top shoot borer)					
		Stenobracon sp.	*I. javensis*	*Elasmus zehntneri*	*Rhaconotus scripophagae*	*T. Japonicum*	*T. chilonis*
16-04-20167 16th SMW	-	-	-	-	-	-	-
30-05-2017 22nd SMW	1.83	2.85	2.00	-	-	-	-
28-06-2017 26th SMW	3.29	5.55	3.12	4.00	2.85	-	-
30-07-2017 31th SMW	6.68	12.00	15.00	9.09	8.00	-	-
28-08-2017 35th SMW	4.39	15.00	18.18	11.11	10.00	-	-
20-09-2017 38th SMW	1.51	5.26	4.28	4.16	4.61	-	-
25-10-2017 43rd SMW	-	-	-	-	-	-	-

E-38:- Formulation and validation of IPM module sugarcane insect-pests.

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The experiment was conducted on half acre plot size with CoS 08272 as a treated and half acre plot as untreated. Both the plots were separated by keeping 100 meter distance. All the IPM module of sugarcane insect pests were adopted in treated plot. The IPM treatments included deep ploughing for exposure of white grub predation, planting of healthy cane –setts treated for 2 minutes in the solution of chlorpyriphos 20% EC @ 40 ml in 10 liter of water, soil application of chlorantraniliprole 0.4G @ 22.5 kg/ha at the time of planting, collection and destruction of egg masses and damaged shoots, setting up of sex pheromone traps two week of planting @ 27/ha (lure changed at on interval of 45 days), spraying of chlorantraniliprole 18.5 SC @ 375 ml/ha at 60 DAP, detrashing of lower leaves, removal of egg masses of pyrilla and infested canes at 90 days, detrashing of lower leaves after 150 days & spraying of clothianidin 50 WDG @ 250 gm/ha after detrash lower leaves. The untreated block was raised under farmer's practice.

The IPM block recorded 50.83 percent germination against 45.00 percent in untreated block. The treated block also recorded minimum cumulative incidence of shoot borer (9.92%), 3rd brood of top borer (2.25%), 4th brood of top borer (2.98%) and at harvest (5.65%) against 14.12, 4.09, 6.08 and 8.80 percent in the untreated block, respectively. Regarding the stalk borer infestation the infestation index was 0.21 in IPM block against 0.37 in untreated block. The IPM block recorded higher number of tillers (169000/ha), millable canes (118000/ha) and cane yield (104 MT/ha) against 153000, 107000/ha and 83.33 MT/ha, respectively in the untreated block. The increase in cane yield in IPM was 23.88 percent higher over untreated block. Regarding the growth attributes the IPM block recorded higher total cane height (277.59 cm) millable cane height (244.13 cm), number of internodes (23) and cane girth (21.99 mm)against 254.56, 198.95 and 20 in untreated block respectively. IPM block the sucrose percent in juice was recorded 19.10 against 18.75 in untreated block. (Table- 4).

Table4(A):- Formulation and validation of IPM module sugarcane insect-pests, (G.S. S. B. and Research Institute, Seorahi)

S.N.	Treatments	%Ger.	Tillers/ha (000)	NMC/ha (000)	Yield MT/ha
1	Treated	50.83	169	118	104
2	Untreated	45.00	153	107	83.33

Table4(B):- Formulation and validation of IPM module sugarcane insect-pests, **(G.S. S. B. and Research Institute, Seorahi)**

S. N.	Treatments	. Growth parameter				Quality paramet er
		Total cane height (cm)	Millable cane height(cm)	Number of inter nodes	Cane girth (mm)	Sucrose (%)in juice
1	Treated	277.59	244.13	23	21.99	19.10
2	Untreated	254.56	198.95	20	19.87	18.75

Table4(C):- Formulation and validation of IPM module sugarcane insect-pests, **(G.S. S. B. and Research Institute, Seorahi)**

Insect-pest	% Incidence of Insect-Pest	
	Treated	Untreated
Shoot bore r (Cumulative)	9.92	14.12
Top borer (3^{nd} brood)	2.25	4.09
Top borer (4^{th} brood)	2.98	6.08
Top borer (At harvest)	5.65	8.80
Stalk borer (Infestation index)	0.21	0.37

Penninsular zone

E. 4.1: Evaluation of varieties for their reaction against major insect pests.

DR.PDKV, Akola

Table 5: Reaction of Sugarcane varieties/genotypes to major insect pests in IVT Early Plant at 30, 60, 90 and 120 DAP, (DR.PDKV, Akola)

Sr. No.	Genotypes	ESB at 30 DAP		ESB at 60 DAP		ESB at 90 DAP		ESB at 120 DAP	
		Average % Infestation	Reaction	Average % Infestation	Reaction	Average % Infestation	Reaction	Average % Infestation	Reaction
1	Co14032	8.93	LS	6.54	LS	5.34	LS	5.69	LS
2	**CoC671**	8.53	LS	7.14	LS	4.53	LS	5.90	LS
3	CoT14367	18.29	**MS**	9.83	LS	5.88	LS	8.81	LS
4	CoVc14062	8.71	LS	7.77	LS	5.03	LS	4.84	LS
5	Co14025	9.43	LS	7.62	LS	4.88	LS	5.63	LS
6	CoT14112	6.62	LS	6.63	LS	4.73	LS	5.50	LS
7	Co14006	6.49	LS	5.11	LS	3.39	LS	5.49	LS
8	CoN14071	5.50	LS	6.50	LS	3.82	LS	4.76	LS
9	Co14016	8.32	LS	5.86	LS	3.82	LS	5.58	LS
10	Co14008	9.44	LS	5.45	LS	4.06	LS	5.71	LS
11	CoSnk14102	7.16	LS	6.42	LS	4.03	LS	5.09	LS
12	**Co86032**	9.88	LS	6.40	LS	5.05	LS	5.60	LS
13	Co13022	16.35	**MS**	8.67	LS	4.66	LS	6.19	LS
14	VSI14121	7.32	LS	7.13	LS	3.38	LS	5.70	LS
15	Co14030	7.35	LS	4.29	LS	2.93	LS	5.81	LS
16	Co14031	6.10	LS	6.83	LS	5.17	LS	5.03	LS
17	Co14012	9.39	LS	6.33	LS	4.84	LS	5.34	LS
18	Co14004	10.39	LS	7.63	LS	4.28	LS	5.44	LS
19	CoT14111	7.42	LS	9.06	LS	4.71	LS	4.31	LS
20	CoT14366	6.27	LS	7.92	LS	4.31	LS	4.60	LS
21	CoN14073	8.31	LS	5.82	LS	4.88	LS	5.05	LS
22	CoN14072	8.19	LS	4.47	LS	4.08	LS	5.72	LS
23	CoVc14061	8.76	LS	7.34	LS	4.38	LS	5.33	LS
24	MS14081	8.43	LS	6.30	LS	4.92	LS	5.62	LS
25	Co14022	8.10	LS	4.97	LS	4.93	LS	5.11	LS
26	Co14026	7.14	LS	4.28	LS	4.58	LS	6.04	LS
27	**CoSnk05103**	8.36	LS	7.39	LS	5.41	LS	5.30	LS
28	Co14009	8.40	LS	6.50	LS	6.81	LS	6.08	LS
29	Co14002	8.60	LS	7.91	LS	6.15	LS	5.30	LS
30	PI14131	9.33	LS	6.67	LS	4.84	LS	6.05	LS
31	Co14023	10.01	LS	5.74	LS	4.62	LS	6.42	LS
32	Co14003	7.88	LS	5.54	LS	4.88	LS	4.10	LS
33	CoN14074	7.96	LS	4.58	LS	4.57	LS	5.55	LS
34	MS14082	7.05	LS	5.56	LS	5.37	LS	4.82	LS
35	Co13021	7.32	LS	6.15	LS	5.55	LS	5.77	LS
36	PI14132	7.71	LS	7.96	LS	4.53	LS	6.64	LS
37	CoSnk14101	9.09	LS	7.51	LS	4.53	LS	7.82	LS
38	CoSnk14103	8.10	LS	11.85	LS	7.18	LS	5.94	LS
39	VSI14122	9.38	LS	5.25	LS	3.60	LS	4.52	LS
40	Co14027	6.19	LS	5.25	LS	4.86	LS	4.09	LS

LS = Less susceptible, MS= Moderately susceptible and HS = Highly susceptible.

Grades LS = Below 15.0 MS= 15.1 to 30.0 HS = above 30.0

Table 6: Reaction of Sugarcane varieties/genotypes to scales in IVT Early Plant at Harvest, (DR.PDKV, Akola)

Sr. No.	Genotypes	Scales		
		% incidence	% intensity	Reaction
1	Co14032	50.00	10.00	**HS**
2	**CoC671**	50.00	9.83	**HS**
3	CoT14367	50.00	10.12	**HS**
4	CoVc14062	40.00	10.00	**HS**
5	Co14025	50.00	8.44	**HS**
6	CoT14112	40.00	6.69	**HS**
7	Co14006	50.00	6.01	**HS**
8	CoN14071	60.00	6.29	**HS**
9	Co14016	50.00	5.34	**HS**
10	Co14008	40.00	5.50	**HS**
11	CoSnk14102	70.00	5.67	**HS**
12	**Co86032**	50.00	6.74	**HS**
13	Co13022	30.00	7.48	MS
14	VSI14121	50.00	7.49	**HS**
15	Co14030	50.00	7.72	**HS**
16	Co14031	30.00	6.65	MS
17	Co14012	50.00	8.72	**HS**
18	Co14004	30.00	8.86	MS
19	CoT14111	40.00	8.28	**HS**
20	CoT14366	50.00	8.01	**HS**
21	CoN14073	40.00	8.74	**HS**
22	CoN14072	40.00	8.39	**HS**
23	CoVc14061	40.00	7.15	**HS**
24	MS14081	40.00	6.75	**HS**
25	Co14022	60.00	6.36	**HS**
26	Co14026	60.00	6.31	**HS**
27	CoSnk05103	40.00	7.14	**HS**
28	Co14009	50.00	7.89	**HS**
29	Co14002	60.00	8.48	**HS**
30	PI14131	30.00	8.06	MS
31	Co14023	40.00	8.10	**HS**
32	Co14003	50.00	7.42	**HS**
33	CoN14074	30.00	7.26	MS
34	MS14082	40.00	7.29	**HS**
35	Co13021	50.00	5.91	**HS**
36	PI14132	30.00	6.14	MS
37	CoSnk14101	40.00	7.39	**HS**
38	CoSnk14103	50.00	6.23	**HS**
39	VSI14122	50.00	5.16	**HS**
40	Co14027	30.00	5.86	MS

LS = Less susceptible, MS= Moderately susceptible and HS = Highly susceptible.
Grades: LS= below 10, MS= 10.1 – 35, HS= Above 35

Table 7: Reaction of Sugarcane varieties/genotypes to *Pyrilla* (Nymph & Adults) per leaf in IVT Early Plant, (DR.PDKV, Akola)

Sr. No.	Genotypes	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction
1	Co14032	0.95	LS	1.35	LS	0.93	LS	0.65	LS
2	**CoC671**	2.00	LS	1.75	LS	1.93	LS	1.25	LS
3	CoT14367	1.03	LS	1.15	LS	0.93	LS	0.75	LS
4	CoVc14062	1.48	LS	1.75	LS	1.38	LS	1.15	LS
5	Co14025	1.18	LS	1.00	LS	1.10	LS	0.80	LS
6	CoT14112	2.00	LS	1.60	LS	1.93	LS	1.23	LS
7	Co14006	1.48	LS	2.20	LS	1.33	LS	1.28	LS
8	CoN14071	1.83	LS	2.05	LS	1.50	LS	1.43	LS
9	Co14016	2.00	LS	1.90	LS	1.78	LS	1.48	LS
10	Co14008	2.00	LS	1.75	LS	1.93	LS	1.20	LS
11	CoSnk14102	2.23	LS	1.70	LS	1.85	LS	1.38	LS
12	**Co86032**	1.10	LS	1.38	LS	0.58	LS	0.78	LS
13	Co13022	0.88	LS	0.83	LS	0.48	LS	0.55	LS
14	VSI14121	0.85	LS	1.20	LS	0.58	LS	0.65	LS
15	Co14030	1.90	LS	1.65	LS	1.65	LS	1.15	LS
16	Co14031	0.93	LS	1.05	LS	0.73	LS	0.85	LS
17	Co14012	1.38	LS	1.65	LS	1.20	LS	1.15	LS
18	Co14004	1.08	LS	0.90	LS	0.90	LS	0.88	LS
19	CoT14111	1.75	LS	1.50	LS	1.58	LS	1.28	LS
20	CoT14366	1.38	LS	2.10	LS	1.10	LS	1.35	LS
21	CoN14073	1.73	LS	1.95	LS	1.48	LS	1.43	LS
22	CoN14072	1.90	LS	1.80	LS	1.55	LS	1.58	LS
23	CoVc14061	1.90	LS	1.65	LS	1.68	LS	1.20	LS
24	MS14081	2.13	LS	1.73	LS	1.65	LS	1.40	LS
25	Co14022	1.00	LS	1.35	LS	0.83	LS	0.83	LS
26	Co14026	0.78	LS	0.83	LS	0.45	LS	0.75	LS
27	**CoSnk05103**	0.85	LS	1.20	LS	0.58	LS	0.65	LS
28	Co14009	1.90	LS	1.55	LS	1.68	LS	1.00	LS
29	Co14002	0.93	LS	1.18	LS	0.75	LS	0.63	LS
30	PI14131	1.38	LS	1.60	LS	1.18	LS	1.15	LS
31	Co14023	1.08	LS	1.10	LS	0.88	LS	0.93	LS
32	Co14003	1.90	LS	1.45	LS	1.15	LS	1.23	LS
33	CoN14074	1.38	LS	2.08	LS	1.18	LS	1.35	LS
34	MS14082	1.73	LS	1.83	LS	1.50	LS	1.35	LS
35	Co13021	1.90	LS	1.45	LS	1.70	LS	1.50	LS
36	PI14132	1.90	LS	1.33	LS	1.70	LS	1.25	LS
37	CoSnk14101	2.20	LS	1.33	LS	1.55	LS	1.43	LS
38	CoSnk14103	1.00	LS	1.30	LS	0.83	LS	0.83	LS
39	VSI14122	0.78	LS	0.83	LS	0.45	LS	0.73	LS
40	Co14027	0.85	LS	0.70	LS	0.55	LS	0.65	LS

LS = Less susceptible Below 5, MS= Moderately susceptible 5.1-20.0 and HS = Highly Susceptible Above 20.

Results :

Early Shoot Borer: The data (Table 5) revealed that all the entries were found Less susceptible at 30, 60, 90 and 120 DAP except CoT14367 and Co13022 were found moderately susceptible at 30 DAP.

Scales: The data (Table 6) revealed that seven varieties were found moderately susceptible and 33 varieties were found Highly susceptible.

***Pyrilla*:** The data (Table 7) of *Pyrilla* at 15 days interval revealed that all the forty entries showed less susceptible reaction to *Pyrilla* at fortnightly intervals.

Conclusions: The early shoot borer infestation at 30 DAP was ranging from 6.10 to 18.29% infestation indicating the genotypes are moderately susceptible to less susceptible, at 60 DAP was ranging from 4.29 to 11.85% infestation indicating the genotypes are less susceptible, at 90 DAP it was ranging from 2.93 to 7.18% infestation indicating the genotypes are less susceptible and at 120 DAP it was ranging from 4.10 to 8.81% infestation indicating the genotypes are less susceptible.

The infestation of the scales was ranging from 30 to 70% incidence indicating the genotypes to be moderately susceptible to highly susceptible and the infestation of *Pyrilla* in all varieties was ranging from 0.45 to 2.20 per leaf indicating less susceptible genotypes.

Table 8: Reaction of Sugarcane varieties/genotypes to major insect pests in AVT I Plant at 30, 60, 90 and 120 DAP, (DR.PDKV, Akola)

Sr. No.	Genotypes	ESB at 30 DAP		ESB at 60 DAP		ESB at 90 DAP		ESB at 120 DAP	
		Average % Infestation	Reaction	Average % Infestation	Reaction	Average % Infestation	Reaction	Average % Infestation	Reaction
1	Co12007	18.61	**MS**	11.00	LS	14.76	LS	8.91	LS
2	**Co86032**	10.69	LS	9.35	LS	9.77	LS	8.59	LS
3	Co12008	13.36	LS	11.94	LS	8.93	LS	10.17	LS
4	**CoC671**	15.97	**MS**	12.22	LS	10.86	LS	10.93	LS
5	Co12009	15.58	**MS**	13.21	LS	10.81	LS	8.83	LS
6	**CoSnk05103**	13.35	LS	11.85	LS	9.66	LS	8.24	LS
7	Co12012	13.02	LS	9.68	LS	8.98	LS	9.46	LS
8	Co12019	15.69	**MS**	17.00	**MS**	11.36	LS	9.52	LS
9	Co12024	11.52	LS	10.72	LS	10.45	LS	9.66	LS
10	CoM12085	18.84	**MS**	11.96	LS	11.94	LS	10.17	LS
11	VSI12121	17.40	**MS**	10.61	LS	11.01	LS	9.17	LS

LS = Less susceptible, MS= Moderately susceptible and HS = Highly susceptible.
Grades LS = Below 15.0 MS= 15.1 to 30.0 HS = above 30.0

Table 9: Reaction of Sugarcane varieties/genotypes to scales in AVT I Plant at Harvest, (DR.PDKV, Akola)

Sr. No.	Genotypes	Scales		
		% incidence	% intensity	Reaction
1	Co12007	30.00	9.74	**MS**
2	**Co86032**	40.00	9.57	HS
3	Co12008	30.00	8.90	**MS**
4	**CoC671**	30.00	9.67	**MS**
5	Co12009	40.00	8.16	HS
6	**CoSnk05103**	30.00	6.86	**MS**
7	Co12012	40.00	5.91	HS
8	Co12019	40.00	6.21	HS
9	Co12024	40.00	5.25	HS
10	CoM12085	40.00	5.26	HS
11	VSI12121	30.00	5.76	**MS**

LS = Less susceptible, MS= Moderately susceptible and HS = Highly susceptible.
Grades: LS= below 10, MS= 10.1 – 35, HS= Above 35

Table 10: Reaction of Sugarcane varieties/genotypes to *Pyrilla* (Nymph & Adults) per leaf in AVT I Plant, (DR.PDKV, Akola)

Sr. No.	Genotypes	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction
1	Co12007	0.78	LS	0.93	LS	0.65	LS	0.70	LS
2	**Co86032**	0.98	LS	1.05	LS	0.85	LS	0.80	LS
3	Co12008	0.65	LS	1.23	LS	0.50	LS	0.60	LS
4	**CoC671**	0.82	LS	0.90	LS	0.65	LS	0.75	LS
5	Co12009	0.70	LS	0.90	LS	0.55	LS	0.65	LS
6	**CoSnk05103**	0.98	LS	1.05	LS	0.85	LS	0.90	LS
7	Co12012	0.43	LS	0.58	LS	0.27	LS	0.37	LS
8	Co12019	1.08	LS	1.25	LS	0.95	LS	1.00	LS
9	Co12024	0.65	LS	0.70	LS	0.50	LS	0.55	LS
10	CoM12085	0.90	LS	1.05	LS	0.75	LS	0.80	LS
11	VSI12121	0.50	LS	0.67	LS	0.35	LS	0.35	LS

LS = Less susceptible Below 5, MS= Moderately susceptible 5.1-20.0 and HS = Highly Susceptible Above 20.

Results :

Early Shoot Borer: The data (Table 8) revealed that the entries Co12007. Co12009, CoC671, CoM12085 and VSI 12121 were found moderately susceptible whereas, the remaining entries were found less susceptible at 30 DAP. At 60 DAP Co12009 was found moderately susceptible while all other entries were found less susceptible. At 90 and 120 DAP all the entries were found less susceptible.

Scale insect: The data (Table 9) revealed that varieties Co12007, Co12008, CoC671, CoSnk05103 and VSI 12121 were found to be moderately susceptible and remaining varieties were found highly susceptible.

***Pyrilla*:** The data (Table 10) of *Pyrilla* at 15 days interval revealed that all the eight entries showed less susceptible reaction to *Pyrilla* at fortnightly intervals.

Table 11: Reaction of Sugarcane varieties/genotypes to major insect pests in AVT Early II Plant at 30, 60, 90 and 120 DAP, (DR.PDKV, Akola)

Sr. No.	Genotypes	ESB at 30 DAP		ESB at 60 DAP		ESB at 90 DAP		ESB at 120 DAP	
		Average % Infestation	Reaction	Average % Infestation	Reaction	Average % Infestation	Reaction	Average % Infestation	Reaction
1	Co11001	14.36	LS	13.16	LS	7.55	LS	5.52	LS
2	**Co85004**	14.17	LS	12.26	LS	6.69	LS	5.11	LS
3	CoM11081	15.32	**MS**	13.04	LS	6.91	LS	4.06	LS
4	**Co94008**	13.31	LS	11.69	LS	7.21	LS	5.27	LS
5	CoM11084	14.26	LS	10.98	LS	7.76	LS	4.17	LS
6	Co11004	15.33	**MS**	11.31	LS	8.49	LS	4.63	LS
7	CoM11082	15.03	**MS**	11.81	LS	9.36	LS	5.41	LS
8	**CoC671**	13.86	LS	11.75	LS	8.08	LS	5.40	LS

LS = Less susceptible, MS= Moderately susceptible and HS = Highly susceptible.

Grades LS = Below 15.0 MS= 15.1 to 30.0 HS = above 30.0

Table 12: Reaction of Sugarcane varieties/genotypes to scales in AVT Early II Plant at Harvest, (DR.PDKV, Akola)

Sr. No.	Genotypes	Scales		
		% incidence	% intensity	Reaction
1	Co11001	40.00	9.23	HS
2	**Co85004**	40.00	8.75	HS
3	CoM11081	30.00	9.48	**MS**
4	**Co94008**	40.00	9.09	HS
5	CoM11084	30.00	8.03	**MS**
6	Co11004	30.00	6.79	**MS**
7	CoM11082	20.00	5.87	**MS**
8	**CoC671**	40.00	6.09	HS

LS = Less susceptible, MS= Moderately susceptible and HS = Highly susceptible.
Grades: LS= below 10, MS= 10.1 – 35, HS= Above 35

Table 13: Reaction of Sugarcane varieties/genotypes to *Pyrilla* (Nymph & Adults) per leaf in AVT Early II Plant , (DR.PDKV, Akola)

Sr. No.	Genotypes	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adult) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction
1	Co11001	0.58	LS	0.70	LS	0.65	LS	0.75	LS
2	**Co85004**	0.88	LS	0.98	LS	0.75	LS	1.00	LS
3	CoM11081	0.95	LS	1.05	LS	1.00	LS	1.10	LS
4	**Co94008**	0.88	LS	1.10	LS	0.73	LS	1.05	LS
5	CoM11084	0.75	LS	0.88	LS	0.75	LS	0.98	LS
6	Co11004	1.05	LS	1.15	LS	1.10	LS	1.25	LS
7	CoM11082	1.20	LS	1.35	LS	0.75	LS	1.03	LS
8	**CoC671**	0.75	LS	0.85	LS	0.75	LS	0.85	LS

LS = Less susceptible Below 5, MS= Moderately susceptible 5.1-20.0 and HS = Highly Susceptible Above 20.

Results :

Early Shoot Borer: The data (Table11) revealed that the entries CoM11081, CoM11082 and Co11004 were found to be moderately susceptible whereas, the remaining entries were found less susceptible at 30 DAP. At 60, 90 and 120 DAP all entries were found Less susceptible.

Scales: The data (Table 12) revealed that varieties CoM11081, CoM11082, CoM11084 and Co11004 were found to be moderately susceptible and remaining varieties were found highly susceptible.

***Pyrilla*:** The data (Table 13) of *Pyrilla* at 15 days interval revealed that all the eleven entries showed less susceptible reaction to *Pyrilla* at fortnightly intervals.

Table 14: Reaction of Sugarcane varieties/genotypes to major insect pests in AVT early ratoon Plant at 30, 60, 90 and 120 DAP, (DR.PDKV, Akola)

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Sr. No.	Genotypes	ESB at 30 DAP		ESB at 60 DAP		ESB at 90 DAP		ESB at 120 DAP	
		Average % Infestation	Reaction	Average % Infestation	Reaction	Average % Infestation	Reaction	Average % Infestation	Reaction
1	Co11001	15.05	**MS**	8.30	LS	8.05	LS	8.50	LS
2	Co11004	9.28	LS	9.05	LS	8.90	LS	9.56	LS
3	CoM11081	9.70	LS	8.70	LS	10.26	LS	10.14	LS
4	CoM11082	9.30	LS	9.88	LS	9.47	LS	9.17	LS
5	CoM11084	8.49	LS	8.84	LS	8.97	LS	7.87	LS
6	**Co85004**	8.83	LS	8.19	LS	7.13	LS	6.86	LS
7	**Co94008**	15.07	**MS**	9.82	LS	8.63	LS	9.90	LS
8	**CoC671**	10.97	LS	10.51	LS	11.74	LS	14.07	LS

LS = Less susceptible, MS= Moderately susceptible and HS = Highly susceptible.
Grades LS = Below 15.0 MS= 15.1 to 30.0 HS = above 30.0

Table 15: Reaction of Sugarcane varieties/genotypes to scales in AVT early ratoon Plant at Harvest, (DR.PDKV, Akola)

Sr. No.	Genotypes	Scales		
		% incidence	% intensity	Reaction
1	Co11001	50.00	10.13	HS
2	Co11004	50.00	9.52	HS
3	CoM11081	50.00	10.58	HS
4	CoM11082	40.00	10.02	HS
5	CoM11084	50.00	9.03	HS
6	**Co85004**	40.00	7.69	HS
7	**Co94008**	20.00	7.49	**MS**
8	**CoC671**	40.00	7.19	HS

LS = Less susceptible, MS= Moderately susceptible and HS = Highly susceptible.
Grades: LS= below 10, MS= 10.1 – 35, HS= Above 35

Table 16: Reaction of Sugarcane varieties/genotypes to *Pyrilla* (Nymph & Adults) per leaf in AVT early ratoon, (DR.PDKV, Akola)

Sr No	Genotypes	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction
1	Co11001	0.70	LS	1.15	LS	0.75	LS	1.05	LS
2	Co11004	0.73	LS	1.13	LS	0.75	LS	0.97	LS
3	CoM11081	0.90	LS	1.15	LS	0.85	LS	0.98	LS
4	CoM11082	0.63	LS	0.92	LS	0.78	LS	0.87	LS

5	CoM11084	0.98	LS	1.02	LS	0.97	LS	0.83	LS
6	**Co85004**	1.03	LS	0.87	LS	0.90	LS	0.77	LS
7	**Co94008**	0.73	LS	0.83	LS	0.77	LS	0.78	LS
8	**CoC671**	0.58	LS	0.83	LS	0.60	LS	0.75	LS

LS = Less susceptible Below 5, MS= Moderately susceptible 5.1-20.0 and HS = Highly Susceptible Above 20.

Results :

Early Shoot Borer: The data (Table14) revealed that the entries Co11001 and Co94008 were found to be moderately susceptible whereas, the remaining entries were found less susceptible at 30 DAP. At 60, 90 and 120 DAP all the entries were found less susceptible.
Scales: The data (Table 15) revealed that the variety Co94008 was found to be moderately susceptible and remaining varieties were found highly susceptible.
***Pyrilla*:** The data (Table 16) of *Pyrilla* at 15 days interval revealed that all the entries showed less susceptible reaction to *Pyrilla* at fortnightly intervals.

Table 17: Reaction of Sugarcane varieties/genotypes to major insect pests in AVT midlate II Plant at 30, 60, 90 and 120 DAP, (DR.PDKV, Akola)

Sr. No.	Genotypes	ESB at 30 DAP		ESB at 60 DAP		ESB at 90 DAP		ESB at 120 DAP	
		Average % Infestation	Reaction	Average % Infestation	Reaction	Average % Infestation	Reaction	Average % Infestation	Reaction
1	Co11005	8.23	LS	8.96	LS	5.91	LS	5.79	LS
2	Co11007	8.87	LS	8.77	LS	6.58	LS	5.76	LS
3	**Co86032**	7.85	LS	8.25	LS	6.22	LS	5.12	LS
4	Co11019	7.31	LS	10.45	LS	6.09	LS	5.77	LS
5	CoM11085	8.94	LS	8.52	LS	6.45	LS	5.42	LS
6	CoM11086	8.99	LS	8.09	LS	5.75	LS	5.07	LS
7	Co11012	8.31	LS	9.19	LS	6.35	LS	5.66	LS
8	**Co99004**	8.23	LS	10.43	LS	7.37	LS	6.49	LS

LS = Less susceptible, MS= Moderately susceptible and HS = Highly susceptible.
Grades LS = Below 15.0 MS= 15.1 to 30.0 HS = above 30.0

Table 18: Reaction of Sugarcane varieties/genotypes to scales in AVT midlate II Plant at Harvest, (DR.PDKV, Akola)

Sr. No.	Genotypes	Scales		
		% incidence	% intensity	Reaction
1	Co11005	30.00	5.97	**MS**
2	Co11007	40.00	7.98	HS
3	**Co86032**	40.00	8.80	HS
4	Co11019	20.00	9.81	**MS**
5	CoM11085	50.00	8.42	HS
6	CoM11086	30.00	6.61	**MS**
7	Co11012	30.00	7.14	**MS**
8	**Co99004**	40.00	6.59	HS

LS = Less susceptible, MS= Moderately susceptible and HS = Highly susceptible.
Grades: LS= below 10, MS= 10.1 – 35, HS= Above 35

Table 19: Reaction of Sugarcane varieties/genotypes to *Pyrilla* (Nymph & Adults) per leaf in AVT midlate II Plant, (DR.PDKV, Akola)

Sr. No.	Genotypes	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction
1	Co11005	0.83	LS	0.73	LS	0.93	LS	0.82	LS
2	Co11007	0.63	LS	0.87	LS	0.73	LS	0.63	LS
3	**Co86032**	0.43	LS	0.68	LS	0.53	LS	0.48	LS
4	Co11019	0.62	LS	0.57	LS	0.72	LS	0.68	LS
5	CoM11085	0.83	LS	0.73	LS	0.93	LS	0.82	LS
6	CoM11086	0.93	LS	0.83	LS	1.02	LS	0.87	LS
7	Co11012	0.75	LS	0.88	LS	0.87	LS	0.73	LS
8	**Co99004**	0.85	LS	0.82	LS	0.95	LS	0.82	LS

LS = Less susceptible Below 5, MS= Moderately susceptible 5.1-20.0 and HS = Highly Susceptible Above 20.

Results :

Early Shoot Borer: The data (Table17) revealed that all the entries were found less susceptible at 30, 60, 90 and 120 DAP.

Scales: The data (Table 18) revealed that varieties Co11019, Co11012, Co11005 and CoM11086 were found to be moderately susceptible and remaining varieties were found highly susceptible.

***Pyrilla*:** The data (Table 19) of *Pyrilla* at 15 days interval revealed that all the eight entries showed less susceptible reaction to *Pyrilla* at fortnightly intervals.

Table 20: Reaction of Sugarcane varieties/genotypes to major insect pests in AVT midlate Ratoon at 30, 60, 90 and 120 DAP, (DR.PDKV, Akola)

Sr. No.	Genotypes	ESB at 30 DAP		ESB at 60 DAP		ESB at 90 DAP		ESB at 120 DAP	
		Average % Infestation	Reaction	Average % Infestation	Reaction	Average % Infestation	Reaction	Average % Infestation	Reaction
1	Co11005	9.13	LS	5.61	LS	5.39	LS	3.98	LS
2	Co11007	9.87	LS	6.27	LS	6.69	LS	5.23	LS
3	Co11012	9.84	LS	5.99	LS	5.92	LS	4.18	LS
4	Co11019	12.21	LS	6.37	LS	5.94	LS	3.96	LS
5	CoM11085	9.59	LS	6.17	LS	5.77	LS	4.69	LS
6	CoM11086	9.26	LS	5.68	LS	5.43	LS	4.27	LS
7	**Co86032**	9.75	LS	8.55	LS	8.22	LS	6.80	LS
8	**Co99004**	8.99	LS	7.47	LS	6.86	LS	5.24	LS

LS = Less susceptible, MS= Moderately susceptible and HS = Highly susceptible.
Grades LS = Below 15.0 MS= 15.1 to 30.0 HS = above 30.0

Table 21: Reaction of Sugarcane varieties/genotypes to scales in AVT midlate Ratoon at Harvest, (DR.PDKV, Akola)

Sr. No.	Genotypes	Scales		
		% incidence	% intensity	Reaction
1	Co11005	50.00	6.51	HS
2	Co11007	50.00	8.41	HS
3	Co11012	60.00	9.64	HS
4	Co11019	50.00	10.47	HS
5	CoM11085	50.00	9.12	HS
6	CoM11086	40.00	7.49	HS
7	**Co86032**	40.00	7.75	HS
8	**Co99004**	40.00	7.12	HS

LS = Less susceptible, MS= moderately susceptible and HS = Highly susceptible.
Grades: LS= below 10, MS= 10.1 – 35, HS= Above 35

Table 22: Reaction of Sugarcane varieties/genotypes to *Pyrilla* (Nymph & Adults) per leaf in AVT midlate Ratoon , (DR.PDKV, Akola)

Sr. No.	Genotypes	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction	*Pyrilla* (Nymph & Adults) per leaf	Reaction
1	Co11005	0.85	LS	0.92	LS	0.70	LS	0.70	LS
2	Co11007	0.77	LS	0.88	LS	0.60	LS	0.60	LS
3	Co11012	0.73	LS	1.15	LS	0.60	LS	0.60	LS
4	Co11019	0.57	LS	1.10	LS	0.33	LS	0.33	LS
5	CoM 11085	0.52	LS	1.03	LS	0.33	LS	0.33	LS
6	CoM 11086	0.58	LS	0.83	LS	0.38	LS	0.38	LS
7	**Co 86032**	0.62	LS	0.83	LS	0.42	LS	0.42	LS
8	**Co 99004**	0.88	LS	0.77	LS	0.68	LS	0.65	LS

LS = Less susceptible Below 5, MS= Moderately susceptible 5.1-20.0 and HS = Highly Susceptible Above 20.

Results :

Early Shoot Borer: The data (Table 20) revealed that all the entries were found to be less susceptible at 30, 60, 90 and 120 DAP.

Scales: The data (Table 21) revealed that all the varieties were found to be highly susceptible.

***Pyrilla*:** The data (Table 22) of *Pyrilla* at 15 days interval revealed that all the entries showed less susceptible reaction to *Pyrilla* at fortnightly intervals.

Results: During 2017-18 totally 58 genotypes under different categories along with their checks were screened for reaction against key pests in the area (Table 1-4). Among the genotypes screened under different categories the following genotypes have shown less susceptible reaction against different pests.

Table: 1. Reaction of Sugarcane genotypes under IVT Early and IVT Mid-late trial against ESB, TSB and INB

Sl. No.	Genotypes	ESB		TSB		INB			
		(%) Incidence	Infest grade	(%) incidence	Infestation grade	(%) incidence	Infest grade	(%) Intensity	Infestation Index
1	Co 13021	6.80(15.11)	LS	4.88(12.63)	LS	18.25(27.27)	LS	2.80	0.51
2	Co 13022	17.50(24.73)	MS	9.88(18.31)	LS	21.50(27.59)	MS	2.24	0.48
3	Co 14008	18.75(25.64)	MS	12.25(20.27)	MS	22.38(28.23)	MS	2.87	0.64
4	Co 14009	21.75(27.79)	MS	14.75(22.56)	MS	15.60(23.19)	LS	2.18	0.34
5	Co 14012	26.50(30.94)	MS	7.88(16.26)	LS	16.13(23.64)	LS	2.60	0.42
6	Co 14016	21.50(27.62)	MS	8.38(16.82	LS	21.88(27.86)	MS	1.56	0.34
7	Co 14022	19.37(26.05)	MS	8.75(17.16)	LS	24.13(29.37)	MS	2.20	0.53
8	Co 14023	22.38(28.23)	MS	11.13(19.42)	MS	19.63(26.28)	LS	2.10	0.41
9	Co 14025	26.13(30.73)	MS	11.25(19.59)	MS	29.50(32.85)	MS	2.80	0.83
10	Co 14026	21.75(27.79)	MS	10.88(19.25)	MS	21.50(27.62)	MS	1.42	0.31
11	Co 14027	22.90(28.58)	MS	8.75(17.16)	LS	23.25(28.79)	MS	1.40	0.32
12	Co 14030	26.50(30.97)	MS	6.75(14.97)	LS	25.50(30.31)	MS	2.20	0.56
13	Co 14031	17.13(24.10)	MS	11.00(19.36)	MS	31.25(33.98)	MS	2.70	0.84
14	Co 14032	11.80(20.03)	LS	8.25(16.67)	LS	16.25(23.77)	LS	1.76	0.29
15	CoN 14073	17.50(24.69)	MS	9.25(17.67)	MS	16.50(23.91)	LS	2.32	0.38
16	CoN 14074	26.37(30.85)	MS	10.25(18.63)	MS	18.75(25.24)	LS	2.00	0.37
17	CoSnk 14103	24.13(29.39)	MS	6.75(14.86)	LS	23.25(28.78)	MS	1.76	0.41
18	CoTI 14111	18.50(25.47)	MS	8.13(16.31)	LS	25.50(30.32)	MS	2.11	0.54
19	CoTI 14112	20.50(26.86)	MS	8.88(17.34)	LS	21.00(27.22)	MS	2.24	0.47
20	CoVC 14061	12.00(20.10)	LS	14.88(22.62)	MS	30.50(33.49)	MS	2.21	0.67
21	CoVC 14062	10.25(18.66)	LS	8.13(16.55)	LS	17.50(24.62)	LS	1.84	0.32
22	PI 14131	21.75(27.79)	MS	9.25(17.69)	LS	22.75(28.45)	MS	2.87	0.65
23	PI 14132	18.50(25.19)	MS	7.75(16.09)	LS	23.10(28.80)	MS	1.27	0.29
24	VSI 14121	23.05(28.69)	MS	10.38(18.56)	MS	22.25(28.12)	MS	1.94	0.43
25	VSI 14122	19.25(26.02)	MS	8.25(16.60)	LS	24.50(29.64)	MS	2.80	0.69
26	Co86032 check	26.50(30.98)	MS	7.88(16.29)	LS	30.25(33.36)	MS	1.90	0.57

		(%) Incidence	Infestation grade	(%) incidence	Infest grade	(%) Incidence	Infestation grade	(%) Intensity	Infestation Index
27	Co 14002	23.50(28.99)	MS	6.88(15.15)	LS	19.75(26.36)	LS	2.14	0.46
28	Co 14003	20.38(26.80)	MS	8.88(17.28)	LS	22.82(28.54)	MS	1.51	0.35
29	Co 14004	24.75(29.78)	MS	7.25(15.51)	LS	32.13(34.52)	MS	2.08	0.63
30	Co 14006	24.88(29.81)	MS	10.88(19.24)	MS	19.88(26.46)	LS	2.21	0.47
31	CoN 14071	25.13(30.07)	MS	9.25(17.67)	LS	21.19(26.68)	MS	2.87	0.63
32	CoN 14072	21.90(27.88)	MS	11.10(19.46)	MS	21.25(27.45)	MS	3.02	0.68
33	CoSnk14101	24.13(29.42)	MS	8.13(16.56)	LS	22.38(28.23)	MS	1.56	0.33
34	CoSnk14102	25.50(30.32)	MS	10.38(18.74)	MS	24.19(29.46)	MS	1.51	0.34
35	CoT 14366	27.90(31.87)	MS	9.00(17.43)	LS	26.57(31.00)	MS	2.34	0.68
36	CoT 14367	8.25(16.63)	LS	9.25(17.71)	LS	18.25(25.23)	LS	2.21	0.34
37	MS 14081	21.00(27.27)	MS	7.38(15.60)	LS	19.75(26.37)	MS	1.50	0.32
38	MS 14082	6.13(14.27)	LS	8.13(16.43)	LS	15.25(22.96)	LS	2.10	0.28
39	Co Snk 05103 check	23.63(29.02)	MS	6.75(14.94)	LS	23.13(28.74)	MS	2.00	0.45
40	CoC 671 check	29.75(33.05)	MS	8.75(17.16)	LS	26.00(30.65)	MS	2.11	0.52
	CD	5.85		4.21		NS			
	CV@5%	14.03		7.82					

Figures in parentheses are arc sine transformed values whereas values present outside the parenthesis are original values

Note: ESB – Early shoot borer, TSB – Top shoot borer, INB – Internode borer, LS – Less susceptible, MS – Moderately susceptible

Table 2: Reaction of Sugarcane genotypes under AVT I PC trial against ESB, TSB and INB

Sl. No.	Genotypes	ESB		TSB		INB			
		(%) Incidence	Infestation grade	(%) Incidence	Infestation grade	(%) Incidence	Infestation grade	(%) Intensity	Infestation Index
1	Co11001	10.50(18.86)	LS	9.75(18.17)	LS	32.33(34.63)	MS	1.33	0.14
2	Co11004	7.80(16.21)	LS	5.92(14.03)	LS	19.58(26.25)	LS	1.15	0.14
3	CoM11081	17.33(24.48)	MS	10.08(18.48)	MS	24.00(29.30)	MS	2.10	0.33
4	CoM11082	8.75(17.17)	LS	6.92(15.13)	LS	18.50(25.38)	LS	1.80	0.31
5	CoM11084	9.25(17.68)	LS	7.42(15.78)	LS	21.00(27.15)	MS	1.65	0.24
6	CO 85004	11.17(19.51)	LS	11.33(19.61)	MS	17.42(24.66)	LS	1.90	0.36
7	Co94008(CHECK)	9.50(17.91)	MS	10.17(18.59)	MS	17.17(24.43)	LS	1.70	0.28
8	CoC671 (CHECK)	12.25(20.41)	MS	9.33(17.78)	LS	21.08(27.32)	MS	1.83	0.26
	S.Em	1.04		0.67		1.64			
	CD	3.06		1.97		4.81			
	CV@5%	25.05		19.72		19.92			

Table: 3. Reaction of Sugarcane genotypes under AVT Early II PC trial against ESB, TSB and INB

Sl. No.	Genotypes	ESB		TSB		INB			
		(%) Incidence	Infest grade	(%) Incidence	Infest grade	(%) Incidence	Infestigrade	(%) Intensity	Infestation Index
1	Co 12007	8.60(16.87)	LS	8.10(16.42)	LS	18.92(25.77)	LS	1.80	0.34
2	Co 12008	15.20(22.89)	MS	10.10(18.46)	LS	23.17(28.73)	MS	1.53	0.35
3	CoC 671 (C)	16.54(23.96)	MS	7.30(15.66)	LS	24.10(29.38)	MS	1.94	0.47
4	CoSnK 05103(C)	19.42(26.10)	MS	15.86(23.42)	MS	17.42(24.62)	LS	4.10	0.72
5	Co 12009	6.15(14.31)	LS	6.80(15.11)	LS	20.00(26.46)	LS	2.34	0.47
6	Co 12012	15.58(25.22)	MS	10.75(19.12)	MS	22.84(28.54)	MS	2.80	0.64
7	Co 12019	18.30(25.25)	MS	14.50(22.34)	MS	19.58(26.26)	LS	2.08	0.41
8	Co 12024	15.32(22.98)	MS	8.17(16.57)	LS	21.08(27.31)	MS	2.34	0.49
9	CoM 12085	9.77(18.17)	LS	7.90(16.31)	LS	15.58(23.17)	LS	2.41	0.37

10	VSI 12121	14.30(22.15)	LS	8.15(16.58)	LS	16.25(23.53)	LS	1.56	0.25
11	Co 86032 (C)	15.80(23.36)	MS	8.17(16.60)	LS	22.08(23.74)	MS	2.00	0.44
	S.Em	1.69		0.79		1.52			
	CD	4.95		2.30		4.46			
	CV@5%	22.22		15.44		14.31			

Figures in parentheses are arc sine transformed values whereas values present outside the parenthesis are original values

Note: ESB – Early shoot borer, TSB – Top shoot borer, INB – Internode borer, LS – Less susceptible, MS – Moderately susceptible

Table: 4. Reaction of Sugarcane genotypes under AVT Midlate II PC trial against ESB, TSB and INB

Sl. No.	Genotypes	ESB		TSB		INB			
		(%) Incidence	Infest grade	(%) Incidence	Infest grade	(%) Incidence	Infest grade	(%) Intensity	Infestation Index
1	Co11005	12.50(20.60)	LS	11.17(19.45)	MS	10.67(19.04)	LS	1.33	0.14
2	Co11007	10.75(19.07)	LS	8.50(16.85)	LS	12.33(20.50)	LS	1.15	0.14
3	Co11012	15.50(23.11)	MS	6.58(14.76)	LS	15.75(23.34)	LS	2.10	0.33
4	Co11019	11.83(20.08)	LS	14.25(22.16)	MS	17.25(24.42)	LS	1.80	0.31
5	Co11085	8.08(16.42)	LS	4.83(12.64)	LS	14.42(22.31)	LS	1.65	0.24
6	COM 11086	9.75(18.15)	LS	7.50(15.88)	LS	18.75(25.65)	LS	1.90	0.36
7	Co86032 (CHECK)	20.25(26.73)	MS	9.00(17.33)	LS	16.25(23.74)	LS	1.70	0.28
8	Co99004 (CHECK)	16.58(23.95)	MS	8.33(16.73)	LS	14.00(21.94)	LS	1.83	0.26
	S.Em	1.02		0.89		1.17			
	CD	2.99		2.61		3.44			
	CV@5%	20.13		26.39		20.41			

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The data presented in table 1 indicated that the cumulative % incidence of early shoot borer was above 30% in Co14032 (54.56), CoT14367 (41.92), Co86032 (38.04), Co14004 (34.53) and CoN14072 (31.52). No of bored plants /ha was maximum 63889 in Co14032, CoT14367 and Co14004 while it was minimum 1389 in PI 14132. The % incidence of internode borer was maximum 14 % in Co 14006, Co14023 and Co86032 while Co 14016 and CoVC 14061 were free from it. The % intensity of internode borer was below 1 % in all varieties/genotypes screened except Co14006 (1.17) and Co86032 (1.06). The infestation index of internode borer was below 1 % in all varieties/genotypes screened. The per cent incidence of mealy bug was 2% in CoVC 14062 and Co86032, while other all varieties/ genotypes were free from it.

Table 1: Reaction of sugarcane genotypes/varieties to major insect pest in IVT early/midlate, (VSI, Pune)

sr. no	Varieties/ genotype	Early shoot borer (% incidence)						Grade	Internode borer			Grade	Mealy bug		Grade
		30 DAS	60 DAS	90 DAS	120 DAS	cum	No. of bored plants/ha		% incidence	% intensity	Infestation index		% incidence SMW=	% intensity SMW=	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Co 14002	0.00	0.00	8.14	5.76	10.74 (18.99)	20833	LS	12.00 3.54)	0.73	0.09	LS	0.00	0.00	LS
2	Co 14003	0.00	0.00	7.55	7.89	11.25 (19.33)	13889	LS	2.00 (1.41)	0.13	0.01	LS	0.00	0.00	LS
3	Co14004	0.00	17.24	38.57	13.46	34.53 (35.97)	63889	HS	10.00 (3.09)	0.60	0.08	LS	0.00	0.00	LS
4	Co 14006	0.00	0.00	10.47	14.47	23.23 (28.41)	27778	MS	14.00 (3.60)	1.17	0.17	LS	0.00	0.00	LS
5	CoN 14071	0.00	11.43	14.55	7.14	16.11 (22.36)	25000	MS	2.00 (1.41)	0.11	0.01	LS	0.00	0.00	LS
6	CoN 14072	0.00	10.26	10.00	21.25	31.52 (33.75)	40278	HS	6.00 (2.52)	0.34	0.03	LS	0.00	0.00	LS
7	CoSnk 14101	0.00	0.00	5.80	4.29	9.41 (17.86)	9722	LS	10.00 (3.23)	0.68	0.08	LS	0.00	0.00	LS
8	CoSnk 14102	5.00	0.00	8.33	14.13	19.74 (25.76)	27778	MS	4.00 (1.81)	0.22	0.02	LS	0.00	0.00	LS
9	CoT 14366	0.00	3.33	24.24	8.33	24.49 (29.34)	33333	MS	8.00 (2.38)	0.46	0.08	LS	0.00	0.00	LS
10	CoT 14367	0.00	6.25	16.25	32.29	41.92 (40.34)	63889	HS	6.00 (2.52)	0.43	0.03	LS	0.00	0.00	LS
11	MS 14081	0.00	5.88	8.64	5.50	12.40 (20.59)	20833	LS	6.00 (2.52)	0.31	0.02	LS	0.00	0.00	LS
12	MS 14082	0.00	0.00	29.81	4.67	26.36 (30.86)	50000	MS	2.00 (1.41)	0.12	0.01	LS	0.00	0.00	LS
13	Co 13021	0.00	0.00	4.17	4.30	7.17 (15.24)	9722	LS	4.00 (1.81)	0.29	0.03	LS	0.00	0.00	LS
14	Co 13022	0.00	0.00	13.24	7.95	15.87 (22.98)	22222	MS	2.00 (1.41)	0.17	0.01	LS	0.00	0.00	LS
15	Co 14008	0.00	20.00	10.00	8.24	15.35	23611	MS	8.00 (2.83)	0.84	0.08	LS	0.00	0.00	LS

						(20.66)									
16	Co 14009	0.00	3.13	12.68	9.59	20.94 (27.05)	23611	MS	4.00 (2.12)	0.26	0.01	LS	0.00	0.00	LS
17	Co 14012	0.00	0.00	8.41	15.83	21.84 (27.54)	43056	MS	6.00 (2.52)	0.34	0.02	LS	0.00	0.00	LS
18	Co 14016	0.00	0.00	12.35	7.20	16.47 (22.73)	26389	MS	0.00 (0.71)	0.00	0.00	LS	0.00	0.00	LS
19	Co 14022	0.00	0.00	13.95	6.82	18.21 (24.29)	25000	MS	2.00 (1.41)	0.12	0.01	LS	0.00	0.00	LS
20	Co 14023	0.00	4.35	14.93	12.12	20.67 (27.01)	31944	MS	14.00 (3.80)	0.91	0.13	LS	0.00	0.00	LS
21	Co 14025	0.00	6.12	16.87	15.31	27.84 (31.83)	44444	MS	6.00 (2.52)	0.39	0.03	LS	0.00	0.00	LS
22	Co 14026	0.00	0.00	16.00	9.88	21.01 (27.21)	27778	MS	4.00 (2.12)	0.26	0.01	LS	0.00	0.00	LS
23	Co 14027	0.00	5.00	16.13	16.44	28.23 (31.1)	33333	MS	8.00 (2.83)	0.45	0.05	LS	0.00	0.00	LS
24	Co 14030	10.00	0.00	13.68	15.04	25.13 (30.05)	44444	MS	12.00 (3.49)	0.77	0.10	LS	0.00	0.00	LS
25	Co 14031	0.00	3.03	6.59	4.81	11.64 (19.42)	16667	LS	6.00 (2.12)	0.39	0.05	LS	0.00	0.00	LS
26	Co 14032	0.00	7.69	38.78	38.46	54.36 (47.70)	63889	HS	2.00 (1.41)	0.15	0.01	LS	0.00	0.00	LS
27	CoN 14073	0.00	6.90	7.29	10.26	18.30 (24.90)	23611	MS	6.00 (2.12)	0.37	0.05	LS	0.00	0.00	LS
28	Co N 14074	0.00	2.56	15.00	6.73	19.32 (25.37)	31944	MS	6.00 (2.51)	0.37	0.03	LS	0.00	0.00	LS
29	CoSnk 14103	0.00	16.00	18.18	9.23	23.35 (28.87)	25000	MS	8.00 (2.83)	0.62	0.06	LS	0.00	0.00	LS
30	CoTL 14111	0.00	2.94	17.72	3.51	14.72 (22.56)	26389	LS	2.00 (1.41)	0.13	0.01	LS	0.00	0.00	LS
31	CoTL 14122	0.00	11.54	15.28	6.45	18.28 (25.22)	27778	MS	8.00 (2.83)	0.44	0.05	LS	0.00	0.00	LS
32	CoVC 14061	0.00	0.00	16.90	8.57	22.07 (28.02)	25000	MS	0.00 (0.71)	0.00	0.00	LS	0.00	0.00	LS
33	CoVC 14062	0.00	0.00	9.23	8.33	15.69 (22.95)	16667	MS	4.00 (2.12)	0.27	0.01	LS	2.00	0.13	LS
34	PI 14131	0.00	0.00	18.75	4.81	14.55 (22.39)	23611	LS	4.00 (1.81)	0.24	0.02	LS	0.00	0.00	LS

35	PI 14132	0.00	0.00	0.00	1.06	1.16 (6.42)	1389	LS	10.00 (3.09)	0.69	0.10	LS	0.00	0.00	LS
36	VSI 14121	5.00	0.00	9.68	3.85	9.44 (17.67)	15278	LS	10.00 (3.09)	0.61	0.08	LS	0.00	0.00	LS
37	VSI 14122	0.00	4.76	28.57	7.06	20.10 (26.08)	26389	MS	6.00 (2.52)	0.37	0.03	LS	0.00	0.00	LS
38	CoC 671 (Std)	0.00	0.00	5.00	5.50	8.80 (17.25)	13889	LS	4.00 (2.12)	0.25	0.01	LS	0.00	0.00	LS
39	Co 86032 (Std)	0.00	0.00	38.46	22.37	38.04 (37.86)	51389	HS	14.00 (3.80)	1.06	0.16	LS	2.00	0.35	LS
40	Co Snk 05103 (Std)	0.00	0.00	28.13	14.00	25.48 (29.97)	44444	MS	4.00 (2.12)	0.38	0.02	LS	0.00	0.00	LS
	S.E ±					4.67			NS						
	C.D at 5%					13.35									
	C.V					25.52									

LS-Less Susceptible, MS-Moderately Susceptible, HS-Highly Susceptible, (VSI, Pune)
Figures in parenthesis are transformed values while those outside original values.

The data in table 2 reveled that the cumulative per cent incidence of early shoot borer was below 15.0 % in CoSnk 05103(8.83) and Co12008 (13.77), while it was maximum in Co 12012 (32.17) and Co86032 (31.58). The no. of bored plants/ha by early shoot borer were minimum in Co12008 (12678) and CoSnk05103 (15079), while it was maximum in Co 12012(46825) and Co86032 (42857). The % incidence of internode borer was minimum 2.67 % in Co 12012, while it was maximum 20 % in VSI 12121. The % intensity and infestation index of internode borer was maximum 1.39 and 0.33 in VSI 12121. The per cent incidence of mealy bug was 1.33% in Co12009 and Co12019, while all other varieties/genotypes were free from it. All varieties/ genotypes were free from scale insect incidence except Co12008 (1.33%).

Table 2: Reaction of sugarcane genotypes/varieties to major insect pest in AVT I plant early/midlate, (VSI, Pune)

Sr N	Varieties/ Genotype	Early shoot borer (% incidence)						Grade	Internode borer			Grade	Mealy bug		Grade	Scale insect		
		30 DAS	60 DAS	90 DAS	120 DAS	cum	No. of bored plants/ha		% incidence	% intensity	Infestation index		% ncidence SMW=	% intensity SMW=		% incidence	% intensity	Grade
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Co 12007	0.00	13.95	14.81	15.75	25.33 (30.17)	32540	MS	13.33 (3.68)	0.98	0.15	LS	0.00	0.00	LS	0.00	0.00	LS
2	Co 12008	0.00	0.00	2.20	11.67	13.77 (21.17)	12698	LS	9.33 (2.92)	0.56	0.09	LS	0.00	0.00	LS	1.33	0.08	LS
3	Co 12009	0.00	2.86	12.66	23.33	29.54 (32.53)	30952	MS	9.33 (2.92)	0.58	0.09	LS	1.33	0.08	LS	0.00	0.00	LS
4	Co 12012	6.67	11.11	17.20	22.64	32.17 (34.50)	46825	HS	2.67 (1.65)	0.15	0.01	LS	0.00	0.00	LS	0.00	0.00	LS
5	Co 12019	0.00	0.00	13.16	32.82	37.03 (37.28)	42063	HS	13.33 (3.57)	0.97	0.16	LS	1.33	0.20	LS	0.00	0.00	LS
6	Co 12024	0.00	2.56	9.59	18.10	27.58 (29.56)	23016	MS	6.67 (2.59)	0.40	0.04	LS	0.00	0.00	LS	0.00	0.00	LS
7	CoM 12085	0.00	14.00	15.00	25.53	34.84 (35.05)	46032	HS	17.33 (4.22)	1.26	0.23	LS	0.00	0.00	LS	0.00	0.00	LS
8	VSI 12121	3.33	2.08	2.88	11.81	16.17 (22.99)	17460	MS	20.00 (4.43)	1.39	0.33	LS	0.00	0.00	LS	0.00	0.00	LS
9	Co 86032 (Std)	0.00	17.39	12.00	20.73	31.58 (33.83)	42857	HS	12.00 (3.45)	0.84	0.12	LS	0.00	0.00	LS	0.00	0.00	LS
10	CoC 671 (Std)	13.33	3.13	23.94	13.64	22.68 (27.21)	31746	MS	16.00 (3.97)	1.09	0.20	LS	0.00	0.00	LS	0.00	0.00	LS
11	CoSnk 05103 (Std)	0.00	0.00	4.76	5.74	8.83 (17.21)	15079	LS	8.00 (2.86)	0.58	0.06	LS	0.00	0.00	LS	0.00	0.00	LS
	S.E ±					NS			NS									
	C.D at 5%																	
	C.V																	

LS-Less Susceptible, MS-Moderately Susceptible, HS-Highly Susceptible

Figures in parenthesis are transformed values, while those outside are original values.

The data in table 3 reveled that the cumulative per cent incidence of early shoot borer was above 30.0 % in CoC 671 (30.61%), while it was minimum 6.70 % in Co 85004. The no. of bored plants/ha by early shoot borer were minimum 8730 in CoM 11082, while it was maximum 32540 in CoC 671. The % incidence of internode borer was maximum 10.67% in CoM 11081, while it was minimum 1.33% in Co 11001 and CoC 671. The % intensity of internode borer was maximum 0.74 % in CoM 11081. The infestation index of internode borer was below 1 % in all varieties/genotypes screened. The per cent incidence of mealy bug was 5.33% in CoM 11081 and 1.33% in Co 85004, while all other varieties/genotypes were free from mealy bug infestation. All varieties / genotypes screened were free from scale insect infestation.

Pooled data in table no.4 indicates that the cumulative per cent incidence of early shoot borer was below 15 % in CoM 11082 (8.38 %), Co 85004(9.18%) and CoM11084 (14.12%). The % incidence of internode borer was minimum 5.33 % in CoC671, while it was maximum 10.22 % in CoM 11081. The per cent incidence of mealy bug was maximum in CoC671 (7.11%) and Co 11001(5.78%), while it was minimum 1.33 % in CoM 11082. The per cent incidence of scale insect was maximum 7.78% in Co 85004.

Table 3: Reaction of sugarcane genotypes/varieties to major insect pest in AVT II plant early, (VSI, Pune)

Sr N	Varieties/ genotype	Early shoot borer (% incidence)						Grade	Internode borer			Grade	Mealy bug		Grade	Scale insect		Grade
		30 DAS	60 DAS	90 DAS	120 DAS	cum	No. of bored plants/ha		% incidence	% intensity	Infestation index		% incidence SMW=	% intensity SMW=		% incidence	% intensity	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Co 11001	0.00	6.45	4.84	8.24	11.56 (19.53)	18254	LS	1.33 (1.18)	0.08	0.00	LS	0.00	0.00	LS	0.00	0.00	LS
2	Co 11004	0.00	6.67	3.57	6.09	10.92 (17.35)	9524	LS	6.67 (2.59)	0.46	0.04	LS	0.00	0.00	LS	0.00	0.00	LS
3	CoM 11081	0.00	1.47	6.54	4.91	8.74 (17.10)	15079	LS	10.67 (2.92)	0.74	0.13	LS	5.33	0.57	LS	0.00	0.00	LS
4	CoM 11082	0.00	2.78	1.94	6.56	9.22 (15.27)	8730	LS	6.67 (2.39)	0.39	0.04	LS	0.00	0.00	LS	0.00	0.00	LS
5	CoM 11084	3.33	1.89	1.55	5.99	8.71 (16.61)	11111	LS	2.67 (1.18)	0.17	0.09	LS	0.00	0.00	LS	0.00	0.00	LS
6	Co 85004 (Std.)	0.00	0.00	6.40	3.59	6.70 (14.56)	12698	LS	8.00 (2.86)	0.57	0.05	LS	1.33	0.10	LS	0.00	0.00	LS
7	Co 94008 (Std.)	0.00	0.00	23.94	6.44	12.82 (20.40)	23810	LS	9.33 (3.03)	0.60	0.07	LS	0.00	0.00	LS	0.00	0.00	LS
8	CoC 671 (Std.)	0.00	41.18	17.50	11.71	30.61 (32.62)	32540	HS	1.33 (1.18)	0.08	0.00	LS	0.00	0.00	LS	0.00	0.00	LS
	S.E ±					NS			NS				-			-		
	C.D at 5%																	
	C.V																	

LS-Less Susceptible, MS-Moderately Susceptible, HS-Highly Susceptible

Figures in parenthesis are transformed values while those outside are original values

Table 4: Mean Per cent incidence of major insect pests in AVT Early (Pooled), (VSI, Pune)

Sr. No.	Varieties/ genotype	Cum. % incidence Early shoot borer				Grade	Mean % incidence Internode borer				Grade	Mean % incidence Mealy bug				Grade	Mean % incidence Scale insect				Grade
		I PL	II PL	Ratoon	Mean		I PL	II PL	Ratoon	Mean		I PL	II PL	Ratoon	Mean		I PL	II PL	Ratoon	Mean	
1	Co 11001	22.65	11.56	15.69	16.63 (23.88)	MS	14.00	1.33	10.67	8.67 (15.89)	LS	4.00	0.00	13.33	5.78 (2.18)	MS	0.00	0.00	16.00	5.33	LS
2	Co 11004	26.96	10.92	19.56	19.15 (25.61)	MS	2.67	6.67	9.33	6.22 (14.05)	LS	0.00	0.00	6.67	2.22 (1.36)	LS	0.00	0.00	0.00	0.00	LS
3	CoM 11081	25.68	8.74	16.76	17.06 (23.94)	MS	13.33	10.67	6.67	10.22 (18.48)	LS	0.00	5.33	5.33	3.55 (1.84)	LS	0.00	0.00	0.00	0.00	LS
4	CoM 11082	9.41	9.22	6.51	8.38 (16.77)	LS	9.33	6.67	5.33	7.11 (15.37)	LS	0.00	0.00	4.00	1.33 (1.18)	LS	0.00	0.00	1.33	0.44	LS
5	CoM 11084	26.10	8.71	7.56	14.12 (21.28)	LS	8.00	2.67	10.67	7.11 (14.97)	LS	0.00	0.00	10.67	3.56 (1.59)	LS	0.00	0.00	0.00	0.00	LS
6	Co 85004 (Std.)	13.57	6.70	7.28	9.18 (17.42)	LS	6.67	8.00	2.67	5.78 (13.60)	LS	6.67	1.33	4.00	4.00 (2.05)	LS	13.33	0.00	10.00	7.78	LS
7	Co 94008 (Std.)	43.25	12.82	9.76	21.94 (26.77)	MS	4.00	9.33	6.67	6.67 (14.76)	LS	1.33	0.00	6.67	2.67 (1.58)	LS	0.00	0.00	0.00	0.00	LS
8	CoC 671 (Std.)	19.55	30.61	10.54	20.23 (26.26)	MS	12.00	1.33	2.67	5.33 (12.10)	LS	2.67	0.00	18.67	7.11 (2.29)	MS	0.00	0.00	0.00	0.00	LS
	S.E ±				NS					NS					NS						
	C.D at 5%																				
	C.V																				

LS-Less Susceptible, MS-Moderately Susceptible, HS-Highly Susceptible
Figures in parenthesis are transformed values while those outside are original values

The data in table 5 reveled that the cumulative per cent incidence of early shoot borer was above 15% in Co 11004(19.56), CoM 11081(16.76) and Co 11001(15.69). The no. of bored plants/ha by early shoot borer was maximum 20635 in Co 11004 and minimum 7143 in Co85004. The % incidence of internode borer was maximum 10.67% in Co 11001 and CoM 11084, while it was minimum 2.67% in Co85004 and CoC 671. The % intensity and infestation index of internode borer was below 1 % in all varieties/genotypes screened. The per cent incidence of mealy bug was maximum 18.67% in CoC671 and 13.33% in Co11001, while it was minimum 4% in CoM 11082 and Co 85004.The percent incidence of scale insect was maximum 16% in Co 11001.

Table 5: Reaction of sugarcane genotypes/varieties to major insect pest in AVT (Ratoon) early, (VSI, Pune)

Sr. No	Varieties/ genotype	Early shoot borer (% incidence)						Grade	Internode borer			Grade	Mealy bug		Grade	Scale Insect		
		30 DAS	60 DAS	90 DAS	120 DAS	cum	No. of bored plants/ha		% incidence	% intensity	Infestation index		% incidence SMW=	% intensity SMW=		% incidence SMW=	% intensity SMW=	Grade
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Co 11001	1.67	3.68	4.27	6.42	15.69 (4.01)	15079	MS	10.67 (2.72)	0.64	0.16	LS	13.33 (20.56)	1.10	MS	16.00 (3.87)	7.98	MS
2	Co 11004	1.03	4.21	16.05	6.90	19.56 (4.44)	20635	MS	9.33 (3.12)	0.79	0.08	LS	6.67 (14.45)	0.63	MS	0.00 (0.71)	0.00	LS
3	CoM 11081	0.00	1.00	10.92	6.06	16.76 (3.81)	17460	MS	6.67 (2.65)	0.60	0.04	LS	5.33 (10.56)	0.76	MS	0.00 (0.71)	0.00	LS
4	CoM 11082	0.00	2.38	5.56	2.13	6.51 (2.42)	8730	LS	5.33 (2.39)	0.45	0.03	LS	4.00 (10.67)	0.30	LS	1.33 (1.18)	0.22	LS
5	CoM 11084	0.00	0.75	6.92	2.63	7.56 (2.83)	11905	LS	10.67 (2.86)	0.74	0.15	LS	10.67 (16.96)	1.05	MS	0.00 (0.71)	0.00	LS
6	Co 85004 (Std.)	0.00	3.61	2.02	3.10	7.28 (2.70)	7143	LS	2.67 (1.65)	0.19	0.01	LS	4.00 (10.67)	0.30	LS	10.00 (2.59)	4.49	LS
7	Co 94008 (Std.)	1.25	1.43	3.61	5.05	9.76 (3.07)	7937	LS	6.67 (2.39)	0.49	0.05	LS	6.67 (13.06)	0.50	MS	0.00 (0.71)	0.00	LS
8	CoC 671 (Std.)	0.00	0.00	3.96	7.55	10.54 (2.88)	9524	LS	2.67 (1.65)	0.17	0.01	LS	18.67 (22.61)	1.64	MS	0.00 (0.71)	0.00	LS
	S.E ±					NS			NS				NS			0.48		
	C.D at 5%															1.45		
	C.V															59.47		

LS-Less Susceptible MS-Moderately Susceptible HS-Highly Susceptible

Figures in parenthesis are transformed values while those outside are original values.

The data in Table 6 indicated that cumulative % incidence of early shoot borer was above 15% in Co 99004 (19.69%) and Co 86032 (20.82 %) while it was minimum in Co 11005(2.68%) and CoM 11085 (5.93%).The no. of bored plants/ha by early shoot borer was maximum 34921 in Co 86032, while it was minimum 3968 in Co 11005. The % incidence of internode borer was maximum 6.67 % in Co 11005, CoM 11085 and CoM 11086 while it was minimum 2.67% in Co 11007. The % intensity/infestation index of internode borer was below 1% in all varieties/genotypes. The incidence of mealy bug was 4.00 % in Co 11005 and Co 11007, while all other varieties/genotypes were free from it. The incidence of Scale insect was 16.00 % in Co 11005, while other varieties / genotypes were free from it.

Pooled data in table no.7 indicates that the cumulative per cent incidence of early shoot borer was maximum 14.45% in Co 11012. The % incidence of internode borer was minimum 4.00 % in Co 11019, while it was maximum 8.89 % in Co 99004. The per cent incidence of mealy bug was above 5 % in CoM 11085(5.33%) and Co 11012 (5.78%). The per cent infestation of scale insect was maximum in CoM 11086 (8%) and Co 11005 (8.44%), while Co 11012 was free from it.

Table 6: Reaction of sugarcane genotypes/varieties to major insect pest in AVT II Plant Midlate, (VSI, Pune)

Sr. no	Varieties/ genotype	Early shoot borer (% incidence)						Grade	Internode borer			Grade	Mealy bug		Grade	Scale Insect		Grade
		30 DAS	60 DAS	90 DAS	120 DAS	cum	No. of bored plants/ ha		% incidence	% intensity	Infestation index		% incidence SMW=	% intensity SMW=		% incidence SMW=	% intensity SMW=	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Co 11005	3.33	1.22	0.00	1.99	2.68 (8.74)	3968	LS	6.67 (2.39)	0.42	0.04	LS	4.00 (2.12)	0.26	LS	16.00	7.98	MS
2	Co 11007	0.00	0.00	4.72	5.99	9.74 (17.49)	12698	LS	2.67 (1.44)	0.17	0.01	LS	4.00 (1.65)	0.77	LS	0.00	0.00	LS
3	Co 11012	0.00	5.13	11.97	6.59	13.95 (20.21)	21429	LS	5.33 (2.39)	0.41	0.02	LS	0.00 (0.71)	0.00	LS	0.00	0.00	LS
4	Co 11019	0.00	6.67	7.06	9.15	13.48 (21.19)	17460	LS	4.00 (2.12)	0.31	0.01	LS	0.00 (0.71)	0.00	LS	0.00	0.00	LS
5	CoM 11085	0.00	6.25	1.90	2.39	5.93 (13.86)	9524	LS	6.67 (2.65)	0.51	0.04	LS	0.00 (0.71)	0.00	LS	0.00	0.00	LS
6	CoM 11086	3.33	5.56	4.10	9.39	12.86 (20.13)	19841	LS	6.67 (2.59)	0.38	0.03	LS	0.00 (0.71)	0.00	LS	0.00	0.00	LS
7	Co 86032 (Std)	0.00	8.89	13.60	12.78	20.82 (25.99)	34921	MS	5.33 (2.18)	0.34	0.03	LS	0.00 (0.71)	0.00	LS	0.00	0.00	LS
8	Co 99004 (Std)	3.33	0.00	13.79	12.61	19.69 (24.00)	19048	MS	4.00 (1.91)	0.25	0.02	LS	0.00 (0.71)	0.00	LS	0.00	0.00	LS
	SE					NS			NS				0.33					
	CD 5%												1.01					
	CV												57.63					

LS-Less Susceptible MS-Moderately Susceptible HS-Highly Susceptible.

Figures in parenthesis are transformed values while those outside are original values

Table 7: Mean Per cent incidence of major insect pests in AVT Midlate (Pooled), (VSI, Pune)

Sr. No.	Variety	Cum. % incidence Early shoot borer				Grade	Mean % incidence Internode borer				Grade	Mean % incidence Mealy bug				Grade	Mean % incidence Scale insect				Grade
		I PL	II PL	Ratoon	Mean		I PL	II PL	Ratoon	Mean		I PL	II PL	Ratoon	Mean		I PL	II PL	Ratoon	Mean	
1	Co 11005	11.41	2.68	7.76	7.28 (15.11)	LS	4.00	6.67	10.67	7.11 (15.19)	LS	4.00	4.00	6.67	4.89 (2.31)	LS	0.00	16.00	9.33	8.44 (2.63)	LS
2	Co 11007	23.69	9.74	6.56	13.33 (20.72)	LS	8.00	2.67	5.33	5.33 (13.06)	LS	2.67	4.00	5.33	4.00 (2.10)	LS	1.33	0.00	6.67	2.67 (1.58)	LS
3	Co 11012	22.30	13.95	7.11	14.45 (21.86)	LS	13.33	5.33	5.33	8.00 (16.04)	LS	6.67	0.00	10.67	5.78 (2.24)	MS	0.00	0.00	0.00	0.00 (0.71)	LS
4	Co 11019	8.63	13.48	2.93	8.35 (16.16)	LS	6.67	4.00	1.33	4.00 (11.04)	LS	9.33	0.00	10.67	6.67 (2.39)	LS	0.00	0.00	4.00	1.33 (1.18)	LS
5	CoM 11085	11.73	5.93	7.52	8.39 (16.68)	LS	6.67	6.67	6.67	6.67 (14.97)	LS	6.67	0.00	9.33	5.33 (2.17)	MS	0.00	0.00	5.33	1.78 (1.28)	LS
6	CoM 11086	19.16	12.86	0.71	10.91 (17.27)	LS	8.00	6.67	9.33	8.00 (16.39)	LS	5.33	0.00	6.67	4.00 (1.93)	LS	0.00	0.00	24.00	8.00 (2.12)	LS
7	Co 86032 (Std)	17.02	20.82	1.28	13.04 (19.34)	LS	4.00	5.33	8.00	5.78 (13.77)	LS	6.67	0.00	4.00	3.56 (1.83)	LS	12.00	0.00	0.00	4.00 (1.65)	LS
8	Co 99004 (Std)	15.99	19.69	1.33	12.34 (18.84)	LS	10.67	4.00	12.00	8.89 (16.96)	LS	8.00	0.00	4.00	4.00 (1.91)	LS	0.00	0.00	9.33	3.11 (1.52)	LS
	S.E ±				NS					NS					NS					NS	
	C.D at 5%																				
	C.V																				

LS-Less Susceptible MS-Moderately Susceptible HS-Highly Susceptible.

Figures in parenthesis are transformed values, while those outside are original values

The data in Table 8 indicated that cumulative % incidence of early shoot borer was below 15% in all varieties/ genotypes screened, while it was maximum 7.76 in Co 11005. The no. of bored plants/ha by early shoot borer was maximum 10317 in Co 11005, while it was minimum 764 in CoM 11086 and Co 99004. The % incidence of internode borer was maximum 12 % in Co 99004, while it was minimum 1.33% in Co 11019. The % intensity/ infestation index of internode borer was below 1 in all varieties/ genotypes screened. The incidence of mealy bug was maximum 10.67% in Co 11012 and Co 11019, while it was minimum 4% in Co 86032 and Co 99004. The incidence of scale insect was maximum 24 % in CoM 11086, while Co 11012 and Co 86032 were free from it.

Table 8: Reaction of sugarcane genotypes/varieties to major insect pest in AVT Ratoon Midlate, (VSI, Pune)

Sr. no	Varieties/ genotype	Early shoot borer (% incidence)						Grade	Internode borer			Grade	Mealy bug		Grade	Scale Insect		Grade
		30 DAS	60 DAS	90 DAS	120 DAS	cum	No. of bored plants/ha		% incidence	% intensity	Infestation index		% incidence SMW=	% intensity SMW=		% incidence SMW=	% intensity SMW=	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	Co 11005	0.00	0.92	4.51	3.77	7.76 (2.85)	10317	LS	10.67 (2.72)	0.62	0.15	LS	6.67 (2.39)	0.72	MS	9.33 (15.97)	1.03	LS
2	Co 11007	0.00	0.00	5.56	1.12	6.56 (2.60)	4762	LS	5.33 (2.39)	0.34	0.02	LS	5.33 (2.18)	0.51	MS	6.67 (14.45)	2.20	LS
3	Co 11012	0.00	2.47	3.16	2.17	7.11 (2.45)	5556	LS	5.33 (2.12)	0.38	0.04	LS	10.67 (3.31)	1.02	MS	0.00 (4.05)	0.00	LS
4	Co 11019	1.72	0.00	0.00	2.44	2.93 (1.67)	3175	LS	1.33 (1.18)	0.19	0.01	LS	10.67 (3.24)	1.17	MS	4.00 (11.54)	1.04	LS
5	CoM 11085	0.00	2.47	4.46	2.04	7.52 (2.46)	7937	LS	6.67 (2.39)	0.52	0.05	LS	9.33 (3.06)	0.92	MS	5.33 (11.95)	0.34	LS
6	CoM 11086	1.11	0.00	0.00	0.00	0.71 (1.01)	794	LS	9.33 (2.77)	0.64	0.09	LS	6.67 (2.59)	0.49	MS	24.00 (27.62)	9.03	MS
7	Co 86032 (Std)	0	0.00	0.88	0.63	1.28 (1.17)	1587	LS	8.00 (2.86)	0.63	0.06	LS	4.00 (1.91)	0.27	LS	0.00 (4.05)	0.00	LS
8	Co 99004 (Std)	0	2.63	0.00	0.00	1.33 (1.18)	794	LS	12.00 (3.50)	0.97	0.12	LS	4.00 (1.91)	0.43	LS	9.33 (15.68)	3.33	LS
	SE					NS			NS				NS			NS		
	CD 5%																	
	CV																	

LS-Less Susceptible MS-Moderately Susceptible HS-Highly Susceptible.

Figures in parenthesis are transformed values while those outside are original value

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The data on per cent incidence of ESB (Table 4.1.1.1) showed that the differences due to various genotypes in respect of cumulative per cent infestation were significant at 60 and 90 DAP. The cumulative per cent infestation of early shoot borer ranged from 0.37 to 19.58 per cent. The least cumulative per cent incidence was observed in CoTl 14112 (0.37 %) followed by Co14025 (0.39 %), while maximum incidence was observed in PI 14131 (19.58 %).

Table -4.1.1.1 Screening of sugarcane varieties against ESB in IVT trial at Main Sugarcane Research Station, Navsari

Sr. No.	Genotype	% Incidence of Early Shoot Borer					Cumulative incidence %	No. of bored plants/ha
		30 DAP	60 DAP		90 DAP			
1	Co 14002	0	2.65	(9.37)	2.60	(9.20)	2.06	6667
2	Co 14003	0	1.69	(7.47)	0.0	(0.00)	0.96	3333
3	Co 14004	0	4.20	(11.83)	6.10	(14.25)	4.19	15000
4	Co 14006	0	2.68	(9.42)	0.0	(0.00)	2.60	8333
5	CoN 14071	0	2.38	(8.87)	0.0	(0.00)	1.44	5000
6	CoN 14072	0	3.70	(11.09)	0.0	(0.00)	2.25	6667
7	CoSnk 14101	0	2.42	(8.95)	0.0	(0.00)	1.33	5000
8	CoSnk 14102	0	2.88	(9.77)	3.90	(11.42)	2.82	11667
9	CoT 14366	0	3.20	(10.30)	0.0	(0.00)	1.85	6667
10	CoT 14367	0	1.42	(6.84)	0.0	(0.00)	0.78	3333
11	MS 14081	0	2.40	(8.91)	0.0	(0.00)	1.41	5000
12	MS 14082	0	2.63	(9.33)	3.80	(11.30)	2.58	11667
13	Co 13021	0	4.76	(12.60)	6.20	(14.46)	4.74	15000
14	Co 13022	0	4.30	(11.97)	3.80	(11.29)	3.47	10000
15	Co 14008	0	3.39	(10.61)	0.0	(0.00)	2.15	6667
16	Co 14009	0	1.96	(8.05)	0.0	(0.00)	1.12	3333
17	Co 14012	0	2.11	(8.35)	0.0	(0.00)	1.18	5000
18	Co 14016	0	0.91	(5.47)	0.0	(0.00)	0.53	1667
19	Co 14022	0	2.17	(8.47)	0.0	(0.00)	1.26	5000
20	Co 14023	0	2.83	(9.68)	0.0	(0.00)	1.70	5000
21	Co 14025	0	0.72	(4.87)	0.0	(0.00)	0.39	1667
22	Co 14026	0	1.61	(7.29)	0.0	(0.00)	0.95	3333
23	Co 14027	0	2.72	(9.49)	0.0	(0.00)	1.64	6667
24	Co 14030	0	1.47	(6.96)	5.30	(13.32)	2.52	10000
25	Co 14031	0	2.24	(8.61)	5.90	(14.01)	2.60	10000
26	Co 14032	0	1.50	(7.03)	2.70	(9.47)	1.35	5000
27	CoN 14073	0	2.13	(8.39)	0.0	(0.00)	1.33	5000
28	CoN 14074	0	1.38	(6.75)	2.00	(8.07)	1.18	5000
29	CoSnk 14103	0	2.10	(8.33)	0.0	(0.00)	1.33	5000
30	CoTl 14111	0	16.22	(23.75)	16.78	(24.18)	16.45	61950
31	CoTl 14112	0	0.65	(4.62)	0.0	(0.00)	0.37	1667
32	CoVC 14061	0	0.80	(5.13)	0.0	(0.00)	0.51	1667
33	CoVC 14062	0	2.24	(8.61)	0.0	(0.00)	1.27	5000
34	PI 14131	0	18.58	(25.53)	18.58	(25.53)	19.58	61667
35	PI 14132	0	3.03	(10.02)	9.70	(18.10)	4.35	11667
36	VSI 14121	0	2.22	(8.57)	0.0	(0.00)	1.28	5000
37	VSI 14122	0	3.00	(9.97)	1.80	(7.79)	2.41	6667
38	Co 86032	0	15.07	(22.84)	15.40	(23.14)	15.22	68500
39	CoC 671	0	15.89	(23.49)	16.20	(23.73)	16.01	70167
40	CoSnk 05103	0	18.70	(25.62)	18.90	(25.77)	18.80	68000

Figures in the parenthesis are arcsine transformed values and those outside are original values

Table -4.1.1.2 Screening of sugarcane varieties against Top borer in IVT trial at Main Sugarcane Research Station, Navsari

Sr. No.	Genotype	% Incidence of Top Borer						Root Borer % incidence	
		5th month		7th month		At harvest			
1	Co 14002	1.80	7.71	0.67	4.68	3.85	11.32	26.33	30.87
2	Co 14003	1.04	5.85	1.70	7.50	2.36	8.84	23.33	28.88
3	Co 14004	2.60	9.28	1.31	6.57	1.84	7.80	20.33	26.80
4	Co 14006	2.41	8.93	0.00	0.00	1.09	5.99	19.33	26.08
5	CoN 14071	0.63	4.55	0.62	4.51	1.73	7.56	19.33	26.08
6	CoN 14072	1.82	7.75	0.63	4.55	0.64	4.59	24.67	29.78
7	CoSnk 14101	2.01	8.15	1.53	7.10	1.74	7.58	19.33	26.08
8	CoSnk 14102	1.45	6.92	0.95	5.60	1.55	7.15	14.00	21.97
9	CoT 14366	1.01	5.77	1.56	7.18	3.87	11.35	19.33	26.08
10	CoT 14367	1.46	6.94	0.93	5.52	1.90	7.92	22.00	27.97
11	MS 14081	1.03	5.82	0.55	4.24	1.09	5.99	22.00	27.97
12	MS 14082	1.34	6.65	1.30	6.55	1.55	7.15	19.33	26.08
13	Co 13021	1.26	6.45	0.00	0.00	1.83	7.77	22.00	27.97
14	Co 13022	2.20	8.53	2.15	8.43	2.30	8.72	19.33	26.08
15	Co 14008	1.67	7.43	1.06	5.90	1.65	7.38	19.33	26.08
16	Co 14009	1.97	8.07	0.00	0.00	0.53	4.17	22.00	27.97
17	Co 14012	2.43	8.97	1.89	7.90	1.61	7.29	19.33	26.08
18	Co 14016	1.85	7.82	1.94	8.00	1.65	7.38	22.00	27.97
19	Co 14022	1.98	8.09	1.53	7.11	1.58	7.22	24.67	29.78
20	Co 14023	1.94	8.01	2.56	9.21	1.66	7.40	19.33	26.08
21	Co 14025	1.48	6.99	0.00	0.00	1.01	5.77	19.33	26.08
22	Co 14026	2.16	8.45	0.55	4.24	0.55	4.25	22.00	27.97
23	Co 14027	1.40	6.80	0.48	3.96	1.35	6.67	19.33	26.08
24	Co 14030	1.49	7.01	0.00	0.00	1.03	5.82	22.00	27.97
25	Co 14031	2.05	8.23	1.03	5.81	0.53	4.17	19.33	26.08
26	Co 14032	2.09	8.31	1.57	7.20	1.52	7.08	16.67	24.10
27	CoN 14073	1.44	6.89	0.97	5.64	0.97	5.65	16.67	24.10
28	CoN 14074	0.98	5.68	0.47	3.93	1.03	5.82	16.67	24.10
29	CoSnk 14103	0.94	5.56	0.49	4.01	1.56	7.17	24.67	29.78
30	CoTl 14111	1.52	7.08	0.51	4.11	1.52	7.08	19.33	26.08
31	CoTl 14112	0.91	5.47	0.00	0.00	0.94	5.56	22.00	27.97
32	CoVC 14061	1.51	7.06	0.54	4.20	0.91	5.47	19.33	26.08
33	CoVC 14062	2.06	8.25	1.60	7.26	1.60	7.27	19.33	26.08
34	PI 14131	2.42	8.95	2.99	9.96	3.26	10.40	22.00	27.97
35	PI 14132	1.94	8.01	1.99	8.10	1.57	7.20	11.33	19.67
36	VSI 14121	1.06	5.91	0.51	4.08	0.53	4.17	19.33	26.08
37	VSI 14122	2.75	9.55	0.74	4.94	1.09	5.99	22.00	27.97
38	Co 86032	1.88	7.88	2.41	8.93	2.07	8.27	22.00	27.97
39	CoC 671	1.35	6.67	0.91	5.48	1.47	6.96	19.33	26.08
40	CoSnk 05103	1.57	7.20	1.49	7.00	0.54	4.21	19.33	26.08

Figures in the parenthesis are arcsine transformed values and those outside are original values

Top borer*: Scirpophaga excerptalis* (Wlk):

From the table 4.1.1.2, data revealed that the differences in respect of per cent incidence of top borer due to various genotypes at 5th month was found non-significant, whereas per cent incidence of ESB at 7th month and at harvest were found significant among all tested genotypes.

Per cent top borer incidence at 5th month ranged from 0.63 to 2.75 per cent. The least incidence was observed in CoN 14071 (0.63 %), while maximum incidence was observed in VSI 14122 (2.75) followed by Co 14004 (2.60 %), Co 14012 (2.43 %), PI 14131 (2.42 %) and Co 14006
(2.41 %), respectively.

Whereas, Data on the per cent incidence of top borer at harvest showed that incidence was ranged from 0.53 to 3.87 per cent. The least incidence (0.53 %) was observed in VSI 14121, Co 14031 and Co 14009. Higher per cent of incidence was observed in CoT 14366 (3.87 %) followed by Co 14002 (3.58 %) and PI 14131 (3.26 %). All tested genotypes were showed less susceptible reaction to top borer.

Root borer: *Emmalocera depresella* (Swinhoe)

From the table 4.1.1.2, it is seen that the differences in respect to per cent incidence in various genotypes were found significant. Per cent incidence of root borer was ranged from 14.00 to
26.33 per cent. The least per cent incidence of root borer was observed in CoSnk 14102. Whereas, maximum incidence were observed in Co 14002 (26.33 %) followed by Co14022, CoN 14072 and CoSnk 14103 with (24.67 %) incidence.

4.1.1.4 Mealy bugs: *Saccharicoccus sacchari* (Cockerell)

The data presented in table 4.1.1.3 revealed that the differences due to various genotypes in respect of per cent incidence of mealy bugs were found significant. It was ranged from 0.00 to 4.00 per cent. Higher incidence was observed in Co 14008 (4.00%).

Same trend was observed in data on per cent intensity and it was found to be ranged from 0.00 to 1.54 per cent. The maximum intensity was observed in Co 14022 (1.54 %).

Table -4.1.1.3 Screening of sugarcane varieties against Scales and Mealy bugs in IVT trial at Main Sugarcane Research Station, Navsari

Sr. No.	Genotype	Mealy bugs			
		% incidence		% intensity	
1	Co 14002	2.78	9.60	0.97	5.65
2	Co 14003	0.00	0.00	0.00	0.00
3	Co 14004	1.89	7.90	0.51	4.10
4	Co 14006	0.00	0.00	0.00	0.00
5	CoN 14071	0.89	5.41	0.00	0.00
6	CoN 14072	0.00	0.00	0.00	0.00
7	CoSnk 14101	0.00	0.00	0.00	0.00
8	CoSnk 14102	1.64	7.36	0.93	5.53
9	CoT 14366	0.00	0.00	0.00	0.00
10	CoT 14367	1.56	7.17	0.17	2.36
11	MS 14081	1.56	7.17	0.18	2.43
12	MS 14082	2.11	8.35	0.86	5.32
13	Co 13021	1.22	6.34	0.15	2.22
14	Co 13022	3.22	10.34	0.52	4.14
15	Co 14008	4.00	11.54	1.03	5.82
16	Co 14009	1.22	6.34	0.42	3.72
17	Co 14012	2.44	8.99	0.81	5.16
18	Co 14016	1.22	6.34	0.79	5.10
19	Co 14022	2.44	8.99	1.54	7.13
20	Co 14023	1.22	6.34	0.74	4.93
21	Co 14025	0.00	0.00	0.00	0.00
22	Co 14026	0.00	0.00	0.00	0.00
23	Co 14027	0.00	0.00	0.00	0.00
24	Co 14030	0.00	0.00	0.00	0.00
25	Co 14031	0.00	0.00	0.00	0.00
26	Co 14032	0.00	0.00	0.00	0.00
27	CoN 14073	0.00	0.00	0.00	0.00
28	CoN 14074	0.00	0.00	0.00	0.00
29	CoSnk 14103	0.00	0.00	0.00	0.00
30	CoTl 14111	0.00	0.00	0.00	0.00
31	CoTl 14112	0.00	0.00	0.00	0.00
32	CoVC 14061	0.00	0.00	0.00	0.00
33	CoVC 14062	0.00	0.00	0.00	0.00
34	PI 14131	0.00	0.00	0.00	0.00
35	PI 14132	0.00	0.00	0.00	0.00
36	VSI 14121	0.00	0.00	0.00	0.00
37	VSI 14122	0.00	0.00	0.00	0.00
38	Co 86032	2.44	8.99	0.29	3.09
39	CoC 671	1.22	6.34	0.21	2.63
40	CoSnk 05103	2.44	8.99	0.81	5.16

Figures in the parenthesis are arcsine transformed values and those outside are original values

E.4.1.2 AVT (E) I Plant trial:

Table -4.1.2.1 Screening of sugarcane varieties against ESB in AVT (E) I plant trial at Main Sugarcane Research Station, Navsari

Sr. No.	Genotype	% Incidence of Early Shoot Borer					Cumulative incidence %	No. of bored plants/ha
		30 DAP	60 DAP		90 DAP			
1	Co 12007	0	3.32	10.50	3.19	10.29	2.89	11667
2	Co 12008	0	0.00	0.00	2.18	8.49	1.18	3333
3	Co 12009	0	4.39	12.09	1.29	6.52	2.50	10000
4	Co 12012	0	3.15	10.22	2.20	8.53	2.62	10000
5	Co 12019	0	0.00	0.00	1.66	7.40	0.83	3333
6	Co 12024	0	5.93	14.09	1.18	6.24	3.19	10000
7	CoM 12085	0	17.08	24.41	17.20	24.50	17.10	76667
8	VSI 12121	0	15.49	23.18	15.59	23.26	15.48	61667
9	Co 86032	0	14.12	22.07	10.17	18.60	11.30	45000
10	CoC 671	0	9.45	17.90	9.66	18.11	8.86	35000
11	CoSnk 05103	0	12.05	20.31	7.67	16.08	9.72	35000

Figures in the parenthesis are arcsine transformed values and those outside are original values

Early shoot borer, *Chilo infuscatellus* (S.):

The data on per cent incidence, cumulative per cent incidence and number of bored plant per ha. showed that differences due to various genotypes in respect of per cent infestation of early shoot borer at 60 DAP and 90 DAP were found significant. Based on cumulative per cent incidence data it was showed the least incidence was observed in Co 12019 (0.83 %) while, maximum incidence was observed in CoM 12085 (17.10 %).

Table -4.1.2.2 Screening of sugarcane varieties against Top borer and Root borer in AVT (E) I P trial at Main Sugarcane Research Station, Navsari

Sr. No.	Genotype	% Incidence of Top Borer						Root Borer % incidence	
		5 month		7th month		At harvest			
1	Co 12007	2.06	8.25	1.00	5.74	1.60	7.27	20.67	27.04
2	Co 12008	1.28	6.50	2.06	8.25	0.91	5.47	28.67	32.37
3	Co 12009	1.08	5.97	1.64	7.36	1.67	7.43	10.00	18.43
4	Co 12012	0.53	4.17	1.31	6.57	1.36	6.70	12.00	20.27
5	Co 12019	1.49	7.01	0.00	0.00	1.62	7.31	14.67	22.52

6	Co 12024	1.26	6.45	0.00	0.00	0.55	4.25	14.67	22.52
7	CoM 12085	0.43	3.76	1.27	6.47	1.61	7.29	12.67	20.85
8	VSI 12121	1.49	7.01	1.20	6.29	1.52	7.08	15.07	22.84
9	Co 86032	2.01	8.15	1.62	7.31	2.17	8.47	11.33	19.67
10	CoC 671	1.01	5.77	1.13	6.10	1.51	7.06	12.67	20.85
11	CoSnk 05103	1.09	5.99	1.45	6.92	1.42	6.84	8.67	17.12

Figures in the parenthesis are arcsine transformed values and those outside are original values

Top borer: - *Scirpophaga excerptalis* (Wlk):

From the data (Table 4.1.2.2) it can be concluded that the per cent infestation of top borer at 5th month was non-significant whereas, 7thmonth and at harvest was found significant. Based on the per cent incidence of top borer at harvest the least per cent incidence was observed in Co 12024 (0.55 %) followed by Co 12008 (0.91 %), while maximum incidence was observed in Co 86032 (2.17 %).

Root borer: *Emmalocera depresella* (Swinhoe)

From the table 4.1.2.2, it is seen that the differences in respect to per cent incidence in various genotypes were found significant. Per cent incidence of root borer was ranged from 8.67 to 28.67 per cent. The least per cent incidence of root borer was observed in CoSnk 05103 (8.67 %) and maximum incidence was observed in Co 12008 (28.67 %) followed by Co 12007 (20.67).

Table -4.1.2.3 Screening of sugarcane varieties against Mealy bugs in AVT (E) I P trial at Main Sugarcane Research Station, Navsari

Sr. No.	Genotype	Mealy bugs			
		% incidence		% intensity	
1	Co 12007	1.22	6.34	0.25	2.87
2	Co 12008	0.00	0.00	0.00	0.00
3	Co 12009	1.89	7.90	0.85	5.29
4	Co 12012	0.00	0.00	0.00	0.00
5	Co 12019	0.00	0.00	0.00	0.00
6	Co 12024	0.00	0.00	0.00	0.00
7	CoM 12085	0.00	0.00	0.00	0.00
8	VSI 12121	1.17	6.21	0.27	2.98
9	Co 86032	1.89	7.90	0.71	4.83
10	CoC 671	3.00	9.97	0.95	5.59
11	CoSnk 05103	2.22	8.57	0.47	3.93

Figures in the parenthesis are arcsine transformed values and those outside are original values

4.1.2.4. Mealy bugs: *Saccharicoccus sacchari* (Cockerell)

Data from the table indicated differences due to various genotypes in respect of per cent incidence of mealy bugs were significant. Per cent incidence of mealy bugs ranged from 0.00 to 3.00 per cent. Maximum per cent incidence was observed in CoC 671 (3.00).

From the data it is seen that the differences due to various genotypes in respect of per cent intensity of mealy bugs were significant. Per cent intensity of mealy bugs, ranged from 0.00 to 0.95 per cent. Maximum per cent intensity was observed in CoC 671 (0.95 %) followed by Co 12009 (0.85 %) respectively.

Project E.4.1.3 AVT (E) II Plant trial:

Table -4.1.3.1 Screening of sugarcane varieties against ESB in AVT (E) II P trial at Main Sugarcane Research Station, Navsari (2017-18).

Sr. No.	Genotype	% Incidence of Early Shoot Borer					Cumulative incidence %	No. of bored plants/ha
		30 DAP	60 DAP		90 DAP			
1	Co 11001	0	4.58	(12.36)	2.44	(8.99)	2.62	10000
2	Co 11004	0	5.36	(13.38)	8.57	(17.02)	7.17	26667
3	CoM 11081	0	6.43	(14.69)	5.87	(14.02)	5.64	25000
4	CoM 11082	0	2.87	(9.76)	2.05	(8.23)	1.68	5000
5	CoM 11084	0	8.21	(16.65)	4.79	(12.64)	6.06	23333
6	Co 85004	0	9.07	(17.53)	6.96	(15.30)	7.73	26667
7	Co 94008	0	8.42	(16.87)	5.74	(13.86)	6.94	25000
8	CoC 671	0	10.88	(19.26)	8.57	(17.02)	7.98	35000

Figures in the parenthesis are arcsine transformed values and those outside are original values

Early shoot borer, *Chilo infuscatellus* (S.):

From the data in table 4.1.3.1 the differences due to various genotypes in respect of cumulative per cent infestation of early shoot borer at 60 DAP and 90 DAP were found significant. Based on the cumulative per cent incidence of early shoot borer the least incidence was observed in CoM 11082 (1.68 %) while, maximum incidence was observed in Check CoC 671 (7.98 %) followed by Co 85004 (7.73 %) and Co 11004 (7.17 %).

Table -4.1.3.2 Screening of sugarcane varieties against top borer and root borer in AVT (E) II P trial at Main Sugarcane Research Station, Navsari

Sr. No.	Genotype	% Incidence of Top Borer						Root Borer % incidence	
		5th month		7th month		At harvest			
1	Co 11001	1.44	6.89	0.98	5.68	1.55	7.15	12.00	20.27
2	Co 11004	2.50	9.10	1.62	7.31	1.53	7.11	15.33	23.05
3	CoM 11081	1.32	6.60	1.39	6.77	1.23	6.37	15.33	23.05
4	CoM 11082	1.41	6.82	0.00	0.00	2.52	9.13	18.33	25.35
5	CoM 11084	1.65	7.38	1.06	5.91	1.00	5.74	18.00	25.10
6	Co 85004	2.30	8.72	2.10	8.33	2.43	8.97	22.00	27.97
7	Co 94008	2.63	9.33	1.59	7.24	1.23	6.37	25.00	30.00
8	CoC 671	1.66	7.40	1.62	7.31	1.66	7.40	21.33	27.51

Figures in the parenthesis are arcsine transformed values and those outside are original values

Top borer: - *Scirpophaga excerptalis* (Wlk):

From the data it can be concluded that the per cent incidence of top borer at 5th month was found non-significant whereas at 7th month and at harvest found significant. Based on the per cent incidence of top borer at harvest least per cent incidence was observed in CoM 11084 (1.00 %) while maximum incidence was observed in CoM 11082 (2.52 %).

Root borer: *Emmalocera depresella* (Swinhoe)

From the data differences in respect to per cent incidence in various genotypes were found significant. Per cent incidence of root borer was ranged from 12.00 to 25.00 per cent. The lowest per cent incidence of root borer was observed in Co 11001 followed by Co 11004 and Co 10024 (15.33
%), respectively.

Table -4.1.3.3 Screening of sugarcane varieties against Scales and Mealy bugs in AVT (E) II P trial at Main Sugarcane Research Station, Navsari

Sr. No.	Genotype	Mealy bugs			
		% incidence		% intensity	
1	Co 11001	0.03	0.99	0.03	0.99
2	Co 11004	0.00	0.00	0.00	0.00
3	CoM 11081	1.54	7.13	0.08	1.62
4	CoM 11082	3.33	10.51	1.61	7.29
5	CoM 11084	0.00	0.00	0.00	0.00
6	Co 85004	0.00	0.00	0.00	0.00
7	Co 94008	2.35	8.82	0.11	1.90
8	CoC 671	0.00	0.00	0.00	0.00

Figures in the parenthesis are arcsine transformed values and those outside are original values

Mealy bugs: *Saccharicoccus sacchari* (Cockerell)

The data are presented in table indicate that per cent incidence of mealy bugs in various genotypes were significant. Per cent incidence ranged from 0.0 to 3.33 per cent. No incidence was observed in Co 11004, CoM 11084, Co 85004 and CoC 671. Maximum per cent incidence was observed in CoM 11082 (3.33 %).

From the data it is seen that differences due to various genotypes in respect of per cent intensity of mealy bugs were significant. Per cent intensity of mealy bugs, ranged from 0.00 to 1.61 per cent. Maximum per cent intensity was observed in CoM 11082 (1.61 %).

Project E.4.1.4 AVT (ML): II Plant 4.1.4.1Early shoot borer, *Chilo infuscatellus* (S.):

From the table, it is concluded that cumulative per cent infestation of early shoot borer in various genotypes at 60, and 90 DAP were found significant. Data of cumulative per cent infestation shows that least incidence was observed in Co 11007 (2.53 %).Whereas, incidence was observed maximum in Co 11019 (15.56 %).

Table -4.1.4.1 Screening of sugarcane varieties against ESB borer in AVT (ML) II Plant at Main Sugarcane Research Station, Navsari

Sr. No.	Genotype	% Incidence of Early Shoot Borer					Cumulative incidence (%)	No. of bored plants/ha
		30 DAP	60 DAP		90 DAP			
1	Co 11005	0	15.11	22.87	15.41	23.11	15.52	71667
2	Co 11007	0	3.24	10.37	2.19	8.51	2.53	10000
3	Co 11012	0	9.42	17.87	2.41	8.93	3.35	11667
4	Co 11019	0	16.68	24.11	15.54	23.22	15.56	58333
5	CoM 11085	0	9.72	18.17	7.26	15.63	8.40	35000
6	CoM 11086	0	5.40	13.44	4.07	11.64	4.59	16667
7	Co 85004	0	8.42	16.87	6.62	14.91	7.73	26667
8	Co 99004	0	15.61	23.27	15.28	23.01	15.42	55000
9	Co 86032	0	2.87	9.75	4.47	12.21	3.68	16667

Figures in the parenthesis are arcsine transformed values and those outside are original values

Table : 4.1.4.2 Screening of sugarcane varieties against top borer and root borer in AVT (ML) II Plant at Main Sugarcane Research Station, Navsari

Sr. No.	Genotype	% incidence of Top Borer						Root Borer % incidence	
		5^{th} month		7^{th} month		At harvest			
1	Co 11005	0.33	3.29	0.94	5.56	1.40	6.80	14.00	21.97
2	Co 11007	0.49	4.01	0.51	4.10	0.95	5.59	16.00	23.58
3	Co 11012	1.06	5.91	1.59	7.24	1.02	5.80	19.33	26.08
4	Co 11019	1.52	7.08	0.00	0.00	0.00	0.00	23.33	28.88
5	CoM 11085	0.98	5.68	0.00	0.00	1.01	5.77	23.33	28.88
6	CoM 11086	1.60	7.27	1.43	6.87	1.37	6.72	26.67	31.09
7	Co 85004	2.30	8.72	2.10	8.33	1.97	8.07	23.33	28.88
8	Co 99004	0.55	4.25	1.11	6.05	1.98	8.09	16.20	23.73
9	Co 86032	0.00	0.00	0.46	3.89	0.90	5.44	20.00	26.57

Figures in the parenthesis are arcsine transformed values and those outside are original values

Top borer*: - Scirpophaga excerptalis* (Wlk):

The data are presented in table shows that difference in respect of per cent incidence of top borer in various genotypes at 5^{th} and 7^{th} month and at harvest shows si gnificant reaction.

Per cent incidence of top borer infestation at 5^{th} month ranged from 0.00 (Co 86032) to 2.30 per cent (Co 85004). Whereas, at 7^{th} month per cent incidence ranged from 0.00 to 2.10 per cent. Highest incidence was observed in Co 85004 (2.10 %).

Based on data on per cent incidence of top borer at harvest it was found that infestation was ranged from 0.00 to 1.98 per cent.

Root borer: *Emmalocera depresella* (Swinhoe)

The data presented in table shows that difference in per cent incidence of root borer in various genotypes were significant. Per cent incidence of root borer ranged from 14.00 to 26.67 per cent. Highest per cent incidence was observed in CoM 11086 (26.66 %).

Table -4.1.4.3 Screening of sugarcane varieties against Mealy bugs in AVT (ML) II Plant trial at Main Sugarcane Research Station, Navsari

Sr. No.	Genotype	Mealy bugs			
		% incidence		% intensity	
1	Co 11005	1.33	6.62	0.09	1.72
2	Co 11007	4.67	12.48	1.45	6.92
3	Co 11012	0.00	0.00	0.00	0.00
4	Co 11019	0.00	0.00	0.00	0.00
5	CoM 11085	1.33	6.62	0.17	2.36
6	CoM 11086	2.67	9.40	0.72	4.87
7	Co 85004	2.67	9.40	1.06	5.91
8	Co 99004	1.33	6.62	0.44	3.80
9	Co 86032	1.33	6.62	0.09	1.72

* Figures in the parenthesis are arcsine transformed values and those outside are original values

Mealy bugs: *Saccharicoccus sacchari* (Cockerell)

Per cent incidence as well as per cent intensity of mealy bugs among various genotypes was found significant. Per cent incidence and per cent intensity was recorded maximum in Co11007 (4.67%) and (1.45 %), respectively.

Zonal Agricultural Research Station, Powarkheda (M.P.)

Five entries of AVT - II (early group), six entries of AVT - II (mid late group), nine entries of AVT I and thirty eight entries of IVT, 2017 – 18 with 3,2,2 and 2 check varieties respectively screened for their reaction against infestation of key pests of the area i.e., Early shoot borer (ESB) and Pyrilla. This year pyrilla infestation observed in traces i.e., in August end, only one or two pyrilla individuals observed per plot. The infestation of insect pests recorded and the reactions are given in Table -1, 2, 3 & 4.

AVT - II (Early):

The early shoot borer infestation ranged in-between 15.05 to 27.85 per cent in various checks and entries screened. All the check as well as entries graded as moderately susceptible (MS). Numerically minimum ESB infestation observed in **Co 85004 (check, 15.05 %),** followed by CoM 11082 (15.33%), Co 11004 (18.32%), **Co 94008 (check, 18.97 %**) and CoM 11084 (19.76%), all were significantly at par with each other. Numerically maximum ESB infestation (27.85%) observed in Co 11001, followed by Co M 11081 (26.89%) both were significantly at par with each other and to followed CoC 671 (check, 22.69%).

Table-1: Reaction of different entries (early group) against early shoot borer AVT 2 Powarkheda, Madhya Pradesh

S. No.	Entry	ESB (%)	Grade
1.	Co 85004	15.05	**MS**
2.	CoM 11082	15.33	**MS**
3.	Co 11004	18.32	**MS**
4.	Co 94008	18.97	**MS**
5.	CoM 11084	19.76	**MS**
6.	CoC 671	22.69	**MS**
7.	CoM 11081	26.89	**MS**
8.	Co 11001	27.85	**MS**

AVT - II (mid late group):

The ESB infestation ranged in-between 5.54 to 24.97 per cent in various check varieties screened. Numerically minimum ESB infestation recorded in CoM 11086 (5.54%), followed by Co 11019 (10.07%), both were significantly at par with each other. The later had non-significant relation with Co 86032 (check, 15.25%), CoM 11085 (16.45%) and Co11005 (16.47%). Numerically maximum ESB infestation recorded in Co 11007 (24.97%), while the Co 1102 (18.32%) was the next highest infested one. The CoM 11086 and Co 11019 graded as least susceptible (LS), while all other including check varieties graded as MS.

Table-2: Reaction of different entries (Mid late group) against early shoot borer AVT II Powarkheda, Madhya Pradesh (2017-18) 8

S. No.	Entry	ESB (%)	Grade
1.	CoM 11086	5.54	**LS**
2.	Co 11019	10.07	**LS**
3.	Co 86032	15.25	**MS**
4.	CoM 11085	16.45	**MS**
5.	Co 11005	16.47	**MS**
6.	Co 99004	18.00	**MS**
7.	Co 11012	18.32	**MS**
8.	Co 11007	24.97	**MS**

AVT – I (Plant) 2017-18:

ESB infestation varied from 5.57 to 29.49 per cent in various entries and check varieties screened. Co 12024 (5.57%) recorded numerically minimum ESB infestation, followed by VSI 12121 (6.36%), Co 12012 (9.36%), Co 12007 (11.02%) and Co SnK 5103 (11.09%), all were significantly at par with each other and graded as **LS**. Later four had non-significant relation with next following CoM 12019 (12.58, LS). Co 12009 received the maximum ESB infestation (29.49%), the Co 12008 (28.32%) was the next highest ESB infested, and both were significantly at par with each other and also to the CoC 671 (25.00%, check). Out of total screened entries, six graded as least susceptible (LS), while two entries and both check varieties graded as MS.

Table-3: Reaction of different entries (early group) against early shoot borer AVT I (Plant) Powarkheda, Madhya Pradesh

S. No.	Entry	ESB (%)	Grade
1.	Co 12024	5.57	**LS**
2.	VSI 12121	6.36	**LS**
3.	Co 12012	9.36	**LS**
4.	Co 12007	11.02	**LS**
5.	CoSnK 5103	11.09	**LS**
6.	CoM 12085	12.58	**LS**
7.	Co 12019	17.02	**MS**
8.	Co 86032	18.14	**MS**
9.	CoC 671	25.00	**MS**
10.	Co 12008	28.32	**MS**
11.	Co 12009	29.49	**MS**

IVT (Plant)

The ESB infestation observed to range in-between 2.34 to 21.02 per cent in various entries and check varieties screened. Thirty two entries graded as least susceptible (LS), whereas sixteen entries and both check varieties graded as moderately susceptible (MS). The Co 14023, Co 14025, CoSnK 05103, Co 14032, Co 14009 and CoT 14367 (2.34 to 4.42%) received ESB infestation less than five per cent and significantly at par with each other, and except last two, significantly superior to both check varieties Co 86032 (10.77%) and CoC 671 (15.69%).

Table-4: Reaction of different entries (early group) against early shoot borer IVT Powarkheda, Madhya Pradesh (2018-19) 11

S. No.	Entry	ESB (%)	Grade
1.	Co 14023	3.52	**LS**
2.	Co 14025	4.15	**LS**
3.	CoSnK 05103	5.11	**LS**
4.	Co 14032	6.12	**LS**
5.	Co 14009	6.47	**LS**
6.	CoT 14367	6.63	**LS**
7.	Co 14002	7.62	**LS**
8.	VSI 14122	7.89	**LS**
9.	CoN 14072	8.33	**LS**
10.	CoN 14073	9.18	**LS**
11.	Co 14026	10.99	**LS**
12.	Co 14022	11.31	**LS**
13.	CoVC 14062	11.69	**LS**
14.	CoTl 14111	12.30	**LS**
15.	Co 13021	12.36	**LS**
16.	PI 14132	12.87	**LS**
17.	CoTl 14112	13.80	**LS**
18.	CoN 14074	14.17	**LS**
19.	MS 14081	14.36	**LS**
20.	VSI 14121	14.51	**LS**
21.	PI 14131	14.55	**LS**
22.	Co 14030	14.69	**LS**
23.	Co 14012	15.39	**MS**
24.	Co 86032	16.15	**MS**
25.	CoVC 14061	16.99	**MS**
26.	CoSnK 14101	17.56	**MS**
27.	Co 14004	18.30	**MS**
28.	CoT 14366	20.38	**MS**
29.	Co 14031	20.52	**MS**
30.	Co 14008	20.84	**MS**
31.	CoSnK 14102	22.04	**MS**
32.	CoC 671	23.54	**MS**
33.	Co 14006	24.72	**MS**
34.	CoSnK 14103	24.85	**MS**
35.	CoN 14071	26.36	**MS**
36.	Co 14003	26.89	**MS**
37.	Co 13022	27.15	**MS**

38.	Co 14016	27.38	**MS**
39.	MS 14082	28.04	**MS**
40.	Co 14027	31.53	**MS**

CSRS, MPKV, PADEGAON

The data is presented in table 1 to 4. From the table, it is seen that the differences due to various genotypes in respect of cumulative per cent infestation of early shoot borer, internode borer, mealy bug and scale insect were statistically significant. It was observed that, there was no incidence of top shoot borer in all entries.

Early shoot borer (ESB) (Table-1) :

The cumulative per cent infestation of early shoot borer ranged from 11.46 to 57.10 per cent. In all test genotypes, 4, 24 & 12 test genotypes showed less susceptible, moderately susceptible & highly susceptible reaction to early shoot borer, respectively. The CoSnk 14101 recorded least incidence of early shoot borer (11.46%) followed by MS 14082 (11.98%).

Table-1. Evaluation of genotypes/varieties for their reaction against early shoot borer, (CSRS, MPKV, Padegaon)

Sr. No.	Genotype	Per cent incidence of ESB					Reaction	No. of bored plants/ha (On the basis of Cumulative % incidence)
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative % incidence		
1	Co 14002	0.00	8.40	15.79	13.59	26.41	MS	18541.67
2	Co 14003	0.00	4.32	8.22	7.43	15.02	MS	9166.667
3	Co 14004	0.00	31.58	18.79	10.10	32.91	HS	27291.67
4	Co 14006	0.00	10.00	13.64	9.82	22.98	MS	15416.67
5	CoN 14071	0.00	3.70	7.09	6.02	13.09	LS	9791.667
6	CoN14072	0.00	10.05	10.67	6.05	17.93	MS	16250
7	CoSnk 14101	0.00	7.34	4.12	4.35	11.46	LS	7708.333
8	CoSnk 14102	0.75	0.50	15.00	12.70	24.66	MS	18750
9	CoT 14366	0.00	27.74	27.63	17.86	41.36	HS	30416.67
10	CoT 14367	0.00	24.00	42.41	26.88	57.10	HS	37708.33
11	MS 14081	0.00	2.99	19.81	11.07	24.91	MS	15000
12	MS 14082	0.00	4.05	5.00	6.51	11.98	LS	8958.333
13	Co 13021	0.00	7.69	12.99	7.04	19.29	MS	12500
14	Co 13022	0.00	10.85	13.15	10.25	23.43	MS	13958.33
15	Co 14008	0.00	9.09	17.49	17.74	32.00	HS	20000
16	Co 14009	0.00	3.66	18.07	15.28	30.22	HS	17500
17	Co 14012	0.00	6.06	18.85	18.38	32.32	HS	22083.33
18	Co 14016	0.00	8.29	10.68	11.76	23.18	MS	17916.67
19	Co 14022	0.00	6.54	10.23	9.80	19.82	MS	13750
20	Co 14023	0.00	10.27	10.53	8.07	19.85	MS	16458.33
21	Co 14025	0.00	4.91	19.14	9.41	25.05	MS	24791.67
22	Co 14026	0.00	1.76	11.97	9.72	18.75	MS	15625
23	Co 14027	0.00	4.79	26.60	16.44	35.32	HS	28333.33
24	Co 14030	0.00	13.66	19.70	15.34	33.81	HS	29375
25	Co 14031	0.00	7.89	16.32	12.50	25.98	MS	17916.67

table continued…

Sr. No.	Genotype	Per cent incidence of ESB					Reaction	No. of bored plants/ha (On the basis of Cumulative % incidence)
		30 DAP	60 DAP	90 DAP	120 DAP	Cumu-lative % inci-dence		
26	Co 14032	0.00	11.46	24.11	21.59	39.65	HS	28333.33
27	CoN 14073	0.00	9.63	28.09	15.36	37.22	HS	27916.67
28	CoN 14074	0.00	13.97	15.81	16.53	33.87	HS	22083.33
29	CoSnk 14103	0.00	11.59	14.63	7.11	23.74	MS	12708.33
30	CoTl14111	0.00	5.05	7.69	5.86	14.57	MS	10833.33
31	CoTl 14112	0.00	4.65	12.37	8.77	19.94	MS	14583.33
32	CoVC14061	0.00	2.07	8.64	9.58	16.61	MS	9791.667
33	CoVC 14062	0.00	3.61	10.05	10.83	20.15	MS	11250
34	PI 14131	0.00	7.09	8.13	17.18	25.98	MS	13750
35	PI 14132	0.00	0.67	5.36	8.98	13.38	LS	7500
36	VSI 14121	0.00	5.81	9.21	9.06	18.24	MS	11666.67
37	VSI 14122	0.00	2.88	9.80	7.62	16.60	MS	8541.667
38	Co 86032	0.00	22.35	17.05	11.50	31.35	HS	24166.67
39	CoC 671	0.00	12.67	12.82	11.76	26.83	MS	16041.67
40	CoSnk 05103	0.00	14.67	10.13	4.96	18.70	MS	15625

Internode borer (IB) (Table-2) :

Regarding internode borer, the incidence ranged from 0 to 75 per cent. The 10, 21 and 9 test genotypes recorded less susceptible, moderately susceptible and highly susceptible reaction to internode borer, respectively. The entry Co 14031 recorded no incidence to internode borer and followed by Co 14026 and CoSnk 05103 (10.00 % each).

Table-2. Evaluation of genotypes/varieties for their reaction against internode borer, (CSRS, MPKV, Padegaon)

Sr. No.	Genotype	Internode borer			
		% incidence	% intensity	% Infestation index	Reaction
1	Co 14002	45.00 (42.11)	4.19	1.88	HS
2	Co 14003	50.00 (45.00)	3.26	1.63	HS
3	Co 14004	75.00(60.11)	5.62	4.21	HS
4	Co 14006	55.00(51.33)	3.74	2.06	HS
5	CoN 14071	25.00(29.88)	1.17	0.29	MS
6	CoN14072	30.00(32.89)	1.71	0.51	MS
7	CoSnk 14101	20.00(25.82)	1.06	0.21	LS
8	CoSnk 14102	15.00(22.50)	0.70	0.10	LS
9	CoT 14366	35.00(36.22)	3.30	2.15	MS
10	CoT 14367	35.00(35.78)	2.20	0.77	MS
11	MS 14081	25.00(29.88)	2.12	0.53	MS
12	MS 14082	25.00(28.83)	1.35	0.34	MS
13	Co 13021	35.00(36.22)	2.30	0.80	MS
14	Co 13022	25.00(29.88)	1.97	0.49	MS
15	Co 14008	30.00(32.89)	1.65	0.49	MS

16	Co 14009	45.00(41.99)	3.10	1.39	HS
17	Co 14012	30.00(33.21)	1.79	0.54	MS
18	Co 14016	15.00(22.50)	0.94	0.14	LS
19	Co 14022	65.00(54.22)	6.98	4.54	HS
20	Co 14023	45.00(42.11)	3.18	1.43	HS
21	Co 14025	40.00(39.10)	2.90	1.16	MS
22	Co 14026	10.00(18.44)	0.70	0.07	LS
23	Co 14027	25.00(32.89)	1.41	0.35	MS
24	Co 14030	15.00(22.50)	0.98	0.15	LS
25	Co 14031	0.00(0.00)	0.00	0.00	LS
26	Co 14032	40.00(49.10)	2.50	1.00	MS
27	CoN 14073	50.00(45.00)	3.60	1.80	HS
28	CoN 14074	20.00(26.56)	1.04	0.21	LS
29	CoSnk 14103	30.00(32.89)	2.26	0.68	MS
30	CoTl14111	15.00(22.50)	0.90	0.13	LS
31	CoTl 14112	40.00(39.23)	2.36	0.94	MS
32	CoVC14061	25.00(32.89)	1.67	0.42	MS
33	CoVC 14062	25.00(28.83)	1.68	0.42	MS
34	PI 14131	25.00(32.89)	2.10	0.52	MS
35	PI 14132	30.00(32.89)	2.99	0.90	MS
36	VSI 14121	50.00(47.88)	5.42	2.41	HS
37	VSI 14122	20.00(25.82)	1.36	0.27	LS
38	Co 86032	25.00(29.88)	1.97	0.49	MS
39	CoC 671	25.00(28.83)	1.97	0.49	MS
40	CoSnk 05103	10.00(18.44)	0.55	0.05	LS

Table-3. Evaluation of genotypes/varieties for their reaction against mealy bug, (CSRS, MPKV, Padegaon)

Sr. No.	Genotype	Mealy bug		
		% incidence	% intensity	Reaction
1	Co 14002	55.00(48.01)	5.07	HS
2	Co 14003	85.00(67.50)	7.60	HS
3	Co 14004	55.00(49.06)	4.78	HS
4	Co 14006	70.00(57.10)	6.16	HS
5	CoN 14071	55.00(48.01)	3.06	HS
6	CoN14072	75.00(61.16)	6.52	HS
7	CoSnk 14101	75.00(60.11)	7.43	HS
8	CoSnk 14102	75.00(60.11)	7.41	HS
9	CoT 14366	75.00(61.16)	5.91	HS
10	CoT 14367	70.00(58.28)	8.07	HS
11	MS 14081	85.00(67.50)	9.26	HS
12	MS 14082	75.00(60.11)	6.23	HS
13	Co 13021	65.00(54.22)	6.98	HS
14	Co 13022	95.00(80.78)	16.67	HS
15	Co 14008	75.00(61.16)	6.21	HS
16	Co 14009	85.00(67.50)	8.06	HS
17	Co 14012	75.00(61.16)	8.44	HS
18	Co 14016	75.00(60.11)	11.39	HS
19	Co 14022	60.00(51.33)	5.6	HS
20	Co 14023	75.00(60.11)	10.88	HS
21	Co 14025	80.00(64.17)	7.51	HS
22	Co 14026	100.00(90.00)	21.28	HS
23	Co 14027	65.00(54.22)	3.83	HS
24	Co 14030	95.00(80.78)	11.31	HS
25	Co 14031	65.00(55.39)	11.24	HS

26	Co 14032	80.00(64.17)	11.72	HS
27	CoN 14073	85.00(67.50)	6.79	HS
28	CoN 14074	85.00(67.50)	9.84	HS
29	CoSnk 14103	95.00(80.78)	11.51	HS
30	CoTl14111	70.00(57.10)	7.75	HS
31	CoTl 14112	80.00(63.44)	8.56	HS
32	CoVC14061	95.00(80.78)	10.91	HS
33	CoVC 14062	85.00(67.50)	8.23	HS
34	PI 14131	65.00(61.60)	9.28	HS
35	PI 14132	95.00(80.78)	8.44	HS
36	VSI 14121	85.00(67.50)	14.52	HS
37	VSI 14122	55.00(47.88)	3.99	HS
38	Co 86032	90.00(71.56)	13.22	HS
39	CoC 671	85.00(73.39)	9.51	HS
40	CoSnk 05103	80.00(64.17)	9.47	HS

Mealy bug (MB) (Table-3):
The mealy bug incidence ranged from 55.00 to cent per cent. All test genotypes recorded highly susceptible reaction to mealy bug. The entries *viz.,* Co 14002, Co 14004 and VSI 14122 observed least incidence of mealy bug (55.00 %), while least per cent intensity was observed in CoN 14071 (3.06%). The cent per cent incidence was observed in Co 14026.

Scale insect (SI) (Table-4):

In case of scale insect, the incidence ranged from 0 to 80 per cent. The 12, 20 and 8 test genotypes showed less susceptible, moderately susceptible and highly susceptible reaction to scale insect, respectively. The entries *viz.,* Co 14002, Co 14003, CoN 14071, CoN 14072, Co 14012, Co 14026 and CoN 14074 showed no incidence to scale insect.

Table-4. Evaluation of genotypes / varieties for their reaction against scale insect, .

Sr. No.	Genotype	Scale Insect		
		% incidence	% intensity	Reaction
1	Co 14002	00.00(00.00)	0.00	LS
2	Co 14003	00.00(00.00)	0.00	LS
3	Co 14004	15.00(16.60)	1.69	MS
4	Co 14006	40.00(39.23)	6.37	HS
5	CoN 14071	00.00(00.00)	0.00	LS
6	CoN14072	00.00(00.00)	0.00	LS
7	CoSnk 14101	80.00(70.38)	31.74	HS
8	CoSnk 14102	55.00(48.01)	8.12	HS
9	CoT 14366	15.00(16.60)	2.13	MS
10	CoT 14367	25.00(29.88)	4.03	MS
11	MS 14081	35.00(36.22)	4.67	MS
12	MS 14082	15.00(16.60)	1.36	MS
13	Co 13021	55.00(48.01)	10.02	HS
14	Co 13022	15.00(16.60)	2.35	MS
15	Co 14008	35.00(36.22)	3.77	MS
16	Co 14009	50.00(45.00)	9.28	HS
17	Co 14012	00.00(00.00)	0.00	LS
18	Co 14016	10.00(13.28)	1.69	LS
19	Co 14022	25.00(29.88)	3.44	MS
20	Co 14023	10.00(13.28)	1.54	LS
21	Co 14025	20.00(26.56)	2.17	MS
22	Co 14026	00.00(00.00)	0.00	LS
23	Co 14027	15.00(16.60)	1.86	MS
24	Co 14030	35.00(36.22)	4.98	MS
25	Co 14031	30.00(25.38)	4.06	MS
26	Co 14032	20.00(25.82)	1.98	MS
27	CoN 14073	40.00(39.23)	5.98	HS

28	CoN 14074	00.00(00.00)	0.00	LS
29	CoSnk 14103	15.00(16.60)	2.85	MS
30	CoTl14111	00.00(00.00)	0.00	LS
31	CoTl 14112	15.00(16.60)	2.28	MS
32	CoVC14061	30.00(33.21)	4.47	MS
33	CoVC 14062	10.00(13.28)	1.44	LS
34	PI 14131	20.00(19.61)	2.45	MS
35	PI 14132	50.00(45.00)	7.13	HS
36	VSI 14121	25.00(29.88)	4.59	MS
37	VSI 14122	10.00(13.28)	3.31	LS
38	Co 86032	15.00(16.60)	2.85	MS
39	CoC 671	40.00(39.10)	4.47	HS
40	CoSnk 05103	25.00(29.88)	2.50	MS

02 Internode borer, scale insect and mealy bugs :

The observations were recorded at harvest on 25 canes. The per cent incidence and intensity of internode borer, scale insect and mealy bugs were worked out.

Table-5. Evaluation of genotypes/varieties for their reaction against early shoot borer.

Sr. No.	Genotype	Per cent incidence of ESB					Reaction	No. of bored plants/ha (On the basis of Cumulative % incidence)
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative % incidence		
1	Co 12007	0.00	11.69	11.00	5.65	17.75	MS	28055.56
2	Co 12008	0.00	7.53	10.25	4.20	15.35	MS	26388.89
3	Co 12009	0.00	3.24	5.88	10.63	17.52	MS	20833.33
4	Co 12012	0.00	14.14	18.85	10.54	28.69	MS	66388.89
5	Co 12019	0.00	10.00	14.71	14.55	26.62	MS	50277.78
6	Co 12024	0.00	6.75	10.73	7.62	17.64	MS	30277.78
7	CoM 12085	0.00	12.59	19.68	9.74	27.48	MS	47777.78
8	VSI 12121	0.00	4.22	10.10	7.14	17.16	MS	29166.67
9	Co 86032	0.00	14.23	15.73	9.83	26.03	MS	47500
10	CoC 671	0.00	8.54	13.64	10.79	23.87	MS	35277.78
11	CoSnk 05103	0.00	2.44	9.08	4.69	12.62	LS	26111.11

Results:

The data is presented in table 5 to 8. From the table, it is seen that the differences due to various genotypes in respect of cumulative per cent infestation of early shoot borer, internode borer and mealy bug were statistically significant. It was observed that, there was no incidence of top shoot borer and scale insect in all entries.

Early shoot borer (ESB) (Table-5):
The cumulative per cent infestation of early shoot borer ranged from 12.62 to 28.69 per cent. Not a single entry recorded highly susceptible reaction to early shoot borer. The 1 and 10 test genotypes observed less susceptible and moderately susceptible reaction to early shoot borer, respectively. The entry CoSnk 05103 showed least infestation (12.62%) followed by Co 12008 (15.35 %) and VSI 12121 (17.16%).

Internode borer (IB) (Table-6):
Regarding internode borer, the incidence ranged from 16.67 to 50.00 per cent. The variety, Co 12009 and Co 12012 showed least incidence of internode borer (16.67% each) followed by, the entry VSI 12121 (20.00 %). In all test genotypes, 2, 5 and 4 test genotypes showed less susceptible, moderately susceptible and highly susceptible reaction to internode borer, respectively.

Mealy bug (MB) (Table-7):
The mealy bug incidence ranged from 43.33 to cent per cent. In AVT Early I Plant, all test genotypes recorded highly susceptible reaction to mealy bug. The variety Co 86032 recorded least incidence of mealy bug (43.33%), followed by Co 12012 and CoSnk 05103 (60.00 per cent each).

Scale insect (SI) (Table-8):
In case of scale insect, the incidence ranged from 0 to 23.33 per cent. None of the entry showed highly susceptible reaction to scale insect. The 5 and 6 test genotypes showed less susceptible and moderately susceptible reaction to scale insect, respectively. The entries *viz.,* Co 12008, VSI 12121 and CoC 671 showed no incidence to scale insect.

Table-6. Evaluation of genotypes/varieties for their reaction against internode borer.

Sr. No.	Genotype	Internode borer			
		% incidence	% intensity	% Infestation index	Reaction
1	Co 12007	50.00(45.00)	3.06	1.53	HS
2	Co 12008	50.00(45.00)	2.83	1.41	HS
3	Co 12009	16.67(23.85)	0.85	0.14	LS
4	Co 12012	16.67(23.85)	1.07	0.18	LS
5	Co 12019	33.33(34.92)	1.84	0.61	MS
6	Co 12024	33.33(34.22)	2.65	0.88	MS
7	CoM 12085	43.33(41.15)	2.70	1.17	HS
8	VSI 12121	20.00(21.93)	1.39	0.28	MS
9	Co 86032	30.00(33.33)	2.08	0.62	MS
10	CoC 671	46.67(42.99)	2.98	1.39	HS
11	CoSnk 05103	23.33(28.29)	1.14	0.27	MS

Table-7. Evaluation of genotypes/varieties for their reaction against mealy bug.

Sr. No.	Genotype	Mealy bug		
		% incidence	% intensity	Reaction
1	Co 12007	76.67(61.92)	9.28	HS
2	Co 12008	66.67(55.78)	7.95	HS
3	Co 12009	70.00(57.00)	7.95	HS

4	Co 12012	60.00(51.84)	5.47	HS
5	Co 12019	90.00(75.00)	10.16	HS
6	Co 12024	100.00(90.00)	8.84	HS
7	CoM 12085	86.67(72.78)	9.39	HS
8	VSI 12121	66.67(55.08)	5.05	HS
9	Co 86032	43.33(41.15)	5.17	HS
10	CoC 671	63.33(52.78)	5.37	HS
11	CoSnk 05103	60.00(50.85)	4.66	HS

Table-8. Evaluation of genotypes/varieties for their reaction against scale insect.

Sr. No.	Genotype	Scale Insect		
		% incidence	% intensity	Reaction
1	Co 12007	10.00(11.07)	0.85	LS
2	Co 12008	0.00(0.00)	0.00	LS
3	Co 12009	20.00(16.92)	4.38	MS
4	Co 12012	13.33(13.08)	1.38	MS
5	Co 12019	20.00(22.14)	2.76	MS
6	Co 12024	16.67(15.00)	3.56	MS
7	CoM 12085	10.00(15.00)	1.13	LS
8	VSI 12121	0.00(0.00)	0.00	LS
9	Co 86032	13.33(13.08)	2.22	MS
10	CoC 671	0.00(0.00)	0.00	LS
11	CoSnk 05103	23.33(28.08)	2.86	MS

02 Internode borer, scale insect and mealy bugs :

The observations were recorded at harvest on 25 canes. The per cent incidence and intensity of internode borer, scale insect and mealy bugs were worked out.

Results:

The data is presented in table 9 to 12. From the table, it is seen that the differences due to various genotypes in respect of cumulative per cent infestation of early shoot borer, internode borer, and mealy bug were statistically significant. It was observed that, there was no incidence of top shoot borer as well as scale insect in all entries.

Early shoot borer (ESB) (Table-9):

The cumulative per cent infestation of early shoot borer ranged from 07.11 to 16.19 per cent. In AVT E II Plant, no entry observed highly susceptible reaction to early shoot borer. The 7 & 1 test genotypes showed less susceptible and moderately susceptible reaction to early shoot borer, respectively. The entry Co 85004 recorded least incidence of early shoot borer (7.11%), followed by Co 11001 (7.28%) and CoM 11082 (9.78 %).

Internode borer (IB) (Table-10):

Regarding internode borer, the incidence ranged from 16.67 to 77.33 per cent. In AVT E II Plant, the 2, 2 and 4 test genotypes showed less susceptible, moderately susceptible and highly susceptible reaction to internode borer, respectively. The entries CoM 11084 and Co 85004 recorded least incidence (16.67% each) followed by entry Co 11004 (26.67 %).

Mealy bug (MB) (Table-11):

The mealy bug incidence ranged from 26.67 to 83.33 per cent. The all test genotypes showed highly susceptible reaction to mealy bug except CoM 11084, which recorded 26.67 per cent incidence. It was followed by CoM 11082 and Co 85004 (36.67 % each).

Table-9. Evaluation of genotypes/varieties for their reaction against early shoot borer.

Sr. No.	Genotype	Per cent incidence of ESB						No. of bored plants/ha (On the basis of Cumulative % incidence)
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative % incidence	Reaction	
1	Co 11001	0.00	3.49	3.45	2.80	7.28	LS	8333.333
2	Co 11004	0.63	2.30	3.66	6.29	10.06	LS	13888.89
3	CoM 11081	0.00	3.43	3.87	8.20	12.16	LS	17222.22
4	CoM 11082	0.00	3.01	4.07	5.41	9.78	LS	10000
5	CoM 11084	0.00	4.41	9.43	6.08	14.77	LS	23055.56
6	Co 85004	0.64	0.49	2.88	4.52	7.11	LS	9444.444
7	Co 94008	0.51	7.05	4.95	3.14	10.84	LS	12500
8	CoC 671	0.00	5.14	8.60	7.85	16.19	MS	18888.89

Table-10. Evaluation of genotypes/varieties for their reaction against internode borer.

Sr. No.	Genotype	Internode borer			
		% incidence	% intensity	% Infestation index	Reaction
01	Co 11001	43.33(41.15)	2.48	1.07	HS
02	Co 11004	26.67(26.07)	1.83	0.49	MS
03	CoM 11081	73.33(60.00)	6.61	4.85	HS
04	CoM 11082	36.67(37.22)	2.02	0.74	MS
05	CoM 11084	16.67(23.85)	0.89	0.15	LS
06	Co 85004	16.67(23.85)	1.17	0.19	LS
07	Co 94008	43.33(41.07)	2.48	1.07	HS
08	CoC 671	66.67(54.78)	4.52	3.01	HS

Table-11. Evaluation of genotypes/varieties for their reaction against mealy bug.

Sr. No.	Genotype	Mealy bug		
		% incidence	% intensity	Reaction
01	Co 11001	76.67(61.71)	11.72	HS
02	Co 11004	83.33(66.64)	12.24	HS
03	CoM 11081	63.33(52.78)	4.79	HS
04	CoM 11082	36.67(37.22)	14.03	HS
05	CoM 11084	26.67(30.00)	6.33	MS
06	Co 85004	36.67(36.15)	11.53	HS
07	Co 94008	40.00(39.23)	3.27	HS
08	CoC 671	50.00(45.00)	3.75	HS

Table-12. Evaluation of genotypes/varieties for their reaction against scale insect.

Sr. No.	Genotype	Scale Insect		
		% incidence	% intensity	Reaction
01	Co 11001	20.00(16.92)	3.30	MS
02	Co 11004	10.00(11.07)	1.19	LS
03	CoM 11081	0.00(0.00)	0.00	LS

04	CoM 11082	3.33(6.15)	0.32	LS
05	CoM 11084	0.00(0.00)	0.00	LS
06	Co 85004	0.00(0.00)	0.00	LS
07	Co 94008	10.00(15.00)	0.32	LS
08	CoC 671	23.33(24.15)	6.10	MS

Scale insect (SI) (Table-12):
In case of scale insect, the incidence ranged from 0 to 23.33 per cent. None of the entry showed highly susceptible reaction to scale insect. The 6 and 2 test genotypes showed less susceptible and moderately susceptible reaction to scale insect, respectively. The entries *viz.,* CoM 11081, CoM 11084 and Co 85004 showed no incidence to scale insect.

02 Internode borer, scale insect and mealy bugs :

The observations were recorded at harvest on 25 canes. The per cent incidence and intensity of internode borer, scale insect and mealy bugs were worked out.

The data is presented in table 13 to 16. From the table, it is seen that the differences due to various genotypes in respect of cumulative per cent infestation of early shoot borer, internode borer, mealy bug and scale insect were statistically significant. It was observed that, there was no incidence of top shoot borer in all entries.

Early shoot borer (ESB) (Table-13):
The cumulative per cent infestation of early shoot borer ranged from 8.99 to 18.02 per cent. In IVT ML trial, 4 test genotypes each showed less susceptible, and moderately susceptible reaction to early shoot borer, respectively. None of the entry showed highly susceptible reaction to early shoot borer. The entry Co 11019 observed least infestation to early shoot borer (8.99%), followed by Co 11012 (10.05%) and Co 99004 (12.77%).

Table-13. Evaluation of genotypes/varieties for their reaction against early shoot borer.

Sr. No.	Genotype	Per cent incidence of ESB					Reaction	No. of bored plants/ha (On the basis of Cumulative % incidence)
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative % incidence		
1	Co 11005	0.00	6.23	11.55	6.47	17.65	MS	26666.67
2	Co 11007	0.00	0.00	9.02	8.87	14.61	LS	14166.67
3	Co 11012	0.00	2.02	4.04	6.34	10.05	LS	10555.56
4	Co 11019	0.00	0.49	4.03	5.81	8.99	LS	8888.889
5	CoM 11085	0.54	4.61	10.51	4.84	15.20	MS	22500
6	***CoM 11086***	0.00	3.13	6.45	9.36	15.40	MS	18611.11
7	Co 86032	0.00	5.88	11.03	8.38	18.02	MS	31388.89
8	Co 99004	0.00	5.42	8.37	3.63	12.77	LS	9722.222

Internode borer (IB) (Table-14):
Regarding internode borer, the incidence ranged from 16.67 to 50.00 per cent. The 2, 4 and 2 test genotypes showed less susceptible, moderately susceptible and highly susceptible reaction to internode borer, respectively. The variety Co 11012 recorded least incidence to internode borer (16.67%), followed by the entry Co 99004 (20%).

Table-14. Evaluation of genotypes/varieties for their reaction against internode borer.

Sr. No.	Genotype	Internode borer			
		% incidence	% intensity	% Infestation index	Reaction
01	Co 11005	43.33(40.37)	2.80	1.21	HS
02	Co 11007	26.67(32.22)	1.62	0.43	MS
03	Co 11012	16.67(19.92)	1.29	0.21	LS
04	Co 11019	30.00(33.00)	2.39	0.72	MS
05	CoM 11085	26.67(30.78)	1.27	0.34	MS
06	***CoM 11086***	50.00(45.00)	3.17	1.58	HS
07	Co 86032	33.33(34.92)	1.65	0.55	MS
08	Co 99004	20.00(22.14)	1.80	0.36	LS

Mealy bug (MB) (Table-15):
The mealy bug incidence ranged from 66.67 to cent per cent. The all test genotypes showed highly susceptible reaction to mealy bug. The entry Co 11019 and variety Co 86032 showed least incidence of mealy bug (66.67 per cent each). The entry CoM 11085 recorded cent per cent incidence of mealy bug.

Table-15. Evaluation of genotypes/varieties for their reaction against mealy bug.

Sr. No.	Genotype	Mealy bug		
		% incidence	% intensity	Reaction
01	Co 11005	80.00(64.63)	8.24	HS
02	Co 11007	83.33(66.50)	12.01	HS
03	Co 11012	90.00(78.93)	17.51	HS
04	Co 11019	66.67(54.78)	7.58	HS
05	CoM 11085	100.00(90.00)	15.00	HS
06	***CoM 11086***	86.67(68.85)	9.60	HS
07	Co 86032	66.67(55.08)	5.55	HS
08	Co 99004	80.00(63.93)	9.41	HS

Table-16. Evaluation of genotypes/varieties for their reaction against scale insect.

Sr. No.	Genotype	Scale Insect		
		% incidence	% intensity	Reaction
01	Co 11005	10.00(11.07)	0.81	LS
02	Co 11007	13.33(17.22)	1.44	MS
03	Co 11012	13.33(13.08)	3.57	MS
04	Co 11019	03.33(06.15)	0.56	LS
05	CoM 11085	06.67(08.85)	0.76	LS

06	***CoM 11086***	33.33(34.63)	4.84	MS
07	Co 86032	06.67(08.85)	0.65	LS
08	Co 99004	03.33(06.15)	0.55	LS

Scale insect (SI) (Table-16):
In case of scale insect, the incidence ranged from 03.33 to 33.33 per cent. The 5 and 3 test genotypes showed less susceptible and moderately susceptible reaction to scale insect, respectively. The entries *viz.,* Co 11019 and Co 99004 recorded least incidence of scale insect (03.33 % each).

02 Internode borer, scale insect and mealy bugs :

The observations were recorded at harvest on 25 canes. The per cent incidence and intensity of internode borer, scale insect and mealy bugs were worked out.

The data is presented in table 17 to 20. From the table, it is seen that the differences due to various genotypes in respect of cumulative per cent infestation of early shoot borer, internode borer and mealy bug were statistically significant. It was observed that, there was no incidence of top shoot borer as well as scale insect in all entries.

Table-17. Evaluation of genotypes/varieties for their reaction against early shoot borer.

Sr. No.	Genotype	Per cent incidence of ESB					Reaction	No. of bored plants/ha (On the basis of Cumulative % incidence)
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative % incidence		
1	Co 11001	0.00	4.62	6.65	9.50	17.93	MS	24060.61
2	Co 11004	0.55	0.63	4.12	10.80	14.95	LS	16944.44
3	CoM 11081	1.14	1.24	6.09	16.51	22.03	MS	13888.89
4	CoM 11082	0.47	3.83	5.21	9.64	16.82	MS	20000
5	CoM 11084	0.00	1.14	6.57	10.49	16.98	MS	22777.78
6	Co 85004	0.00	5.23	7.42	13.49	22.31	MS	32222.22
7	Co 94008	0.00	5.42	5.16	10.69	18.16	MS	17500
8	CoC 671	0.00	1.46	7.06	10.70	17.12	MS	13888.89

Early shoot borer (ESB) (Table-17):
The cumulative per cent infestation of early shoot borer ranged from 14.95 to 22.31 per cent. In AVT Early Ratoon trial, only one entry i.e. Co 11004 (14.95 %) showed less susceptible reaction to early shoot borer. It was followed by CoM 11082 (16.82 %) and CoM 11084 (16.98 %). Not a single entry showed highly susceptible reaction to early shoot borer.

Internode borer (IB) (Table-18):
Regarding internode borer, the incidence ranged from 10.00 to 23.33 per cent. In this trial, no test genotypes showed highly susceptible reaction to internode borer. The 7 and 1 test genotypes showed less susceptible and moderately susceptible reaction to internode borer, respectively. The entries Co 11001 and Co 85004 showed least incidence to internode borer (10 % each).

Table-18. Evaluation of genotypes/varieties for their reaction against internode borer.

Sr. No.	Genotype	Internode borer			
		% incidence	% intensity	% Infestation index	Reaction
1	Co 11001	10.00(15.00)	0.89	0.09	LS
2	Co 11004	13.33(17.71)	0.98	0.13	LS
3	CoM 11081	13.33(17.22)	0.99	0.13	LS
4	CoM 11082	20.00(25.37)	1.06	0.21	LS
5	CoM 11084	13.33(21.15)	0.98	0.13	LS
6	Co 85004	10.00(15.00)	0.54	0.05	LS
7	Co 94008	23.33(27.29)	1.25	0.29	MS
8	CoC 671	16.67(23.36)	1.03	0.17	LS

Mealy bug (MB) (Table-19):
The mealy bug incidence ranged from 56.67 to cent per cent. All test genotypes showed highly susceptible reaction to mealy bug. The Co 94008 recorded least incidence of mealy bug (56.67 %) followed by CoM 11081 (70.00 %).

Table-19. Evaluation of genotypes/varieties for their reaction against mealy bug.

Sr. No.	Genotype	Mealy bug		
		% incidence	% intensity	Reaction
1	Co 11001	100.00(90.00)	12.12	HS
2	Co 11004	93.33(81.15)	13.19	HS
3	CoM 11081	70.00(57.29)	7.73	HS
4	CoM 11082	100.00(90.00)	20.46	HS
5	CoM 11084	83.33(66.64)	9.84	HS
6	Co 85004	100.00(90.00)	20.34	HS
7	Co 94008	56.67(48.93)	4.49	HS
8	CoC 671	86.67(72.21)	8.85	HS

Table-20. Evaluation of genotypes/varieties for their reaction against scale insect.

Sr. No.	Genotype	Scale Insect		
		% incidence	% intensity	Reaction
1	Co 11001	43.33(41.07)	10.67	HS
2	Co 11004	80.00(68.85)	21.15	HS
3	CoM 11081	36.67(37.22)	6.63	HS
4	CoM 11082	50.00(45.00)	7.41	HS
5	CoM 11084	40.00(39.23)	6.58	HS

6	Co 85004	60.00(50.57)	17.30	HS
7	Co 94008	20.00(22.14)	2.98	MS
8	CoC 671	10.00(15.00)	2.00	LS

Scale insect (SI) (Table-20):
In case of scale insect, the incidence ranged from 10.00 to 80.00 per cent. The 6, 1 and 1 test genotypes showed less susceptible, moderately susceptible and highly susceptible reaction to scale insect, respectively. The variety CoC 671 recorded least incidence of scale insect (10 %).

02 Internode borer, scale insect and mealy bugs :
The observations were recorded at harvest on 25 canes. The per cent incidence and intensity of internode borer, scale insect and mealy bugs were worked out.

Results: The data is presented in table 21 to 24. From the table, it is seen that the differences due to various genotypes in respect of cumulative per cent infestation of early shoot borer, internode borer, mealy bug and scale insect were statistically significant. It was observed that, there was no incidence of top shoot borer in all entries.

Table-21. Evaluation of genotypes/varieties for their reaction against early shoot borer.

Sr. No.	Genotype	Per cent incidence of ESB					Reaction	No. of bored plants/ha (On the basis of Cumulative % incidence)
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative % incidence		
01	Co 11005	1.74	4.98	5.31	9.07	17.77	LS	25277.78
02	Co 11007	0.00	3.54	6.12	5.38	13.44	LS	11388.89
03	Co 11012	0.52	3.08	4.25	10.95	16.94	LS	17500
04	Co 11019	0.00	3.72	4.40	6.59	13.15	LS	16111.11
05	CoM 11085	0.00	3.41	2.62	6.64	11.69	LS	15000
06	CoM 11086	0.00	7.00	5.68	8.40	17.27	LS	25277.78
07	Co 86032	0.00	2.16	2.14	5.83	9.21	LS	11388.89
08	Co 99004	2.56	1.74	5.86	6.15	13.91	LS	10277.78

Early shoot borer (ESB) (Table-21):
The cumulative per cent infestation of early shoot borer ranged from 9.21 to 17.77 per cent. The 5 and 3 test genotypes showed less susceptible and moderately susceptible reaction to early shoot borer, respectively. The variety Co 86032 showed least incidence of early shoot borer (9.21 %), followed by CoM 11085 (11.69 %) and Co 11019 (13.15 %).

Internode borer (IB) (Table-22):
Regarding internode borer, the incidence ranged from 06.67 to 40.00 per cent. In this trial, 3 and 5 test genotypes showed less susceptible and moderately susceptible reaction to internode borer, respectively. The entries Co 11012, Co 11019 and CoM 11086 showed least incidence to internode borer (06.67 % each), followed by Co 11005 (23.33 %).

Table-22. Evaluation of genotypes/varieties for their reaction against internode borer.

Sr. No.	Genotype	Internode borer			
		% incidence	% intensity	% Infestation index	Reaction
01	Co 11005	23.33(24.15)	1.29	0.30	MS
02	Co 11007	26.67(30.29)	1.90	0.51	MS
03	Co 11012	06.67(12.29)	0.39	0.03	LS
04	Co 11019	06.67(12.29)	0.35	0.02	LS
05	CoM 11085	26.67(30.29)	2.55	0.68	MS
06	CoM 11086	06.67(08.15)	0.33	0.02	LS
07	Co 86032	40.00(38.85)	2.31	0.92	MS
08	Co 99004	30.00(33.33)	2.68	0.80	MS

Mealy bug (MB) (Table-23):
The mealy bug incidence ranged from 83.33 to cent per cent. All test genotypes showed highly susceptible reaction to mealy bug. The entry CoM 11085 showed least incidence to mealy bug (83.33%).

Scale insect (SI) (Table-24):
In case of scale insect, the incidence ranged from 3.33 to 70.00 per cent. The 1, 2 and 5 test genotypes showed less susceptible, moderately susceptible and highly susceptible reaction to scale insect, respectively. The variety Co 86032 recorded least incidence to scale insect (3.33 %).

Table-23. Evaluation of genotypes/varieties for their reaction against mealy bug.

Sr. No.	Genotype	Mealy bug		
		% incidence	% intensity	Reaction
01	Co 11005	96.67(83.85)	19.57	HS
02	Co 11007	93.33(81.15)	16.85	HS
03	Co 11012	100.00(90.00)	22.69	HS
04	Co 11019	100.00(90.00)	16.33	HS
05	CoM 11085	83.33(66.15)	7.98	HS
06	CoM 11086	100.00(90.00)	25.74	HS
07	Co 86032	93.33(77.71)	9.21	HS
08	Co 99004	86.67(68.85)	9.90	HS

Table-24. Evaluation of genotypes/varieties for their reaction against scale insect.

Sr. No.	Genotype	Scale Insect		
		% incidence	% intensity	Reaction
01	Co 11005	26.67(26.15)	3.87	MS
02	Co 11007	26.67(30.99)	3.21	MS
03	Co 11012	60.00(50.85)	11.69	HS
04	Co 11019	70.00(57.29)	20.04	HS
05	CoM 11085	56.67(48.93)	12.35	HS
06	CoM 11086	46.67(43.08)	9.21	HS
07	Co 86032	03.33(06.15)	0.34	LS
08	Co 99004	36.67(36.93)	7.51	HS

E 4.1: Evaluation of zonal varieties/genotypes for their reaction against major insect pests

Out of the 37 entries under IVT-Early, only one entry (CoN 14072) showed LS reaction to shoot borer, whereas 14 entries showed MS reaction and 22 entries showed HS reaction (Table 1). All entries showed HS reaction to internode borer (Table:8) and less susceptible to top borer (Table:10).

Against early shoot borer, out of the four entries under AVT-I Plant, two entries showed HS reaction and the other two showed MS reaction to the borer (Table 2). In AVT-Early II Plant, out of the seven entries, six were found to be highly susceptible and only the check CoC 671 showed MS reaction to the borer (Table 3). In AVT-Midlate II Plant, five entries were found to be MS and two entries showed HS reaction to the borer (Table 4).

Out of the 10 entries in AVT-I Plant, internode borer incidence was maximum in the genotype CoM 12085 (93.3%) and minimum (50.7%) in the genotype Co 12009 (Table 5).

Among the eight entries under AVT-II Plant (midlate), INB incidence was maximum in the genotype CoM 11085 which has also recorded the maximum intensity of the borer (Table 6)..

In AVT – II Plant (Early) category, incidence of INB was maximum (90%) in the check Co 94008 which also recorded the maximum intensity (Table 7). Minimum (70%) incidence of the borer was in the entry CoM 11084 which also recorded minimum intensity of attack.

In AVT-II Plant (Midlate), top borer incidence was very low ranging between nil and 6% (Table 11).

In AVT – II Plant (Early), mean top borer incidence was very low being less than 10% making all the entries resistant (Table 12). Co 85004 was free of the borer,whereas maximum incidence of 8% was recorded in two entries Co 11001 and the check CoC 671.

Table 1. Early Shoot Borer incidence in IVT – Early, (SBI, Coimbatore)

S. No	Entry	% Incidence					No. of bored plants/ha	Infestation Grade
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative incidence		
1	Co13021	44.29	26.95	23.25	33.77	58.68	30247	HS
2	Co14002	19.64	8.42	13.66	14.03	25.68	14506	MS
3	Co14003	27.50	15.81	9.68	26.66	31.61	15123	HS
4	Co14004	56.88	68.50	14.57	41.13	78.48	25925	HS
5	Co14006	27.94	11.45	41.84	20.69	30.15	12654	HS
6	Co14008	38.15	31.48	27.82	39.82	40.60	16667	HS
7	Co14009	43.75	64.44	40.04	54.09	69.70	21296	HS
8	Co14012	8.26	8.61	9.39	8.01	18.26	6481	MS
9	Co14016	18.13	9.50	18.13	27.63	34.74	20370	HS
10	Co14022	21.69	50.72	19.63	36.21	65.94	28086	HS
11	Co14023	13.94	19.19	22.89	16.67	22.89	11728	MS
12	Co14025	18.52	11.65	14.92	15.09	20.00	8333	MS
13	Co14026	13.95	5.45	15.38	9.70	15.39	9259	MS
14	Co14026	7.34	10.46	17.81	8.90	15.38	18518	MS
15	Co14027	21.83	10.46	21.83	16.15	28.45	20987	MS
16	Co14030	39.18	16.81	40.00	32.90	41.81	29938	HS
17	Co14031	22.88	8.64	13.48	14.76	30.72	14506	HS
18	Co14032	9.09	6.32	19.39	15.41	27.55	8333	MS
19	CoN14071	35.92	27.81	24.23	31.87	48.45	29012	HS
20	CoN14072	12.12	8.62	6.49	5.37	13.64	5538	LS
21	CoN14073	18.18	2.29	15.68	12.05	18.83	8951	MS
22	CoN14074	25.70	32.73	17.01	29.21	35.57	21296	HS
23	CoTi14111	25.95	5.45	21.43	15.70	26.37	14815	MS
24	CoTi14112	16.08	11.45	35.80	13.77	35.80	19444	HS
25	CoT14367	16.78	5.41	23.42	22.19	34.23	15740	HS
26	CoSnk14102	24.67	27.43	6.33	25.50	33.33	24382	HS
27	CoSnk14103	38.84	35.54	18.99	37.19	48.04	26543	HS
28	CoSnk14101	38.10	60.00	35.15	54.05	64.85	33024	HS
29	CoVc14061	36.15	8.51	34.66	27.33	43.37	22222	HS
30	CoVc14062	18.28	16.00	52.86	17.14	58.60	11728	HS
31	MS 14081	32.11	32.74	31.81	32.43	45.45	21604	HS
32	MS 14082	27.21	32.74	18.64	29.98	43.55	28086	HS
33	PI14131	10.17	7.33	9.84	17.50	19.67	7407	MS
34	VSI 14121	26.90	23.68	28.00	20.29	28.29	13271	MS
35	VSI 14122	19.33	17.95	26.0	23.64	26.97	24691	MS
36	CoC671	8.78	4.30	13.01	13.08	19.59	8923	MS
37	Co86032	34.01	62.39	12.82	31.36	65.77	27160	HS

Table 2. Early Shoot Borer incidence in AVT – I Plant, (SBI, Coimbatore)

S. No	Entry	% Incidence				Cumulative incidence	No. of bored plants/ha	Infestation Grade
		30 DAP	60 DAP	90 DAP	120 DAP			
1	Co 12007	11.62	4.04	21.08	16.35	26.64	17593	MS
2	Co 12012	12.50	8.75	24.86	18.68	30.60	21913	HS
3	Co 86032	34.01	62.39	12.82	31.36	65.77	27160	HS
4	CoC 671	8.78	4.30	13.01	13.08	19.59	8923	MS

Table 3. Early Shoot Borer incidence in AVT – Early II Plant, (SBI, Coimbatore)

S. No	Entry	% Incidence				Cumulative incidence	No.of bored plants/ha	Infestation Grade
		30 DAP	60 DAP	90 DAP	120 DAP			
1	Co 11001	16.38	51.39	54.24	33.89	67.24	24074	HS
2	Co 11004	13.76	46.88	22.97	30.32	54.87	19135	HS
3	CoM 11081	41.12	10.28	28.95	25.70	49.20	28703	HS
4	CoM 11082	26.58	10.81	17.39	18.69	30.07	27469	HS
5	Co 85004	12.03	11.49	35.30	11.76	33.41	37037	HS
6	Co 94008	17.27	21.15	34.81	19.21	34.77	37345	HS
7	CoC 671	8.78	4.30	13.01	13.08	19.59	8923	MS

Table 4. Early Shoot Borer incidence in AVT – Midlate II Plant, (SBI, Coimbatore)

S. No	Entry	% Incidence				Cumulative incidence	No. of bored plants/ha	Infestation Grade
		30 DAP	60 DAP	90 DAP	120 DAP			
1	Co 11005	6.61	11.18	15.79	17.79	20.47	10802	MS
2	Co 11007	20.61	22.70	23.08	21.66	22.36	15740	MS
3	Co 11012	23.86	28.99	10.78	16.93	29.79	21604	MS
4	Co 11019	9.35	18.75	12.77	14.05	20.40	14815	MS
5	CoM 11085	34.75	15.15	8.42	24.95	42.79	26543	HS
6	Co 86032	34.01	62.39	12.82	31.36	65.77	27160	HS
7	Co 99004	15.63	8.82	6.02	12.23	19.73	13580	MS

Table 5. Incidence of Internode Borer in AVT – I Plant, (SBI, Coimbatore)

S. No	Genotype	% Incidence			Mean	% Intensity			Mean	Infestation Index	Infestation Grade
		R1	R2	R3		R1	R2	R3			
1	Co 12007	40.00	52.00	72.00	54.67	2.05	2.64	4.44	3.04	1.17	HS
2	Co 12008	52.00	92.00	80.00	74.67	3.16	5.43	3.77	4.12	3.08	HS
3	Co 12009	44.00	16.00	92.00	50.67	2.42	0.75	6.07	3.08	1.56	HS
4	Co 12012	36.00	88.00	76.00	66.67	1.46	3.92	3.16	2.85	1.90	HS
5	Co 12019	72.00	92.00	84.00	82.67	4.25	7.81	4.91	5.66	4.68	HS
6	Co 12024	76.00	52.00	92.00	73.33	4.44	3.10	6.43	4.66	3.42	HS
7	CoM 12085	92.00	92.00	96.00	93.33	5.08	7.23	4.93	5.75	5.37	HS
8	CoVSI 12121	60.00	76.00	92.00	76.00	3.67	4.70	6.87	5.08	3.86	HS
9	Co 86032	76.00	64.00	56.00	65.33	4.55	3.93	3.18	3.89	2.54	HS
10	CoC 671	52.00	72.00	96.00	73.33	2.64	3.96	6.51	4.37	3.20	HS

Table 6. Incidence of Internode Borer in AVT - II Plant (Midlate), (SBI, Coimbatore)

S. No	Genotypes	% Incidence		Mean	% Intensity		Mean	Infestation Index	Infestation Grade
		R1	R2		R1	R2			
1	Co 11005	56.00	72.00	64.00	3.42	3.42	3.42	2.19	HS
2	Co 11007	76.00	88.00	82.00	4.29	3.62	3.96	3.25	HS
3	Co 11012	84.00	88.00	86.00	4.87	4.31	4.59	3.95	HS
4	Co 11019	76.00	68.00	72.00	3.48	2.72	3.10	2.23	HS
5	CoM11085	92.00	88.00	90.00	4.60	6.31	5.45	4.91	HS
6	CoM11086	84.00	88.00	86.00	4.15	4.30	4.22	3.63	HS
7	Co 86032	92.00	80.00	86.00	4.75	4.69	4.72	4.06	HS
8	Co 99004	80.00	84.00	82.00	4.35	4.17	4.26	3.49	HS

Table 7. Incidence of Internode Borer in AVT - II Plant (Early), (SBI, Coimbatore)

S. No	Genotypes	% Incidence			% Intensity			Infestation Index	Infestation Grade
		R1	R2	Mean	R1	R2	Mean		
1	Co 11001	96.00	80.00	88.00	5.25	4.01	4.63	4.05	HS
2	Co 11004	72.00	92.00	82.00	5.48	4.68	5.08	4.17	HS
3	CoM 11081	84.00	80.00	82.00	4.74	4.00	4.37	3.58	HS
4	CoM 11082	76.00	72.00	74.00	4.36	4.25	4.30	3.18	HS
5	CoM 11084	72.00	68.00	70.00	3.83	3.47	3.65	2.56	HS
6	CoC 671	84.00	72.00	78.00	3.76	4.25	4.00	3.12	HS
7	Co 94008	88.00	92.00	90.00	5.26	5.73	5.49	4.95	HS
8	Co 85004	72.00	92.00	82.00	3.61	4.96	4.29	3.52	HS

Table 8. Incidence of Internode Borer in IVT, (SBI, Coimbatore)

S. No	Genotypes	% Incidence		Mean	% Intensity		Mean	Infestation Index	Infestation Grade
		R1	R2		R1	R2			
1	Co 13021	64.00	88.00	76.00	3.27	4.01	3.64	2.77	HS
2	Co 13022	40.00	56.00	48.00	2.18	3.38	2.78	1.33	HS
3	Co 14002	64.00	84.00	74.00	4.64	3.74	4.19	3.10	HS
4	Co 14003	88.00	56.00	72.00	5.40	3.95	4.67	3.36	HS
5	Co 14004	76.00	84.00	80.00	5.87	4.85	5.36	4.29	HS
6	Co 14006	68.00	64.00	66.00	3.67	4.28	3.97	2.62	HS
7	Co 14008	24.00	88.00	56.00	0.94	4.33	2.64	1.48	HS
8	Co 14009	88.00	68.00	78.00	6.29	4.57	5.43	4.24	HS
9	Co 14012	76.00	84.00	80.00	6.42	4.10	5.26	4.21	HS
10	Co 14016	56.00	40.00	48.00	3.34	2.36	2.85	1.37	HS
11	Co 14022	88.00	76.00	82.00	5.05	5.38	5.22	4.28	HS
12	Co 14023	64.00	76.00	70.00	4.62	5.22	4.92	3.44	HS
13	Co 14025	64.00	80.00	72.00	3.57	3.79	3.68	2.65	HS
14	Co 14026	76.00	24.00	50.00	4.04	1.33	2.69	1.35	HS
15	Co 14027	88.00	84.00	86.00	5.87	4.55	5.21	4.48	HS
16	Co 14030	64.00	60.00	62.00	3.69	3.06	3.38	2.10	HS
17	Co 14031	64.00	76.00	70.00	2.78	2.98	2.88	2.02	HS
18	Co 14032	44.00	48.00	46.00	2.49	1.97	2.23	1.03	HS
19	CoN 14071	68.00	48.00	58.00	3.13	2.52	2.83	1.64	HS
20	CoN14072	76.00	56.00	66.00	4.29	3.31	3.80	2.51	HS
21	CoN14073	76.00	72.00	74.00	5.55	2.61	4.08	3.02	HS

22	CoN14074	80.00	52.00	66.00	5.13	2.31	3.72	2.46	HS
23	CoSnk05103	56.00	36.00	46.00	3.15	1.41	2.28	1.05	HS
24	CoSnk14102	60.00	28.00	44.00	2.86	1.51	2.19	0.96	HS
25	CoSnk14101	88.00	76.00	82.00	6.64	4.06	5.35	4.39	HS
26	CoSnk14103	72.00	88.00	80.00	4.83	5.04	4.93	3.94	HS
27	CoT 14111	52.00	24.00	38.00	2.90	1.27	2.09	0.79	MS
28	CoT 14112	72.00	84.00	78.00	3.56	4.68	4.12	3.21	HS
29	CoT 14366	80.00	76.00	78.00	5.00	3.16	4.08	3.18	HS
30	CoT 14367	60.00	52.00	56.00	3.07	3.71	3.39	1.90	HS
31	CoVc14061	76.00	52.00	64.00	5.52	3.83	4.67	2.99	HS
32	CoVc14062	60.00	68.00	64.00	4.62	3.85	4.24	2.71	HS
33	MS14081	76.00	80.00	78.00	4.29	4.88	4.58	3.57	HS
34	MS14082	68.00	48.00	58.00	3.50	2.27	2.89	1.68	HS
35	PI14131	60.00	72.00	66.00	4.20	4.51	4.35	2.87	HS
36	PI14132	64.00	80.00	72.00	2.85	4.79	3.82	2.75	HS
37	VSI14121	68.00	52.00	60.00	3.32	2.26	2.79	1.67	HS
38	VSI14122	76.00	92.00	84.00	6.98	5.68	6.33	5.32	HS
39	CO86032	60.00	80.00	70.00	3.14	3.88	3.51	2.46	HS
40	COC671	52.00	56.00	54.00	2.68	3.68	3.18	1.72	HS

Table 9. Incidence of Internode Borer in AVT Ratoon, (SBI, Coimbatore)

S. No	Genotype	% Incidence			% Intensity			Infestation Index	Infestation Grade
		R1	R2	Mean	R1	R2	Mean		
1	Co11004	60.00	80.00	70.00	4.43	4.44	4.44	3.11	HS
2	Co 11005	60.00	60.00	60.00	4.43	4.43	4.43	2.66	HS
3	Co 11007	36.00	68.00	52.00	3.20	3.20	3.20	1.66	HS
4	Co 11012	52.00	52.00	52.00	3.49	3.49	3.49	1.81	HS
5	Co 11019	52.00	52.00	52.00	3.24	3.24	3.24	1.68	HS
6	CoM 11085	56.00	56.00	56.00	4.44	4.44	4.44	2.49	HS
7	CoM 11086	68.00	85.00	76.50	4.48	6.38	5.43	4.15	HS
8	Co 99004	52.00	52.00	52.00	3.63	3.63	3.63	1.89	HS
9	Co 86032	92.00	68.00	80.00	5.41	3.13	4.27	3.42	HS
10	CoC 671	36.00	80.00	58.00	3.20	5.22	4.21	2.44	HS
11	Co 85004	60.00	92.00	76.00	3.69	4.75	4.22	3.21	HS

Table 10. Incidence of Top Borer in IVT, (SBI, Coimbatore)

S. No	Genotypes	% Incidence		7th Month	Harvest	Infestation Grade
		R1	R2			
1.	Co 13021	0.00	0.00	0.00	0.00	LS
2.	Co 13022	0.00	0.00	0.00	0.00	LS
3.	Co 14002	0.00	0.00	0.00	0.00	LS
4.	Co 14003	0.00	0.00	0.00	0.00	LS
5.	Co 14004	4.00	0.00	2.00	2.00	LS
6.	Co 14006	0.00	0.00	0.00	0.00	LS
7.	Co 14008	0.00	4.00	2.00	2.00	LS
8.	Co 14009	0.00	0.00	0.00	0.00	LS
9.	Co 14012	4.00	0.00	2.00	2.00	LS
10.	Co 14016	0.00	0.00	0.00	0.00	LS
11.	Co 14022	0.00	0.00	0.00	0.00	LS
12.	Co 14023	0.00	0.00	0.00	0.00	LS
13.	Co 14025	0.00	0.00	0.00	0.00	LS
14.	Co 14026	0.00	0.00	0.00	0.00	LS
15.	Co 14027	0.00	0.00	0.00	0.00	LS
16.	Co 14030	0.00	0.00	0.00	0.00	LS
17.	Co 14031	0.00	8.00	4.00	4.00	LS
18.	Co 14032	0.00	0.00	0.00	0.00	LS
19.	CoN 14071	0.00	8.00	4.00	4.00	LS
20.	CoN14072	0.00	4.00	2.00	2.00	LS
21.	CoN14073	0.00	8.00	4.00	4.00	LS
22.	CoN14074	0.00	0.00	0.00	0.00	LS

23.	CoSnk05103	0.00	0.00	0.00	0.00	LS
24.	CoSnk14101	4.00	4.00	4.00	4.00	LS
25.	CoSnk14102	0.00	0.00	0.00	0.00	LS
26.	CoSnk14103	24.00	8.00	16.00	16.00	LS
27.	CoT14112	0.00	0.00	0.00	0.00	LS
28.	CoT14367	8.00	0.00	4.00	4.00	LS
29.	CoT14111	0.00	0.00	0.00	0.00	LS
30.	CoT14366	0.00	0.00	0.00	0.00	LS
31.	CoVc14062	0.00	4.00	2.00	2.00	LS
32.	CoVc14061	4.00	0.00	2.00	2.00	LS
33.	MS14081	4.00	0.00	2.00	2.00	LS
34.	MS14082	0.00	0.00	0.00	0.00	LS
35.	PI14131	4.00	4.00	4.00	4.00	LS
36.	PI14132	8.00	8.00	8.00	8.00	LS
37.	VSI14121	4.00	0.00	2.00	2.00	LS
38.	VSI14122	8.00	0.00	4.00	4.00	LS
39.	Co 86032	4.00	0.00	2.00	2.00	LS
40.	CoC671	0.00	0.00	0.00	0.00	LS

Table 11. Top Borer Incidence in AVT – II Plant, (SBI, Coimbatore)

S.No	Genotypes	% Incidence		7th Month	Harvest	Infestation Grade
		R1	R2			
1.	Co 11005	4.00	4.00	4.00	4.00	LS
2.	Co 11007	0.00	4.00	2.00	2.00	LS
3.	Co 11012	0.00	0.00	0.00	0.00	LS
4.	Co 11019	0.00	0.00	0.00	0.00	LS
5.	CoM11085	8.00	4.00	6.00	6.00	LS
6.	CoM11086	8.00	4.00	6.00	6.00	LS
7.	Co 86032	4.00	4.00	4.00	4.00	LS
8.	Co 99004	0.00	0.00	0.00	0.00	LS

Table 12. Incidence of Top borer in AVT - II Plant (Early), (SBI, Coimbatore)

S. No	Genotypes	% Incidence		7th Month	Harvest	Infestation Grade
		R1	R2			
1	Co 11001	0.00	16.00	8.00	8.00	LS
2	Co 11004	4.00	4.00	4.00	4.00	LS
3	CoM 11081	0.00	12.00	6.00	6.00	LS
4	CoM 11082	4.00	4.00	4.00	4.00	LS
5	CoM 11084	0.00	4.00	2.00	2.00	LS
6	CoC 671	0.00	16.00	8.00	8.00	LS
7	Co 94008	0.00	4.00	2.00	2.00	LS
8	Co 85004	0.00	0.00	0.00	0.00	LS

E.28: Survey and surveillance of sugarcane insect pests
DR.PDKV, Akola

Table-4: Survey and surveillance of insect pests of sugarcane at Amravati, Wardha, and Yavatmal (DR.PDKV, Akola)

Sr. No.	Varieties	Location	Name of the farmers	Name of Pest	Internode borer				*Pyrilla* per leaf
					Per cent incidence	Per cent Intensity	Infestation Index	Reaction	
1.	Co-265 (Ratoon) and CoVSI-3102	Ghuikhed Tal. Chandur Railway Dist. Amravati	Shri. Ravindra D. Udaykar	Internode borer *Pyrilla* (*Pyrilla perpusilla*)	12.00 10.00	4.24 4.50	0.51 0.45	LS LS	4.00 6.00

2.	Co-265 Adsali Co-86032	AdegaonTal. Deoli Dist. Wardha	Shri.Shrikant Rambhau Thakare	Internode borer *Pyrilla* (*Pyrilla perpusilla*)	12.00 10.00	3.98 4.25	0.48 0.43	LS LS	12.00 12.00
3.	Krishna 7714 Co-265 (Termite infestation)	Bhidi Tal. Deoli Dist. Wardha	Umesh R. Kale	Internode borer *Pyrilla* (*Pyrilla perpusilla*) Whitefly (*Aleurolobus barodensis*)	14.00 12.00 10.00	3.71 3.98 3.71	0.52 0.48 0.37	LS LS LS	12.00 11.00 16.00 6-7/ cm^2
4.	Co-8005	Bhidi Tal. Deoli Dist. Wardha	Shri. Satish Vasantrao Kale	Internode borer *Pyrilla* (*Pyrilla perpusilla*) Whitefly (*Aleurolobus barodensis*)	8.00	2.45	0.20	LS	14.00 18-20/ cm^2
5.	Co-94012 Co-7701	Babgaon Tal. Deoli Dist. Wardha	Shri. Manohar Nathoba Dabhire	Internode borer *Pyrilla* (*Pyrilla perpusilla*)	6.00 10.00	2.45 3.12	0.15 0.31	LS LS	9.00 12.00
6.	Co-8005	Babgaon Tal. Deoli Dist. Wardha	Mangesh Khote	Internode borer *Pyrilla* (*Pyrilla perpusilla*)	8.00	2.45	0.20	LS	9.00
7.	Co-265	Agar Tal.Deoli Dist. Wardha	Sau. Malabai Bhaiyji Ingle	Internode borer *Pyrilla* (*Pyrilla perpusilla*)	14.00	4.98	0.70	LS	11.00
8.	Co-8005 1234 Co-265	Mahakal Tal. Wardha Dist. Wardha	Shri. Raju Vishwanath Pahune	Internode borer *Pyrilla* (*Pyrilla perpusilla*) Whitefly (*Aleurolobus barodensis*)	12.00 10.00 9.00	2.77 2.84 1.63	0.33 0.28 0.15	LS LS LS	12.00 11.00 16.00 6-7/ cm^2
9	Shidagiri	Shripur Tal. Mahagaon Dist Yavatmal	Milind Hanumantrao Gaikwad	Internode borer *Pyrilla* (*Pyrilla perpusilla*)	14.00	2.88	0.40	LS	16.00
10	Co-3102	Shripur Tal. Mahagaon Dist Yavatmal	Gajanan Kanwade	Internode borer *Pyrilla* (*Pyrilla perpusilla*)	16.00	3.25	0.52	LS	14.00

UNIVERSITY OF AGRICULTURAL SCIENCES, BANGALORE
Zonal Agricultural Research Station V.C.Farm, Mandya-571 405

Survey was conducted at monthly interval in sugarcane growing areas of Mandya district. Totally eleven insect pests and two species of mites were recorded on sugarcane. Due to long dry spell in the early part of rainy season and heavy and frequent rainfall in the later part of rainy season resulted in higher incidence of all the three borer pests namely Early shoot borer , Top shoot borer and Inter node borer. Army worms moved from paddy to sugarcane fields. Damage was more in young sugarcane crop. An unidentified weevil was also found feeding on the leaves of sugarcane. Incidence of root grubs was more in the area. Due to more frequent rains from August to October, incidence of woolly aphid was also more but the *Dipha* and *Encarcia* appeared in good number and kept the pest under control. Even though Pyrilla leaf hopper, whitefly, leaf weevil and termite appeared in few places they did not reach EIL (Table.5).

Table 5: Survey and Surveillance of insect pests of sugarcane at Mandya

Sl. No	**Location**	**Varieties**	**Name of the Pest**	**% Incidence/Population**			**Remarks**
1	Chamundi sugars K.M.Doddi Maddur	Co86032 Co62175 VCF 0517		**Minimum**	**Maximum**	**Average**	
			Early shoot borer *Chilo infuscatellus*	5.00	32.00	18.50	ESB activity was moderate in all the factory areas
			Top shoot borer *Scirpophaga excerptalis*	3.00	18.25	11.50	TSB activity was low in all the factory areas
			Internode borer *Chilo sacchariphagus indicus*	16.50	46.75	23.50	Activity was moderate in all the factory areas
			Woolly aphid *Ceratovacuna lanigera*	8.00/ Cm²	39.50	18.00	*Dipha* and *Micromus* were found active
			Mite *Oligonychus indicus*	10.00/Cm²	49.00/Cm²	21.00/ Cm²	Occurred only in low lying areas during summer when crop was young. Less than 10% area was affected at village.
			Abacarus sacchari	3.0/Cm^2	35.0/Cm^2	17.0/Cm^2	High incidence in VCF 0517, four months after planting
			Root grub *Holotrichia serrata*	3/m²	5/ m²	4/m²	Sporadic incidence, Ratoons suffered more, more severe in bore well irrigated plots
			Army worm *Mythimna separata*	3.0larva /plant	8.0 larva /plant	5.0larva /plant	5.0-20.0% leaf area damaged
			Un identified weevil	1.0 adult/plant	5.0adults /plant	2.0adults /plant	5.0 leaf area damaged only in three plots

2	My Sugar Co. Mandya	Co86032 Co62175 Co99463 Co86032					
			Early shoot borer *Chilo infuscatellus*	5.50	16.00	11.25	
			Top shoot borer *Scirpophaga excerptalis*	4.00	13.50	9.50	
			Internode borer *Chilo sacchariphagus indicus*	17.50	31.50	16.00	
			Woolly aphid *Ceratovacuna lanigera*	11.00/ Cm²	34.00/ Cm²	16.00/ Cm²	*Encarsia* sp. kept the pest under check
			Saccharicoccus sacchari		13.25% Incidence		Intensity 23.5%
			Root grub *Holotrichia serrata*	2.00/m²	4.00/m²	3.00/m²	Sporadic incidence, occurred in small patches, more severe in bore well irrigated plots.More severe in Co 86032
			Abacarus sacchari	1.50/Cm^2	19.0/Cm^2	14.0/Cm^2	High incidence in VCF 0517
			Pyrilla perpusilla		0.5nymph/ adult/plant		
			Whitefly *Neomaskellia bergii*		6.0nymphs/Cm^2		Occurred only in two fields *Encarsia tristis* Parasitoid was also recovered from the nymphs
3	N.S.L.Sugars Koppa, K.R.Pet	Co86032 Co62175 Co99463 VCF 0517					
			Early shoot borer *Chilo infuscatellus*	7.50	24.00	11.00	
			Top shoot borer *Scirpophaga excerptalis*	3.50	11.00	7.50	
			Internode borer *Chilo sacchariphagus indicus*	17.00	43.00	24.00	
			Saccharicoccus sacchari		63%setts failed to germinate		

			Pyrilla perpusilla	Traces	0.5nymph/ adult/plant		
			Abacarus sacchari	6.50/Cm^2	19.0/Cm^2	15.0/C m^2	High incidence in VCF 0517
			Ceratovacuna lanigera				
			Root grub *Holotrichia serrata*	3.0/ m²	4.00/ m²	3.00/ m²	Sporadic incidence, border plants affected more, bore well irrigated plots suffered more.
			Termite *Odontotermes obesus*		12.05% setts affected		Damage occurred in patches in two fields

Vasantdada Sugar Institute, Pune

Found severe infestation of white fly in area of operation of Dr. V.V Patil Dist. A'Nagar, Agasti Dist. A'Nagar and Ashok Dist. A'Nagar in the month of June, July and August 2017 respectively. Noticed severe infestation of white fly and wire worm in the area of operation of S.B.Thorat Dist. A'Nagar on sugarcane crop in the month of August 2017. Observed severe infestation of white grub in the area of operation of SMSM Patil Dist. Solapur and Sahyadri Dist. Satara in the month of September 2017. Recorded severe infestation of internode borer and root borer in the area of operation of Malegaon SSK Dist. Pune in the month of December 2017.

NAVSARI AGRICULTURAL UNIVERSITY, NAVSARI, GUJARAT

Table 1: Survey and surveillance of insect pests of sugarcane in South Gujarat during 2017-18.

Name of pest	Vari eties	Location	Per cent Incidence Ave.	Remarks
Early shoot borer, Top borer, Root borer	Co 86032, CoSi 95071 Co M 265, MS 10001	Ganesh Vatariya Sugar factory area	6.71	
White fly			8.71	
Early shoot borer, Top borer	Co 86032, Co 86002 CoSi 95071,CoN 07072 CoN 05071, Co M 265,MS 10001	Sayan sugar factory area	6	
White fly			10	
Early shoot borer, Top borer	MC 707 (Co 9007) Co 86032, CoN 07072	Valsad Sugar factory area	10.03	
Early shoot borer, Top borer	CoC 0671**,** Co 86032, Co 86002,CoSi 95071	Narmada sugar factory area	0.81	
White fly	Co 86032, CoC 0671,Co 86002,CoSi 95071, CoN 05071 and CoN 05072		1.08	
Mealy bugs			0.69	
Early shoot borer, Top borer, Root borer	Co 86032, Co 86002 MC 707 (Co 9007) CoN 07072 CoN 05071, Co M 265,MS 10001	Bardoli Sugar factory area	4.30	
White fly			1.77	
Rodent			1.57	

Early shoot borer, Top borer, Root borer	Co 86002,Co 86032, CoN 07072, MS 10001, MC 707 (Co 97009), CoSi 95071, CoN 13073,CoN 05071 and Co M 265	Kamrej Sugar factory area	15.0	
White fly	Co 86002,Co 86032, Co M 265 and MS 10001		16.68	
Early shoot borer, Top borer, Root borer	CoC 0671, Co 86002,Co 86032, MC 707, (Co 97009), CoSi 95071, CoN 95132 and CoN 05071, CoN 07072 and Co M 265	Mahuva Sugar factory area	7.16	
White fly	Co 86002,Co 86032, Co M 265 and MS 10001		1 to 2	
Thrips	Co 86032, Co 86002, MC 707 (Co 97009), Co M 265 ,CoN 05071,CoN 07072 and CoN 95132		1 to 3	

Result:-

In South Gujarat incidence of major insect pest was found to be ranged from trace to moderate intensity. During the period of survey incidence of borers (early shoot, top borer and root borer) was ranged from 0.81 % to 15 % in Co 86032, Co 86002, Co 97009 (MC 707), CoSi 95071, CoN 05071 and CoM 0265, respectively. White fly incidence varies from 1.08 to 16.68 % in plant sugarcane. Incidence of mealy bugs found to be infesting 0.69 % in madhi sugar factory area. Rodent damage was reported only 1.57 % in bardoli sugar factory area.

Zonal Agricultural Research Station, Powarkheda (M.P.)

The pyrilla and early shoot borer are key pests, while the top shoot borer, root borer, pink stem borer, whitefly, mealy bug and scale insect are minor insect pests of sugarcane. Among the areas surveyed, highest infestation of early shoot borer as well as pyrilla recorded at Bankhedi sugar factory area. Adsali sugarcane cultivation and trash burning seem to be reason for pyrilla severity. While, plantation of sugarcane mostly in autumn season/ late ratooning is conductive for building-up severe infestation of early shoot borer.

Table: 5. Occurrence of naturally occurring insect pests on sugarcane

Sr. No.	Location	Name of pest % incidence/Population	Min.	Max.	Average
1	Kareli	ESB (%)	4.07	22.20	13.14
		TSB (%)	1.53	8.87	5.20
		RB (%)	0.87	4.53	2.70
		Pyrilla /Leaf	4.25	8.92	6.59
		Epiricania melanoleuca/plant	3.32	5.12	4.22
		Whitefly (per 2.5 sq.cm.)	0.37	1.23	0.80
2	Bankhedi	ESB (%)	5.20	24.55	14.88

		TSB (%)	1.15	3.20	2.18
		RB (%)	0.80	2.20	1.50
		Pyrilla /Leaf	4.65	8.65	6.65
		Epiricania melanoleuca/Leaf	3.43	5.39	4.41
		Whitefly (per 2.5 sq.cm.)	0.21	1.21	0.71
3	**Gadarwada**	ESB (%)	4.67	16.33	10.50
		TSB (%)	1.87	4.00	2.94
		RB (%)	0.67	2.13	1.40
		Pyrilla /Leaf	3.08	6.85	4.97
		Epiricania melanoleuca/Leaf	2.02	3.97	3.00
		Whitefly (per 2.5 sq.cm.)	0.35	0.93	0.64
4	**Hoshangabad**	ESB (%)	5.27	11.87	8.57
		TSB (%)	0.13	0.70	0.42
		RB (%)	0.10	0.80	0.45
		Pyrilla /Leaf	0.03	0.19	0.11
		Epiricania melanoleuca/Leaf	0.00	0.07	0.04
		Whitefly (per 2.5 sq.cm.)	0.07	0.70	0.39
	Overall Average	**ESB (%)**	**4.80**	**18.74**	**11.77**
		TSB (%)	**1.17**	**4.19**	**2.68**
		RB (%)	**0.61**	**2.42**	**1.52**
		Pyrilla /Leaf	**3.00**	**6.15**	**4.58**
		***Epiricania melanoleuca*/Leaf**	**2.19**	**3.64**	**2.92**
		Whitefly (per 2.5 sq.cm.)	**0.25**	**1.02**	**0.64**

Note - ESB – Early shoot borer; TSB – Top Shoot Borer; RB – Root Borer

CSRS, MPKV, Padegaon

Roving survey of sugarcane fields were carried out in the area around Central Sugarcane Research Station, Padegaon. Survey was carried out during 2017-18 on farmer's field in different villages *viz.*, Nimbut (Baramati), Padegaon (Khandala), Pandare (Baramati), Malegaon (Baramati), Padegaon (Phaltan) etc. In most of the fields, CoM 0265 and Co 86032 varieties were planted. The new varieties *viz.,* MS 10001 and VSI 8005 were also planted in very few fields. The observations on the incidence of borers on 100 canes were examined at five places and for sucking pests 20 canes were observed as per technical programme.

The incidence of early shoot borer ranged from 10.20 to 34.67 per cent, whereas average incidence was recorded 14.33 per cent. The incidence of early shoot borer was high in suru planting (especially in late suru planting) as compare to adsali and pre-season plantings. The incidence of early shoot borer was highest on March onward plantings due to high temperature. The per cent incidence of internode borer ranged from 10.33 to 20.00 and intensity ranged from 1.67 to 3.80 per cent. The incidence of top shoot borer and root borer was in traces to very low level. The incidence of root borer was observed at Pawaimal, Pandare, Malegaon bk. etc. (Baramati) area

Table : Survey and surveillance of sugarcane insect pests, (CSRS, MPKV, Padegaon)

Sr. No.	Variety	Location	Name of pest	% incidence/Population			Remark
				Min.	Max.	Average	
	Co 86032 CoM 0265 MS 10001	Malegaon (Baramati), Nimbut (Baramati), Padegaon (Phaltan), Padegaon (Khandala), Pandare (Baramati)	Early shoot borer (% incidence)	10.20	34.67	14.33	
			Top shoot borer (% incidence)	0	2.00	0.05	
			Internode borer -% incidence (% intensity)	10.33 (1.67)	20.00 (3.80)	14.67 (3.33)	
			Stalk borer (% incidence/% intensity)	--	--	--	
			Root borer (% incidence)	3.00	11.00	4.67	Pandare, Malegaon
			Any other borer (% incidence)	--	--	--	
			Pyrilla/ leaf	0	05	--	very rare incidence
			Epiricania melanoleuca/plant	3	10	--	
			Whitefly (per 2.5 sq.cm.)	0	01.33	--	very rare incidence
			Woolly aphid (Average grade)	0	4.67	2.33	On very few stools
			Scale insect (% incidence/% intensity)	4.67	10.00	02.67	
			Mealy bug - % incidence / (% intensity)	10.00 (1.67)	24.67 (4.67)	15.33 (3.33)	Pandare area
			Black bug/leaf	--	--	--	
			Spittle bug (% incidence)	--	--	--	
			Thrips (% incidence)	--	--	--	In traces
			Mite (% incidence)	--	--	--	
			White grub	0	45	07.33	Pandare, Malegaon
			Termite (% incidence) At germination/harvest	1	7	1.33	Pandare, Malegaon
			Derbid plant hopper, *Proutista moesta*	05.00	12.00	03.33	**--**
			Sugarcane grass hopper, *Hieroglyphus banian*	--	--	--	In traces
			Any other (New Pest)	--	--	--	--

Regarding sucking pests, the pyrilla, whitefly, thrips, scale insects was in traces to low level. The incidence of mealy bug was ranged from 10.00 to 24.67 per cent, where as intensity ranged from 1.67 to 4.67 per cent. The derbid plant hopper, *Proutista moesta* was recorded from 5.00 to 12.00 per cent. During this year (2017-18), the incidence of sugarcane woolly aphid observed only on few stools on sugarcane and ranged from 0 to 4.67 per cent. In case of soil pests, the incidence of white grub ranged from 0 to 45 per cent particularly in Malegaon and Hol area of Baramati, whereas termites were in traces.

E.28: Survey and surveillance of sugarcane insect pests

Table 1. Status of sugarcane pests and their natural enemies in and around Coimbatore, Tamil Nadu

S. No.	Variety	Location	Name of pest/ parasitoid	% incidence/population			Remarks
				Min	Max	Average	
1	Co 86032	Telungupalayam	Shoot borer	2.22%	9.74%		
			Internode borer	2.38%	11.76%		
			Top borer	0.56%	1.17%		
			Pink mealybug				Traces
			Scale insect				Traces
			Woolly aphid	Mean rating=1.8			In one patch of four canes
			Pyrilla				Traces
2	Co 86032	Athipalayam	Shoot borer	1.26%			
			Top borer	0.63%			
3	Co 86032	Annur	Internode borer	0.0%			
			Pyrilla				Traces. *Epiricania* 1-2 coccons/ leaf

E.30: Monitoring of insect pests and bio-agents in sugarcane agro-ecosystem
DR.PDKV, Akola

The insect pests recorded on sugarcane var. Co-86032 during 2017-18 were early shoot borer, scales, *Pyrilla*, White fly and aphids.

The data presented in Table 2 revealed that the early shoot borer incidence on Co-86032 has shown non-significant correlation with morning relative humidity, evening relative humidity, rainfall and Maximum temp. Similarly, in case of scales the incidence of scales has also shown non-significant correlation with rainfall and Relative humidity at evening. But it showed Significant correlation with relative humidity at morning hours, Max. Temperature and Min. Temperature. In case of *Pyrilla* it showed significant correlation with Relative humidity at morning and evening hours, rainfall and Max. temperature and non-significant with Min. temperature.

Table 1: Seasonal incidence of major insect pests and natural enemies of sugarcane Recorded on Co-86032 during, (DR.PDKV, Akola)

Sr. No	MW	Per cent infestation of early shoot borer	Per cent incidence of scales	Per cent intensity of Scale insects	Bio agents per 3 plants		Aphids per 3 leaves	White fly per 3 leaves	*Pyrilla* Nymph adult per leaf	Rainfall (mm)	Temperature (0C)		RH I (%)	RH II (%)
					LBB	Spiders					Max	Min		
1	1	--	--	--	--	--	--	--	--	0	29.5	9.3	82	33
2	2	--	--	--	--	--	--	--	--	0	27.3	8.4	84	40
3	3	--	--	--	--	--	--	--	--	0	29.3	12.2	80	36
4	4	--	--	--	--	--	--	--	--	0	31.3	13.8	77	36
5	5	--	--	--	--	--	--	--	--	0	31.6	11.8	80	27
6	6	--	--	--	--	--	--	--	--	0	32.5	14.2	72	27
7	7	10.69	--	--	7	5	--	--	--	0.5	33.2	16.4	74	27
8	8	9.35	--	--	12	08	--	--	--	0	35.1	14.8	59	14
9	9	9.77	--	--	6	8	--	--	--	0	36.4	15.6	42	12
10	10	8.59	--	--	12	7	--	--	--	0	34.7	17.4	46	16
11	11	7.27	--	--	15	8	--	--	--	0	34.2	16	42	14
12	12	6.22	--	--	10	8	--	--	--	0	37.7	18.9	35	13
13	13	6.21	--	--	15	4	--	--	--	0	42.5	22.5	32	11
14	14	7.42	--	--	12	8	--	--	--	0	40.7	26.2	33	15
15	15	7.01	--	--	09	06	--	--	--	0	41.9	20	27	8
16	16	5.12	--	--	08	08	--	--	--	0	43.9	27.7	25	6
17	17	4.53	--	--	09	08	--	--	--	0	41.1	25.5	35	10
18	18	4.17	--	--	12	11	--	--	--	0	42.2	26.7	28	14
19	19	3.73	--	--	7	8	--	--	--	0.3	43.3	27.7	30	15
20	20	4.23	--	--	8	8	--	--	--	0	43.9	30.4	37	17
21	21	3.28	--	--	5	5	--	--	--	0	43.6	30.1	41	18
22	22	3.46	--	--	4	9	--	--	--	0.8	40.5	28.9	58	31
23	23	4.00	--	--	6	5	--	--	--	24.6	38	25.5	74	41
24	24	2.72	--	--	8	3	--	--	--	45.4	35.6	23.8	80	50
25	25	3.64	--	--	6	3	--	--	--	5.7	37.4	26.3	67	36
26	26	2.67	--	--	4	6	--	--	--	10.5	34.8	25	75	48
27	27	2.67	--	--	4	8	4	3	0.00	37.6	33.2	24.4	79	51
28	28	2.32	--	--	8	6	9	5	0.00	10.8	33.9	24.9	77	51
29	29	1.58	--	--	4	7	6	4	0.00	101.1	29.8	23.8	88	72
30	30	1.57	--	--	6	7	6	4	0.98	35.8	30.5	23	87	65
31	31	0.00	--	--	5	8	14	8	1.05	10	31.9	23.6	85	58
32	32	0.00	--	--	5	5	19	5	1.50	4.4	30.7	24.1	80	63
33	33	--	--	--	6	4	28	8	1.80	18.9	32.9	23.8	83	58
34	34	--	--	--	5	4	10	4	1.80	25.3	29.1	23.4	92	76
35	35	--	--	--	6	5	11	5	2.00	70.2	30.5	23.3	88	68
36	36	--	--	--	8	6	10	6	2.00	9.7	32.7	23.8	89	61
37	37	--	40.00	9.57	9	5	11	6	1.20	27.9	31.8	23.8	93	69
38	38	--	40.00	8.80	8	4	10	7	1.50	12.5	30.8	23	92	69

39	39	--	40.00	7.75	10	5	11	6	0.43	4.1	33.8	52.3	89	50
40	40	--	40.00	6.31	8	6	8	8	0.63	0	35.5	21.1	82	42
41	41	--	40.00	5.45	9	6	10	10	1.20	57.5	31.9	23	91	64
42	42	--	28.00	3.21	9	7	11	6	1.20	0	33.7	20.5	83	43
43	43	--	40.00	3.35	10	8	10	6	0	4.5	33.9	16.6	77	29
44	44	--	40.00	3.85	10	9	10	7	0	0	32.7	14	82	26
45	45	--	32.00	4.72	11	8	11	8	0	0	31.6	14.7	81	28
46	46	--	40.00	4.88	10	7	10	0	00	0	31	13.7	79	37
47	47	--	28.00	3.74	9	8	9	0	0	0	31.8	17.9	84	40
48	48	--	32.00	3.62	8	7	0	0	0	0	30.6	11.2	79	23
49	49	--	32.00	3.45	11	6	0	0	00	0	29.7	14.5	78	38
50	50	--	28.00	3.53	10	7	0	0	0	0	31.2	13.7	74	27
51	51	--	36.00	3.62	10	8	0	0	0	0	29.7	10.4	80	25
52	52	--	44.00	4.76	10	9	0	0	0	0	29.4	8.7	72	22
							Total Rainfall Jan to Dec			**518.1**				

MW : Meteorological Week

Table 2: Correlation of incidence of insect pests on sugarcane at Akola with the weather parameters during the year 2017-18.

Variety		**Rainfall (mm)**	**Max. Temp**	**Min. Temp**	**RH I (%)**	**RH II (%)**
Early shoot borer						
Co 86032	**R**	-0.28	0.59	0.02	-0.74	-0.884
	t (cal)	-1.86	4.74	0.15	-7.09	-12.26
	n=21	**NS**	**NS**	**NS**	**NS**	**NS**
Scales						
Co 86032	**R**	-0.12	-0.46	-0.29	0.47	0.15
	t (cal)	-0.76	-3.35	-2.00	3.47	0.99
	n=16	**Non Sig**	**Sig**	**Sig**	**Sig**	**Non Sig**
Pyrilla						
Co 86032	**R**	0.36	-0.39	0.24	0.51	0.79
	t (cal)	2.48	-2.77	1.62	3.86	8.24
	n=13	**Sig**	**Sig**	**Non Sig**	**Sig**	**Sig**

Here r= coefficient of correlation, t = calculated t NS = Non significant
S = significant at 0.05%* and 0.01%**

Table 3: Seasonal incidence of major insect pests of sugarcane recorded during 2017-18

Sr.No.	Insect Pests	Infestation period (MW)	Highest infestation	Meteorological parameters				
				RF (mm)	**T max ºC**	**T min ºC**	**RH I (%)**	**RH II (%)**
1	Early Shoot Borer % infestation	7th to 30th MW	(10.69%) 7th MW	**0.5**	33.2	16.4	74	27
2	*Pyrilla* per leaf	30th to 42nd MW	(2.00 per leaf) 35th and 36th MW	**70.2**	30.5	23.3	88	68
3	Scale insect % incidence	37th to 52nd MW	(44%) 52nd MW	**0.0**	29.4	8.7	72	22
4	Scale insect % intensity	37th to 52nd MW	(9.57%) 37th MW	**27.9**	31.8	23.8	93	69

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Cumulative incidence of ESB in Co 86032 sugarcane variety was 23.35 % in the first four months after planting. Incidence of TSB was 23.98% at 7th month. Incidence of Inter node borer was 29.60%. Aphid, whitefly, and pyrilla appeared in very small numbers but failed to establish and spread. Woolly aphid incidence was observed at 150 and 180 days after sowing and it was restricted to few clumps. *Dipha* (2larva/2pupa/clump) *Encarsia* (6 adults/leaf), kept the woolly aphid under control. Sugarcane pink mealy bug *S.sacchari* infested 8.50% Millable canes with 22.65% intensity (Table.6).

Table 6: Monitoring of insect pests and bio-agents in sugarcane agro ecosystem, (Mandya)

Time of Observation	(%)Incidence			Woolly aphid	Mealy bug		Natural enemies
	ESB	TSB	INB	Leaf area covered	(%) Incidence	(%) Intensity	
30 DAP	**4.15**	**---**	**---**	**---**	**---**	**---**	**Parasitisation by Trichogramma parasitoids (8.30% egg masses)**
60 DAP	**9.15**	**---**	**---**	**---**	**---**	**---**	**---**
90 DAP	**8.30**	**---**	**---**	**---**	**---**	**---**	**---**
120DAP	**3.75**	**---**	**---**	**---**	**---**	**---**	**---**
150DAP	**----**	**10.48**	**--**	**50 %**		**---**	***Dipha* 2 larva/2 pupa /leaf**
180DAP	**---**	**---**	**-----**	**55 %**	**--**	**---**	***Encarsia* Adults 6/leaf** ***Micromus* larva 2 /leaf**

210DAP	**---**	**13.50**		**---**	**8.50**	**22.65**	---
At harvest			**29.60**	**--**	--	--	---

Vasantdada Sugar Institute, Pune

The per cent incidence of early shoot borer was maximum 16.97 % in June 2017, while in March 2017 it was minimum 0.83 %. The % incidence, % intensity and infestation Index of internode bore was maximum 38 %, 2.76% and 1.05 in Nov. 2017, while it was minimum 2,0.70 and 0.01 in the month of July 2017. This plot was free from mealy bug and scale insect infestation (Table 9).

Table 9: The % incidence / intensity of major insect pests during, (VSI, Pune)

Sr. No	**Month**	**Early shoot borer**	**Internode borer**			**Mealy bug**	
		% incidence	**% incidence**	**% intensity**	**Infestation index**	**% incidence**	**% intensity**
1	March 2017	0.83					
2	April 2017	4.34					
3	May 2017	11.97					
4	June 2017	16.97					
5	July 2017		2.00	0.70	0.01	0	0
6	August 2017		9.00	1.29	0.12	0	0
7	September 2017		11.00	1.09	0.12	0	0
8	October 2017		25.00	2.43	0.61	0	0
9	November 2017		38.00	2.76	1.05	0	0

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A. Early shoot borer (ESB)

Period of Observation (SMW)	**% incidence of ESB**	**% Parasitism**		
		T. Chilonis	***E. annulipes***	***S. inferens***
7	1.18	4.69	-	-
11	2.81	7.32	-	-
16	0.23	1.24	-	-

Incidence of early shoot bore in 7, 11 and 16 SMW was 1.18, 2.81 and 0.23 respectively. During period of study only *T. chilonis* was found to be parasitized early shoot borer. Parasitism ranged from 1.24 to 7.32 per cent.

B. Top borer (TSB)

Period of Observation (SMW)	% incidence of TSB	% Parasitism			
		T. japonicum	*T. chilonis*	*Apanteles flavipes*	*B. bassiana*
20	1.14	4.31	1.18	1.09	0.94
28	2.62	2.68	1.62	1.89	1.05
50	1.91	1.22	0.97	1.17	1.13

Incidence of top shoot bore in 20, 28 and 50 SMW was 1.14, 2.62 and 1.91 respectively. During period of study per cent parasitism by *T. japonicum* was 4.31, 2.68 and 1.11, respectively. Whereas *T. chilonis* found to be parasitizing at the rate of 1.18, 1.62 and 0.97 per cent, Parasitism done by *Apanteles flavipes* was ranged from 1.09 to 1.89 per cent. Fungus parasitism ranged from
0.94 to 1.13 % caused by *B. bassiana.*

Zonal Agricultural Research Station, Powarkheda (M.P.)

For monitoring the insect pests and the bio-agents activity in sugarcane, Co 06022 was planted in 0.2 ha area by following the recommended package of practices except application of insecticides. At each standard meteorological week (SMW) the observations on infestation of both key pests i.e., early shoot borer and pyrilla and their natural enemies were recorded. This year only ESB observed to infest sugarcane, but pyrilla didn't appear, negligible pyrilla individuals observed at August last week. Data of meteorological parameters were obtained from Agro-Meteorological Project, ZARS, Powarkheda. (Table 6 & Fig. 1).

RESULT:

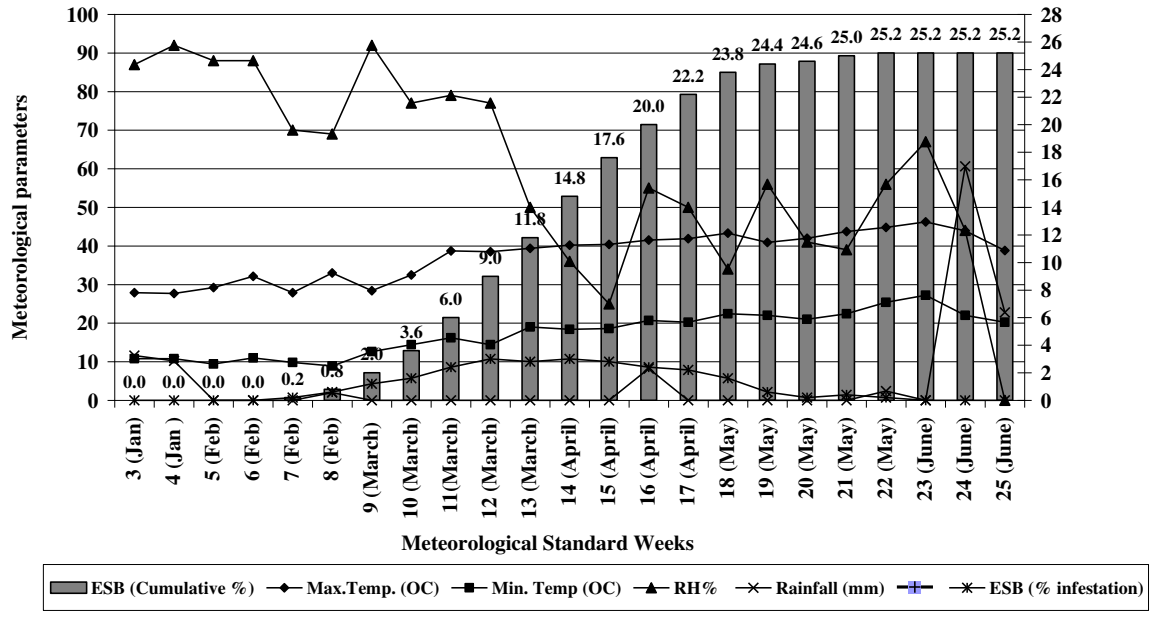
The infestation of early shoot borer initiated (0.2%/ week) at 7th SMW (3rd week of Feb.). Thereafter, it increased gradually and reached to the seasonal peak activity (>2.5%/week) from 12th to 15th SMW (second last week of March to 2nd week of April). Afterwards, ESB observed decline trend and its activity seized after 22nd SMW (last week of May).

Table 6: Activity of Early Shoot Borer and meteorological data, 2017, ZARS, Powarkheda (M. P.)

Date	SMW	Max.Temp. (O^C)	Min. Temp (O^C)	RH%	Rainfall (mm)	ESB (% infestation)	ESB (Cumulative %)
15 to 21/1	3 (Jan)	27.90	10.80	87.00	11.60	0.0	0.0
22 to 28/1	4 (Jan)	27.70	10.80	92.00	10.20	0.0	0.0
29/1 to 4/2	5 (Feb)	29.20	9.40	88.00	0.00	0.0	0.0
5 to 11/2	6 (Feb)	32.10	11.00	88.00	0.00	0.0	0.0
12 to 18/2	7 (Feb)	27.90	9.80	70.00	0.00	0.2	0.2
19 to 25/2	8 (Feb)	33.00	8.90	69.00	2.00	0.6	0.8

26/2 to 4/3	9 (March)	28.40	12.60	92.00	0.00	1.2	2.0
5 to 11/3	10 (March)	32.50	14.40	77.00	0.00	1.6	3.6
12 to 18/3	11(March)	38.70	16.20	79.00	0.00	2.4	6.0
19 to 25/3	12 (March)	38.50	14.40	77.00	0.00	3.0	9.0
26/3 to 1/4	13 (March)	39.40	19.00	50.00	0.00	2.8	11.8
2 to 8/4	14 (April)	40.20	18.40	36.00	0.00	**3.0**	14.8
9 to 15/4	15 (April)	40.40	18.60	25.00	0.00	2.8	17.6
16 to 22/4	16 (April)	41.50	20.70	55.00	8.20	2.4	20.0
23 to 29/4	17 (April)	41.90	20.20	50.00	0.00	2.2	22.2
30/4 to 6/5	18 (May)	43.30	22.40	34.00	0.00	1.6	23.8
7 to 13/5	19 (May)	40.90	22.00	56.00	0.00	0.6	24.4
14 to 20/5	20 (May)	42.00	21.00	41.00	0.00	0.2	24.6
21 to 27/5	21 (May)	43.70	22.40	39.00	0.00	0.4	25.0
28/5 to 3/6	22 (May)	44.80	25.40	56.00	2.40	0.2	25.2
4 to 10/6	23 (June)	46.20	27.20	67.00	0.00	0.0	25.2
11 to 17/6	24 (June)	43.90	22.00	44.00	60.60	0.0	25.2
18 to 24/6	25 (June)	38.80	20.20	0.00	22.80	0.0	25.2

Fig.1: Seasonal Incidence of Early Shoot Borer & Meteorological Data (2017) ZARS, Powarkheda (M.P.)



Maximum day temperature of >30^{O}C, minimum of near 11^{O}C above, RH of <90%, respectively seems to be favorable to initiate the ESB activity. While, maximum temperature of 38 to 40^{O}C, minimum of >14^{O}C, morning and evening RH <70 %, found to be conductive to induce the peak activity of ESB.

Pyrilla :

This year (2017-18), only early shoot borer observed to infest sugarcane, while pyrilla recorded to be in traces, i.e., only a few individuals recorded at last week of August, 2017. A few

egg masses were also observed, the *Tetrastichus pyrillae* damaged eggs were 4 to 9 per cent. No activity of *Epiricania melanolueca* observed throughout the season.

Summary:

The infestation of early shoot borer initiated (0.2%/week) at 7th SMW (3rd week of Feb.). Thereafter, it increased gradually and reached to the seasonal peak activity (>2.5%/week) from 12th to 15th SMW (second last week of March to 2nd week of April). Afterwards, ESB observed decline trend and its activity seized after 22nd SMW (last week of May).

Maximum day temperature of >30^{O}C, minimum of near 11^{O}C above, RH of <90%, respectively seems to be favorable to initiate the ESB activity. While, maximum temperature of 38 to 40^{O}C, minimum of >14^{O}C, morning and evening RH <70 %, found to be conductive to induce the peak activity of ESB.

CSRS, MPKV, Padegaon

The data regarding monitoring of insect pests and their bio-agents in sugarcane agro-ecosystem are presented in table 26 to 29.

During this year (2017-18), the incidence of early shoot borer ranged from 0.67 to18.33 per cent. The peak incidence of early shoot borer was observed in 18 MW (30 April to 6 May, 2017) and it was 18.33 per cent (table-26). The parasitism of *T. chilonis* was observed 13 to 24 MW. The incidence of pyrilla per leaf was ranged from 1 to 4. The *T. pyrillae* and *E. melanoleuca* was also observed (table-27). The first incidence of woolly aphid was observed in 30 MW (July 23 to 29, 2017) and it was 0.67 woolly aphid per leaf (table-28). However, the peak incidence was observed in 48 MW (November 26 to December 02 of 2017) and it was 34.67 woolly aphid per leaf. And it was continued up to 3 MW of 2018. The parasitoid, *Encarsia flavoscutellum* was ranged from 1 to 127 per 150 leaves and peak was observed in 49 MW of 2017 (03 to 09 Dec). The predator, *Micromus igorotus* was ranged from 1 to 54 per 150 leaves and peak was observed in 43 MW of 2017 (22-28 Oct). The peak predatism of *D. aphidivora* on woolly aphid was observed in 44 MW (Oct 29 to Nov 04) of 2017 and it was 27 *Dipha* per 150 leaves. The *Syrphids* was observed since 39 MW of 2017 to 3 MW of 2018 and peak activity was recorded in 01 MW of 2018.

Table 26 : Monitoring of insect pests and natural enemies of Sugarcane (ESB), Padegaon

Period of observation (2017)	% incidence early shoot borer	% Parasitism (ESB), If Any		
		T. chilonis	*E. annulipes*	*S. inferens*
1	2	3	4	5
06 (Feb 05-11)	0.00	--	--	--
07 (Feb 12-18)	0.00	--	--	--
08 (Feb 19-25)	0.00	--	--	--
09 (Feb 26 to Mar 04)	0.00	--	--	--
10 (Mar 05-11)	0.00	--	--	--
11 (Mar 12-18)	0.00	--	--	--
12 (Mar 19-25)	1.33	--	--	--
13 (Mar 26-Apr 01)	2.67	0.20	--	--
14 (April 02-08)	7.33	0.40	--	--

15 (April 09-15)	11.67	0.80	--	--
16 (April 16-22)	14.56	1.00	--	--
17 (April 23-29)	16.67	1.20	--	--
18 (April 30- May06)	18.33	2.00	--	--
19 (May 07-13)	14.86	2.20	--	--
20 (May 14-20)	12.33	2.80	--	--
21(May 21-27)	4.67	3.00	--	--
22 (May 28-June 03)	3.17	2.00	--	--
23 (June 04-10)	1.33	1.20	--	--
24 (June 11-17)	0.67	0.40	--	--
25 (June 18-24)	0.00	0.00	--	--

Table 27 : Monitoring of insect pests and natural enemies of Sugarcane (pyrilla), Padegaon

Period of observation (2017)	**Pyrilla / leaf**	**Pyrilla/leaf**				
		T. pyrillae (% parasitism on eggs)	***Cheilon eurus pyrillae***	***Ooencyrtus papilionis***	***E. melanoleuca***	
					% Parasitism	***Egg mass & Cocoon***
1	**5**	**6**	**7**	**8**	**9**	**10**
29 (July 16-22)	-	-	-	-	-	-
30 (July 23-29)	0	-	-	-	-	-
31 (July 30-Aug 05)	0	-	-	-	-	-
32 (Aug 06-12)	1	-	-	-	-	-
33 (Aug 13-19)	0	-	-	-	10	-
34 (Aug 20-26)	1	-	-	-	20	1
35 (Aug 27-Sept 02)	1-2	10	-	-	10	0
36 (Sept 03-09)	2	10	-	-	10	1-2
37 (Sept 10-16)	2-3	20	-	-	40	1-2
38 (Sept 17-23)	3-4	30	-	-	30	2-3
39 (Sept 24-30)	2-3	40	-	-	10	2-3
40 (Oct 01-07)	1-2	20	-	-	20	1-2
41 (Oct 08-14)	1-2	10	-	-	0	0
42 (Oct 15-21)	1	0	-	-	0	1

Table 28 : Monitoring of insect pests and natural enemies of Sugarcane (Woolly aphid)

Period of observation	woolly aphid per leaf	% Parasitism/Predator population per plant (per 150 leaves)				
		Encarsia flavoscutellum	*Micromus igorotus*	*D. aphidivora*	Syrphid fly	*Chrysoperla zastrowi sillemi*
1	**2**	**3**	**4**	**5**	**6**	**7**
28 (July 09-15) 2017	-	-	-	-	-	-
29 (July 16-22)	-	-	-	-	-	-
30 (July 23-29)	**0.67**	-	-	-	-	-
31 (July 30-Aug 05)	1.33	-	-	-	-	-
32 (Aug 06-12)	1.00	-	-	-	-	-
33 (Aug 13-19)	1.67	-	-	-	-	-
34 (Aug 20-26)	2.00	-	-	-	-	-
35 (Aug 27-Sept 02)	4.33	-	-	-	-	-
36 (Sept 03-09)	3.67	**2**	**0**	-	-	-
37 (Sept 10-16)	4.00	3	0	-	-	-
38 (Sept 17-23)	7.33	1	0	-	-	-
39 (Sept 24-30)	11.33	4	2	-	1	-
40 (Oct 01-07)	15.00	18	11	-	-	-
41 (Oct 08-14)	21.33	27	18	1	-	-
42 (Oct 15-21)	20.67	35	27	7	-	-
43 (Oct 22-28)	18.00	41	54	5	-	-
44 (Oct 29- Nov 04)	21.67	55	32	27	-	Eggs of *Chrysoperla* were observed on 2-4 stools
45 (Nov 05-11)	14.00	52	21	18	2	
46 (Nov 12-18)	22.23	84	24	10	-	
47 (Nov 19-25)	24.00	111	22	12	-	
48 (Nov 26-Dec 02)	34.67	98	8	16	7	-
49 (Dec 03-09)	33.00	127	7	19	3	-
50 (Dec 10-16)	24.33	77	9	10	9	-
51 (Dec 17-23)	15.67	54	2	4	11	-
52 (Dec 24-31)	11.33	22	4	3	14	-
01 (Jan 01-07) 2018	7.00	13	0	1	17	-
02 (Jan 08-14)	2.33	18	1	2	12	-
03 (Jan 15-21)	0.33	9	0	0	4	-
04 (Jan 22-28)	0.00	3	0	0	0	-
05 (Jan 29-Feb 04)	0.00	5	0	0	0	-
Note : The incidence of woolly aphid was observed on 15-20 R area in the experimental field at one corner on Co 86032. The observations are based on the infested parts of the field.						

Table 29 : Monitoring of insect pests and natural enemies of Sugarcane (Mealy bugs)

Period of observation (2016)	% incidence Mealy bug	% Parasitism/Predator population per plant (Mealy bug)			
		Coccinella septempunctata/ cane	*P. horni*	*Cheilomenes sexmaculata/* cane	*C. zastrowi sillemi*
1	**8**	**9**	**10**	**11**	**12**
35 (Aug 27-Sept 02)	0	-	-	-	-
36 (Sept 03-09)	1	0	-	-	-
37 (Sept 10-16)	2.33	0	-	-	-
38 (Sept 17-23)	5.00	0	-	0	-
39 (Sept 24-30)	4.00	1-2	-	1	-
40 (Oct 01-07)	4.67	2	-	1	-
41 (Oct 08-14)	3.00	1	-	1	-
42 (Oct 15-21)	2.00	0	-	0	-
43 (Oct 22-28)	0.67	0	-	0	-
44 (Oct 29-Nov 04)	0	0	-	0	-

Project E.30: Monitoring of insect pests and natural enemies of sugarcane

Table 14. Pest and natural enemy status in monitoring plot at Coimbatore, Tamil Nadu during 2017-18

S. No.	Location	Insect pest	Prevalence period	Max. incidence /population	Natural enemy	Prevalence period	Max. parasitization/ population
1	Coimbatore	SB	May	8.41%			
			July	9.34%			
		TB	July	0.28%			
		INB	February	7.69%	*Telenomus dingus* (60.0%)	Throughout the year	100.0%
		Pyrilla	February	Traces			
		Pink mealybug	February	Traces			
		Sheath mite	February	Traces			

E.34: Standardization of simple, cost effective techniques for mass multiplication of sugarcane bioagents.

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Vasantdada Sugar Institute, Pune

Studies on mass production of *Corcyra cephalonica*, laboratory host for *Trichogramma* egg parasite

Filling of *Corcyra* rearing boxes: Dried yeast tablets are mixed in it to increase the nutritive value of the diet. Nucleus culture of 0.5 cc (Approximately 10,000) *Corcyra* eggs has introduced in it. The rearing cage has a wooden lid at the top. The lid has a window of wire mesh for ventilation. Laboratory sanitation and sterilization of wares has adopted to avoid fungal / bacterial contamination. At hatching, *Corcyra* larvae feed on the provided diet throughout their larval period and pupate in the cages. In each cage, 10,000 introduced *Corcyra* eggs hatched into only 3000 to 5000 larvae/adult within 60 days. The life of *Corcyra* adult varies from 3 to 5 days.

Collection of host eggs: Collected adults have placed to egg laying chamber for mating. A size of wooden *Corcyra* eggs laying chamber is 8x8x8 cubic h. The eggs laid by the female come out directly through the wire mesh fitted at the bottom of egg laying chamber. The chambers are provided with iron steel tripod stand with egg collecting vial at the bottom. On the next day, an egg-collecting vial has removed from eggs laying chambers. Dust, scale and antennae are separated with the help of tea sieve, hairbrush and blotting paper. Cleaned eggs were counted with measuring cylinder/cc unit and poured in screw jar & stored at 10 C in B.O.D. incubator up to 10 to 21 days and used for *Trichogramma* multiplication.

12. Results:

Table No.10 indicates that during 2017-18 Entomology Section produced Corcyra eggs 1054.4 cc (210.88 lac) with a monthly average of 87.87 cc (17.57 lac). During 2017-18 Entomology Section produced 834 Tricho cards (166.80 lac parasites) of *Trichogramma chilonis* parasites with a monthly average of 69.5 cards (13.90 lac parasites).

During 2017-18 Entomology Section supplied 475 Tricho cards for the control of borers on 31.67 ha area (Table 11).

Table 10: Monthly production of *C. cephalonica* eggs and *T. chilonis* parasitoids cards, Mandya

Sr. No.	Month	*Corcyra* eggs Produced (cc)		*T. chilonis* parasitoids cards	
		Per month	Per day	Per month	Per day
1	April 2017	34.00	1.13	15	0.50
2	May 2017	61.00	1.97	20	0.64
3	June 2017	54.90	1.83	28	0.93
4	July 2017	154.00	4.97	100	3.23
5	August 2017	78.00	2.52	111	3.58
6	September 2017	93.6	3.12	46	1.53
7	October 2017	71.8	2.32	51	1.65
8	November 2017	114.1	3.80	90	3
9	December 2017	79.4	2.56	60	1.94
10	January 2018	111.2	3.59	90	2.90
11	February 2018	118.4	4.23	135	6.75

12	March 2018	84	2.71	88	2.84
	Total	1054.4	34.75	834	29.49
	Average	87.87	2.89	69.5	2.46

Table 11: Supply of *T. chilonis* parasitoids cards/Corcyra eggs, Mandya

Name of sugar mill/other	**No. of Tricho cards supplied**	**Amount (Rs.)**	**Area covered (ha)**
Sonhira, Sangli	100	9500	6.67
Farmers	227	21565	15.13
Total A=	327	**31065**	21.8
VSI Farm (Gratis) Total B=	148	**14060**	9.87
Total C= (A+B)=	475	**45125**	31.67

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CSRS, MPKV, Padegaon

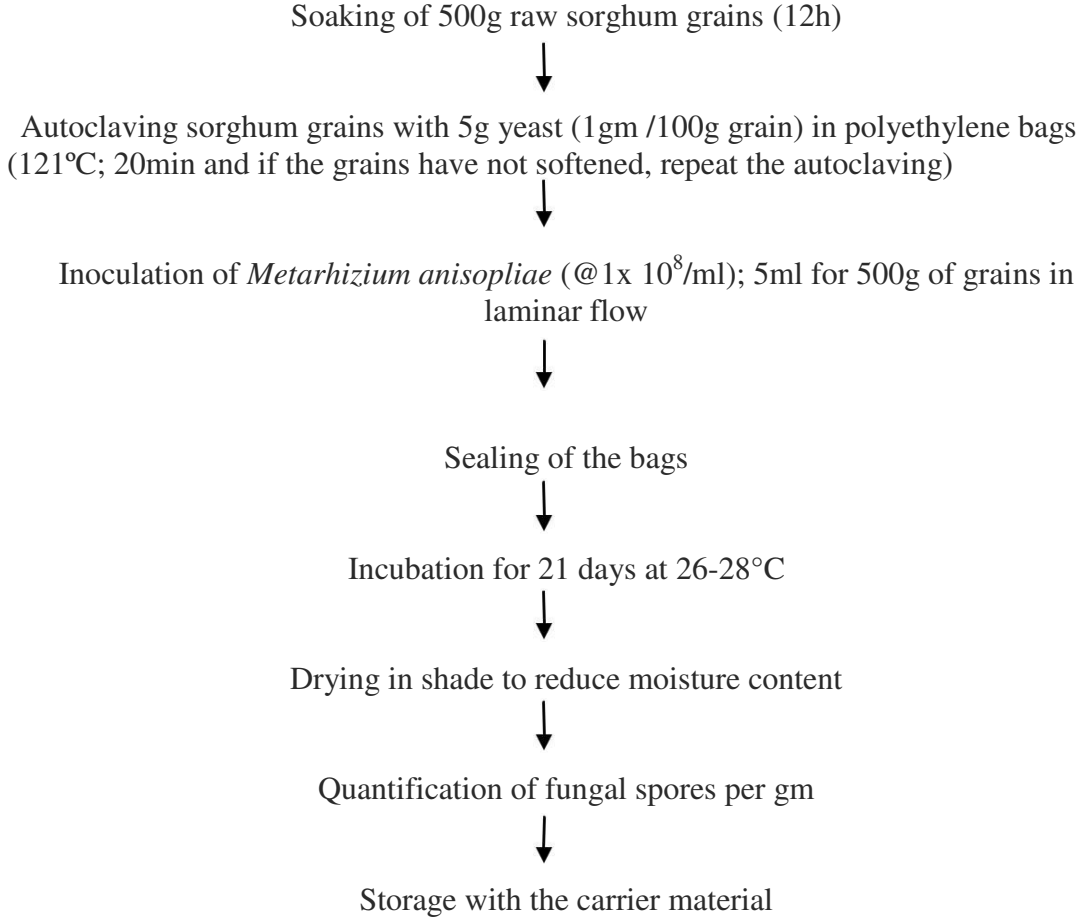
In the experiment, "Standardization of simple, cost effective techniques for mass multiplication of sugarcane bio-agents (E.34)," the *Chrysoperla carnea (Chrysoperla zastrowi sillemi)* can be multiplied 2-5 numbers neonate larvae per stool of sugarcane in fifty per cent green shade net

Project E.34: Standardization of simple and cost effective techniques for mass multiplication of sugarcane bio-agents: *Beauveria brongniartii* & *Metarhizium anisopliae*

Mass culture of *Beauveria brongniartii* & *Metarhizium anisopliae* in molasses media

An economical mass production method developed for the fungi involves the use of dilute molasses broth medium fortified with salts. The medium is dispensed in autoclavable PVC bottles or glass jars with lids, autoclaved, inoculated with a suspension of pure fungal culture in aseptic conditions and incubated at a constant temperature of 27 □ 2^0C. Three weeks later, fungal mats showing symptoms of sporulation are collected, blended with little broth, mixed with pressmud or lignite as carrier material, air-dried and packed. About 2 kg of the above formulation, calibrated to contain 10^{12} spores of the fungus, is required for one acre as soil application. The formulation may be mixed with suitable quantity of pressmud or farmyard manure, applied to the base of clumps and covered with soil, followed by irrigation. The formulation can be applied as a single dose in June when first instar grubs start appearing in the field.

Mass production of *Metarhizium anisopliae* on sorghum grain



E.38: Formulation and validation of IPM module of Sugarcane insect pests
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IPM Module

1. Selection of healthy seed material b) Seed treatment with 0.4% chlorpyriphos 20 EC solution. c) Ploughing the land to expose the root grub larvae to the birds. d) Incorporation of chlorantroniliprole 0.4G @22.5 kg/ha e) collection and destruction of sugarcane borer egg masses f) Installing pheromone traps @27/ha g) spray 60DAP chlorantroniliprole18.5 SC@375ml/ha h) Remove dried lower leaves @90 and 150 DAP i) Release Trichogramma egg parasitoids @ 50,000 at weekly interval five times j)Removal of water shoots @180,210 and 240DAP

Farmers Practice

a) Incorporate carbofuron 3G @30kg/ha at the time of planting and @150DAP b) when the pest incidence was noticed spray the crop with quinolphos 25EC @500ml/ac

Result:

In IPM plot, the incidence of major pests was low compared to farmers practice plot. Apart from this, the yield of IPM plot was 24.18 percent more than the farmers practice plot, with the cost benefit ratio of 1:4.36 in favor of IPM practice (Table.7).

Table 7: Formulation and validation of IPM module of Sugarcane insect pests

Pest	**IPM Plot**	**Farmers Practice Plot**
	Infestation level (%)	**Infestation level (%)**
Early shoot borer	6.25	18.30
Top shoot borer	5.90	14.50
Inter node borer	12.50	29.80
Woolly aphid	12 clumps 40% leaf area covered by aphids	17 clumps50% leaf area covered by aphids
Pyrilla	<0.5 adults/nymphs/clump	<0.5 adults/nymphs/clump
Yield	69.25ton/ac	52.50ton/ac

II. TEACHING: Courses offered

Course no.	**Credit hours**	**Course title**
AET 511	1+1	Pests of field crops

III. Extension Activities

Extension Activities	**Details**
1. Training programmes	9
2. Field visits	6
3. Krishi mela	1
4. Consultancy	57
5.T.V.Programme	-
6.Radio Talk	-
7.Field days	2

Vasantdada Sugar Institute, Pune

The cumulative % incidence of early shoot borer was 0.53% in IPM block, while 5.44% in farmers practice block. At harvest plant population per ha was numerically high 70714 in IPM Block and it was 64615 in farmers practice block. At harvest sugarcane yield per ha was numerically high 173.81 in farmers practice block and it was 141.35 in IPM Block

The germination % at 45 DAP was 53.25 % and 86.25% in IPM block and farmers practice block respectively. The tillering ratio at 120 DAP was 3.49 & 2.60 in IPM Block and Farmers practice block respectively.

At 90 DAP the mean % incidence of early shoot borer was statistically low 0.06 in IPM Block, while in farmers practice it was 3.47. At 120 DAP the mean % incidence of early shoot borer was statistically low 0.22 in IPM Block, while in farmers practice it was 1.69. The cumulative % incidence of early shoot borer was 0.53% in IPM block, while 5.44% in farmers practice block. No. of bored plants/ha were 549 and 7692 in IPM Block and Farmers practice block respectively.

At 150 DAP both IPM and farmers practice block were free from internode borer infestation and there was 1% incidence of mealy bug in IPM Block while farmers practice block was free from it.

At 10 month after planting both IPM and farmers practice block were free from mealy bug. There was 5% and 13% incidence of internode borer in IPM Block and farmers practice block.

At harvest total cane height, single cane weight and CCS % was numerically high 329.73, 2.69 and 15.46 in farmers practice block respectively, while it was 316.07, 2.00 and 14.19 in IPM Block respectively.

At harvest plant population per ha was numerically high 70714 in IPM Block and it was 64615 in farmers practice block. At harvest sugarcane yield per ha was numerically high 173.81 in farmers practice block and it was 141.35 in IPM Block. At harvest B:C ratio was high 4.33 in farmers practice block and it was 3.46 in IPM Block.(Table 12)

Data in Table 12 is not statistically significant because IPM block soil type was light, while farmers practice block soil type was heavy and per cent incidence of early shoot borer was also below ETL level in both plots.

Table 12: Per cent incidence of ESB, Growth and yield parameter, Padegaon

Sr. No	Parameters	T1	T2	Cal t
1	Per cent incidence of ESB at 30 DAP	0.00	0.39	NS
2	Per cent Germination at 45 DAP	53.25	86.25	NS
3	Per cent incidence of ESB at 45 DAP	0.00	0.28	NS
4	Per cent incidence of ESB at 60 DAP	0.92	2.38	NS
5	Per cent incidence of ESB at 90 DAP	0.06	3.47	4.29
6	Per cent incidence of ESB at 120 DAP	0.22	1.69	5.21
7	Cumulative incidence of ESB	0.53	5.44	
8	Tillering ratio at 120 DAP	3.49	2.60	4.35
9	No. of bored plants/ha.	549	7692	
10	Per cent incidence of INB at 150 DAP	0.00	0.00	
11	Per cent incidence of MB at 150 DAP	1.00	0.00	NS
12	Per cent intensity of MB at 150 DAP	0.31	0.00	NS
13	Per cent incidence of INB at 10 months after planting	5.0	13.0	NS
14	Per cent intensity of INB at 10 months after planting	0.28	0.82	NS
15	Infestation index of INB at 10 months after planting	0.02	0.13	NS
16	Per cent incidence of MB at 10 months after planting	0.00	0.00	
17	Plant Population/ha	70714	64615	NS
18	Single cane wt kg	2.00	2.69	NS
19	Sugarcane yield t/ha	141.35	173.81	NS
20	CCS t/ha	20.13	26.86	NS
21	Total cane height (cm)	316.07	329.73	NS
22	Milable cane height (cm)	282.50	299.07	NS
23	No. of internode	20	21	NS

24	Diameter (cm)	2.74	2.98	NS
25	Brix %	19.64	21.26	NS
26	Sucrose %	19.31	21	NS
27	Purity %	98.11	98.83	NS
28	CCS%	14.19	15.46	NS
29	B:C Ratio	3.46	4.33	

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The data in table 1 revealed that effect of treatments in respect of per cent incidence of early shoot borer, top borer and mealy bug were found less susceptible whereas, percent incidence of root borer were found moderately susceptible. White fly incidence was noticed highly susceptible in IPM block while in farmer's practices it was moderately susceptible.

Table: 1 Effect of IPM on pest incidence at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Treatments	Per cent incidence				
		Early shoot borer	Top borer	Root borer	Mealy bugs	White fly
1	IPM	LS	LS	MS	LS	HS
2	Farmers Practices	LS	LS	MS	LS	MS

Yield, Growth and Quality parameters viz., Brix %, Sucrose %, Purity %, C.C.S %

The highest millable cane yield of sugarcane was recorded Farmers practices (139.58 t/ha) and it was at 132.50 t/ha in IPM block. Brix per cent, Sucrose per cent, Purity per cent and C.C.S per cent were found non- significant. The treatment did not show any significant difference in quality parameter.

Growth parameters like germination per cent and numbers of tillers reported higher in farmers practices 49.14 per cent and 195320 per ha., respectively.

Table -2 Effect of new insecticide on yield and quality parameter at Main Sugarcane Research Station, Navsari (2016-17)

Sr. No.	Treatments	Germination %	Tillering (no/ha)	Number of millable cane	Cane Yield (t/ha)	Quality parameter (%)			
		30 DAS	120 DAS	('000 /ha)		Brix	Sucrose	Purity	C.C.S.
1	IPM	48.21	194.95	88.00	132.50	21.90	19.69	89.90	13.73
2	Farmers Practices	49.14	195.32	93.33	139.58	21.80	19.70	90.36	13.78

Zonal Agricultural Research Station, Powarkheda (M.P.)

The IPM block recorded 74.2 per cent germination, while in farmers practice block it was 69.2 per cent. In farmers practice block, 13.87 per cent early shoot borer infestation recorded, while it was 4.02 per cent in IPM block (i.e., 71.01 per cent less). Later on, experiment failed due to drought and lack of irrigation in later summer. Hence, the yield its quantity/ quality attributes couldn't be recorded.

CSRS, MPKV, Padegaon

Table 32 : Validation of IPM module vs farmers practice, Padegaon

Parameters	T_1 - IPM Block	T_2 - Farmer's Practice
Growth Parameter's		
Per cent Germination 45 DAP	87.33	65.67
Total cane height (cm)	321.5	305.5
Millable cane height (cm)	298.5	287
Number of Internodes	21.3	19.25
Girth of Cane (inch)	4.295	4.08
Early shoot borer		
45 DAP (%)	0.00	0.58
60 DAP (%)	1.34	18.21
90 DAP (%)	3.08	14.04
120 DAP (%)	2.60	6.28
Cumulative Incidence (%)	6.95	25.10
Number of bored plants /ha	5833.33	26041.67
Internode Borer (%)		
At 150 DAP	0	5
At Harvest (Intensity)	15 (1.33)	35(3.06)
Mealy Bug (%)		
At 150 DAP	0	0
At Harvest	2.33	5.67
Yield		
Number of Millable cane ['000 / ha]	86.85	71.76
Cane yield [t / ha]	110.28	76.30

Data recorded on growth parameters, per cent incidence of early shoot borer (ESB), internode borer, mealy bug, total number of millable canes (000 per ha) and yield (t/ha) are presented in table 32. The incidence of top shoot borer, mealy bug, scale insect, pyrilla, white fly etc. are negligible and hence releases of *Epiricania (=Fulgoreica) melanoleuca* , Spray clothionidin 50 WDG @ 250 g/ha, as well as installation of 'Biological-cum-Mechanical' traps were not done. In Farmers practice block, all measures were undertaken as per technical programme.

In IPM block, the growth parameters *viz.,* per cent germination at 45 DAP, total cane height (cm), millable cane height (cm), number of internodes and girth of cane showed higher than farmers practice block (table-32). In IPM block, less cumulative incidence of early shoot borer recorded (6.95 %) as compare to farmers practice block (25.10%). Internode borer incidence and intensity was less in IPM block 15 and 1.33 per cent as compare to farmers practice 35 and 3.06 per cent during harvesting stage. The incidence of mealy bug was low. IPM block recorded 86.85 thousand millable canes per ha as compare to farmers practice 71.76 thousand /ha. In IPM block higher cane yield (110.28 t /ha) was recorded as compare to farmers practice (76.30 t /ha).

East Cost Zone
RAS, ANGRAU, Anakapalle (A. P.)
DETAILED REPORT OF ENTOMOLOGY DESCIPLINE
E.4.1 : **Evaluation of zonal varieties / genotypes for their reaction against major insect pests**

Three IVT and nine AVT-I & eight AVT -II entries in comparison with two susceptible checks were field screened against major insect pests in sugarcane. Among twenty entries, four entries *viz.*, Co V 13 356 (5.43%DH), Co C 13336 (10.74%DH), Co A 13322 (10.79%DH), Co C 13337 (11.78%DH) showed least susceptible reaction(<15%DH) and found promising against early shoot borer whereas the entries *viz.*, Co C 14337 (22.39%), Co 13029 (25.26%), PI 14377 (26.44%), Co Or 13346 (27.36%), Co C 13339 (28.67%DH), Co C 14336 (29.04%DH) and Co A 14321 (29.43% DH) showed moderate susceptible reaction towards early shoot borer (Table 3) compared to susceptible check, Co A 99082 (33.78%DH). Remaining all the test entries showed high susceptible reaction towards early shoot borer (> 30% DH) and the incidence was ranged from 30. 13% DH in Co 13023 to 46.78 % DH in Co A 11326. . The entries *viz.*, Co 13028 (27.41%), Co A 12324 (29.90%), PI 15376 (29.09%) recorded moderate incidence of internode borer compared to susceptible checks, Co A 99082 (60.49%) and Co A 92081 (82.13%) and found promising against internode borer. Three entries *viz.*, Co A 14321 (3.03%), Co V 15356 (6.06%), PI 14377 (6.06%), showed least susceptible reaction and found promising against scale insect compared to susceptible checks, Co A 92081 (68.25%) and Co A 99082 (47.89%) (Table 1 & 2).

Table 1: Reaction of IVT, AVT-I & AVT-II entries against early shoot borer, (RAS, ANGRAU, Anakapalle)

Genotype	% incidence of ESB (%DH)						
	30 DAP	60DAP	90DAP	120DAP	Cumulative up to 120 DAP	No . of bored plants/ha	Reaction
Initial Varietal Trial - Early							
Co V 15356	1.44	19.09	9.36	10.33	34.76	37037	HS
Initial Varietal Trial - Midlate							
PI 15376	5.54	14.18	10.19	9.90	37.10	29321	HS
PI 15377	3.03	20.76	10.65	9.61	36.65	36111	HS
Advanced Varietal Trial - Early (Plant)-I							
Co 13023	2.38	14.14	11.81	1.87	30.13	37346	HS
Co A 14321	3.64	14.20	9.58	6.60	29.43	28395	MS
Co C 14336	0.89	16.46	12.70	4.13	29.04	31790	MS
Advanced Varietal Trial - Midlate (Plant)-I							
Co 13028	1.52	20.98	11.82	11.13	33.54	31790	HS
Co 13029	2.78	14.02	14.01	3.61	25.26	28086	MS
Co 13031	1.99	15.28	11.10	6.00	32.69	37037	HS
Co A 14323	1.64	24.04	14.25	6.75	31.89	25926	HS
Co C 14337	0.77	13.10	16.16	3.09	22.39	37963	MS
PI 14377	4.16	11.66	11.32	3.78	26.44	29321	MS
Advanced Varietal Trial- Early (Plant)-II							
Co A 13322	5.01	0.60	3.23	0	10.79	6790	LS
Co C 13336	4.56	2.42	3.97	0	10.74	6173	LS
Co C 13337	3.79	3.13	3.49	0	11.78	9259	LS
Co V 13356	2.99	0.68	2.33	0	5.43	4938	LS
Advanced Varietal Trial - Midlate (Plant)-II							

Co A 11326	6.35	24.29	13.23	10.42	46.78	47840	HS
Co A 12324	2.11	21.33	15.66	8.20	41.79	36111	HS
Co C 13339	8.10	18.23	9.96	2.91	28.67	29321	MS
Co Or 13346	4.37	19.17	9.62	2.33	27.36	31790	MS
Susceptible checks							
Co A 99082	7.15	14.32	8.13	3.95	33.78	41021	HS
Co A 92081	6.55	20.98	7.31	3.28	25.16	40292	MS
'F' test	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**Sig.**	**-**	**-**
CD (p = 0.05)	2.28	4.1	2.59	1.62	9.32	-	-
CV %	28.16	14.60	13.66	16.92	17.88	-	-

Table 2 Reaction of IVT, AVT-I and AVT-II entries against internode borer and scale insect, (RAS, ANGRAU, Anakapalle)

Genotype	Internode borer				Scale insect		
	Incidence (%)	Intensity (%)	Infestation index	Reaction	Incidence (%)	Intensity (%)	Reaction
Initial Varietal Trial - Early							
Co V 15356	45.45	4.36	1.98	HS	6.06	0.57	LS
Initial Varietal Trial - Midlate							
PI 15376	29.09	3.32	0.97	MS	17.73	2.05	MS
PI 15377	56.28	6.42	3.62	HS	32.73	4.69	HS
Advanced Varietal Trial - Early (Plant)-I							
Co 13023	50.35	3.90	1.96	HS	6.06	0.69	LS
Co A 14321	38.18	3.65	1.39	MS	3.03	0.41	LS
Co C 14336	34.85	2.85	0.99	MS	36.33	5.38	HS
Advanced Varietal Trial - Midlate (Plant)-I							
Co 13028	27.41	2.17	0.59	MS	17.41	1.43	MS
Co 13029	37.68	3.06	1.15	MS	6.36	0.29	LS
Co 13031	44.07	5.46	2.41	HS	43.33	6.79	HS
Co A 14323	45.45	3.66	1.67	HS	6.67	0.67	LS
Co C 14337	71.11	8.78	6.24	HS	43.89	6.71	HS
PI 14 377	48.48	5.13	2.49	HS	6.06	0.44	LS
Advanced Varietal Trial- Early (Plant)-II							
Co A 13322	58.39	7.65	2.99	HS	38.71	5.42	HS
Co C 13336	41.71	4.23	1.76	HS	72.48	23.91	HS
Co C 13337	43.13	7.11	3.06	HS	47.62	16.22	HS
Co V 13356	44.23	3.48	1.54	HS	37.50	7.21	HS
Advanced Varietal Trial - Midlate (Plant)-II							
Co A 11326	55.45	5.11	2.84	HS	28.59	4.38	HS
Co A 12324	29.90	3.55	1.06	MS	34.90	5.27	HS
Co C 13339	51.21	3.96	2.03	HS	12.17	0.74	MS
Co Or 13346	51.01	4.13	2.11	HS	23.48	2.14	HS
Susceptible checks							
Co A 99082	60.49	5.42	3.28	HS	47.89	8.90	HS
CO A 92081	82.13	9.44	7.75	HS	68.25	22.29	HS
'F test	**Sig.**	**Sig.**	**-**	**-**	**Sig.**	**Sig.**	-
CD (p=0.05)	23.95	2.70	-	-	8.41	2.24	-
CV %	20.24	26.57	-	-	20.69	23.01	-

Three IVT and nine AVT-I & eight AVT -II entries in comparison with two susceptible checks were field screened against major insect pests in sugarcane.
Among twenty entries, four entries *viz.*, Co V 13 356 (5.43%DH), Co C 13336 (10.74%DH), Co A 13322 (10.79%DH), Co C 13337 (11.78%DH) showed least susceptible reaction(<15%DH) and found promising against early shoot borer whereas the entries *viz.*, Co C 14337 (22.39%), Co 13029 (25.26%), PI 14377 (26.44%), Co Or 13346 (27.36%), Co C 13339 (28.67%DH), Co C 14336 (29.04%DH) and Co A 14321 (29.43% DH) showed moderate susceptible reaction towards early shoot borer (Table 3) compared to susceptible check, Co A 99082 (33.78%DH). Remaining all the test entries showed high susceptible reaction towards early shoot borer (> 30% DH) and the incidence was ranged from 30. 13% DH in Co 13023 to 46.78 % DH in Co A 11326. . The entries *viz*., Co 13028 (27.41%), Co A 12324 (29.90%), PI 15376 (29.09%) recorded moderate incidence of internode borer compared to susceptible checks, Co A 99082 (60.49%) and Co A 92081 (82.13%) and found promising against internode borer. Three entries *viz*., Co A 14321 (3.03%), Co V 15356 (6.06%), PI 14377 (6.06%), showed least susceptible reaction and found promising against scale insect compared to susceptible checks, Co A 92081 (68.25%) and Co A 99082 (47.89%)

E 28 :Survey and surveillance of sugarcane insect pests.

9. Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc.,

Roving surveys were done in sugarcane fields of Srikakulam, Vizinagaram, Viskhapatnam and East Godavari districts and observed moderate to severe incidence of early shoot borer on 30-90 days age crop of all commercially grown varieties of sugarcane *viz.*, Co A 92081, Co V 09356, Co A 08 323, CoA06321, Co 86032 *etc*., in Visakhapatnam (12 - 36%), Vizianagaram (26 - 60%), Srikakulam (4 - 28%) and East Godavari (23 - 42%) districts during March to June months. In trash mulched fields comparatively less incidence of early shoot borer was observed and the incidence was more where single node seedlings were cultivated under stress conditions (on Co 92081, Co86032 in Routhulapudi village of East Godavari district). A new species of yellow mealybug, *Kiritshenkella sacchari* (Green) along with pink mealy bug (*Saccharicoccus sacchari* Cockerell) was observed on internodes of 87 A 298 variety in B. Polavaram village of Tuni mandal. Severe incidence of viral diseases (appeared to be mosaic/streak mosaic/fleck disease) were observed on 87 A 298 during June month. Low to moderate incidence of pink mealy bug (5-30%) and yellow mealybug (5-15%) were observed in different sugarcane operational areas during April-June months..

From July- November months, moderate to severe incidence of internode borer was observed in sugarcane fields of Visakhapatnam (20-90%), Vizianagaram (20-50%), Srikakulam (30- 70%) and East Godavari (30-90%) districts. Moderate to severe incidence of whitefly (16-39 nymphs/sq.inch) was observed during August- September months (Co A 92081,Co V 09356, Co V 89101, CoA06321, Co 7805) in inundated fields in operational area of Navabharath Ventures, Samalkot, East Godavari, Thandava Cooperative Sugar factory and in operational area of SVGS Cooperative Sugar factory, Bheemasingi, Vizianagaram.

Incidence of sugarcane aphid, *Melanaphis sacchari* was observed on Co V09356 and Co A 92081 varieties (on 90 days old crop) from October month and continued upto December

month with peak incidence during November month (20-33/leaf). Most of the aphid population was observed on senescent leaves of sugarcane plants during October-December months.

Table: Survey and surveillance of insect pests in sugarcane (RAS, ANGRAU, Anakapalle)						
Insect pest	**Location**	**Incidence**			**Varieties affected**	**Any other information**
		Min	**Max**	**Ave**		
Early shoot borer (%)	Vizianagaram district Anantavaram, Gandhavaram, L. Kota, M. Singavaram, Barthavani palem in Bheemasingi Cooperative sugar factory	26.0	60.0	43.0	Co A 92081, Co V 09356, Co A 08 323, CoA06321	March-June
Yellow mite, *O. indicus* (%)		4.0	11.0	7.5	Co A 07321 (2000 A 56), Co A 08 323	May
Mealy bug (%)		10	15	12.5	Co A 92081	April-May
Whitefly (puparia/sq.inch)		23	37	30	Co A 92081	September
Internode borer (%)		20	50	35	Co A 92081, Co V 09 356, , Co A 08 323	September
Scale insect (%)		30	70	50	Co A 92081	November-December
Early shoot borer, *C. infuscatellus* (%DH)	Operational area of EID parry, Sankili, Srikakulam district	4.0	28.0	16.0	Co A 92081, CoA06321	March-May
Red mite, *O. sacchari* (%)		2.0	6.0	4.00	Co A 92081	March
Internode borer (%) *C.sacchariphagus indicus*		23	54	38.50	Co A 92081	August
Scale insect (%)		20	50	35	Co A 92081	
Early shoot borer (%)	Parupaka, M Chemavaram, Mokapalli, China sankerlapudi, Poduru villages of Routhulapudi & Eleswaram, Kirlam pudi mandals in East Godavari district	23.0	42.0	32.50	Co V 09 356, Co A 92081, Co 86032	May
Red mite (%)		6.0	13.0	9.50	Co A 92081	May
Mealybug (%)		15	30	22.5	Co 86032	May
Whitefly (nymphs& pupae/sq.inch)		26	39	32.5	Co V 09 356	September
Internode borer (%)		30	60	45.0	Co A 92081, Co V 09 356, Co86032	September
Scale insect (%)		20	55	32.5	Co V 09 356, Co A 92081, Co 86032	November-December

Early shoot borer (%)	Sugarcane fields in Munagapaka mandal and Chodavaram mandal in Visakhapatnam district	22.0	33.0	27.50	Co A 92081, Co A 62175, Co 7805 Co V 89101, CoA06321	March-June
Red mite (%)		5.0	11.0	8.00		May
Mealybug (%)		15	26	20.5		April-May
Sugarcane aphid (N & A/leaf)		13	24	18.5/leaf		October
Internode borer (%)		20	90	55.0		August- November
Scale insect (%)		30	80	55.0		November-December
Early shoot borer (%)	Thandava Cooperative Sugar factory, Payaka rao peta & Narsipatanm mandal in Visakhapatnam	12	36	24.0	Co A 92081, CoA06321	March-June
Yellow mealy bug, *Kiritshenkella sacchari* (Green) (%)		5	15	10.0		June
Pink mealy bug (%) *Saccharicoccus sacchari*		5	20	12.5 %		June
Sugarcane aphid (N& A/leaf)		20	33	26.5		November
Internode borer (%)		15	23	14		August- November
Scale insect (%)						November-December in ratoon crop
Early shoot borer (%)	Makavarapalem, Rolugunta, Syamavaram, Vandapalli, Kotavartala, Pulaprathi, Jalluru of Etikoppaka cooperative sugar factory, Visakhapatnam dt	15	33	24	Co A 92081, Co V 09 356, CoA06321, Co A 62175	March-May.
Internode borer (%)		30	80	55		Moderate to severe incidence was observed from July to November months
Whitefly(puparia/2.5cm^2)		16	24	20		September month in ratoon crop
Scale insect (%)		26	60	43		Observed moderate to severe incidence during Jan-February in ratoon crop

E 30 : Monitoring of insect pests and bio-agents in agro ecosystem

Table 5 Monitoring of sucking pests and bio-agents in a fixed plot during 2017-18

Period of observation	Crop	Aphids (no./leaf)	Syrphids (no./leaf)	Spittle bug (% incidence)	*Pyrilla perpusilla*	*Epiricania melanoleuca (% parasitisation)*	Derbid, *Proutista moesta*	Scale insect (%)
July, 2017	Plant	4-10/leaf	3-4/leaf	15	-	-	-	
	Ratoon	3-13/leaf	3-5/leaf	18	-	-	-	
August, 17	Plant	3-10/leaf	-	-	-	-	-	
	Ratoon	3-6/leaf	-	-	-	-	-	
September, 17	Plant	2-8/leaf	-	-	1/leaf	-	1-2/leaf	
	Ratoon	1-3/leaf	-	-	1/leaf	-	1-3/leaf	
October, 17	Plant	4-8/leaf	-	-	1/leaf	-	1-2/leaf	
	Ratoon	2-6/leaf	-	-	1/leaf	0.5	1-2/leaf	
November, 17	Plant	11-23/leaf	2-3/leaf	-	1/leaf	1	1/leaf	-
	Ratoon	4-8/leaf	1-2/leaf	-	1-2/leaf	2.0	1/leaf	10.00
December, 17	Plant	16-21/leaf	1-3/leaf	-	-	-	-	10.00
	Ratoon	6-8/leaf	3-4/leaf	-	-	-	-	20.79
January, 18	Plant	5-9/leaf	-	-	-	-	-	20.00
	Ratoon	-	-	-	-	-	-	-
February, 18	Plant	2-3/leaf	-	-	-	-	-	57.86
	Ratoon	-		-	-	-	-	-

Fig. 3 Incidence of scale insect (%) in plant & Ratoon crop

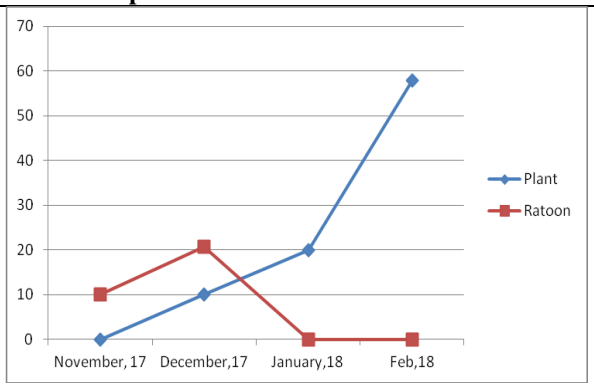
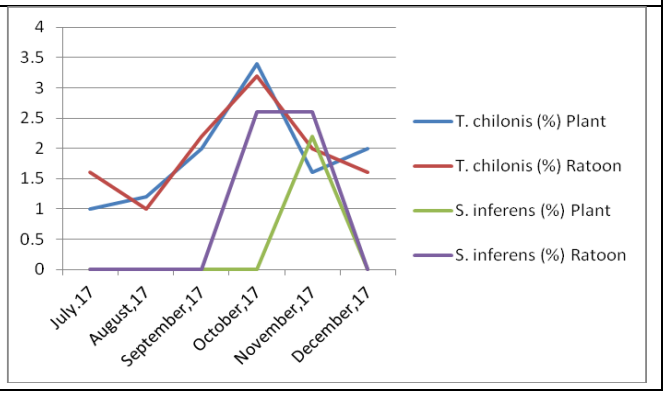


Fig.4 Parasitisation of *T. chilonis, S. inferens*



Project E 30: Standardisation **of simple, cost effective techniques for mass multiplication of sugarcane bioagents (*Fulgoraecia (Epiricania) melanoleuca***

9. Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc., :

Standardisation of Rearing of host insect, *Pyrilla perpusilla* in laboratory :

The *Pyrilla* adults were collected from the field and reared under laboratory at temperature, ranged from 25˚ to 26˚C. The glass jar, having 15 cm diameter and 20 cm height, was used for rearing. The bottom of the jar was filled with 4 to 5 cm thick layer of sterilized moist sand. About 10 cm long leaf cuts, 6 to 7 per jar were vertically thrust in the sand layer of glass jar. In each jar, 4-5 pairs of male and female *Pyrilla*, collected from the field, were released for egg laying purpose. The top of the jar is covered with muslin cloth by using rubber band. On hatching of the eggs, the nymphs were transferred daily with the help of a fine hair brush to same type of glass jar, prepared for rearing adults (Plate 1). After allowing 4-5 days feeding without disturbance in the same jar, the nymphs were transferred to another jar, wherein they were further rear for 4-5 days and transfer to next jar. The same process continued till adult emergence.

Biology of *Pyrilla perpusilla*:

The eggs were laid in clusters of 20 to 40 eggs on the undersurface of the leaves. The clusters were covered with whitish fine hairs produced from the anal pads of the female. The colour of the eggs was light blue and the shape cylindrical. They hatched in 7 to 10 days. The newly hatched nymph was milky white in colour and bears two characteristic anal filaments. The nymph jumps about from leaf to leaf and passes through five stages of development in a period of 14 to 18 days before attaining the adult stage. Females lived longer than males. The adults lived for 25-30 days. The total life-cycle was completed within 45 to 61 days during October –November months(Table 7).

Table 7 Life cycle of *Pyrilla perpusilla* under laboratory

S.no	Stage	Duration during October–November months
1	No. of eggs/mass	20- 40
2	Egg	7-13
3	Nymph	14- 18
4	Adult	25- 30
	Total life cycle	**45- 61 days**

Expt No.6 : Project E 38
1.Title : Formulation and validation of IPM module.

At 210 day	INB	➢ Removal of water shoots of the crop.
At 240 day	INB	➢ Removal of water shoots of the crop.
June-July	*Pyrilla*, whitefly, scale insect, mealy bug	➢ Installation of 'Biological-cum-Mechanical' traps @ 20/ha during first fortnight of June for management of whitefly. ➢ Spray clothionidin 50 WDG @ 250 g/ha after detrash lower leaves.
*** Need based application of insecticides, if insect pest cross the ETL.**		

Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc.,

Data on per cent germination at 35 DAP, incidence of early shoot borer at 30, 60, 90 and 120 DAP; tiller population at 120 DAP, number of millable canes, incidence of internode borer and scale insect, growth parameters (total cane height, millable cane height, number of internodes, girth of the cane), cane yield and quality parameters were recorded at harvest and the data revealed that less cumulative incidence of early shoot borer was recorded in IPM module (22.89 %DH) compared to zonal recommendation (27.87%DH) and in untreated control, it was 49.17%DH (Table 7, Fig.5). Highest number of tillers were recorded in IPM module at 120 days after planting (84352/ha) compared zonal recommendation (76435/ha) and untreated control (66509/ha) (Table 8).

Less incidence and intensity of internode borer was recorded in IPM Module (23.91% &1.86%) compared to zonal recommendation (49.50%& 3.5%) whereas in untreated control it was 65% & 4.78% (Table 9 & Fig 6). Incidence and intensity of scale insect was very less in zonal recommendation (1%; 0.04%) compared to IPM module (28.8 & 2.59%) whereas in untreated control it was 56.02 % and16.52% (Table 9 & Fig.6). Highest NMC/ha and cane yield were recorded in IPM module (64,353/ha; 70.79 t/ha) compared to zonal recommendation (63435 NMC/ha and 69.78 t/ha) whereas in untreated control, less NMC /ha and cane yield were recorded (53509/ha; 58.86 t/ha) (Table 10 , Fig.7). Growth and quality parameters *viz*., millable cane height , Cane girth and percent juice sucrose were also comparatively more in IPM module (2.98 m/cane, 2.47cm/cane & 22.37%) than zonal recommendation (2.75 m/cane, 2.35 cm/cane & 21.56%) whereas in untreated control, it was very less (2.07 m/cane, 1.97cm/cane & 21.35%).

Table 8 : Per cent germination and per cent incidence of early shoot borer in different treatments

Treatment	Per cent germination at 35 DAP	Per cent incidence of early shoot borer (%DH)					Stalk population at 120 DAP/ha
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative upto 120 DAP (%DH)	
T1- IPM Module	86.52	4.02	7.91	7.68	0	22.89	84352
T2- Zonal recommendation	84.81	10.90	6.72	8.10	1.26	27.87	76435
Untreated control	78.20	39.14	19.05	20.05	4.03	49.17	66509

Fig. 5 Incidence of early shoot borer in IPM module

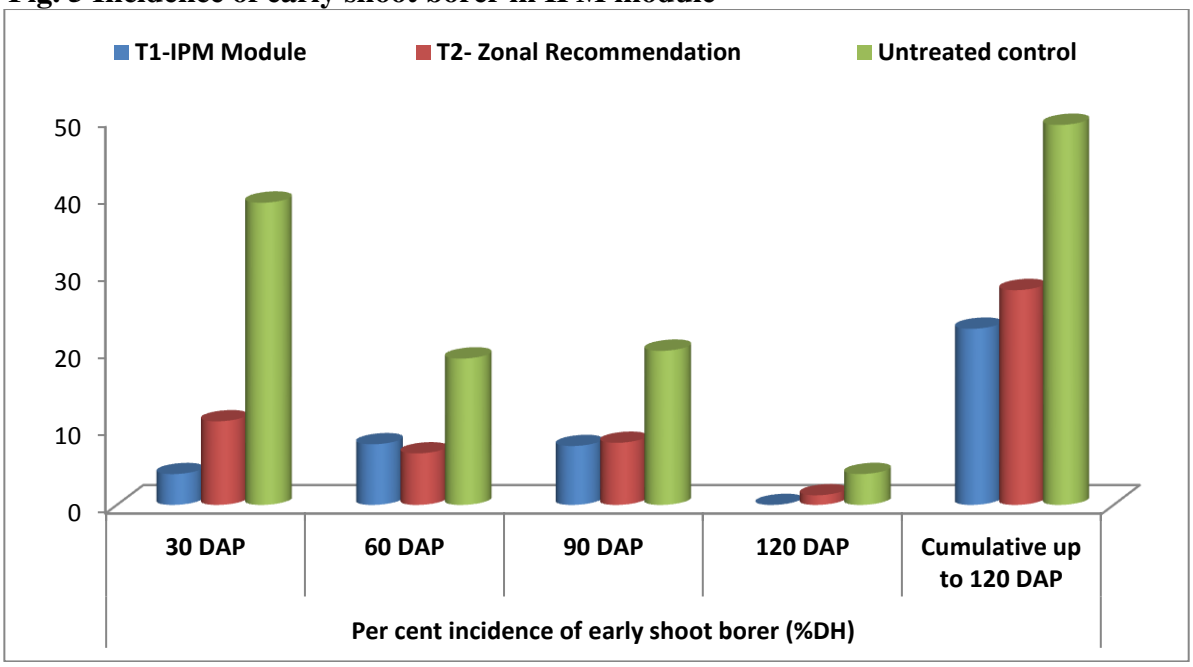


Table 9 Incidence & intensity of internode borer and scale insect in IPM module						
Treatment	**Internode borer (%)**		**Infestation index**	**Scale insect (%)**		**Infestation index**
	Incidence	**Intensity**		**Incidence**	**Intensity**	
T1- IPM Module	23.91	1.86	0.44	28.8	2.59	0.75
T2-Zonal recommendation	49.50	3.5	1.73	1.00	0.04	0.01
Untreated control	65.00	4.78	3.11	56.02	16.52	9.25

Fig. 6 Incidence and intensity of internode borer, scale insect in IPM module

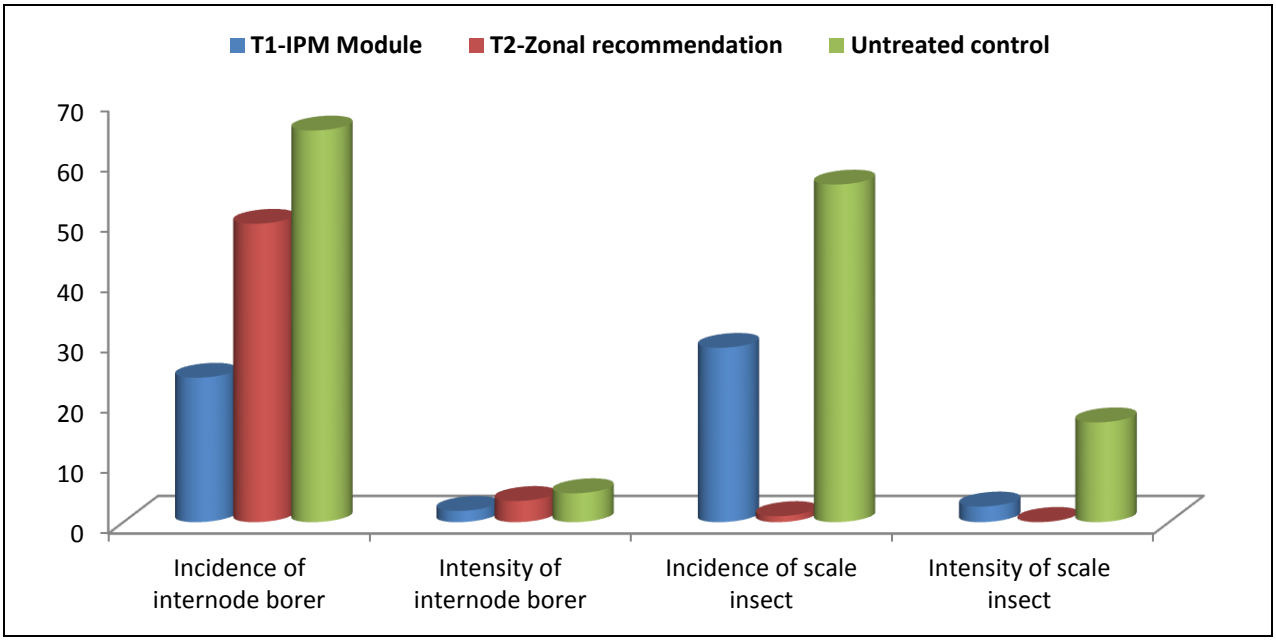
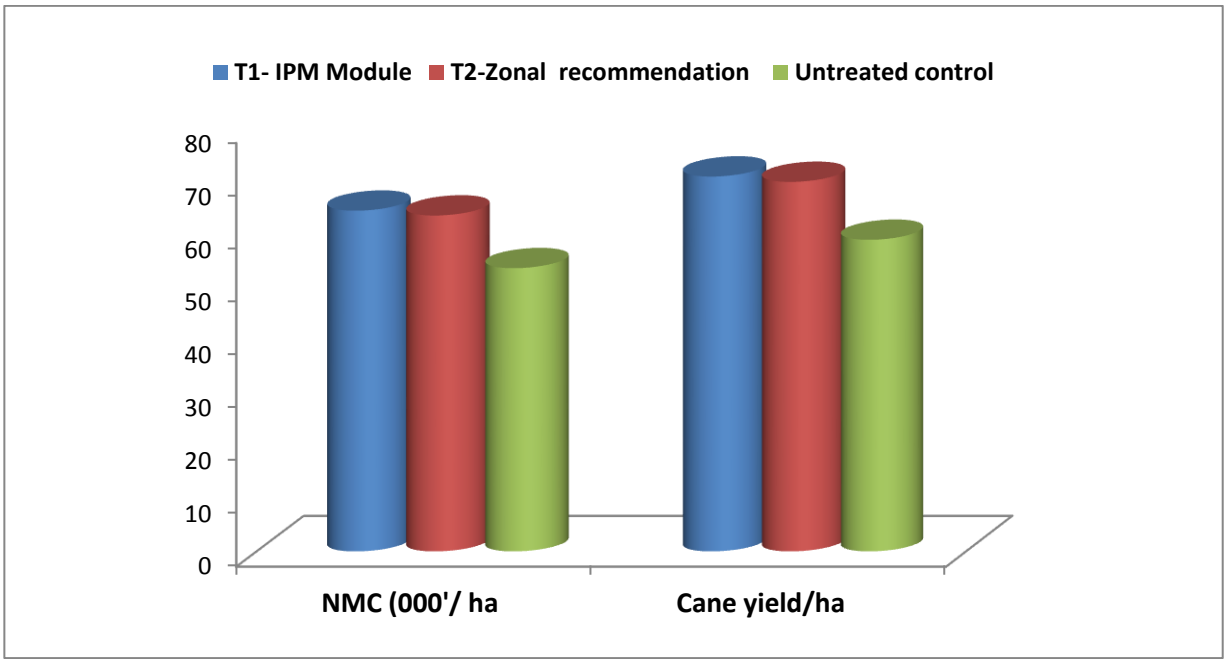


Table 10 Impact of IPM on growth parameters, juice sucrose, NMC and cane yield

Treatment	Total cane height (m)	Millable cane height (m)	Number of internodes	Girth of the cane (cm)	% Juice sucrose	NMC/ ha	Cane yield/ha
T1- IPM Module	3.10	2.98	24	2.47	22.37	64352	70.79
T2-Zonal recommendation	2.92	2.75	23	2.35	21.56	63435	69.78
Untreated control	2.23	2.07	18	1.97	21.35	53509	58.86

Fig.7 Impact of IPM on NMC (000'/ha) and Cane yield (t/ha)



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