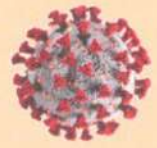




एक कदम स्वच्छता की ओर



## ALL INDIA COORDINATED RESEARCH PROJECT ON SUGARCANE

# TECHNICAL REPORT 2019-2020 ENTOMOLOGY

*Compiled by*

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



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

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## PROJECT WISE TECHNICAL PROGRAMME

### Project E. 4.1

<b>Title of Project</b>	:	<b>Evaluation of zonal varieties/ genotypes for the reaction against major insect pests.</b>
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	:	Karnal (SBI), Shahjahanpur and Lucknow.
North Central Zone and Eastern Zone.	:	Seorahi
Peninsular Zone	:	Akola, Padegaon, Pune, Mandya, Coimbatore
East Coast Zone	:	Anakapalle
No. of replication	:	03 ( Three)
Plot size	:	A minimum of 3 (three), six metre row /variety per replication.

### Project E. 28

<b>Title of Project</b>	:	<b>Survey and surveillance of sugarcane insect pests.</b>
Objective	:	To identify key insect of sugarcane in the area
Year of start	:	2003-04.
Duration	:	Long term
Location	:	All centres where entomologist are available

### Project E. 30

<b>Title of Project</b>	:	<b>Monitoring of insect pests and bio-agents in sugarcane agro-ecosystem.</b>
Objective	:	To monitor the key insect pests and natural enemies in the area.
Year of start	:	2006-07.
Duration	:	Long term
Location	:	Karnal, (SBI),Shahajhanpur Lucknow, Seorahi, Akola, Padegaon, Pune, Mandya, Kolhapur, Coimbatore, and Anakapalle
Plot size	:	Planting of sugarcane variety recommended for the region in 0.2 ha area.

### Project E. 34

<b>Title of Project</b>	:	<b>Standardization of simple and cost effective techniques for mass multiplication of sugarcane bio-agent.</b>
Objective	:	To develop simple and cost effective mass multiplication techniques of promising bio-agents of the area.
Year of start	:	2012-2013.
Modified year	:	2018-2019 [In 31 <sup>st</sup> Biennial Workshop of AICRP on Sugarcane held at VSI, Pune (MS) on November 16-17,2016.
Duration	:	Three years
Location	:	Location and bio-agents to be multiplied.
Ankapalle	:	<b>Beauveria Bassiana</b>
Lucknow	:	<b>Metarhizium anisopliae, Beauveria bassiana, Chrysoperla carnae and E. melanoleuca.</b>
Padegown	:	<b>Chrysoperla zastrowl sillemi</b>
Coimbatore	:	<b>Cotesia flazvipes</b>
Pune	:	<b>Trichogramma sp.</b>

### Project E .38

<b>Title of Project</b>	:	<b>Formulation and validation of IPM Module of sugarcane insect pests.</b>
Objective	:	To evaluate IPM Module in current.
Year of start	:	2017-2018
Duration	:	
Location	:	Under here
North central zone and Eastern zone		Seorahi
Peninsular Zone	:	Padegaon, Pune, Mandya
East Coast Zone	:	Anakapalle,
No. of replication	:	-
Plot size	:	A minimum of 3 (three) ,six metre row/ variety per replication

### Project E.40

<b>Title of Project</b>	:	Integrated approach to manage white grubs in sugarcane
Objective	:	To develop Integrated Management of white grubs in Maharashtra state.
Year of start	:	2019-2020.
Duration	:	Three years
Location	:	Padegaon, Pune, Akola
Treatments		T <sub>1</sub> . Spraying of trees nearby sugarcane fields with contact insecticides at first shower of the season to kill the beetles
		T <sub>2</sub> Installation of IISR Combo light trap on trees or stands at the distance of 500 meter for collecting the beetles.
		T <sub>3</sub> . Soil application of Lecenta @ 400 g WG/ha
		T <sub>4</sub> . Soil application of chlorpyrifos 5 G @ 50 Kg/ha at planting
		T <sub>5</sub> . Farmers standard practice in the area

#### Observations to be recorded

- Outbreak of the pest
- Shower time
- Observations on pests population and infestation by destructive sampling (digging of 5 clumps/sample) and number of samples as maximum as possible
- Cane damage by measuring plant height, cane girth, cane weight and leaf colour and size.
- Recording and removal of trap catch on daily basis
- Cane yield at harvest

**NOTE:** T1 and T2 should be taken four traps covering 2000 meter periphery of a square sugarcane field (five hectare) and rest of the treatments may be taken at least in one hectare sugarcane field with the help of progressive farmers of the area.

### Project E. 41.

<b>Title of Project</b>	:	Assessment of yield losses caused by borer pests of sugarcane under changing climate scenario
Objective	:	To develop simple and cost effective mass multiplication techniques of promising bio-agents of the area.
Year of start	:	2019-20
Duration	:	Three years
Location	:	All Centres

## Technical Programme

Loss estimation can be assessed by two methods for more precision

### A. Chemical Protection of the Crop

Parameters	Treated with recommended effective chemical insecticide	Untreated open for natural normal infestation of borers
Area	0.1 ha	0.1 ha
Infestation Borer wise	All most Nil	Value recorded
Yield	t/ha	t/ha

The correlation between the crop yield and degree of infestation is to be worked out to estimate the loss in yield.

### Observations to be recorded

- Recording of incidence and pest population of borer pests generation wise
- Intensity of insect damage by splinting the cane (counting of damage internodes)
- Weight of infested and healthy cane for comparison (sample size as per availability of infested and healthy cane).
- Analysis of cane juice quality of infested cane with different intensity separately and healthy canes

### B. Comparison of Average Yield of Individual Plants Free from Pest Incidence with that of Infested Ones

- In this, individual plants from the same field is examined or the pest incidence and their yield are determined individually.
- The loss in yield is estimated by comparing the average yield of healthy plants with that of plots showing different degrees of infestation.
- The same data can also be used for working out a correlation equation between yield and infestation on the basis of individual plants. This technique may be used with some modifications in this study. Correlation between damage by borer and Yield of sugarcane in the following way:

$$Y=6.6204 X_1-0.9257 X_2-27.17$$

In this case, Y is the yield of sugarcane,  $X_2$  is the percentage of stalk length infested (intensity of damage) and  $X_1$  is the number of cane/ plot.

**Project No. E. 4.1. Evaluation of Zonal varieties/genotypes for their reaction against major insect pests of sugarcane.**

**North West Zone**

**ICAR-SBI-RC, Karnal**

**AVT Ratoon**

A total of eleven genotypes along with two check varieties were evaluated against major insect pests of sugarcane. Early shoot borer and top borer incidence ranged from 0.0 to 3.8 and 0.0 to 3.9 per cent, respectively. Black bug population varied from 1.2 to 2.3 bugs/plant. All the Co 14035, Co 14261, CoS 14233, CoLk 14203, CoLk 14201, CoPb 14181, CoPb 14184, Co 14034, CoPb 14185, CoLk 14204 and CoPb 14211 showed Tolerant reaction to black bug. and top borer (<10.0%).

**Table-1. Reaction of sugarcane genotypes against major insect pests in ratoon.**

Sl. No.	Variety/Genotypes	Popn./ 20 leaves	% Incidence			Stalk borer		
			Black Bug	ESB	Top borer	Root borer	Incidence (%)	Intensity (%)
1	Co 14035	1.6	1.7	1.0	12.3	8.4	8.4	0.7
2	Co 14261	1.7	1.1	1.1	10.9	4.8	7.1	0.3
3	CoS 14233	2.3	0.9	1.3	14.4	12.0	9.5	1.0
4	CoLk 14203	1.9	1.1	2.8	22.0	9.8	9.0	0.8
5	CoLk 14201	1.6	3.1	2.6	14.4	7.5	8.3	0.5
6	Co 0238	1.1	3.8	3.9	19.8	8.4	8.3	0.8
7	CoPb 14181	1.6	1.3	2.5	24.6	9.7	8.3	0.7
8	CoPb 14184	2.3	0.0	3.2	17.4	7.4	10.2	0.8
9	Co 14034	1.4	2.4	1.1	20.2	4.8	9.8	0.4
10	Co 05011	1.7	0.8	3.5	12.9	6.2	10.4	0.7
11	CoPb 14185	1.7	0.0	0.0	19.7	4.6	8.1	0.4
12	CoLk 14204	1.2	1.7	0.0	20.0	16.6	8.0	1.2
13	CoPb 14211	1.2	0.0	3.6	19.0	7.5	9.4	0.7

Root borer incidence ranged from 10.9 to 24.6per cent. Four genotypes; Co 14035, Co 14261, CoS 14233 and CoLk 14201 were tolerant (<15%); Seven genotypes; CoLk 14203, CoPb 14181, CoPb 14184, Co 14034, CoPb 14185, CoLk 14204 and CoPb 14211 were moderately tolerant (15.1 to 30.0 %) to root borer. Against stalk borer all genotypes;gave tolerant raction.

**AVT (I plant):** A total of thirteen genotypes along with two check varieties were evaluated against insect pests and found that all genotypes (Co 15023, Co 15024, Co 15027, CoLk 15201, CoLk 15205, CoPb 15212, Co 15026, CoLk 15206, CoLk 15207, CoLk 15209, CoPb 15213, CoS 15232 , CoS 15233) were tolerant to early shoot and top borer. In case of root borer, Co 15023, Co 15024, Co 15027,CoLk 15205,Co 15026 and CoS 12232 were moderately tolerant and CoLk 15201, CoPb 15212, CoLk 15206, CoLk 15207, CoLk 15209, CoPb 15213 and CoS 15233 showed susceptible reaction (Table 2).

**Table-2. Reaction of sugarcane genotypes against major insect pests in AVT I Plant**

Sl. No.	Variety/Genotypes	Incidence (%)			Stalk borer		
		Early shoot borer	Top borer	Root borer	Incidence (%)	Intensity (%)	Infestation Index
1	Co 15023	0.8	1.4	25.6	15.7	7.5	1.2
2	Co 15024	3.6	0.7	27.2	18.8	10.7	2.0
3	Co 15027	0.9	2.5	27.0	23.6	9.1	2.2



4	CoLk 15201	2.1	0.2	34.9	22.4	8.0	2.0
5	CoLk 15205	1.3	0.3	29.6	17.2	8.0	1.5
6	CoPb 15212	1.0	2.7	44.1	7.4	8.6	0.7
7	Co 0238	1.9	0.5	37.2	16.0	6.3	1.0
8	Co 15026	1.1	1.1	26.1	15.0	8.3	1.2
9	CoLk 15206	1.4	0.8	37.9	22.8	11.1	2.7
10	CoLk 15207	1.0	0.4	37.9	9.4	8.5	0.9
11	CoLk 15209	1.5	0.4	31.8	24.5	10.0	2.1
12	Co 05011	1.3	0.6	46.8	13.1	7.8	1.1
13	CoPb 15213	1.8	0.2	52.4	19.4	9.3	1.8
14	CoS 15232	0.9	0.7	27.2	10.9	6.7	0.7
15	CoS 15233	1.1	0.6	30.6	22.0	8.4	2.0

In case of stalk borer 10 genotype; Co 15023, Co 15024, CoLk 15201, CoLk 15205, CoPb 15212, Co 15026, CoLk 15207, CoPb 15213, CoS 15232 and CoS 15233 were tolerant and three genotypes; Co 15027, CoLk 15206 and CoLk 15209 were showed moderately tolerant reaction.

**AVT (II Plant):** A total of eleven genotypes and two standards were evaluated against insect pests and found that all the 11 genotypes; Co 14035, Co 14261, CoS 14233, CoLk 14203, CoLk 14201, CoPb 14181, CoPb 14184, Co 14034, CoPb 14185, CoLk 14204 and CoPb 14211 were showed tolerant reaction to early shoot borer and top borer. Eight genotypes; CoLk14204, CoLk14203, Co14035, Co14261, CoS14233, CoLk14201, CoPb14181 and Co 14034 exhibited moderately tolerant reaction (15.1-30%) to root borer and three genotypes, CoPb14185, CoPb 14184 and CoPb 14211 were susceptible (Table-3).

**Table-3. Reaction of sugarcane genotypes against major insect pests in AVT II Plant**

Sl. No.	Variety/Genotypes	Incidence (%)			Stalk borer		
		Early shoot borer	Top borer	Root borer	%Incidence	Intensity (%)	Infestation Index
1	CoLk 14204	1.1	1.4	21.1	16.5	8.7	1.5
2	CoLk 14203	1.2	0.3	26.3	18.2	10.1	1.9
3	Co 14035	1.5	1.9	25.4	18.6	8.5	1.6
4	Co 14261	0.9	0.7	18.0	13.7	8.9	1.2
5	CoS 14233	1.4	0.2	19.9	10.3	9.1	1.0
6	Co 0238	1.3	1.1	25.1	22.4	9.5	2.1
7	CoLk 14201	0.8	0.5	29.2	15.8	9.2	1.6
8	CoPb 14181	1.4	0.2	19.6	20.2	7.8	1.7
9	Co 05011	0.3	0.9	23.0	17.2	9.5	1.6
10	Co 14034	1.1	1.5	28.4	13.8	8.9	1.2
11	CoPb 14185	0.4	0.6	50.6	14.5	14.5	2.2
12	CoPb 14184	0.3	1.2	44.5	23.8	11.5	2.7
13	CoPb 14211	2.1	0.3	30.6	19.1	9.9	2.0

In case of stalk borer, 8 genotypes; CoLk 14204, CoLk 14203, Co 14035, Co 14261, CoS 14233, CoLk 14201, CoPb 14181 and Co 14034 were toilerant and three genotypes; CoPb 14185, CoPb 14184 and CoPb 14211 showed moderately susceptible reaction (infestation index 2.1 to 5.0).

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#### In AVT Early (I Plant):

In early maturing group, 6 + 3 sugarcane genotypes, Co 15023, CO 15024, Co 15027, CoLk 15201, CoLk 15205, CoPb 15212 and three standards, CoJ 64, Co 0238, Co 05009 were evaluated against insect pests and found that all genotypes were tolerant to early shoot borer. Sugarcane genotypes Co 15023, CoPb 15212 and standard check CoJ 64, CO 0238 showed moderately tolerant reaction to top

borer while rest four sugarcane genotypes and one standard check Co 05009 showed susceptible reaction to top borer. All the six genotypes along with three standards check showed tolerant reaction to stalk borer (Table 1a, b).

**In AVT Early (II Plant):**

There were, 4 + 3 sugarcane genotypes (CoPb 14181, CoPb 14211, Co 14034, CoLk 14201 and three standard check viz; CoJ 64, Co 0238 and Co 05009) evaluated and found that all genotypes and standard checks tolerant reaction to early shoot borer. Four genotypes along with three standards showed tolerant reaction to top borer and stalk borer. ( Table 1 c, d).

**In AVT Mid late (I Plant):**

A total of 10 (7+ 3) sugarcane genotypes (CoS 15232, CoS 15233, Co 15026, CoLk 15206, Co 15207, CoLk 15209, CoPb 15213; CoS 767, CoPant 97222, Co 05011) were evaluated against major insect pests and found that all genotypes along with standards showed tolerant reaction to early shoot borer. At harvest, CoPb 15213 showed susceptible, CoS 767 and CoPant 97222 standards checks were moderately tolerant and rest of the genotypes along with one standard check showed less susceptible reaction to top borer. All the seven genotypes along with three standards showed tolerant reaction to stalk borer.

**In AVT Mid late (II Plant):**

Ten sugarcane genotypes, (7+ 3) (CoS 14233, Co 14035, CoLk 14203, Co 14204, CoPb 14184, CoPb 14185, CoH 14261 + CoS 767, CoPant 97222, Co 05011) were evaluated and found that all genotypes including standards showed tolerant reaction to early shoot borer. At harvest, CoPb 14184 and CoPant 97222 showed Moderately tolerant, while rest six sugarcane genotypes and two standards showed tolerant to top borer. All genotypes including standards showed tolerant reaction to stalk borer (Table 1 g, h).

**In AVT early (Ratoon):**

In AVT early (Ratoon), 4+ 3 sugarcane genotypes (CoPb 14181, CoPb 14211, Co 14034, CoLk 14201 + CoJ 64, Co 0238, Co 05009) were evaluated against major insect pest and found that all four genotypes along + standards were tolerant to early shoot borer. At harvest except Co 0238, all genotypes showed moderate tolerant reaction to top borer. All genotypes including standards showed tolerant reaction to stalk borer (Table 1 i, j).

**In AVT Mid late (Ratoon):**

In AVT Mid late (Ratoon), 7+ 3 sugarcane genotypes (CoS 14233, Co 14035, CoLk 14203, CoLk 14204, CoPb 14184, CoPb 14185, CoH 14261 + CoS 767, CoPant 97222, Co 05011) were evaluated for their reaction against insect pests and found that all genotypes including standards showed tolerant reaction to early shoot borer. At harvest, CoLk 14204 and CoPb 14184 were moderately tolerant to top borer and rest of the genotypes including standards tolerant to top borer. All genotypes and standards were tolerant to stalk borer (Table 1 k, l).

**Table 1 a. Evaluation of zonal varieties /genotypes for their reaction against major insect-pests of sugarcane, (UPCSR, Shahjahanpur) in AVT (Early) I Plant.**

Sl. No	Varieties/ Genotypes	Early shoot borer (% incidence)					Cumulative incidence	Infestation grade	No. of bored plants/ ha.
		30 DAP	60 DAP	90 DAP	120 DAP				
1	Co 15023	7.15	5.11	4.26	1.74	8.39	T	5350	
2	Co 15024	3.63	3.84	3.51	1.67	7.94	T	5144	
3	Co 15027	3.63	2.82	4.24	1.58	7.49	T	4115	
4	CoLk 15201	3.28	2.42	3.28	1.45	6.60	T	3909	
5	CoLk 15205	4.57	5.21	4.07	1.68	8.40	T	4527	
6	CoPb 15212	3.47	1.90	2.75	1.10	5.26	T	3086	

Ck	CoJ 64	3.08	2.07	3.83	2.01	7.09	T	3909
	Co 0238	4.29	2.94	2.99	1.19	6.81	T	3909
	Co 05009	4.43	1.80	2.09	1.42	5.15	T	3086
	SE	1.19	1.44	0.88	0.57			
	CD	NS	NS	NS	NS			

**Table 1 b. Evaluation of zonal varieties /genotypes for their reaction against major insect-pests of sugarcane, (UPCSR, Shahjahanpur) in AVT (Early) I Plant**

Sl. No.	Varieties /Genotypes	Percent incidence of Top borer				Stalk borer			
		3rd brood	4th brood	At harvest	Infestation on grade	% incidence	% intensity	Infestation index	Infestation on grade
1	Co 15023	9.91	3.55	13.33	MT	36.00	2.57	0.94	T
2	Co 15024	10.64	3.21	6.67	T	34.67	2.68	0.97	T
3	Co 15027	3.98	2.47	8.00	T	30.67	1.96	0.62	T
4	CoLk15201	1.73	1.46	5.33	T	21.33	1.60	0.35	T
5	CoLk15205	3.06	1.57	9.33	T	4.00	0.23	0.01	T
6	CoPb15212	3.33	1.57	10.67	MT	12.00	0.99	0.13	T
Ck	CoJ 64	5.93	2.47	10.67	MT	10.67	0.66	0.07	T
	Co 0238	7.57	4.20	12.00	MT	30.67	2.24	0.70	T
	Co 05009	2.80	1.42	9.33	T	26.67	1.91	0.53	T
	SE	1.01	0.69	2.71	-	-	-	-	-
	CD	2.14	1.47	NS	-	-	-	-	-

**Table 1 c. Evaluation of zonal varieties /genotypes for their reaction against major insect- pests of sugarcane, (UPCSR, Shahjahanpur) in AVT (Early) II plant**

Sl. No	Varieties/ Genotypes	Early shoot borer (% incidence)						infestation grade	No. of bored plants / ha.
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative incidence			
1	CoPb 14181	4.47	3.84	3.44	1.27	7.51	T	3909	
2	CoPb 14211	3.50	3.26	3.34	1.63	5.03	T	3704	
3	Co 14034	4.13	3.07	2.58	1.08	6.16	T	3703	
4	CoLk 14201	3.22	3.85	3.51	1.20	7.72	T	4321	
Ck	CoJ 64	5.22	4.25	4.35	1.71	9.49	T	4938	
	Co 0238	4.64	4.71	4.83	1.94	10.00	T	5761	
	Co 05009	2.39	1.82	2.18	1.06	4.76	T	2881	
	SE	1.81	2.40	0.77	0.39	-	-	-	
	CD	NS	NS	NS	NS	-	-	-	

**Table 1 d. Evaluation of zonal varieties /genotypes for their reaction against major insect- pests of sugarcane, (UPCSR, Shahjahanpur) in AVT (Early) II plant.**

Sl. No.	Varieties /Genotypes	Percent incidence of Top borer				Stalk borer			
		3rd brood	4th brood	At harvest	Infestation grade	% incidence	% intensity	Infestation index	Infestation grade
1	CoPb 14181	2.18	1.35	5.33	T	30.67	1.63	0.51	T
2	CoPb 14211	5.79	2.47	6.67	T	29.33	1.72	0.51	T
3	Co 14034	1.93	1.13	6.67	T	45.33	2.45	1.19	T

4	CoLk 14201	5.84	2.53	4.00	T	34.67	2.03	0.73	T
Ck	CoJ 64	2.34	1.56	6.67	T	22.67	1.17	0.27	T
	Co 0238	3.59	1.94	9.33	T	41.33	2.53	1.07	T
	Co 05009	16.29	4.93	6.67		24.00	1.61	0.39	T
	SE	2.71	0.79	2.12	-	5.70	0.32	0.24	-
	CD	5.9	1.73	NS	-	12.42	0.71	0.52	-

**Table 1e. Evaluation of zonal varieties /genotypes for their reaction against major insect- pests of sugarcane, (UPCSR, Shahjahanpur) in AVT (Mid late) I plant**

Sl. No	Varieties/ Genotypes	Early shoot borer (% incidence )					Cumulative incidence	infestation grade	No. of bored plants/ha
		30 DAP	60 DAP	90 DAP	120 DAP				
1	CoS 15232	3.21	3.05	2.77	1.13	5.78	T	3292	
2	CoS 15233	3.11	4.37	5.12	1.75	9.35	T	5967	
3	Co 15026	5.73	4.29	3.81	1.53	8.24	T	4732	
4	CoLk 15206	5.27	6.67	5.64	2.07	11.85	T	6584	
5	CoLk 15207	2.88	3.29	2.67	1.88	6.76	T	3909	
6	CoLk 15209	3.03	1.80	2.66	1.11	5.32	T	3086	
7	CoPb 15213	4.82	6.74	5.50	2.00	10.70	T	5967	
Ck	CoS 767	2.76	2.41	3.08	1.61	6.74	T	3704	
	CoPant 97222	2.14	1.47	2.04	1.08	4.86	T	2881	
	Co 05011	2.98	3.8	3.81	1.56	7.35	T	4115	
	SE	1.50	2.05	0.98	0.35	-	-	-	
	CD	NS	NS	2.05	NS	-	-	-	

**Table 1 f. Evaluation of zonal varieties /genotypes for their reaction against major insect- pests of sugarcane, (UPCSR, Shahjahanpur) in AVT (Mid late) I plant**

Sl. No	Varieties /Genotypes	Percent incidence of Top borer				Stalk borer			
		3rd brood	4th brood	At harvest	Infestation grade	% incidence	% intensity	Infestation index	Infestation grade
1	CoS 15232	1.82	1.19	9.33	T	14.67	0.92	0.14	T
2	CoS 15233	5.59	3.12	5.33	T	21.33	1.62	0.37	T
3	Co 15026	1.87	2.46	5.33	T	36.00	3.31	1.29	T
4	CoLk 15206	1.86	1.15	6.67	T	18.67	1.03	0.20	T
5	CoLk 15207	3.44	2.42	6.67	T	12.00	0.62	0.10	T
6	CoLk 15209	12.79	5.73	16.00	T	25.33	1.96	1.53	T
7	CoPb15213	1.15	1.06	21.33	S	25.33	2.61	0.73	T
Ck	CoS 767	1.75	1.62	10.67	MT	13.33	0.80	0.11	T
	CoPant97222	6.37	3.65	10.67	MT	21.33	1.31	0.28	T
	Co 05011	1.40	1.23	8.00	T	26.67	2.07	0.60	T
	SE	1.43	0.70	2.00	-	5.29	0.64	0.30	-
	CD	3.00	1.48	4.20	-	11.12	1.35	0.63	-

**Table 1 g. Evaluation of zonal varieties /genotypes for their reaction against major insect- pests of sugarcane, (UPCSR, Shahjahanpur) in AVT (Mid late) II plant**

Sl. No	Varieties/ Genotypes	Early shoot borer (% incidence )					infestation grade	No. of bored plants/ ha
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative incidence		
1	CoS 14233	4.22	2.76	5.09	2.19	9.46	T	5761
2	Co 14035	3.95	4.49	2.37	2.02	9.05	T	3909
3	CoLk 14203	4.52	4.07	1.73	1.38	8.33	T	4115
4	CoLk 14204	3.24	1.79	2.60	1.83	7.99	T	3498
5	CoPb 14184	2.57	3.11	1.26	1.63	6.64	T	3498
6	CoPb 14185	4.47	3.21	3.52	1.75	8.26	T	4115
7	CoH 14261	3.67	3.08	2.05	1.78	7.47	T	3704
Ck	CoS 767	3.26	3.62	4.82	2.15	10.51	T	5556
	CoPant 97222	4.34	4.34	2.61	1.39	7.79	T	3704
	Co 05011	4.73	3.21	4.17	1.56	8.27	T	4732
	SE	1.19	1.92	0.91	0.48	-	-	-
	CD	NS	NS	1.90	NS	-	-	-

**Table 1 h. Evaluation of zonal varieties /genotypes for their reaction against major insect- pests of sugarcane, (UPCSR, Shahjahanpur) in AVT (Mid late) II plant.**

Sl. No.	Varieties /Genotypes	Percent incidence of Top borer				Stalk borer			
		3rd brood	4th brood	At harvest	Infestation grade	% incidence	% intensity	Infestation index	Infestation grade
1	CoS 14233	1.46	0.97	5.33	LS	36.00	2.82	1.01	T
2	Co 14035	6.32	2.26	9.33	LS	42.67	3.34	1.45	T
3	CoLk14203	2.39	1.19	4.00	LS	18.67	1.01	0.19	T
4	CoLk14204	3.65	1.39	9.33	LS	14.67	1.06	0.18	T
5	CoPb14184	1.85	1.46	13.33	MS	21.33	1.41	0.32	T
6	CoPb14185	1.78	1.09	8.00	LS	42.67	3.24	1.64	T
7	CoH 14261	1.32	1.12	5.33	LS	33.33	2.59	0.88	T
Ck	CoS 767	2.60	1.77	6.67	LS	21.33	1.35	0.33	T
	CoPant 97222	2.73	1.56	10.67	MS	32.00	21.23	0.69	T
	Co 05011	1.18	1.01	6.67	LS	45.33	3.09	1.41	T
	SE	0.71	0.40	2.54	-	6.74	0.42	0.42	-
	CD	1.49	NS	5.33	-	14.17	0.88	0.88	-

**Table 1 i. Evaluation of zonal varieties /genotypes for their reaction against major insect- pests of sugarcane, (UPCSR, Shahjahanpur) in AVT (Early) Ratoon**

Sl. No	Varieties/ Genotypes	Early shoot borer (% incidence )					infestation grade	No. of bored plants/ha
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative incidence		
1	CoPb 14181	5.19	5.08	3.84	1.62	9.23	T	5144
2	CoPb 14211	3.59	4.76	3.53	1.53	8.30	T	4732
3	Co 14034	3.20	4.21	3.45	1.88	8.39	T	4938
4	CoLk 14201	3.23	4.39	4.82	1.79	9.60	T	5967
Ck	CoJ 64	4.22	5.35	5.04	2.12	11.15	T	5967
	Co 0238	6.18	5.58	5.46	1.95	11.88	T	6996

	Co 05009	2.03	2.22	2.11	1.46	5.61	T	3292
	SE	1.18	1.29	1.24	0.67	-	-	-
	CD	NS	NS	NS	NS	-	-	-

**Table 1 j. Evaluation of zonal varieties /genotypes for their reaction against major insect- pests of sugarcane, (UPCSR, Shahjahanpur) in AVT (Early) Ratoon**

Sl. No.	Varieties /Genotypes	Percent incidence of Top borer				Stalk borer			
		3rd brood	4th brood	At harvest	Infestation grade	% incidence	% intensity	Infestation index	Infestation grade
1	CoPb14181	2.50	1.58	6.67	T	5.33	0.29	0.02	T
2	CoPb14211	5.07	2.71	9.33	T	16.00	1.15	0.19	T
3	Co 14034	2.10	2.13	6.67	T	5.33	0.25	0.02	T
4	CoLk14201	7.30	3.15	6.67	T	6.67	0.37	0.03	T
Ck	CoJ 64	2.82	1.79	9.33	T	6.67	0.28	0.02	T
	Co 0238	3.94	2.11	10.67	MT	20.00	1.55	0.33	T
	Co 05009	10.87	4.26	9.33	T	18.67	0.95	0.18	T
	SE	1.40	0.47	2.67	-	2.49	0.25	0.07	-
	CD	3.05	1.03	NS	-	5.42	0.55	0.14	-

**Table 1 k. Evaluation of zonal varieties /genotypes for their reaction against major insect- pests of sugarcane, (UPCSR, Shahjahanpur) in AVT (Mid late) Ratoon**

Sl. No.	Varieties/ Genotypes	Early shoot borer (% incidence)						infestation grade	No. of bored plants/ha
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative incidence			
1	CoS14233	4.17	1.72	3.03	1.42	7.12	T	4321	
2	Co14035	2.37	2.57	1.55	1.33	5.91	T	2881	
3	CoLk 14203	4.41	2.19	1.29	2.35	8.52	T	3909	
4	CoLk 14204	3.21	2.55	1.64	2.73	7.76	T	3704	
5	CoPb 14184	1.64	1.87	1.13	2.32	6.72	T	3086	
6	CoPb 14185	4.14	2.27	1.81	1.27	6.40	T	3292	
7	CoH 14261	3.46	2.15	1.56	1.74	6.88	T	3498	
Ck	CoS 767	3.11	2.69	2.69	1.67	8.20	T	4321	
	CoPant 97222	2.76	2.71	1.78	1.89	6.73	T	3086	
	Co 05011	3.49	1.74	2.04	2.20	7.20	T	3498	
	SE	1.09	0.82	0.60	0.51	-	-	-	
	CD	NS	NS	NS	NS	-	-	-	

**Table 1 l. Evaluation of zonal varieties /genotypes for their reaction against major insect- pests of sugarcane, (UPCSR, Shahjahanpur) in AVT (Mid late) Ratoon**

Sl. No.	Varieties /Genotypes	Percent incidence of Top borer				Stalk borer			
		3rd brood	4th brood	At harvest	Infestation grade	% incidence	% intensity	Infestation index	Infestation grade
1	CoS14233	0.98	1.22	6.67	T	13.33	0.86	0.15	T
2	Co 14035	3.52	1.72	5.33	T	10.67	0.85	0.09	T
3	CoLk 14203	1.77	1.53	5.33	T	17.33	0.92	0.17	T

4	CoLk 14204	3.04	1.24	10.67	MT	12.00	0.75	0.10	T
5	CoPb 14184	2.06	1.08	10.67	MT	10.67	0.91	0.13	T
6	CoPb 14185	1.13	1.33	6.67	T	5.33	0.33	0.02	T
7	CoH 14261	1.52	1.38	6.67	T	14.67	0.95	0.16	T
8	CoS 767	1.84	1.88	5.33	T	6.67	0.34	0.02	T
9	CoPant9722 2	2.22	1.44	9.33	T	20.00	1.14	0.24	T
10	Co 05011	1.40	1.60	5.33	T	29.33	1.42	0.41	T
	SE	0.47	0.35	2.26	-	3.61	0.22	0.07	-
	CD	0.99	NS	NS	-	7.57	0.47	0.16	-

### **ICAR-Indian Institute of Sugarcane Research, Lucknow**

#### **In Advanced Varietal Trial (AVT):**

In early maturing group, 13+3 sugarcane genotypes viz., Co14034 (II plant), Co15027, CoLk14201 (II Plant), CoLk15201, CoLk15205, CoLk16201, CoLk16202, CoPant 16221, CoPant 16222, Co Pb14181, Co Pb14211 (II Plant), Co Pb15212, Co Pb16181 and three standard (CoJ 64, Co0238, Co05009) and in mid late maturing group 19+3 genotypes viz., Co14035 (II Plant), Co 16030, CoH 14261, CoLk 14203 (II Plant), CoLk 14204 (II Plant), CoLk 15206, CoLk 15207, CoLk 15209, CoLk 16203, CoLk 16204, CoPb14184 (II Plant), CoPb14185 (II Plant), CoPb15213, CoPb16212, CoPant16223, CoS14233 (II Plant), CoS 15232, CoS 15233, CoS 116233 and three standards (Co 5011, CoPant97222, CoS 767) (Table 1) were planted on March 2-4, 2019 in plots of 3.6 x 6m plot size with 90 cm row to row distance and each treatment was replicated three times. Recommended agronomic practices were followed to raise a good crop. No insecticide was applied at any stage of the crop.

#### **Scale**

**Top Borer**= <10.0 Tolerant (T), 10.1-20.0 Moderately Tolerant (MT), >20.0 Susceptible (S), mealy bug <10.0 Tolerant (T), 10.1-3.0 Moderately Tolerant (MT), >20.0 Susceptible (S).

**Stalk borer**: <2.0 Tolerant (T), 2.1-5.0 Moderately Tolerant (MT), >5.0 Susceptible (S).

**Internode Borer**: <20.0 Tolerant (T), 20.1-40.0 Moderately Tolerant (MT), >40.0 Susceptible (S).

In early group, germination was ranged from 27.63% in Co14034 to 52.91 % in Co0238. Incidence of top borer (II & III Brood) was >10 per cent in genotypes evaluated. Therefore all genotypes were rated as tolerant ones.

Incidence of top borer (IV Brood) was ranged between 8.44 per cent in CoLk 16201 and 49.17 per cent in Co0238. CoLk15201, CoLk15205 and CoPb14181 were MS while CoLk16201 was tolerant to IV brood incidence of top borer.

Incidence stalk borer ranged from 1.97 per cent in CoPb14211 and 14.68 per cent in Co15027. CoPb14211 was tolerant to stalk borer while Co0238 was MS and rest of the genotypes were HS to stalk borer.

Incidence of internode borer was less than 20.0 percent in all genotypes, thus all the genotypes were rated as tolerant to internode borer.

Incidence of root borer was <10.0% in all the genotypes including standards then all genotypes were rated as tolerant to root borer.

Corrected brix, sucrose percent and purity coefficient in the month of November were on par in all the genotypes.

In mid late maturing, incidence of top borer (II Brood) was >10 per cent in all genotypes including standards. Therefore all genotypes were rated as tolerant ones. Co 16030 gave moderately tolerant reaction to top borer (III Brood).

Incidence of top borer (IV Brood) was ranged between 8.49 per cent in CoLk 16203 and 52.06 per cent in Co14035. Ten genotypes viz., Co14035, Co 16030, CoH 14261, CoLk 14204, CoLk 15207, CoPb14185, CoPb16212, CoPant16223, CoS14233, CoS 16233 and CoS 767 were susceptible to top borer (IV Brood) , seven genotypes were Moderately Tolerant and rests of the genotypes were Tolerant (Table-3).

Incidence stalk borer ranged from 4.31 to 10.85 per cent. Three genotypes viz., CoLk 15209, CoLk 16203 and CoS 15232 were moderately tolerant and rests of the genotypes were susceptible to stalk borer (Table-3).

Incidence of internode borer was less than 20.0 percent in all genotypes, thus all the genotypes were rated as tolerant to moderately tolerant.

Corrected brix, sucrose percent and purity coefficient in the month of November were on par in all the genotypes.

**Table-1: List of genotypes evaluated (AVT)**

S.N.	Early maturing	S.N.	Mid late maturing
<b>II Plant</b>		<b>II Plant</b>	
1	Co14034	1	Co14035
2	CoLk14201	2	CoLk 14203
3	Co Pb14211	3	CoLk 14204
<b>II Plant</b>		4	CoPb14184
4	Co15027	5	CoPb14185
5	CoLk15201	6	CoS14233
6	CoLk15205	<b>I Plant</b>	
7	CoLk16201	7	Co 16030
8	CoLk16202	8	CoH 14261
9	CoPant 16221	9	CoLk 15206
10	CoPant 16222	10	CoLk 15207
11	Co Pb14181	11	CoLk 15209
12	Co Pb15212	12	CoLk 16203
13	Co Pb16181	13	CoLk 16204
14	CoJ 64	14	CoPb15213
15	Co0238	15	CoPb16212
16	Co05009	16	CoPant16223,
		17	CoS 15232
		18	CoS 15233
		19	CoS 116233
		20	Co 5011
		21	CoPant97222
		22	CoS 767



**Table-2: Incidence of insect pests in early maturing genotypes (AVT)**

SN	Variety	Incidence of top borer and varietal reaction						Stalk Borer		Internode borer		Mealy bug	
		II brood		III Brood		IV brood		Inci.	Rat.	Inci.	Rat.	Inci.	Rat.
		Inci.	Rat.	Inci.	Rat.	Inci.	Rat.						
1	Co14034	3.51	T	6.63	T	31.49	S	5.58	S	6.87	T	16.44	MT
2	Co15027	4.84	T	4.56	T	23.66	S	14.68	S	7.68	T	16.67	MT
3	CoLk14201	6.38	T	4.76	T	32.72	S	6.54	S	3.88	T	11.27	MT
4	CoLk15201	4.86	T	3.29	T	16.61	MT	8.17	S	9.29	T	14.42	MT
5	CoLk15205	3.83	T	2.57	T	15.49	MT	5.51	S	4.12	T	11.75	MT
6	CoLk16201	6.95	T	3.33	T	8.44	T	5.05	S	6.30	T	19.48	MT
7	CoLk16202	4.95	T	5.38	T	41.81	S	7.55	S	8.51	T	17.87	MT
8	CoPant 16221	2.71	T	2.15	T	22.14	S	9.83	S	5.52	T	0.00	T
9	CoPant 16222	4.64	T	5.62	T	30.84	S	12.09	S	10.65	T	33.10	S
10	Co Pb14181	3.60	T	4.10	T	14.33	MT	8.52	S	4.36	T	10.94	MT
11	Co Pb14211	5.01	T	4.93	T	27.80	S	1.97	T	9.16	T	10.02	MT
12	Co Pb15212	4.07	T	3.78	T	20.45	S	5.97	S	8.91	T	14.69	MT
13	Co Pb16181	7.05	T	2.67	T	20.14	S	9.66	S	4.36	T	9.57	T
14	Co0238	4.90	T	7.98	T	49.17	S	3.23	MT	12.41	T	21.77	S
15	Co05009	8.93	T	7.57	T	30.88	S	5.60	S	8.87	T	15.23	MT
16	CoJ 64	6.77	T	5.44	T	42.87	S	7.09	S	8.80	T	53.44	S

T=Tolerant, MT=Moderately Tolerant, S=Susceptible

**Table-3: Incidence of insect pests in mid late maturing genotypes (AVT)**

SN	Variety	Incidence of top borer and varietal reaction						Stalk Borer		Internode borer		Mealy bug	
		II brood		III Brood		IV brood		Inci.	Rat.	Inci.	Rat.	Inci.	Rat.
		Inci.	Rat.	Inci.	Rat.	Inci.	Rat.						
1	Co14035	5.25	T	5.94	T	52.06	S	5.49	S	14.15	MT	33.39	S
2	Co 16030	9.42	T	10.31	MT	28.69	S	5.20	S	12.05	MT	7.04	T
3	CoH 14261	7.93	T	8.22	T	20.5	S	5.17	S	12.92	MT	1.02	T
4	CoLk 14203	2.22	T	1.71	T	14.7	MT	7.23	S	10.62	MT	21.95	MT
5	CoLk 14204	3.29	T	4.56	T	28.13	S	9.76	S	14.01	MT	16.81	MT
6	CoLk 15206	4.67	T	4.67	T	15.39	MT	7.81	S	18.12	MT	8.05	T
7	CoLk 15207	4.28	T	4.78	T	26.72	S	10.75	S	7.41	T	9.98	T
8	CoLk 15209	5.49	T	5.49	T	12.47	MT	4.31	MT	10.38	MT	20.43	S
9	CoLk 16203	5.63	T	5.01	T	8.49	T	4.63	MT	8.28	T	26.91	S
10	CoLk 16204	2.45	T	2.97	T	8.96	T	9.73	S	11.46	MT	16.25	MT
11	CoPb14184	5.72	T	6.12	T	14.01	MT	7.55	S	11.00	MT	18.55	MT
12	CoPb14185	5.33	T	5.55	T	28.25	S	10.85	S	12.79	MT	12.99	MT
13	CoPb15213	8.13	T	8.51	T	14.49	MT	6.28	S	10.33	MT	1.31	T
14	CoPb16212	3.50	T	1.72	T	25.41	S	9.24	S	11.59	MT	1.81	T
15	CoPant16223	7.45	T	9.18	T	28.38	S	8.47	S	7.14	T	20.75	S
16	CoS14233	5.35	T	1.89	T	26.87	S	7.58	S	8.52	T	13.82	MT
17	CoS 15232	8.39	T	9.60	T	6.99	T	5.87	MT	7.68	T	17.93	MT
18	CoS 15233	5.67	T	5.66	T	11.07	MT	7.37	S	10.34	MT	18.67	MT
19	CoS 16233	7.57	T	7.69	T	26.45	S	7.45	S	10.22	MT	1.35	T
20	Co 5011	3.29	T	1.87	T	9.99	T	6.2	S	11.27	MT	41.34	S
21	CoPant97222	7.00	T	8.35	T	16.81	MT	8.75	S	19.85	MT	12.87	MT
22	CoS 767	3.51	T	4.62	T	22.9	S	6.05	S	10.47	MT	7.03	T

T=Tolerant, MT=Moderately Tolerant, S=Susceptible

## **North Central Zone**

**Sugarcane research institute, Dr. Rajendra prasad central agricultural university**

**Pusa, samastipur, Bihar**

Forty six varieties/genotypes compressing of 11 IVT E, 8 AVT E 1P, 7 AVT E II P 12 IVT M, 10 AVT ML I P, and 8 AVT ML IIP including standard check were evaluated against root, shoot, top and stalk borer at SRI, Pusa (Table 1-6).

The cumulative incidence of early shoot borer was recorded as lowest (3.38%) in variety CoP 15436 AVT E IP and highest (18.94%) in variety CoLK 16471 IVT M. 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 (5.10%) in variety CoP 15440 AVT M I P and maximum (7.20 %) in variety CoLK 16467 IVT E graded as less susceptible reaction. The incidence of top borer was recorded as less to moderate being 8.90 % in variety CoP 15436 AVT E I Pand 12.10% in variety CoLK 14206 AVT E II P against 4<sup>th</sup> brood of top borer. All the genotypes evaluated under different maturity groups exhibited less to moderately susceptible reaction against top borer based on 4<sup>th</sup> brood incidence. The stalk borer infestation index was varied from 0.00 to 0.12 per cent and showed less susceptible reaction for all tested genotypes.

**Table .1: Evaluation of IVT (E) zonal variety/genotypes of reaction against borer pest of sugarcane**

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	Cum m	Reaction	III brood 5 <sup>th</sup> month	IV Brood 7 <sup>th</sup> month	*Reaction	% incidence	% intensity	Infestation index	Reaction		
<b>IVT (Early) 8+3</b>																
1	CoP 16436	8.33	4.68	4.76	0.94	7.89	T	7.20	9.40	T	1.3	0.33	0.00	T	6.10	T
2	CoP 16437	11.11	5.97	3.29	1.47	7.58	T	6.80	9.70	T	1.7	1.3	0.02	T	5.90	T
3	CoP 16438	12.50	4.76	3.37	1.61	7.57	T	7.60	9.20	T	0.66	1.20	0.00	T	5.40	T
4	CoLK 16466	5.55	5.63	3.60	1.40	7.94	T	8.10	11.10	MT	0.50	1.66	0.00	T	6.50	T
5	CoLK 16467	9.52	4.00	4.00	1.92	7.83	T	8.70	10.40	MT	0.33	0.66	0.00	T	7.20	T
6	CoLK 16468	8.0	2.59	4.44	1.19	6.77	T	9.30	10.90	MT	2.10	1.22	0.02	T	6.20	T
7	CoSe 16451	7.14	4.91	4.54	1.44	6.84	T	7.80	10.20	MT	1.50	0.33	0.01	T	7.40	T
8	CoBLn 16501	12.0	5.47	3.93	0.70	8.49	T	9.50	11.50	MT	2.33	1.43	0.02	T	7.60	T
9	CoLK 94184	7.14	5.0	3.64	1.28	7.78	T	8.60	10.80	MT	1.60	0.66	0.00	T	6.30	T
10	CoSe 95422	0.0	3.57	5.26	2.18	6.94	T	7.30	10.3	MT	0.50	0.33	0.00	T	6.40	T
11	CoSe 01421	7.69	4.34	3.66	1.36	6.45	T	6.60	10.50	MS	0.25	0.75	0.00	T	5.80	T

\*Reaction based on 4<sup>th</sup> brood percent incidence

**Table .2: Evaluation of AVT(E) 1<sup>st</sup> P Zonal variety/genotypes of reaction against borer pest of sugarcane**

S.N.	Varieties/g enotypes	Early shoot borer (% incidence)						Top borer (% incidence)			Stalk borer				Root borer % incidence	Reaction
		30 DAP	60 DAP	90 DAP	120 DAP	Cum m	Reaction	III brood 5 <sup>th</sup> month	IV Brood 7 <sup>th</sup> month	*Reaction	% incidence	% intensity	Infestation index	Reaction		
<b>AVT (Early) 1<sup>st</sup> plant 5+3</b>																
1	CoLk 15466	0.0	4.76	4.0	1.70	4.09	T	8.30	11.30	MT	3.25	1.36	0.04	T	6.55	T
2	CoLk 15467	7.60	5.55	4.76	2.36	6.18	T	7.20	10.90	MT	4.10	0.67	0.03	T	6.90	T
3	CoP15436	0.0	3.07	2.75	1.16	3.38	T	5.30	8.90	T	0.00	0.00	0.00	T	5.90	T
4	CoSe 15452	5.20	2.81	4.04	1.91	6.79	T	7.50	9.80	T	0.00	0.00	0.00	T	7.10	T
5	CoSe 15455	4.76	4.05	3.20	1.74	6.25	T	8.60	10.50	MT	3.25	0.33	0.02	T	6.80	T
6	CoLk 94184(Std.)	11.11	4.61	4.39	1.37	5.84	T	7.90	11.10	MT	2.75	0.66	0.01	T	6.20	T
7	CoSe 95422(Std.)	9.52	4.47	2.15	3.38	5.94	T	8.60	10.80	MT	0.00	0.00	0.00	T	6.50	T
8	CoSe 01421(Std.)	5.55	3.27	3.97	7.10	7.73	T	6.70	10.40	MT	2.60	1.15	0.02	T	6.10	T

\*Reaction based on 4<sup>th</sup> brood percent incidence

**Table .3: E. 4.1 Evaluation of AVT (Early) II<sup>nd</sup> plant zonal variety/genotypes of reaction against borer pest of sugarcane**

S.N	Varieties/genotypes	Early shoot borer (%) incidence)						Top borer (%) incidence)			Stalk borer				Root borer % incidence	Reaction
		30 DA P	60 DA P	90 DA P	120 DA P	Cum m	Reaction	III brood 5 <sup>th</sup> month	IV Brood 7 <sup>th</sup> month	*Reaction	% incidence	% intensity	Infestation index	Reaction		
<b>AVT (Early) II<sup>nd</sup> plant 4+3</b>																
1	CoLk 14206	4.76	3.70	2.96	1.94	6.17	T	9.50	12.10	MT	5.80	1.20	0.06	T	6.40	T
2	CoP 14437	5.88	3.89	2.47	2.70	7.00	T	5.10	9.70	T	3.50	0.66	0.02	T	5.80	T
3	CoSe 14451	5.26	4.59	3.44	2.42	8.00	T	7.80	10.20	MT	2.40	0.70	0.20	T	6.10	T
4	CoSe 14454	9.09	3.89	3.05	2.54	7.27	T	9.30	11.30	MT	1.70	0.33	0.01	T	6.70	T
5	CoLk84184 (Std.)	0.0	4.81	2.36	2.83	7.43	T	6.20	10.90	MT	3.60	1.40	0.05	T	5.90	T
6	CoSe 95422(Std.)	10.0	4.54	3.10	1.44	6.16	T	7.90	11.10	MT	5.30	1.70	0.9	T	7.10	T
7	CoSe 01421(Std.)	4.16	5.10	2.58	1.16	6.52	T	8.30	11.50	MT	3.70	1.30	0.04	T	6.90	T

\*Reaction based on 4<sup>th</sup> brood percent incidence

**Table .4: Evaluation of IVT (Midlate) zonal variety/genotypes of reaction against borer pest of sugarcane**

S.N	Varieties/genotypes	Early shoot borer (%) incidence)						Top borer (%) incidence)			Stalk borer				Root borer % incidence	Reaction
		30 DA P	60 DA P	90 DA P	120 DA P	Cum m	Reaction	III brood 5 <sup>th</sup> month	IV Brood 7 <sup>th</sup> month	*Reaction	% incidence	% intensity	Infestation index	Reaction		
<b>IVT (Midlate) 9 + 3</b>																
1	CoP 16439	5.88	5.08	5.95	4.13	10.68	T	6.50	9.60	T	2.25	1.30	0.02	T	5.20	T
2	CoP 16440	6.89	8.10	6.29	3.64	13.72	T	7.40	9.20	T	3.66	2.10	0.07	T	5.90	T
3	BO 156	4.34	5.74	6.04	2.45	10.91	T	6.90	9.80	T	4.33	2.5	0.10	T	5.40	T
4	CoLk 16469	6.25	6.34	5.51	3.59	11.82	T	7.60	10.90	MT	5.56	1.60	0.08	T	6.10	T
5	CoLk 16470	5.55	7.14	7.28	3.53	13.06	T	5.70	9.30	T	3.26	2.30	0.07	T	5.80	T
6	CoLk 16471	6.66	6.40	12.05	5.52	18.94	MT	9.10	11.10	MT	5.77	1.60	0.09	T	6.40	T
7	CoSe 16452	7.40	4.05	5.59	2.79	9.80	T	7.10	9.60	T	3.43	1.30	0.04	T	6.70	T
8	CoSe 16453	5.88	7.40	7.51	3.20	12.56	T	9.30	11.60	MT	4.66	2.66	0.12	T	5.90	T
9	CoBln 16502	4.0	6.30	7.14	2.79	13.43	T	8.90	11.90	MT	5.88	1.23	0.07	T	6.90	T
10	BO 91(Std.)	9.09	4.08	5.18	2.04	11.	T	7.50	9.90	T	4.87	2.56	0.12	T	5.80	T

						25										
11	COP 06436(Std.)	3.57	5.50	6.47	2.64	11.97	T	8.10	10.10	MT	3.76	1.36	0.05	T	5.40	T
12	COP 9301(Std.)	2.85	5.97	4.41	2.21	9.21	T	7.80	9.30	T	2.66	0.63	0.01	T	5.50	T

\*Reaction based on 4<sup>th</sup> brood percent incidence.

**Table .5: Evaluation of AVT (ML) 1<sup>st</sup> P zonal variety/genotypes of reaction against borer pest of sugarcane**

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	Cum m	Reaction	III brood 5 <sup>th</sup> month	IV Brood 7 <sup>th</sup> month	*Reaction	% incidence	% intensity	Infestation index	Reaction		
<b>AVT (Midlate) 1<sup>st</sup> Plant 7 + 3</b>																
1	CoLk 15468	11.11	8.19	7.86	3.57	14.28	T	8.30	10.90	MT	0.00	0.00	0.00	T	6.40	T
2	CoLk 15469	4.34	5.79	6.06	2.23	9.65	T	9.10	11.20	MT	2.66	1.36	0.03	T	6.10	T
3	CoP 15438	4.0	4.22	7.47	3.93	12.23	T	8.50	10.10	MT	0.00	0.00	0.00	T	5.30	T
4	CoP 15439	10.0	7.24	8.03	5.30	15.54	MT	6.70	9.90	T	3.50	0.67	0.02	T	5.80	T
5	CoP 15440	7.40	7.22	8.66	5.63	16.77	MT	5.80	9.40	T	2.20	2.34	0.05	T	5.10	T
6	CoSe 15453	10.52	6.77	8.04	3.73	12.24	T	6.10	9.30	T	4.15	1.56	0.06	T	6.20	T
7	CoSe 15454	7.69	5.66	6.18	1.91	7.78	T	9.30	11.10	MT	3.33	1.23	0.04	T	6.50	T
8	BO 91(Std.)	10.59	9.52	9.56	4.40	14.60	T	6.70	9.30	T	3.67	1.87	0.06	T	5.40	T
9	COP 06436(Std.)	3.70	6.84	9.48	4.90	14.83	T	7.20	9.70	T	1.33	.36	0.01	T	5.90	T
10	CoP 9301 (Std.)	8.0	9.09	10.20	5.97	16.82	MT	7.60	9.90	T	1.76	0.73	0.01	T	5.60	T

\*Reaction based on 4<sup>th</sup> brood percent incidence

**Table .6: Evaluation of AVT (ML) 1I<sup>nd</sup> P zonal variety/genotypes of reaction against borer pest of sugarcane**

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	Cum m	Reaction	III brood 5 <sup>th</sup> month	IV Brood 7 <sup>th</sup> month	*Reaction	% incidence	% intensity	Infestation index	Reaction		
<b>AVT (Midlate) 1I<sup>nd</sup> Plant 5 + 3</b>																
1	CoLk 14208	5.88	7.46	8.60	4.09	13.97	T	8.60	11.30	MT	0.00	0.00	0.00	T	6.10	T
2	CoLk 14209	9.52	9.85	10.67	5.10	17.19	MT	9.30	11.50	MT	4.76	2.30	0.10	T	6.50	T
3	CoP 14438	5.26	8.77	7.86	4.27	13.84	T	8.10	10.40	MT	2.25	1.35	0.02	T	5.90	T
4	CoP 14439	7.40	7.79	10.43	4.82	16.36	MT	6.50	9.90	T	0.00	0.00	0.00	T	5.20	T
5	CoSe	6.66	8.6	10.6	5.88	17.2	MT	9.70	11.5	MT	0.00	0.00	0.00	T	6.30	T

	14455		4	5		4			0							
6	BO 91(Std.)	0.0	7.8 9	8.40	4.02	13.3 3	T	6.80	9.40	T	4.56	1.36	0.05	T	5.60	T
7	CoP 06436(Std.)	7.68	11. 11	9.60	4.45	15.9 0	MT	7.50	9.20	T	3.70	1.66	0.04	T	5.70	T
8.	CoP 9301 (Std.)	5.26	8.6 2	8.73	3.93	14.0 8	T	6.90	9.70	T	0.00	0.00	0.00	T	4.90	T

\*Reaction based on 4<sup>th</sup> brood percent incidence

## Peninsular Zone

### DR. PDKV, Akola

Totally fifteen (CoN 13072, Co 13020, CoN 13073, Co 13014, CoSnk 13106, Co 13003, CoSnk 05103, Co 13009, MS 13081, Co 13018, CoC 671, Co 13002, CoSnk 13103, Co 86032, Co 13004) were evaluated against insect pests of sugarcane and found that Co13004 and Co13081 were tolerant and rest of the genotypes including standards were moderately tolerant to early shoot borer (Table 4).

**Table 4: Reaction of Sugarcane varieties/genotypes to major insect pests in AVT II Plant at 30, 60, 90 and 120 DAP.**

Sr. No.	Genotypes	Early shoot borer infestation (%)					Reaction	Number of bored plants/ha (On the basis of Cumulative % incidence)
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative		
1	Co 13002	4.17 (6.90)	3.70 (6.49)	17.36 (24.61)	16.03 (23.36)	12.71 (20.58)	T	12707
2	Co 13003	0.00 (0.00)	9.53 (14.80)	30.55 (33.50)	14.29 (18.17)	8.89 (14.17)	T	8890
3	Co 13004	5.56 (8.03)	4.17 (6.90)	22.02 (27.66)	17.49 (24.66)	14.02 (21.87)	T	14017
4	CoN 13072	0.00 (0.00)	4.76 (7.40)	0.00 (0.00)	3.33 (6.14)	3.03 (5.85)	T	56000
5	CoSnk 13101	0.00 (0.00)	12.22 (16.88)	13.59 (21.58)	19.17 (25.75)	15.45 (22.96)	MT	15453
6	MS 13081	0.00 (0.00)	9.72 (14.93)	11.01 (15.95)	14.17 (22.06)	11.42 (19.72)	T	11420
7	Co 13006	4.77 (7.40)	6.67 (8.85)	15.60 (23.15)	19.76 (26.25)	15.87 (23.26)	MT	15873
8	Co 13008	0.00 (0.00)	15.60 (23.15)	18.85 (25.39)	29.72 (33.01)	22.51 (28.31)	MT	22507
9	Co 13009	0.00 (0.00)	7.41 (9.37)	8.47 (13.89)	11.62 (16.44)	9.53 (14.80)	T	9527
10	Co 13013	0.00 (0.00)	16.39 (23.78)	19.89 (26.11)	25.12 (29.38)	18.89 (25.24)	MT	18890
11	Co 13014	0.00 (0.00)	12.22 (16.88)	17.42 (20.49)	10.32 (15.43)	7.87 (13.39)	T	7870
12	Co 13018	0.00 (0.00)	21.43 (27.18)	21.80 (27.78)	15.28 (22.96)	11.64 (19.88)	T	11640
13	Co 13020	0.00 (0.00)	8.33 (10.00)	7.14 (9.19)	8.93 (14.30)	7.04 (12.63)	T	7037
14	CoN 13073	4.17 (6.90)	10.32 (15.43)	4.17 (6.90)	9.72 (14.93)	7.41 (12.98)	T	7407
15	CoSnk 13103	0.00 (0.00)	11.43 (16.25)	3.70 (6.49)	14.99 (22.71)	13.43 (21.42)	T	13427
16	CoSnk 13106	0.00 (0.00)	8.47 (13.89)	12.63 (20.79)	10.23 (15.31)	8.46 (13.84)	T	8460
17	PI 13132	0.00 (0.00)	10.32 (15.43)	16.99 (24.28)	18.56 (25.30)	15.87 (23.21)	MT	15867
18	Co 86032	5.56 (8.03)	11.43 (16.25)	8.93 (14.30)	16.67 (23.89)	13.85 (21.66)	T	13853
19	CoC 671	0.00 (0.00)	11.11 (11.75)	0.00 (0.00)	13.69 (17.67)	12.50 (16.90)	T	12500
20	CoSnk 05103	0.00 (0.00)	8.93 (14.30)	0.00 (0.00)	10.23 (15.31)	9.26 (14.52)	T	9260
	SE (±)	3.81	7.83	5.05	5.75	5.09		
	C.D. (0.05)	NS	NS	11.75	NS	NS		

Figures in parenthesis are Arc sin transformed values

T=Tolerant, MT=Moderately Tolerant, S=Susceptible

Grades T = Below 15.0 MT= 15.1 to 30.0 S = above 30.0

**Table 5: Reaction of Sugarcane varieties/genotypes to scales insect in AVT II Plant at Harvest**

Sr. No.	Genotypes	Scale Insect		Reaction
		% incidence	% intensity	
1	Co 13002	16.00	4.00	MT
2	Co 13003	12.00	5.00	MT
3	Co 13004	8.00	6.00	T
4	CoN 13072	16.00	9.00	MT
5	CoSnk 13101	16.00	8.00	MT
6	MS 13081	8.00	7.50	T

7	Co 13006	16.00	9.00	MT
8	Co 13008	16.00	9.50	MT
9	Co 13009	12.00	6.00	MT
10	Co 13013	12.00	8.00	MT
11	Co 13014	12.00	7.50	MT
12	Co 13018	12.00	10.00	MT
13	Co 13020	16.00	13.00	MT
14	CoN 13073	12.00	11.50	MT
15	CoSnk 13103	20.00	9.50	MT
16	CoSnk 13106	16.00	8.50	MT
17	PI 13132	16.00	9.00	MT
18	Co 86032	20.00	8.00	MT
19	CoC 671	16.00	9.50	MT
20	CoSnk 05103	12.00	10.00	MT

T = Tolerant, MT= Moderately Tolerant and S = Susceptible.

Grades: T= below 10, MT= 10.1 – 35, S= Above 35

The data revealed that the scale insect incidence ranged from 8.00 to 20.00 %. The genotypes Co 13004 and MS 13081 recorded least incidence (8.00%) and tolerant reaction to Scale insect. Remaining other entries recorded moderately tolerant reaction to scale insect. (Table 5)

**Table 6: Reaction of Sugarcane varieties/genotypes to *Pyrilla* (Nymph & Adults) per leaf in AVT II Plant**

Sr. No.	Genotypes	<i>Pyrilla</i>	Reaction	<i>Pyrilla</i>	Reaction	<i>Pyrilla</i>	Reaction	<i>Pyrilla</i>	Reaction
		30 DAP		45 DAP		60 DAP		75 DAP	
1	Co 13002	1.77	T	2.56	T	3.30	T	4.90	T
2	Co 13003	1.33	T	3.15	T	2.95	T	3.65	T
3	Co 13004	1.65	T	2.04	T	3.45	T	4.10	T
4	CoN 13072	1.75	T	1.95	T	2.75	T	3.35	T
5	CoSnk 13101	1.63	T	2.21	T	3.60	T	4.55	T
6	MS 13081	1.98	T	3.05	T	2.45	T	3.45	T
7	Co 13006	1.43	T	2.40	T	2.55	T	2.85	T
8	Co 13008	1.03	T	1.85	T	2.35	T	2.10	T
9	Co 13009	0.69	T	1.45	T	2.40	T	3.10	T
10	Co 13013	1.70	T	1.90	T	2.85	T	2.40	T
11	Co 13014	1.45	T	1.80	T	2.75	T	3.20	T
12	Co 13018	1.32	T	1.65	T	3.20	T	4.20	T
13	Co 13020	1.31	T	1.75	T	3.45	T	4.35	T
14	CoN 13073	1.44	T	1.80	T	2.75	T	3.75	T
15	CoSnk 13103	1.48	T	2.05	T	3.65	T	4.25	T
16	CoSnk 13106	1.55	T	1.90	T	2.75	T	4.15	T
17	PI 13132	1.64	T	1.80	T	2.65	T	3.20	T
18	Co 86032	0.78	T	1.35	T	3.70	T	4.85	T
19	CoC 671	1.67	T	2.10	T	3.10	T	3.90	T
20	CoSnk 05103	1.51	T	2.15	T	2.15	T	3.45	T

T = Tolerant, MT= Moderately Tolerant and S = Susceptible. Susceptible Above 20.

The data on incidence of *Pyrilla* perpusilla Walker at 15 days interval revealed that all genotypes received population of pest ranging from 0.69 to 4.90 per leaf. All the entries showed Tolerant reaction to *P. perpusilla* at fortnightly intervals (Table 6).

#### **ICAR-Sugarcane Breeding Institute, Coimbatore, Tamilnadu**

In IVT, total 18 genotypes including standard checks were evaluated for their reaction against insect pests of sugarcane and found that six entries were tolerant (T), 11 entries were moderately tolerant (MT) and only one entry Co 16006 was susceptible (S) to early shoot borer (Table 1).



**Table 1. Shoot Borer Incidence in IVT Trial**

S.No	Entries	% Incidence				Bored Plants/ha	Rating
		30 DAP	60 DAP	90 DAP	Cumulative		
1	Co16006	6.58	15.55	7.42	33.42	25926	S
2	Co16009	8.26	7.00	1.52	16.55	13992	Mt
3	Co16010	4.79	7.70	1.29	12.70	11523	T
4	Co 16017	4.19	11.07	9.28	24.93	19547	MT
5	Co16018	4.01	4.11	7.47	13.93	11523	T
6	Co 09004	11.30	3.52	11.21	25.88	12140	MT
7	Co11015	2.46	4.06	6.37	14.08	10288	T
8	CoM16081	6.63	16.89	6.57	24.15	20576	MT
9	CoM16082	6.07	9.91	8.85	22.46	12757	MT
10	CoN16071	20.89	10.66	6.41	28.34	29218	MT
11	CoR 16141	14.83	12.65	11.28	28.26	32510	MT
12	CoR16142	3.99	8.38	3.25	21.61	13786	MT
13	CoVC16061	4.69	5.50	3.12	16.88	8025	MT
14	CoVC16062	2.94	9.40	2.70	17.13	11523	MT
15	CoVSI16121	1.78	4.79	5.60	12.03	5967	T
16	PI 16131	1.17	1.94	5.39	9.04	3292	T
17	CoC 671	11.24	9.87	0.82	9.70	9877	T
18	Co 86032	4.83	8.67	2.82	15.03	17695	MT

In AVT-I Plant, total 14 entries screened for SB incidence, seven entries were LS and an equal number were MS. None of the entries was HS. The cumulative incidence of the borer varied from 6.9 % (Co 86032) to 29.4% (MS 14082). Co 14016 had minimum number of bored plants/ha (3704) and the highest number of bored plants/ha was in the entry MS 14082 (Table 2).

**Table 2. Shoot Borer Incidence in AVT- I Trial**

S.No	Entry	% incidence				Bored Plants/ha	Rating
		30 DAP	60 DAP	90 DAP	Cumulative		
1	Co14002	8.55	5.34	6.58	14.63	4938	T
2	Co14004	1.80	9.02	13.23	23.30	8436	MT
3	Co14012	4.38	6.32	6.64	17.16	7202	MT
4	Co14016	0.74	2.57	5.75	7.66	3704	T
5	Co14027	8.07	17.17	7.54	11.89	10082	T
6	CoSnk14103	2.98	8.99	5.96	12.46	8436	T
7	CoT14367	4.80	11.79	16.52	26.36	17901	MT
8	CoT14111	6.15	11.58	6.28	20.12	13786	MT
9	CoVC14062	0.30	15.75	13.82	21.43	11111	MT
10	MS14081	5.18	10.71	12.37	20.66	14198	MT
11	MS14082	5.70	9.37	9.61	29.30	28395	MT
12	CoSnk14102	1.62	5.14	4.86	13.86	11523	T
13	CoC671	2.59	7.14	4.45	10.90	6996	T
14	Co86032	4.10	1.65	3.79	6.97	4115	T

In AVT-II trial, out of 19 entries, including two check varieties, only one entry (CoSnk 13106) showed tolerant reaction Twelve entries were in the moderately tolerant category and six entries were susceptible. Cumulative incidence of the borer varied from 3.9 % (CoSnk 13106) to 41.9 % (Co 13002). CoSnk 13106 had the least number of bored plants/ha (2881) and the entry PI 13132 recorded the highest number (35185) of bored plants/ha. (Table 3).

**Table 3. Shoot Borer Incidence in AVT- II Trial**

S.No	Entries	% Incidence				Bored Plants/ha	Rating
		30 DAP	60 DAP	90 DAP	Cumulative		
1	Co 13002	3.11	27.85	15.81	41.94	32099	S
2	Co 13003	5.22	10.58	18.22	27.62	17901	MT
3	Co 13004	3.00	10.13	13.92	25.00	16255	MT
4	Co 13006	0.83	8.84	7.28	16.44	10082	MT
5	Co 13008	6.86	15.13	13.37	31.88	24074	S
6	Co 13009	7.99	6.35	5.02	24.28	12140	MT
7	Co 13013	17.61	12.60	12.60	33.05	31481	S
8	Co 13014	5.80	3.48	2.31	17.01	5144	MT
9	Co 13018	8.13	8.19	7.01	16.26	13580	MT
10	Co 13020	6.76	15.09	13.29	32.00	29630	S
11	CoN 13072	3.71	17.12	13.31	27.39	22428	MT
12	CoN 13073	1.44	27.85	17.52	41.84	25309	S
13	CoSnk 13101	8.98	7.87	7.11	25.89	23868	MT
14	CoSnk 13103	7.67	8.3 2	10.88	23.63	19547	MT
15	CoSnk 13106	0.68	1.3 6	1.68	3.92	2881	T
16	MS 13081	3.08	20. 15	18.18	26.74	23663	MT
17	PI 13132	11.6 7	21. 75	17.30	39.68	35185	S
18	CoC 671	2.27	12. 49	9.66	23.48	18313	MT
19	Co 86032	4.67	4.4 3	4.69	20.69	8642	MT

Internode borer (INB) incidence and intensity were recorded at the time of harvest in IVT trial. The incidence of the borer varied from 5.9 % (Co 16009) to 13.6% (CoM 16081) (Table 4). Intensity of attack was minimum in the check CoC 671 (1.3%), whereas maximum intensity of attack was recorded in the entry Co 16006 (4.55%). Infestation index ranged from 0.11 (Co 16009, CoC 671, Co 86032) to 0.6 (Co 16006). Overall incidence of the borer in this trial was low and all the entries fall in tolerant category.

**Table 4. Internode Borer Incidence in IVT Trial**

S.No	Entry	% Incidence	% Intensity	Infestation Index	Infestation Grade
1	Co16006	13.22	4.55	0.60	T
2	Co 16009	5.94	1.84	0.11	T
3	Co16010	12.65	2.33	0.29	T
4	Co 16017	10.78	3.28	0.35	T
5	Co16018	10.05	2.12	0.21	T
6	Co 09004	10.58	2.40	0.25	T
7	Co11015	11.02	2.94	0.32	T
8	CoM16081	13.63	2.90	0.40	T
9	CoM16082	10.76	2.37	0.25	T
10	CoN16071	8.33	2.23	0.19	T
11	CoR 16141	9.95	2.27	0.23	T
12	CoR16142	7.84	4.26	0.33	T
13	CoVC16061	10.34	1.40	0.14	T
14	CoVC16062	8.13	1.78	0.14	T
15	CoVSI16121	10.09	1.70	0.17	T
16	PI 16131	7.17	2.21	0.16	T
17	CoC 671	8.45	1.30	0.11	T
18	Co 86032	6.86	1.62	0.11	T

INB incidence and intensity recorded at the time of harvest in AVT-I showed that the incidence of the borer was low and all the entries fall in the category tolerant (Table 5). The incidence of the borer varied from 3.0 % (Co 14004) to 16.7% (MS 14081). Intensity of attack of the borer varied from 1.0 % (Co 14002) to 3.9% (MS 14081). Infestation index was minimum in three varieties viz. Co 14002, Co 14004 & Co 14016. Highest index was recorded in the entry MS 14081 which had the highest incidence.

**Table 5. Internode Borer Incidence in AVT- I Trial**

S.No	Entry	% Incidence	% Intensity	Infestation Index	Infestation Grade
1	Co14002	4.17	1.00	0.04	T
2	Co14004	3.04	1.27	0.04	T
3	Co14012	4.54	2.17	0.10	T
4	Co14016	1.92	1.84	0.04	T
5	Co14027	7.88	1.12	0.09	T
6	CoSnk 14103	12.28	1.35	0.17	T
7	CoSnk 14102	9.45	2.30	0.22	T
8	CoT14367	12.25	1.30	0.16	T
9	CoT14111	8.91	1.89	0.17	T
10	CoVC14062	8.03	3.80	0.31	T
11	MS14081	16.73	3.94	0.66	T
12	MS14082	5.51	2.34	0.13	T
13	CoC 671	9.24	1.92	0.18	T
14	Co 86032	8.34	2.44	0.20	T

Incidence of INB recorded at harvest in AVT-II trial indicated that the borer incidence was low in all the entries (Table 6). Incidence of the borer varied from 1.5% (Co 13009) to 31.7% (Co 13004). Intensity of the borer attack ranged from nil (Co 13009) to 4.8% (Co 13014). Infestation index was less than one in the trial, varying from nil (Co 13009) to 0.9 (Co 13004). Except Co 13004 all the entries fall under tolerant category.

**Table 6. Internode Borer Incidence in AVT –II Trial**

S.No	Entry	% Incidence	% Intensity	Infestation Index	Infestation Grade
1	Co 13002	7.38	1.22	0.09	T
2	Co 13003	6.78	1.79	0.12	T
3	Co 13004	31.67	2.92	0.92	MT
4	Co 13006	8.40	2.56	0.22	T
5	Co 13008	8.11	2.09	0.17	T
6	Co 13009	1.49	0.00	0.00	T
7	Co 13013	5.13	1.63	0.08	T
8	Co 13014	6.06	4.82	0.29	T
9	Co 13018	11.29	2.63	0.30	T
10	Co 13020	8.08	2.08	0.17	T
11	CoN 13072	5.48	2.00	0.11	T
12	CoN 13073	14.29	2.40	0.34	T
13	CoSnk 13101	12.50	3.78	0.47	T
14	CoSnk 13103	7.09	3.26	0.23	T
15	CoSnk 13106	8.65	1.99	0.17	T
16	MS 13081	17.19	2.14	0.37	T
17	PI 13132	13.13	0.87	0.11	T
18	CoC 671	5.41	1.45	0.08	T
19	Co 86032	6.17	2.44	0.15	T

**Top borer and root borer incidences were in traces (<1%) in all the trials.**

#### **UAS, Zonal Agricultural Research Station V. C. Farm, Mandya, Karnataka**

During 2019-20, total 56 genotypes of sugarcane along with standard checks were screened for their reaction against insect pests of sugarcane. The following genotypes were tolerant to borer pests.

#### **IVT Genotypes**

Total 15 genotypes with their Zonal checks (Co 86032, CoC 671 and Co 09004) were screened for their reaction against major sugarcane pests. In this, genotypes Co 11015, Co 116010, Co 16017, Co 16018, PI 16131, CoN 16071, VSI 16121 and CoR 16142 registered tolerant reaction against all the borer pests. (Table-1).

#### **AVT- I Plant**

Total 15 genotypes with their Zonal checks (Co 86032, CoC 671 and CoSnk 05103) were screened for their reaction against major sugarcane pests. Among the genotypes screened Co VC 14062 and MT 14081 genotypes registered tolerant reaction against all the borer pests (Table-2).

#### **AVT- II Plant**

Total 17 genotypes with their Zonal checks (Co 86032, CoC 671 and CoSnk 05103) were screened for their reaction against major sugarcane pests. Among the genotypes screened MS 13081, Co 13013, Co 13014 and CoN 13073 exhibited tolerant reaction against all the borer pests (Table-3).

**Table: 1. Cumulative Incidence of sugarcane borers under IVT trial**

Sl.no	Varieties/genotypes	Cumulative Incidence of sugarcane borers (%)		
		ESB	TSB	INB
1	Co 16006	16.66	4.33	16.00
2	Co 11015	5.33	1.66	10.67
3	Co 16009	7.33	0.66	22.67
4	Co 116010	10.33	2.33	17.33
5	Co 16017	8.66	4.33	14.67
6	Co 16018	9.33	0.66	16.00
7	Co VC 16061	8.66	5.33	18.67
8	Co VC 16062	7.66	1.33	22.67
9	CoN 16071	10.33	6.33	18.67
10	CoM 16081	21.66	9.00	25.33
11	CoM 16082	16.66	6.33	24.00
12	CoVSI 16121	7.33	1.66	16.00
13	PI 16131	8.33	3.00	16.00
14	CoR 16141	8.66	2.33	21.33
15	CoR 16142	10.66	1.66	20.00
16	Co 86032	7.155	3.33	22.67
17	CoC 671	7.3	1.66	17.33
18	Co 09004	8.025	4.33	16.00

**Table 2: Cumulative Incidence of sugarcane borers under AVT- I PC trial**

Sl.No	Varieties/genotypes	Cumulative Incidence of sugarcane borers (%)		
		ESB	TSB	INB
1	Co 14002	8.33	8.33	24.00
2	Co 14002	9.33	9.67	26.67
3	Co 14012	19.67	9.00	29.33
4	Co 14016	14.66	7.67	22.67
5	Co 14027	17.33	8.33	30.67
6	Co 14030	21.00	7.00	17.33
7	Co 14032	18.67	10.33	29.33
8	CoN 14073	15.67	11.33	22.67
9	CoSnk 14102	17.00	12.67	25.33
10	CoSnk 14103	16.00	8.67	34.67
11	CoT 14367	16.67	14.33	13.33
12	Co TI 14111	12.00	11.00	28.00
13	Co VC 14062	4.33	9.00	18.67
14	MS 14081	9.00	9.33	14.67
15	MS 14082	15.33	10.67	22.67
16	Co 86032	24.67	10.33	21.33
17	CoC 671	9.67	11.67	24.00
18	CoSnk 05103	17.67	9.33	18.67

**Table: 3. Cumulative Incidence of sugarcane borers under AVT -II PC trial**

Sl.No	Varieties/genotypes	Cumulative Incidence of sugarcane borers (%)		
		ESB	TSB	INB
1	Co 13002	21.00	10.33	25.33
2	Co 13003	20.67	13.67	29.33
3	Co 13004	22.00	10.67	22.67
4	CoN 13072	21.33	12.33	21.33
5	CoSnk 13101	28.33	11.00	25.33
6	MS13081	12.33	7.66	17.33
7	Co 13006	16.33	9.67	25.33
8	Co 13008	22.00	11.66	24.00
9	Co 13009	20.33	14.33	28.00
10	Co 13013	9.67	12.00	16.00
11	Co 13014	13.00	8.67	20.00
12	Co 13018	21.67	10.00	13.33
13	Co 13020	17.00	9.33	18.67
14	CoN13073	13.33	8.00	18.67
15	CoSnk 13103	22.67	12.33	21.33
16	CoSnk 13106	10.67	11.33	22.67
17	PI13132	19.33	14.00	13.33
18	Co86032(C)	10.67	9.33	17.33
19	CoC671(C)	10.00	8.67	24.00
20	Co Snk 05103(C)	12.00	9.67	16.00

Note: ESB – Early shoot borer, TSB – Top shoot borer, INB – Internode borer.

**CSR, MPKV, Pade gaon, Maharashtra**

**Table-1a. Evaluation of genotypes/varieties for their reaction against ESB (IVT ).**

Sr. No.	Genotype	Per cent incidence of ESB days after planting					Reaction	No. of bored plants/ha (On the basis of Cumulative % incidence)
		30	60	90	120	Cumulative % incidence		
1	Co 11015	0.85 (3.07)	11.79 (18.89)	2.85 (7.90)	5.67 (13.50)	5.73	T	5730
2	Co 16006	1.43 (5.61)	13.72 (20.15)	5.07 (13.00)	3.84 (9.25)	6.09	T	6090
3	Co 16009	0.00 (0.00)	14.37 (22.25)	2.79 (7.54)	2.67 (7.39)	5.21	T	5210
4	Co 16010	0.00 (0.00)	14.59 (22.06)	11.76 (20.04)	9.56 (14.78)	9.64	T	9640
5	Co 16017	0.00 (0.00)	19.54 (25.03)	7.09 (14.93)	3.71 (10.54)	8.22	T	8220
6	Co 16018	0.00 (0.00)	11.44 (18.93)	5.73 (9.96)	1.89 (6.45)	4.86	T	4860
7	Co VSI 16121	0.00 (0.00)	4.38 (11.85)	1.86 (6.41)	10.17 (18.38)	4.56	T	4560
8	PI 16131	0.00 (0.00)	6.25 (11.87)	13.35 (19.97)	10.23 (18.20)	7.77	T	7770
9	Co R 16141	0.00 (0.000)	25.22 (28.84)	12.38 (19.16)	17.10 (23.78)	14.68	T	14680
10	Co R 16142	0.00 (0.00)	9.46 (17.580)	3.77 (11.02)	6.97 (15.09)	5.26	T	5260
11	Co Vc 16061	0.00 (0.00)	10.87 (18.69)	6.44 (12.02)	6.59 (14.31)	6.84	T	6840
12	Co 16062	0.00 (0.00)	17.48 (24.52)	0.65 (2.68)	1.72 (6.16)	4.94	T	4940
13	Co N 16071	0.81 (3.00)	29.84 (33.09)	13.02 (21.12)	7.57 (15.75)	13.75	T	13750

14	Co M16081	0.00	21.79	23.38	12.81	14.83	T	14830
		(0.00)	(27.28)	(28.77)	(20.08)			
15	Co M 16082	0.68	15.98	4.17	0.69	6.08	T	6080
		(2.74)	(23.28)	(9.63)	(2.76)			
16	Co 9004	0.00	8.80	5.65	2.56	4.36	T	4360
		(0.00)	(17.15)	(11.25)	(7.29)			
17	Co C 671	0.00	14.15	9.97	5.38	7.88	T	7880
		(0.00)	(21.87)	(17.75)	(13.13)			
18	Co 86032	0.00	23.93	10.32	9.03	11.29	T	11290
		(0.00)	(29.15)	(18.08)	(16.01)			
S. E. ±		(1.37)	(4.25)	(4.21)	(3.77)	--	--	--
C.D. at 5 %		NS	(11.22)	(12.10)	(10.82)	--	--	--
Tolerant. (T)							0-15	
Moderate ly Tolerant (MT)							15.1-30	
Susceptible. (S)							above 30	

Bold figures are arc sin transformed values

**Table-1b. Reaction of sugarcane genotypes / varieties to sugarcane borer (IVT Early)**

Sr. No	Genotypes/ Varieties	Internode Borer				Top Shoot Borer			
		% Incidence	% Intensity	% Infestation index	Reaction	% Incidence	% Intensity	Reaction	
01	Co 11015	53.33(46.92)	3.99	2.13	S	00.00(00.00)	0.00	T	
02	Co 16006	53.33(46.92)	4.46	2.38	S	00.00 (00.00)	0.00	T	
03	Co 16009	20.00(21.93)	1.69	0.34	T	00.00 (00.00)	0.00	T	
04	Co 16010	36.67(36.64)	1.66	0.61	MT	00.00 (00.00)	0.00	T	
05	Co 16017	43.33(41.07)	3.02	1.31	S	00.00 (00.00)	0.00	T	
06	Co 16018	40.00(38.85)	3.79	1.51	MT	00.00 (00.00)	0.00	T	
07	Co VSI 16121	26.67(30.99)	2.26	0.60	MT	00.00 (00.00)	0.00	T	
08	PI 16131	43.33(41.07)	4.06	1.76	S	00.00 (00.00)	0.00	T	
09	Co R 16141	60.00(51.60)	4.65	2.79	S	00.00(00.00)	0.00	T	
10	Co R 16142	33.33(34.22)	2.48	0.83	MT	00.00(00.00)	0.00	T	
11	Co Vc 16061	36.67(36.93)	3.56	1.30	MT	00.00(00.00)	0.00	T	
12	Co 16062	56.67(49.14)	3.85	2.18	S	00.00(00.00)	0.00	T	
13	Co N 16071	66.67(54.78)	5.09	3.39	S	00.00(00.00)	0.00	T	
14	Co M16081	53.33(46.92)	4.60	2.45	S	00.00(00.00)	0.00	T	
15	Co M 16082	63.33(51.93)	3.79	2.40	S	00.00(00.00)	0.00	T	
16	Co 9004	50.00(44.91)	4.16	2.08	S	00.00(00.00)	0.00	T	
17	Co C 671	53.33(48.00)	4.39	2.34	S	00.00(00.00)	0.00	T	
18	Co 86032	46.67(43.08)	3.39	1.58	S	00.00(00.00)	0.00	T	
S. E. ±		6.64							
C.D. at 5 %		NS							
Tolerant. (T)		0 – 20				0 – 10			
Moderate ly Tolerant (MT)		20.1 – 40				10.1 – 20			
Susceptible. (S)		Above 40				Above 20			

Figures in the parentheses are arc sin transformed values

**Table-1c. Reaction of sugarcane genotypes / varieties to sucking pests. (IVT early)**

Sr. No	Genotypes/ Varieties	Mealy Bug			Scale insect		
		% Incidence	% Intensity	Reaction	% Incidence	% Intensity	Reaction
01	Co 11015	90.00(75.00)	1.02	S	43.33 (41.15)	3.93	S
02	Co 16006	96.67(83.85)	16.11	S	13.33 (13.08)	1.35	MT
03	Co 16009	93.33(77.71)	17.39	S	13.33	1.39	MT

					(13.08)		
04	Co 16010	96.67(83.85)	14.63	S	00.00 (00.00)	0.00	T
05	Co 16017	93.33(81.15)	11.89	HS	00.00 (00.00)	0.00	T
06	Co 16018	93.33(81.15)	16.60	S	00.00 (00.00)	0.00	T
07	Co VSI 16121	96.33(83.85)	15.94	S	00.00 (00.00)	0.00	T
08	PI 16131	80.00(63.93)	10.84	S	00.00 (00.00)	0.00	T
09	Co R 16141	70.00(62.71)	8.69	S	13.33 (13.08)	1.43	MT
10	Co R 16142	83.33(70.78)	18.65	S	13.33 (13.08)	1.60	MT
11	Co Vc 16061	100.00(90.00)	22.15	S	10.00 (11.07)	1.80	T
12	Co 16062	86.67(72.78)	14.04	S	20.00 (16.92)	1.66	MT
13	Co N 16071	80.00(68.07)	13.16	S	00.00 (00.00)	0.00	T
14	Co M16081	76.67(62.71)	8.21	S	16.67 (15.00)	1.38	MT
15	Co M 16082	96.67(83.85)	13.28	S	13.33 (13.08)	1.65	MT
16	Co 9004	100.00(90.00)	16.59	S	00.00 (00.00)	0.00	T
17	Co C 671	90.00(75.00)	12.62	S	00.00 (00.00)	0.00	T
18	Co 86032	83.33(66.64)	10.54	S	30.00 (27.99)	3.69	MT
S. E. ±		7.13			9.75		
C.D. at 5 %		NS			NS		
Tolerant. (T)		0 – 5			0 – 10		
Moderate ly Tolerant (MT)		5.1 – 30			10.1 – 35		
Susceptible. (S)		Above 30			Above 35		

**Figures in the parentheses are arc sin transformed values IVT**

Toatl all 18 sugarcane genotypes including standar checks were were screened against ESB, IB, TP, Mealy bug and scale insect.

On the basis of cumulative per cent incidence all the entries at 30, 60, 90 and 120 DAP were found tolerant to early shoot borer, top shoot borer, scale insect (**Table-2a, b, c**).

There were non-significant differences of per cent incidence among the entries in respect of mealy bug and scale insect. On the basis of per cent incidence of mealy bug all the entries of sugarcane recorded susceptible to mealy bug. Whereas.

**Table-2a. Reaction of sugarcane genotypes / varieties to ESB (AVT I Plant)**

Sr. No.	Genotype	% incidence of ESB days after planting					Reaction	No. of bored plants/ha (On the basis of Cumulative % incidence)
		30	60	90	120	Cumulative % incidence		
1	Co 14002	1.80	10.82	8.62	4.30	6.55	T	6550
		4.48	15.80	16.53	9.69			
2	Co 14004	0.00	6.92	9.11	5.92	6.08	T	6080
		0.00	15.12	16.04	13.50			



3	Co 140612	0.00	10.80	8.42	8.84	7.21	T	7210
		0.00	15.39	16.84	16.75			
4	Co 14016	0.00	10.53	9.56	6.02	8.67	T	8670
		0.00	15.29	16.96	14.09			
5	Co 14027	0.00	15.23	4.70	8.85	6.96	T	6960
		0.00	22.33	12.34	17.14			
6	Co 14030	0.74	11.37	10.06	14.07	9.41	T	9410
		2.86	18.52	18.17	18.14			
7	Co 14032	0.00	10.25	6.73	9.47	7.11	T	7110
		0.00	17.80	14.77	14.72			
8	Co N 14073	0.00	8.34	10.39	9.77	6.91	T	6910
		0.00	15.21	17.29	18.21			
9	Co SNK 14102	0.00	10.30	13.91	9.29	8.14	T	8140
		0.00	17.67	21.68	17.19			
10	Co SNK 14103	1.11	8.63	7.25	7.20	6.46	T	6460
		3.50	15.60	12.82	14.72			
11	CoT 14167	0.79	12.46	10.90	10.46	8.41	T	8410
		2.96	18.70	18.86	17.41			
12	Co TI 14111	0.00	12.12	5.91	6.87	6.34	T	6340
		0.00	20.12	13.63	14.57			
13	Co Vc 14062	2.08	4.66	10.21	3.85	5.64	T	5640
		4.83	9.86	18.36	11.27			
14	MS 14081	0.00	8.38	4.47	2.60	3.84	T	3840
		0.00	15.54	9.93	8.88			
15	MS 14082	0.74	2.27	5.88	4.59	3.86	T	3860
		2.86	6.83	13.87	11.79			
16	Co 86032	0.00	6.03	9.05	10.06	6.78	T	6780
		0.00	13.37	16.89	18.37			
17	Co C 671	0.85	15.92	9.10	3.71	5.61	T	5610
		3.07	21.83	16.50	10.89			
18	Co SNK 5103	0.00	12.98	9.80	10.89	8.53	T	8530
		0.00	21.10	18.11	19.09			
S. E. ±		2.16	5.38	3.65	3.99	--	--	--
C.D. at 5 %		NS	NS	NS	NS	--	--	--
Tolerant. (T)							0-15	
Moderate ly Tolerant (MT)							15.1-30	
Susceptible. (S)							Above 30	

**Table-2b. Reaction of sugarcane genotypes / varieties against sugarcane borer (AVT I Plant)**

Sr. No	Genotypes/ Varieties	Internode Borer				Top Shoot Borer		
		% Incidence	% Intensity	% Infestation index	Reaction	% Incidence	% Intensity	Reaction
01	Co 14002	60.00 (51.15)	4.86	2.91	S	00.00 (00.00)	0.00	T
02	Co 14004	40.00 (39.15)	3.39	1.35	MT	00.00 (00.00)	0.00	T
03	Co 140612	50.00 (45.08)	3.58	1.79	S	00.00 (00.00)	0.00	T
04	Co 14016	23.33	1.63	0.38	MT	00.00	0.00	T

		(28.29)				(00.00)		
05	Co 14027	36.67 (36.15)	2.77	1.01	MT	00.00 (00.00)	0.00	T
06	Co 14030	33.33 (35.01)	2.72	0.91	MT	00.00 (00.00)	0.00	T
07	Co 14032	30.00 (33.00)	2.57	0.77	MT	00.00 (00.00)	0.00	T
08	Co N 14073	33.33 (34.92)	2.29	0.76	MT	00.00 (00.00)	0.00	T
09	Co SNK 14102	36.67 (36.85)	2.61	0.96	MT	00.00 (00.00)	0.00	T
10	Co SNK 14103	20.00 (26.56)	1.32	0.26	T	00.00 (00.00)	0.00	T
11	CoT 14167	46.67 (42.99)	3.54	1.65	S	00.00 (00.00)	0.00	T
12	Co TI 14111	20.00 (26.07)	1.10	0.22	T	00.00 (00.00)	0.00	T
13	Co Vc 14062	56.67 (48.93)	3.48	1.97	S	00.00 (00.00)	0.00	T
14	MS 14081	26.67 (30.00)	1.72	0.46	MT	00.00 (00.00)	0.00	T
15	MS 14082	33.33 (34.14)	2.29	0.76	MT	00.00 (00.00)	0.00	T
16	Co 86032	50.00 (44.71)	3.78	1.89	S	00.00 (00.00)	0.00	T
17	Co C 671	36.67 (36.93)	2.52	0.92	MT	00.00 (00.00)	0.00	T
18	Co SNK 5103	33.33 (35.22)	2.15	0.72	MT	00.00 (00.00)	0.00	T
S. E. ±		6.54				0		
C.D. at 5 %		NS				0		
Tolerant. (T)		0 – 20				0 – 10		
Moderately Tolerant (MT)		20.1 – 40				10.1 – 20		
Susceptible. (S)		Above 40				Above 20		

Figures in the parentheses are arc sin transformed values

**Table-2c. Reaction of sugarcane genotypes / varieties against sucking pests. (AVT I Plant)**

Sr. No	Genotypes/ Varieties	Mealy Bug			Scale insect		
		% Incidence	% Intensity	Reaction	% Incidence	% Intensity	Reaction
01	Co 14002	80.00 (68.07)	10.72	S	00.00 (00.00)	0.00	T
02	Co 14004	73.33 (59.71)	12.13	S	00.00 (00.00)	0.00	T
03	Co 140612	66.67 (55.78)	8.04	S	00.00 (00.00)	0.00	T
04	Co 14016	76.67 (61.22)	8.66	S	00.00 (00.00)	0.00	T
05	Co 14027	66.67 (55.08)	5.57	S	00.00 (00.00)	0.00	T
06	Co 14030	83.33 (66.15)	10.37	S	00.00 (00.00)	0.00	T
07	Co 14032	66.67 (55.78)	9.53	S	00.00 (00.00)	0.00	T
08	Co N 14073	70.00 (58.78)	12.81	S	00.00 (00.00)	0.00	T
09	Co SNK 14102	90.00 (71.56)	10.17	S	00.00 (00.00)	0.00	T

10	Co SNK 14103	80.00 (67.86)	8.19	S	00.00 (00.00)	0.00	T
11	CoT 14167	90.00 (75.00)	9.63	S	00.00 (00.00)	0.00	T
12	Co TI 14111	80.00 (67.86)	8.69	S	00.00 (00.00)	0.00	T
13	Co Vc 14062	90.00 (75.00)	8.69	S	00.00 (00.00)	0.00	T
14	MS 14081	76.67 (61.22)	6.26	S	00.00 (00.00)	0.00	T
15	MS 14082	86.67 (72.29)	10.23	S	00.00 (00.00)	0.00	T
16	Co 86032	70.00 (57.00)	8.67	S	00.00 (00.00)	0.00	T
17	Co C 671	90.00 (75.00)	14.19	S	00.00 (00.00)	0.00	T
18	Co SNK 5103	86.67 (72.78)	11.86	S	00.00 (00.00)	0.00	T
S. E. ±		7.72					
C.D. at 5 %		NS					
Tolerant. (T)		0 – 5			0 – 10		
Moderately Tolerant (MT)		5.1 – 30			10.1 – 35		
Susceptible. (S)		Above 30			Above 35		

Figures in the parentheses are arc sin transformed values

#### AVT II Plant:

On the basis of cumulative per cent incidence all the entries showed their tolerant reaction to Early shoot borer. On the basis of score categorization entry Co 13013, PI 13132, Co86032, Co C 671 & Co SNK 0503 were showed moderately tolerant reaction whereas, remaining entries were found susceptible to internode borer. As regards Top borer all the entries showed tolerant reaction to Top borer. There were non-significant differences of per cent incidence among the entries in respect of mealy bug and scale insect. On the basis of per cent incidence of mealy bug, all the entries recorded HS to mealy bug. Whereas, scale insect showed LS reaction to all entries (Table-3a, b,c).

**Table-3a. Evaluation of genotypes/varieties for their reaction against ESB (AVT II Plant).**

Sr. No.	Genotype	Per cent incidence of ESB days after planting					Reaction	No. of bored plants/ha (On the basis of Cum. % incidence)
		30	60	90	120	Cumulative % incidence		
1	Co 13002	0.00 (0.00)	1.59 (4.20)	10.39 (17.24)	2.07 (6.77)	3.77	T	3770
2	Co 13003	1.67 (4.31)	2.09 (6.79)	4.93 (12.45)	3.49 (8.56)	3.33	T	3330
3	Co 13004	0.00 (0.00)	0.67 (2.71)	8.73 (17.12)	4.44 (7.14)	4.47	T	4470
4	Co N 13070	0.00 (0.00)	1.35 (3.87)	8.95 (17.11)	4.42 (12.00)	4.28	T	4280
5	Co SNK 13101	0.00 (0.00)	14.28 (21.84)	16.68 (22.70)	11.94 (18.66)	12.33	T	12330
6	MS 13081	0.00 (0.00)	14.15 (18.06)	14.30 (20.48)	5.82 (11.45)	10.17	T	10170
7	Co 13006	0.81 (2.99)	1.51 (4.10)	6.69 (13.90)	5.25 (10.85)	4.03	T	4030
8	Co 13008	0.95 (3.24)	8.13 (15.11)	10.36 (14.49)	3.62 (8.71)	6.01	T	6010

9	Co 13009	0.00 (0.00)	7.52 (15.90)	4.69 (12.24)	3.31 (10.43)	4.04	T	4040
10	Co 13013	0.79 (2.96)	8.47 (16.83)	9.29 (17.64)	10.56 (18.52)	8.39	T	8390
11	Co 13014	0.00 (0.00)	0.00 (0.00)	0.58 (2.53)	3.29 (10.03)	1.23	T	1230
12	Co 13018	0.00 (0.00)	0.00 (0.00)	8.74 (14.95)	4.65 (10.17)	4.13	T	4130
13	Co 13020	0.00 (0.00)	12.84 (19.72)	3.79 (8.39)	1.19 (3.63)	3.05	T	3050
14	Co N 13073	0.00 (0.00)	10.43 (18.41)	10.06 (15.91)	3.92 (6.69)	6.83	T	6830
15	CoSNK 13103	0.00 (0.00)	5.58 (13.12)	5.19 (12.28)	0.94 (3.22)	2.84	T	2840
16	CoSNK 13106	0.00 (0.00)	0.59 (2.56)	1.42 (5.49)	0.91 (4.46)	0.87	T	870
17	PI 13132	0.90 (3.15)	0.74 (2.86)	2.44 (5.23)	1.22 (5.19)	1.47	T	1470
18	Co 86032	0.00 (0.00)	0.44 (2.21)	2.19 (4.95)	7.11 (13.19)	1.77	T	1770
19	Co C 671	0.90 (3.15)	5.07 (7.65)	3.54 (6.34)	0.00 (0.00)	3.75	T	3750
20	Co SNK 0503	1.21 (3.66)	2.18 (6.94)	0.90 (3.15)	6.55 (11.64)	2.62	T	2620
S. E. ±		1.92	4.14	4.64	4.62	--	--	--
C.D. at 5 %		NS	11.89	13.27	12.93	--	--	--
Tolerant. (T)							0-15	
Moderately Tolerant (MT)							15.1-30	
Susceptible. (S)							Above 30	

Bold figures are arc sin transformed values

**Table-3b. Reaction of sugarcane genotypes / varieties to major insect pests. (AVT II Plant)**

Sr. No	Genotypes/ Varieties	Internode Borer				Top Shoot Borer		
		% Incidence	% Intensity	% Infestation index	Reaction	% Incidence	% Intensity	Reaction
01	Co 13002	46.67 (43.08)	3.53	1.65	S	00.00 (00.00)	0.00	T
02	Co 13003	43.33 (41.07)	3.16	1.37	S	00.00 (00.00)	0.00	T
03	Co 13004	43.33 (39.99)	4.54	2.31	S	00.00 (00.00)	0.00	T
04	Co N 13070	53.33 (47.01)	3.19	1.70	S	00.00 (00.00)	0.00	T
05	Co SNK 13101	50.00 (45.00)	4.73	2.36	S	00.00 (00.00)	0.00	T
06	MS 13081	60.00 (51.15)	4.50	2.70	S	00.00 (00.00)	0.00	T
07	Co 13006	60.00 (50.77)	4.32	2.59	S	00.00 (00.00)	0.00	T
08	Co 13008	53.33 (46.92)	5.04	2.69	S	00.00 (00.00)	0.00	T
09	Co 13009	46.67 (43.08)	3.26	1.52	S	00.00 (00.00)	0.00	T
10	Co 13013	40.00 (39.23)	2.12	0.85	MT	00.00 (00.00)	0.00	T
11	Co 13014	46.67 (43.08)	3.16	1.47	S	00.00 (00.00)	0.00	T
12	Co 13018	43.33	3.57	1.55	S	00.00	0.00	T

		(41.07)				(00.00)		
13	Co 13020	53.33 (47.01)	3.61	1.92	S	00.00 (00.00)	0.00	T
14	Co N 13073	53.33 (46.92)	3.42	1.82	S	00.00 (00.00)	0.00	T
15	CoSNK 13103	40.00 (39.15)	3.18	1.27	S	00.00 (00.00)	0.00	T
16	CoSNK 13106	53.33 (46.92)	4.52	2.41	S	00.00 (00.00)	0.00	T
17	PI 13132	33.33 (34.92)	3.75	1.25	MT	00.00 (00.00)	0.00	T
18	Co 86032	40.00 (39.15)	3.37	1.35	MT	00.00 (00.00)	0.00	T
19	Co C 671	40.00 (38.85)	2.71	1.08	MT	00.00 (00.00)	0.00	T
20	Co SNK 0503	36.67 (36.93)	2.22	0.81	MT	00.00 (00.00)	0.00	T
S. E. ±		5.38						
C.D. at 5 %		NS						
Tolerant. (T)		0 – 20				0 – 10		
Moderately Tolerant (MT)		20.1 – 40				10.1 – 20		
Susceptible. (S)		Above 40				Above 20		

Figures in the parentheses are arc sin transformed values

**Table-3c. Reaction of sugarcane genotypes / varieties to major insect pests. (AVT II Plant)**

Sr. No	Genotypes/ Varieties	Mealy Bug			Scale insect		
		% Incidence	% Intensity	Reaction	% Incidence	% Intensity	Reaction
01	Co 13002	63.33(53.07)	6.93	S	00.00 (00.00)	0.00	T
02	Co 13003	56.67(48.93)	5.43	S	00.00 (00.00)	0.00	T
03	Co 13004	73.33(59.71)	8.27	S	00.00 (00.00)	0.00	T
04	Co N 13070	70.00(56.79)	7.27	S	00.00 (00.00)	0.00	T
05	Co SNK 13101	66.67(54.78)	6.49	S	00.00 (00.00)	0.00	T
06	MS 13081	63.33(52.78)	4.77	S	00.00 (00.00)	0.00	T
07	Co 13006	60.00(50.85)	5.49	S	00.00 (00.00)	0.00	T
08	Co 13008	63.33(52.78)	5.18	S	00.00 (00.00)	0.00	T
09	Co 13009	93.33(81.15)	16.08	S	00.00 (00.00)	0.00	T
10	Co 13013	90.00(71.56)	8.23	HS	00.00 (00.00)	0.00	T
11	Co 13014	73.33(64.22)	8.47	S	00.00 (00.00)	0.00	T
12	Co 13018	66.67(55.08)	6.98	S	00.00 (00.00)	0.00	T
13	Co 13020	80.00(63.44)	9.44	S	00.00 (00.00)	0.00	T
14	Co N 13073	70.00(58.08)	7.41	S	00.00 (00.00)	0.00	T
15	CoSNK 13103	53.33(47.22)	5.97	S	00.00 (00.00)	0.00	T

16	CoSNK 13106	86.67(72.78)	15.48	S	(00.00)	0.00	T
17	PI 13132	70.00(62.01)	6.84	S	00.00 (00.00)	0.00	T
18	Co 86032	66.67(55.78)	6.24	S	00.00 (00.00)	0.00	T
19	Co C 671	86.67(68.85)	8.20	S	00.00 (00.00)	0.00	T
20	Co SNK 0503	63.33(53.07)	5.22	S	00.00 (00.00)	0.00	T
	SE±	6.59					
	CD at 5%	NS					
Tolerant. (T)		0 – 5			0 – 10		
Moderately Tolerant (MT)		5.1 – 30			10.1 – 35		
Susceptible. (S)		Above 30			Above 35		

Figures in the parentheses are arc sin transformed values

#### AVT (I Plant)

In all 20 entries were screened against ESB, IB, TP, Mealy bug and scale insect. The data is analyzed in RBD and presented here in respect of per cent infestation of early shoot borer, internode borer, mealy bug and scale insect in table 4a to 4c.

On the basis of cumulative per cent incidence all the entries were found less susceptible to early shoot borer. Data of IB was found non-significant. Top borer was not observed throughout the crop period. On the basis of score categorization entry Co 13002, Co N 13070, Co SNK 113106 & Co SNK 0503 showed less susceptible reaction. Whereas, remaining entries were moderately tolerant to IB. As regards Top borer, all the entries showed tolerant reaction to Top borer. On the basis of per cent incidence of mealy bug all the genotypes recorded susceptible to mealy bug. Regarding the scale insect, entries Co 16017 & Co C 671 recorded 16.67 % incidence, it was significantly lower than other entries except entry Sr. Nos. 13, 15, 6, 1,10, 11 & 16. These entries were at par with each other. On the basis of score values entries Co 16017, Co N 16071Co M 16082 and Co C 671 were observed moderately tolerant and remaining entries were susceptible to scale insect (**Table-4a, b, c**).

**Table4a. Evaluation of genotypes/Var. for their reaction against ESB (AVT I plant ratoon)**

Sr. No.	Genotype	% incidence of ESB days after planting					Reaction	No. of bored plants/ha (On the basis of Cumulative % incidence)
		30	60	90	120	Cumulative % incidence		
1	Co 13002	0.99 <b>(4.59)</b>	9.99 <b>(17.93)</b>	9.44 <b>(17.78)</b>	7.20 <b>(15.17)</b>	6.98	T	6980
2	Co 13003	0.66 <b>(2.70)</b>	5.16 <b>(13.10)</b>	8.42 <b>(16.01)</b>	5.68 <b>(13.37)</b>	5.38	T	5380
3	Co 13004	0.74 <b>(4.04)</b>	6.49 <b>(11.64)</b>	7.78 <b>(16.17)</b>	7.58 <b>(15.85)</b>	4.73	T	4730
4	Co N 13070	0.81 <b>(5.17)</b>	7.44 <b>(15.27)</b>	7.90 <b>(16.18)</b>	6.73 <b>(14.96)</b>	6.03	T	6030
5	Co SNK 13101	1.13 <b>(4.89)</b>	14.00 <b>(20.90)</b>	12.00 <b>(20.05)</b>	7.13 <b>(15.24)</b>	8.95	T	8950
6	MS 13081	1.30 <b>(5.32)</b>	8.71 <b>(16.82)</b>	11.07 <b>(19.39)</b>	7.42 <b>(15.73)</b>	8.33	T	8330
7	Co 13006	0.00 <b>(0.00)</b>	9.80 <b>(18.07)</b>	10.47 <b>(18.86)</b>	7.61 <b>(15.77)</b>	7.35	T	7350
8	Co 13008	0.96 <b>(4.52)</b>	6.36 <b>(13.94)</b>	5.46 <b>(13.13)</b>	5.14 <b>(12.57)</b>	4.67	T	4670

9	Co 13009	0.59	4.95	8.60	4.24	4.94	T	4940
		<b>(3.60)</b>	<b>(12.76)</b>	<b>(16.88)</b>	<b>(11.68)</b>			
10	Co 13013	0.23	6.97	8.36	5.64	5.77	T	5770
		<b>(1.60)</b>	<b>(15.13)</b>	<b>(16.68)</b>	<b>(13.07)</b>			
11	Co 13014	0.48	8.66	9.85	9.19	7.30	T	7300
		<b>(3.23)</b>	<b>(17.09)</b>	<b>(18.26)</b>	<b>(18.18)</b>			
12	Co 13018	0.00	5.73	9.21	7.94	6.56	T	6560
		<b>(0.00)</b>	<b>(13.59)</b>	<b>(17.65)</b>	<b>(16.15)</b>			
13	Co 13020	0.00	8.07	8.72	5.63	6.02	T	6020
		<b>(0.00)</b>	<b>(16.34)</b>	<b>(17.05)</b>	<b>(13.05)</b>			
14	Co N 13073	0.00	5.36	8.06	6.95	5.93	T	5930
		<b>(0.00)</b>	<b>(13.02)</b>	<b>(16.11)</b>	<b>(15.10)</b>			
15	Co SNK 13103	0.00	5.10	5.62	4.19	4.30	T	4300
		<b>(0.00)</b>	<b>(13.06)</b>	<b>(13.72)</b>	<b>(11.18)</b>			
16	Co SNK 13106	0.23	5.42	8.21	6.17	5.39	T	5390
		<b>(1.60)</b>	<b>(12.62)</b>	<b>(16.49)</b>	<b>(14.37)</b>			
17	PI 13132	0.00	12.85	15.88	6.59	9.29	T	9290
		<b>(0.00)</b>	<b>(20.85)</b>	<b>(23.15)</b>	<b>(14.71)</b>			
18	Co 86032	0.35	9.70	9.96	9.46	8.15	T	8150
		<b>(1.97)</b>	<b>(18.12)</b>	<b>(18.35)</b>	<b>(17.89)</b>			
19	Co C 671	0.00	18.57	9.16	4.82	7.57	T	7570
		<b>(0.00)</b>	<b>(25.04)</b>	<b>(17.22)</b>	<b>(12.67)</b>			
20	Co SNK 0503	0.24	4.23	6.43	6.03	4.66	T	4660
		<b>(1.62)</b>	<b>(11.78)</b>	<b>(14.61)</b>	<b>(14.16)</b>			
S. E. ±		1.64	2.88	1.88	2.00	--	--	--
C.D. at 5 %		NS	N.S.	N.S.	NS	--	--	--
Tolerant. (T)							0-15	
Moderately Tolerant (MT)							15.1-30	
Susceptible. (S)							Above 30	

Bold figures are arc sin transformed values

**Table-4b. Reaction of sugarcane genotypes / varieties to borer pests. (AVT I Plant Ratoon)**

Sr. No	Genotypes/ Varieties	Internode Borer				Top Shoot Borer		
		% Incidence	% Intensity	% Infestation index	Reaction	% Incidence	% Intensity	Reaction
01	Co 13002	40.00(38.85)	2.41	0.96	MT	00.00 (00.00)	0.00	T
02	Co 13003	56.67(48.85)	3.66	3.66	S	00.00 (00.00)	0.00	T
03	Co 13004	63.33(53.07)	4.15	2.63	S	00.00 (00.00)	0.00	T
04	Co N 13070	40.00(39.15)	2.85	1.14	MT	00.00 (00.00)	0.00	T
05	Co SNK 13101	53.33(47.01)	3.43	1.83	S	00.00 (00.00)	0.00	T
06	MS 13081	56.67(49.22)	4.63	2.62	S	00.00 (00.00)	0.00	T
07	Co 13006	56.79(48.93)	4.91	2.79	S	00.00 (00.00)	0.00	T
08	Co 13008	70.00(56.79)	4.52	3.16	S	00.00 (00.00)	0.00	T
09	Co 13009	60.00(51.93)	2.94	1.76	S	00.00 (00.00)	0.00	T
10	Co 13013	46.67(43.08)	2.87	1.34	S	00.00 (00.00)	0.00	T
11	Co 13014	66.67(54.76)	4.45	2.97	S	00.00	0.00	T

						(00.00)			
12	Co 13018	70.00(56.79)	4.99	3.49	S	00.00 (00.00)	0.00	T	
13	Co 13020	80.00(68.07)	6.87	5.49	S	00.00 (00.00)	0.00	T	
14	Co N 13073	50.00(45.00)	3.35	1.67	S	00.00 (00.00)	0.00	T	
15	Co SNK 13103	60.00(51.93)	3.93	2.36	S	00.00 (00.00)	0.00	T	
16	Co SNK 13106	33.33(34.92)	2.54	0.85	MT	00.00 (00.00)	0.00	T	
17	PI 13132	53.33(46.92)	3.54	1.89	S	00.00 (00.00)	0.00	T	
18	Co 86032	56.67(48.93)	3.81	2.16	S	00.00 (00.00)	0.00	T	
19	Co C 671	50.00(45.00)	3.66	1.83	S	00.00 (00.00)	0.00	T	
20	Co SNK 0503	40.00(39.23)	2.27	0.91	MT	00.00 (00.00)	0.00	T	
S. E. ±		6.85							
C.D. at 5 %		NS							
Tolerant. (T)								0 – 20	
Moderately Tolerant (MT)								20.1 – 40	
Susceptible. (S)								Above 40	

Figures in the parentheses are arc sin transformed values

**Table-4c. Reaction of sugarcane genotypes / varieties to sucking pests. . (AVT I Plant Ratoon)**

Sr. No	Genotypes/ Varieties	Mealy Bug			Scale insect		
		% Incidence	% Intensity	Reaction	% Incidence	% Intensity	Reaction
01	Co 11015	66.67 (54.99)	6.39	S	46.67 (43.08)	2.76	S
02	Co 16006	73.33 (59.22)	6.84	HS	53.33 (46.92)	3.98	S
03	Co 16009	63.33 (53.85)	6.75	S	66.67 (60.00)	9.40	S
04	Co 16010	60.00 (51.15)	4.79	S	63.33 (53.36)	6.97	S
05	Co 16017	86.67 (72.78)	12.01	S	16.67 (15.00)	0.92	MT
06	Co 16018	60.00 (50.85)	4.82	S	43.33 (41.07)	4.36	S
07	Co VSI 16121	70.00 (58.08)	5.71	S	50.00 (42.29)	7.83	S
08	PI 16131	46.67 (43.08)	3.98	S	70.00 (57.78)	8.97	S
09	Co R 16141	90.00 (75.00)	16.75	S	60.00 (49.92)	6.43	S
10	Co R 16142	70.00 (57.29)	5.35	S	46.67 (43.08)	5.40	S
11	Co Vc 16061	70.00 (56.79)	8.27	S	50.00 (45.00)	7.06	S
12	Co 16062	73.33 (59.22)	8.85	S	63.33 (53.15)	10.64	S
13	Co N 16071	60.00	6.71	S	20.00	2.10	S



		(50.85)			(16.92)		
14	Co M16081	56.67 (48.93)	5.98	S	60.00 (50.85)	6.37	S
15	Co M 16082	53.33 (46.92)	3.61	S	20.00 (16.92)	2.88	MT
16	Co 9004	96.67 (83.85)	16.77	S	50.00 (45.00)	6.00	S
17	Co C 671	66.67 (55.86)	5.82	S	16.67 (15.00)	1.83	MT
18	Co 86032	80.00 (68.85)	7.96	S	63.33 (53.07)	6.76	S
19	Co C 671	70.00 (57.00)	6.57	S	53.33 (47.01)	6.24	S
20	Co SNK 0503	76.67 (66.93)	7.91	S	73.33 (63.85)	10.32	S
S. E. ±		7.18				10.57	
C.D. at 5 %		20.52				30.19	
Tolerant. (T)		0 – 20				0 – 10	
Moderately Tolerant (MT)		20.1 – 40				10.1 – 20	
Susceptible. (S)		Above 40				Above 20	

Figures in the parentheses are arc sin transformed values

### Vasantdada Sugar Institute, Pune. Maharashtra

#### Sugarcane genotypes : Twenty(15+4+1)

1.	Co16006	2.	Co11015	3.	Co16009	4.	Co16010	5.	Co16017
6.	Co16018	7.	CoVc16061	8.	CoVc16062	9.	CoN16071	10.	CoM16081
11.	CoM16082	12.	CoVSI16121	13.	PI16131	14.	CoR16141	15.	CoR16142
16.	Co 86032 (Std.)	17.	CoC 671(Std.)	18.	Co09004(Std)	19.	Co85004(Std)	20.	CoVSI18121

The data presented in Table 1 indicated that The cumulative % incidence of early shoot borer was below 15 % in CoM16081 (4.01%), Co 16018 (4.04%), Co09004 (4.51%), CoVSI18121 (5.09%), CoVSI16121 (5.45%), CoR16141 (5.52), CoR16142 (6.23%), CoVc 16062 (9.15%), Co16009 (9.97%), Co16010 (10.97%), Co16017 (11.10%), Co 85004 (12.69%) and Co 16006 (13.20%) and while it was above 30% in CoC 671 (std) (33.83%). No of bored plants /ha was maximum (15,8333) in CoC 671 (std), while it was minimum (22,222) in Co 16018 and CoM 16081. The % incidence of internode borer was above 20 % in PI 16131 (29.33%) and CoN 16071 (28.00%), while it was minimum 4.00 % in Co 09004 (std). The % intensity of internode borer was maximum 2.90% in PI 16131, While it was minimum 0.21% in Co 09004(std). The infestation index of internode borer was below 1.00% in all varieties/genotypes screened except PI 16131(1.07%). All varieties/genotypes screened were free from mealy bug infestation except Co 11015 (4.00%) and CoVc 16061 (6.67%). The scale insect infestation was found in CoVSI 18121 (17.33%), Co16010 (12.00%), Co16009 (4.00%) and CoVc 16061(2.67%).

**Table 1: Reaction of sugarcane genotypes/varieties to major insect pest in IVT**

Sr. No	Varieties/ genotype	Early shoot borer (% incidence)						Internode borer				Mealy bug			Scale insect		
		60 DAP	90 DAP	120 DAP	cum	No. of bored plants/ha	Grade	% incidence	% intensity	Index	Grade	% incidence	% intensity	Grade	% incidence	% intensity	Grade
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Co 16006	0.00	3.13	10.81	13.20 (19.46)	55556	T	12.00 (20.09)	0.95	0.12	T	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
2	Co 11015	0.00	10.78	17.01	22.42 (28.10)	100000	MT	9.33 (17.018)	0.68	0.14	T	4.00 (1.44)	2.67	T	0.00 (0.71)	0.00	T
3	Co16009	2.70	3.70	5.84	9.97 (17.19)	44444	T	13.33 (21.37)	0.68	0.09	T	0.00 (0.71)	0.00	T	4.00 (1.09)	0.99	T
4	Co 16010	2.78	6.20	5.99	10.97 (19.06)	52778	T	9.33 (15.68)	0.49	0.08	T	0.00 (0.71)	0.00	T	12.00 (1.63)	3.85	MT
5	Co 16017	3.03	5.22	7.41	11.10 (18.24)	55556	T	18.67 (25.57)	1.43	0.27	T	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
6	Co 16018	0.00	0.73	3.70	4.04 (11.14)	22222	T	13.33 (21.37)	1.12	0.15	T	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
7	Co Vc 16061	0.00	11.71	12.90	20.39 (26.31)	91667	MT	13.33 (21.37)	1.18	0.17	T	6.67 (1.12)	0.81	MT	2.67 (0.84)	0.23	T
8	CoVc 16062	0.00	2.86	7.87	9.15 (17.33)	47222	T	17.33 (23.19)	1.28	0.32	T	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
9	CoN 16071	0.00	4.49	14.81	18.66 (25.38)	97222	MT	28.00 (30.46)	1.72	0.81	MT	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
10	CoM 16081	0.00	0.82	3.72	4.01 (11.15)	22222	T	16.00 (21.62)	1.00	0.28	T	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
11	CoM 16082	0.00	2.84	13.94	15.40 (21.79)	75000	MT	14.67 (21.48)	0.82	0.82	T	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
12	CoVSI 16121	0.00	0.00	5.20	5.45 (12.80)	25000	T	13.33 (20.73)	1.15	0.18	T	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
13	PI 16131	14.71	5.10	15.86	21.10 (25.91)	91667	MT	29.33 (32.36)	2.90	1.07	MT	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
14	CoR 16141	4.17	1.72	3.36	5.52 (13.37)	36111	T	12.00 (19.81)	0.83	0.13	T	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
15	CoR 16142	0.00	4.73	3.05	6.23 (13.58)	36111	T	12.00 (19.56)	0.73	0.11	T	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
16	Co86032 (std)	0.00	5.15	14.37	17.81 (24.780)	88889	MT	18.67 (24.98)	1.30	0.29	T	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
17	CoC 671(std)	8.57	10.69	26.32	33.83 (35.07)	158333	S	9.33 (17.35)	0.51	0.05	T	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
18	Co 09004	0.00	2.36	3.03	4.51 (11.82)	22222	T	4.00 (9.46)	0.21	0.03	T	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
19	Co 85004	0.00	6.54	9.44	12.69 (18.59)	66667	T	13.33 (21.37)	0.80	0.11	T	0.00 (0.71)	0.00	T	0.00 (0.71)	0.00	T
20	Co VSI 14-22 (18121) Add.	0.00	5.26	1.56	5.09 (10.37)	30556	T	17.33 (23.99)	1.10	0.21	T	0.00 (0.71)	0.00	T	17.33 (1.59)	3.21	MT
S.E +					4.31												
C.D at 5%					12.33			NS				NS			NS		
C.V					39.13												

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

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

**Sugarcane Genotypes: Twenty (15+3+2)**

1.	Co 14002	2.	Co 14004	3.	Co14012	4.	Co14016
5.	Co14027	6.	Co 14030	7.	CoM14032	8.	CoN14073
9.	CoSnk14102	10.	CoSnk14103	11.	CoT 14367	12.	CoTI 14111
13	CoVc14062	14	MS 14081	15	MS 14082	16	Co 86032 (Std)
17	CoC 671 (Std)	18	CoSnk05103(Std)				

The data in Table 2 revealed that the cumulative per cent incidence of early shoot borer was above 30.0 % in Co 86032 (Std) (33.69%) and CoSnk14103 (33.71%), while it was below 15 % in CoT 14367 (5.67%), Co 14016 (7.76%), CoTI 14111 (8.58%), MS 14081 (9.69%), CoSnk 14102 (10.60%), Co14027 (12.50%), Co14030 (13.98%) and CoSnk 05103 (14.32%). The no. of bored plants/ha by early shoot borer were minimum (36111) in MS 14081 and it was maximum (163889) in Co 86032 (Std). The % incidence of internode borer was maximum (14 %) in CoT14367. The % intensity and infestation index of internode borer was below 1.0 in all varieties/genotypes screened. The % incidence of mealy bug was found only in CoT 14367 (2.00). The infestation of SWA was recorded only in CoVc 14062, CoT 14367 and CoSnk 14103.

**Conclusion:** Out of 18 varieties/ genotypes screened CoT 14367, Co 14016, CoTI14111, MS14081, CoSnk 14102, Co14027, Co14030 and CoSnk 05103 varieties /genotypes showed less susceptible reaction to early shoot borer. All varieties/ genotypes showed less susceptible reaction to internode bore. All varieties/ genotypes were free from mealy bug infestation expect CoT 14367 and All varieties/ genotypes were free from SWA infestation expect CoVc14062, CoT14367 and CoSnk14103.

**Table 2: Reaction of sugarcane genotypes/varieties to major insect pest in AVT I plant**

Sr.	Varieties/ Nogenotype	Early shoot borer (% incidence)					No. of bored plants/ha	Grade	Internode borer				Mealy bug			SWA	
		30 DAP	60 DAP	90 DAP	120 DAP	cum			% inciden ce	% intens ity	Infest ation index	Grade	% incidenc e SMW= SMW=	% intensity SMW=	Gr ade	Observ ed grade	Grade
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Co14002	10.00	10.17	7.26	7.43	19.44 (14.23)	94444	MT	2.00 (1.41)	0.12	0.01	T	0 (071)	0	T	0	T
2	Co14004	0.00	6.90	11.38	8.28	17.75 (24.91)	86111	MT	4.00 (1.81)	0.22	0.02	T	0(0.71)	0	T	0	T
3	Co14012	0.00	1.75	8.70	16.32	21.46 (27.57)	119444	MT	10.00 (3.23)	0.61	0.06	T	0(0.71)	0	T	0	T
4	Co14016	0.00	1.87	2.92	4.59	7.76 (16.13)	44444	T	0.00 (0.71)	0.00	0.00	T	0(0.71)	0	T	0	T
5	Co 14027	0.00	1.32	3.23	9.48	12.50 (20.71)	41667	T	4.00 (2.12)	0.28	0.01	T	0(0.710)	0	T	0	T
6	Co 14030	0.00	13.68	2.80	5.33	13.98 (21.96)	72222	T	6.00 (2.12)	0.37	0.04	T	0(0.71)	0	T	0	T
7	CoM14032	0.00	11.11	6.19	7.62	16.38 (23.81)	52778	MT	0.00 (0.71)	0.00	0.00	T	0(0.71)	0	T	0	T
8	CoN14073	0.00	10.11	8.76	4.41	16.73 (40.03)	75000	MT	4.00 (1.81)	0.35	0.03	T	0(0.71)	0	T	0	T
9	Co Snk14102	0.00	3.88	9.01	3.13	10.60 (18.84)	52778	T	8.00 (2.38)	0.45	0.07	T	0(0.71)	0	T	0	T
10	CoSnk14103	0.00	28.57	17.53	14.46	33.71 (35.30)	97222	S	12.00(3 54)	0.67	0.08	T	0(0.710)	0	T	1.3	MT
11	CoT14367	0.00	4.35	1.05	3.70	5.67 (12.80)	16667	T	14.0(3. 54)	0.80	0.17	T	2(1.41)	0.12	T	0.6	T
12	CoTl 14111	0.00	2.04	7.58	2.42	8.58 (14.92)	44444	T	6.00 (2.52)	0.36	0.02	T	0(0.710)	0	T	0	T
13	CoVc14062	0.00	9.30	8.79	11.76	17.56 (21.48)	72222	MT	0.00(0. 71)	0.00	0.00	T	0(0.71)	0	T	0.6	T
14	MS14081	0.00	6.93	1.67	3.23	9.69 (17.85)	36111	T	6.00(2. 52)	0.32	0.02	T	0(0.71)	0	T	0	T
15	MS14082	0.00	10.89	5.43	6.12	16.80 (24.06)	75000	MT	4.00(1. 81)	0.21	0.02	T	0(0.71)	0	T	0	T
16	Co86032 (std)	0.00	3.85	20.97	20.69	33.69 (35.43)	163889	S	2.00(1. 41)	0.12	0.01	T	0(0.71)	0	T	0	T
17	CoC 671(std)	0.00	1.16	6.72	8.63	15.14 (22.51)	58333	T	10.00(3 .09)	0.63	0.09	T	0(0.71)	0	T	0	T
18	Cosnk 05103 (std)	0.00	12.00	8.70	2.05	14.32 (19.17)	80556	T	6.00 (2.12)	0.38	0.05	T	0(0.71)	0	T	0	T
	S.E +																
	C.D at 5%					NS			NS				NS				
	C.V																

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

T-Tolerant, MT-Moderately Tolerant, S- Susceptible

**Sugarcane Genotypes: Twenty(17+3)**

1.	Co 13002	2.	Co 13003	3.	Co13004	4.	CoN13072
5.	CoSnk13101	6.	MS13081	7.	Co13006	8.	Co 13008
9	Co 13009	10	CoC 13013	11	Co 13014	12	Co 13018
13	Co13020	14	CoN13073	15	CoSnk13103	16	CoSnk13106
17	PI13132	18	Co86032(Std)	19	CoC671(Std)	20	CoSnk05103(Std)

The data in Table 3 revealed that the cumulative per cent incidence of early shoot borer was above 30.00% PI 13132 (31.50%), and MS13081 (30.27%), while it was below 15.00 % in CoSnk05103(3.21%), Co13004(5.20%), Co13002(6.07%), CoSnk13106(7.61%) and CoN 13073 (8.25%), Co13018 (8.45%) Co13006(8.53%), Co13003(10.08%),CoSnk13101(10.53%)and Co13014(11.70%) The no. of bored plants/ha by early shoot borer were minimum (13889)in CoSnk05103(Std), while it was maximum (130556)in MS13081.

The % incidence of internode borer was maximum (16.00%) in Co13009 and Co13002. Per cent intensity and infestation index of internode borer was maximum 1.81% and 0.48% respectively in Co 13009, while CoC13013 and MS13081 were free from it. The infestation index of internode borer was below 1 in all varieties/genotypes screened. The per cent incidence of mealy bug was above 5 % in CoSnk 13106(10.00%), While it was 2% and 4% in MS13081and CoN13073 respectively, while other varieties/genotypes screened were free from it.

Pooled data (Table 4) indicates that the cumulative per cent incidence of early shoot borer was in the range of 15 to 30% in Co13020 (16.00), CoC13013 (15.45%), PI13132 (17.18%), Co13009 (18.12%), Co13008 (19.19%), CoC671 (19.64%), Co86032 (21.27%) and MS 13081(21.70%). The % incidence of internode borer was below 20 % in all varieties / genotypes screened. The per cent incidence of mealy bug was above 5 % in CoN 13072(6.00%), CoSnk13106 (6.00%), I13132(8.67%) and Co13004 (9.33%). and Co 13004, CoN 13072,CoSnk 13106 and PI 13132 were moderately tolerant to mealy bug.

**Table 3: Reaction of sugarcane genotypes/varieties to major insect pest in AVT II plant**

Sr. No	Varieties/ genotype	Early shoot borer (% incidence)						Grade	Internode borer			Grade	Mealy bug		Grade
		30 DAP	60 DAP	90 DAP	120 DAP	cumulative	No. of bored plants/ha		% incidence	% intensity	Infestation index		% incidence	% intensity	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Co 13002	0.00	1.15	2.11	3.57	6.07 (14.22)	25000	T	16.00(4.03)	0.95	0.16	T	0(0.71)	0	T
2	Co 13003	0.00	1.25	2.70	7.20	10.08 (18.50)	36111	T	12.00(3.49)	0.76	0.10	T	0(0.71)	0	T
3	Co 13004	0.00	1.32	2.04	2.54	5.20 (12.88)	16667	T	4.00(2.12)	0.26	0.01	T	0(0.71)	0	T
4	CoN 13072	0.00	2.44	2.70	12.00	15.30 (22.96)	55556	MT	8.00(2.91)	0.64	0.05	T	0(0.71)	0	T
5	CoSnk 13101	0.00	0.00	5.45	6.03	10.53 (18.63)	36111	T	6.00(2.52)	0.36	0.02	T	0(0.71)	0	T
6	MS 13081	0.00	5.26	12.84	21.54	30.27 (32.37)	130556	S	0.00(0.71)	0.00	0.00	T	2(1.41)	0.14	T
7	Co 13006	0.00	7.50	1.71	3.42	8.53 (16.63)	36111	T	6.00(2.52)	0.36	0.02	T	0(0.71)	0	T
8	Co 13008	0.00	9.30	9.09	13.85	24.32 (29.47)	100000	MT	6.00(2.52)	0.48	0.03	T	0(0.71)	0	T
9	Co 13009	0.00	12.05	14.71	7.27	24.07 (28.85)	91667	MT	16.00(3.73)	1.81	0.48	T	0(0.71)	0	T
10	CoC 13013	0.00	2.33	11.00	8.53	16.88 (24.25)	66667	MT	0.00(0.71)	0.00	0.00	T	0(0.71)	0	T
11	Co 13014	0.00	0.00	7.62	5.93	11.70 (19.83)	41667	T	10.00(3.23)	0.68	0.07	T	0(0.71)	0	T
12	Co 13018	0.00	2.50	1.08	6.47	8.45 (16.90)	33333	T	6.00(2.52)	0.39	0.02	T	0(0.71)	0	T
13	Co 13020	0.00	9.21	4.95	16.41	23.45 (28.96)	91667	MT	8.00(2.91)	0.51	0.04	T	0(0.71)	0	T
14	CoN 13073	0.00	1.52	1.94	6.25	8.25 (16.63)	30556	T	14.00(3.72)	0.89	0.15	T	4(1.81)	0.72	T
15	CoSnk 13103	0.00	4.55	5.05	9.73	16.34 (23.76)	55556	MT	12.00(3.33)	0.94	0.16	T	0(0.71)	0	T
16	CoSnk 13106	0.00	0.94	4.00	3.68	7.61 (15.18)	30556	T	14.00(3.72)	1.02	0.17	T	10(2.62)	1.18	MT
17	PI 13132	0.00	13.16	9.28	21.55	31.50 (33.86)	122222	S	2.00(1.41)	0.14	0.01	T	0(0.71)	0	T
18	Co 86032 (Std)	0.00	5.19	19.49	9.29	23.25 (28.40)	111111	MT	12.00(3.33)	0.71	0.12	T	0(0.71)	0	T
19	CoC 671 (Std)	0.00	0.00	9.09	14.05	20.55 (26.95)	75000	MT	6.00(2.12)	0.43	0.05	T	0(0.71)	0	T
20	CoSnk 05103 (Std)	0.00	0.00	3.13	0.65	3.21 (9.76)	13889	T	8.00(2.38)	0.43	0.07	T	0(0.71)	0	T
	<b>S.E ±</b>					4.33									
	<b>C.D at 5%</b>					12.81			NS				NS		
	<b>C.V</b>					27.87									

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

T-Tolerant, MT-Moderately Tolerant, S- Susceptible

**Table 4: Mean Per cent incidence of major insect pests in AVT (Pooled)**

Sr. No.	Variety	Cumulative incidence of ESB (%)		% incidence of INB		% incidence of MB	
		Mean	Grade	Mean	Grade	Mean	Grade
1	Co 13002	13.66(21.18)	T	18.67 (25.07)	T	1.33 (1.18)	T
2	Co 13003	8.13 (16.51)	T	14.00 (20.82)	T	2.00 (1.47)	T
3	Co 13004	10.05 (16.29)	T	8.00 (16.14)	T	9.33 (2.25)	MT
4	CoN 13072	9.89 (16.45)	T	10.67 (18.18)	T	6.00 (2.12)	MT
5	CoSnk 13101	14.73 (21.53)	T	14.67 (21.70)	T	2.67 (1.61)	T
6	MS 13081	21.70 (27.39)	MT	9.33 (14.28)	T	2.00 (1.47)	T
7	Co 13006	12.84 (20.34)	T	11.33(19.37)	T	0.00 (0.71)	T
8	Co 13008	19.19 (25.64)	MT	16.00 (22.70)	T	0.67 (1.00)	T
9	Co 13009	18.12 (24.52)	MT	20.00 (24.78)	T	2.67 (1.61)	T

10	CoC 13013	15.45 (23.09)	MT	1.33 (6.77)	T	1.33 (1.29)	T
11	Co 13014	9.26 (17.63)	T	8.67 (16.75)	T	1.33 (1.18)	T
12	Co 13018	10.62 (18.86)	T	6.00 (14.05)	T	4.00 (1.91)	T
13	Co 13020	16.00 (22.89)	MT	10.67 (18.95)	T	3.33 (1.79)	T
14	CoN 13073	8.19 (16.60)	T	10.00 (18.20)	T	2.00 (1.47)	T
15	CoSnk 13103	12.79 (19.88)	T	10.00(17.93)	T	0.67 (1.00)	T
16	CoSnk 13106	11.65 (19.10)	T	12.00 (19.91)	T	6.00 (2.46)	MT
17	PI 13132	17.18 (23.04)	MT	8.67 (15.80)	T	8.67 (2.52)	MT
18	Co 86032 (Std)	21.27 (27.45)	MT	12.00 (20.090)	T	1.33 (1.29)	T
19	CoC 671 (Std)	19.64 (26.27)	MT	12.00 (19.73)	T	3.33 (1.73)	T
20	CoSnk 05103 (Std)	6.95 (14.95)	T	4.67 (12.03)	T	0.67 (1.00)	T
	S.E ±						
	C.D at 5%	NS		NS		NS	
	C.V						

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

T-Tolerant, MT-Moderately Tolerant, S- Susceptible

**Sugarcane Genotypes:Twenty(17+3)**

1.	Co 13002	2.	Co 13003	3.	Co13004	4.	CoN13072
5.	CoSnk13101	6.	MS13081	7.	Co13006	8.	Co 13008
9	Co 13009	10	CoC 13013	11	Co 13014	12	Co 13018
13	Co13020	14	CoN13073	15	CoSnk13103	16	CoSnk13106
17	PI13132	18	Co86032(Std)	19	CoC671(Std)	20	CoSnk05103(Std)

The data in Table 5 revealed that the cumulative per cent incidence of early shoot borer was below 15% in Co 13003(6.99), Co 13014 (7.15), CoSnk 05103 (9.18), CoN13073(9.45), CoN 13072(14.36) and Co13018(14.83), while in other varieties/genotypes it was in the range of 15 to 30%. The no. of bored plants/ha by early shoot borer was maximum (138889) in MS13081 and minimum (27778) in Co13003. The % incidence of internode borer was maximum 16.00% in Co 86032(Std), while it was minimum 2.0% in MS13081, CoC 13013 and CoSnk 05103(Std).The % intensity of internode borer was maximum 1.21 in Co 13008, while it was minimum 0.10 in CoSnk 05103 (Std) and infestation index of internode borer was below 1 % in all varieties/genotypes screened.The per cent incidence of mealy bugwas above 5% in CoC 671 (8.0) and Co 13020(6.0).



**Table 5: Reaction of sugarcane genotypes/varieties to major insect pest in AVT (Ratoon)**

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		% intensity		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
1	Co 13002	1.06	8.05	3.57	8.16	19.87 (26.40)	91667	MT	10.00(3.09)	0.75	0.11	T	4.00(1.81)	0.36	T	
2	Co 13003	0.00	3.16	2.42	1.44	6.97 (15.26)	27778	T	4.00(1.81)	0.23	0.02	T	2.00(1.41)	0.15	T	
3	Co 13004	0.00	10.20	6.35	8.28	23.63 (28.96)	125000	MT	10.00(3.23)	0.71	0.07	T	0.00(0.71)	0.00	T	
4	CoN 13072	0.89	4.93	5.36	4.70	14.36 (22.25)	66667	T	4.00(1.81)	0.25	0.02	T	2.00(1.41)	0.12	T	
5	CoSnk 13101	1.15	16.15	9.02	8.59	28.1 (31.98)	125000	MT	12.00(3.49)	0.73	0.10	T	2.00(1.41)	0.13	T	
6	MS 13081	0.00	9.13	9.46	4.79	22.87 (27.23)	138889	MT	2.00(1.41)	0.12	0.00	T	4.00(2.12)	0.31	T	
7	Co 13006	0.00	8.77	11.05	3.03	19.63 (25.600)	130556	MT	14.00(3.80)	0.69	0.10	T	0.00(0.71)	0.00	T	
8	Co 13008	0.00	12.12	7.02	5.03	22.75 (28.43)	122222	MT	14.00(3.72)	1.21	0.24	T	2.00(1.41)	0.13	T	
9	Co 13009	2.67	10.16	11.11	4.12	23.35 (28.77)	138889	MT	4.00(1.81)	0.23	0.02	T	2.00(1.41)	0.24	T	
10	CoC 13013	0.00	9.78	10.69	2.06	17.03 (24.37)	108333	MT	2.00(1.41)	0.13	0.01	T	2.00(1.41)	0.48	T	
11	Co 13014	0.00	3.27	2.33	3.35	7.15 (15.36)	38889	T	6.00(2.52)	0.38	0.02	T	4.00(2.12)	0.00	T	
12	Co 13018	0.00	13.50	0.83	1.94	14.83 (22.60)	75000	MT	4.00(1.81)	0.27	0.02	T	4.00(2.12)	0.26	T	
13	Co 13020	0.00	10.56	5.92	3.75	18.54 (25.39)	97222	MT	10.00(3.23)	0.63	0.07	T	6.00(2.52)	0.50	MT	
14	CoN 13073	0.00	4.27	4.46	2.58	9.45 (17.39)	44444	T	10.00(2.62)	0.55	0.11	T	0.00(0.71)	0.00	T	
15	CoSnk 13103	0.00	12.06	13.70	0.62	19.10 (25.77)	105556	MT	4.00(2.12)	0.24	0.01	T	2.00(1.41)	0.12	T	
16	CoSnk 13106	0.76	14.04	7.96	2.45	22.04 (28.03)	125000	MT	6.00(2.52)	0.57	0.03	T	2.00(1.41)	0.11	T	
17	PI 13132	0.00	10.60	7.60	2.75	16.29 (23.53)	94444	MT	6.00(2.52)	0.48	0.03	T	4.00(1.81)	0.24	T	
18	Co 86032 (Std)	0.00	8.67	11.17	4.79	19.61 (26.24)	119444	MT	16.00(3.73)	1.11	0.29	T	2.00(1.41)	0.13	T	
19	CoC 671 (Std)	0.00	6.00	8.48	5.68	16.83 (24.14)	91667	MT	10.00(3.23)	0.75	0.08	T	8.00(2.38)	0.74	MT	
20	CoSnk 05103 (Std)	0.00	2.99	3.21	2.96	9.18 (17.46)	55556	T	2.00(1.41)	0.10	0.01	T	0.00(0.71)	0.00	T	
	S.E ±															
	C.D at 5%				NS											
	C.V															

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

T-Tolerant, MT-Moderately Tolerant, S-Susceptible

## East Coast Zone

### Regional Agricultural Research Station, Anakapalle, ANGRAU, Andhra Pradesh

Among nineteen entries, , one entry, Co C 16336 (11.02%) in AVT (early) I plant crop, two entries viz., Co C 15336 (6.13%DH) and Co C 15338 (5.17%DH) in AVT (early) – II plant crop and two entries viz., Co V 15357 (5.06% DH) and Co C 16338 (7.18 % DH) in AVT (midlate)-I plant crop registered less incidence of early shoot borer and found promising against early shoot borer whereas high incidence of early shoot borer (32.24%DH) was registered in susceptible check, Co A 99082 (Table 1).

Among all the test entries, Co C 16 339 (16.67%) of AVT (midlate) I plant crop, Co C 16 336 (23.33%), Co V 16356 (23.33%) of AVT (Early) I plant crop and Co C15338 (40.00%) of AVT(Early) II plant crop found promising against internode borer whereas high incidence of internode borer (76.67%) was register

Table 1 Reaction of different AVT entries towards the incidence of early shoot borer						
Genotype	Incidence of early shoot borer up to 120 DAP (%DH)					Reaction
	30 DAP	60 DAP	90 DAP	120 DAP	Cumulative up to 120 DAP	
<b>AVT (Early) I plant</b>						
Co A 16321	(4.53)	(11.59)	(6.18)	(2.61)	(23.98)	MS
Co C 16 336	(2.94)	(9.08)	(4.75)	(2.05)	(11.02)	LS
Co C 16 337	(5.30)	(15.45)	(12.31)	(5.33)	(23.62)	MT
Co V16 356	(5.40)	(10.10)	(3.37)	(5.09)	(19.60)	MT
<b>AVT (Early) II Plant</b>						
Co C 15336	(2.13)	(3.87)	(0.21)	(1.77)	(6.13)	T
Co C 15338	(1.58)	(1.82)	(0.97)	(1.15)	(5.17)	T
Co V 15 356	(6.09)	(9.12)	(0.26)	(1.25)	(15.33)	MT
Co A 92081 (C)	(3.30)	(6.78)	(2.07)	(0.43)	(12.42)	MT
Co Or 03151 (C)	(3.05)	(7.00)	(0.62)	(3.51)	(11.65)	T
Co C 01061 (C)	(5.59)	(1.88)	(0.29)	(3.16)	(9.57)	T
<b>AVT (Mid late) I plant</b>						
Co C15339	(5.39)	(3.92)	(3.69)	(2.31)	(13.01)	T
Co Or 15346	(3.26)	(1.63)	(1.79)	(3.06)	(11.01)	T
Co C 16 338	(3.97)	(4.19)	(1.40)	(0.25)	(7.18)	T
Co C16 339	(5.08)	(3.67)	(3.27)	(0.00)	(12.02)	T
Co V 16 357	(2.05)	(1.34)	(0.75)	(0.82)	(5.06)	T
Co 06030 (C)	(1.60)	(1.88)	(0.83)	(1.18)	(5.81)	T
Co V92102 (C)	(5.84)	(6.83)	(2.61)	(0.00)	(10.82)	T
Co 86 249 (C)	(4.18)	(9.69)	(3.11)	(2.13)	(14.28)	T
Co A 99082 (Sus.Check)	(5.26)	(19.89)	(2.28)	(4.81)	(32.24)	S
Insect pest	Tolerant	Moderately Tolerant -	Suscep tible	Insect pest	Tolerant	Moderately Tolerant -
ESB	0 - 15.0%	15.1 - 30.0%	> 30.1 %	ESB	0 - 15.0%	15.1 - 30.0%

Susceptible check, Co A 99082 (Table 2)

SC: Susceptible check DAP: Days after planting .

<b>Table 2 Reaction of AVT entries towards the incidence of internode borer</b>				
<b>Genotype</b>	<b>Internode borer</b>			
<b>AVT (Early) I plant</b>	<b>Incidence (%)</b>	<b>Intensity (%)</b>	<b>Infestation index</b>	<b>Reaction</b>
Co A 16321	63.33	6.47	4.66	S
Co C 16 336	23.33	1.86	0.52	MT
Co C 16 337	60.00	5.01	2.49	S
Co V16 356	23.33	2.21	0.91	MT
Co A 92081 (Check)	36.67	2.63	1.58	MT
Co Or 03151 (Check)	60.00	6.41	3.74	S
Co C 01061(Check)	26.67	2.71	0.68	MT
Co A 99082 (Sus.Check)	76.67	5.96	4.61	S
<b>AVT (Early) II Plant</b>				
Co C 15336	44.85	4.52	2.16	S
Co C 15338	40.00	3.72	1.92	MT
Co V 15 356	46.67	3.54	2.00	S
Co A 99082 (Sus. Check)	76.67	5.96	4.61	S
<b>AVT (Midlate) I plant</b>				
Co C15339	43.33	4.71	2.75	S
Co Or 15346	56.30	4.18	2.98	S
Co C 16 338	56.67	6.26	4.20	S
Co C16 339	16.67	1.66	0.59	T
Co V 16 357	56.67	4.21	2.92	S
Co 06030 (Check)	70.00	6.48	6.27	S
Co V92102 (Check)	40.00	3.74	1.46	MT
Co 86 249 (Check)	43.33	3.32	1.72	S
Co A 99082 (Sus.Check)	76.67	5.96	4.61	HS
Insect pest	Tolerant	Moderately Tolerant -	Susceptible	Insect pest
INB	0 - 20.0%	20.1 - 40.0%	> 40.1%	INB

SC: Susceptible check

DAP: Days after planting

## Project E-28: Survey and surveillance of sugarcane insect-pests

### North West Zone

#### ICAR-SBI, RC, Karnal, Haryana

To identify the key insect pests' of sugarcane under North Western Zone, insect pests' survey was carried out under the reserved areas of 12 Co-operative sugar mills of Haryana namely; Shahabad, Karnal, Meham, Sonipat, Palwal, Jind, Kaithal, Asandh Gohana, Rohtak, Panipat and Yamuna nagar Haryana and 03 sugar mills of Uttar Pradesh viz., Dhampur, Sheohara, Ramnagar and Laxar sugar mills, Uttarakhand. Early shoot borer, top borer, root borer, stalk borer; pyrilla, black bug and termites were listed as key pests of sugarcane in Haryana. Gurdaspur borer, Pink borer and Blister mite were identified as minor pest of Sugarcane in Haryana, UP and UK. Pyrilla, army worm, grass hopper, white fly, yellow mites, mealy bug and thrips were recorded as occasional pest of sugarcane under the zone. The incidence of whorl weevil, plant hopper and blister mites was 0.0 to 4.0, 0.0 to 2.0 and 0.0 to 2.0 weevils/ whorl; 0.0 to 41.0, 0.0 to 52.00 and 0.0 to 49.0 adults/nymphs/ whorl and 0.0 to 75.0, 0.0 to 87.0 and 0.0 to 85.0% in Haryana, western Uttar Pradesh and Uttarakhand, respectively. Early shoot borer and pink borer incidence was 0.0 to 13.6, 0.0 to 17.0, and 0.0 to 22.0 per cent in Haryana, western Uttar Pradesh and Uttarakhand, respectively. Top borer incidence was 0.0 to 30.0, 0.0 to 46.0 and 0.0 to 51.0 per cent in Haryana, western Uttar Pradesh and Uttarakhand, respectively (where farmers have not applied control measures properly). Root borer incidence was 0.0 to 15.0, 0.0 to 22.0 and 0.0 to 27.0 per cent in Haryana, western Uttar Pradesh and Uttarakhand, respectively. Stalk borer incidence was 0.0 to 35.0, 0.0 to 45.0 and 0.0 to 40.0 per cent in Haryana, western Uttar Pradesh and Uttarakhand, respectively.

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

S.No	Area	Pop./Incidence									
		BB/ tiller	WW / whorl	PH / whorl	WG/m <sup>2</sup>	BM (%)	ESB (%)	PB (%)	TB (%)	RB (%)	SB
1	Haryana	0.0 to 09.0	0.0 to 4.0	0.0 to 41.0	0.0 to traces	0.0 to 75.0	0.0 to 13.6	0.0 to 17.5	0.0 to 30.0	0.0 to 15.0	0.0 to 35.0
2	UP	0.0 to 13.0	0.0 to 2.0	0.0 to 52.0	0.0 to 2.0	0.0 to 87.0	0.0 to 17.0	0.0 to 11.3	0.0 to 46.0	0.0 to 22.0	0.0 to 45.0
3	UK	0.0 to 12.0	0.0 to 2.0	0.0 to 49.0	0.0 to 2.0	0.0 to 85.0	0.0 to 22.0	0.0 to 12.0	0.0 to 51.0	0.0 to 27.0	0.0 to 40.0

**BB= Black bug, WW= whorl weevil, PH= Plant hopper, WG=white grubs, BM=Blister mite, ESB= Early shoot borer, PB=Pink borer, TB =Top borer, RB= Root borer, SB= Stalk bore.**

Black bug incidence varied from traces to 9.0, 13.0 and 12.0, individuals/ tillers in Haryana, western Uttar Pradesh and Uttarakhand, respectively. White grub incidence varied from 0 to T, T to 2.0 grubs/m<sup>2</sup> and T to 2.0 grubs/m<sup>2</sup> mostly in sandy soils in Haryana, western Uttar Pradesh and Uttarakhand, respectively. White grub early shoot borer, top borer, root borer, stalk borer; pyrilla, black bug and Termites were identified as key pests in western Uttar Pradesh and Uttarakhand.

#### UP Council of Sugarcane Research, Shahjahanpur, Uttar Pradesh.

A survey has been made in different sugar factory zones of five districts viz; Shahjahanpur, (Rosa, Maksudapur, Nigohi sugar mill), Pilibhit (Pilibhit and Barkhera sugar mill area), Hardoi (Loni sugar mill), Sitapur (Jawaharpur, Ramgarh, Hargaon sugar mill area) and Lakhimpur Kheri (Ajabapur, Kumbhi, Gola, Palia, Gularia, Aira, Khambarkhedha sugar mill area) to know the major insect pest of the areas. During hot weather the incidence of shoot borer was low and ranged from 1.50% (Jawaharpur, Ramgarh, Hargaon sugar mill area) to 4.5% (Rosa, Maksudapur, Nigohi sugar mill). The incidence of top borer was recorded low and ranged from 1.50% (Jawaharpur, Ramgarh, Hargaon, Pilibhit, Barkhera, Loni sugar mill area) to 2.5% (Rosa, Maksudapur, Nigohi sugar mill area). The incidence of root borer was recorded low ranged from 0.5% (Jawaharpur, Ramgarh and Hargaon sugar

mill area) to 7% (Lakhimpur kheri district sugar mill area). The incidence of stalk borer was recorded low ranged from 4.0% (Pilibhit, Barkhera, Loni sugar mill area) to 7.5% (Jawaharpur, Ramgarh, Hargaon sugar mill area). The defoliator grass hopper was recorded in stray in all factory zones while army worm was found in stray in all factory zones except Loni sugar mill area. Sucking pest mealy bug and thrips were recorded in stray in all sugar mill zones except Jawaharpur, Ramgarh and Hargaon sugar mill area. Sucking pest web mite was found only in Rosa sugar mill area in patches. White grub incidence was found in Barkhera sugar mill area in one field only (Table 2).

**Table 2.** Survey and surveillance of sugarcane insect pests in the area (U.P.C.S.R. Shahjahanpur).

Sl. No.	Varieties	Location	Name of pest	Incidence/population		
				Min.	Max.	Avg.
1	Co 0118, Co 0238, CoH 160 (Ratoon), CoLk 94184	Rosa, Maksudapur, Nigohi sugar mill area (Shahjahanpur district)	Early shoot borer (% incidence)	1	8	4.5
			Top borer (% incidence)	1	4	2.5
			Root borer (% incidence)	1	3	2
			Stalk borer (% incidence)	3	7	5
			Army worm	1	2	1.5
			Mite (Rosa)	20	30	25
			Thrips	8	12	10
			Mealy bug	5	8	6.5
			Grass hopper	1	3	2
2	Co 0238, CoS 08272, CoS 08279, CoH 160,	Pilibhit sugar mill and Barkhera sugar mill area (Pilibhit district)	Early shoot borer (% incidence)	1	3	2
			Top borer (% incidence)	1	2	1.5
			Stalk borer (% incidence)	2	6	4
			White grub (Barkhera)	2	3	2.5
			Army worm	1	2	1.5
			Thrips	3	5	4
			Mealy bug	1	4	2.5
Grass hopper	1	2	1.5			
3	Co 0238, Co 0118, CoS 08272	Loni Sugar mill area (Hardoi district)	Early shoot borer (% incidence)	1	4	2.5
			Top borer (% incidence)	1	2	1.5
			Stalk borer (% incidence)	3	5	4
			Root borer (% incidence)	1	3	2
			Mealy bug	2	6	4
Grass hopper	2	3	2.5			
4	Co 0238, Co 0118, CoS 08272, CoLk 94184	Jawaharpur, Ramgarh and Hargaon Sugar mill area (Sitapur district)	Early shoot borer (% incidence)	1	2	1.5
			Top borer (% incidence)	1	2	1.5
			Stalk borer (% incidence)	6	9	7.5
			Root borer (% incidence)	0	1	0.5
			Army worm	0	2	1
			Grass hopper	1	2	1.5
5	Co 0238, Co 0118, Co 98014, CoLk 94184, CoS 08272, CoS 13231, CoS 08279	Ajbapur, Kumbhi, Gola, Pallia, Gularia, Aira, Khambharkhera sugar mill area (Lakhimpur Kheri)	Early shoot borer (% incidence)	1	3	2
			Top borer (% incidence)	1	3	2
			Root borer (% incidence)	2	12	7
			Stalk borer (% incidence)	4	8	6
			Army worm	1	2	1.5
			Grass hopper	2	3	2.5
			Thrips	2	3	2.5
			Mealy bug	2	4	3
Black bug	2	5	3.5			

**Table 3 (a). Monitoring of insect-pests and bio-agents in sugarcane (UPCSR Shahjahanpur).**

Period of observation Dates + SMW	% incidence early shoot borer	% Parasitism (ESB)		Stalk borer			% Parasitism (Stalk borer)
		<i>T.chilonis</i>	<i>E.annulipes</i>	% incidence	% intensity	Infestation index	<i>Cotesia flavipes</i>
1	2	3	4	5	6	7	8
16-04-19, 16 <sup>th</sup> SMW	2.10	-	-	-	-	-	-
18-05-19, 20 <sup>th</sup> SMW	3.07	-	-	-	-	-	-
17-06-19, 24 <sup>th</sup> SMW	4.31	-	-	-	-	-	-
20-07-19, 29 <sup>th</sup> SMW	1.56	-	-	-	-	-	-
20-08-19, 34 <sup>th</sup> SMW	-	-	-	-	-	-	-
22-09-19, 38 <sup>th</sup> SMW	-	-	-	21.33	1.71	0.36	6.00
25-10-19, 43 <sup>th</sup> SMW	-	-	-	22.67	1.79	0.41	8.00
19-11-19, 47 <sup>th</sup> SMW	-	-	-	-	-	-	-

**Table 3 (b). Monitoring of insect pests and bio-agents in sugarcane, (UPCSR Shahjahanpur)**

Period of observation Dates + SMW	% incidence top shoot borer	% Parasitism (Top shoot borer)						
		<i>T. beneficiens</i>	<i>L. javensis</i>	<i>A. flavipes</i>	<i>Rhaconotus Scripophugae</i>	<i>Elasmus zehntneri</i>	<i>S. deesae</i>	<i>B. bassiana</i>
1	2	3	4	5	6	7	8	9
16-04-19, 16 <sup>th</sup> SMW	-	-	-	-	-	-	-	-
30-05-19, 22 <sup>nd</sup> SMW	1.38	1.25	-	-	-	-	-	-
28-06-19, 26 <sup>th</sup> SMW	2.62	3.00	1.00	-	1.20	-	-	-
30-07-19, 31 <sup>st</sup> SMW	3.00	7.00	3.00	-	1.50	-	2.00	-
28-08-19, 35 <sup>th</sup> SMW	5.28	2.00	2.00	-	3.00	-	2.50	-
20-09-19, 38 <sup>th</sup> SMW	-	-	-	-	1.00	-	3.00	-
25-10-19, 43 <sup>rd</sup> SMW	-	-	-	-	-	-	-	-

**ICAR-Indian Institute of Sugarcane Research, Lucknow, Uttar Pradesh**

The incidence of Delphacid Plant Hopper, *Eoerysa flavocapitata* has also been reported in sugarcane from Triveni Sugar Mill, Khatauli, Muzaffarnagar area. Crop vigor is withered (Fig. 1). Some sort of sticky honey dew was observed on under surface of newly opened leaves that invited black sooty mould. Under surface of most of the leaves were covered with black sooty mould. In spite of yield loss to the crop it made the green cane tops unfit for cattle feed.



Fig.1: Affected crop with Delphacid plant hopper

The incidence of internode, top and stalk borer (5-6%) was noticed at several locations in Loni sugar mill area. In one location, cane leaves damage by unidentified weevil was observed. The incidence of black beetle (*Heteronychus* sp.) was observed at several locations and contributed more than 30% of dead heart in the field in areas of Biswa and Chilberia sugar mill.

Incidence of borer pests of sugarcane has decreased in western Uttar Pradesh specially early shoot borer due to excess use of Chlorantraniliprole a borer specific insecticide.

### North Central Zone

#### Sugarcane Research Institute Dr. Rajendra prasad central agricultural university, Pusa, samastipur, Bihar

A survey was conducted on the insect pests of sugarcane under Bihar sugarcane Agro-ecosystem during cropping season of 2019-20. The data presented in table 7 revealed that the average per cent incidence of root borer (3.40-5.25 %), shoot borer (6.65-8.80%), top borer (9.65-10.5 %), stalk borer (2.25-3.5%) and plassey borer (3.15-3.50%) were observed as the key pests of sugarcane. The incidence of other pests like Mealy bug, Termite, Grass hopper, Scale insect, White fly, mites, pyrilla etc were also recorded in traces.

**Table.7: Survey and surveillance of sugarcane insect pests under Bihar agroecosystem (2019-20).**

Sl No.	Variety	Location	Name of pest	% Incidence		
				Min.	Max.	Average
1	CoP 9301, Rajendra Ganna-1, BO 153, CoP 112, CoP 2061	Kalyanpur	Root borer	3.60	6.30	4.95
			Pyrilla/leaves	2.70	9.50	6.1
			Shoot borer	5.90	11.70	8.8
			Top borer	4.60	14.70	9.65
2	CoP 9301, BO 153, BO 153, CoP 112, COP 2061, Rajendra Ganna-1	Madhopur	Pyrilla	2.50	7.90	5.2
			Shoot borer	3.70	9.60	6.65
			Root borer	2.30	6.30	4.3
			Grasshopper	3.50	10.90	7.3
3	Co 0238	Hasanpur	Pyrilla	1.70	5.60	3.65
4	BO 91, BO 146, BO 130, CoP 2061, CoP 9301, CoP 9206, Rajendra Ganna-1	SRI, Museum	Pyrilla	4.00	6.30	5.15
			Top borer	6.70	14.10	10.4
			Plassey borer	2.00	5.00	3.5
			Grasshopper	2.00	7.00	4.5
			Shoot borer	5.00	10.30	7.65
			Stalk borer	2.00	2.50	2.25
5	Co 0238, Co 0233, Co 98014, Co pant 98224, CoP 9301	Narkatiyagang	White fly	2.00	8.00	5.0
			Mite	4.00	7.00	5.5
6	CoP 2061, BO 154, CoP 153, CoP 9206, Rajendra Ganna-1, CoP 9301	Pusa Farm	Pyrilla	1.50	3.70	2.6
			Root borer	3.50	7.00	5.25
			Scale insect	2.90	8.60	5.75
			Shoot borer	4.00	12.00	8
			Top borer	6.00	15.00	10.5
			Stalk borer	2.00	5.00	3.5
			Plassey borer	1.25	5.00	3.15

## Peninsular Zone

### ICAR-Sugarcane Breeding Institute, Coimbatore, Tamil Nadu

In July 2019, white grub was moderate in Thalavady with the numbers in the range of 0-10 per meter length. The numbers were slightly lower in August. At Satyamangalam, the incidence was lower with 0-3 grubs in September 2019. The numbers further decreased in October 2019 with pupal and adult occurrence in the root zone of the crop. High incidence of whitefly was noticed at Mundiampakkam area under M/s Rajshree Sugars & Chemicals Ltd; however the field had equally high natural incidence (> 90%) of entomopathogenic fungus *Aschersonia placenta*.

**Table 8. Status of sugarcane pests and their natural enemies in sugar factory areas of Tamilnadu**

S. No.	Variety	Location	Name of pest/parasitoid	% incidence/population			Remarks
				Min	Max	Average	
1	Co 86032	M/s Bannari Amman Sugars, Annur, Coimbatore, Satyamangalam	Shoot borer	2.26	32.23	-	
			Internode borer	4.5	20.08	-	
			Top borer	0.20	0.44	-	Traces
			Fall armyworm	-	-	-	Traces
			Pink mealybug	0.94	23.77	-	
			Scale insect			-	Traces
			Woolly aphid	1.8	2.68	-	Patches
2	Co 86032	M/s Rajashree Sugars Ltd, Mundiampakkam	Whitefly	24/2 cm <sup>2</sup>	104/2 cm <sup>2</sup>	65.4/2 cm <sup>2</sup>	High natural incidence of <i>Aschersonia placenta</i>
			Shoot borer	0.0	12.5	-	
3	Co 86032	M/s Ponni Sugars Erode	Shoot borer	0.0	30.0	-	

### UAS, Zonal Agricultural Research Station V. C. Farm, Mandya, Karnataka

#### Experiment-2

During 2019-20 survey was conducted at monthly interval in three sugar factory areas of Mandya district. During the survey ten insect pests and two species of mites was recorded on sugarcane. Due to long dry spell in the early part of rainy season and frequent rainfall in later part resulted in higher incidence of all three borers namely Early shoot borer, Top shoot borer and Internode borer. Activity of army worm in sugarcane was low. Incidence of root grubs was more in borewell irrigated plots. Due to frequent rains during August to October, incidence of woolly aphid was more, but the natural enemies *Encarsia flavoscutellum* and *Dipha aphidivora* kept the pest under check. Even though Pyrilla leaf hopper and termite appeared in few places they did not cause economic loss to the crop (Table-4).



**Table 4: Survey and Surveillance of insect pests of sugarcane at Mandya**

Sl.No	Pest	Level of Incidence (%)
1	Early shoot borer	6.50 – 28.00
2	Top shoot borer	8.00 – 21.50
3	Internode borer	17.50 – 39.50
4	Sugarcane pyrilla	<0.50- 1.0 adult / nymph / clump
5	Mealy bug	28.00- 45.00% setts failed to germinate (3instances) Incidence in grownup cane with 22.25 % Intensity.
6	Woolly aphid	Few clumps to one gunta area (40 – 65 % leaf area covered by aphids) 30 instances. In all the places activity of <i>Encarsia</i> and <i>Dipha</i> was observed.
7	Red spider Mite	7 -18 % shoots showing symptoms (12 instances )
8	White fly <i>N.bergi</i>	In traces ( 2 instances)
9	White fly <i>A.rugiperculatus</i>	Egg laying on sugarcane ( 3instances)
10	Termite	Damage in patches (2 instances)
11	Root grub	One gunta to 10gunta area affected 8 instances .larval population range 3 – 4grubs / clump.
12	Army worm	6-20 % leaf area affected in 3 instances.

**CSR, MPKV, Pade gaon, Maharashtra**

Roving survey of sugarcane was carried out during 2019-20 in the sugarcane fields of areas of Pune, Satara, Kolhapur and Sangli and different villages of the respective districts. In most of the fields, CoM 0265 and Co 86032 varieties were planted. The new varieties viz., MS 10001 was 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.

**Results :** The incidence/infestation of ESB, Top borer, IB, Pirelli, Woolly aphids, Scale insect, Mealy bug, White fly and White grub and their natural enemies were observed during the survey (Table-5).

**Pune Dist. :** Survey was undertaken in villages viz., Someswar, Wanewadi, Wagalwadi, Gulanche and Nimbut. During the survey range of per cent incidence of ESB, TB and IB was 9.53 to 29.14, 0.00 to 3.33 and 10.66 to 20.00, respectively, were observed. Whereas, sucking pests viz, pyrilla, woolly aphids, scale insect, mealy bug and white fly showed their population in the range of 0.00,2.20 to 37.20, 0.00, 10.00 30.33 and 0.00, respectively on above mentioned sugarcane varieties. The infestation of white grub was not observed throughout the crop period due to severe rain fall (flood situation) during the rainy season. At Pune Dist. borer incidence was found low to moderate level. Sucking pests was found low level whereas, white grub population was not observed.

**Satara Dist. :** Survey was undertaken in villages viz., Rethare, Bhoinj, Phaltan, Taradgaon and Padegaon. During the survey range of per cent incidence of ESB, TB and IB was 5.40-19.10, 0.00 and 7.60-15.00, respectively. However, sucking pests viz, pyrilla, woolly aphids, scale insect, mealy bug and white fly showed their population in the range of 0.00,5.20-25-20, 0.00, 9.5020.80 and 0.00, respectively on above mentioned sugarcane varieties. The infestation of white grub was not observed throughout the crop period due to severe rain fall (flood situation) during the rainy season.

**Kolhapur :** Survey was undertaken in villages viz., Unchgaon, Kasba Bavada, Kuditre and Kagal. The range of per cent incidence of borer ESB, TB and IB was 15.40-40.80, 0.00 and 10.20-25.60, respectively was observed during the survey. Whereas, sucking pests viz, pyrilla, woolly aphids, scale insect, mealy bug and white fly showed their population in the range of 2.66-4.33, 16.30-45.50, 0.00, 11.50-24.20 and 0.00, respectively on above mentioned sugarcane varieties. The infestation of white grub was not observed throughout the crop period due to severe rain fall (flood situation) during the rainy season.

**Sangli :** Survey was undertaken in villages viz., Islampur, Asta, Tung and Digraj. During the survey range of per cent incidence of ESB and IB was 8.40-32.60 and 5.60-15.80, respectively. However, sucking pests viz, woolly aphids, mealy bug and white fly showed their population in the range of 12.00-47.00,9.20-23.40 and 0.00, respectively on above mentioned sugarcane varieties. The infestation of white grub was not observed throughout the crop period due to severe rain fall (flood situation) during the rainy season.

Overall survey indicated that, borer incidence was low to moderate. Whereas, sucking pests showed low to moderate level on infestation. White grub was not observed due to severe rains and flood situation during middle of June to August 2019.

**Table 5 : Survey and surveillance of sugarcane insect pests (2019-20).**

Sr. No	Variety	Dist. & Location	Name of pest	% incidence/Population		Remark
				Min.	Max.	
1	Co 86032 CoM 0265 MS 10001	<b>Pune</b> Someswar, Wanewadi Wagalwadi Gulanche Nimbut	Early shoot borer	9.35	29.14	At Pune Dist. borer incidence was found low to moderate level. Sucking pests was found low level whereas, white grub population was not observed.
			Top shoot borer	0	3.33	
			Internode borer	10.66	20.00	
			Pyrilla/ leaf	--	--	
			<i>Epiricania melanoleuca</i> /plant	--	--	
			Woolly aphid	2.20	37.20	
			Scale insect	0.0	0.0	
			Mealy bug	10.00	30.33	
			White fly	--	--	
			White grub	--	--	
			Any other new pests	--	--	
2	Co 86032 CoM 0265	<b>Satara</b> Rethare, Bhoinj Phaltan Taradgaon Padegaon	Early shoot borer	5.40	19.10	At Satara Dist. borer incidence was found low level. Similarly sucking pest infestation was also found lower level. However, white grub was not observed during the survey
			Top shoot borer	0.00	0.00	
			Internode borer	7.60	15.00	
			Pyrilla/ leaf	--	--	
			<i>Epiricania melanoleuca</i> /plant	--	--	
			Woolly aphid	5.20	25.20	
			Scale insect	0.0	0.0	
			Mealy bug	9.50	20.80	
			White fly	--	--	
			White grub	--	--	
			Any other new pests	--	--	
3	Co 86032 CoM 0265	<b>Kolhapur</b> Unchagaon Kasbabavda Kuditre Kagal	Early shoot borer	15.40	40.80	In Kolhapur Dist. ESB and IB showed moderate level of incidence. Sucking pests infestation was observed less except woolly aphid infestation, it was moderate level. <b>Due to sever flood white grub not observed.</b>
			Top shoot borer	0.00	0.00	
			Internode borer	10.20	25.60	
			Pyrilla/ leaf	2.66	4.33	
			<i>Epiricania melanoleuca</i> /plant	1.33	2.00	
			Woolly aphid	16.30	45.50	
			Scale insect	0.0	0.0	
			Mealy bug	11.50	24.20	
			White fly	--	--	
			White grub	0.00	0.00	
			Any other new pests	--	--	
4		<b>Sangli</b> Islampur Asta Tung Digraj	Early shoot borer	8.40	32.6	ESB & IB were found low to moderate level. Among the Sucking pests, Woolly aphid & Mealy bug showed moderate infestation. <b>Due to sever flood situation white grub not observed.</b>
			Internode borer	5.60	15.80	
			Woolly aphid	12.00	47.00	
			Mealy bug	9.20	23.40	
			White fly	--	--	
			White grub	--	--	
			Any other new pests	--	--	

## Vasantdada Sugar Institute, Pune, Maharashtra

Roving survey of sugarcane fields at 5-8 Km distance were recorded.

- Report containing information on location, variety, date of planting. Spacing, fertilizer doses and intercrops, if any.
- Observations on incidence of borers be recorded by examining 100 canes at five places (four corners and in the middle), sucking pests by examining 20 canes and others as mentioned in technical programme of E 4.1.

### 11.Results

Data in Table (6) showed that % incidence of early shoot borer was in the range of 0.33 to 4.15%, while it was maximum 4.15% in December 2019 ratoon crop of CoM 0265. The % incidence of internode borer was in the range 20.00 to 60.00%, while it was maximum. 60.00 % in CoM 0265 planted in the month on July 2019. The incidence of mealy bug(30%) was found only in July 2019 ratoon crop of CoM 0265

**Table 6:Per cent incidence / intensity of major pest at Someshwar SSK. Ltd Dist. Pune**

Sr. No	Name of the Farmer	Village	Variety	Date of planting/ ratoon	Name of the pest				
					Early shoot borer	Internode borer		Mealy bug	
						% Inci.	% inci	% inten	% inci
1	Mr. Kadam M. B.	Murum	CoM 0265	1.7.2019	-	40	3.01	30	5.26
2	Mr. Kadam M. B.	Murum	CoM 0265	Jan.2020 R	0.97	-	-	-	-
3	Mr. Kadam M. B.	Murum	CoM 0265	1.2.2019	2.65	-	-	-	-
4	Mrs. Pawar P. P.	Murum	CoM 0265	11.12.2019 R	4.15	-	-	-	-
5	Mr. Pawar R. P.	Murum	CoM 0265	15.12.2019 R	2.24	-	-	-	-
6	Mrs. Bhosale Y. S.	Wanewadi	CoM10001	17.11.2019	0.33	-	-	-	-
7	Mr. Bhosale, V. B.	Wanewadi	CoM 0265	1.7.2019	-	60	4.97	0	0
8	Mr. Bhosale, M. B.	Wanewadi	CoM 0265	25.12.2019 R	2.90	-	-	-	-
9	Mr. Bhosale, N. B.	Wanewadi	VSI 8005	1.1.2018	-	30	0.95	0	0
10	Mr. Jagtap P.R.	Wanewadi	CoSnk 09293	Dec.2019	0.59	-	-	-	-
11	Mr. Kakade U N.	Nimbut	CoM 0265	1.7.2019	-	20	2.61	0	0
12	Mr. Kakade P. B.	Nimbut	CoM 0265	1.7.2019	-	40	4.32	0	0

### East Coast Zone

#### Regional Agricultural Research Station, Anakapalle, ANGRAU, Andhra Pradesh

During 2019-20, roving surveys were conducted in Visakhapatnam, Vizianagaram and East Godavari districts of Andhra Pradesh. Moderate to severe incidence of early shoot borer (30-60%) recorded during the months of March-June with maximum incidence (40-60%) during June at Chodavaram mandal of Visakhapatnam district due to high temperature and low relative humidity prevailed during that period. Low to moderate incidence of fall army worm (2-20%) was observed during the months of March to May with maximum incidence during April (20%). Moderate to severe incidence of sugarcane mite, *O.indicus* (30-60%) was recorded on 93 A 145 which was planted during April month with peak incidence during May month (60%) at RARS, Anakapalle. Moderate incidence of leaf mealybug was observed in leaf whorls on 30-40 days old crop (10-30%) with peak incidence during June month. Moderate to severe incidence of web mite, *Schizotetranychus* spp (30-80%) was observed with maximum incidence (60-80%) in ratoon crop of the variety 87 A 298 (60-80%) at Vizianagaram district during July month. Maximum incidence of oriental thrips, *Fulmikiola orientalis* (10-30%) termite (50-60%), yellow mealybug, *K. sacchari* (20-50%) were observed during the month of June in Chodavaram mandal in rainfed sugarcane (Table 3).

Moderate incidence of internode borer (10-25% bored canes), maximum incidence of sugarcane aphid, *M. sacchari* (50-150/leaf) and spotted whitefly, *N. bergii* (5-8 no/leaf) were observed on 2003 A 255 and 87A 298 varieties in Vizianagaram district during July month. Moderate to severe incidence of scale insect (10-60%), woolly aphid, *C. lanigera* (>25-50% leaf area in some patches) were observed during December, 19 – February, 2020 (Table 3). The two mite infested leaf samples of sugarcane and mite population collected / preserved in ethyl alcohol were sent to Dr. Sinivasa Nagappan, The University Head, Entomology & Principal Investigator - AINP, Agril. Acarology, UAS , GKVK, Bangalore. The two mite samples which are occurring in sugarcane agro ecosystem in Andhra Pradesh were characterized at molecular level at UAS, Bengaluru and identified as follows.

1. **Sugarcane mite** (earlier termed as **Red mite**)- *Oligonychus indicus*, *Tetranychidae*, *Acarina* (**GenBank: MN190324.1**)

2. **Web mite** (Earlier termed as **Yellow mite**- *Oligonychus sacchari*) - *Schizotetranychus krungthepensis*, *Tetranychidae*, *Acarina* (**GenBank: MN238811.1**)

Molecular identification of Sugarcane aphid (*Melanaphis sacchari*) and sugarcane/ spotted whitefly (*Neomaskellia bergii*) was done by extracting DNA from the above insect samples collected in sugarcane and amplified DNA by PCR at Regional Agril. Research Station, Anakapalle were sent for sequencing and confirmed the species.

**Table 3 Survey on occurrence of insect pests in sugarcane during 2019-20**

Period of Visit	Varieties	Location	Name of the insect pest	Incidence (%) /population of major insect pests			Remarks
				Min.	Max.	Average	
March, 19	2005 A 128	Research farm, RARS, Anakapalle	Early shoot borer, <i>Chilo infuscatellus</i> (%)	30.0	40.0	35.0	Due to high temperatures low to moderate incidence of early shoot borer was observed on all commercial varieties
April, 19	2009 A 107		Early shoot borer, <i>C. infuscatellus</i> (%)	12.0	2.0	16.0	
		Fall army worm, <i>Spodoptera frugiperda</i> (%)	3.0	5.0	4.0		
	87 A 298, 2009 A 107	Research farm, RARS, Anakapalle Visakhapatnam district	Early shoot borer, <i>C. infuscatellus</i> (%DH)	8.0	17.0	11.5	
			Fall army worm, <i>S. frugiperda</i> (%)	10.0	20.0	15.0	
May, 19	87 A 298	Chuchukonda	Fall army worm, <i>S. frugiperda</i> (%)	5.0	10.0	7.5	
		Thotada (V), Ganaparthi (V), Chuchukonda (V), Appalanaidupalem (V) of Munagapaka (M)	Early shoot borer, <i>C. infuscatellus</i> (%)	3.0	12.0	7.5	
		Kotturu (V) in Anakapalle (M)	Early shoot borer (%DH) ( <i>C. infuscatellus</i> )	4.0	10.0	7.0	
			Fall army worm (%) ( <i>S. frugiperda</i> )	2.0	5.0	3.5	Observed on 20days old crop.
		M.S. Peta (V) of Payakaraopeta(M)	Early shoot borer (%) ( <i>C. infuscatellus</i> )	20.0	40.0	30.0	
			Termite (%)	6.0	15.0	10.5	
June, 19	87 A 298	Bavulawada (V) in Anakapalle (M)	Termite (%)	50.0	60.0	55.0	Rainfed sugarcane. Severe drought conditions prevailed
			Yellow mealybug (%incidence) <i>Kiritshenkella sacchari</i>	20.0	50.0	35.0	
	87 A 298, 2009 A 107, Co 7508	Gajapathinagaram (V), Juttada (V), Gajapathinagaram (V), Simhadripuram (V), Lakkavaram (V), Gavaravaram	Early shoot borer (%DH) ( <i>C. infuscatellus</i> %)	40.0	60.0	50.0	Rainfed sugarcane
			Oriental thrips (%) (incidence) ( <i>Fulmikiola orientalis</i> )	10.0	30.0	20.0	

	87 A 298, 2003 A 225, 2000 A 255	(V) in Chodavaram (M)	Red mite (% incidence) <i>Oygonichus indicus</i>	10.0 0	30.00 20.00	20.00	High temperatures coupled with no rainfall.
	87 A 298, 2009 A 107	Lakshmi puram (V), Pottidora palem (V), Bangarumetta (V), Kumundanupeta (V) in Vaddadi (M)	Early shoot borer (%DH) Yellow mealybug (% incidence)	10.0 10.0	20.0 15.0	15.0 12.5	
		Research farm, Anakapalle	Web mite (% incidence) <i>Schizotetranychus krungthepensis</i>	10.0	20.0	15.0	
July, 19	87 A 298, ROC 16, 2003 46	Velaki (V) Kirlam pudi (M), East Godavari	Rusty plum aphid (aphids/leaf) <i>(H.setariae)</i>	5.0	10.0	7.5	
			Grasshoppers (% incidence)	1.0	2.0	1.5	
			Yellow mealybug (% incidence) <i>(K.sacchhari)</i>	10.0	30.0	20.0	
	87 A298, 2003 A255, 2009 A107	Jami (V) in Jami (M), Vizianagaram	Yellow mealybug (% incidence) <i>(K.sacchhari)</i>	30.0	50.0	40.0	YLD incidence was observed
			Internode borer (% incidence) Sugarcane aphid (Aphids/leaf) <i>(M. sacchhari)</i>	10.0 50.0	20.0 150.0 0	15.0 100.0	
	87 A 298 (Ratoon crop)		Web mite (% incidence) <i>(Schizotetranychus krungthepensis)</i>	60.0	80.0	70.0	
August, 19	87 A 298 & 2009 A 107 (Single node seedlings(Plant crop))	Pedaramabhadrapuram (V) in Paykarao peta(M)	Internode borer (%)	20.0	30.0	25.0	Incidence of Mosaic & YLD was observed
			Yellow mealybug (% incidence) <i>(K.sacchhari)</i>	10.0	30.0	20.0	
	87 A 298 (Ratoon crop)	D. Polavaram (V) in Tuni (M)	Spotted whitefly (No adults/leaf) <i>N.bergii</i>	10.0	13.0	11.5	
	87 A 298, 2009 A107	(M)	Yellow mealybug (% incidence) <i>(K.sacchhari)</i>	5.0	10.0	7.5	Incidence of Mosaic & YLD was observed
			Internode borer (% incidence) <i>(C. sacchariphagus indicus)</i>	10.0	20.0	15.0	
			Sugarcane aphid (Aphids/leaf) <i>(M.sacchhari)</i>	30.0	80.0	55.0	
		87 A 298		Web mite (%)	10.0	20.0	15.0

	(Ratoon crop)		incidence ( <i>Schizotetranychus krungthepensis</i> )				
			Spotted whitefly (No adults/leaf) ( <i>Neomaskellia.bergii</i> )	6.0	8.0	7.0	
September, 19	87 A 298 (Ratoon crop)	Tangedu (V) Kotavuratla (M)	Internode borer (% incidence) ( <i>C. sacchariphagus indicus</i> )	5.0	8.0	6.5	
	2009 A 107	Research farm, RARS, Anakapalle	Sugarcane aphid/leaf ( <i>M. sacchari</i> )	30.0	40.0	35.0	
			Rusty plum aphid/leaf ( <i>Hysteroneura setarea</i> )	10.0	20.0	15.0	
			Sugarcane oriental thrips/leaf ( <i>Fulmekiola serrata</i> )	2.0	8.0	5.0	
			Internode borer (% incidence) ( <i>C. sacchariphagus indicus</i> )	10.0	25.0	17.5	
			Spotted whitefly/leaf ( <i>Neomaskellia bergii</i> )	10.0	12.0	11.0	
			Sugarcane oriental thrips/leaf ( <i>Fulmekiola serrata</i> )	2.0	8.0	5.0	
October, 19	87 A 298 (Ratoon crop)	Payakarao peta (V)	Internode borer (% incidence) <i>Chilo sacchariphagus indicus</i>	5.0	10.0	7.5	
			Sugarcane aphid/leaf <i>M.sacchari</i>	20.0	50.0	35.0	
	2009 A 107, 93 A 145, 2003 A 225, 87 A 298	Research farm, RARS, Anakapalle	Sugarcane aphid/leaf ( <i>M. sacchari</i> )	15.0	30.0	22.5	
			Rusty plum aphid/leaf ( <i>Hysteroneura setariae</i> )	10.0	15.0	12.5	
			Internode borer (% incidence) <i>C. sacchariphagus indicus</i>	8.0	15.0	11.50	
			Spotted whitefly/leaf ( <i>N. bergii</i> )	5.0	8.0	6.5	
			<i>Pyrilla perpusilla</i> /Leaf	2.0	3.0	2.5	
	87 A 298 (Ratoon crop)	Payakarao peta (M)	Internode borer (% incidence) <i>C. sacchariphagus indicus</i>	5.0	10.0	7.5	
			Sugarcane aphid/leaf	20.0	50.0	35.0	

			( <i>M.sacchar</i> )				
	2009 A 107, 93 A 145, 2003 A 225, 87 A 298	Research farm, RARS, Anakapalle	Sugarcane aphid/leaf ( <i>M. sacchari</i> )	15.0	30.0	22.5	
			Rusty plum aphid/leaf ( <i>H. setariae</i> )	10.0	15.0	12.5	
November, 19	2009 A 107, 93 A 145, 87 A 298	Research farm, RARS, Anakapalle	Sugarcane aphid / leaf ( <i>M.sacchari</i> )	5.0	10.0	7.5	
			Woolly aphid (% incidence) <i>C. lanigera</i>	10.0	25.0	17.0	In some pockets
			Internode borer (% incidence) C. <i>sacchariphagus indicus</i>	5.0	8.0	6.7	
			Whitefly (puparia/2.cm leaf) <i>A. barodensis</i>	5.0	15.0	10.0	
			<i>Pyrilla perpusilla</i> / leaf	1.0	2.0	1.5	
			Scale insect (% incidence) <i>M. glomerata</i>	10.0	40.0	25.0	
December,1 9	2009 A 107, 93 A 145, 87 A 298 93 A 145	Research farm, RARS, Anakapalle	Sugarcane aphid / leaf ( <i>M.sacchari</i> )	20.0	50.0	35.0	
			Woolly aphid (% incidence) ( <i>Ceratovacuna lanigera</i> )	25.0	50.0	35.5	In some pockets
			Internode borer (% incidence) (C. <i>sacchariphagus indicus</i> )	1.0	2.0	1.5	
			Whitefly (puparia/2.5cm leaf) ( <i>Aleurolobus barodensis</i> )	10.0	15.0	12.5	
			<i>Pyrilla perpusilla</i> / leaf	1.0	2.0	1.5	
			Scale insect (% incidence) <i>M. glomerata</i>	10.0	20.0	15.0	
January, 2020	87 A 298	V. Madugula	Internode borer (% incidence) C. <i>sacchariphagus indicus</i>	5.0	20.0	12.5	
			Scale insect (% incidence) ( <i>M. glomerata</i> )	20.0	30.0	25.0	
	2009 A 107	RARS, Anakapalle	Sugarcane aphid/ leaf	100.0	150.0	125.0	



			<i>(M.sacchari)</i>				
February, 2020	87 A 298	Boddvaram (V), Subhadrayamma peta(V) in Tuni (M)	Internode borer (% incidence) C. <i>sacchariphagus indicus</i>	15.0	20.0	17.5	Incidence of Mosaic & YLD was observed
			Scale insect (% incidence) <i>(M. glomerata)</i>	40.0	60.0	50.0	
		Research station	Fall army worm (% incidence) <i>(S. frugiperda)</i>	3.0	5.0	4.0	

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

### North West Zone

#### ICAR- SBI, RC, Karnal, Haryana

A non-replicated 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.

#### Prevalence of Insect pests of sugarcane and their bio- agents

S.no.	Insect-pests	Incidence / Population	Bio- agents	Parasitisation (%)
1	Pink borer	7.0%	-	-
2	Early shoot borer	5.2 %	-	-
3	Top borer	4.9 %	<i>Isotima javensis</i>	1.3 (Larvae)
			<i>Stenobracon deesae</i>	1.9 (Larvae)
4	Root borer	16.5%	-	-
5	Termite	16.2%	-	-
6	Black bug	9.0/tiller : 3.9/cane	-	-
7	Stalk borer	Incidence - 30.4 % intensity - 8.5 % Infestation index - 2.6	<i>Cotesia flavipes</i>	1.2 (Larvae)
8	Pyrilla	0.1 /20 leaves	<i>Epiricania melanoleuca</i>	35.0 (N/A)
			<i>Tetrastiscus pyrillae.</i>	1.3 (eggs)

The cumulative incidence of pink borer right from shoot stage till harvest of the crop was 7.0 per cent. The incidence of early shoot borer and top borer was below ETL (<15.0 and <10%, respectively). Root borer and termite incidence was 16.5 and 16.2%, respectively. The mean population of black bug was 9.0/canes in ratoon and 3.9/canes in planted crop. Stalk borer incidence, intensity and infestation index were 30.4%, 8.5 % and 2.6, respectively. The Pyrilla population was 0.1 individual/20 leaf. Among bio agent's, *Epiricania melanoleuca*, identified as an effective parasitoid of pyrilla nymphs and adult's with 35.0 per cent parasitisation. *Tetrastiscus pyrillae*, an egg parasitoid of pyrilla, parasitized 1.3 per cent egg masses. *Isotima javensis* and *Stenobracon deesae* parasitisation of top borer larvae was 1.3 and 1.9 per cent respectively. *Cotesia flavipes* a larval cum pre pupal parasitoid of stalk borer which parasitized 1.2 % stalk borer larvae during the month of October in canes.

#### UPCSR, Shahjahanpur, Uttar Pradesh

An experiment was conducted with planting of variety UP 05125 in 0.2 ha area at Shahjahanpur (UP) to monitor the key insect pest and their bio-agent. The incidence of early shoot borer was recorded maximum 4.31% during 24<sup>th</sup> SMW followed by 3.07%, 2.10% and 1.56% during 20<sup>th</sup>, 16<sup>th</sup> and 29<sup>th</sup> SMW, respectively. The incidence of top borer was recorded maximum 5.28% during 35<sup>th</sup> SMW followed by 3.00%, 2.62%, 1.38% during 31<sup>st</sup>, 26<sup>th</sup> and 22<sup>nd</sup> SMW, respectively. The per cent incidence of stalk borer (on cane basis) was recorded maximum 18.00% during 43<sup>rd</sup> SMW followed by 15.0% during 38<sup>th</sup> SMW, respectively.

The bio-agent viz; *Telenomus beneficiens*, *Isotima javensis*, *Rhaconotus scirpophagae* and *Stenobracon deesae* were recorded as major parasitoids of top borer. *Cotesia flavipes*, a larval parasitoid of stalk borer was also recorded from fields. The peak activity of egg-parasitoid *T. beneficiens* was observed to be 7.00% during 31<sup>st</sup> SMW and declined up to 2.00% during 35<sup>th</sup> SMW. A parasitisation of larvae by *Isotima javensis* was observed from 26<sup>th</sup> SMW (1.00%) and increases up to 3.00% during 31<sup>st</sup> SMW thereafter decreases up to 2.0% during 35<sup>th</sup> SMW. The parasitisation of top borer by *Rhaconotus scirpophagae* was recorded minimum (1.20%) during 26<sup>th</sup> SMW which increase up to 3.0% during 35<sup>th</sup> SMW, thereafter decrease up to 1.0% during 38<sup>th</sup> SMW. The parasitisation of *Stenobracon deesae* was ranged from 2.0% during 31<sup>st</sup> SMW to 3.0% during 38<sup>th</sup> SMW. The parasitisation of stalk borer larvae by *Cotesia flavipes* was recorded maximum 8.0% during 43<sup>rd</sup> SMW (Table 3 a,b).

**Table 3 (a). Monitoring of insect-pests and bio-agents in sugarcane (UPCSR Shahjahanpur)**

Period of observation Dates + SMW	% incidence early shoot borer	% Parasitism (ESB)		Stalk borer			% Parasitism (Stalk borer)
		<i>T.chilonis</i>	<i>E.annulipes</i>	% incidence	% intensity	Infestation index	<i>Cotesia flavipes</i>
1	2	3	4	5	6	7	8
16-04-19, 16 <sup>th</sup> SMW	2.10	-	-	-	-	-	-
18-05-19, 20 <sup>th</sup> SMW	3.07	-	-	-	-	-	-
17-06-19, 24 <sup>th</sup> SMW	4.31	-	-	-	-	-	-
20-07-19, 29 <sup>th</sup> SMW	1.56	-	-	-	-	-	-
20-08-19, 34 <sup>th</sup> SMW	-	-	-	-	-	-	-
22-09-19, 38 <sup>th</sup> SMW	-	-	-	21.33	1.71	0.36	6.00
25-10-19, 43 <sup>th</sup> SMW	-	-	-	22.67	1.79	0.41	8.00
19-11-19, 47 <sup>th</sup> SMW	-	-	-	-	-	-	-

**Table 3 (b). Monitoring of insect pests and bio-agents in sugarcane, (UPCSR Shahjahanpur)**

Period of observation Dates + SMW	% incidence top shoot borer	% Parasitism (Top shoot borer)						
		<i>T. beneficiens</i>	<i>I. javensis</i>	<i>A. flavipes</i>	<i>Rhaconotus Scirpophagae</i>	<i>Elasmus zehntneri</i>	<i>S. deesae</i>	<i>B. bassiana</i>
1	2	3	4	5	6	7	8	9
16-04-19, 16 <sup>th</sup> SMW	-	-	-	-	-	-	-	-
30-05-19, 22 <sup>nd</sup> SMW	1.38	1.25	-	-	-	-	-	-
28-06-19, 26 <sup>th</sup> SMW	2.62	3.00	1.00	-	1.20	-	-	-
30-07-19, 31 <sup>st</sup> SMW	3.00	7.00	3.00	-	1.50	-	2.00	-
28-08-19, 35 <sup>th</sup> SMW	5.28	2.00	2.00	-	3.00	-	2.50	-
20-09-19, 38 <sup>th</sup> SMW	-	-	-	-	1.00	-	3.00	-
25-10-19, 43 <sup>rd</sup> SMW	-	-	-	-	-	-	-	-

### ICAR-IISR, Lucknow, Uttar Pradesh

Field experiment was conducted to monitor the insect pests of sugarcane with three sugarcane varieties viz., CoLk 94184, Co0238 and CoLk7201. Three bud sets of all three varieties were planted in November, 2018 and all recommended agronomic practices were followed to raise a good crop. Periodic observations on incidence of insect pests and parasitoids of pests were recorded.

**Table 1: Incidence of different insect pests of sugarcane**

S. N.	Variety	Top Borer		Stalk borer	Internode borer	Root borer	Termites	Black bug	Mealy Bug	White fly	<i>Pyrilla perpusilla</i>
		III Brood	IV Brood								
1	Co0238	18.41	45.86	15.06	15.06	36.74	27.10	5.00	32.50	5.00	2
2	CoLk7201	17.13	38.52	18.25	19.66	33.98	0.00	15.00	19.57	12.00	2
3	CoLk94184	16.22	43.73	23.43	11.71	33.05	10.87	19.66	26.00	0.00	0

Incidence of top borer II brood was nil in all three sugarcane varieties. Incidence of III brood varied from 16.22 to 18.41 percent and incidence in IV brood increased and ranged from 38.52 to 45.86 percent. Incidence of stalk borer, internode borer, root borer, black bug, mealy bug and white fly was high. CoLk7201 was recorded to escape termite damage. Low incidence of white fly and *Pyrilla perpusilla* was observed (Table1).

**Table 1 Parasitisation of insect pests**

S. N.	Variety	Top borer		Stalk borer	Internode borer	White fly	<i>P. perpusilla</i>
		<i>Rhaconotus</i> sp.	<i>Isotima javensis</i>	<i>Cotesia flavipes</i>	<i>Cotesia flavipes</i>	<i>Encarsia</i> sp.	<i>Epiricania</i>
1	Co0238	15.0	6.67	14.86	13.33	25.00	50.00
2	CoLk7201	21.43	9.52	25.00	50.00	13.33	50.00
3	CoLk94184	6.67	13.33	28.57	50.00	15.00	0.00

Parasitisation of top borer by *Rhaconotus* sp. and *Isotima javensis* was observed. Larval parasitisation of stalk borer and internode borer by *Cotesia flavipes* was observed. Puparium of white fly and *Pyrilla perpusilla* were parasitized by *Encarsia* sp. and *Epiricania melanoleuca* (Table1).

### North central zone

#### Sugarcane research institute Dr. Rajendra prasad central agricultural university, Pusa, samastipur, Bihar

Sugarcane variety CoP 2061 was planted in 0.2 hectare area at Pusa Farm, Sugarcane Research Institute, Pusa. The population of root borer shoots borer, top borer, stalk borer, pyrilla and their natural enemies were recorded at monthly interval during cropping season of 2019-20. 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 1.70 to 9.10%, 2.60 to 10.30%, 3.30 to 11.80% and 1.30 to 5.60%, respectively. Whereas, the incidence of sugarcane *Pyrilla* was recorded which varied from 1.30 to 9.80 per leaf. The meteorological data was also recorded and presented in Table 8.

The bio-agents of Root and Early shoot borer were not observed during cropping season of 2019-20. While, parasitization of bio-agents such as *Apantelis flavipes*, *Rhaconotus scirpophagae* and *Stenobracon deesa* were recorded against top borer. The data presented in table 9 to 10 revealed that population of *S. deesa* varied from 2.30 to 10.70 during May to November. Where its peaks (10.70%) noticed in September (Table 10). Population of *Apantelis flavipes* was ranged in between 3.30 to 11.30 during May to November with its highest population (11.30%) was recorded in month of August. The activity of *R. scirpophagae* was recorded from July to November with its peak (8.90 %) 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 October (16.30 %) and September (15.70%), respectively. In case of Stalk borer the parasitization of *Apantalisflavipes* was recorded from 6.50 to 13.70 during August to November (Table 10).

**Table 8. Meteorological observation during crop season (2019-20)**

Month	Fortnightly	Temperature(°C)		Relative humidity (%)		Rainfall (mm)
		Maximum	Minimum	0700hrs	1400hrs	
February 2019	I	24.22	9.30	85.13	55.40	13.20
	II	25.90	12.36	83.46	54.92	12.20
March 2019	I	29.96	11.68	75.93	45.20	00.00
	II	32.50	15.21	74.56	43.25	4.20
April 2019	I	33.03	20.66	79.20	63.86	6.40
	II	36.38	22.04	71.93	47.46	1.20
May 2019	I	39.29	24.20	78.33	50.60	1.00
	II	38.63	25.13	76.31	50.12	13.40
June 2019	I	36.98	25.60	79.73	56.46	13.20
	II	38.04	27.48	79.66	61.53	17.20
July 2019	I	32.95	25.94	88.06	72.73	222.50
	II	33.46	26.27	88.06	73.80	131.80
August 2019	I	34.63	26.84	87.60	75.13	116.60
	II	34.05	26.75	90.50	75.18	55.10
September 2019	I	32.12	26.69	88.26	75.20	51.0
	II	29.76	23.78	93.93	84.20	352.0
October 2019	I	29.59	23.13	92.46	84.13	6.60
	II	29.11	21.18	91.00	79.75	00.00
November 2019	I	28.50	18.82	93.46	69.06	00.00
	II	28.22	14.29	92.40	66.13	00.00
December 2019	I	25.35	11.95	92.86	75.20	22.0
	II	16.99	07.60	91.37	74.12	00.00
January 2020	I	18.16	08.91	92.13	79.86	1.80
	II	20.35	09.93	91.68	69.50	4.40
February 2020	I	23.28	8.45	89.2	60.0	0
	II	25.74	13.12	78.80	68.0	1.6

**Table 9: Monitoring of insect pests in Sugarcane agro-ecosystem (2019-20).**

Period of observation	% incidence of top borer	% incidence of Shoot borer	% incidence of root borer	Pyrilla/leaf	% incidence of stalk borer
February, 19	-	-	-	-	-
March, 19	-	4.50	3.70	1.30	-
April, 19	3.60	8.70	6.20	2.50	-
May, 19	4.35	10.30	9.10	5.10	-
June, 19	9.60	7.70	6.20	7.60	-
July, 19	11.80	2.60	1.70	9.80	2.60
August, 19	10.50	-	-	8.20	3.50
September, 19	8.30	-	-	7.30	5.60
October, 19	5.90	-	-	5.60	3.10
November, 19	3.30	-	-	3.10	1.30
December, 19	-	-	-	-	-
January, 20	-	-	-	-	-

**Table.10:Natural enemies of insect pests in sugarcane agro-ecosystem**

Period of observation	% parasitism (Top borer)			% Parasitism (Stalk borer) <i>A. flavipes</i>	% Parasitism (Pyrilla)		% Parasitism (root and shoot borer) if any
	<i>A. Flavipes</i>	<i>R. Scripoph agae</i>	<i>S. Deesae</i>		<i>T. Pyrillae</i>	<i>E. melanoleuc</i>	
February, 19	-	-	-	-	-	-	-
March, 19	-	-	-	-	-	-	-
April, 19	3.30	-	-	-	-	-	-
May, 19	3.70	-	2.30	-	-	3.70	Not observed
June, 19	8.40	-	6.10	-	-	6.10	-
July, 19	10.40	2.10	7.80	-	6.44	8.80	-
August, 19	11.30	4.60	9.20	11.50	8.60	11.10	-
September, 19	8.50	8.90	10.70	13.70	10.90	15.70	-
October, 19	7.60	6.50	8.40	10.30	16.30	12.60	-
November, 19	6.10	4.30	4.90	6.50	14.70	7.60	-
December, 19	-	-	-	-	-	-	-
January, 20	-	-	-	-	-	-	-

**Peninsular Zone****Dr. PDKV, Akola, Maharashtra**

The insect pests recorded on sugarcane var. Co-86032 during 2019-20 were early shoot borer, scales and *Pyrilla*.

**Early shoot borer:**

The seasonal incidence data (Table:1) revealed that infestation of early shoot borer infestation was stated in 9<sup>th</sup> SMW with its initial infestation of 3.25%, reached its peak (12.10%) in 21<sup>st</sup> SMW and continued upto 26<sup>th</sup> SMW.

It had non-significant correlation with Maximum and Minimum Temperatures, rainfall and Evaporation. However, recorded negative significant correlation with Morning and Evening relative humidity, rainy days, bright sunshine and wind speed.

**Table 1: Seasonal incidence of major insect pests and natural enemies of sugarcane  
Recorded on Co-86032 during 2019-20**

Sr. No.	SMW	Early shoot borer (% infestation)	Scales		Pyrilla (Nymph & Adults) (No./leaf)	Natural Enemies (No./Plant)	
			% incidence	% intensity		LBB	Spiders
1	7	--	--	--	--	2.1	1.5
2	8	--	--	--	--	3.9	2.4
3	9	3.25	--	--	--	3.2	2.6
4	10	4.65	--	--	0.05	3.4	3.4
5	11	7.20	--	--	0.10	4.1	3.8
6	12	9.10	--	--	0.40	2.7	4.3
7	13	7.45	--	--	0.60	3.4	3.8
8	14	8.60	--	--	1.01	<b>4.2</b>	4.6
9	15	8.75	--	--	2.03	2.7	4.8
10	16	7.45	--	--	2.55	3.3	5.1
11	17	6.10	--	--	2.75	2.9	4.6
12	18	7.15	--	--	2.90	3.7	6.5
13	19	8.13	--	--	3.02	3.1	<b>7.3</b>
14	20	9.72	--	--	3.15	2.4	6.4
15	21	12.10	--	--	3.36	2.1	5.1
16	22	5.20	--	--	3.65	2.5	4.9
17	23	3.10	--	--	3.05	3.6	4.6
18	24	2.75	--	--	4.15	2.4	5.1
19	25	1.64	--	--	3.85	2.2	5.4
20	26	0.82	--	--	4.35	2.1	5.2
21	27	0.00	--	--	3.75	3.1	4.4
22	28	0.00	--	--	3.00	2.4	3.8
23	29	--	--	--	2.45	2.0	4.2
24	30	--	--	--	2.05	1.9	5.4
25	31	--	--	--	1.01	2.4	4.6
26	32	--	--	--	0.75	3.5	5.3
27	33	--	--	--	2.45	4.2	4.1
28	34	--	--	--	1.40	3.9	4.2
29	35	--	--	--	1.35	3.4	7.6
30	36	--	--	--	0.85	4.1	8.4
31	37	--	--	--	0.65	3.3	6.7
32	38	--	4.00	1.14	0.35	2.9	7.4
33	39	--	4.00	1.71	0.15	3.4	8.2
34	40	--	8.00	2.86	0.05	3.7	9.4
35	41	--	8.00	4.00	0.75	2.9	8.6
36	42	--	12.00	6.86	0.05	3.4	5.4
37	43	--	12.00	8.57	0.04	3.6	7.3
38	44	--	8.00	4.57	--	3.4	6.4
39	45	--	8.00	5.00	--	2.4	7.1
40	46	--	12.00	6.00	--	2.2	6.9
41	47	--	8.00	3.00	--	4.1	5.4
42	48	--	16.00	7.50	--	2.7	6.2
43	49	--	12.00	4.76	--	2.4	3.4
44	50	--	8.00	2.86	--	3.2	4.5
45	51	--	20.00	6.19	--	4.2	5.6
46	52	--	16.00	4.09	--	2.5	4.7
47	1	--	12.00	4.89	--	--	--
48	2	--	8.00	3.48	--	--	--
49	3	--	12.00	2.59	--	--	--
50	4	--	16.00	5.53	--	--	--

SMW : Standard Meteorological Week

**Table 2: Correlation coefficient between weather parameters and population dynamics of major sugarcane insect pests and their natural enemies (Co-86032)**

Weather parameters	Correlation coefficient ('r' value)				
	Incidence of sugarcane pests			Natural Enemies (No./plant)	
	Early Borer	Shoot Scale	Pyrilla	Lady bird beetle	Spiders
Temperature (°C) Max	0.372 <sup>NS</sup>	-0.503*	0.564**	-0.135 <sup>NS</sup>	-0.143 <sup>NS</sup>
Temperature (°C) Min	0.206 <sup>NS</sup>	-0.705**	0.726**	-0.106 <sup>NS</sup>	0.196 <sup>NS</sup>
Humidity (%) Morning	-0.725**	-0.194 <sup>NS</sup>	-0.356*	0.048 <sup>NS</sup>	0.244 <sup>NS</sup>
Humidity (%) Evening	-0.588*	-0.181 <sup>NS</sup>	-0.425*	0.097 <sup>NS</sup>	0.258 <sup>NS</sup>
Rainfall (mm)	-0.441 <sup>NS</sup>	-0.588*	-0.173 <sup>NS</sup>	-0.082 <sup>NS</sup>	0.241 <sup>NS</sup>
Rainy Days (No.)	-0.483*	-0.561*	-0.275 <sup>NS</sup>	0.086 <sup>NS</sup>	0.307*
Bright sunshine (hrs.)	0.639**	0.128 <sup>NS</sup>	0.330 <sup>NS</sup>	-0.117 <sup>NS</sup>	-0.379**
Wind Speed (Km/hr)	-0.475*	0.053 <sup>NS</sup>	0.691**	-0.193 <sup>NS</sup>	-0.252 <sup>NS</sup>
Evaporation (mm)	0.016 <sup>NS</sup>	-0.275 <sup>NS</sup>	0.670**	-0.193 <sup>NS</sup>	-0.114 <sup>NS</sup>
No. of observations	18	15	34	46	46

Significant P = (0.05%)\* & (0.01%)\*\*

#### Scales:

The incidence of scales was initiated during 38<sup>th</sup> SMW (4 % incidence and 1.14 % intensity) and it was continued up to 4<sup>th</sup> SMW. Peak % incidence (20.00 %) and % intensity (6.19 %) was recorded in 51<sup>st</sup> SMW.

It had significant negative correlation with Maximum and Minimum Temperatures, rainfall and rainy days. However, recorded non significant correlation with Morning and Evening relative humidity, bright sunshine, wind speed and evaporation.

#### Pyrilla:

The incidence of *Pyrilla* was initiated during 10<sup>th</sup> SMW (0.05 per leaf) and it was continued up to 43<sup>rd</sup> SMW. The peak *Pyrilla* incidence per leaf was recorded in 26<sup>th</sup> SMW (4.35 per leaf). It had significant positive correlation with Maximum and Minimum Temperatures, wind speed and evaporation; significant negative correlation with Morning and Evening relative humidity. However, recorded non significant correlation with rainfall, rainy days and bright sunshine.

#### Natural enemies:

Lady bird beetle and spiders are the major generalist predators of the sugarcane insect pests. Their incidence was recorded in 7<sup>th</sup> SMW (LBB- 2.1 and Spiders-1.50 per plant). Lady bird beetle population reached its peak (4.2 per plant) in 14<sup>th</sup> SMW and spiders (7.3 per plant) in 19<sup>th</sup> SMW (Table-1.1). Their incidence continued upto 52<sup>nd</sup> SMW.

Incidence of the natural enemies basically correlated with the population of the host insects as they are generalist predator. However, their population recorded non significant correlation with all major weather parameters.



### ICAR-SBI, Coimbatore, Tamil Nadu

In monitoring plot, shoot borer incidence was 1.23, 2.23, 4.69, 4.11% in the months of March, April, May and June 2019 respectively (Table 9). Internode borer incidence of 2.64% was recorded in September 2019 with *Telenomus* sp. activity. Pyrilla, mealybug and sheath mite were found in traces during June-July 2019. Woolly aphid was observed in December 2019 in a patch with a mean rating of 2.84%. *Encarsia flavoscutellum* activity was observed to the extent of 6.4%.

Table 9. Pest and natural enemy status in monitoring plot at Coimbatore, Tamil Nadu during 2019-2020							
S. No.	Location	Insect pest	Prevalence period	Max. incidence /population	Natural enemy	Prevalence period	Max. parasitization/ population
1	Coimbatore	SB	March 2019	1.23%	-	-	-
			April	2.23%	-	-	-
			May	4.69%	-	-	-
			June	4.11%	-	-	-
2		INB	September	2.64%	<i>Telenomus</i> sp.	Throughout the year	100.0% within parasitized egg masses
3		Pyrilla	June 2019	Traces	-	-	-
4		Sheath mite	June 2019	Traces	-	-	-
5		Sheath mite	July 2019	Traces	-	-	-
6		Mealy-bug	June 2019	Traces	-	-	-
7		Mealy-bug	July 2019	Traces			
8		Woolly aphid	December 2019	Mean rating 2.84	<i>Encarsia</i> (6.4%)	-	-

**Table 5: Monitoring of insect pests and bio agents in sugarcane agro ecosystem**

Time of observation	Percent Incidence			Woolly aphid	Natural enemies
	ES B	TSB	INB	Leaf area covered	
30DAP	4.50	---	---	---	
60DAP	10.25	---	---	---	---
90DAP	6.00	---	---	---	---
120DAP	1.25	---	---	---	---
150DAP	----	12..50	--	65%	<i>Dipha</i> 2 larva/1 pupa /leaf
180DAP	---	---	-----	70 %	<i>Encarsia</i> Adults 8/leaf <i>Micromus</i> larva 2 /leaf
210DAP	---	14.25		30 %	---
At harvest	-	-	36.40	--	---

Due to long dry spell in the early part of rainy season and frequent rainfall in later part resulted in higher incidence of all three borers namely Early shoot borer, Top shoot borer and Internode borer. Activity of army worm in sugarcane was low. Incidence of root grubs was more in borewell irrigated plots. Due to frequent rains during August to October, incidence of woolly aphid was more, but the natural enemies *Encarsia flavoscutellum* and *Dipha aphidivora* kept the pest under check. Even though *Pyrilla* leaf hopper and termite appeared in few places they did not cause economic loss to the crop.

Cumulative incidence of ESB in VCF 0517 sugarcane variety was 22.00 % in the first four months after planting. Incidence of TSB was 26.75% at 7<sup>th</sup> month. Incidence of Inter node borer was 36.40%. Woolly aphid incidence was observed from 150 DAP to 210 days after planting. *Dipha* (2larva/1pupa/leaf) *Encarsia* (8 adults/leaf) and *Micromus* (2larva/leaf) kept the woolly aphid under control. Aphid, whitefly, and pyrilla appeared in very small numbers but failed to establish and spread.

### CSR, MPKV, Padegaon, Maharashtra

The data of ESB, *Pyrilla* Mealy bug and Woolly aphid and their natural enemies are presented in table 06. The data regarding monitoring of insect pests and their bio-agents in sugarcane agro-ecosystem are presented in table 05. During the year 2019-20, the incidence of early shoot borer was found in the range of 2.30 to 27.00 per cent. Initial incidence was recorded during 11<sup>th</sup> MW week (2.30 %). Thereafter the incidence showed increasing trend and recorded peak incidence on 23<sup>rd</sup> MW with 27.00 per cent. After that the incidence showed decreasing trend. The parasitism due to *T. chilonis* was observed from 15<sup>th</sup> MW to 24<sup>th</sup> MW in the range of 0.20 to 2.20 per cent.

The infestation of *pyrilla* was noticed from 32<sup>th</sup> MW to 41<sup>th</sup> MW in the range of 1.00 to 4.00 per leaf. The infestation was very low on sugarcane. However, *E. melanoleuca* was seen during the 34<sup>th</sup> to 41 MW with 3.00 to 15.00 per cent parasitism and 1.00 to 3.60 egg mass & cocoon.

The mealy bug population was noticed from 41<sup>th</sup> MW to end of observations i.e. 52<sup>nd</sup> MW in the range of 15 to 80.00 per 10 plants. Trend of population was found increasing up to end of observations. The predatory coccinellids seen during 42 MW (1.20) and steadily increased up to 52<sup>nd</sup> MW (4.40).

The initial population of woolly aphid was observed during 40 MW (7.22 / 150 leaves). Thereafter population was steadily increased and showed its peak population (40.97 /150 leaves ) during 44<sup>th</sup> MW. Then after the population showed decreasing trend up to end of the observation (52<sup>nd</sup> MW). Predatory *D. aphidivora* observed during 45 MW with 28.00 larvae. The peak population noticed on 46 MW (31.00 larvae) then after population showed decreasing up to last observation. Similar trend was also noticed in respect of *micromus*. The population of *micromus* observed in the range of 6.00 to 30.00 grubs/150 leaves from 45<sup>th</sup> MW to 52<sup>nd</sup> MW. The peak population noticed during 47<sup>th</sup> MW (29.00 grubs /150 leaves). After that the decreasing trend of population was noticed.

**Table 6 : Monitoring of insect pests and their natural enemies on Sugarcane**

Date & (MW)	Shoot		Pyrilla/leaf			Mealy bug/ 10 plant		Woolly aphids/ 150 leaf		
	Early Borer % incidence	% Parasitism	Av. No.	<i>E. melanoleuca</i> % Parasitism Egg mass & Cocoon		% incidence	Coccinellids	Av. No.	<i>D. aphidivora</i>	<i>micro mus</i>
11.3.19 (10)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18.3.19 (11)	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25.3.19 (12)	7.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.4.19 (13)	11.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.4.19 (14)	15.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15.4.19 (15)	17.65	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22.4.19 (16)	12.52	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29.4.19 (17)	8.12	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.5.19 (18)	9.30	1.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13.5.19 (19)	12.16	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20.5.19 (20)	8.79	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27.5.19 (21)	16.40	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.6.19 (22)	24.36	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10.6.19 (23)	27.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17.6.19 (24)	25.58	2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
24.6.19 (25)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1.7.19 (26)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8.7.19 (27)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15.7.19 (28)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22.7.19 (29)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29.7.19 (30)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.8.19 (31)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12.8.19 (32)	0.00	0.00	3.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Date & (MW)	Early Borer	Shoot	Pyrilla/leaf			Mealy bug/ 10 plant		Woolly aphids/ 150 leaf		
	% incidence	% Parasitism	Av. No.	<i>E. melanoleuca</i> % Parasitism	Egg mass & Cocoon	% incidence	Coccinellids	Av. No.	<i>D. aphidivora</i>	<i>micro mus</i>
19.8.19 (33)	0.00	0.00	3.60	0.00	0	0.00	0.00	2.02	0.00	0.00
26.8.19 (34)	0.00	0.00	3.00	3.00	0	0.00	0.00	0.64	0.00	0.00
2.9.19 (35)	0.00	0.00	3.40	5.00	0	0.00	0.00	0.00	0.00	0.00
9.9.19 (36)	0.00	0.00	4.00	15.00	0	0.00	0.00	0.00	0.00	0.00
16.9.19 (37)	0.00	0.00	3.00	11.00	3.60	0.00	0.00	0.00	0.00	0.00
23.9.19 (38)	0.00	0.00	2.00	8.20	2.20	0.00	0.00	0.00	0.00	0.00
30.9.19 (39)	0.00	0.00	1.20	6.30	2.00	0.00	0.00	0.00	0.00	0.00
7.10.19 (40)	0.00	0.00	1.00	5.50	1.80	0.00	0.00	7.22	0.00	0.00
14.10.19 (41)	0.00	0.00	1.00	4.00	1.00	15.00	0.00	14.99	0.00	0.00
21.10.19 (42)	0.00	0.00	0.00	0.00	0.00	20.60	1.20	27.19	0.00	0.00
28.10.19 (43)	0.00	0.00	0.00	0.00	0.00	20.80	1.40	30.40	0.00	0.00
4.11.19 (44)	0.00	0.00	0.00	0.00	0.00	25.60	1.00	40.97	0.00	0.00
11.11.19 (45)	0.00	0.00	0.00	0.00	0.00	45.00	2.30	37.18	28.00	30.00
18.11.19 (46)	0.00	0.00	0.00	0.00	0.00	55.00	3.00	24.52	31.00	23.00
25.11.19 (47)	0.00	0.00	0.00	0.00	0.00	57.00	3.00	20.11	23.00	29.00
2.12.19 (48)	0.00	0.00	0.00	0.00	0.00	60.00	3.60	12.64	22.00	24.00
9.12.19 (49)	0.00	0.00	0.00	0.00	0.00	75.60	4.00	8.01	21.00	13.00
16.12.19 (50)	0.00	0.00	0.00	0.00	0.00	75.00	4.00	5.07	9.00	6.00
23.12.19 (51)	0.00	0.00	0.00	0.00	0.00	77.20	4.30	1.91	6.00	6.00
31.12.19 (52)	0.00	0.00	0.00	0.00	0.00	80.00	4.40	0.00	0.0	0.00

**Vasantdada Sugar Institute, Pune, Maharashtra**

The per cent incidence of early shoot borer was maximum 3.08% in 23<sup>rd</sup> SMW, while it was free from it in 9<sup>th</sup> and 11<sup>th</sup> SMW. The % incidence of internode bore was maximum 12%, in 45<sup>th</sup> SMW, while it was free from it in 27<sup>th</sup> SMW. The % intensity of internode bore was maximum 1.02 in 37 SMW. The % infestation index of internode bore was maximum 0.10 in 37 SMW and 45 SMW. The % incidence and % intensity of Mealy bug was 4.0 and 0.55 in the 29<sup>th</sup> SMW. This plot was free from scale insect infestation (Table 7).

**Table 7: The % incidence / intensity of major insect pests during 2019-20**

Sr. No	SMW	Early shoot borer	Mealy bug		Internode borer		
		% incidence	% incidence	% intensity	% incidence	% intensity	Inf. index
1	9	0.00					
2	11	0.00					
3	13	2.74					
4	15	2.01					
5	18	2.92					
6	19	2.65					
7	21	0.58					
8	23	3.08					
9	25		0	0	2	0.41	0.01
10	27		2	0.39	0	0	0
11	29		4	0.55	2	0.27	0.01
12	31		0	0	5	0.66	0.03
13	33		1	0.11	5	0.66	0.03
14	35		0	0	5	0.42	0.02
15	37		0	0	10	1.02	0.10
16	39		0	0	5	0.41	0.02
17	41		2	0.14	3	0.20	0.01
18	43		0	0	3	0.31	0.01
19	45		0	0	12	0.81	0.10
20	47		0	0	7	0.60	0.04
21	49		0	0	6	0.44	0.03
22	51		0	0	8	0.53	0.04

**East Coast Zone**

**Regional Agricultural Research Station, Anakapalle, ANGRAU, Andhra Pradesh**

During 2019-20, maximum incidence of insect pests viz., early shoot borer (28.0% DH) & red mite (60.0%) in 2<sup>nd</sup> fortnight of May, termite (20.0%) and leaf mealybug (30.0%) in 1<sup>st</sup> fortnight of June, web mite (33.0%) in 2<sup>nd</sup> fortnight of July, sugarcane aphid (70A&N/leaf) in 2<sup>nd</sup> fortnight of August, spotted whitefly, *N.bergii* (12 adults/leaf) in 2<sup>nd</sup> fortnight of August and internode borer

(25%) in 2<sup>nd</sup> fortnight of October month were recorded during the crop period of sugarcane variety, 93 A 145 ( Table 4,5 & 6).

In studies on association of insect pests with weather parameters (Table 7), early shoot borer incidence showed negative correlation with rainfall (-0.74%) and relative humidity(- 0.88) and positive correlation with temperature (r=0.72, 0.61). Incidence of termite showed negative correlation with rainfall (r= -0.38) and relative humidity (-0.54). Incidence of internode borer showed positive correlation with rainfall (r=0.67) and relative humidity (r=0.52). Red mite showed positive correlation with maximum temperature (r=0.76) and forenoon relative humidity (r=0.62) and negative correlation with minimum temperature (r=-0.79) and afternoon relative humidity (r=-0.88). Sugarcane aphid showed significant negative correlation with temperature (r= -0.71) and positive correlation with relative humidity (r=0.74) . Scale insect showed negative correlation with rainfall (r=-0.71) and afternoon relative humidity (r=-0.81). White woolly aphid showed negative correlation with rainfall (r=-0.67), temperature (r=-0.94) and after noon relative humidity (r=-0.75) (Table 8).

**Table 4 Incidence of early shoot borer, termite, internode borer, leaf mealybug and egg parasitoid *T.chilonis* and sugarcane borer moths captured in Delta traps during 2019-20**

Period of observation	Early shoot borer (%DH)	ESB moths /pheromone trap	Termite (%)	Internode borer (%)	INB moths /pheromone trap	<i>Trichogramma chilonis</i> (%)	Leaf mealybug (%)	Rainfall	Temperature (°C)		Relative humidity (%)	
									Max.	Min.	FN	AN
1 <sup>st</sup> FN of May,19	12.00	16	2.00	-	-	1.00	-	1.20	37.700	27.90	80.00	55.00
2 <sup>nd</sup> FN of May,19	28.00	23	16.00	-	-	2.00	6.00	9.70	37.90	28.55	76.50	51.00
1 <sup>st</sup> FN of June,19	19.30	19	20.00	-	-	1.00	30.00	81.60	35.40	26.70	81.50	58.50
2 <sup>nd</sup> FN of June,19	18.90	13	15.00	-	-	0.80	10.00	6.70	33.95	26.75	81.50	60.00
1 <sup>st</sup> FN of July,19	16.78	11	10.00	-	-	1.00	-	46.40	33.75	25.65	87.00	70.50
2 <sup>nd</sup> FN of July, 19	5.73	4	5.00	-	3	2.00	-	84.00	31.85	25.35	85.00	66.50
1 <sup>st</sup> FN of Aug,19	2.00	0	2.00	0.00	3	0.60	-	47.50	34.55	26.05	89.50	62.50
2 <sup>nd</sup> FN of Aug, 19	0.24	0	0.00	5.00	5	1.40	-	115.90	32.60	25.45	88.50	68.50
1 <sup>st</sup> FN of Sep, 19	0.00	0	-	5.00	5	2.00	-	117.10	32.35	25.35	92.50	77.00
2 <sup>nd</sup> FN of Sep, 19	-	0	-	8.00	7	2.60	-	183.60	32.05	24.30	94.50	76.00
1 <sup>st</sup> FN of Oct, 19	-	0	-	10.0	7	1.00	-	69.90	31.80	24.20	95.00	72.50
2 <sup>nd</sup> FN of Oct, 19	-	-	-	25.0	13	1.60	-	205.50	31.25	22.40	94.50	72.00
1 <sup>st</sup> FN of Nov, 19	-	-	-	7.00	10	0.40	-	1.20	32.15	21.80	87.50	49.00
2 <sup>nd</sup> FN of Nov, 19	-	-	-	7.00	8	1.00	-	9.70	31.05	20.55	91.00	54.00
1 <sup>st</sup> FN of Dec, 19	-	-	-	1.00	2	1.00	-	0.00	29.85	19.15	90.50	51.00
2 <sup>nd</sup> FN of Dec, 19	-	-	-	1.00	0	2.00	-	0.00	29.45	18.40	92.50	51.50

Period of observation	Red mite, <i>Olygonychus indicus</i> (%)	Web mite, <i>S. krugthe pensis</i> (%)	Sugar cane aphid / leaf ( <i>M. sacchari</i> )	Rusty plum aphid/ leaf ( <i>H. setariae</i> )	Spotted whitefly, <i>N. bergii</i> (Adults/ leaf)	Rainfall (mm)	Temperature (° C)		Relative humidity (%)		BSH (H)
							Max.	Min.	Forenoon	Afternoon	
1 <sup>st</sup> FN of May, 19	15.0	5.0	-	-	-	1.2	37.70	27.90	80.00	55.00	7.00
2 <sup>nd</sup> FN of May, 19	60.0	9.0	-	-	-	9.7	37.90	28.55	76.50	51.00	2.75
1 <sup>st</sup> FN of June, 19	30.0	12.0	-	-	-	81.6	35.40	26.70	81.50	58.50	4.00
2 <sup>nd</sup> FN of June, 19	10.0	14.0	15.0	-	-	6.7	33.95	26.75	81.50	60.00	2.40
1 <sup>st</sup> FN of July, 19	3.0	20.0	45.0	-	6.0	46.4	33.75	25.65	87.00	70.50	3.90
2 <sup>nd</sup> FN of July, 19	-	33.0	20.0	-	7.0	84.0	31.85	25.35	85.00	66.50	3.10
1 <sup>st</sup> FN of Aug, 19	-	18.0	35.0	-	9.0	47.5	34.55	26.05	89.50	62.50	3.95
2 <sup>nd</sup> FN of Aug, 19	-	16.0	70.0	-	12.0	115.9	32.60	25.45	88.50	68.50	1.90
1 <sup>st</sup> FN of Sep, 19	-	8.0	46.0	8.0	6.0	117.1	32.35	25.35	92.50	77.00	4.85
2 <sup>nd</sup> FN of Sep, 19	-	11.0	73.0	13.0	9.0	183.6	32.05	24.30	94.50	76.00	2.95
1 <sup>st</sup> FN of Oct, 19	-	9.0	35.0	8.0	3.0	69.9	31.80	24.20	95.00	72.50	5.20
2 <sup>nd</sup> FN of Oct, 19	-	3.0	58.0	8.0	3.0	205.5	31.25	22.40	94.50	72.00	4.85
1 <sup>st</sup> FN of Nov, 19	-	3.0	30.0	6.0	1.0	1.2	32.15	21.80	87.50	49.00	6.40
2 <sup>nd</sup> FN of Nov, 19	-	5.0	46.0	12.0	1.0	9.7	31.05	20.55	91.00	54.00	5.65
1 <sup>st</sup> FN of Dec, 19	-	8.0	53.0	8.0	1.0	0	29.85	19.15	90.50	51.00	5.15
2 <sup>nd</sup> FN of Dec, 19	-	2.0	68.0	5.0	2.0	0	29.45	18.40	92.50	51.50	2.45

Period of observation	Incidence of sucking insect pests			Rainfall (mm)	Temperature (° C)		Relative humidity (%)	
	White woolly aphid (%)	Scale insect (%)	White fly (puparia/ 2.5 cm leaf area)		Max °C	Min °C	FN	AN
1 <sup>st</sup> FN of Sep, 19	0.0	0.0	0.0	117.1	32.4	25.4	92.5	77.0
2 <sup>nd</sup> FN of Sep, 19	0.0	0.0	0.0	183.6	32.1	24.3	94.5	76.0
1 <sup>st</sup> FN of Oct, 19	3.0	4.0	3.0	69.9	31.8	24.2	95.0	72.5
2 <sup>nd</sup> FN of Oct, 19	6.0	7.0	6.0	205.5	31.3	22.4	94.5	72.0
1 <sup>st</sup> FN of Nov, 19	10.0	10.0	8.0	1.2	32.2	21.8	87.5	49.0
2 <sup>nd</sup> FN of Nov, 19	22.0	19.0	10.0	9.7	31.1	20.5	91.0	54.0
1 <sup>st</sup> FN of Dec, 19	32.0	28.0	6.0	0.0	29.9	19.2	90.5	51.0
2 <sup>nd</sup> FN of Dec, 19	53.0	37.0	7.0	0.0	29.5	18.4	92.5	51.5

Month	Total rainfall (mm)	Rainy days	Temperature °c		R.H%		Wind velocity	B.S.S.H	Evaporation (mm)
			Max.	Min	Morn	Even			
March, 19	7.2	1	34.9	22.9	92	48	-	7.1	5.2
April, 19	43.1	1	36.6	24.2	82	47	6.7	8.1	7.1
May, 19	9.4	1	37.5	27.6	79	55	7.3	6.5	6.9
June, 19	91.3	5	37.1	27.8	79	55	3.7	4.7	6.1
July, 19	55.3	5	33.6	26.1	84	65	3.0	3.1	4.1
August, 19	129.3	10	33.6	25.8	87	64	1.8	3.2	3.7
September, 19	380.1	19	31.7	25.0	93	77	3.1	3.2	2.5
October, 19	312.6	14	31.8	24.3	95	74	2.7	4.6	2.7
November, 19	3.3	1	31.8	21.4	90	52	2.6	6.2	3.2
December, 19	0.2	0	29.7	19.0	91	52	2.7	3.8	2.9
January, 2020	0.8	0	30.3	18.5	95	54	3.0	4.2	3.2
February, 20 20	17.6	3	31.6	19.5	91	52.0	3.4	5.9	4.2

Insect pest	Rainfall (mm)	Temp °C (Max.)	Temp °C (Min)	RH % (FN)	RH% (AN)
ESB	-0.74*	0.72*	0.61*	-0.88*	-0.41
Termite	-0.38	0.24	0.32	-0.54	-0.32
Internode borer	0.67*	-0.06	0.15	0.52*	0.48
<i>Trichogramma</i>	0.52*	-0.15	0.01	0.19	0.39
Red mite	-0.40	0.76*	-0.79*	0.62*	-0.88*
Web mite	-0.84*	-0.75*	-0.74*	-0.95*	-0.84
Sugarcane aphid	0.29	-0.71*	-0.54*	0.74*	0.16
Scale insect	-0.71*	-0.95*	-0.97*	-0.35	-0.81*
woolly aphid	-0.67*	-0.94*	-0.93*	-0.27	-0.75*



**Project No. E. 34: Standardisation of simple and cost effective techniques for mass multiplication of sugarcane bio-agents**

**North West Zone**

**ICAR-IISR, Lucknow, Uttar Pradesh**

*Eumicrosoma* spp. (Hymenoptera : Scelionidae) is a potential egg parasitoid of black bugs of sugarcane, *Cavelerious sweeti* Myamoto and *Dimorphopterus gibbus*. *Eumicrosoma* spp. is mass multiplied in the laboratory on the eggs of laboratory reared *Dimorphopterus gibbus*. *D. gibbus* is multiplied on natural host plant.

**Rearing of black bug, *Dimorphopterus gibbus* (Fabricius) and *Cavelerius Sweeti* Myamoto**

There are two major steps in rearing of black bug in the laboratory.

**Muslin bag for oviposition:** A muslin bag (20.0 x 8.0 cm) containing cut tops of sugarcane with 5 cm leaf portion is used as egg laying bag. In one bag 50 pairs of adult bugs are released. Bag with insects are kept in tray for egg laying. Fresh eggs are rice shaped and creamy white in colour. At maturity eggs become dark orange in colour.

**Paper cone for nymph development:** Paper cone was developed by rolling a cut cane (8-10) with leaf sheath in a sterilized A4 paper. Narrow end of the paper cone was tightened with the help of rubber bands and broad upper and is closed after releasing the either mature eggs or newly hatched nymphs by locking the con ends. Nymphs are shifted to new cone at the interval of 4-5 days in summer and 5-6 days interval in winter and rainy seasons. Nymphs hatch in 6.0 to 10 days. Lifecycle is completed in 29 to 55days (Table-1).

Nymphal and total period of

**Table -1: Duration of different life stages of *Dimorphopterus gibbus* on natural food.**

Duration	Incubation period (days)	Nymphal period (Days)	Total period (days)
February-March	6-8	26-27	31-35
April-May	8-9	25-28	33-38
June -July	6-8	25-27	30-35
August- September	6-7	22-26	29-33
October -November	9-10	27-29	35-38
December-January	9-10	45-47	51-55

**Mass multiplication of *Eumicrosomas*p (Hymenoptera: Scelionidae) an egg parasitoid of Lygaeid bugs of sugarcane**

*Eumicrosoma* sp. is a black shiny Scelionid wasp. Eggs of black bug *D. gibbus* were used as laboratory host.

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. Parasitization ranged from 10.00 to 80.00 percent. Single gravid female could parasitize on an average of 15.67 eggs. Development period of parasitoid varies from 7-10 days. Parasitisation and longevity of adults varies from 62.89 to 80.75 per cent and 1-3.5 days, respectively (Table-2).

**Table-2: Parasitisation by *Eumicrosoma* spp. and its development**

Duration	Parasitisation (%)	Development period (Days)	Adult emergence (%)	Longevity of Adults (Days)
February	40.00	8.00	72.00	1-2
March	48.00	8.00	75.00	2-3
April	55.00	8.00	65.00	1-2
May	44.00	8.00	65.50	1-2
June	50.00	8.00	75.00	1-2

July	67.00	7.00	79.00	2-2.5
August	70.00	7.00	80.00	2-3
September	80.00	7.00	82.00	2-3.5
October	75.00	7.00	75.50	2-2.5
November	59.00	8.00	62.89	2.2.5
December	35.00	9.00	79.00	1-2
January	10.00	10.00	80.75	1-1.5

### Peninsular zone

#### ICAR-SBI, Coimbatore, Tamil Nadu

For economizing mass culture of EPF, media containing agricultural by-products and grains were assessed with and without addition of peptone at different concentrations (5, 10 and 15%). For production of *M. anisopliae*, no differences among the concentrations used were observed among the by-products viz., extracts of rice bran, wheat bran, red gram husk, sesame seed cake, groundnut cake, cotton seed cake along with peptone supplement. The spore production ranged from  $2.13 \times 10^9/100\text{ml}$  (cotton seed cake) to  $8 \times 10^9/100\text{ml}$  (wheat bran). When the media were assessed without peptone supplement, irrespective of the concentration, the effect of media showed overlapping levels of significant variation. Cotton seed cake was the best ( $7.3 \times 10^9/100\text{ml}$ ) which was on par with jaggery, wheat bran, groundnut cake ( $4.8 \times 10^9/100\text{ml}$ ) and SD broth ( $5.2 \times 10^9/100\text{ml}$ ).

Similar tests with *Beauveria* spp., showed that production of *B. bassiana* was higher in sesame seed cake extract ( $2.81 \times 10^8/\text{ml}$ ) than other media including standard SD ( $0.77 \times 10^8/\text{ml}$ ). Several media including sesame seed cake extract were cost effective at 5% concentration. For *B. brongniartii*, irrespective of concentrations tested many media viz., coconut seed cake ( $11.93 \times 10^7/\text{ml}$ ), rice bran extract ( $11.02 \times 10^7/\text{ml}$ ), wheat bran ( $11.67 \times 10^7/\text{ml}$ ), red gram husk ( $8.27 \times 10^7/\text{ml}$ ) and cotton seed cake ( $5.8 \times 10^7/\text{ml}$ ) were on par and significantly better than the others. Wheat bran at 15% and rice bran extract at 15% were most cost effective.

#### CSR, MPKV, Padegaon, Maharashtra

The experiment was not conducted by the earlier scientist due to mega transfer of university staff during the 2019. The Deptt. of Agril Entomology, College of Agriculture Pune has bio control laboratory. They are producing bio agents for supply to different University departments. At Padegaon there is no microbiologist at present.

#### Vasantdada Sugar Institute, Pune, Maharashtra

**Filling of *Corcyra* rearing boxes:** Emergence of adults took place 40-45 days and it continues for further 45 days. The wooden *Corcyra* rearing cages of 20x10x7 cubic inch are used for filling of heat sterilized 2.5 Kg of half crushed jowar flour. 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:** The emerged *Corcyra* adults were collected regularly, using plastic tubes preferably in morning hours. Collected adults have placed to egg laying chamber for mating. A size of wooden *Corcyra* eggs laying chamber is 8x8x8 cubic inch. Eggs laying chamber has a wire mesh at bottom and a wooden lid at the top with wire mesh window to provide the honey (35% diluted) swab to adult moths as a feeding material. 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.

**Results:**

Table No. 8 indicates that during 2019-20 produced 1737.9 cc (347.58 lac) *Corcyra* eggs with a monthly average of 144.82cc (28.96 lac). Produced 1286 Tricho cards (257.20 lac parasites) of *Trichogramma chilonis* parasites with a monthly average 107.17 Tricho cards (21.43 lac parasites). Supplied 827.5 Tricho cards for the control of borers on 55.17 ha area and 247cc *Corcyra* Eggs to Govt. Biocontrol lab in Maharashtra state as nucleus culture (Table 9).

**Table 8: Monthly production of *C. cephalonica* eggs and *T. chilonis* parasitoids cards during 2019-2020**

Sr. No.	Month	<i>Corcyra</i> eggs Produced (cc)		<i>T. chilonis</i> cards	
		Per month	Per day	Per month	Per day
1	April 2019	36.3	1.21	31	1.03
2	May 2019	96.0	3.10	42	1.35
3	June 2019	105.4	3.51	85	2.83
4	July 2019	76.5	2.47	33	1.06
5	August 2019	127.2	4.10	74	2.39
6	September 2019	376.2	12.54	205	6.83
7	October 2019	56.1	1.81	249	8.30
8	November 2019	356.5	11.88	136	4.53
9	December 2019	38.1	1.23	124	4
10	January 2020	136.8	4.21	148	4.77
11	February 2020	36.80	1.27	36	1.24
12	March 2020	296	9.55	123	3.97
	Total	1737.9	56.88	1286	42.3
	Average	144.82	4.74	107.17	3.52

**Table 9: Supply of *T. chilonis* parasitoids cards/*Corcyra* eggs during 2019.2020**

Name of sugar mill/other	No. of Tricho cards supplied	Amount (A) (Rs.)	Area covered (ha)	<i>Corcyra</i> eggs supplied (cc)	Amount (B) (Rs.)
Bio-control Lab., Vardha				50	4750
bio lab, Parbhani	2	190		20	1900
VNMKV, Parbhani	1	95		20	1900
Bio-control Lab., Khopoli	2	190		15	1425
Bio-control Lab., dhule	10	950			
Bio-control Lab., A.nagar				5	475
College of Agriculture, Kolhapur				2	190
College of Agriculture, Pune	1	95		10	950
				125	11875
Farmers	259	24605	17.27		
Total A=	275	26125	18.33		
Total B=				247	23465
Total C= (A+B)		49590.00			
VSI Farm (Gratis)	552.5	52487.5	36.83		
Grand Total F= (C+D)=		102077.5			

## East Coast Zone

### Regional Agricultural Research Station, Anakapalle, ANGRAU, Andhra Pradesh

During 2019-20, a total of 213 cocoons and 36 egg masses of *F. melanoleuca* were multiplied and utilized for release in IPM module plot (Table 9).

Month	No. of Nymphs of host insect <i>Pyrilla</i> reared	Cocoons of <i>F.melanoleuca</i> produced (No)	Egg masses
October, 19	53	0	0
November, 19	210	94	0
December, 19	168	109	36
Total	431	213	36

## 7. Methodology adopted :

Rearing of *F. melanoleuca* on *P. perpusilla*

To initiate the laboratory culture of *Pyrilla*, the adults were collected from the field and reared under laboratory. After sufficient production of *Pyrilla* nymphs and adults, field collected egg mass or cocoons of *F. melanoleuca* were released in the glass jars and mass multiplied in glass jars.

## 8. Results of the previous year

During 2018-19. the *Pyrilla* adult were collected from the field and reared under laboratory at temperature, ranging from 25<sup>0</sup> to 26<sup>0</sup>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 cut, 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. After production of *Pyrilla* nymphs and adults, field collected egg mass or cocoons of *F. melanoleuca* were released in the glass jars. Fresh leaves of sugarcane were added at 3 to 4 days interval simultaneously, dried leaves were removed from the Jar. By this technique, harvested eggs and cocoons of *F. melanoleuca* daily and utilised for field release programme. A total of 171 cocoons and 23 egg masses of *F. melanoleuca* were multiplied and utilized for release in IPM module plot.

**Project No. E-38: Formulation and validation of IPM module sugarcane insect-pests.**

**North West Zone**

**UPCSR, Shahajahanpur, Uttar Pradesh**

The experiment was conducted in 0.2 ha plot size with variety UP 05125 as a treated IPM block and 0.2 ha plot as a untreated farmer's practice block. Both the plots were separated by keeping 100 meters distance. In IPM block, the growth parameters viz; per cent germination (51.09%), total cane height (m) 3.20, millable cane height (m) 2.38, number of internodes 25 and girth of cane (cm) 2.48 showed higher than farmer's practice block viz; per cent germination (46.92%), total cane height (m) 3.05 millable cane height (m) 2.10, number of internodes 24 and girth of cane (cm) 2.30. In IPM block less cumulative incidence of shoot borer was recorded (1.86%) in comparison to farmer's practice block (3.89%). The top borer incidence were recorded less viz; 3<sup>rd</sup> brood (0.14%), 4<sup>th</sup> brood (0.19%) and at harvest (3.35%) in comparison to farmer's practice block i.e. 3<sup>rd</sup> brood (0.43%), 4<sup>th</sup> brood (0.32%) and at harvest (4.86%). IPM block recorded 100.98 thousand millable cane per ha as compare to farmer's practice 87.09 thousand per ha. In IPM block higher cane yield (87.25 t/ha) was recorded in comparison to farmer's practice block (70.10 t/ha). Stalk borer incidence, per cent intensity and infestation index were recorded less in IPM block 8.00%, 0.41% and 0.04% as compare to farmer's practice block 25.33%, 1.32% and 0.35% at the time of harvest (Table 4 a, b, c).

**Table 4 a. Formulation and validation of IPM module of sugarcane insect pests.**

S.N.	Treatments	% Germ.	Tillers/ha (000)	NMC/ha (000)	Yield t/ha
1	IPM Block	51.09	114	100	87.25
2	Farmer's Practice	46.92	100	87	70.10

**Table 4 b. Formulation and validation of IPM module of sugarcane insect pests.**

Sl. No.	Treatments	Growth parameter				Sucrose (%) in juice (Quality)
		Total cane height (m)	Millable cane height (m)	Number of internodes	Cane girth (cm)	
1	IPM Block	3.20	2.38	25	2.43	20.83
2	Farmer's practice	3.05	2.10	24	2.30	20.73

**Table 4 c. Formulation and validation of IPM module of sugarcane insect pests.**

Insect pest	% incidence of insect pests	
	IPM Block	Farmer's practice
Shoot borer (cumulative)	1.86	3.89
Top borer (3 <sup>rd</sup> brood)	0.14	0.43
Top borer (4 <sup>th</sup> brood)	0.19	0.32
Top borer ( At harvest)	3.35	4.86
Stalk borer (infestation index)	0.08	0.35

**Table 4 d. Moth catches (2019-20).**

Month	Moth trapped		
	Shoot borer	Top borer	Stalk borer
March 2019	2	2	3
April 2019	5	2	4
May 2019	8	4	6
June 2019	3	5	8
July 2019	2	6	10
August 2019	-	2	12
September 2019	-	1	10
October 2019	-	-	-

**North central zone**

**Sugarcane research institute**

**Dr. Rajendra prasad central agricultural university, Pusa, samastipur, Bihar**

The experiment was conducted with variety BO-154 at Pusa Farm, Sugarcane Research Institute, RPCAU, Pusa during cropping season of 2019-20 to study the formulation and validation of IPM module of sugarcane insect pests. The data presented in table 11 to 11c revealed that germination, number of millable canes/ha, cane yield (kg/ha) being 7.51 %, 16.91% and 13.48%, respectively, which were increased over farmer practices under yield parameter characters of the crop. In growth parameters, millable can height (5.24%) and number of internodes (3.14%) were increased over farmer practices.

The incidence percentage of borer pests were reduction over farmer practices varied from 11.97 to 30.57% and maximum (30.97%) incidence reduction was noticed with plassey borer. In case of sucking pests, maximum (39.02%) reduction in incidence of mealy bug and minimum (24.83%) reduction with scale insect over farmer practices. Whereas under quality parameters, 3.36%, 4.09%, 1.30% and 4.51% of brix, sucrose, purity and CCS, respectively, were increased over farmer practices. Hence, it may be inferred from the results that the IPM module has potential to increase yield, growth and quality parameters and reduction in insect pests incidence in sugarcane crop.

**Table 11: Impact of treatment on growth and yield component of sugarcane during 2019-20**

Treatment	Yield parameter						Growth parameter			
	Germination (%)	% increased over farmer practices	No. of millable cane (000/ha)	% increased over farmer practices	Cane yield (kg/ha)	% increased cane yield over farmer practices	Millable cane height (cm)	% increased over farmer practices	No. of internodes	% increased over farmer practices
IPM block	38.60	7.51	123140	16.91	8970	13.48	267	5.24	21.33	3.14
Farmer practices	35.70	-	102313	-	7760	-	253	-	20.66	-

**Table 11a: Impact of treatment on borer pest of sugarcane during 2019-20**

Treatment	Per cent incidence of borer pest									
	Root	% reduction farmer practice	Shoot	% reduction over farmer practices	Top	% reduction over farmer practices	Stalk	% reduction over farmer practices	Plassey	% reduction over farmer practices
IPM block	6.46	18.02	8.52	13.93	10.36	11.97	3.22	26.14	2.83	30.57
Farmer practices	7.88	-	9.90	-	11.77	-	4.36	-	4.10	-

**Table 11b: Impact of treatment on sucking pest of sugarcane during 2019-20**

Treatment	Incidence of sucking pest							
	Pyrrilla/leaf	% reduction over farmer practices	Whitefly/sq. cm	% reduction over farmer practices	Mealy bug (%)	% reduction over farmer practices	Scale insect (%)	% reduction over farmer practices
IPM block	3.86	39.02	1.25	30.55	7.22	26.02	5.66	24.83
Farmer practices	6.33	-	1.80	-	9.76	-	7.53	-

**Table 11c: Impact of treatment on quality parameters of sugarcane during 2019-20**

Treatment	Quality parameters							
	Brix (%)	% increased over farmer practices	Pol (%)	% increased over farmer practices	Purity (%)	% increased over farmer practices	CCS (%)	% increased over farmer practices
1 PM block	18.40	3.26	16.10	4.09	87.88	1.30	11.08	4.51
Farmer practices	17.80	-	15.44	-	86.73	-	10.58	-

**Peninsular Zone**

**UAS, Zonal Agricultural Research Station V. C. Farm, Mandya, Karnataka**

**1. Treatment details:**

	<b>T1 : IPM Module</b>		a.	Selection of seed material from pest free field.
			b.	Seed treatment with chlorpyrifos 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.	Release of Trichogramma egg parasitoids @ 50,000 at weekly interval five times
			f.	Remove water shoots @180,210 and 240DAP
	<b>T2 : Farmers Practice</b>		a.	Incorporation of carbofuron 3G @30kg/ha at the time of planting and @150DAP

**2. Inference:** In IPM plot, the incidence of major pests was low compared to farmers practice plot. Apart from this, the yield of IPM plot was 13.36 percent more than the farmers practice plot, with the cost benefit ratio of 1:3.86 in favor of IPM practice (Table.6).

**3. Scientists involved:** Dr. V.N. Patel, Dr. S. N. Swamygowda, Dr. M.S. Kittur Mata, Mr. J.S.Nadeesh, Mrs. B.P. Sunitha & Mr. B. Santhosh

**Table 6: Formulation and validation of IPM module of sugarcane insect pests**

Pest	IPM Plot	Farmers practice plot
	Infestation level (%)	Infestation level (%)
Early shoot borer	2.25	17.50
Top shoot borer	1.50	12.50
Internode borer	16.50	11.00
Woolly aphid	4 clumps 50% leaf area covered by aphids	7 clumps 65% leaf area covered by aphids
Pyrilla	<1.0 adults/nymphs/clump	<1.0 adults/nymphs/clump
Yield	74.25ton/ac	65.50ton/ac

### CSR, MPKV, Padegaon, Maharashtra

The experiment was conducted during 2019-20, but due to scarcity of water very poor germination was seen in both the treatments. Plant population was also very low as compare to IPM block than non-IPM block. Hence there was no chance to justice for both the treatment. Therefore, the treatments were not imposed on IPM block. It is therefore, the experiment mat please be treated as vitiated due scarcity of water during growth stage of sugarcane

### Vasantdada Sugar Institute, Pune , Maharashtra

#### T1: IPM Block [Peninsular Zone]

Stage of the cultivation/Period	Target pest	Activities need to be carried out*
Seed selection	Borers, Mealy bug, scale insect, woolly aphid	➤ Selection from uninfested field. ➤ Rejecting infested pieces.
Pre-planting	Borers, Mealy bug, Scale insect, white grub, termite	➤ Ploughing for exposure of stages of white grub for predation. ➤ Dipping the setts for 2 minutes in the solution of Chlorpyriphos 20 EC @ 40 ml and Carbendazim 50% @ 50gm in 10 litre of water.
At planting	Borers	➤ Soil application of Fertera 0.4G @ 22.5 kg/ha at the time of planting.
At 45 day	ESB	➤ Release of Tricho cards @7.5 cards/ha
At 60 day	Borer	➤ Spraying of Chlorantraniliprole 18.5 SC @ 375 ml/ha at 60 DAP
At 75DAP	ESB	➤ Release of Tricho cards @7.5 cards/ha
At 150 DAP	INB	➤ Release of Tricho cards @7.5 cards/ha
At 180 DAP	INB	➤ Release of Tricho cards @7.5 cards/ha

#### T2: Farmer practices of the Zone [Peninsular Zone]

- Soil application of Carbofuran @33 kg /ha at pre-planting

The germination % at 45 DAP was 58.0% and 56.0% in IPM block and farmers practice block respectively. The tillering ratio at 120 DAP was 4.50 & 4.15 in IPM Block and Farmers practice block, respectively.

At 60 DAP the mean % incidence of early shoot borer was low0.52% in IPM Block, while in farmers practice, it was 2.25%. At 90 DAP the mean % incidence of early shoot borer was statistically low 0.82% in IPM Block while in farmers practice, it was 10.22%. At 120 DAP the mean % incidence of early shootborer was statistically low 0.79% in IPM Block, while in farmers practice it was 5.35%.

The cumulative incidence of early shoot borer was less(1.99%) in IPM block, while (13.77%) in farmers practice block. No. of bored plants/ha were 2143 and 15357 in IPM Block and Farmers practice block respectively.



At 150 DAP in IPM block % incidence, % intensity and infestation index of INB was 3.00, 1.04 and 0.07% respectively, while in farmers practice block % incidence, % intensity and infestation index of INB was 3.00, 1.04 and 0.13 %, respectively. At 11 months after planting in IPM block % incidence, % intensity and infestation index of INB was 3.00, 0.16 and 0.02 % respectively, while in farmers practice block % incidence, % intensity and infestation index of INB was 8.00, 0.45 and 0.05 %, respectively.

At harvest total cane height and Millable cane height was numerically high 305.66 and 264.44 cm in IPM block while 293.33 and 251.15 cm in farmers practice block., Single cane weight was high 2.05 Kg in IPM block, while it was 1.97 kg in farmers practice block. No. of internodes were 19 in IPM block, while it was 20 in farmers practice block. CCS % and CCS t /ha was numerically high 13.89 and 14.70 in IPM Block, while 13.62 and 12.01 in farmers practice block.

At harvest plant population per ha was numerically high 51500 in IPM block and it was 44857 in farmers practice block. Sugarcane yield per ha was numerically high 105.86 t in IPM block and it was 88.16 in farmers practice block. The B:C ratio was numerically high 2.75 in IPM block and it was 2.55 in farmers practice block and ICBR was 3.46 (Table 10).

**Table 10: Per cent incidence of ESB, Growth and yield parameters**

Sr. No	Parameters	T1	T2	Cal t
1	Per cent incidence of ESB at 30 DAP	0.00	0.00	
2	Per cent Germination at 45 DAP	58.00	56.00	NS
3	Per cent incidence of ESB at 45 DAP	0.29	0.00	NS
4	Per cent incidence of ESB at 60 DAP	0.52	2.25	NS
5	Per cent incidence of ESB at 90 DAP	0.82	10.22	5.22
6	Per cent incidence of ESB at 120 DAP	0.79	5.35	4.32
7	Cumulative incidence of ESB	1.99	13.77	
8	Tillering ratio at 120 DAP	4.50	4.15	NS
9	No. of bored plants/ha.	2143	15357	
10	Per cent incidence of INB at 150 DAP	3.00	3.00	NS
11	Per cent intensity of INB at 150 DAP	1.04	1.04	NS
12	Infestation index of INB at 150 DAP	0.07	0.13	NS
13	Per cent incidence of MB at 150 DAP	0	0	
14	Per cent incidence of INB at 11 months after planting	3.00	8.00	NS
15	Per cent intensity of INB at 11 months after planting	0.16	0.45	NS
16	Infestation index of INB at 11 months after planting	0.02	0.05	NS
17	Infestation index of MB at 11 months after planting	0	0	
18	Plant Population/ha	51500	44857	NS
19	Single cane wt kg	2.05	1.97	NS
20	Sugarcane yield t/ha	105.86	88.16	NS
21	CCS t/ha	14.70	12.01	NS
22	Total cane height (cm)	305.56	293.33	NS
23	Milable cane height (cm)	264.44	251.11	NS
24	No. of internode	19	20	NS
25	Diameter (cm)	3.49	3.50	NS
26	Brix %	20.77	20.25	NS
27	Sucrose %	19.34	18.93	NS
28	Purity %	93.11	93.46	NS
29	CCS%	13.89	13.62	NS
30	B:C Ratio	2.75	2.55	
31	ICBR	3.46		

## Conclusion:

The cumulative % incidence of early shoot borer was low 1.99% in IPM block, while 13.77% in farmers practice block. At harvest plant population per ha was numerically high 51500 in IPM block and 44857 in farmers practice block. Sugarcane yield per ha was numerically high 105.86 t in IPM block and 88.16 t in farmers practice block. ICBR was 3.46.

## East Coast Zone

### Regional Agricultural Research Station, Anakapalle, ANGRAU, Andhra Pradesh

#### 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 chlorpyrifos 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, <i>Pyrilla</i> , scale insect, mealy bug	Spraying of chlorantraniliprole 18.5 SC @ 375 ml/ha at 60 DAP
At 90 day	Borer, <i>Pyrilla</i> , scale insect, mealy bug	Detrash the lower leaves, remove egg masses and infested canes.
At 150 day	INB, Mealy bug, Scale insect, whitefly, <i>Pyrilla</i>	Release of <i>Epiricania (=Fulgoreica) melanoleuca</i> @ 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	<i>Pyrilla</i> , 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/lit at 4<sup>th</sup>, 6<sup>th</sup> & 9<sup>th</sup> week after planting and twice at 120 days after planting after detraging of old dried leaves.
- Field release of *T.chilonis* @ 50,000/ha at 130 days after planting for 2 times at 7-10 days interval

During 2019-20, new IPM Module recorded less incidence of early shoot borer (6.17%DH), moderate incidence of internode borer (48.92%) with less intensity (4.06%) and nil incidence of scale insect with more number of shoot population at 120 DAP (1,09,430/ha) compared to zonal recommendation (27.62%DH; 64.10% & 6.50; 30% & 6 %; 88,300/ha) whereas in untreated control, high incidence of early shoot borer (76.25%), internode borer (84%) with high intensity (12%) and scale insect (50 %) with high intensity (14 %) with less number of shoots at 120 DAP (72,840/ha) were recorded (Table 9, 10). High cane yield was recorded in new IPM (74.50 t/ha) followed by zonal recommendation (54.64 t/ha) compared to untreated control (46.62 t/ha) (Table 11).

Overall results revealed that new IPM module found effective by recording high per cent germination (76.74%), less incidence of early shoot borer (11.22%DH), moderate incidence of internode borer (40.41%) with low intensity (3.88%) and less incidence of scale insect (6.27%) with low intensity (0.86%) compared to untreated control (61.60%; 52.41%DH; 76.33% & 9.59%; 46.34% & 7.10%). Whereas in zonal recommendation, the per cent germination (71.20) and incidence of early shoot borer were 71.20% and 23.66% DH, respectively; high incidence of internode borer (63.61%) with 6.24% intensity and less incidence of scale insect (10%) with 2.01% intensity were recorded (Table 12).

More number of millable canes (69,390 NMC/ha) and superior cane yield were recorded in IPM module with a benefit cost ratio of 1.64 compared to untreated control (53,340 NMC/ha; 55.08 t/ha; 1.42) whereas in zonal recommendation 59,390 NMC/ha and 63.68 t/ha of cane yield were recorded with a benefit cost ratio of 1.52 (Table 13).

Treatment	Germination (%)	Per cent incidence of early shoot borer (%DH)					Per cent reduction over control	Shoot population at 120 DAP/ha
		30 DAP	60 DAP	90 DAP	120 DAP	Cumulative up to 120 DAP (%DH)		
T1- New IPM Module	68.69	2.21	2.60	1.36	0.00	6.17	91.90	1,09,430
T2- Zonal recommendation	67.45	9.74	10.32	7.60	0.00	27.62	63.72	88,300
T3- Untreated control	57.00	28.46	33.24	10.21	4.34	76.25	-	72,840

Treatment	Internode borer (%)		Infestation index	Scale insect (%)		Infestation index
	Incidence	Intensity		Incidence	Intensity	
T1- IPM module	48.92	4.06	1.99	0	0	0
T2- Zonal recommendation	64.10	6.50	4.17	30.00	6.00	2.01
T3- Untreated control	84.00	12.00	10.08	50.00	14.00	7.01

**Table 11 Impact of new IPM on growth parameters, juice sucrose, NMC and cane yield during 2019-20**

Treatment	Total cane height (m)	Millable cane height (m)	Number of internodes	Girth of the cane (cm)	Weight of single cane (kg)	Juice sucrose (%)	NMC/ha (000 <sup>3</sup> )	Cane yield/ ha
T1- IPM Module	2.20	2.09	21	2.31	1.00	19.90	74.50	74.50
T2-Zonal recommendation	1.90	1.70	19	1.53	0.99	19.60	55.19	54.64
T3-Untreated control	0.89	0.87	16	1.53	0.88	18.90	52.98	46.62

**Table 12 Impact of new IPM module on insect pest incidence, juice quality (pooled data of three years)**

S. No.	Particulars	IPM Module				Zonal recommendation				Untreated control			
		2017	2018	2019	Mean	2017	2018	2019	Mean	2017	2018	2019	Mean
1	Germination (%)	86.52	66.9	68.69	76.74	84.81	62.00	67.45	71.42	78.20	45.00	57.00	61.60
2	Incidence of ESB up to 120 DAP (%DH)	22.89	4.60	6.17	11.22	27.87	15.50	27.62	23.66	49.17	31.80	76.25	52.41
3	Incidence of internode borer (%)	23.91	48.40	48.92	40.41	49.50	65.0	64.10	63.61	65.00	80.00	84.00	76.33
	Intensity of internode borer (%)	1.86	5.71	4.06	3.88	3.50	8.71	6.50	6.24	4.78	12.00	12.00	9.59
	Infestation index	0.44	1.62	1.99	1.35	1.73	5.66	4.17	3.85	3.11	9.60	10.08	7.60
4	Incidence of scale insect	18.80	0.00	0.00	6.27	1.00	0.00	30.0	10.00	56.02	33.00	50.00	46.34
	Intensity of scale insect	2.59	0.00	0.00	0.86	0.04	0.00	6.0	2.01	16.52	4.78	14.00	7.10
5	Shoot population at 120 DAP (000 <sup>3</sup> /ha)	84.35	69.33	106.43	86.70	76.44	64.88	88.30	72.21	66.51	58.52	78.84	67.96
6	Juice sucrose (%)	20.04	20.37	19.90	20.10	19.56	20.02	19.60	19.72	18.95	20.35	18.90	19.40
7	NMC/ ha (000 <sup>3</sup> /ha)	64.35	69.33	74.50	69.39	63.44	59.55	55.19	59.39	53.51	53.52	52.98	53.34
8	Cane yield (t/ha)	70.20	70.79	74.50	71.83	69.78	68.80	52.45	63.68	57.80	58.86	48.57	55.08

**Project E41 : Assessment of yield losses caused by borer pests of sugarcane under changing climate scenario**

**North West Zone**

**ICAR-Indian Institute of Sugarcane Research, Lucknow**

Field experiment was conducted to study cane yield losses due to insect pests with Co0238. Two blocks of 0.1 hectare were maintained. One block was kept under management practice especially insecticide (application of chlorpyrifos 20 EC @ 1.0 kg a. i./ha at planting, soil application of carbofuran @ 1. Kg a. i./ha against III brood of top borer, foliar spray of quinalphos 25 EC @ 250 g a. i./ha against cane borers), bio-agents such as *Trichogramma* spp. and *Cotesia flavipes* have also been released. Other block no insect pest management practices were applied. Average per cent incidence of top borer II brood, III brood, IV brood, stalk borer, internode borer and mealy bug was 2.31, 18.91, 30.28, 13.68, 10.69 and 28.89 per cent, respectively in un protected block while incidence of top borer II brood was nil and of III brood, IV brood, stalk borer, internode borer and mealy bug was 3.81, 5.31, 3.22, 1.86 and 6.44 per cent, respectively in protected block. Reduction in cane weight in cane damaged by top borer III brood, IV brood, Stalk borer, internode borer and mealy bug was 12.87, 19.51, 6.09, 8.80 and 18.89 per cent respectively.

**Penninsular Zone**

**VSI, PUNE, Maharashtra**

Field experiment was conducted to study cane yield losses due to insect pests with VSI08005. Two blocks of 0.1 hectare were maintained. One block was kept under management practice especially, pre planting ploughing, seed selection, insecticide applications and bio-agents were released. In 0.1 hectre crop no treatments were given.

**IPM Schedule**

Stage of the cultivation/Period	Target pest	Activities need to be carried out*
Seed selection	Borers	➤ Selection from uninfested field. ➤ Rejecting infested pieces.
Pre-planting	Borers	➤ Ploughing for exposure of stages of white grub for predation. ➤ Dipping the setts for 2 minutes in the solution of Chlorpyrifos 20 EC @ 40 ml and Carbendazim 50% @ 50gm in 10 litre of water.
At planting	Borers	➤ Soil application of Fertera 0.4G @ 22.5 kg/ha at the time of planting.
At 45 day	ESB	➤ Release of Tricho cards @7.5 cards/ha
At 60 day	Borer	➤ Spraying of Chlorantraniliprole 18.5 SC @ 375 ml/ha at 60 DAP
At 75 DAP	ESB	➤ Release of Tricho cards @7.5 cards/ha
At 150 DAP	INB	➤ Release of Tricho cards @7.5 cards/ha ➤ Drenching of Chlorpyrifos 20 EC @ 5 lit. /ha
At 180 DAP	INB	➤ Release of Tricho cards @7.5 cards/ha

At 60 DAP the mean % incidence of early shoot borer was statistically low 1.22 in IPM Block while in control it was 9.98. At 90 DAP the mean % incidence of early shoot borer was statistically low 1.57 in IPM Block while in control it was 16.14. At 120 DAP the mean % incidence of early shoot borer was statistically low 1.16 in IPM Block, while in control it was 5.96.

The cumulative % incidence of early shoot borer was less 4.49% in IPM block, while 28.99% in farmers practice block. No. of bored plants/ha were 3714 and 28000 in IPM Block and control block respectively.

At 150 DAP in IPM block% incidence, % intensity and infestation index of INB was 1.00, 0.23 and 0.01% respectively, while in control block% incidence, % intensity and infestation index of INB was 7.00, 2.31 and 0.22 %, respectively. At 300 DAP in IPM block % incidence, % intensity and infestation index of INB was 3.00, 0.16 and 0.01% respectively, while in control block% incidence, % intensity and infestation index of INB was 7.00, 0.42 and 0.04 %, respectively.

At harvest Millable cane height was statistically high 272.29 cm in IPM block while 238.76 cm in farmers practice block., Single cane weight was high 2.50 Kg in IPM block, while it was 1.89 kg in farmers practice Block. No. of internodes were 21 in IPM block, while it was 20 in farmers practice Block. CCS % and CCS t /ha was statistically high 14.53 and 21.83 in IPM Block, while 13.22 and 14.32 in farmers practice block.

At harvest plant population per ha was statistically high 61667 in IPM Block and it was 51667 in farmers practice block. Sugarcane yield per ha was statistically high 154.79 t in IPM block and it was 98.88 t in farmers practice Block. Table No. 11 indicate that there was 36.11 % reduction in sugarcane yield and 1.31-unit loss in sugar recovery due to borer infestation. B:C ratio was numerically high 3.81 in IPM block and it was 2.97 in farmers practice Block and ICBR was 7.64.

**Table 10: Infestation of Borers, Growth and yield parameters**

Sr.No	Parameters	T1	T2	Cal.t
1	Per cent incidence of ESB at 30 DAP	0.00	0.00	NS
2	Per cent Germination at 45 DAP	69.40	67.40	NS
3	Per cent incidence of ESB at 45 DAP	1.70	3.12	NS
4	Per cent incidence of ESB at 60 DAP	1.22	9.98	4.71
5	Per cent incidence of ESB at 90 DAP	1.57	16.14	10.68
6	Per cent incidence of ESB at 120 DAP	1.16	5.96	3.15
7	Cumulative incidence of ESB	4.49	28.99	
8	Tillering ratio at 120 DAP	2.28	2.19	NS
9	No. of bored plants/ha.	3714	28000	
10	Per cent incidence of INB at 150 DAP	1	7	2.32
11	Per cent intensity of INB at 150 DAP	0.23	2.31	2.81
12	Infestation index of INB at 150 DAP	0.01	0.22	2.43
13	Per cent incidence of INB at 300 DAP	3	7	NS
14	Per cent intensity of INB at 300 DAP	0.16	0.42	NS
15	Infestation index of INB at 300 DAP	0.01	0.04	NS
16	Plant Population/ha	61667	51667	3.70
17	Single cane wt kg	2.50	1.89	5.12
18	Sugarcane yield t/ha	154.79	98.88	5.80
19	Per cent reduction in sugarcane yield	36.11		
20	CCS t/ha	21.83	14.32	5.49
21	Total cane height (cm)	9.86	8.81	NS
22	Milable cane height (cm)	8.93	7.83	2.32
23	No. of internode	21	20	NS
24	Diameter (cm)	3.00	2.88	3.05
25	Brix %	21.26	20.22	NS
26	Sucrose %	20.10	18.54	2.37
27	Purity %	94.54	91.68	NS
28	CCS%	14.53	13.22	2.34
29	Unit loss in CCS %	1.31		
30	B:C Ratio	3.81	2.97	
31	ICBR	7.64		

### SBI, Coimbatore, Tamilnadu

To assess yield loss due to INB attack, infested and uninfested canes were selected from an experimental plot with the popular variety Co 86032 at the time of harvest. Infested canes were segregated based on position of INB attack viz. top, middle, bottom, top-middle, middle-bottom, top-bottom and top-middle-bottom. Measurements on cane weight, cane girth, internode number and cane length were taken for 20 canes in each infested category and control. Data were analysed and presented in Table 7. In infested canes the proportion of bore holes in top and bottom was more (20% each) compared to middle and top-bottom categories (15.7% each) followed by middle-bottom (14.3%) and top-middle (11.4%). The proportion of canes attacked in all the three portions was low (2.9%). In terms of intensity of attack, maximum intensity was in TMB category as more number of internodes was attacked than in other categories. Cane girth was affected most by TMB category compared to other categories. Internode number and cane length were not much affected, whereas cane weight was reduced by 50% in TMB category. Yield loss depends upon the proportion of canes having TMB attack as 50% weight is lost in canes within this category of attack. In other words, three generations of pest attack can cause significant yield loss compared to attack by one or two generations in the early season or late season of crop growth.

**Table 7. Yield parameters in sugarcane with varying levels of internode borer infestation**

S.No	Damage category <sup>@</sup>	Proportion of canes in each category	% INB intensity <sup>#</sup>	Cane girth (cm)	Internode number	Cane length (cm)	Cane weight (kg)
1	TM	11.4	16.6 (4.0) cd <sup>§</sup>	29.47 abc	19.9 ab	204.00 a	1.275 a
2	MB	14.3	10.7 (3.3) bc	28.96 abc	23.9 bc	206.60 a	1.230 a
3	TB	15.7	15.1 (3.9) cd	28.20 ab	27.5 bc	216.09 a	1.218 a
4	TMB	2.9	18.7 (4.4) d	25.64 a	26.5 bc	185.50 a	0.675 b
5	T	20.0	8.9 (3.0) b	30.94 bc	18.6 ab	199.07 a	1.275 a
6	B	20.0	10.5 (3.2) bc	29.65 abc	18.9 ab	189.21 a	1.114 a
7	M	15.7	6.7 (2.7) b	32.93 c	16.8 a	201.00 a	1.455 a
8	C		0.0 (0.7) a	31.36 bc	17.2 a	198.38 a	1.383 a
9	r <sup>!</sup>	-	-	-0.791 <sup>*</sup>	0.721 <sup>*</sup>	-0.013 <sup>ns</sup>	-0.681 <sup>ns</sup>
10	F value	-	34.77	2.45	5.49	0.77	1.54
11	P value	-	< 0.0001	< 0.05	< 0.0001	0.616	0.165

<sup>#</sup> Figures in parentheses are  $(x+0.5)^{0.5}$  values

<sup>§</sup> Means followed by the same letter in a column are not significantly different ( $P>0.05$ ) by DMRT

<sup>@</sup> T: top; M: middle; B: bottom; TM: top and middle; TB: top and middle; MB: middle and bottom; TMB: top, middle and bottom

<sup>!</sup> Correlation between % intensity and cane parameters

<sup>\*</sup>  $P<0.05$ ;  $P>0.05$

### East coast zone

#### Regional Agricultural Research Station, Anakapalle, ANGRAU, Andhra Pradesh

High cumulative incidence of early shoot borer (74.11% DH), high incidence of internode borer (92.80%) with 6.48% intensity were recorded in unprotected plot which resulted in reduced cane weight (0.88 kg/cane), less NMC/ha (55,290) and 48.6 per cent reduction in cane yield (48.57t/ha) compared to protected plot in which less cumulative incidence of early shoot borer (14.62% DH) and internode borer (68.41%) with low intensity (4.94%) were recorded and resulted in comparatively good cane weight (1.48 kg/cane), more number of NMC / ha (63,860) and superior cane yield (94.52t/ha) (Table 14 & 15).

Treatment	Incidence of ESB up to 120 DAP (%DH)					Per cent reduction of ESB over control (%)	Total shoots/ha at 120 DAP
	30 DAP	60 DAP	90 DAP	120 DAP	Cumulative up to 120 DAP		
T1- Protected plot	2.21	6.42	4.79	1.20	14.62	82.62	1,06,439
T2-Unprotected plot	20.73	19.30	26.84	7.24	74.11	-	78,840

Treatment	Incidence of internode borer (%)	Intensity of internode borer (%)	Infestation index	Cane girth (cm)	Cane height (m)	Cane weight (Kg)	Per cent Sucrose (%)	NMC (000'/ha)	Cane yield (t/ha)	Yield reduction over protected plot (%)
T1- Protected plot	68.41	4.94	3.38	1.50	2.32	1.48	20.25	63.86	94.52	-
T2- Unprotected plot	92.80	6.48	6.01	1.43	0.89	0.88	18.28	55.19	48.57	48.61



# **ALL INDIA COORDINATED RESEARCH PROJECT ON SUGARCANE**



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