

**ANNUAL REPORT (2013-14)**  
**AICRP ON SUGARCANE (ENTOMOLOGY),**  
**Zonal Agricultural Research Station, Powarkheda (M.P.)**

**Technical Programme 2013-14:**

S. No.	Experiments Allotted	C/ NC*
1.	E. 4.1: Evaluation of zonal varieties/genotypes for their reaction against major insect pests	C
2.	E. 28: Survey and surveillance of sugarcane insect pests.	C
3.	E. 30: Monitoring of insect pests and bio-agents in sugarcane agro-ecosystem	C
4.	E. 36: Management of borer complex of sugarcane through lures	C
5.	E.37: Bio-efficacy of new insecticides for the control of sugarcane early shoot borer	C

\*C/NC – Conducted/ Not Conducted

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

**Objective...:** To screen the entries of the zonal varietal trails for their behaviour towards damage caused by key pests in the area

**Year of Start:** 1985-86 (Continuing)

**Experimental details:**

Twenty one entries with three checks of early, and twenty eight entries with two checks of mid-late group were screened for their reaction against infestation of key pests of the area. The infestation of insect pests recorded and the reactions are given in Table -1 & 2.

**Results:**

**Early group:**

**Early Shoot Borer (ESB %):**

The ESB infestation ranged between 10.25 to 31.16 per cent among various entries screened. Check varieties i.e., Co C 671, Co 85004 and Co 94008 received 23.90, 20.64 and 20.11 per cent ESB infestation, respectively. Out of the genotypes screened, eight graded as less susceptible to early shoot (ESB) borer. The Co 10005 received the least infestation of ESB (10.25%), followed by Co 10024, CoM 10082 CoN 09071, CoT 10366 and Co 09007 (10.82 to 13.22%) all were significantly at par with each other. The Co 10006 received the maximum ESB infestation (31.16%), but

was significantly at par with preceding Co 09006, CoN 10071 and Co 10026 (29.81 to 28.92%).

**Table-1: Reaction of different entries (Early group) against early shoot borer and pyrilla Powarkheda, Madhya Pradesh (2013-14)**

S. No.	Trial	Entries	ESB (%)	Grade	Pyrilla/leaf	Grade
1	AVT (E) - II (13-14)	Co 08001	20.84	MS	8.65	MS
2	AVT (E) - II (13-14)	VSI 08121	25.76	MS	7.83	MS
3	IVT (E) (12-13)	Co 09006	29.81	MS	7.87	MS
4	IVT (E) (12-13)	Co 09007	13.12	LS	10.33	MS
5	IVT (E) (12-13)	CoN 09071	11.55	LS	8.20	MS
6	IVT (E) (12-13)	CoN 09072	25.94	MS	9.40	MS
7	IVT (E) (12-13)	Co 09002	26.52	MS	8.87	MS
8	IVT (E) (12-13)	Co 09003	18.05	MS	10.65	MS
9	IVT (E) (12-13)	Co 94004	27.19	MS	8.80	MS
10	IVT (E) (13-14)	Co 10004	14.47	LS	9.98	MS
11	IVT (E) (13-14)	Co 10005	10.25	LS	9.93	MS
12	IVT (E) (13-14)	Co 10006	31.16	MS	10.90	MS
13	IVT (E) (13-14)	Co 10024	10.82	LS	10.68	MS
14	IVT (E) (13-14)	Co 10026	28.92	MS	11.90	MS
15	IVT (E) (13-14)	Co 10027	19.25	MS	9.27	MS
16	IVT (E) (13-14)	CoM 10081	14.34	LS	9.63	MS
17	IVT (E) (13-14)	CoM 10082	11.09	LS	8.63	MS
18	IVT (E) (13-14)	CoN 10071	29.62	MS	10.32	MS
19	IVT (E) (13-14)	CoN 10072	15.44	MS	11.58	MS
20	IVT (E) (13-14)	CoT 10366	12.66	LS	9.55	MS
21	IVT (E) (13-14)	CoT 10367	15.05	MS	11.48	MS
22	Check	Co 85004	20.64	MS	10.88	MS
23	Check	Co 94008	20.11	MS	9.82	MS
24	Check	CoC671	23.90	MS	12.87	MS
<b>S Em ±</b>			<b>1.41</b>		<b>0.38</b>	
<b>CD (p=0.05)</b>			<b>3.34</b>		<b>0.91</b>	

**Pyrilla (per leaf):**

Pyrilla population ranged from 7.83 to 12.87 individuals per leaf in various genotypes/ checks evaluated. All the genotypes and check varieties graded as moderately susceptible (MS). The check varieties, Co 94008 and Co 85004 received 9.82 and 10.88 pyrilla individuals/leaf, respectively, while the Co C 671 received

significantly the maximum pyrilla infestation (12.87 individuals/leaf). Among the genotypes screened, VSI 08121 received the lowest infestation (7.83 pyrilla individuals/leaf), but was significantly at par with the following Co 09006, CoN 09071, CoM 10082 and Co 08001 (7.87 to 8.65 pyrilla individuals/leaf). The Co 10026 received the maximum pyrilla (11.90 individuals/leaf), preceded by Co CoN 10072 (11.58 individuals/leaf) and Co T 10367 (11.48 individuals/leaf). All the three were significantly at par with each other but significantly less infested as compared CoC 671.

**Mid late group:**

**Early Shoot Borer (ESB %):**

Early shoot borer infestation (dead heart) ranged from 10.80 to 31.11 per cent in various entries screened. Thirteen genotypes graded as least susceptible, while others as moderately susceptible (MS). The check varieties, Co 86032 and Co 99004 received 19.05 and 22.43 per cent ESB and graded as moderately susceptible to early shoot borer. The Co 08009, CoN 10073, Co 08020, Co VSI 10121 and CoN 09013 (10.80 to 13.85%) received comparatively less infestation of ESB and all were significantly par with each other. Among the entries, maximum ESB infestation recorded in CoM 10084 (31.11%) and was significantly at par to preceding Co 10015, PI 10132, CoM 10083 and CoT 10369 (30.90 to 25.04%).

**Pyrilla (per leaf):**

Pyrilla per leaf population varied from 4.73 to 13.57 individuals per leaf in different genotypes/ varieties evaluated. The Co 09010 received significantly the least pyrilla infestation and graded as least susceptible. Some other genotypes received comparatively less pyrilla were Co 09009, CoN 09013, Co 09012, CoN 09074 and Co 09014 (7.23 to 7.87 individuals/ leaf), all were significantly at par with each other. The check varieties, i.e., Co 99004 and Co 86032 (9.47 and 9.67 individuals/leaf, respectively) received moderate pyrilla infestation (MS). CoSnk 08101, Co 08009 and Co08016 (13.57 to 13.47 individuals/leaf) found to be the maximum pyrilla infested genotypes and were significantly at par with each other.

**Table-2: Reaction of different entries (Midlate group) against early shoot borer and Pyrrilla Powarkheda, Madhya Pradesh (2013-14)**

S.No.	Trial	Entries	ESB (%)	Grade	Pyrrilla/ leaf	Grade
1	AVT (ML)-II (13-14)	Co 08008	17.14	MS	12.25	MS
2	AVT (ML)-II (13-14)	Co 08009	10.80	LS	13.57	MS
3	AVT (ML)-II (13-14)	Co 08016	24.28	MS	13.47	MS
4	AVT (ML)-II (13-14)	Co 08020	13.67	LS	11.33	MS
5	AVT (ML)-II (13-14)	Co Snk 08101	19.69	MS	13.57	MS
6	IVT (ML) (12-13)	Co 09009	16.30	MS	7.23	MS
7	IVT (ML) (12-13)	Co 09010	14.43	LS	4.73	LS
8	IVT (ML) (12-13)	Co 09012	22.86	MS	7.48	MS
9	IVT (ML) (12-13)	Co N 09013	13.85	LS	7.33	MS
10	IVT (ML) (12-13)	Co 09014	18.43	MS	7.87	MS
11	IVT (ML) (12-13)	Co 02040	13.92	LS	8.47	MS
12	IVT (ML) (12-13)	Co N 09073	14.94	LS	9.82	MS
13	IVT (ML) (12-13)	Co N 09074	22.86	MS	7.65	MS
14	IVT (ML) (12-13)	Co Snk 05102	13.99	LS	9.40	MS
15	IVT (ML) (13-14)	Co 10015	30.90	MS	11.17	MS
16	IVT (ML) (13-14)	Co 10017	14.95	LS	11.63	MS
17	IVT (ML) (13-14)	Co 10031	18.70	MS	11.02	MS
18	IVT (ML) (13-14)	Co 10033	14.37	LS	11.47	MS
19	IVT (ML) (13-14)	CoM 10083	28.12	MS	9.37	MS
20	IVT (ML) (13-14)	CoM 10084	31.11	MS	11.55	MS
21	IVT (ML) (13-14)	CoN 10073	13.50	LS	11.85	MS
22	IVT (ML) (13-14)	CoT 10368	14.23	LS	10.15	MS
23	IVT (ML) (13-14)	CoT 10369	25.04	MS	10.47	MS
24	IVT (ML) (13-14)	CoVC 10061	14.38	LS	9.30	MS
25	IVT (ML) (13-14)	Co VSI 10121	13.81	LS	11.12	MS
26	IVT (ML) (13-14)	Co VSI 10122	18.88	MS	11.17	MS
27	IVT (ML) (13-14)	PI 10131	22.53	MS	11.47	MS
28	IVT (ML) (13-14)	PI 10132	30.31	MS	12.60	MS
29	Check	Co 86032	19.05	MS	9.67	MS
30	Check	Co 99004	22.43	MS	9.47	MS
S Em ±			1.73			0.33
CD (p=0.05)			4.10			0.79

**Summary:**

*Out of twenty one entries with three checks of early, and twenty eight entries with two checks of mid-late group were screened, in early group, Co 10005, Co 10024, CoM 10082 and VSI 08121, Co 09006, CoN 09071 observed to received comparatively less infestation of ESB and pyrrilla, respectively. Where as mid late group, comparatively less infested entries*

were Co 08009, Co N 10073, Co 08020 for ESB and Co 09010, Co 09009, Co 08020 for pyrilla.

The CoN 09071 and CoM 10082 of early group and Co 09010 of early group showed multiple resistance for both the key pests.

#### **E. 28: Survey and surveillance of sugarcane insect pests.**

**Objectives: To identify key insect pests of sugarcane in the area.**

**Duration : Long term.**

**Year of Start: 2003-04**

#### **Experimental Details:**

The Hoshangabad, Bankhedi, Salechouka and Kareli sugarcane growing area were surveyed for the purpose of recording the sugarcane insect pests and their natural enemies

#### **Results:**

Different sugarcane factory areas were surveyed and insect pest status (average) of respective places is given in Table no. 3, while the detailed given in annexure 1. Some important observations emerged are as under –

1. The Co J 64, Co 86032, Co M 265, Co Lk 8001 and Co 238 are varieties occupied major area, while the Co 7318, Co 6304, CoC 671, CoJN 86 141, CoJN 86-600 and Co 99004 are also under cultivation.
2. In area, early shoot borer and pyrilla is major while root borer, scale, whitefly and mealy bug are the minor insect pests infesting sugarcane.
3. Early shoot borer infestation were observed to be 14, 12.63, 17.63 and 15.30 per cent in various varieties at Kareli, Bankhedi, Salechouka and Hoshangabad, respectively. No bio agent activity observed against early shoot borer.
4. The pyrilla infestation observed was 12.17, 17.15, 16.70 and 9.08 pyrilla per leaf at Kareli, Bankhedi, Salechouka and Hoshangabad, respectively. The *E. melanoleuca* and *T. pyrrillae* also observed to work effectively.
5. The severe infestation of pyrilla at Bankhedi and Salechouka is seems to be because of introduction of Adsali sugarcane cultivation.
6. The infestation of whitefly also noticed at water stagnated field because of poor drainage.

#### **Summary:**

Survey was undertaken in Bankhedi, Salechouka, Kareli and Hoshangabad area to record the insect pests status of sugarcane. The Co J 64, Co 86032, Co M 265, Co Lk 8001 and Co 238 are varieties occupying major area, while Co 7318, Co 6304, CoC 671, CoJN 86 141, CoJN 86-600 and Co 99004 are also under cultivation The early shoot borer and pyrilla were observed to worked as key pests, while the top shoot borer, root borer, whitefly, mealy bug and scale insect worked as minor insect pests of sugarcane. Severe infestation of pyrilla observed at Bankhedi and Salechouka factory areas, the trash burning and adoption of adsali cultivation

seems to be possible cause for this severity. The whitefly infestation was observed in road side sugarcane fields having poor water drainage system.

**Table: 3. Occurrence of naturally occurring insect pests on sugarcane**

Sr.No.	Location	Name of pest (% incidence/Population)	Min.	Max.	Average
<b>1</b>	<b>Kareli</b>	ESB (%)	11.00	17.00	14.00
		TSB (%)	2.33	4.33	3.33
		RB (%)	3.67	5.67	4.67
		Pyrilla /Leaf	8.42	15.92	12.17
		<i>E. melanoleuca/plant</i>	5.92	12.27	9.10
		Whitefly (per 2.5 sq.cm.)	0.38	1.53	0.96
<b>2</b>	<b>Bankhedhi</b>	ESB (%)	9.50	15.75	12.63
		TSB (%)	3.00	4.50	3.75
		RB (%)	1.75	4.25	3.00
		Pyrilla /Leaf	15.59	18.71	17.15
		<i>E. melanoleuca/plant</i>	11.78	17.14	14.46
		Whitefly (per 2.5 sq.cm.)	0.35	1.11	0.73
<b>3</b>	<b>Salichouka</b>	ESB (%)	13.75	21.50	17.63
		TSB (%)	2.75	5.00	3.88
		RB (%)	1.00	3.00	2.00
		Pyrilla /Leaf	14.86	18.53	16.70
		<i>E. melanoleuca/plant</i>	11.30	14.29	12.80
		Whitefly (per 2.5 sq.cm.)	0.35	0.85	0.60
<b>4</b>	<b>Hoshangabad</b>	ESB (%)	11.20	19.40	15.30
		TSB (%)	0.00	0.40	0.20
		RB (%)	0.00	0.00	0.00
		Pyrilla /Leaf	6.48	11.68	9.08
		<i>E. melanoleuca/plant</i>	4.70	7.80	6.25
		Whitefly (per 2.5 sq.cm.)	0.40	1.01	0.89

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

**E. 30: Monitoring of Insect Pests and their Bio-agents in Sugarcane Agro-ecosystem.**

**Objectives:** To monitor the key insect pests and their natural enemies of sugarcane in the area.

**Year of start: 2006-07 Variety: Co 86032 Area: 0.2 ha**

**Experimental Details:**

Sugarcane variety, Co 86032 was planted in 0.2 ha area for the study and all recommended package of practices were followed except application of insecticides. At each Standard meteorological week (SMW) the observations on infestation of both key pests i.e.,

early shoot borer and pyrilla and their natural enemies were recorded. Data regarding meteorological parameters were obtained from Agro-Meteorological Project, ZARS, Powarkheda. (Table 4 to 6 & Fig. 1 to 3).

## RESULT:

In the season, cumulative infestation of early shoot borer remained 23.20 per cent. The infestation initiated at last week of January. Infestation gradually increased and peak activity observed from 10<sup>th</sup> to 14<sup>th</sup> SMW during March (more than 2.2%/week). Afterwards the borer observed a declining trend and continued till 22<sup>nd</sup> SMW. During the season, no activity of bio agent was observed on early shoot borer. During the peak activity period the maximum & minimum temperature and relative humidity ranged from 35.20 to 40.7<sup>o</sup>C, 13.40 to 17.60<sup>o</sup>C and 68 to 79 per cent, respectively.

**Table 4: Activity of Early Shoot Borer and meteorological data, 2013, ZARS, Powarkheda (M.P.)**

SMW	Date (2011)	Max. Temp. (°C)	Min. Temp (°C)	RH%	Rainfall (mm)	ESB infestation (%)	
						Weekly	Cumulative
3	15 to 21/1	31.40	10.00	87.00	0.00	0.00	0.00
4	22 to 28/1	24.60	7.20	85.00	5.00	0.00	0.00
5	29/1 to 4/2	28.10	8.60	89.00	0.00	0.20	0.20
6	5 to 11/2	31.30	13.30	96.00	1.20	0.60	0.80
7	12 to 18/2	32.50	13.80	91.00	57.60	0.20	1.00
8	19 to 25/2	31.30	12.00	92.00	0.00	0.80	1.80
9	26/2 to 4/3	32.70	12.50	84.00	0.00	1.80	3.60
10	5 to 11/3	35.20	13.40	82.00	0.00	2.20	5.80
11	12 to 18/3	35.50	15.60	77.00	5.40	3.00	8.80
12	19 to 25/3	37.70	16.80	79.00	0.00	3.60	12.40
13	26/3 to 1/4	38.00	16.00	74.00	0.00	2.40	14.80
14	2 to 8/4	40.70	17.60	68.00	4.20	2.20	17.00
15	9 to 15/4	40.50	20.20	60.00	0.00	1.80	18.80
16	16 to 22/4	39.70	19.60	64.00	7.60	1.40	20.20
17	23 to 29/4	42.50	20.80	62.00	0.00	1.00	21.20
18	30/4 to 6/5	43.70	22.10	55.00	0.00	0.80	22.00
19	7 to 13/5	44.50	22.20	51.00	0.00	0.40	22.40
20	14 to 20/5	46.50	24.10	51.00	0.00	0.20	22.60
21	21 to 27/5	45.90	24.90	60.00	0.00	0.40	23.00
22	28/5 to 3/6	43.70	24.00	61.00	11.00	0.20	23.20
23	4 to 10/6	42.10	22.40	68.00	21.80	0.00	23.20
24	11 to 17/6	36.60	22.00	76.00	104.80	0.00	23.20
25	18 to 24/6	34.40	23.70	92.00	27.40	0.00	23.20

## Pyrilla:

This year the pyrilla activity remained much lower as compared to last year. During which outbreak in pyrilla population observed because of prolong winter and comparative low temperature during summer.

In 1<sup>st</sup> phase, the pyrilla infestation initiated at 10<sup>th</sup> SMW (2<sup>nd</sup> week of March), reached to its peak at 15<sup>th</sup> SMW (3<sup>rd</sup> week of April) and were active up to 17<sup>th</sup> SMW (last week of April). Egg parasite, *Tetrastichus Pyrillae* (up to 28.00%) and *Epiricania malanoleuca* parasitism up to 16.60 per cent observed.

**Table 5: Seasonal incidence of pyrilla and its bio-agents and meteorological data (Summer-2013), ZARS, Powarkheda (M.P.).**

Standard WEEK	Date (2011)	Max. Temp (°C)	Min. Temp (°C)	RH%	Rainfall (mm)	Pyrilla/leaf	Pyrilla egg masses/ leaf	<i>Epiricania</i> (%)	<i>Epiricania</i> Egg masses & <i>cacaon</i> Leaf	<i>T. pyrillae</i> (%)
10	5 to 11/3	35.2	13.4	82	0.0	0.40	0.05	0.00	0.00	0.00
11	12 to 18/3	35.5	15.6	77	5.4	0.70	0.10	5.80	1.05	6.4
12	19 to 25/3	37.7	16.8	79	0.0	0.90	0.45	11.20	1.55	7.4
13	26/3 to 1/4	38	16	74	0.0	2.15	0.45	11.80	2.35	8.8
14	2 to 8/4	40.7	17.6	68	4.2	3.05	0.55	14.60	2.35	11.6
15	9 to 15/4	40.5	20.2	60	0.0	4.05	0.75	16.60	5.45	13.8
16	16 to 22/4	39.7	19.6	64	7.6	4.45	0.85	12.60	3.75	22.8
17	23 to 29/4	42.5	20.8	62	0.0	4.50	0.95	5.60	2.60	28.0
18	30/4 to 6/5	43.7	22.1	55	0.0	1.65	0.00	1.20	2.05	-

In 2<sup>nd</sup> phase, pyrilla population ranged from 0.7 to 12.55 individuals/leaf, the pyrilla egg masses observed in-between 0.35 to 2.75 masses/leaf, per cent parasitism of *Epiricania melanoleuca* and *Tetrastichus pyrillae* ranged in-between 2.40 to 82.00 and 4.00 to 88.00 per cent, respectively.

The pyrilla activity initiated from 26<sup>th</sup> SMW (last week of June). The activity of *Tetrastichus pyrillae* and the *Epiricania melanoleuca* started after one and two weeks of pyrilla appearance. Thereafter, infestation of pyrilla as well as of the both bio-control agents gradually increased. The pyrilla and *Tetrastichus pyrillae* reached to peak at 36<sup>th</sup> SMW (12.55 individuals and 88.00 per cent, respectively), while *Epiricania malanoleuca* observed its peak activity at 38<sup>th</sup> SMW. The pyrilla, *Epiricania* and *Tetrastichus* remained active up to



39<sup>th</sup> SMW. Maximum temperature of  $31 \pm 3^{\circ}\text{C}$ , minimum temperature of  $22 - 23^{\circ}\text{C}$  and 86 to 96 per cent RH seems to be favourable for built-up of peak activity of pyrilla.

**Table 6: Activity of pyrilla and its bio agents in rainy season with meteorological data, 2013 at ZARS, Powarkheda (M.P.).**

Standard WEEK	Date (2013)	Max. Temp . ( $^{\circ}\text{C}$ )	Min. Temp ( $^{\circ}\text{C}$ )	RH%	Rainfall (mm)	Pyrilla/leaf	Pyrilla egg masses/ leaf	<i>Epiricania</i> (%)	<i>Epiricania</i> Egg masses & cocoon /leaf	<i>T. pyrillae</i> (%)
24	18 to 24/6	36.6	22	76	104.8					
25	25/6 to 1/7	34.4	23.7	92	27.4					
26	25/6 to 1/7	30.6	23.4	95	134.0	0.70				
27	2 to 8/7	32.1	20.2	92	98.0	0.85	0.35			4.00
28	9 to 15/7	31.4	23.4	92	103.8	2.45	0.55	2.40	0.50	11.00
29	16 to 22/7	30	20.2	90	134.4	3.45	0.55	6.20	1.50	12.60
30	23 to 29/7	32	23.5	92	95.9	4.65	0.85	11.40	2.35	23.80
31	30/7 to 5/8	30.2	23	94	156.8	7.05	1.35	17.00	2.75	29.00
32	6 to 12/8	30.7	22.9	89	80.6	7.90	1.80	18.20	5.55	34.60
33	13 to 19/8	30.5	23.5	88	32.4	9.35	2.20	41.40	6.45	60.00
34	20 to 26/8	28.8	22.2	96	266.7	10.65	2.25	54.20	5.65	69.40
35	27/8 to 2/9	31.2	22.1	95	5.2	11.90	2.50	55.20	8.50	77.60
36	3 to 9/9	34.8	22.4	86	0.0	12.55	2.75	81.40	12.45	88.00
37	10 to 16/9	36.2	23	68	8.6	7.90	1.50	81.60	12.10	74.40
38	17 to 23/9	35.4	23.5	69	57.8	2.60	0.60	82.00	4.30	80.00
39	24 to 30/9	34.2	22.6	73	6.0	1.00	0.50	73.00	1.45	14.00
40	1 to 7/10	34.20	22.00	89.00	36.00					
41	8 to 14/10	32.50	20.20	90.00	30.20					

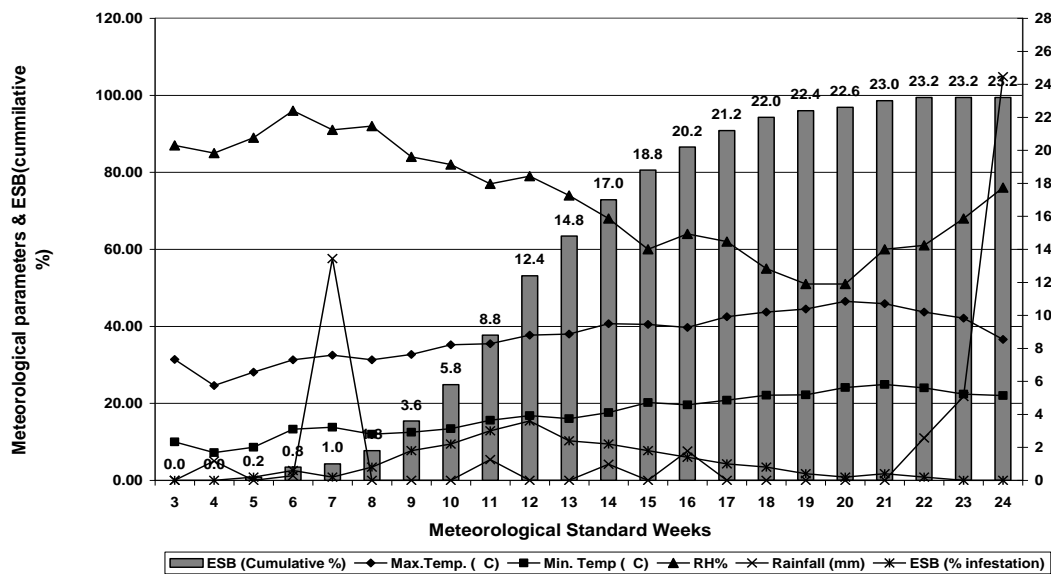
**Summary:**

*In Monitoring of Insect Pests and their Bio-agents in Sugarcane Agro-ecosystem, it is observed that the infestation of early shoot borer initiated in 1<sup>st</sup> week of February, gradually increased and reached the peak activity (> 2%) during 2<sup>nd</sup> week of March to 2<sup>nd</sup> week of April. Thereafter, the infestation followed the decreasing trend and ESB remained active up to the 1<sup>st</sup> week of June. The maximum & minimum temperature and relative humidity ranged from 35.20 to 40.7 $^{\circ}\text{C}$ , 13.40 to 17.60 $^{\circ}\text{C}$  and 68 to 79 per cent, respectively seems to be favourable to built-up the peak activity of pest.*

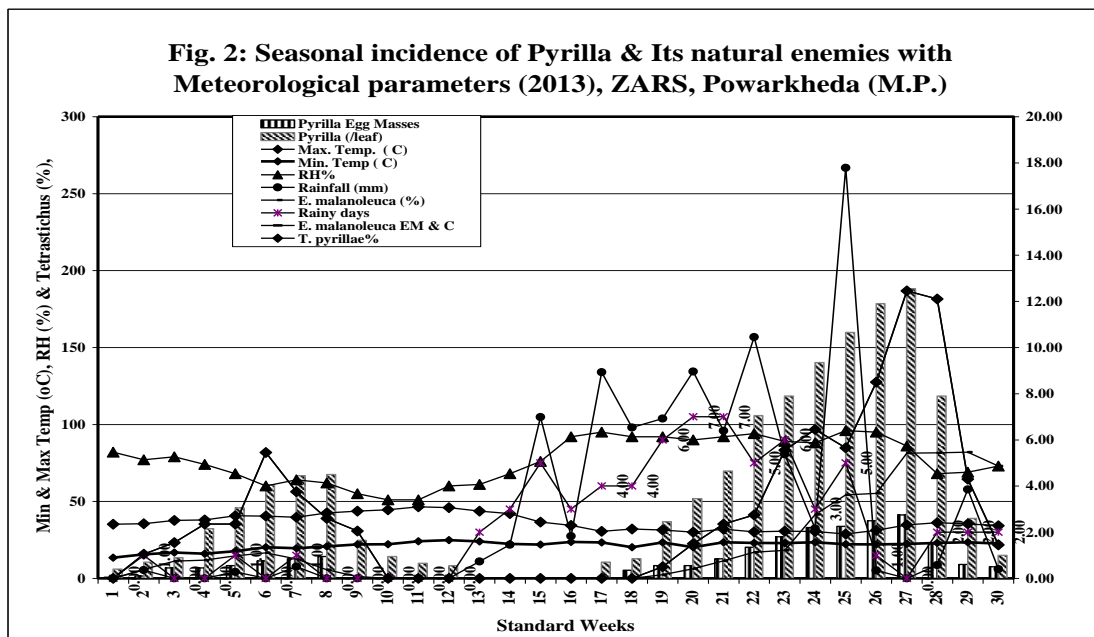
In the 1<sup>st</sup> phase, the pyrilla activity remained low i.e., <5 individuals/leaf. The peak activity (>4 5 individuals/leaf) observed in 15 to 17 SMW. During this phase, 16.60 and 28 per cent parasitism of *E. melanoleuca* and *T. pyrillae* also recorded.

During 2<sup>nd</sup> phase, pyrillae appeared at 26 SMW. The pyrilla and *Tetrastichus pyrillae* reached to peak at 36<sup>th</sup> SMW (12.55 individuals and 88.00 per cent, respectively), while *Epiricania malanoleuca* observed its peak activity at 38<sup>th</sup> SMW. Maximum temperature of 31 ± 3<sup>o</sup>C, minimum temperature of 22 - 23<sup>o</sup>C and 86 to 96 per cent RH seems to be favourable for built-up of peak activity of pyrilla.

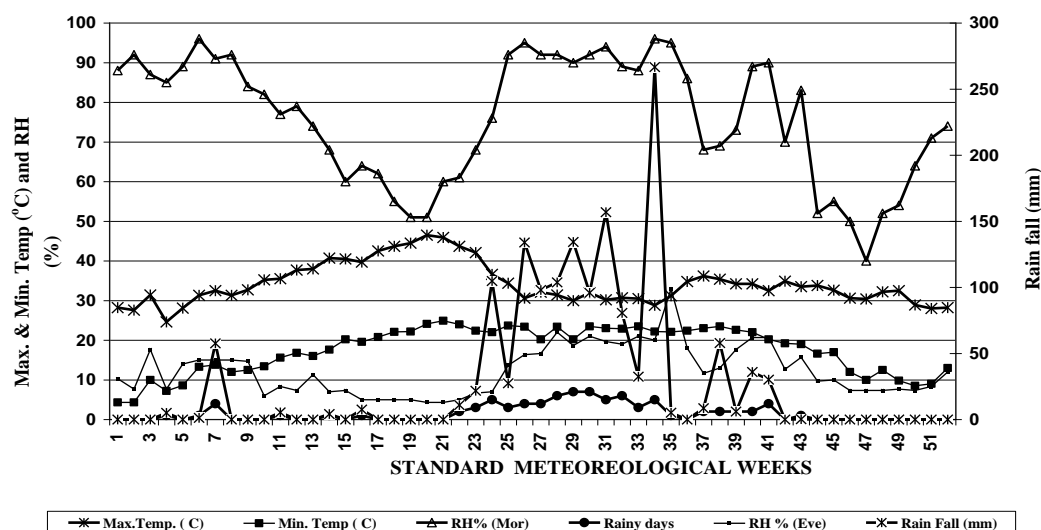
**Fig.1: Seasonal Incidence of Early Shoot Borer & Meteorological Data (2013)  
ZARS, Powarkheda (M.P.)**



**Fig. 2: Seasonal incidence of Pyrilla & Its natural enemies with Meteorological parameters (2013), ZARS, Powarkheda (M.P.)**



**Fig. 3: METEOREOLOGICAL SITUATIONS DURING 2013, ZARS, POWARKHEDA (M. P.)**



**Project E.36: Management of borer complex of sugarcane through lures**

**Objective :** To manage sugarcane borers (early shoot borer, top borer, internode borer and stalk borer) through pheromone traps

**Year of Start:** 2012-2013      **Variety:** Co 86032

**Methodology:**

The Co 86032 sown in two separate blocks i.e. in first one early shoot borer pheromone traps installed, while second one kept as control. Observations recorded on early shoot borer infestation at both the blocks and captures of early shoot borer moth daily. The moth captured per day at each standard meteorological week calculated. The correlation and regression was also worked out in-between the average moths captures with the meteorological parameters and presented in table no.8

**Result:**

During the season, early shoot borer (ESB), dead hearts observed from 4<sup>th</sup> standard meteorological week (SMW) i.e., 2<sup>nd</sup> last week of January. After two weeks of ESB field infestation, ESB moth capture at pheromone trap also initiated. Maximum ESB infestation was observed in control block (3.40%) and lure managed block (2.40%) at 12<sup>th</sup> and 13<sup>th</sup> SWM, respectively. Maximum moth captures at pheromone trap was observed from last week of March to last of April. The cumulative ESB infestation in the control block remained 22.60

per cent, while it was 16.00 per cent in lure managed block i.e., 29.20 per cent lower as compared to control block.

The correlation and regression of the meteorological parameters with the number of moth captured per day per SMW were also worked out. The Correlation values obtained were 0.50, 0.20, -0.61 and -0.41 for maximum and minimum temperature, relative humidity (%) and quantum of rain (mm), respectively. The multiple regression also workout and equation obtained is given below –

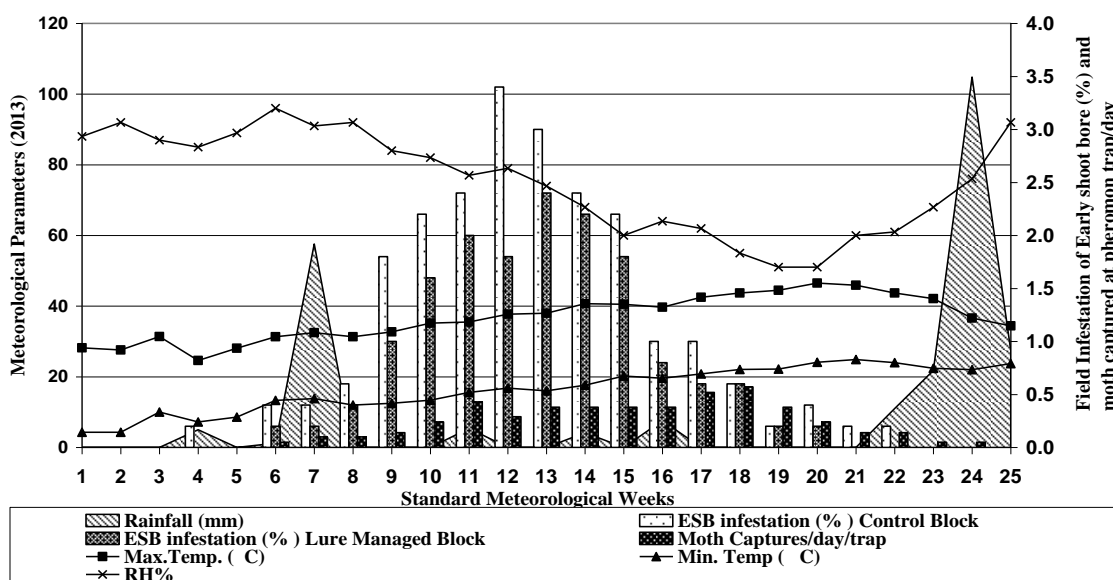
$$Y = 0.5216 + 0.0033 * X^1 - 0.017 * X^2 - 0.010 * X^3 - 0.0009 * X^4$$

Where Y= number of moth captured;  $X^1$ – maximum temperature,  $X^2$  – minimum temperature,  $X^3$  – relative humidity (%), and  $X^4$  - quantum of rain (mm).

**Summary:**

*Installment of pheromone trap (ESB) @ 3/acre and change of lures at two month interval will reduced the ESB infestation by 29.20 per cent. Peak moth capture was recorded during last week of March to last of April. The moth capture at pheromone trap's Correlation values are 0.50, 0.20, -0.61 and -0.41 for maximum and minimum temperature, relative humidity (%) and quantum of rain (mm), respectively.*

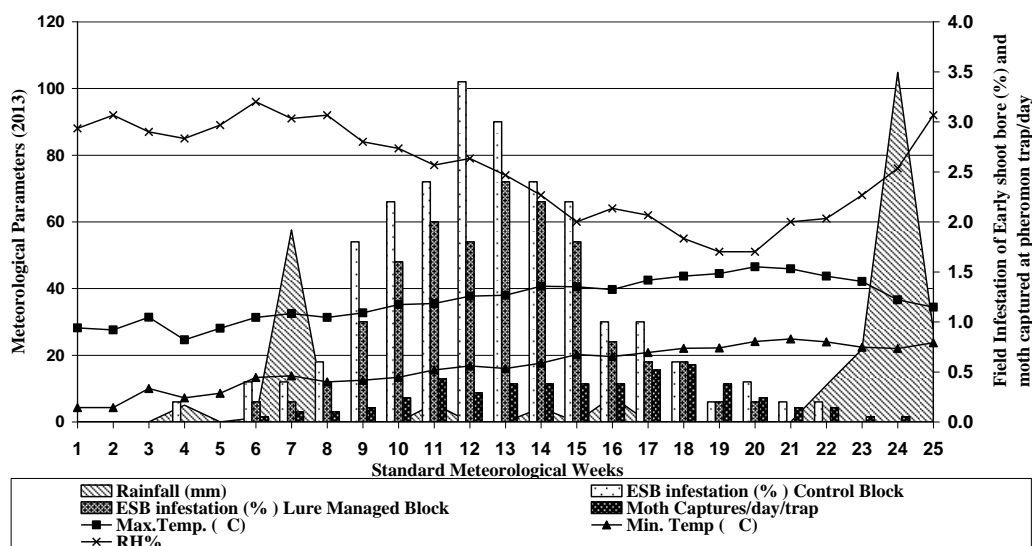
**Fig 4 : E.36:Management of Early Shoot Borer through Lures**



**Table -7 : Meteorological Parameters, Early shoot borer infestation of Lure managed V/S Control Block & Moth captured, ZARS, Powarkheda (2013).**

2013	Meteorological Parameters					ESB (% infestation)			Moth Captures/day/trap
Date From To	STD Weeks	Max. Temp. ( C)	Min. Temp ( C)	RH%	Rainfall (mm)	Control Block	Lure Managed Block	Difference Over Control (+/-)	
1 to 7/1	2	27.60	4.30	92.00	0.00	0.00	0.00	0.00	0.00
8 to 14/1	3	31.40	10.00	87.00	0.00	0.00	0.00	0.00	0.00
15 to 21/1	4	24.60	7.20	85.00	5.00	0.20	0.00	-0.20	0.00
22 to 28/1	5	28.10	8.60	89.00	0.00	0.00	0.00	0.00	0.00
29/1 to 4/2	6	31.30	13.30	96.00	1.20	0.40	0.20	-0.20	0.00
5 to 11/2	7	32.50	13.80	91.00	57.60	0.40	0.20	-0.20	0.05
12 to 18/2	8	31.30	12.00	92.00	0.00	0.60	0.40	-0.20	0.10
19 to 25/2	9	32.70	12.50	84.00	0.00	1.80	1.00	-0.80	0.10
26/2 to 4/3	10	35.20	13.40	82.00	0.00	2.20	1.60	-0.60	0.14
5 to 11/3	11	35.50	15.60	77.00	5.40	2.40	2.00	-0.40	0.24
12 to 18/3	12	37.70	16.80	79.00	0.00	3.40	1.80	-1.60	0.38
19 to 25/3	13	38.00	16.00	74.00	0.00	3.00	2.40	-0.60	0.38
26/3 to 1/4	14	40.70	17.60	68.00	4.20	2.40	2.20	-0.20	0.48
2 to 8/4	15	40.50	20.20	60.00	0.00	2.20	1.80	-0.40	0.43
9 to 15/4	16	39.70	19.60	64.00	7.60	1.00	0.80	-0.20	0.52
16 to 22/4	17	42.50	20.80	62.00	0.00	1.00	0.60	-0.40	0.57
23 to 29/4	18	43.70	22.10	55.00	0.00	0.60	0.60	0.00	0.52
30/4 to 6/5	19	44.50	22.20	51.00	0.00	0.20	0.20	0.00	0.43
7 to 13/5	20	46.50	24.10	51.00	0.00	0.40	0.20	-0.20	0.38
14 to 20/5	21	45.90	24.90	60.00	0.00	0.20	0.00	-0.20	0.24
21 to 27/5	22	43.70	24.00	61.00	11.00	0.20	0.00	-0.20	0.14
28/5 to 3/6	23	42.10	22.40	68.00	21.80	0.00	0.00	0.00	0.14
4 to 10/6	24	36.60	22.00	76.00	104.80	0.00	0.00	0.00	0.05
11 to 17/6	25	34.40	23.70	92.00	27.40	0.00	0.00	0.00	0.05
<b>Total .....</b>						<b>22.60</b>	<b>16.00</b>	<b>-6.60</b>	

**Fig 4 : E.36:Management of Early Shoot Borer through Lures**



**E.37: Bio-efficacy of new insecticides for the control of sugarcane early shoot borer**

**Objective :** To find out effective strategy for the management of sugarcane early shoot borer

**Year of Start :** 2013-14      **Variety :** Co 86032      **Design :** RBD

**Number of treatments :** 6 (Six)      **Number of replication :** 4 (Four)

**Plot size :** Gross: 6 m x 5.4 m      Net: 6 m x 6.3 m

**Spacing :** Between two rows; 0.9 m (R-R)

**Treatments details:**

S.NO.	Treatment	Dose	Time of Application	Method of Application
1.	Chlorantraniliprole 0.4 G	22.5 kg/ ha	Planting & 60 DAP	Soil Application
2.	Chlorantraniliprole 18.5 SC	375 ml/ ha	30 and 60 DAP	Spray
3.	Flubendiamide 39.35% m/m SC	250 ml/ ha	30 and 60 DAP	Spray
4.	Phorate 10 G	15 kg/ ha	Planting & 60 DAP	Soil Application
5.	Carbofuran 3	33 kg/ ha	Planting & 60 DAP	Soil Application
6.	Control	Untreated		

**Following treatments not included as these were not available at market and the company refused to supply because of some technical problems at their end.**

Tr. No.	Company	Chemical	Formulation
1	Bayer	Fipronil	0.3 G
4	Bayer	Spinosad	45 SC
6	Bayer	Flubendiamide	10 EC

**Results:**

**Germination:**

The germination per cent in various treatments ranged in-between 76.18 to 79.20 and differed non-significantly.

**EAB (% infestation):**

**EAB (% infestation) at 30 DAS:**

The ESB infestation observed in between 1.11 to 8.72 per cent in different treatments and differed significantly. The chlorantraniliprole 0.4 G @ 22.5 kg /ha at the time of planting and 60 DAP (SA) received the lowest ESB infestation (1.11%), followed by Phorate 10 G @ 15 kg/ha at the time of planting and 60 DAP (SA) (1.24%) and Carbofuran 3 G @ 33 kg/ha at the time of planting and 60 DAP (SA) (1.79 %); all were significantly at par with each other.

**ESB (% infestation) at 60 DAS:**

The Chlorantraniliprole 0.4 G @ 22.5 kg /ha at the time of planting and 60 DAP (SA) (1.86%) infested the least by ESB and was significantly at par with the following chlorantraniliprole 18.5 SC 375 ml/ha at 30 and 60 DAP (S) (2.15%) and Flubendiamide @ 250 ml/ha at 30 and 60 DAP (S) (2.86%). Among the treatments, the Carbofuran 3 G @ 33 kg/ha at the time of planting and 60 DAP (SA) (4.03%) and Phorate 10 G @ 15 kg/ha at the time of planting and 60 DAP (SA) (4.69%) received the maximum ESB infestation, both were significantly at par with each other, but was significantly superior to the untreated control (11.69%).

**ESB (% infestation) at 90 DAS:**

The ESB infestation ranged in between 1.35 to 9.64 per cent in various treatment and differed significantly. The rank and statistical significance was the same as at ESB (% infestation) at 60 DAS.

**ESB (% infestation) at 120 DAS:**

The ESB infestation ranged in between 1.21 to 7.89 per cent in various treatments and differed significantly. The rank and statistical significance was the same as at ESB (% infestation) at 60 DAS, except Flubendiamide @ 250 ml/ha at 30 and 60 DAP (S) become significantly independent and significantly inferior to the both the Chlorantraniliprole treatments.

**EAB (% infestation) Cumulative:**

The treatments differed significantly in respect of ESB infestation received (2.93 to 19.27%). Significantly the lowest ESB infestation (2.93%) observed in Chlorantraniliprole 0.4 G @ 22.5 kg /ha at the time of planting and 60 DAP (SA) followed by Chlorantraniliprole 18.5 SC 375 ml/ha at 30 and 60 DAP (S) (5.20%) and Flubendiamide @ 250 ml/ha at 30 and 60 DAP (S) (6.43%), both later were also significantly independent. All though the Carbofuran 3 G @ 33 kg/ha at the time of planting and 60 DAP (SA) (8.34%) and Phorate 10 G @ 15 kg/ha at the time of planting and 60 DAP (SA) (8.96%) were significantly inferior to the other treatments evaluated but reduced the ESB significantly.

**Cane Diameter (cm) and Cane Height (cm):**

The cane diameter (mm) and cane height (cm) ranged in-between 2.75 to 2.81 cm and 212.20 to 218.53cm, respectively. Although, due to the insecticidal treatments there is numerical advantage in both parameters, but their difference to the untreated control was non-significant.

**Number of Millable canes (NMC, 000’):**

All the insecticidal treatments produced significantly more NMC as compared to the untreated control (76.04). Significantly maximum NMC (82.06) were observed in Chlorantraniliprole 0.4 G @ 22.5 kg /ha at the time of planting and 60 DAP (SA) followed by Chlorantraniliprole 18.5 SC 375 ml/ha at 30 and 60 DAP (S), Flubendiamide @ 250 ml/ha at 30 and 60 DAP (S) (80.21), all were significantly at par with each other. The Carbofuran 3 G @ 33 kg/ha at the time of planting and 60 DAP (SA) (79.98) and Phorate 10 G @ 15 kg/ha at the time of planting and 60 DAP (SA) (79.17), although inferior to the previous, but still significantly souper to the untreated control.

**Cane yield (t/ha):**

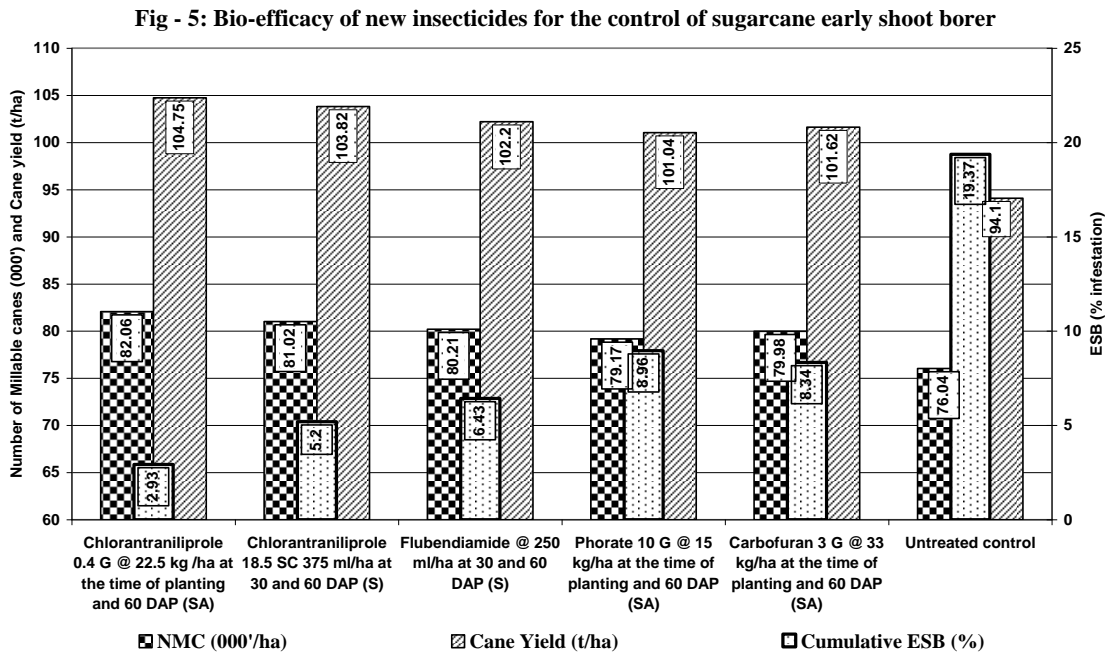
Significantly more cane yield (101.62 to 104.75 t/ha) was produced in insecticidal treatments as against untreated control (94.10 t/ha). Chlorantraniliprole 0.4 G @ 22.5 kg /ha at the time of planting and 60 DAP (SA) produced the significantly the maximum cane yield, followed by Chlorantraniliprole 18.5 SC 375 ml/ha at 30 and 60 DAP (S) (103.83 t/ha),



Flubendiamide @ 250 ml/ha at 30 and 60 DAP (S) and Carbofuran 3 G @ 33 kg/ha at the time of planting and 60 DAP (SA) (101.62 t/ha), all were significantly at par with each other. Later three were also significantly at par to the Phorate 10 G @ 15 kg/ha at the time of planting and 60 DAP (SA) (101.04 t/ha).

**Summary:**

*In Bio-efficacy of new insecticides for the control of sugarcane early shoot borer, the Chlorantraniliprole 0.4 G @ 22.5 kg /ha at the time of planting and 60 DAP (SA) and Chlorantraniliprole 18.5 SC 375 ml/ha at 30 and 60 DAP (S) (103.83 t/ha) found to reduce the natural infestation of ESB effectively (84.87 and 73.15 %, respectively). Both these treatment also increases the NMC and cane yield by 7.9,1 11.32 and 6.54, 10.33 per cent, respectively.*



**Table 8: Bio-efficacy of new insecticides for the control of sugarcane early shoot borer**

S.No	Treatments	ESB (%)						Diameter (cm)	Height (cm)	NMC (000'/ha)	Cane Yield (t/ha)	Dead Hearts /ha ('000)
		Germi. (%)	30 DAP	60 DAP	90 DAP	120 DAP	Cumu.					
1	<b>Chlorantraniliprole 0.4 G @ 22.5 kg /ha at the time of planting and 60 DAP (SA)</b>	79.20	1.11	1.86	1.35	1.21	2.93	2.81	218.53	82.06	104.75	14.93
2	<b>Chlorantraniliprole 18.5 SC 375 ml/ha at 30 and 60 DAP (S)</b>	76.18	8.56	2.15	1.92	1.62	5.20	2.80	217.60	81.02	103.82	25.12
3	<b>Flubendiamide @ 250 ml/ha at 30 and 60 DAP (S)</b>	79.01	8.01	2.86	2.46	2.35	6.43	2.79	215.05	80.21	102.20	30.90
4	<b>Phorate 10 G @ 15 kg/ha at the time of planting and 60 DAP (SA)</b>	78.91	1.24	4.69	4.53	4.22	8.96	2.78	211.43	79.17	101.04	41.67
5	<b>Carbofuran 3 G @ 33 kg/ha at the time of planting and 60 DAP (SA)</b>	77.45	1.79	4.03	4.19	3.97	8.34	2.78	212.85	79.98	101.62	39.35
6	<b>Untreated control</b>	76.96	8.72	11.69	9.64	7.87	19.37	2.75	212.20	76.04	94.10	84.03
<b>S Em ±</b>		<b>1.88</b>	<b>0.50</b>	<b>0.23</b>	<b>0.21</b>	<b>0.18</b>	<b>0.24</b>	<b>2.2</b>	<b>4.06</b>	<b>0.80</b>	<b>1.10</b>	<b>1.10</b>
<b>CD (p=.05)</b>		<b>NS</b>	<b>1.67</b>	<b>0.78</b>	<b>0.72</b>	<b>0.59</b>	<b>0.80</b>	<b>NS</b>	<b>NS</b>	<b>2.66</b>	<b>3.67</b>	<b>3.67</b>

Table: 9. Occurrence of naturally occurring insect pests on sugarcane

Sr.No.	Variety	Location	Name of pest (% incidence/Population)	Min.	Max.	Average	Remark
1.1	Co J 64	Kareli	ESB (%)	2.00	3.00	2.50	Corgen @150ml/ha for ESB
			TSB (%)	1.00	3.00	2.00	
			RB (%)	2.00	5.00	3.50	
			Pyrilla /Leaf	7.25	16.60	11.93	
			Epiricania melanoleuca/plant	6.10	12.25	9.18	
			Whitefly (per 2.5 sq.cm.)	1.15	2.75	1.95	
1.2	Co J 64	Kareli	ESB (%)	12.00	22.00	17.00	
			TSB (%)	2.00	4.00	3.00	
			RB (%)	4.00	6.00	5.00	
			Pyrilla /Leaf	7.75	14.60	11.18	
			Epiricania melanoleuca/plant	5.55	10.25	7.90	
			Whitefly (per 2.5 sq.cm.)	0.00	0.75	0.38	
1.3	Co Lk 8001	Kareli	ESB (%)	19.00	26.00	22.50	
			TSB (%)	4.00	6.00	5.00	
			RB (%)	5.00	6.00	5.50	
			Pyrilla /Leaf	10.25	16.55	13.40	
			Epiricania melanoleuca/plant	6.10	14.30	10.20	
			Whitefly (per 2.5 sq. cm.)	0.00	1.10	0.55	
1	Average of (1.1,1.2,1.3)	Kareli	ESB (%)	11.00	17.00	14.00	
			TSB (%)	2.33	4.33	3.33	
			RB (%)	3.67	5.67	4.67	
			Pyrilla /Leaf	8.42	15.92	12.17	
			Epiricania melanoleuca/plant	5.92	12.27	9.10	
			Whitefly (per 2.5 sq.cm.)	0.38	1.53	0.96	
2.1	CoM 265	Bankhedi	ESB (%)	5.00	8.00	6.50	Water stagnation
			TSB (%)	4.00	6.00	5.00	
			RB (%)	1.00	3.00	2.00	
			Pyrilla /Leaf	17.05	19.80	18.43	
			Epiricania melanoleuca/plant	9.75	21.65	15.70	
			Whitefly (per 2.5 sq.cm.)	1.15	2.75	1.95	
2.2	CoLK 8001	Bankhedi	ESB (%)	8.00	14.00	11.00	
			TSB (%)	2.00	4.00	3.00	
			RB (%)	2.00	5.00	3.50	
			Pyrilla /Leaf	17.70	21.05	19.38	
			Epiricania melanoleuca/plant	16.25	18.70	17.48	
			Whitefly (per 2.5 sq.cm.)	0.00	0.40	0.20	
2.3	Co 238	Bankhedi	ESB (%)	13.00	19.00	16.00	
			TSB (%)	3.00	4.00	3.50	
			RB (%)	3.00	6.00	4.50	
			Pyrilla /Leaf	12.80	15.25	14.03	
			Epiricania melanoleuca/plant	11.05	13.35	12.20	
			Whitefly (per 2.5 sq.cm.)	0.00	0.60	0.30	

Sr.No.	Variety	Location	Name of pest (% incidence/Population)	Min.	Max.	Av.	Remark
2.3	CoJ 64	Bankhedi	ESB (%)	12.00	22.00	17.00	
			TSB (%)	3.00	4.00	3.50	
			RB (%)	1.00	3.00	2.00	
			Pyrilla /Leaf	14.80	18.75	16.78	
			E. melanoleuca/plant	10.05	14.85	12.45	
			Whitefly (per 2.5 sq.cm.)	0.25	0.70	0.48	
2	Average of (2.1,2.2,2.3)	Bankhedi	ESB (%)	9.50	15.75	12.63	
			TSB (%)	3.00	4.50	3.75	
			RB (%)	1.75	4.25	3.00	
			Pyrilla /Leaf	15.59	18.71	17.15	
			E. melanoleuca/plant	11.78	17.14	14.46	
			Whitefly (per 2.5 sq.cm.)	0.35	1.11	0.73	
3.1	CoLk 8001	Salichouka	ESB (%)	12.00	16.00	14.00	Water stagnation
			TSB (%)	2.00	3.00	2.50	
			RB (%)	0.00	0.00	0.00	
			Pyrilla /Leaf	11.50	16.25	13.88	
			Epiricania melanoleuca/plant	11.05	14.50	12.78	
			Whitefly (per 2.5 sq.cm.)	1.10	2.25	1.68	
3.2	Co 238	Salichouka	ESB (%)	12.00	19.00	15.50	
			TSB (%)	2.00	4.00	3.00	
			RB (%)	1.00	3.00	2.00	
			Pyrilla /Leaf	16.70	19.35	18.03	
			E. melanoleuca/plant	11.25	14.35	12.80	
			Whitefly (per 2.5 sq.cm.)	0.00	0.40	0.20	
3.3	Co 86032	Salichouka	ESB (%)	16.00	22.00	19.00	Autumn Planted
			TSB (%)	6.00	10.00	8.00	
			RB (%)	3.00	8.00	5.50	
			Pyrilla /Leaf	16.80	20.30	18.55	
			Epiricania melanoleuca/plant	12.85	17.00	14.93	
			Whitefly (per 2.5 sq.cm.)	0.00	0.00	0.00	
3.4	Co 88-230	Salichouka	ESB (%)	15.00	29.00	22.00	Late Ratooned
			TSB (%)	1.00	3.00	2.00	
			RB (%)	0.00	1.00	0.50	
			Pyrilla /Leaf	14.45	18.20	16.33	
			E. melanoleuca/plant	10.05	11.30	10.68	
			Whitefly (per 2.5 sq.cm.)	0.30	0.75	0.53	
3	Average of (3.1,3.2,3.3, 3.4)	Salichouka	ESB (%)	13.75	21.50	17.63	
			TSB (%)	2.75	5.00	3.88	
			RB (%)	1.00	3.00	2.00	
			Pyrilla /Leaf	14.86	18.53	16.70	
			E. melanoleuca/plant	11.30	14.29	12.80	
			Whitefly (per 2.5 sq.cm.)	0.35	0.85	0.60	

Sr.No.	Variety	Location	Name of pest (% incidence/Population)	Min.	Max.	Average	Remark
4.1	Co 86032	Hoshangabad	ESB (%)	12.00	21.00	16.50	Water stagnation
			TSB (%)	0.00	1.00	0.50	
			RB (%)	0.00	0.00	0.00	
			Pyrilla /Leaf	7.80	11.10	9.45	
			E. melanoleuca/plant	5.10	6.10	5.60	
			Whitefly (per 2.5 sq.cm.)	1.10	2.25	1.68	
4.2	Co 99004	Hoshangabad	ESB (%)	17.00	26.00	21.50	Late ratooned
			TSB (%)	0.00	1.00	0.50	
			RB (%)	0.00	0.00	0.00	
			Pyrilla /Leaf	7.10	12.75	9.93	
			E. melanoleuca/plant	6.05	7.15	6.60	
			Whitefly (per 2.5 sq.cm.)	0.60	0.90	0.75	
4.3	CoJN 86 600	Hoshangabad	ESB (%)	7.00	12.00	9.50	
			TSB (%)	0.00	0.00	0.00	
			RB (%)	0.00	0.00	0.00	
			Pyrilla /Leaf	4.80	8.80	6.80	
			E. melanoleuca/plant	3.90	6.25	5.08	
			Whitefly (per 2.5 sq.cm.)	0.30	0.75	0.53	
3.4	CoC 671	Hoshangabad	ESB (%)	16.00	29.00	22.50	Spring Planted
			TSB (%)	0.00	0.00	0.00	
			RB (%)	0.00	0.00	0.00	
			Pyrilla /Leaf	10.45	15.20	12.83	
			E. melanoleuca/plant	5.10	11.70	8.40	
			Whitefly (per 2.5 sq.cm.)	0.00	1.15	0.58	
3.4	CoJN 86 141	Hoshangabad	ESB (%)	4.00	9.00	6.50	
			TSB (%)	0.00	0.00	0.00	
			RB (%)	0.00	0.00	0.00	
			Pyrilla /Leaf	2.25	10.55	6.40	
			E. melanoleuca/plant	3.35	7.80	5.58	
			Whitefly (per 2.5 sq.cm.)	0.00	0.00	0.00	
4	Average of (4.1,4.2,4.3, 4.4)	Hoshangabad	ESB (%)	11.20	19.40	15.30	
			TSB (%)	0.00	0.40	0.20	
			RB (%)	0.00	0.00	0.00	
			Pyrilla /Leaf	6.48	11.68	9.08	
			E. melanoleuca/plant	4.70	7.80	6.25	
			Whitefly (per 2.5 sq.cm.)	0.40	1.01	0.89	