

ANNUAL REPORT (2015-16)
AICRP ON SUGARCANE (ENTOMOLOGY),
Zonal Agricultural Research Station, Powarkheda (M.P.)

Technical Programme 2015-16:

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 entries with four checks of early, and fifteen entries with tree checks of mid-late group were screened for their reaction against infestation of key pests of the area i.e., Early shoot borer (ESB) and Pyrilla. The infestation of insect pests recorded and the reactions are given in Table -1 & 2.

Results: Early group:

ESB (% infestation): The ESB infestation (%) ranged in between 6.30 to 35.84 per cent in various genotypes/ varieties evaluated. The CoT 12367 received the lowest ESB infestation (6.30%), followed by CoM 12081 (9.07%) and Co 10005 (10.33%), all were significantly at par with each other, while the later both were also at par with Check, Co 85004 (12.77%), CoN 12072 (12.92%), CoT 12366 (13.02%) and check, CoJN 86-141 (14.12%). The CoT 10367 registered the highest ESB infestation (35.84%), followed by Co 10004 (34.83%) and Co 10006 (30.57%), all were at par with each other, while the Co 10006 was at par with CoM 12083 (30.13%).

Out of the different varieties/ genotypes evaluated, seven genotypes and two checks i.e., Co 80004 and CoJN 86-141 graded as least susceptible (LS), while all remaining were as moderate susceptible (MS)

Pyrilla (per leaf): The pyrilla per leaf population ranged in-between 9.65 to 18.63 individuals/leaf in various genotypes/ varieties evaluated. The Co 12008 had the least pyrilla per leaf, followed by check CoJN 86-141, Co 10004 and CoT 10367, all were significantly at par with each other (9.65 to 9.77). Significantly the highest pyrilla recorded in Co 10005 (18.63), preceded by Co 10026, CoC 671 (Check), Co 100024, Co 940008 (check) and Co 85004 (check), all were at par with each other and also with CoT 12366 and Co 10027. All the evaluated genotypes and checks were graded as MS.

Table-1: Reaction of different entries (Early group) against pyrilla Powarkheda, Madhya Pradesh (2015-16)

S. No.	Trial	Entries	ESB (% infestation)		Pyrilla (per leaf)	
			Mean	Grade	Mean	Grade
1	AVT early I	Co 10004	34.83	MS	9.73	MS
2	AVT early I	Co 10005	10.33	LS	18.63	MS
3	AVT early I	Co 10006	30.57	MS	10.9	MS
4	AVT early I	Co 10024	12.62	LS	15.88	MS
5	AVT early I	Co 10026	25.53	MS	16.3	MS
6	AVT early I	Co 10027	16.29	MS	15.07	MS
7	AVT early I	COT 10366	22.52	MS	14.23	MS
8	AVT early I	COT 10367	35.84	HS	9.77	MS
9	IVT early	Co 12001	24.29	MS	10.22	MS
10	IVT early	Co 12003	26.02	MS	10.63	MS
11	IVT early	Co 12006	23.08	MS	12.5	MS
12	IVT early	Co 12007	19.59	MS	13.73	MS
13	IVT early	Co 12008	16.68	MS	9.65	MS
14	IVT early	CoM 12081	9.07	LS	10.37	MS
15	IVT early	CoM 12082	23.63	MS	11.8	MS
16	IVT early	CoM 12083	30.13	MS	10.03	MS
17	IVT early	CoN 12071	14.23	LS	10.63	MS
18	IVT early	CoN 12072	12.92	LS	13.25	MS
19	IVT early	CoT 12366	13.02	LS	15.23	MS
20	IVT early	CoT 12367	6.30	LS	10.43	MS
21	Check	Co 85004	12.77	LS	15.37	MS
22	Check	Co94008	21.26	MS	15.44	MS
23	Check	CoC 671	23.18	MS	16.23	MS
24	Check	Co JN 86-141	14.12	LS	9.68	MS
S Em ±			2.32		0.55	
CD p=0.05			5.51		1.31	

Midlate group:

ESB (% infestation): ESB (% infestation): ESB infestation ranged in-between 7.89 to 28.97 per cent in various entries and check varieties evaluated. The Co 12024, Co 12012, Co 12019 and CoM 12086 graded as LS, while remaining all as MS.

The Co 12024 received the least ESB infestation (7.89), followed by Co 12012 (9.40), and Co 12019 (10.27) all were significantly at par with each other and superior to check varieties i.e., CoJN 86-141 (16.35), Co 86032 (21.33) and Co 99004 (22.68). CoM 12086 is next in order and significantly at par with prior two and also to check CoJN 86-141. The Co 12009 (28.97) recorded the numerically the maximum ESB infestation, followed by Co 12016, Co 12014 and CoT 12368 (27.03 to 25.65). Except the Co12009, all were at par with each other and Check Co 99004 and Co86032.

Table-2: Reaction of different entries (Midlate group) against Pyrilla Powarkheda, Madhya Pradesh (2015-16)

S. No.	Trial	Entries	ESB (% infestation)		Pyrilla (per leaf)	
			Mean	Grade	Mean	Grade
1	IVT ML	Co 12009	28.97	MS	14.60	MS
2	IVT ML	Co 12012	9.40	LS	15.72	MS
3	IVT ML	Co 12014	26.3	MS	12.58	MS
4	IVT ML	Co 12016	27.03	MS	10.18	MS
5	IVT ML	Co 12017	23.98	MS	10.78	MS
6	IVT ML	Co 12019	10.27	LS	16.82	MS
7	IVT ML	Co 12021	18.34	MS	18.23	MS
8	IVT ML	Co 12024	7.89	LS	19.10	MS
9	IVT ML	CoM 12084	19.94	MS	14.05	MS
10	IVT ML	CoM 12085	25.03	MS	9.87	MS
11	IVT ML	CoM 12086	13.75	LS	15.78	MS
12	IVT ML	CoN 12073	23.29	MS	11.25	MS
13	IVT ML	CoN 12074	23.07	MS	11.05	MS
14	IVT ML	CoT 12368	25.65	MS	10.35	MS
15	IVT ML	VSI 12121	20.92	MS	10.40	MS
16	IVT ML	Co JN 86-600	16.35	MS	16.07	MS
17	IVT ML	Co 86032	21.33	MS	10.52	MS
18	IVT ML	Co 99004	22.68	MS	12.53	MS
S Em ±			2.24		1.22	
CD p=0.05			5.36		2.93	

Pyrilla (per leaf): The pyrilla population ranged between 9.87 to 19.10 pyrilla/leaf in various genotypes evaluated and check-varieties. The check varieties, i.e., Co 99004, CoJN 86-600 and Co 86032 received 10.52, 12.53 and 16.07 pyrilla per leaf. All the genotypes as well as the checks graded as MS.

Pyrilla (population per leaf) received in various entries differed significantly. The CoM 12085 (9.87) received numerically the least pyrilla population, followed by Co 12016 (10.18), CoT 12368 (10.35) and VSI 12121 (10.40). All were significantly at par with each other and to the check Co 99004 (10.52) and CoJn 86-600 (12.53), except the CoM 12085, which was superior to both the checks. The Co 12024 (19.10) received numerically the maximum pyrilla population, preceded by Co 12021 (18.23) and Co 12019 (16.82), all were significantly at par with each other and also to the check Co 86032.

Summary: Twenty entries with four checks of early, and fifteen entries with tree checks of mid-late group were screened for their reaction against infestation of key pests of the area i.e., Early shoot borer (ESB) and Pyrilla.

ESB infestation (%): In early group, the ESB infestation (%) ranged in between 6.30 to 35.84 per cent in various genotypes/ varieties evaluated. The CoT 12367 received the lowest ESB infestation (6.30%), followed by CoM 12081 (9.07%) and Co 10005 (10.33%), all were significantly at par with each other. The CoT 10367 registered numerically the highest ESB infestation (35.84%). Out of the different varieties/ genotypes evaluated, seven genotypes and two checks i.e., Co 80004 and CoJN 86-141 graded as least susceptible (LS), while all remaining were as moderate susceptible (MS). Among the Midlate group entries evaluated, Co 12024, Co 12012 and Co 12019 (7.89 to 10.27%) received significant less ESB infestation as compared to all the check varieties. While, the Co 12009 (28.97%) received the maximum ESB infestation. Among the evaluated genotypes, less infested the three above genotypes and the CoM 12086 gaded as LS, while all other and the check varieties graded as MS.

Pyrilla (per leaf): In early group pyrilla ranged in-between 9.65 to 18.63 individuals/leaf in various genotypes/ varieties evaluated. The Co 12008 had the numerically the least pyrilla per leaf. Significantly the highest pyrilla recorded in Co 10005 (18.63), preceded by Co 10026, CoC 671 (Check), all were at par with each other. All the evaluated genotypes and checks were graded as MS. In the Midlate group, the pyrilla per leaf population ranged in-between 9.87 to 19.10 individuals/leaf in various genotypes/ varieties evaluated. Numerically the least pyrilla per leaf received by the Co 12085, followed by Co 12016 (10.18), while Co 12024 (19.10) preceded by Co 12021 and Co 12019 received maximum pyrilla infestation. All the evaluated genotypes and checks were graded as MS.

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 Bankhedi, Kareli and Salichouka Sugar Factory area sugarcane growing area were surveyed for the purpose of recording the sugarcane insect pests status and their natural enemies

Results: The insect pest status is averaged for the different sugarcane areas surveyed, some imperative observations emerged are as under –

1. The Co 86032, Co J 64, Co M 265 and Co 0238 are important sugarcane varieties grown in the area, while the Co 7318, Co 6304, CoC 671, CoJN 86 141, CoJN 86-600 and Co 99004 are also under cultivation.

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

S.No.	Location	Name of pest % incidence/Population	Min.	Max.	Average
1.	Bankhedi	ESB (%)	10.7	23.65	17.18
		TSB (%)	2.10	4.70	3.40
		RB (%)	1.65	3.85	2.75
		Pyrilla /Leaf	13.19	19.89	16.54
		<i>E. melanoleuca/Leaf</i>	7.79	18.35	13.07
		Whitefly (per 2.5 sq.cm.)	0.19	1.18	0.68
2.	Hoshangabad	ESB (%)	10.72	26.64	18.68
		TSB (%)	0.20	0.56	0.38
		RB (%)	0.00	0.84	0.42
		Pyrilla /Leaf	8.47	16.85	12.66
		<i>E. melanoleuca/Leaf</i>	8.69	15.09	11.89
		Whitefly (per 2.5 sq.cm.)	0.08	0.97	0.53
3.	Kareli	ESB (%)	5.60	28.20	16.90
		TSB (%)	1.87	5.60	3.73
		RB (%)	3.13	4.20	3.67
		Pyrilla /Leaf	13.93	21.67	17.8
		<i>E. melanoleuca/Leaf</i>	8.01	14.46	11.24
		Whitefly (per 2.5 sq.cm.)	0.87	4.70	2.79
4.	Salichouka	ESB (%)	12.75	27.90	20.33
		TSB (%)	3.55	6.90	5.23
		RB (%)	2.35	4.70	3.53
		Pyrilla /Leaf	14.33	20.60	17.47
		<i>E. melanoleuca/Leaf</i>	8.30	16.18	12.24
		Whitefly (per 2.5 sq.cm.)	0.54	1.14	0.84
Overall Average of ESB (%).....			10.26	26.50	18.38
Overall Average of TSB (%).....			1.95	4.40	3.17
Overall Average of RB (%).....			1.69	3.31	2.50
Overall Average of Pyrilla/Leaf.....			12.14	19.45	15.8
Overall Average of <i>E. melanoleuca/Leaf</i>....			8.20	16.02	12.11
Overall Average of Whitefly (per 2.5 sq.cm.)			0.39	1.80	1.10
Area/ variety/ min./max. and average etc. given in Annexure - 1					

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

2. Early shoot borer and pyrilla works as major while top shoot borer/ root borer/ pink stem borer, scale, whitefly and mealy bug are the minor insect pests infesting sugarcane.

3. Early shoot borer infestation were observed to be 17.18, 18.68, 16.90 and 20.33 per cent in various varieties at Bankhedi, Hoshangabad, Kareli and Salichouka respectively. No bio agent activity observed against early shoot borer.
4. The pyrilla infestation observed was 16.54, 12.66, 17.80 and 17.47 pyrillaper leaf, while, nymphal cum adult parasitoid, *E malanoleuca* was 13.07, 11.89, 11.24 and 12.24 per leaf at Bankhedi, Hoshangabad, Kareli and Salichouka, respectively. Egg parasitoid, *T. pyrillae* also observed to parasitized the pyrilla effectively.

Summary: The pyrilla and early shoot borer worked as key pests, while the top shoot borer, root borer, pink stem borer, whitefly, mealy bug and scale insect worked as minor insect pests of sugarcane. Among the areas surveyed, highest infestation of early shoot borer recorded at Salichouka sugar factory area, while maximum infestation of pyrilla observed at Kareli factory areas. The introduction of adsali sugarcane cultivation and trash burning seem to be potential reason for pyrilla severity. While, plantation of sugarcane mostly in autumn season/late ratooning is conducive for building-up severe infestation of early shoot 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: For monitoring the insect pests and the bio agents activity in sugarcane, Co 86032 was planted in 0.2 ha area by following the recommended package of practices except application of insecticides. At each standard meteorological week (SMW) the observations on infestation of both key pests i.e., early shoot borer and pyrilla and their natural enemies were recorded. Data of meteorological parameters were obtained from Agro-Meteorological Project, ZARS, Powarkheda. (Table 4 and 5 & Fig. 1 to 3).

RESULT: In the season, cumulative infestation of early shoot borer remained 21.40 per cent. The infestation initiated at 1st week of February. Gradually increased and reached to peak activity i.e., 2.20 to 2.40 per cent per week from 13th to 15th SMW (last week of March to 2nd week of April). Afterwards, the pest observed decline trend and the observed up to 24th SMW.

For initiation of ESB activity, max. temp. >27°C and above, min. temp >10.80°C, 87% RH; for peak activity max. temp. >39.40°C, min. temp –around 18 to 19°C and 50 RH% seems to be favorable.

Table 4: Activity of Early Shoot Borer and meteorological data, 2015, ZARS, Powarkheda (M.P.)

SMW	Date (2015)	Max. Temp. (°C)	Min. Temp (°C)	RH%	Rainfall (mm)	ESB infestation (%)	
						Weekly	Cumulative
3	15 to 21/1	27.90	10.80	87.00	11.60	0.00	0.00
4	22 to 28/1	27.70	10.80	92.00	10.20	0.00	0.00
5	29/1 to 4/2	29.20	9.40	88.00	0.00	0.20	0.20
6	5 to 11/2	32.10	11.00	88.00	0.00	0.20	0.40
7	12 to 18/2	27.90	9.80	70.00	0.00	0.40	0.80
8	19 to 25/2	33.00	8.90	69.00	2.00	0.80	1.60
9	26/2 to 4/3	28.40	12.60	92.00	0.00	1.00	2.60
10	5 to 11/3	32.50	14.40	77.00	0.00	1.20	3.80
11	12 to 18/3	38.70	16.20	79.00	0.00	1.60	5.40
12	19 to 25/3	38.50	14.40	77.00	0.00	1.80	7.20
13	26/3 to 1/4	39.40	19.00	50.00	0.00	2.40	9.60
14	2 to 8/4	40.20	18.40	36.00	0.00	2.20	11.80
15	9 to 15/4	40.40	18.60	25.00	0.00	2.20	14.00
16	16 to 22/4	41.50	20.70	55.00	8.20	1.80	15.80
17	23 to 29/4	41.90	20.20	50.00	0.00	1.60	17.40
18	30/4 to 6/5	43.30	22.40	34.00	0.00	1.00	18.40
19	7 to 13/5	40.90	22.00	56.00	0.00	0.80	19.20
20	14 to 20/5	42.00	21.00	41.00	0.00	0.60	19.80
21	21 to 27/5	43.70	22.40	39.00	0.00	0.40	20.20
22	28/5 to 3/6	44.80	25.40	56.00	2.40	0.60	20.80
23	4 to 10/6	46.20	27.20	67.00	0.00	0.40	21.20
24	11 to 17/6	43.90	22.00	44.00	60.60	0.20	21.40
25	18 to 24/6	38.80	20.20	0.00	22.80	0.00	21.40

In 1st phase, the pyrilla infestation initiated at 10th SMW (2nd week of March), reached to its peak activity during 17th to 19th SMW (last week of April to 2nd week of May). Maximum egg masses were recorded during 14 to 17th SMW (April), while maximum parasitism by *E. melanoleuca* (5.2 to 6.00%) was observed during 18th to 20 SMW, its maximum egg masses observed (1.75 to 2.05 egg masses/ leaf) during 16th to 19th SMW i.e., one week before and two weeks before peak activity of pyrilla and *E. melanoleuca*, respectively. The maximum egg parasitism of pyrilla by *Tetrastichus pyrillae* recorded at 16th SMW.

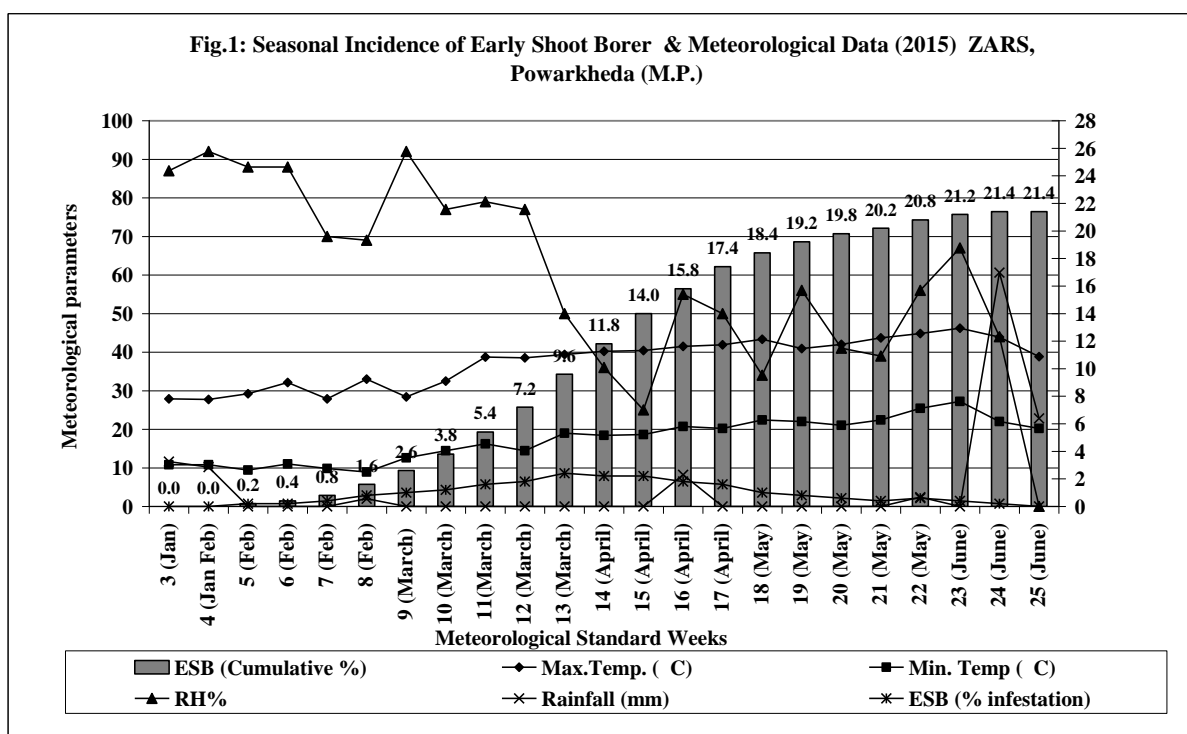
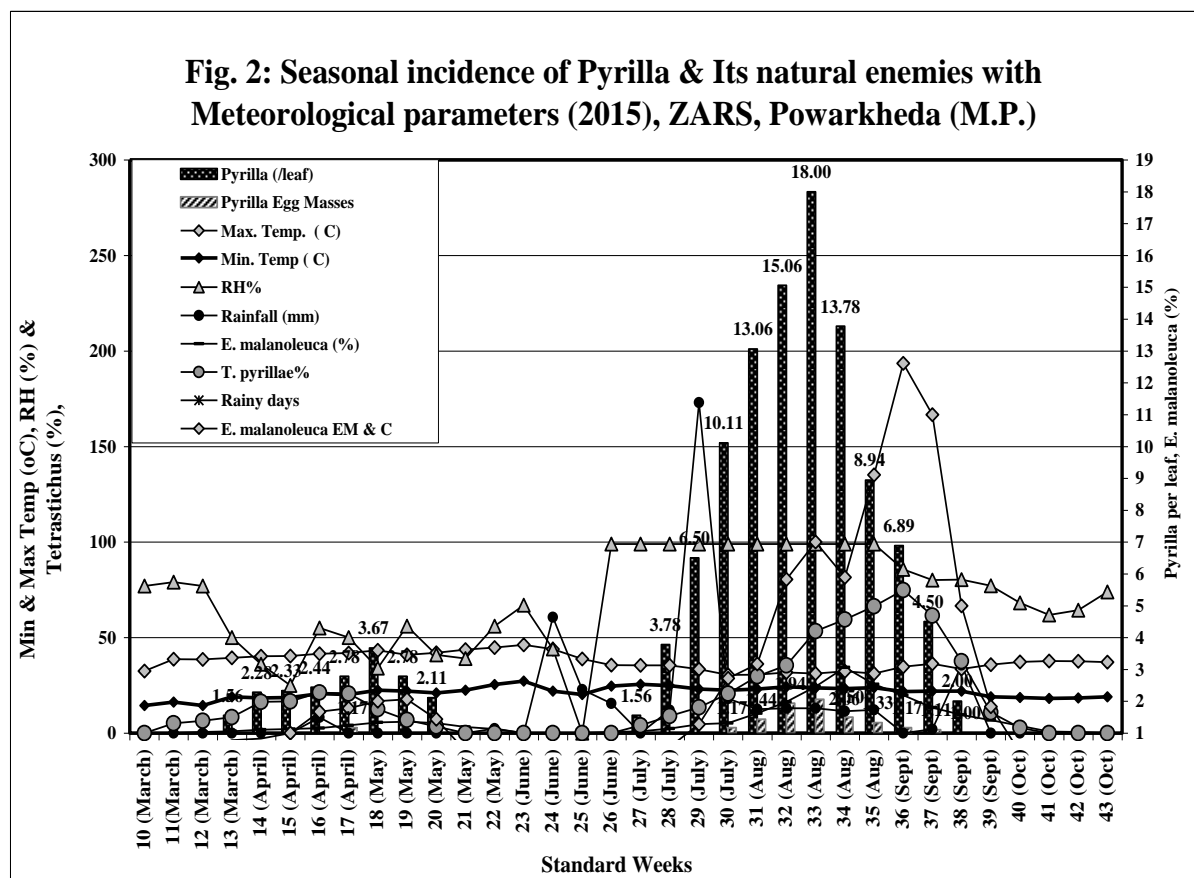


Table 5: Seasonal incidence of pyrilla and its bio-agents and meteorological data, ZARS, Powarkheda (M.P.).

SMW 2015	Max. Temp (°C)	Min. Temp (°C)	RH %	Rainfall (mm)	Pyrilla (/leaf)	Pyrilla Egg Masses	<i>E. malanoleuca</i> (%)	<i>E. malanoleuca</i> EM & C	<i>T. pyrilla</i> %
10 (March)	32.50	14.40	77.00	0.00	0.00	0.05	0.00	0.05	0.00
11 (March)	38.70	16.20	79.00	0.00	0.35	0.10	0.00	0.00	4.80
12 (March)	38.50	14.40	77.00	0.00	0.80	0.35	0.60	0.40	6.80
13 (March)	39.40	19.00	50.00	0.00	1.55	0.60	1.00	0.75	8.50
14 (April)	40.20	18.40	36.00	0.00	2.25	0.90	1.80	0.90	15.60
15 (April)	40.40	18.60	25.00	0.00	2.30	0.80	2.20	1.00	17.00
16 (April)	41.50	20.70	55.00	8.20	2.40	0.80	2.60	1.70	21.10
17 (April)	41.90	20.20	50.00	0.00	2.75	1.10	4.00	1.75	20.60
18 (May)	43.30	22.40	34.00	0.00	3.60	0.30	5.60	1.90	12.30
19 (May)	40.90	22.00	56.00	0.00	2.80	0.20	6.00	2.05	7.00
20 (May)	42.00	21.00	41.00	0.00	2.10	0.10	5.20	1.40	3.50
21 (May)	43.70	22.40	39.00	0.00	0.95	0.00	3.20	0.40	0.00
22 (May)	44.80	25.40	56.00	2.40	0.70	0.00	2.20	0.15	0.00
23 (June)	46.20	27.20	67.00	0.00	0.30	0.00	0.00	0.05	0.00
24 (June)	43.90	22.00	44.00	60.60	0.00	0.00	0.00	0.00	0.00
25 (June)	38.80	20.20	0.00	22.80	0.00	0.00	0.00	0.00	0.00
26 (June)	35.60	24.60	99.00	15.50	0.85	0.00	0.60	0.25	0.00
27 (July)	35.40	25.60	99.00	0.00	1.45	0.25	1.00	0.20	3.90

SMW 2015	Max. Temp (OC)	Min. Temp (OC)	RH %	Rainfall (mm)	Pyrilla (/leaf)	Pyrilla Egg Masses	E. malanoleuca (%)	E. malanoleuca EM & C	T. pyrillae %
28 (July)	35.40	24.80	99.00	12.00	3.75	0.25	2.40	0.55	8.80
29 (July)	33.40	23.00	99.00	173.00	6.40	0.80	4.60	1.30	13.50
30 (July)	30.40	22.50	99.00	18.00	10.30	1.10	5.20	2.70	20.30
31 (Aug)	30.60	23.00	99.00	12.50	13.35	1.55	10.40	3.15	29.70
32 (Aug)	31.70	24.20	99.00	13.00	15.20	1.95	16.40	5.75	36.00
33 (Aug)	31.10	23.60	99.00	13.00	18.35	2.10	24.40	7.00	54.10
34 (Aug)	32.30	23.30	99.00	11.50	13.90	1.55	34.40	5.95	60.00
35 (Aug)	31.10	23.80	99.00	12.20	8.80	1.30	25.60	9.10	66.40
36 (Sept)	34.70	21.70	85.71	0.00	6.85	1.30	19.80	12.70	75.00
37 (Sept)	36.30	22.00	80.14	2.00	4.40	1.15	13.40	11.10	61.20
38 (Sept)	33.50	22.00	80.29	35.60	2.05	1.00	9.60	4.90	37.30
39 (Sept)	35.80	19.00	77.14	0.00	0.85	0.55	6.80	1.90	11.00
40 (Oct)	37.20	18.60	68.14	0.00	0.35	0.10	3.80	0.35	2.60
41 (Oct)	37.70	18.20	61.86	0.00	0.25	0.00	0.80	0.20	0.00
42 (Oct)	37.60	18.40	64.29	0.00	0.00	0.00	0.60	0.10	0.00
43 (Oct)	37.10	19.00	73.86	0.00	0.00	0.00	0.00	0.00	0.00

Fig. 2: Seasonal incidence of Pyrilla & Its natural enemies with Meteorological parameters (2015), ZARS, Powarkheda (M.P.)



In 2nd of pyrilla (rainy seasonal) initiated from 27th SMW (1st week of July), The pyrilla population increased continuously and reached to its peak (>10 per leaf) during 30th to 34 SMW (last week of July to 4th week of August). Maximum pyrilla egg masses (1.95 to 2.10 per leaf) observed during 32 and 33rd SMW. The maximum parasitism by *E. malanoleuca* (24.40 to 34.40%) recorded during 33rd to 35th SMW, i.e., during last two weeks and one week later the peak activity of pyrilla. The highest egg parasitism of pyrilla recorded at 36th SMW (1st week of September). The pyrilla activity observed decline trend after 33rd SMW and remained active up to 41st SMW.

In rainy season, for initiation of pyrilla infestation, a maximum temperature of about 35^oC, minimum temperature around 24^oC, 99 per cent RH; while for peak activity, a maximum temperature of about 31^oC, minimum temperature around 24^oC, 99 per cent RH seems to be encouraging.

Summary:

In Monitoring of Insect Pests and their Bio-agents in Sugarcane Agro-ecosystem, it is observed that the cumulative infestation of early shoot borer remained 21.40 per cent. The infestation initiated at 1st week of February. Peak activity (>2% per week) observed during 13th to 15th SMW, i.e., last week of March to mid of April. No bio-agents activity recorded.

In 1st phase, the pyrilla infestation initiated at 10th SMW (2nd week of March), reached to its peak (3.6 per leaf) at 18th SMW (1st week of May). *Epriricania melanoleuca* up to 6.00 per cent and *Tetrastichus pyrillae* up to 21.10 per cent also recorded. While, in the 2nd phase, pyrilla reached to its peak activity at 33rd SMW (3rd week of Aug), at this week the maximum egg masses of pyrilla also noticed. Maximum parasitism of *E. malanoleuca* (34.40%) recorded one week after (i.e., at 34th SMW). While, maximum egg masses/ live cocoons of *E. melanoleuca* (12.70 per leaf) and *T. pyrillae* (75% parasitism) observed at 36th SMW, i.e., two weeks after the peak pyrilla infestation.

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 at standard meteorological weeks and captures of early shoot borer moth at pheromone trap daily. The moth captured per day per trap at each standard meteorological week was 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) and EBS moth captures at pheromone traps observed from 6th standard meteorological week (SMW) i.e., 2nd last week of February. Maximum ESB infestation in control block recorded at 13th SMW (1st week of April), while the peak field infestation was observed from 12th to 15th SMW i.e., last week of March to 3rd week of April, while moth captures at pheromone trap captures were maximum from 11th to 17th SMW (3rd week of March to last week of April. The cumulative ESB infestation in the control block remained 26.60 per cent, while it was 16.60 per cent in lure managed block i.e., 25.22 per cent lower as compared to control block.

Table 6: Meteorological Parameters, Early shoot borer infestation (%) of Lure managed V/S Control Block & Moth captured per day per Trap, ZARS, Powarkheda (2015).

2015	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	
1 to 7/1	1	23.70	6.00	88.00	24.10	0.00	0.00	0.00	0.00
8 to 14/1	2	27.80	4.60	88.00	0.00	0.00	0.00	0.00	0.00
15 to 21/1	3	26.00	4.90	77.00	0.00	0.00	0.00	0.00	0.00
22 to 28/1	4	27.50	8.80	88.00	0.40	0.20	0.00	-0.20	0.00
29/1 to 4/2	5	30.70	5.60	92.00	7.00	0.40	0.00	-0.40	0.00
5 to 11/2	6	30.70	11.20	86.00	12.40	0.80	0.20	-0.60	0.10
12 to 18/2	7	30.80	8.60	0.00	0.00	0.80	0.20	-0.60	0.14
19 to 25/2	8	33.80	11.40	0.00	0.00	1.00	0.40	-0.60	0.10
26/2 to 4/3	9	32.80	13.20	0.00	23.60	1.80	1.00	-0.80	0.19
5 to 11/3	10	32.50	12.00	0.00	167.50	1.60	1.60	0.00	0.29
12 to 18/3	11	32.50	13.40	0.00	4.30	1.80	2.00	0.20	0.43
19 to 25/3	12	38.30	14.80	68.00	0.00	2.20	1.80	-0.40	0.43
26/3 to 1/4	13	37.80	17.00	99.00	0.00	2.60	2.40	-0.20	0.62
2 to 8/4	14	37.10	18.10	61.00	0.00	2.20	2.20	0.00	0.48
9 to 15/4	15	37.50	18.10	99.00	1.00	2.20	1.80	-0.40	0.48
16 to 22/4	16	41.20	18.30	99.00	0.50	1.60	1.00	-0.60	0.57
23 to 29/4	17	41.80	20.50	46.00	0.00	1.40	0.80	-0.60	0.48
30/4 to 6/5	18	41.10	21.10	44.00	0.00	0.80	0.80	0.00	0.38
7 to 13/5	19	42.50	23.60	85.00	0.00	0.40	0.20	-0.20	0.38
14 to 20/5	20	44.90	24.40	86.00	0.00	0.40	0.20	-0.20	0.29
21 to 27/5	21	43.10	26.50	61.00	0.00	0.20	0.00	-0.20	0.19
28/5 to 3/6	22	43.60	26.70	50.00	0.00	0.20	0.00	-0.20	0.14
4 to 10/6	23	41.20	26.00	86.00	0.00	0.00	0.00	0.00	0.00
11 to 17/6	24	37.20	24.00	99.00	4.50	0.00	0.00	0.00	0.00
Total						22.60	16.60	-6.00	

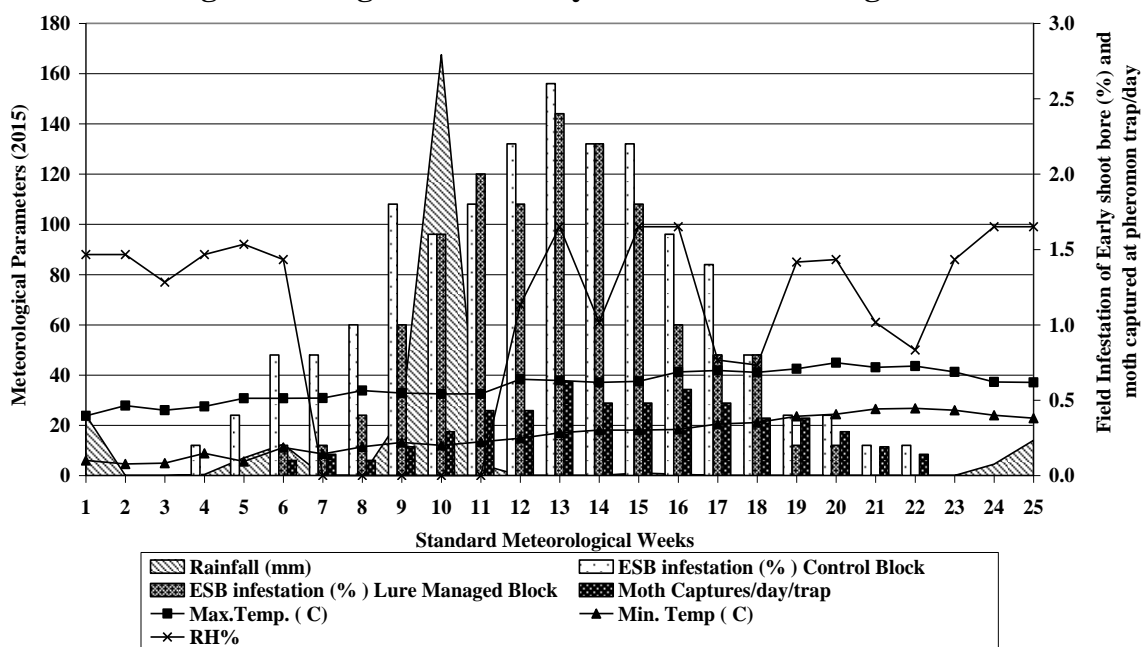
The correlation and regression of the meteorological parameters with the number of moth captured per day per SMW was also worked out. The Correlation values is 0.49, 0.37, -0.50 and -0.33 for maximum and minimum temperature, relative humidity (%) and quantum of rain (mm), respectively. The multiple regression obtained is given below –

$$Y = 0.3439 + 0.2877 * X^1 + 0.4944 * X^2 - 0.4416 * X^3 - 0.1154 * X^4$$

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: During the season, early shoot borer (ESB dead hearts) and ESB moth captures at pheromone traps observed from 6th standard meteorological week (SMW), with peak activity in control block at 13th SMW (1st week of April). The maximum moth captures at pheromone trap captures were from 11th to 17th SMW (3rd week of March to last week of April). The cumulative ESB infestation in the control block remained 26.60 per cent, while it was 16.60 per cent in lure managed block i.e., 25.22 per cent lower as compared to control block.

Fig 3 : 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

Treatments details:

S. N0.	Treatment	Dose	Time of Application	Method of Application
1.	Fipronil 0.3 G	25 kg./ha	Planting & 60 DAP	SA
2.	Chlorantraniliprole 0.4 G	22.5 kg/ ha	Planting & 60 DAP	SA
3.	Chlorantraniliprole 18.5 SC	375 ml/ ha	30 and 60 DAP	S
4.	Spinosad 45 SC	90 ml/ha	30 and 60 DAP	S
5.	Flubendiamide 39.35% m/m SC	125 ml/ ha	30 and 60 DAP	S
6.	Phorate 10 G	15 kg/ ha	Planting & 60 DAP	SA
7.	Carbofuran 3	33 kg/ ha		
8.	Control	Untreated		

SA – Soil application; S-Spray

Results:

(A) Germination: The germination per cent in various treatments ranged in-between 76.30 to 80.73 and differed non-significantly.

(B) ESB (% infestation):

(B-1) ESB (% infestation) at 30 DAS: The ESB infestation observed to vary in between 0.86 to 8.75 per cent in different treatments and differed significantly. Chlorantraniliprole 0.4 G @ 22.5 kg/ ha at planting & 60 DAP (SA) received numerically the least ESB infestation (0.86%), followed by fipronil 0.3 G @25 kg./ha at planting & 60 DAP (SA) (1.02%), both were significantly at par with each other. Phorate 10 G @ 15 kg/ ha at planting & 60 DAP (SA) and carbofuran 3G @ 33 kg/ ha at planting & 60 DAP (SA) were significantly independent and next better performing treatments. Maximum ESB infestation recorded in chlorantraniliprole 18.5 SC @ 375 ml/ ha at 30 and 60 DAP (S), followed by control (untreated), phorate 10 G @ 15 kg/ ha at Planting & 60 DAP (SA) and flubendiamide 39.35% m/m SC @ 125 ml/ ha at 30 and 60 DAP(S) (8.75 to 7.95%), all were significantly at par with each other.

(B-2) ESB (% infestation) at 60 DAS: Treatments differed significantly in respect of ESB infestation at 60 DAP (1.60 to 9.97%). Chlorantraniliprole 0.4 G @ 22.5 kg/ ha at planting & 60 DAP (SA) received numerically least ESB infestation (1.60%), followed by fipronil 0.3 G @ 25 kg./ha at planting & 60 DAP (SA) (1.76%) and chlorantraniliprole 18.5 SC @ 375 ml/ha at 30 and 60 DAP (S) (2.18%), all were significantly at par with each other. Control (untreated) had significantly the maximum ESB infestation (9.97%), carbofuran 3G @ 33 kg/ ha at planting & 60 DAP (SA) (4.93%) was next highest ESB infested treatment, but was

significantly inferior to spinosad 45 SC @ 90 ml/ha at 30 and 60 DAP (S), phorate 10 G @ 15 kg/ ha at planting & 60 DAP (SA) and flubendiamide 39.35% m/m SC @ 125 ml/ ha at 30 and 60 DAP(S) (3.78 to 3.43%).

(B-3) ESB (% infestation) at 90 DAS: The ESB infestation ranged in between 1.30 to 10.13 per cent in various treatments and differed significantly. All the chemical control treatments received significantly less ESB infestation as compared to control (untreated). The chlorantraniliprole 0.4 G @ 22.5 kg/ ha at planting and 60 DAP (SA) (1.30%) received the numerically least ESB infestation, followed by flubendiamide 39.35% m/m SC @ 125 ml/ ha at 30 and 60 DAP(S) (1.37%) and fipronil 0.3 G @25 kg./ha at planting & 60 DAP (SA) (1.43%), all were significantly at par with each other. Significantly the maximum ESB infestation recorded in control (untreated) (10.13%), preceded by carbofuran 3G @ 33 kg/ ha at Planting and 60 DAP (SA) (5.33%), spinosad 45 SC @ 90 ml/ha at 30 and 60 DAP (S) (4.48%) and phorate 10 G @ 15 kg/ ha at planting & 60 DAP (SA) (2.69%), all were significantly independent.

(B-4) ESB (% infestation) at 120 DAS: The ESB infestation ranged in between 1.42 to 6.58 per cent in various treatments and differed significantly. All the chemical control treatments received significantly less ESB infestation than the control (untreated) (6.58%) . The rank and statistical significance was the same as at 90 DAS, except the fipronil 0.3 G @ 25 kg./ha at planting & 60 DAP (SA) and flubendiamide 39.35% m/m SC @ 125 ml/ ha at 30 and 60 DAP(S) exchanged their rank and phorate 10 G @ 15 kg/ ha at planting & 60 DAP (SA) and spinosad 45 SC @ 90 ml/ha at 30 and 60 DAP (S) were become significantly at par.

(B-5) ESB (% infestation) Cumulative: The treatments differed significantly in respect of ESB infestation received (3.00 to 16.77%). Numerically the lowest ESB infestation (3.00%) observed in chlorantraniliprole 0.4 G @ 22.5 kg/ ha at planting & 60 DAP (SA), followed by fipronil 0.3 G @ 25 kg./ha at planting and 60 DAP (SA) (3.23%) both were significantly at par with each other. The flubendiamide 39.35% m/m SC @ 125 ml/ ha at 30 and 60 DAP(S) (5.29%) and chlorantraniliprole 18.5 SC @ 375 ml/ ha at 30 and 60 DAP (S) (5.49%) were next better performing treatments and were significantly at par with each other. Significantly the maximum ESB infestation was recorded in control (untreated) (16.77%), preceded by carbofuran 3G @ 33 kg/ ha at planting & 60 DAP (SA) (10.45%) and spinosad 45 SC @ 90 ml/ha at 30 and 60 DAP (S)

(C) Cane Diameter (mm) and Cane Height (cm): The cane diameter (mm) and cane height (cm) ranged in-between 27.18 to 28.36 mm and 204.80 to 209.10 cm, respectively. Although,

due to the insecticidal treatments there is numerical advantage in both parameters, but the increase was not statistically non-significant as compared to untreated control.

(D) Number of Millable canes (NMC, 000’): All the insecticidal treatments produced significantly more NMC as compared to the untreated control (75.92). Numerically the maximum NMC (82.72) were observed in chlorantraniliprole 0.4 G @ 22.5 kg/ ha at planting and 60 DAP (SA), followed by fipronil 0.3 G @ 25 kg./ha at planting & 60 DAP (SA) (82.25), chlorantraniliprole 18.5 SC @ 375 ml/ ha at 30 and 60 DAP (S) (80.71), flubendiamide 39.35% m/m SC @ 125 ml/ ha at 30 and 60 DAP(S) (80.25) and phorate 10 G @ 15 kg/ ha at planting and 60 DAP (SA) (80.1), all were significantly at par with each other. Last three were also had significant at par relation with spinosad 45 SC @ 90 ml/ha at 30 and 60 DAP (S) (79.32) and carbofuran 3G @ 33 kg/ ha at planting & 60 DAP (SA) (79.17).

(E) Cane yield (t/ha): Significantly more cane yield (107.41 to 95.06 t/ha) was produced in insecticidal treatments as against untreated control (88.12 t/ha). The chlorantraniliprole 0.4 G @ 22.5 kg/ ha at planting & 60 DAP (SA) (107.41t/ha) yielded the maximum, but was significantly at par with the following fipronil 0.3 G @ 25 kg./ha at planting & 60 DAP (SA) (105.4 t/ha). The chlorantraniliprole 18.5 SC @ 375 ml/ ha at 30 and 60 DAP (S) (102.32 t/ha) and flubendiamide 39.35% m/m SC @ 125 ml/ ha at 30 and 60 DAP(S) (100.16 t/ha) were the next better performing treatments, both are significantly at par with each other, while the later one was also had non-significant difference with the next following phorate 10 G @ 15 kg/ ha at planting & 60 DAP (SA) (97.84 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) found to reduced the natural infestation of ESB effectively (82.11 and 80.74 %, respectively). Both these treatment also increases cane yield also (t/ha) by 21.89 and 19.61 per cent, respectively.

Table 7 : Bio-efficacy of new insecticides for the control of sugarcane early shoot borer (2015).

S.No.	Treatments	ESB (%)						Diameter (mm)	Height (cm)	NMC (000'/ha)	Cane Yield (t/ha)	% increase
		Germi. (%)	30 DAP	60 DAP	90 DAP	120 DAP	Cumu.					
T1	SA of fipronil 0.3 G @ 25 kg a.i./ha at the time of planting and 60 DAP	77.86	1.02	1.76	1.43	1.43	3.23	28.36	208.17	82.25	105.40	19.61
T2	SA of Chlorantranilprole 0.4 G @ 22.5 kg /ha at the time of planting and 60 DAP	78.26	0.86	1.60	1.30	1.42	3.00	28.03	208.23	82.72	107.41	21.89
T3	S of Chlorantranilprole 18.5 SC 375 ml/ha at 30 and 60 DAP	77.08	8.75	2.18	2.10	1.66	5.49	27.76	209.10	80.71	102.32	16.11
T4	S of spinosad 45 SC @ 90 ml/ha at 30 and 60 DAP	80.73	7.95	3.78	4.48	4.52	9.94	27.79	205.10	79.32	95.22	8.06
T5	S of flubendiamide 39.35 % SC @ 125 ml/ha at 30 and 60 DAP (50 g a.i./ha)	78.39	8.29	3.69	1.37	1.51	5.29	27.79	205.87	80.25	100.16	13.66
T6	SA of phorate 10 G @ 15 kg/ha at the time of planting and 60 DAP (1500g a.i./ha)	79.17	1.87	3.43	2.69	4.45	7.68	27.87	205.37	80.10	97.84	11.03
T7	SA of carbofuran 3 G @ 33 kg/ha at the time of planting and 60 DAP (1000 g a.i./ha)	77.86	2.88	4.93	5.33	4.95	10.45	27.64	205.50	79.17	95.06	7.88
T8	Untreated control	76.30	8.62	9.97	10.13	6.58	16.77	27.18	204.80	75.92	88.12	0.00
S Em ±		1.24	0.29	0.23	0.14	0.10	0.13	0.32	2.75	0.86	1.13	
CD (p=.05)		NS	0.88	0.71	0.43	0.30	0.39	NS	NS	2.62	3.43	

SA – Soil application; S-Spray

Fig - 4: Bio-efficacy of new insecticides for the control of sugarcane early shoot borer

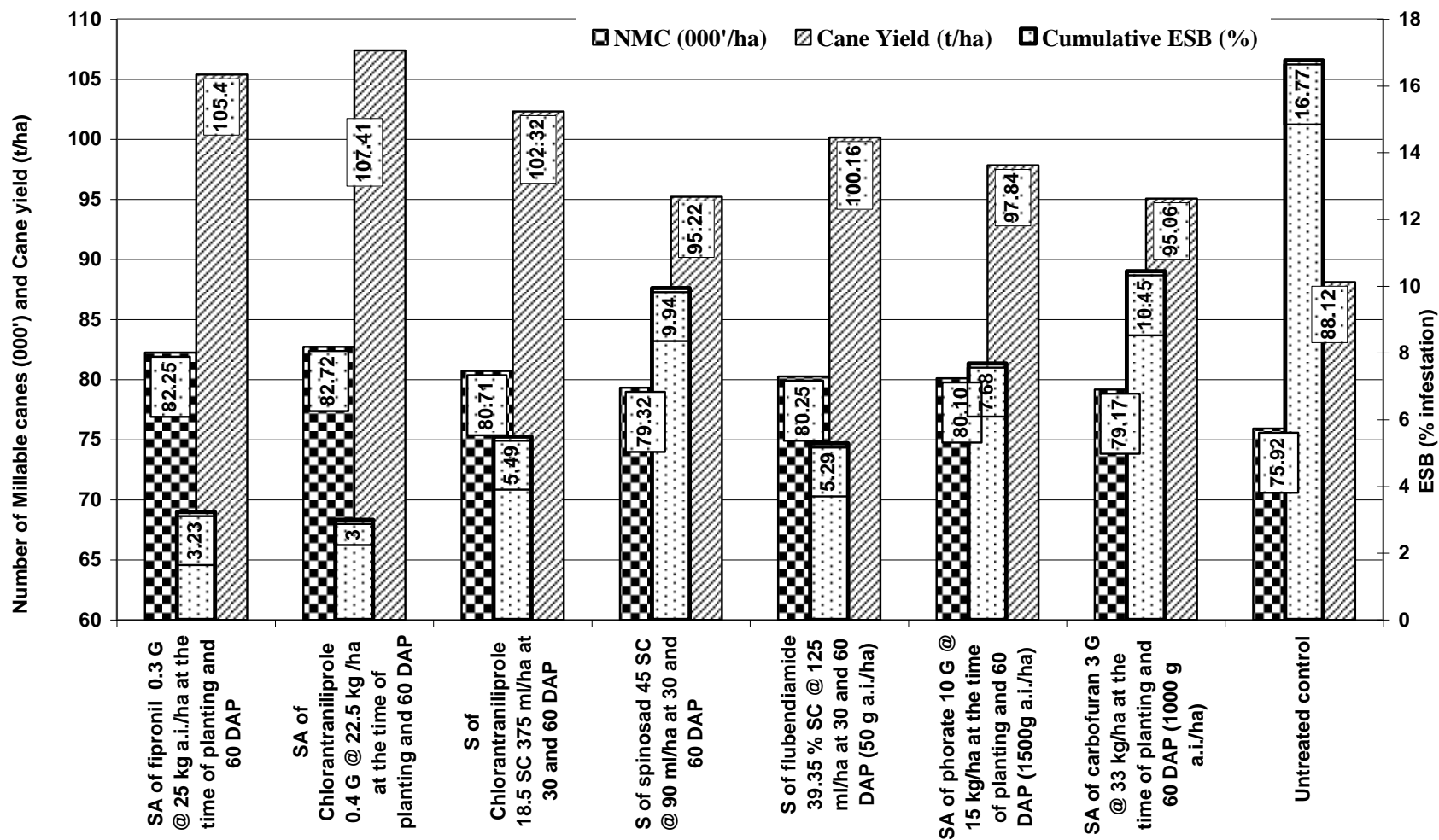


Table: 8. Occurrence of naturally occurring insect pests on sugarcane

Variety	Location	Name of pest % incidence/Population	Min.	Max.	Average
Co 238	Bankhedi	<i>E. melanoleuca/Leaf</i>	6.60	16.70	11.65
CoJ 64	Bankhedi	<i>E. melanoleuca/Leaf</i>	5.05	15.60	10.33
CoLK 8001	Bankhedi	<i>E. melanoleuca/Leaf</i>	11.60	19.35	15.48
CoM 265	Bankhedi	<i>E. melanoleuca/Leaf</i>	7.90	21.75	14.83
Average of Locality			7.79	18.35	13.07
Co 86032	Hoshangabad	<i>E. melanoleuca/Leaf</i>	11.60	19.90	15.75
Co 99004	Hoshangabad	<i>E. melanoleuca/Leaf</i>	11.15	19.35	15.25
CoC 671	Hoshangabad	<i>E. melanoleuca/Leaf</i>	7.25	12.30	9.78
CoJN 86 141	Hoshangabad	<i>E. melanoleuca/Leaf</i>	6.75	11.10	8.93
CoJN 86 600	Hoshangabad	<i>E. melanoleuca/Leaf</i>	6.70	12.80	9.75
Average of Locality			8.69	15.09	11.89
Co 86032	Kareli	<i>E. melanoleuca/Leaf</i>	8.80	16.65	12.73
Co J 64	Kareli	<i>E. melanoleuca/Leaf</i>	7.80	15.00	11.40
Co Lk 8001	Kareli	<i>E. melanoleuca/Leaf</i>	6.75	11.10	8.93
Average of Locality			8.01	14.46	11.24
Co 238	Salichouka	<i>E. melanoleuca/Leaf</i>	7.80	16.65	12.23
Co 86032	Salichouka	<i>E. melanoleuca/Leaf</i>	9.35	17.80	13.58
Co 88-230	Salichouka	<i>E. melanoleuca/Leaf</i>	7.25	15.25	11.25
CoLk 8001	Salichouka	<i>E. melanoleuca/Leaf</i>	8.80	15.00	11.90
Average of Locality			8.30	16.18	12.24
Overall Average of <i>E. melanoleuca/Leaf</i>.....			8.20	16.02	12.11
Co 238	Bankhedi	ESB (%)	9.00	25.00	17.00
CoJ 64	Bankhedi	ESB (%)	9.00	22.20	15.60
CoLK 8001	Bankhedi	ESB (%)	11.40	25.00	18.20
CoM 265	Bankhedi	ESB (%)	13.40	22.40	17.90
Average of Locality			10.70	23.65	17.18
Co 86032	Hoshangabad	ESB (%)	11.20	31.40	21.30
Co 99004	Hoshangabad	ESB (%)	13.20	37.60	25.40
CoC 671	Hoshangabad	ESB (%)	15.60	24.40	20.00
CoJN 86 141	Hoshangabad	ESB (%)	6.60	13.40	10.00
CoJN 86 600	Hoshangabad	ESB (%)	7.00	26.40	16.70
Average of Locality			10.72	26.64	18.68

Variety	Location	Name of pest % incidence/Population	Min.	Max.	Average
Co 86032	Kareli	ESB (%)	5.00	24.60	14.80
Co J 64	Kareli	ESB (%)	7.00	37.80	22.40
Co Lk 8001	Kareli	ESB (%)	4.80	22.20	13.50
Average of Locality			5.60	28.20	16.90
Co 238	Salichouka	ESB (%)	9.60	27.40	18.50
Co 86032	Salichouka	ESB (%)	17.60	31.00	24.30
Co 88-230	Salichouka	ESB (%)	12.60	26.80	19.70
CoLk 8001	Salichouka	ESB (%)	11.20	26.40	18.80
Average of Locality			12.75	27.90	20.33
Overall Average of ESB (%).....			10.26	26.50	18.38
Co 238	Bankhedi	Pyrilla /Leaf	14.45	20.60	17.53
CoJ 64	Bankhedi	Pyrilla /Leaf	9.45	19.25	14.35
CoLK 8001	Bankhedi	Pyrilla /Leaf	11.05	19.65	15.35
CoM 265	Bankhedi	Pyrilla /Leaf	17.80	20.05	18.93
Average of Locality			13.19	19.89	16.54
Co 86032	Hoshangabad	Pyrilla /Leaf	11.25	19.35	15.30
Co 99004	Hoshangabad	Pyrilla /Leaf	8.90	17.75	13.33
CoC 671	Hoshangabad	Pyrilla /Leaf	6.15	16.65	11.40
CoJN 86 141	Hoshangabad	Pyrilla /Leaf	8.80	11.70	10.25
CoJN 86 600	Hoshangabad	Pyrilla /Leaf	7.25	18.80	13.03
Average of Locality			8.47	16.85	12.66
Co 86032	Kareli	Pyrilla /Leaf	12.30	27.50	19.90
Co J 64	Kareli	Pyrilla /Leaf	14.50	20.00	17.25
Co Lk 8001	Kareli	Pyrilla /Leaf	15.00	17.50	16.25
Average of Locality			13.93	21.67	17.80
Co 238	Salichouka	Pyrilla /Leaf	11.10	20.20	15.65
Co 86032	Salichouka	Pyrilla /Leaf	16.65	21.60	19.13
Co 88-230	Salichouka	Pyrilla /Leaf	17.80	22.80	20.30
CoLk 8001	Salichouka	Pyrilla /Leaf	11.75	17.80	14.78
Average of Locality			14.33	20.60	17.47
Overall Average of Pyrilla/Leaf.....			12.14	19.45	15.80
Co 238	Bankhedi	RB (%)	0.60	3.00	1.80
CoJ 64	Bankhedi	RB (%)	1.20	4.20	2.70
CoLK 8001	Bankhedi	RB (%)	2.40	3.80	3.10
CoM 265	Bankhedi	RB (%)	2.40	4.40	3.40
Average of Locality			1.65	3.85	2.75

Variety	Location	Name of pest % incidence/Population	Min.	Max.	Average
Co 86032	Hoshangabad	RB (%)	0.00	1.00	0.50
Co 99004	Hoshangabad	RB (%)	0.00	0.00	0.00
CoC 671	Hoshangabad	RB (%)	0.00	1.80	0.90
CoJN 86 141	Hoshangabad	RB (%)	0.00	0.00	0.00
CoJN 86 600	Hoshangabad	RB (%)	0.00	1.40	0.70
Average of Locality			0.00	0.84	0.42
Co 86032	Kareli	RB (%)	3.00	3.40	3.20
Co J 64	Kareli	RB (%)	4.00	4.40	4.20
Co Lk 8001	Kareli	RB (%)	2.40	4.80	3.60
Average of Locality			3.13	4.20	3.67
Co 238	Salichouka	RB (%)	1.80	6.40	4.10
Co 86032	Salichouka	RB (%)	3.20	6.80	5.00
Co 88-230	Salichouka	RB (%)	2.80	3.60	3.20
CoLk 8001	Salichouka	RB (%)	1.60	2.00	1.80
Average of Locality			2.35	4.70	3.53
Overall Average of RB (%).....			1.69	3.31	2.50
Co 238	Bankhedi	TSB (%)	0.80	4.80	2.80
CoJ 64	Bankhedi	TSB (%)	1.60	3.60	2.60
CoLK 8001	Bankhedi	TSB (%)	3.20	5.40	4.30
CoM 265	Bankhedi	TSB (%)	2.80	5.00	3.90
Average of Locality			2.10	4.70	3.40
Co 86032	Hoshangabad	TSB (%)	0.00	0.00	0.00
Co 99004	Hoshangabad	TSB (%)	0.00	0.80	0.40
CoC 671	Hoshangabad	TSB (%)	1.00	1.60	1.30
CoJN 86 141	Hoshangabad	TSB (%)	0.00	0.40	0.20
CoJN 86 600	Hoshangabad	TSB (%)	0.00	0.00	0.00
Average of Locality			0.20	0.56	0.38
Co 86032	Kareli	TSB (%)	1.80	4.40	3.10
Co J 64	Kareli	TSB (%)	3.00	8.00	5.50
Co Lk 8001	Kareli	TSB (%)	0.80	4.40	2.60
Average of Locality			1.87	5.60	3.73
Co 238	Salichouka	TSB (%)	3.60	9.00	6.30
Co 86032	Salichouka	TSB (%)	3.80	7.00	5.40
Co 88-230	Salichouka	TSB (%)	4.40	6.00	5.20
CoLk 8001	Salichouka	TSB (%)	2.40	5.60	4.00
Average of Locality			3.55	6.90	5.23
Overall Average of TSB (%).....			1.95	4.40	3.17

Variety	Location	Name of pest % incidence/Population	Min.	Max.	Average
Co 238	Bankhedi	Whitefly (per 2.5 sq.cm.)	0.00	0.60	0.30
CoJ 64	Bankhedi	Whitefly (per 2.5 sq.cm.)	0.15	0.80	0.48
CoLK 8001	Bankhedi	Whitefly (per 2.5 sq.cm.)	0.00	0.60	0.30
CoM 265	Bankhedi	Whitefly (per 2.5 sq.cm.)	0.60	2.70	1.65
Average of Locality			0.19	1.18	0.68
Co 86032	Hoshangabad	Whitefly (per 2.5 sq.cm.)	0.00	0.75	0.38
Co 99004	Hoshangabad	Whitefly (per 2.5 sq.cm.)	0.00	1.05	0.53
CoC 671	Hoshangabad	Whitefly (per 2.5 sq.cm.)	0.40	1.65	1.03
CoJN 86 141	Hoshangabad	Whitefly (per 2.5 sq.cm.)	0.00	0.25	0.13
CoJN 86 600	Hoshangabad	Whitefly (per 2.5 sq.cm.)	0.00	1.15	0.58
Average of Locality			0.08	0.97	0.53
Co 86032	Kareli	Whitefly (per 2.5 sq.cm.)	0.20	0.45	0.33
Co J 64	Kareli	Whitefly (per 2.5 sq.cm.)	0.65	7.50	4.08
Co Lk 8001	Kareli	Whitefly (per 2.5 sq.cm.)	1.75	6.15	3.95
Average of Locality			0.87	4.70	2.79
Co 238	Salichouka	Whitefly (per 2.5 sq.cm.)	0.60	1.15	0.88
Co 86032	Salichouka	Whitefly (per 2.5 sq.cm.)	0.30	0.90	0.60
Co 88-230	Salichouka	Whitefly (per 2.5 sq.cm.)	1.10	1.75	1.43
CoLk 8001	Salichouka	Whitefly (per 2.5 sq.cm.)	0.15	0.75	0.45
Average of Locality			0.54	1.14	0.84
Overall Average of Whitefly (per 2.5 sq.cm.).....			0.39	1.80	1.10

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