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Entomology

(All India Coordinated Research Project on Sugarcane)



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

In Advanced Varietal Trial (AVT):

In early maturing group 6 sugarcane genotypes viz., CoH10261, Co10035, CoS10231, CoLk11201, CoLk11202, CoLk11203 and CoJ64 as standard and in mid late maturing group 10 genotypes viz., Co10036, CoPant10221, CoH10262, CoPb10182, CoLk11204, CoPb10281, CoH11263, CoLk11206, CoPb11214 and CoPant97222 & CoS 767 as standard (Table 1) were planted in plots of 3.6 x 6m plot size in February, 2015 with 90 cm row to row distance and each treatment was replicated three times. CoJ 64 was taken as standard for early group and CoPant 97222 and CoS767 for mid late group. Recommended agronomic practices were followed to raise a good crop. No insecticide was applied at any stage of the crop.

In early group, incidence of top borer III and IV brood was ranged 2.27 to 14.87 and 6.25 to 53.32 per cent, respectively. Incidence and intensity of internode borer ranged 3.33 to 14.57 and 1.60 to 6.48 percent, respectively. Infestation index was higher (6.48%) in CoH10261. Incidence and intensity of stalk borer ranged 0.95 to 13.48 and 1.60 to 3.58 percent, respectively. Infestation index was >1 in all the genotypes (Table 2).

In early group only six genotypes (CoH10261, Co10035, CoS10231, CoLk11201, CoLk11202, CoLk11203) and one standard (CoJ64) were evaluated for their reaction to insect pests of sugarcane. Two genotypes viz., CoLk11202 and CoLk11203 showed MS reaction and rest of the genotypes showed LS (Less Susceptible) reaction to 3rd brood of top borer. CoS10231 showed LS reaction to 4th brood of top borer and rest of the genotypes showed HS reaction. CoH10261 and CoS10231 were HS and rest of the genotypes were MS to stalk borer. CoS10231 and CoLk11201 were LS and rest of the genotypes was MS to internode borer.

Corrected brix, sucrose percent and purity coefficient ranged 17.07 to 19.90, 14.66 to 16.33 and 82.68 to 87.02, respectively in the month of November. Corrected brix and Sucrose percent were less than standard in two genotypes (CoH10261 and CoLk11202). Cane yield ranged from 29.99 to 50.75 t/ha. (Table 4).

Ten mid late maturing sugarcane genotypes (Co10036, CoPant10221, CoH10262, CoPb10182, CoLk11204, CoPb10281, CoH11263, CoLk11206, CoPb11214, CoS11232) and two standards (CoS767 and CoPant9722) were evaluated for their reaction against insect pests of sugarcane.

In mid late group, incidence of top borer III and IV brood was ranged 3.16 to 16.43 and 6.21 to 43.93 per cent, respectively. Incidence and intensity of internode borer ranged 3.33 to 14.57 percent and 1.55 to 6.60, respectively. Incidence and intensity of stalk borer ranged 0.95 to 14.57 and 1.41 to 5.28 percent, respectively. Infestation index was >1 in all the genotypes (Table 5).

Only one genotype (CoLk11206) was MS (moderately susceptible) and rests of the genotypes were LS (less susceptible) to top borer (III brood). Against top borer (IV brood), CoH10262 and

CoS11232 were LS and MS, respectively and others were HS (highly susceptible). All genotypes were found LS to internode borer. Against stalk borer, CoPb10182 was MS. CoPant 10221, CoH10262, CoLk11206 and CoS11232 were HS and rests of the genotypes were LS.

Corrected brix, sucrose percent and purity coefficient ranged 17.81 to 20.81, 15.58 to 18.22 and 85.54 to 88.61, respectively in the month of February. Cane yield ranged from 33.33 to 54.17 t/ ha. (Table 7).

Incidence of *Pyrilla perpusilla* was very high in all the genotypes and was checked by *Epiricania melanoleuca* and lower surface of leaves was full of *Epiricania* cocoons in the month of September. Incidence of mealy bug was cent per cent in all genotypes. No incidence of white fly white grubs was noticed in any of the genotypes. Termite incidence was also negligible

Prasitisation of top borer larvae by *Rhaconotus* sp., *Stenobracon* spp. *Isotima javensis* was observed. Amongst predatory fauna, coccinellid beetles, spiders and green lace wing were prominent ones

Table-1: List of genotypes evaluated (AVT)

S.N.	Early maturing	S.N.	Mid late maturing
First Plant		First Plant	
1	CoH10261	1	Co10036
2	Co10035	2	CoPant10221
3	CoS10231	3	CoH10262
4	CoLk11201	4	CoPb10182
5	CoLk11202	5	CoLk11204
6	CoLk11203	6	CoPb10181
7	CoJ64	7	CoH11263
		8	CoLk11206
		9	CoPb11214
		10	CoPant 97222
		11	CoS767

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

S.N	Variety	Germination (%)	Incidence of top borer		Stalk borer			Internode Borer		
			III brood	IV brood	Incidence (%)	Intensity (%)	Infestation index	Incidence (%)	Intensity (%)	Infestation index
1	Co10035	16.85	4.67	22.50	4.20	1.98	0.08	10.80	3.96	0.42
2	CoH10261	24.44	5.27	37.25	8.80	3.24	0.28	14.82	6.48	0.96
3	CoS10231	22.77	8.03	8.37	5.65	3.58	0.19	7.68	3.58	0.24
5	CoLk11201	23.51	7.55	21.00	2.90	1.82	0.05	2.09	1.82	0.04
4	CoLk11202	18.14	13.29	21.06	3.26	1.73	0.06	10.61	5.19	0.54
6	CoLk11203	42.40	14.87	27.24	2.25	2.07	0.05	10.46	6.21	0.65
8	CoJ64	27.73	2.27	28.80	2.36	1.60	0.04	5.73	1.60	0.09

Table:3. Reaction of sugarcane genotypes (Early maturing) against top borer and internode borer (AVT)

Insect pests	Scale (% incidence)	Category	Genotype
Top borer III Brood	<10.0	LS	Co10035, CoH10261, CoS10231, CoLk11201, CoJ64
	10.1-20.0	MS	CoLk11202, CoLk11203
	>20.0	HS	-
Top borer IV Brood	<10.0	LS	-
	10.1-20.0	MS	CoH10231
	>20.0	HS	Co10035, CoH10261, CoLk11201, CoLk11202, CoLk11203 CoJ64
Internode borer	<20.0	LS	CoS10231, Co10035, CoS10261, CoLk11201, CoLk11202, CoLk11203 CoJ64
	20.1-40.0	MS	-
	>40.0	HS	-
Stalk borer	<2.0	LS	-
	2.1-5.0	MS	Co10035, CoLk11201, CoLk11202, CoLk11203 CoJ64
	>5.0	HS	CoH10261, CoS10231

Table-4: Quality parameters and cane yield in early maturing group

S.N	Variety	Quality parameters			Cane Yield (t/ha)
		Corrected Brix	Sucrose (%)	Purity Coefficient	
1	CoH10261	17.07	14.48	84.87	33.77
2	Co10035	18.34	15.21	82.68	34.67
3	CoS10231	19.90	17.42	86.02	32.96
4	CoLk11201	18.73	16.33	87.09	48.50
5	CoLk11202	17.44	14.66	84.14	47.36
6	CoLk11203	19.04	15.80	82.98	50.74
7	CoJ64	17.92	14.77	82.69	37.03

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

S.N	Variety	Germination (%)	Incidence of top borer		Stalk borer			Internode Borer		
			III brood	IV brood	Incidence (%)	Intensity (%)	Infestation index	Incidence (%)	Intensity (%)	Infestation index
1	Co10036	28.33	5.51	43.93	1.64	1.97	0.03	4.11	1.97	0.08
2	CoPant10221	24.49	3.16	43.22	6.39	1.74	0.11	6.5	3.48	0.23
3	CoH10262	27.59	7.31	6.21	13.48	5.28	0.71	14.57	3.52	0.51
4	CoPb10182	30.92	8.79	27.10	3.03	1.97	0.06	9.01	5.91	0.53
5	CoLk11204	34.25	5.14	32.48	1.58	1.65	0.03	8.35	6.60	0.55
6	CoPb10181	32.96	5.91	33.47	0.95	1.81	0.02	4.44	1.81	0.08
7	CoH11263	9.56	6.24	39.29	1.45	1.55	0.02	3.76	1.55	0.06
8	CoLk11206	49.25	16.63	35.14	8.34	3.68	0.31	12.42	7.36	0.91
9	CoPb11214	23.07	3.75	26.74	1.94	1.85	0.03	3.33	1.85	0.06
10	CoS11232	7.21	6.79	18.82	7.36	1.41	0.10	5.29	2.82	0.15
11	CoPant 97222	29.62	3.64	25.34	4.30	1.93	0.08	4.24	3.86	0.16
12	CoS767	29.25	6.71	33.82	4.03	2.26	0.09	7.15	4.52	0.32

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

Insect pests	Scale (%) incidence)	Catagory	Genotype
Top borer III Brood	<10.0%	LS	Co10036, CoPant10221, CoH10262, CoPb10182, CoLk11204, CoPb10281?, CoH11263, CoPb11214, CoS11232, CoPant 97222, CoS767
	10.1-20.0	MS	CoLk11206,
	>20.0	HS	-
Top borer IV Brood	<10.0%	LS	CoH10262
	10.1-20.0	MS	CoS11232
	>20.0	HS	Co10036, CoPant10221, CoPb10182, CoLk11204, CoLk11206, CoPb10281?, CoH11263, CoPb11214, CoPant 97222, CoS767
Internode borer	<20.0	LS	Co10036, CoPant10221, CoH10262, CoPb10182, CoLk11204, CoLk11206, CoPb10281?, CoH11263, CoPb11214, CoS11232, CoPant 97222, CoS767
	20.1-40.0	MS	-
	>40.0	HS	-
Stalk borer	<10.0%	LS	Co10036, CoPant10221, CoPb10182, CoLk11204, CoLk11206, CoPb10281?, CoH11263, CoPb11214, CoS11232, CoPant 97222, CoS767
	10.1-20.0	MS	CoH10262,
	>20.0	HS	-

Table-7: Quality parameters and cane yield in mid late group

S.N	Variety	Quality parameters			Cane Yield (t/ha)
		Corrected Brix	Sucrose (%)	Purity Coefficient	
1	Co10036	18.98	16.73	88.15	42.22
2	CoPant10221	20.34	17.88	87.89	35.55
3	CoH10262	20.68	18.22	88.09	45.55
4	CoPb10182	20.05	17.52	87.39	38.89
5	CoLk11204	20.81	18.01	86.56	47.22
6	CoPb10281?	20.60	18.13	88.01	35.00
7	CoH11263	20.79	17.92	86.16	54.17
8	CoLk11206	19.54	17.14	87.70	41.16
9	CoPb11214	20.13	17.48	86.85	37.78
10	CoS11232	18.88	15.58	85.54	33.33
11	CoPant 97222	17.81	15.82	88.61	42.22
12	CoS767	19.17	16.68	87.01	42.22

E. 28 : Survey and surveillance of sugarcane insect pests

Insect pest survey was conducted in command areas of different sugar mills in Uttar Pradesh and Bihar. In command area of New Swadeshi Sugar Mill, Narkatiaganj, West Chmparan, Bihar, the incidence of top borer high in Co0118. Incidence of white fly along with cane borers was also observed in one plot. Incidence of *Pyrilla perpusilla* was moderate to severe in most of the areas surveyed. A good number of Coccinellid predators were present in sugarcane. Lady bird beetles feed upon eggs of *Pyrilla* voraciously. Number of *Epiricania melanoleuca* (a potential adult and nymph parasitoid of *Pyrilla*) was scanty. In command area of Seksaria Sugar Mill, Biswan, Sitapur, the incidence of *Pyrilla perpusilla* was also severe. In command area of Gularia Sugar Mill, the incidence of white grub was observed in the fields having sandy soil. Incidence of borers was low.

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

Canes of CoLk 8102 were planted by cutter planter in February, 2015. Recommended agronomic practices were followed to raise a good crop. Periodic observations on incidence of insect pests and parasitoids of pests were recorded. Germination was 33.33 to 50.00 per cent. Incidence of termite was in traces. Incidence of top borer II, III and IV brood was 5.50, 23.85 and 44.44 percent, respectively. Incidence of root borer at shoot stage was 5.45 per cent and in the month of September incidence it was 45.27 per cent. Incidence of internode borer was 21.63 and the incidence of stalk borer was 7.96 per cent. The incidence of *Pyrilla perpusilla* was very high which was suppressed in the month of October by its parasite, *Epiricania melanoleuca*. Incidence of mealy bug was 100 percent. No incidence of white fly was seen. The population of black bug varied from 2-50/cane.

Parasitisation (in parentheses) by *Telenomus beneficiens* (44% on egg mass basis), *Stenobracon* sp. (1.5-4.0 per cent), *Rhaconotus* sp. (3.5-11per cent), *Isotima javensis* (3.4-4.0 per cent) was observed. The cocoons of *Epiricania melanoleuca* on per leaf basis, varied from 7-20 in the month of August and 20-80 in the month of October. Predatory fauna comprising of Coccinellids, spiders and ants were noticed in the field at different stages of the crop.

Table 1: Incidence of different insect pests of sugarcane

Top borer

Period of Observation	Incidence of top borer (%)	% parasitisation (Top borer)									
		<i>T. japonicum</i>	<i>T. chilonis</i>	<i>T. beneficiens</i>	<i>I. Javensis</i>	<i>Cotesia flavipes</i>	<i>Rhaconotus scirpophagae</i>	<i>Elasmus zehntneri</i>	<i>S. desae</i>	<i>B. bassiana</i>	
1	2	3	4	5	6	7	8	9	10	11	
II brood 08-05-15 (I Week)	5.50	-	-	44% on egg mass basis	0.0	-	11.0	-	0.0	-	
III brood 17-06-15 (IV Week)	23.85	-	-	-	3.5	-	3.5	-	4.0	-	
IV brood 24-09-2015 (IV Week)	44.44	-	-	-	4.0	-	0.0	-	1.5	-	

Internode and root borer

Period of Observation	Incidence of internode borer	% parasitisation				Period of Observation	Incidence of Root borer	% parasitisation		
		<i>T. chilonis</i>	<i>T. japonicum</i>	<i>Cotesia flavipes</i>	<i>B. bassiana</i>			<i>T. chilonis</i>	<i>Cotesia flavipes</i>	<i>B. bassiana</i>
1	2	3	4	5	6	1	2	3	4	5
26-08-15 (IV Week)	21.63	-	-	-	-	8-6-15 (II Week)	5.45	-	-	-
-	-	-	-	-	-	7-9-15 (I Week)	45.27	-	-	-

Stalk borer and Mealy bug

Period of Observation	Incidence of stalk borer	% parasitisation				Period of Observation	Incidence of Mealy bug	% parasitisation		
		<i>T. chilonis</i>	<i>T. japonicum</i>	<i>Cotesia flavipes</i>	<i>B. bassiana</i>			<i>T. chilonis</i>	<i>Cotesia flavipes</i>	<i>B. bassiana</i>
1	2	3	4	5	6	1	2	3	4	5
24-08-15 (IV Week)	7.96	-	-	-	-	09-10-15 (II Week)	100.0 on cane basis	-	-	-

Pyrilla perpusilla

Period of Observation	Incidence of <i>P. perpusilla</i>			% Parasitisation				
	No. of adults/leaf	No. Of nymphs/leaf	No. of egg mass/leaf	<i>Epiricania melanoleuca</i>			<i>Tetrastichus pyrrillae</i>	<i>Lestrodyrinus pyrrillae</i>
				Cocoon	Egg mass	Adults	% parasitisation On egg mass basis	% parasitisation On egg mass basis
1	2	3	4	5	6	7	8	9
22-07-2015 (IV Week)	1-3	10-20	1.3	traces	-	-	-	-
22-08-2015 (IV Week)	7-9	50-80	5.10	7-20	0-2	1	-	0-5
10-10-15 (II Week)	traces	5-7	-	20-80	3-5	2	-	-

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

Green lace wing, *Chrysoperla carnea* is a predatory insect as its grubs are voracious feeders and feed upon a number of soft bodied insects, eggs and newly emerged borer larvae. Laboratory rearing of this predatory insect was carried out.

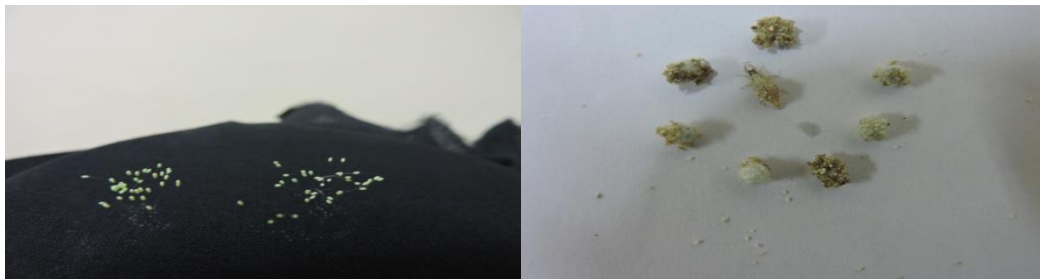
It is abundant in monsoon period therefore; nucleus culture (adults) of the insect was collected from sugarcane fields in the month of September. Collected male and female insects were allowed for mating in egg laying tray. Egg laying trays were wrapped with black paper on inner surface and covered with black cloth (Fig 1). Egg laying trays were supplied with promising protein rich diets combinations and single female laid 400 to 600 stalked eggs on black cloth (Fig 2). Eggs are greenish white in colour and appear contrast on black colour of the cloth (Fig 3). At black head stage, eggs were separated by cutting their stalks and transferred to glass vials containing freshly laid eggs of *Corcyra cephalonica* (rice moth) and kept at 27 °C in BOD incubator for the emergence of larvae (grubs). Newly hatched grubs fed on *C. cephalonica* eggs and larval (grub) stage lasts 14-19 days and adult insects emerged from the pupae in 3-4 days (Fig 4). Pupae are polygonal in shape (Fig 4). For the development of grubs, dried goat liver powder and yolk of hen egg based diets were accepted by the grubs and they completed their stage successfully and converted to pupae. For mass rearing of the insect plastic cages, glass jars and tissue culture plates with multi wells were also used. Egg, grub, pupal and adult period is 3-4, 14-19, 6-7 and 15-20 days, respectively when multiplied on artificial diets.

Rearing of *Chrysoperla carnea*



Fig 1: Egg laying Tray

Fig 2: Artificial diet for adult insects



E.36 (AICRP): Management of borer complex of sugarcane through lures

To evaluate the effect of sex pheromones on incidence of borer pests of sugarcane a field experiment was conducted in one acre of sugarcane field. Planting was done in the month of February, 2015. In half of the area, 6 sex pheromone traps at the distance of 20 meter apart were placed when the top borer moth was seen in the field. Moth catches were recorded daily. Trapped moths were removed from the trap after recording their number. No sex pheromones for other borers were available.

Six sex pheromone traps were installed in 0.5 acre sugarcane field and half of the acre field was kept without traps for comparison. Sex pheromone lures for top borer were procured from PCI, Bangalore (India). Moth catches were recorded daily. Water and mobile oil were changed daily when moth catches were recorded. Trapped moths were removed from the trap after recording their number. In second and third brood catches were observed while in fourth brood low catches were observed.

Total number of male moths of top borer (II brood) caught in traps was 337 (56.17 moths/trap), total catch of top borer moth (III brood) was 166 (27.67 moths /trap) and of IV brood was only 77 (12.83/trap).

Incidence of top borer (II brood) in plot with traps ranged from 3.45-5.62 % (average 4.77%) as against 4.39-8.89 % (average 6.74%) in without traps (Table 1). Incidence of top borer (III brood) in plots with traps and without traps were 5.20-16.30% (average 11.69 %) and 7.78-23.33 % (average 14.80 %), respectively. Incidence of IV brood was severe 28.62-48.57 % (average 38.13 %) incidence in plot without trap was 25.00-45.00% (average 32.89 %) (Table 2). No significant difference in top borer incidence was recorded in plots with and without sex pheromone traps.

Table 1. Number of moths trapped in the respective pheromone lures during 2014-15

No. of moths trapped		
Top borer		Stalk borer
II Brood (05-05-2015 to 28-05-2015)	III Brood (10-06-2015to 07-07-2015)	Nil
337 (56.17 moths/trap),	166 (27.67 moths /trap)	Nil

Table 2. Effect of pheromone lures on the incidence of top borer

Treatments	Brood-wise Incidence of top borer (%)	
	III	IV
With pheromone traps	5.20-16.30% (average 11.69 %)	28.62-48.57 % (average 38.13 %)
Without pheromone traps	7.78-23.33 % (average 14.80 %)	25.00-45.00% (average 32.89 %)

