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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 9 sugarcane genotypes (CoS10231, Co10035, CoH10261, CoPb09181, CoLk09202, CoS09246, CoH09262, CoH09263 and CoJ64. In mid late maturing group 12 genotypes (Co10036, CoPb10181, CoPb10182, CoPant 10221, CoH10262, Co09022, Colk09204, CoPb09214, CoS09232, CoH09264, CoPant97222 and CoS 767) (Table 1) were planted in plots of 3.6 x 6m plot size in March, 2013 with 90 cm row to row distance and three replications. 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 4.22 to 16.09 and 2.96 to 15.02 per cent, respectively. Incidence and intensity of internode borer ranged 18.67 to 40.00 and 1.28 to 2.99 percent, respectively. Infestation index was higher (1.06) in CoH10261. Incidence and intensity of stalk borer ranged 5.33 to 26.67 and 0.40 to 2.65 percent, respectively. Infestation index was >1 in all the genotypes (Table 2).

Five genotypes CoS10231, Co10035, CoPb09181, CoLk09202, CoS09246, showed LS reaction and two genotypes viz., CoH10261 and CoH09262 showed MS reaction and no genotype showed HS reaction to top borer (III Brood). Five genotypes CoS10231, Co10035, CoLk09202, CoS09246, CoH09262, showed LS reaction and two genotypes viz., CoPb09181, CoH10261 showed MS reaction and no genotype showed HS reaction to top borer (IV brood). In case of internode borer, one genotype, CoS09246 showed LS reaction and rest of genotypes showed MS reaction. All genotypes showed HS Reaction to stalk borer (Table 3).

Corrected brix, sucrose percent and purity coefficient ranged 17.60 to 20.62, 14.24 to 17.65 and 80.63 to 86.61, respectively in the month of November. Cane yield was higher in CoPb09181 (72.10 t/ha). Corrected brix was significantly higher in CoH09262, CoS09246, CoLk09202, Co10035 and CoS10231 and same trends were observed in sucrose and purity coefficient (Table 4).

In mid late group, incidence of top borer III and IV brood was ranged 2.81 to 8.95 and 1.15 to 9.38 per cent, respectively. Incidence and intensity of internode borer ranged 18.67 to 38.67 percent and 1.15 to 3.00, respectively. Infestation index was higher (1.12) in CoPb10181. Incidence and intensity of stalk borer ranged 6.67 to 21.33 and 0.41 to 2.02 percent, respectively. Infestation index was >1 in all the genotypes (Table 5).

In mid late group, all genotypes showed LS reaction to top borer (III & IV brood). In the case of internode borer, only one genotype, Co09022 was LS and rest of the genotypes were MS. All genotypes were HS to stalk borer (Table 6).

Corrected brix, sucrose percent and purity coefficient ranged 18.34 to 21.21, 14.66 to 18.83 and 80.25 to 89.24, respectively in the month of February. Cane yield was higher in CoPb10181, Co09022, CoS09232, CoH09264 and CoS767 (Table 7).

Incidence of *Pyrilla perpusilla* was very high in all the genotypes, it was checked by *Epiricania melanoleuca* and lower surface of leaves was full of Epiricania cocoons. 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

Table-1: List of genotypes evaluated (AVT)

S.N.	Early maturing	S.N.	Mid late maturing
First Plant		First Plant	
1	CoS 10231	1	Co10036
2	Co10035	2	CoPb10181
3	CoH10261	3	CoPb10182
	Second Plant	4	CoPant 10221
4	CoPb 09181	5	CoH10262
5	CoLk 09202		Second Plant
6	CoS 09246	6	Co 09022
7	CoH 09262	7	CoLk 09204
8	CoH 09263	8	CoPb 09214
9	CoJ64	9	CoS 09232
		10	CoH 09264
		11	CoPant 97222
		12	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	CoS 10231	27.59 (31.68)	8.58 (16.95)	7.28 (15.63)	5.33 (13.17)	0.40 (3.50)	0.02	20.00 (26.55)	1.28 (6.41)	0.26
2	Co10035	22.03 (27.92)	5.29 (13.12)	8.89 (17.30)	20.00 (26.55)	1.61 (7.26)	0.32	33.33 (35.26)	2.43 (8.95)	0.81
3	CoH10261	15.37 (23.07)	16.09 (23.56)	15.02 (22.65)	21.33 (27.49)	2.00 (7.85)	0.43	36.00 (36.85)	2.94 (9.83)	1.06
5	CoPb 09181	33.33 (35.18)	9.60 (17.83)	10.00 (18.43)	21.33 (27.36)	1.21 (6.22)	0.26	40.00 (39.23)	2.51 (9.09)	1.00
4	CoLk 09202	30.92 (33.75)	7.69 (15.98)	6.13 (14.22)	12.00 (20.09)	1.21 (6.22)	0.14	25.33 (30.22)	1.82 (7.67)	0.46
6	CoS 09246	10.74 (19.11)	4.99 (12.88)	6.21 (14.42)	26.67 (30.92)	2.65 (8.96)	0.71	18.67 (25.57)	1.37 (7.39)	0.25
8	CoH 09262	27.03 (31.30)	11.55 (19.61)	9.56 (17.98)	9.33 (17.71)	0.86 (5.22)	0.08	32.00 (34.42)	2.99 (9.94)	0.96
7	CoH 09263	18.52 (25.45)	4.22 (11.86)	2.96 (9.89)	14.67 (22.37)	0.98 (5.59)	0.14	29.33 (32.72)	2.11 (8.35)	0.62
9	CoJ64	26.67 (31.03)	5.33 (15.32)	7.57 (15.87)	17.33 (24.59)	1.30 (6.11)	0.22	24.00 (29.25)	1.68 (7.41)	0.40
CD at 5%		4.467	4.121	2.896	4.111	NS		3.958	1.838	

Figures in parentheses are Arc sin values

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	CoS10231, Co10035, CoPb09181, CoLk09202, CoS09246, CoH09263
	10.1-20.0	MS	CoH10261, CoH09262
	>20.0	HS	-
Top borer IV Brood	<10.0	LS	CoS10231, Co10035, CoLk09202, CoS09246, CoH09263, CoH09262
	10.1-20.0	MS	CoPb09181, CoH10261
	>20.0	HS	-
Internode borer	<20.0	LS	CoS09246
	20.1-40.0	MS	CoS10231, Co10035, CoLk09202, CoH09263, CoH09262, CoH10261, CoPb09181
	>40.0	HS	-
Stalk borer	<2.0	LS	-
	2.1-5.0	MS	-
	>5.0	HS	CoS10231, Co10035, CoPb09181, CoLk09202, CoS09246, CoH09263, CoH10261, CoH09262

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	CoS 10231	19.80	16.48	83.23	29.99
2	Co10035	19.82	16.76	84.59	46.81
3	CoH10261	17.60	14.24	80.87	37.03
4	CoPb 09181	17.79	14.36	80.63	72.10
5	CoLk 09202	19.18	16.73	83.73	64.46
6	CoS 09246	19.71	16.39	83.53	48.99
7	CoH 09262	20.62	17.65	85.57	42.96
8	CoH 09263	17.89	14.59	81.55	40.14
9	CoJ64	19.18	16.58	86.61	46.81
CD at 5%		1.212	1.227	2.664	9.989

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	22.40 (28.22)	7.00 (15.31)	4.67 (12.41)	8.00 (16.37)	0.59 (7.73)	0.05	22.67 (28.29)	1.79 (7.69)	0.40
2	CoPb10181	31.66 (34.24)	2.81 (9.64)	1.15 (6.16)	13.33 (21.40)	1.04 (5.24)	0.14	37.33 (37.64)	3.00 (9.95)	1.12
3	CoPb10182	29.81 (33.07)	8.78 (17.14)	7.51 (15.84)	16.00 (23.49)	1.16 (5.88)	0.18	25.33 (38.44)	2.51 (9.11)	0.63
4	CoPant 10221	31.85 (34.29)	2.96 (9.86)	2.22 (8.52)	20.00 (26.55)	2.02 (5.39)	0.40	22.67 (28.29)	1.72 (7.49)	0.39
5	CoH10262	29.63 (32.52)	5.74 (13.85)	2.67 (9.35)	21.33 (27.36)	1.94 (8.12)	0.41	21.33 (27.49)	1.33 (6.59)	0.28
6	Co 09022	22.78 (28.50)	4.62 (12.22)	2.95 (9.71)	21.33 (27.44)	1.21 (6.34)	0.26	18.67 (25.57)	1.15 (5.98)	0.21
7	CoLk 09204	24.23 (29.43)	8.48 (16.44)	9.38 (17.18)	13.33 (21.40)	1.08 (3.95)	0.14	26.67 (31.04)	1.76 (7.59)	0.47
8	CoPb 09214	33.70 (35.47)	5.63 (13.66)	5.79 (13.87)	6.67 (14.79)	0.50 (5.52)	0.03	24.00 (29.28)	2.14 (8.35)	0.51
9	CoS 09232	37.78 (34.91)	8.95 (17.27)	5.52 (13.53)	14.67 (22.51)	1.06 (3.43)	0.15	24.00 (29.28)	1.47 (6.89)	0.35
10	CoH 09264	34.63 (36.03)	6.45 (14.70)	7.52 (15.92)	9.33 (17.77)	1.32 (5.76)	0.12	38.67 (34.44)	2.53 (9.14)	0.98
11	CoPant 97222	21.85 (27.86)	3.89 (11.34)	6.56 (14.71)	8.00 (16.37)	0.57 (4.02)	0.04	28.00 (31.91)	2.38 (8.85)	0.67
12	CoS767	38.52 (38.35)	6.35 (14.58)	5.34 (13.34)	14.67 (22.51)	0.41 (3.43)	0.06	29.33 (32.78)	1.81 (7.70)	0.53
CD at 5%		3.740	2.946	2.832	4.393	NS		4.394	1.667	

Figures in parentheses are Arc sin values

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

Insect pests	Scale incidence (%)	Category	Genotype
Top borer III Brood	<10.0%	LS	Co10036, CoPb10181, CoPb10182, CoPant 10221, CoH10262, Co 09022, CoLk09204, CoPb 09214, CoS 09232, CoH 09264
	10.1-20.0	MS	-
	>20.0	HS	-
Top borer IV Brood	<10.0%	LS	Co10036, CoPb10181, CoPb10182, CoPant 10221, CoH10262, Co 09022, CoLk09204, CoPb 09214, CoS 09232, CoH 09264
	10.1-20.0	MS	-
	>20.0	HS	-
Internode borer	<20.0	LS	Co 09022
	20.1-40.0	MS	Co10036, CoPb10181, CoPb10182, CoPant10221, CoH10262, CoLk09204, CoPb 09214, CoS 09232, CoH 09264
	>40.0	HS	-
Stalk borer	<10.0%	LS	-
	10.1-20.0	MS	-
	>20.0	HS	Co10036, CoPb10181, CoPb10182, CoPant 10221, CoH10262, Co 09022, CoLk09204, CoPb 09214, CoS 09232, CoH 09264

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	20.94	16.69	89.24	47.77
2	CoPb10181	20.49	17.94	87.53	64.14
3	CoPb10182	19.62	17.26	87.93	82.96
4	CoPant 10221	18.89	17.35	87.15	65.92
5	CoH10262	20.01	17.57	87.74	60.73
6	Co 09022	21.21	18.79	88.58	79.59
7	CoLk 09204	19.25	16.77	86.98	75.37
8	CoPb 09214	18.85	16.01	84.79	70.07
9	CoS 09232	20.63	18.28	88.62	85.55
10	CoH 09264	19.98	16.68	86.85	86.14
11	CoPant 97222	18.34	14.66	80.25	60.44
12	CoS767	19.17	16.83	86.71	79.25
CD at 5%		1.655	2.189	3.867	12.141

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

Canes of CoLk 8102 were planted by cutter planter in March, 2014. 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 26.17 to 51.83 per cent. Incidence of termites on sett basis was 9.09 to 29.412112 per cent, on shoot basis it was 2.00 per cent while after cane formation damage of termites was limited to only dry leaves only. Incidence of top borer II, III and IV brood was 2.58, 21.62 and 31.89 percent, respectively. Incidence of root borer at shoot stage was 7.33 per cent and in the month of September incidence it was 41.87 per cent. Incidence of internode borer was 14.43 and the incidence of stalk borer was >5 per cent. The incidence of *Pyrilla perpusilla* was very high which was suppressed by its parasite, *Epiricania melanoleuca*. Incidence of mealy bug was 100 percent. White fly (1.7 puparia/clump), black bug (6/cane) were observed.

Parasites like *Telenomus beneficiens* (54% on egg mass basis), *Stenobracon* sp., *Rhaconotus* sp., *Isotima javensis*, *Epiricania melanoleuca* and 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 03-05-14 (I Week)	2.58,	-	-	54% on egg mass basis	4.0	-	12.0	-	4.0	-
III brood 27-07-13 (IV Week)	21.62	-	-	-	6.0	-	6.0	-	8.0	-
IV brood 24-09-2014 (IV Week)	31.89	-	-	-	4.0	-	8.0	-	4.0	-

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
28-08-14 (IV Week)	14.43	-	-	-	-	03-06-14 (I Week)	7.33	-	-	-
-	-	-	-	-	-	6-9-14 (I Week)	41.87	-	-	-

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
28-08-14 (IV Week)	>5.00	-	-	-	-	10-10-14 (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 pyrillae</i>	<i>Lestrodryinus pyrillae</i>
				Cocoon	Egg mass	Adults	% parasitisation On egg mass basis	% parasitisation On egg mass basis
1	2	3	4	5	6	7	8	9
28-08-2014 (IV Week)	2-7	2-10	0-1	1-2	-	-	-	-
04-09-2014 (I Week)	3-8	20-40	1-2	10-20	0-2	1	20.00 on egg mass basis	0-2
10-10-14 (II Week)	0-2	8-20	-	10-30	3-5	2	-	-

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 of CoLk 8102 sugarcane variety. 6 sex pheromone traps were installed at the distance of 20 meter apart and another one acre field was taken as check without traps. Pheromone traps were installed for the catch of male moths of top borer in last week of April, 2014 and moths of top borer (II brood) were caught in traps from 01-05-2014 and continued up 30-05-2014. Total number of male moths of top borer (II brood) caught in traps was 451 (75.16/trap). Lure Septa for top borer were changed brood wise. Against top borer (III brood), lure septa were placed on 15-06-2014 and total catch of top borer moth (III brood) was 532 (88.67 /trap). No catches were noticed in IV brood due to continuous rains. Lure septa of stalk borer were placed in the trap in first week of July, 2014. No catches of stalk borer were noticed. Incidence of top borer (II brood) in plot with traps ranged from 0-2.5% as against 0-3.66 % in without traps (Table-1). Incidence of top borer (III brood) in plots with traps and without traps were 11.76-35.00% and 13.75-36.00 %, respectively. Incidence of top borer (IV brood) in plots with traps and without traps were 18.95 to 28.42% and 22.05-33.33%, respectively (Table-2). No significant decrease in top borer incidence was recorded in plots with and without sex pheromone traps. No catches of top borer (IV brood) were observed due to continuous rains in rainy season.

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

No. of moths trapped		
Top borer		Stalk borer
II Brood (01-05-2014 to 25-05-2014)	III Brood (15-06-2014 to 13-06-2014)	Overlapping Broods (05.07.14)
451 (6 traps)	532 (Traps)	NIL(6 traps)

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

Treatments	Brood-wise Incidence of top borer (%)	
	III	IV
With pheromone traps	11.76 to 35.00	18.95 to 28.42
Without pheromone traps	13.75-36.00	22.05-33.33

E. 28 : Survey and surveillance of sugarcane insect pests

Insect pest survey was carried out in Chhattishgarh, Maharashtra, Bihar and Uttar Pradesh.

In Kawardha area (Chhattisgarh), sugarcane fields were severely attacked by *Pyrilla perpusilla*. On an average 10-20 adults and 50-100 nymphs/leaf were present on the lower surface of the leaves while upper surface of lower leaves in the affected clumps were covered with black sooty moulds (*Capnodium* sp.). Egg parasite, *Tetrastichus pyrillae* was present but *Epiricania melanoleuca* (nymph and adult parasite) and *Lestrodrynus pyrillae* (nymph parasitoid) were not present in the area.

Cocoons of *Epiricania melanoleuca* (about 400 cocoon and some egg masses) collected from IISR, Research Farm were released at S. K. College of Agriculture Research Station, Kawardha. Cocoons and egg masses were also released in two farmers sugarcane fields (Co 8036) belongs to Mr. Rajendra Kumar Sahu, Village Khadoda and Mr. Manik Ram, Village Raveli Gaon.

In Ahmednagar area of Maharashtra, incidence of scale insect was observed in some leading sugarcane varieties of the area.

Observations on incidence of insect pests in Seed plots under Bihar Seed Project maintained at IISR- RC, Motipur, Hasanpur and Harinagar Sugar Mills were recorded. Incidence of top borer was >5 per cent. Incidence of sugarcane weevil and grass hopper was noticed at Motipur and in Harinagar Sugar Mill area.

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

Nucleus culture (adults) of the insect was collected from sugarcane fields during post monsoon months. Collected male and female insects were released to glass jar. Females lay the eggs on glass surface. 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 for further embryonic development. 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. Adults were allowed to feed on 50 % honey solution on which adult could only survive not laid the eggs. Some protein rich diet combinations were tried to feed the adults to induce egg laying and some diet combinations induced egg laying and about one female laid 400 to 600 eggs. For the development of grubs, some animal protein based diets were tried and found that some diet combinations 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 used. Egg, grub, pupal and adult period is 3-4, 14-19, 6-7 and 15-20 days, respectively when multiplied on artificial diets.