ANNUAL REPORT SUGARCANE ENTOMOLOGY FOR 2011-12

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

Result achieved: Result achieved: A total of fifty six entries/genotypes were screened against major insect-pests of sugarcane that included entries in seven trials viz. Initial Varietal Trial (IVT Early, Plant I and II), Advanced Varietal Trial (AVT Early, Plant I and II, Initial Varietal Trial (IVT Mid-late), Advanced Varietal Trial (AVT Plant 1, Mid-late) and Advanced Varietal Trial (AVT Ratoon, Mid-late) against 2 standards for early and 3 for mid and late.

In AVT (Early- Plant I, Table 1), five entries were evaluated against two standards. Shoot borer infestation ranged form a minimum of 4.9 in CoH 07261 to a maximum of 12.9 percent recorded in standard CoP 84211. However, all the entries including the standards CoJ 64 and CoP 84211 were found least susceptible to shoot borer, *Chilo infuscatellus*. The standard CoP 84211 also contained the highest incidence of root borer and thrips, albeit their incidence remained quite low during 2011-12. Of all the three major borer species prevalent in the region, highest stalk borer damage was recorded in CoH 07261 followed by standard CoP 84211. The genotype Co 7023 contained the lowest stalk borer, *Chilo auricilius*

Table 1: Reaction of sugarcane genotypes in Advanced Varietal Trial (Early, Plant I) to major insect-pests

Sr. No.	Variety/ Genotype	Borers (per cent % infestation)				Sucking pests(number/inch^2)		
		Shoot Borer	Top Borer	Root Borer	Stalk borer*	Whitefly	Webbing mite	Thrips
1	Co 06032	5.8	8.7	0.7	3.1	2.1	0.7	1.3
2	Co7023	6.2	15.4	1.3	2.6	0	1.4	2.1
3	Co 7025	5.7	11.2	2.1	3.7	0	0.9	3.7
4	CoH 7261	4.9	16.1	1.7	6.1	1.2	0.6	1.3
5	CoLk 07201	11.7	13.3	2.4	3.9	2.4		1.4
	CoJ 64	7.6	15.2	0.6	3.2	1.7	0.4	0.7
	CoP84211	12.9	14.2	3.1	5.4	0.9	0	2.3

* Infestation index

incidence followed by Co 06032 and the standard CoJ 64. The genotype Co 06032 also showed lowest incidence (8.7 per cent) of the top borer, *Scirpophaga excerptalis*. The remaining genotypes including the standards were found moderately susceptible to this borer species. All the genotypes and standards showed negligible to low damage by sucking pests like white fly, webbing mite and thrips during 2011 monsoon and post monsoon.

Under the AVT (Mid Late) Plant I group (Table 2) nine entries were evaluated against the standards CoS 8436, CoS 767 and Co 1148. All the genotypes including the standard were found least susceptible to the shoot borer, its incidence ranging from 5.1 in genotype CoLk 07202 to 9.3 per cent in standard CoS 8436 and 0 in CoPb 07212 to 3.3 per cent in standard Co 1148, respectively. The top borer incidence, however, was moderate in the test entries. It remained less than 10 per cent in four entry namely, CoH 07264, CoPB 07213, CoLk 07202 and Co 07208 and two standards, Co 1148 and CoS 767, while in the remaining the incidence ranged from10.2

Table 2: Reaction of sugarcane genotypes in Advanced Varietal Trial (Mid Late, Plant I) to major insect-pests

Sr. No.	**Variety/ Genotype**	**Borers (per cent % infestation)**				**Sucking pests(number/inch^2)**		
		Shoot Borer	Top Borer	Root Borer	Stalk borer*	Whitefly	Webbing mite	Thrips
1	Co 07208	9.1	9.2	1.7	5.5	0.9	0.7	1.7
2	CoH 07263	7.2	10.2	0.9	4.1	0.6	0.5	2.1
3	CoH 07264	5.1	7.3	1.3	5.5	0.8	0.9	0.8
4	CoLk 07202	4.9	9.1	0.4	3.4	0.4	0.3	0.6
5	CoLk 07203	5.1	8.6	0.8	3.6	0.3	0.8	0.7
6	CoPb 07212	6.8	13.3	1.4	5.4	0.2	0.9	0.2
7	CoPb 07213	5.1	7.9	0	5.1	0	0.3	0.6
8	CoS 07232	8.3	12.4	1.3	2.5	0.7	0.7	1.6
9	CoS 07234	8.2	14.2	2.3	2.5	0.4	0.9	0
	CoS 8436	9.3	15.7	2.3	8.4	1.3	0.5	3.4
	Co1148	7.6	9.9	3.3	5.2	2.1	0.9.	1.4
	CoS 767	5.2	8.3	0.7	1.9	0	0.5	1.2

* Infestation index

(CoH 07263) to a highest of 15.7 recorded in standard CoS 8436. Likewise, two CoS entriesnamely CoS 07232 and CoS 07234 and the standard CoS 767 with a infestation index of 2.5 or less were observed least susceptible to the stalk borer in contrary to the highly susceptible CoS 8436. In the remaining entries the borer infestation was moderate. Low incidence of root borer sucking pest insects viz. whitefly, webbing mite and thrips was also observed invariably in the test entries as also the standards. The Standard, CoS 8436 contained the highest thrips population (3.4 per square inch of leaf area). Whitefly and webbing mite infestation remained negligible in both the entries and the standards.

Seven entries were evaluated in AVT (Mid late) Plant -II trial (Table 3). All the entries were LS to shoot borer and the root borer. Shoot borer incidence ranged from 5.2 (CoS 767) to 9.8 (Co 06266) while root borer damage ranged from negligible to low. The top borer incidence varied from 8.2 (Co 06033, CoS 06247) to 15.7 per cent (CoS 8436). Most of the genotypes were moderately susceptible to this borer species. The standard CoS 767 with 5.7 per cent incidence was minimally infested with the borer. Likewise, the genotypes CoPb 06219 and Co CoH 06265 were found least susceptible to the stalk borer followed by CoP 06224 and CoS 06247. These entries had much lower stalk borer infestation than the standards CoS 8436 and Co 1148 and genotype Co 06034. The incidence of whitefly, thrips and webbing mite was recorded very low in both the genotypes and the standards.

Table 3: Reaction of sugarcane genotypes in Advanced Varietal Trial (Mid Late, Plant II) to major insect-pests

Sr. No.	Variety/ Genotype	Borers (per cent % infestation)				Sucking pests(number/inch^2)		
		Shoot Borer	Top Borer	Root Borer	Stalk borer*	Whitefly	Webbing mite	Thrips
1	Co 06033	5.9	8.2	1.6	2.8	0.9	0.7	0.3
2	Co 06034	7.2	12.3	0.9	6.2	1.3	0.9	0.9
3	CoH 06265	5.6	11.4	0.3	1.2	0.7	1.3	1.1
4	CoH 06266	9.8	9.7	0.8	2.8	0.6	0.6	0.4
5	CoP 06224	7.1	11.3	1.6	2.4	0.3	0.9	0

6	CoPb 06219	6,9	9.6	1.2	1.2	1.7	0	0.6
7	CoS 06247	8.2	11.3	0	2.6	0.9	0	0
	CoS 8436	9.3	15.7	2.3	8.4	1.3	0.5	3.4
	Co1148	7.6	9.9	3.3	5.2	2.1	0.9.	1.4
	CoS 767	5.2	8.3	0.7	1.9	0	0.5	1.2

* Infestation index

Table 4: Reaction of sugarcane genotypes in Advanced Varietal Trial (Mid Late, Ratoon) to major insect-pests

Sr. No.	Variety/ Genotype	Borers (per cent % infestation)				Sucking pests(number/inch^2)		
		Shoot Borer	Top Borer	Root Borer	Stalk borer*	Whitefly	Webbing mite	Thrips
1	Co 06033	9.4	12.4	1.6	2.8	0.8	0.3	1.3
2	Co 06034	7.2	13.2	0.9	4.2	1.0	0.7	0.9
3	CoH 06265	6.9	18.4	1.3	1.7	1.6	0.5	1.3
4	CoH 06266	13.1	11.2	1.2	4.3	0	0.2	0.6
5	CoP 06224	8.3	15.3	0.6	2.6	0.6	0.5	0.9
6	CoPb 06219	10,7	14.5	0.8	0.8	0.4	0.6	0.5
7	CoS 06247	5.8	10.2	0.6	2.8	0.7	0.3	0.8
	CoS 8436	10.2	16.3	3.1	7.3	0.9	0.2	2.1
	Co1148	8.2	9.4	1.2	4.1	1.4	0.6	1.2
	CoS 767	4.7	7.5	1.4	1.2	0.7	0.3	0.9

* Infestation index

The ratoon crop of seven entries comprising AVT mid-late was evaluated for damages by pest insects (Table 4). All the entries including the standards were LS to shoot borer and the root borer. Shoot borer incidence ranged from 5.2 (CoS 767) to 13.1 (CoH 06224) while root borer damage remained quite low. All the AVT genotypes were moderately to highly susceptible to the top borer. The top borer incidence in these varied from 10.2 to 18.4 per cent. The genotype CoH 06265 was the highly susceptible followed by genotypes CoP 06224 (15.3), CoPb 06219 (14.5) and Co 06034 (13.2). The standard CoS 8436 contained the highest top borer incidence. The incidence of the borer in other two standards Co 1148 and CoS 767 was however, less than 10 per cent. Surprisingly, the ratoon crop of mid late AVT entries including the standard CoS 767

showed low to moderate susceptibility to the stalk borer inspite of availability of congenial conditions (favourable weather) for its build up. The stalk borer infestation index in these entries varied from 1.7 in CoH 06265 to 4.2 in Co 06034 as against 7.3 recorded in standard CoS 8436. The whitefly, thrips and webbing mite infestation in the entries as also the standards remained negligible.

In IVT Early, plant I trial (Table 5), eight entries were evaluated against two standards. The shoot borer incidence ranged from 4.1 (CoPb 08213) to 12.6 (CoP 84211) per cent indicating low susceptibility of the all the genotypes to this borer species. The root borer incidence was also quite low reaching a maximum of 2.1 per cent in CoPb 08212. However, all the entries save for genotype CoS 08233 (9.3 per cent) recorded moderate to high incidence of top borer. It ranged from 11.5 in CoPb 08213 to 18.1 percent in CoP 84211. All the entries, with their infestation index varying between 1.3 (CoPb 08212) to 3.9 (CoS 08231) were found to be low to moderately susceptible to the stalk borer as against the highly susceptible standard, CoP 84211. The webbing mite, whitefly and thrip incidences were negligible in most of the entries and standards.

Table 5: Reaction of sugarcane genotypes in Initial Varietal Trial (Early, Plant I) to major insect-pests

Sr. No.	Variety/ Genotype	Borers (per cent % infestation)				Sucking pests(number/inch ^{2})		
		Shoot Borer	Top Borer	Root Borer	Stalk borer*	Whitefly	Webbing mite	Thrips
1	CoP 08221	9.3	16.9	1.5	2.8	0.7	0.0	0.7
2	CoP 08222	6.7	14.8	0.5	2.1	0.8	0.0	0.4
3	CoPb 08211	6.2	12.7	0.8	1.8	1.2	0.0	0.9
4	CoPb 08212	4.5	15.4	2.1	1.3	1.3	0.0	0.2
5	CoPb 08213	4.1	11.5	0.9	2.2	2.0	0.0	0
6	CoS 08231	7.2	16.2	0.2	3.9	0.6	0.0	0
7	CoS 08232	8.3	12.4	0.5	3.2	1.2	0.0	0
8	CoS 08233	5.3	9.3	0.7	2.7	0.9	0.4	1.1
	CoJ 64	6.3	14.3	1.3	4.8	0.7	0.0	0
	C0P 84211	12.6	18.1	0.3	6.4	0.6	0.0	0

* Infestation index

In IVT Early, plant II trial (Table 6), nine entries were evaluated against two standards. The shoot borer incidence ranged from 3.4 (Co 07025) to 8.3 (CoP 84211) per cent indicating low susceptibility of the all the genotypes to this borer species. The root borer incidence was also quite low reaching a maximum of 1.2 percent in Co 07026. However, all the entries save for CoPant 07221(6.7 per cent) and Co 07025 (7.4 per cent) recorded moderate to high incidence of top borer. It ranged from 11.3 in Co 07023 to 18.2 percent in Co 07024. The entry Co 07024 recorded lowest stalk borer infestation. The remaining entries, with their infestation index varying between 2.6 (Co 07023, Co 07025) to 7.1 (CoH 07261) were found to be moderate to highly susceptible to the stalk borer as against the highly susceptible standard, CoP 84211. The webbing mite, whitefly and thrips incidences were almost negligible.

Table 6: Reaction of sugarcane genotypes in Initial Varietal Trial (Early, Plant II) to major insect-pests

Sr. No.	Variety/ Genotype	Borers (per cent % infestation)				Sucking pests(number/inch ^{2})		
		Shoot Borer	Top Borer	Root Borer	Stalk borer*	Whitefly	Webbing mite	Thrips
1	Co 07023	6.2	11.3	0.8	2.6	0.6	0.0	1.3
2	Co 07024	5.4	18.2	0.4	2.1	0.0	0.0	0.8
3	Co 07025	3.4	7.4	0.7	2.6	0.8	0.0	1.8
4	Co 07026	5.5	14.3	1.2	3.9	0.3	0.0	0.6
5	CoLk 07201	7.2	12.1	0.8	5.2	0.0	0.0	0.0
6	CoPb 07211	6.1	17.2	0.6	2.8	0.0	0.0	0.6
7	CoPant 07221	4.5	6.7	0.0	3.7	0.4	0.0	0.4
8	CoH 153 (07261)	4.2	16.3	0.7	7.1	0.0	0	1.6
9	CoH 154 (07262)	4.1	12.8	0.3	4.2	0.0	0.6	2.1
	CoJ 64	3.8	16.8	0.2	3.7	0.0	0.0	0.9
	C0P 84211	8.3	13.3	0.4	7.9	0.0	0.0	0.4

- Infestation index

In the IVT Mid- Late trial (Table 7) eleven entries were evaluated against standards CoS 8436, Co 1148 and CoS 767. All the genotypes showed low susceptibility to shoot borer as well as root borer. The shoot borer incidence varied between 3.4 and 8.1 per cent during first fortnight of June (peak activity period). The genotype COLk 08201 contained the lowest incidence while, the genotype CoH 08261 possessed the highest incidence. The standard CoS 8436 was more susceptible to shoot borer than the entries. The entries showed low to moderate incidence to the top and the stalk borer while the incidence of root borer in these entries was quite low. The incidence of top borer in the genotypes including the standards varied from 6.2 per cent (CoPb 08216) to 15.7 (CoS 8436). Most of the genotypes were categorized as moderately susceptible to top borer. All the test entries with infestation index ranging between 1.9 (CoH 08261, CoS 767) to

Table 7: Reaction of sugarcane genotypes in Initial Varietal Trial (Mid Late, Plant I) to major insect-pests

Sr. No.	Variety/ Genotype	Borers (per cent % infestation)				Sucking pests(number/inch ^{2})		
		Shoot Borer	Top Borer	Root Borer	Stalk borer*	Whitefly	Webbing mite	Thrips
1	CoH 08261	8.1	11.3	0.3	1.9	0.6	0.7	0.6
2	CoH 08262	4.2	8.4	0.9	2.1	0.8	0.3	0.2
3	CoH 08263	5.8	12.8	0.6	3.2	0.4	0.4	0.9
4	CoH 08264	7.2	14.2	0.3	2.9	0.5	0.4	0.6
5	CoLk 08201	3.4	9.3	0.2	2.1	0.4	0.5	0.7
6	CoPb 08214	5.7	11.7	0.5	1.9	0.3	0.6	0.9
7	CoPb 08215	6.5	10.3	0.6	2.7	0.7	0.6	0.2
8	CoPb 08216	7.3	6.2	1.1	3.2	0.6	0.3	0.4
9	CoPb 08217	6.5	7.4	0.9	2,3	0.3	0.9	0.7
10	CoS 08234	7.2	9.8	0.3	4.1	0.4	0.4	0.7
11	CoS 08235	6.2	7.9	0.4	3.1	0,3	00	0.9
	CoS 8436	9.3	15.7	2.3	8.4	1.3	0.5	3.4
	Co1148	7.6	9.9	3.3	5.2	2.1	0.9.	1.4
	CoS 767	5.2	8.3	0.7	1.9	0	0.5	1.2

* Infestation index

4.1 (CoS 08234) were low to moderately susceptible to stalk borer except for two standards Co 1148 and CoS 8436 which were found highly susceptible. The standard CoS

8436 contained the highest infestation of stalk borer (8.1 infestation index). Whitefly, thrips and webbing mite incidence was found negligible in the test genotypes.

Project No. E.27: Standardization of simple and cost effective methods for mass multiplication of potential bio-agents of sugarcane insect pests.

Results achieved: For mass multiplication of green muscardine fungus, *Metarhizium anisoplie,* sugar industry wastes/byproducts namely molasses, bagasse, pressmud and cane trash alone as well as amended individually with aqueous molasses and yeast (as exogenous sources of carbon and nitrogen, respectively) in different combinations and concentrations were tested as media. Supplementing the nutrients by addition of molasses and yeast in various proportions led to the evidently variable time to sporulate, and conidial size and yields, Of molasses, bagasse, press mud and cane trash media, the fungus sporulated profusely on press mud amended with 3 per cent molasses and 1.5 per cent yeast. A highest conidial yield ($6.98x10^9$) was achieved when the fungus was cultivated on this media whilst, the coarsely powdered press mud alone on its moistening with distilled water was shown to support inadequate fungal growth. Of all the substrates investigated, the lowest number of conidia were produced when the fungus was allowed to grow on medium containing finely chopped and moistened cane trash alone. The spores harvested from this medium were also distinctly smaller in size. Contrarily, largest sized conidia were noticed when the fungus was allowed to grow and sporulate on 4 per cent aqueous molasses amended with 1.5 per cent baker's yeast.

The pattern of fungus growth on the surface of various media seemed to vary according to conidiation. The surface area of medium occupied by the fungal colonies decreased with decrease in conidiation e.g. *M. anisolie* covered the maximum surface (more than 75 per cent) of press mud medium containing 3 per cent molasses and 1.5 per cent yeast that produced maximum conidia, while on cane trash alone from which lowest conidial load was harvested, the surface area covered by the fungus was also the minimum (10-15 per cent).

The time taken by the fungus to complete sporulation also varied widely among the variously amended solid and liquid media. On bagasse medium to which 2 per cent

aq. molasses and 1.5 per cent yeast was added, the fungus took least time (7 days) to grow and sporulate completely while on cane trash alone it was recorded to be 19 days, the longest among all the media.

Simultaneously, the Mass multiplication of *Trichogramma spp.* namely *T. chilonis* and *T. japonicum* was carried out in laboratory on coarsely milled maize grain amended with yeast, the media standardized previously. On using this modified diet the biocontrol laboratory at RRS, Uchani, produced and supplied to farmers 3116 Tricho cards for use against sugarcane stalk borer, *Chilo auricilius* and 1968 cards for the top borer, *Scirpophaga excerptalis* management. Egg and nymphal adult parasitoids of Pyrilla were also supplied to farmers for use in more than 1960 acre of sugarcane and sorghum fields.

Project No. E. 28: Survey and surveillance of sugarcane insect pests

Results achieved: Cooperative sugar mills zones, Shahbad, Kaithal, Palwal, Panipat, Gohana, Jind, Rohtak and Karnal were surveyed for insect pests of sugarcane crop at formative phase of crop growth as also at grand growth and maturity stage. During formative phase, the shoot borer and black bug incidences were low to moderate in ratoon crop of prevalent varieties of all zones. A few sugarcane fields in Cooperative Sugar Mills Zones Shahbad, Kaithal, Rohtak and Gohana showed moderate incidence of shoot borer (17.7-25.4 per cent) and moderate to high incidence of black bug (37-56 nymphs and adults/plant particularly in varieties CoH 119 and CoS 8436 while in most others the damages by these pests remained below economic injury level as the frequent pre-monsoon showers kept the population densities of these pests at low (Table 8). In Palwal, Jind and Gohana mill zones, the incidence of top borer was generally recorded low to medium in CoH 152, CoS 767, CoH 119 and CoJ 64 during pre-monsoon and monsoon period. During monsoon and post monsoon period moderate incidence of Pyrilla was observed on varieties CoH 119, Co 0238, CoJ 85 in sugar mills zone of Kaithal and Asandh while, white fly incidence was sporadically low this year in almost all the mill zones of Haryana. Thrips infestation, however, was observed in Co 7717 CoH 119, Co 89003, CoJ 64, CoS 8436 during July in mill zones of Karnal, Kaithal, Panipat,

Gohana. Severe webbing mite infestation was observed on a unidentified variety brought in Kaithal mill zone from UP and moderate infestation in CoH 119, CoS 8436. High stalk borer and low to moderate white grub incidence in variety CoJ 85 was observed in Karnal, Panipat and Palwal sugar Mills zones, while grasshopper, Pyrilla, white fly and termites were recorded sporadically during post monsoon. Post monsoon black bug occurrence was also recorded in variety CoH 119, CoS 8436 and CoJ 85 in mill zones of Panipat, Karnal, Kaithal and Gohana. In Panipat and Karnal mill zones, the variety Co 89003 was observed to be low to moderately infested by the root borer and webbing mite. In Maham mill zone, a few fields of variey CoH 119 were observed to be highly infested with black bug. High incidence of top borer was also seen in some fields planted with Co 0238 and Co o118 in Karnal, Kaithal and Panipat mill areas.

Table 8: Incidence of sugarcane insect pests in mill zones of Haryana during 2011

Sugar Mills Zone	Variety	Crop	Insect-pest	Incidence (%)
Rohtak	CoH 119	Ratoon	Black bug, shoot borer, webbing mite ,Pyrilla, Stalk borer	Moderate
	CoH 119	Plant	Pyrilla, whitefly, stalk borer	Low to moderate
	CoS 8436	Ratoon	Black bug, stalk borer, thrips	Moderate to high
	CoH 110	Plant	Whitefly, thrips	Low to Moderate
	Co 238	Plant	Top borer	severe
Panipat	CoH 119	Plant	Shoot & root borer	Low to moderate
		Ratoon	Shoot borer and black bug, white grub	Low to moderate
	Co 89003	Plant	White fly, thrips	Low to high
			Root borer	moderate
			Grass hopper	Low
			Top borer	Low
			Pyrilla	Sporadic
	Co89003	Ratoon	Top borer	moderate
			Webbing mite	Very Low
			Root borer	moderate
			Black bug	Low

			Pyrilla	Low to moderate
	CoH 119	Ratoon	Grass hopper	Low to medium
			Top borer	Low to medium
			White fly	Very low
			Root borer	low
Maham	CoJ 64	Ratoon	Top borer	Low to medium
			Pyrilla	low
			Black bug	Low to moderate
	CoH 119	Plant	Webbing mite, thrips	Low to moderate
			Top borer	Low to medium
			Root borer	low
	Co H 119	Ratoon	Black bug, webbing mite, thrips	Low to high
			Pyrilla	Low to medium
			Root borer	Low
			Top borer	Low
			White fly	Very Low
lwal	CoJ 64	Plant	White fly, thrips	low
			Root borer	Low to medium
			Top borer	moderate
	CoS 767	Plant	Shoot borer, termite	Low to medium
		Ratoon	Root borer	Low to medium
			Stalk borer	medium
	CoJ 85	Plant	White grub	Low
			Top borer	Low to medium
			Root borer	medium
			Stalk borer	high
		Ratoon	White grub	Low to moderate
			Top borer	moderate
			Black bug	Low to medium
			Shoot borer	medium to high
			Root borer	medium
	CoH 119	Plant	Top borer	Medium to high
			Root borer	Low to medium
			Stalk borer	Medium to high
		Ratoon	Black bug	Medium to high
			Root borer	Low to medium
			Top borer	moderate
			grasshopper	Low to medium
Karnal	Co89003	Plant	Top & root borers	Low to medium

			White grub	Low
			Pyrilla	Low to medium
			Stalk borer	Medium
		Ratoon	Root borer, Pyrilla	moderate
			Shoot & top borer	Low to medium
			Grasshopper	sporadic
			White grub	Low to medium
	CoH 119	Plant	Top borer	Medium to high
			Stalk borer	Medium to high
		Ratoon	Shoot borer	Low to medium
Shahbad	CoS 8436	Ratoon	Black bug, shoot borer, top borer	moderate
	CoS 8436	Plant	Top borer, stalk borer	Moderate
	CoJ 85	Plant	Top borer	moderate
	CoJ 85	Ratoon	Black bug	Low to medium
	CoH 119	Plant	Top borer, stalk borer	moderate
	CoH 119	Ratoon	Black bug	Moderate to high
	Co 238	Plant	Top borer	high
	Co 238	Ratoon	Top borer, black bug	Moderate to high
	Co 118	Plant	Shoot borer, top borer, root borer	Low to moderate
	Co 118	Ratoon	Black bug, root borer	Low to moderate
	CoJ 64	Ratoon	Black bug	Moderate
			Shoot borer	Medium to high
			grasshopper	Sporadic
			Top borer	Moderate

Project No. E.30: Monitoring of insect pests and bioagents in sugarcane agro-ecosystem

Results achieved: During the initial stage of crop establishment (formative phase), shoot borer, *Chilo infuscatellus* and the top borer, *Scirpophaga excerptalis* were the main pest in spring (February) planted sugarcane variety CoH 119 during pre-monsoon period (Table 9). The damage occurrence of shoot borer was started in first fortnight of April, its incidence being relatively low in end April (3.1 per cent). During first fortnight of May, shoot borer incidence increased to a maximum of 4.7 per cent. The incidence of this borer

species was noticed to decline subsequently and was not recorded during June. Top borer infestation was observed to begin in mid April with an infestation level reaching 2.3 per cent in April. The infestation was shown to rise with the build up of second brood raising the population density to 8.3 per cent in end June. It increased rapidly and was doubled (17.9 per cent) by end August (third brood) and to 22.3 per cent in last week of September (fourth brood). The infestation of this borer species in variety CoH 119 was at its peak in November when the pest reached the fifth brood and the cumulative incidence to 28.6 per cent. Moths of third brood started emerging from second week of August and of 4th brood from last week of September The black bug, *Cavelerius sweeti* infestation in the crop was first recorded in May. It increased during June when the crop were found to inhabit a mean of 12.3 nymphs and adults/ shoot. The number was lowered to a mean of 9.4/ shoot in the month of September. It declined further in the subsequent months, but the pest infestation persisted in the crop till harvest.

Leaf hopper, *Pyrilla perpusilla* was noticed to begin in June because of intermittent rains during May-June and remained in the crop till November. It was naturally controlled by the egg and nymphal- adult parasitoids. Whitefly appeared quite late (mid September) and in low proportion in this variety during 2011. Similarly, webbing mite also appeared quite late during end September with moderate incidence (3.4 webbings/inch^2). It increased slowly to a mean webbing number of 4.1/ inch^2 by October end and subsequently declined rapidly to 0.4 webbings/inch^2 by end November. While the root borer, *Polyocha depressella* incidence remained quite low in the crop, the stalk borer, *Chilo auricilius* was moderately high reaching to about 50 per cent at harvest. The intensity of this borer at harvest was measured 28.3 percent. Minor infestation by grasshoppers and thrips was also observed on this variety. The year 2011 was characterized by good pre-monsoon spanning over mid April –May which was followed by a moderately good monsoon starting from mid July which added to luxuriant crop growth. The winter was very severe and foggy and culminated in to frosty in early February.

In pre-monsoon (May and June) period of 2011, spiders, beetles and earwigs were the main natural enemies recorded in the experimental field. The population of spiders and coccinellids during 2011 was observed to be higher (1-6/ plant) than that recorded in 2010 (1-3/ plant). The earwigs were observed feeding on eggs and young nymphs of black bug during May-June. During formative phase of crop growth, the population densities of spiders and beetles remained low. However, a gradual increment in their number was witnessed from May onwards and peaked during maturity phase (October-November). The lacewing, *Chrysoperla carnea* activity was also moderate (2-3 larvae per whitefly infested leaf) because of adequate monsoon during 2011. A strong natural parasitism of eggs, nymphs and adults of *Pyrilla perpusilla* July through September and October 2011 in varieties CoJ 85, CoH 119 and Co238 was observed that helped contain its population in the region. Parasitism of Pyrilla was noticeable even during pre-monsoon period of 2011 because of good pre-monsoon intermittent rains during May and June. The parasitism build up was first observed during first fortnight of June when the leaf hopper infested field of variety CoH 119 recorded 2.3 per cent parasitism by *Epiricania melanoleuca.* A rapid increase in *Pyrilla* parasitism was subsequently recorded during July-August followed by a consistent increase ranging between 76.5 to 87.5 per cent during September (Table 10). A maximum of total parasitism measuring above 87.0 percent by both egg and nymphal adult parasitoids was recorded during second fortnight of September while during 2010 this peak was attained during first week of October. *Cheiloneurus pyrillae* was the dominant egg parasitoid during monsoon and post monsoon period, attaining a peak parasitic activity to the tune of 44.2 percent in the first week of September. The parasitism of Pyrilla eggs by *Tetrastichus pyrillae* varied from negligible to a maximum of 14.7 percent in the first week of August. Thereafter, consistent and gradual decline in parasitic activity of *T. pyrillae* was observed in the month of September, while it remained obscure during October. A comparison of activity periods of the two egg parasitoids indicated that *Tetrastichus pyrillae* was more abundant during August while, *C. pyrillae* had its peak activity period during September. The nymphal adult parasitoid, *E. melanoleuca* remained active from mid July to mid

Table 9. Incidence of pest insects during 2011-12 in variety CoH 119 at RRS, Uchani

Period of	Mean % incidence				Mean number/ plant			Mean number/ sq. inch	
Observation	Shoot borer	Top borer	Root borer	Stalk borer	Black bug	Thrips	Pyrilla	Whitefly	Webbing mite
April	3.1	2.3	-	-	-	-	-	-	-
May	4.7	5.2	0.3	-	7.2	0.7	-	-	-
June	0.0	8.3	0.5	-	12.3	7.6	2.3	-	-
July	-	12.2	0.1	3.5-	9.4	4.3	5.7	-	-
August	-	17.9	0.7	15.7	5.3	-	8.3	-	-
September	-	22.3	1.2	23.1	9.4	-	7.7	1.6	3.4
October	-	25.8	1.1	45.3	4.7	-	5.8	0.2	4.1
November	-	28.6	1.6	48.3	5.3	-	2.4	-	0.4
December	-	-	1.2	49.9	3.9	-	-	-	-
January	-	-	1.7	44.2	4.9	-	-	-	-
February	-	-	0.9	49.3	1.7	-	-	-	-

November, with a maximum parasitism of 54.8 percent recorded during first week of October.

Table 10: Natural enemy complex of *Pyrilla* at RRS Uchani during 2011

Period of observation	*Cheiloneurus pyrillae*	*Tetrastichus pyrillae*	*Epiricania melanoleuca*	Total parasitism
16-31 May, 2010	0	0	0	0
1-15 June	0	0	2.3	2.3
16-30 June	0	0	4.8	4.8
1-15 July	0	4.3	8.3	12.6
16-31 July	1.6	9.6	15.3	26.5
1-7 August	5.2	14.7	16.1	36.0
8-15August	11.6	10.2	16.9	38.7
16-23 August	21.2	12.6	18.3	52.1
24- 31August	35.1	8.6	22.6	66.3
1-7 September	41.5	6.4	28.6	76.5
8-15 September	44.2	3.3	34.7	83.2
16-23 September	40.5	2.3	38.9	81.7
24-30 September	33.2	2.6	51.7	87.5
1-7 October	30.2	2.3	54.8	87.3
8-15 October	17.3	0.6	53.3	71.8
16-23 October	21.1	0.3	42.6	64.0
24-31 October	15.2	-	39.4	54.6
1-15 November	3.2	-	9.3	12.5
16-30 November	-	-	3.1	3.1

White muscardine fungus *Beauveria bassiana* infected 7.3 per cent of stalk borer, 7.4 per cent of top borer and 8.9 per cent of root borer larvae (Table 11). The natural parasitism by tachinid fly *Sturmiopsis inferens* in stalk borer larvae during January was found to 9.7 percent while *Cotesia flavipes* was parasitic to 5.7 percent of stalk borer and 4.7 per cent of top borer larvae, respectively. A natural parasitism by *Isotima javensis* of top borer larvae during October was 8.2 per cent.

Table 11: Natural enemy complex of important insect-pests of sugarcane at CCS HAU RRS, Uchani, Karnal

Pest	Stage	Natural enemies	Parasitism (%)
Stalk borer, *Chilo auricilius*	Larva	*Sturmiopsis inferens*	9.7
		Cotesia flavipes	5.7
		Beauveria bassiana	7.3
		Nosema sp.	3.1
Top borer, *Scirpophaga excerptalis*	Larva	*Isotima javensis*	8.2
		Cotesia flavipes	4.7
		Beauveria bassiana	7.4
Root borer, *Polychola* (*Emmalocera*) *depressella*	Larva	*Beauveria bassiana*	8.9

Project No. E.31: Management of whitefly (*Aleurolobus bardensis*) in sugarcane agro-ecosystem.

Results achieved: Low infestation of whitefly started appearing on variety CoH 152 during July and culminated into a moderately high incidence during August. The treatments T1-T4 against the untreated check, therefore, were applied at peak infestation period in fourth week of August. The pest was most effectively managed by imidacloprid 17.8 percent (Confidor 200 SL) application @ 0.005% coupled with removal of puparia bearing leaves resulting in a maximum of 76.8 per cent reduction in its population within 15 days of topical application. The treatment lowered down the population of white fly from a mean intensity of 4.18 puparia/ inch^2 to 0.96 puparia/ inch^2 in a fortnight and to 0.53 puparia/ inch^2 in a month's time. Contrarily, in control plot the population of white fly after about a month of treatment was raised from 3.88 puparia/ inch^2 to 4.48 puparia/inch$^{2.}$ Foliar application of 0.04 per cent Neem after removal of lower infested leaves of cane plants offered moderate control of whitefly leading to a maximum of 46.3 per cent pest eradication within a month of applying the treatment. Installation of *Encarsia* release cages at eight places covering an acre of a field and

removal of old whitefly infested leaves too was moderately effective (45.6 per cent) in population. Stripping of cane plants off infested lower leaves alone helped in curtailing the whitefly population by about 35 per cent.

Table 12. Management of whitefly (*Aleurolobus bardensis*) in sugarcane plant crop

Treatments	Mean whitefly puparia population/10 plants			% Reduction over pretreatment		Whitefly puparia population on leaves (mean)					
						Per plant (18 inch^2)			Per inch^2		
	Pre Treatment	15 DAT	30 DAT	15 DAT	30 DAT	Pre Treatment	15 DAT	30 DAT	Pre Treatment	15 DAT	30 DAT
T1 -Leaves removed	603	414	384	-31.2	-34.7	60.3	41.4	38.4	3.52	2.30	2.13
T2- Imidacloprid 0.05%+T 1	712	172	96	-76.8	-87.0	71.2	17.2	9.6	4.18	0.96	0.53
T3 - Neem 0.04%+ T 1	678	408	364	-40.0	-46.3	67.8	40.8	36.4	3.86	2.28	2.02
T4 –Cages+ T 1	563	426	306	-22.5	45.6	56.3	42.6	30.6	3.13	2.38	1.80
Control	698	742	798	+6.6	+16.0	69.8	74.2	79.8	3.88	4.12	4.48

- Values are the mean of 3 replications

Project E.32: Population dynamics of sugarcane borers through pheromone lures

Results achieved: The crop planted on March 12, 2011 completed its germination by mid April. Traps filled with kerosene Layered water and fitted with pheromone lures for the shoot, the top and the stalk borers individually were placed in the field on 20th of April, 2011. The first shoot borer, *C. infuscatellus* moth capture was recorded on April 24, 2011 when a maximum of 3 moths were trapped in a Wota T trap. The number of captures increased speedily during first week of May reaching a maximum of 11 moth captures in a day (Table 12). The captures receded gradually during the next four weeks and no moths of shoot borer were trapped after first week of June, 2011. The intermittent pre-monsoon showers during May-June seem to deter the population build up of shoot borer.

Top borer, *S. excerptalis* moths were trapped from last week of April onwards. The first top borer moth catches were observed on 26th of April. The catches during end week of April ranged from an average of 4-8 moths /trap/day and during the first week of May

from 6-9 moths /trap. Thus during 2011, the peak period of catches for the second brood of top borer was between May 2-9, followed by a lean period from third week. The moth catches for the third brood were mainly witnessed from June 17, 2011 to June 29, 2011 with a maximum catch of 8 moths/ trap recorded on June 22, 2011. During subsequent period,, the catches for third and fourth broods were relatively low with a maximum of 6 moths/trap on August 22, 2010 and a peak activity for fourth brood ranging between 1-4 moths/trap followed by a lean period in later period of August and first week of September. The captures for fourth brood attained a peak in third week of September with a mean catch number of 4.8 moths/trap/day which then declined gradually till first week of October. The catches again increased but mildly (3.7 moths/trap/day) in mid October. No top borer moths were trapped during November.

The activity of stalk borer, *C. auricilius* fluctuated widely between end April to mid October. The number of stalk borer moths trapped during this period, however, remained comparatively lower than the shoot and the top borers. Four peak capture periods could be distinctly marked when highest catches for individual broods were recorded i.e. first during third week of May, second during first week of July, third in third week of August and fourth and fourth during last week of September. The number of moths captured per trap increased gradually with each succeeding brood that is to say during May, a mean maximum of 3.6 moths/trap/day were trapped for second brood while for fifth brood this number rose to 5.2 moths/trap/day.

Table 12. Weekly pheromone traps catches from April to October during 2011

Period of observation		Mean number of moths/trap		
Month	**Week**	**Shoot borer**	**Top borer**	**Stalk borer**
April	First	-	-	-
	Second	-	-	-
	Third	-	-	-
	Fourth	0.8	5.3	0.8
May	First	6.3	7.3	0.6
	Second	4.6	4.2	2.3
	Third	2.6	0.3	3.6
	Fourth	1.3	1.1	1.5
June	First	0.6	1.2	0.3
	Second	-	3.2	-
	Third	-	5.2	0.7
	Fourth	-	4.2	1.3
July	First		1.3	3.8
	Second		0.2	2.6
	Third		-	0.4
	Fourth		0.3	0.7
August	First		4.2	2.2
	Second		5.7	2.6
	Third		1.9	4.3
	Fourth		0.2	1.5
September	First		0.6	0.7
	Second		2.4	0.1
	Third		4.8	0.6
	Fourth		3.5	5.2
October	First		0.3	4.7
	Second		0.9	2.4
	Third		3.7	0.6
	Fourth		2.1	-