

ANNUAL REPORT - 2015-16
OF
ENTOMOLOGY DISCIPLINE UNDER
AICRP ON SUGARCANE

REGIONAL AGRICULTURAL RESEARCH STATION,
ANAKAPALLE
ANGRAU, ANDHRA PRADESH

**TECHNICAL PROGRAMME OF ENTOMOLOGY DISCIPLINE UNDER
AICRP ON SUGARANE, RARS, ANAKAPALLE (2015-16)**

| Project No. | Title of the Project | Page No. |
|--------------------|---|-----------------|
| 1 (E4.1) | Evaluation zonal varieties / genotypes for their reaction against major insect pests IVT- Early & Mid late AVT- Early | 3-5 6-8 |
| 2 (E 28) | Survey and surveillance of sugarcane insect pests. | 9-11 |
| 3 (E 30) | Monitoring of insect pests and bio-agents in sugarcane agro- ecosystem. | 12-15 |
| 4 (E 34) | Standardization of simple and cost effective techniques for mass multiplication of Sugarcane bio-agents. | 16-17 |
| 5 (E 36) | Management of borer complex of sugarcane through pheromone lures. | 18-22 |
| 6 (E 37) | Bio-efficacy of newer insecticide for the control of sugarcane early shoot borer. | 23-25 |

DETAILED REPORT AICRP ON SUGARCANE

Project No. E.4.1 (1)

- 1. Title** : Evaluation zonal varieties / genotypes for their reaction against major insect pests [IVT (Early & Mid-late)].
- 2. Objective** : To grade the entries in the trials for their behaviour towards damage by key pest in the area.
- 3. Year of start** : 1990-91
- 4. Duration** : Recurring study
- 5. Location** : Regional Agricultural Research Station, Anakapalle
- 6. Project leader and her associates** : Dr. B. Bhavani, Senior Scientist (Entomology)
Dr. M. Charumathi, Senior Scientist (Plant Breeding)
Dr. K. Veerabhadra Rao, Principle Scientist (sugarcane)

Experimental Details :

- a Date of Planting** : 13/03/2015
- b Varieties -IVT (early)** : Co A 13321, Co A 13322, Co A 13323 and Co A 13324
- IVT (midlate) : Co A 13 326, Co A 13 327, Co A 13 328
Susceptible checks : Co A 99082 (93 A 145) for ESB & INB;
: Co A 92081 (87 A 298) for scale insect
:
- c Fertilizers** : 112:100:120 NPK (Kg ha⁻¹)
- d Intercultural operations** : Weeding as and when required and earthing up after 4 months after planting.
- e Irrigation** : At an interval of 10-15 days as per requirement
- f Plant protection measures** : Not applied.
- g Plot size** : Gross : 6m X 0.8 m X 4R= 19.2m²
- h Design** : RBD
- i Replications** : Three
- j Harvesting date** : 30/01/2016

7. Methods of recording observations:

a Early shoot borer :

The observations on the total number of shoots and number of dead hearts due to the early shoot borer were recorded at 30, 60, 90 and 120 days after planting and cumulative per cent incidence upto 120 DAP and number of bored plants /ha was worked out.

b Internode borer :

The observations were recorded at harvest on 10 randomly selected canes of each entry per replication. The per cent incidence, intensity of internode borer and infestation index was worked out.

c Scale insect:

The observations were recorded at harvest on 10 randomly selected canes of each entry per replication. The per cent incidence, intensity of scale insect was worked out.

8. Results of the previous year:

During 2013-14, among three test entries in IVT (early), Co C 10 336 (16.38% DH) recorded highest incidence of early shoot borer whereas Co A 11 321 (12.50%) and Co A 11 323 (11.33%) recorded less incidence of early shoot borer as against 17.22% DH in the susceptible check, 93 A 145 (Co A 99082) and found promising against early shoot borer. All the entries found susceptible to internode borer.

During 2014-15, in Initial varietal trial (early), out of four test entries, lowest cumulative per cent incidence of early shoot borer was recorded in Co A 12 322 (6.91 % DH) and highest incidence was recorded in Co A 12 323 (12.85 % DH) as against 37.89% DH in susceptible check, 93 A 145 (Co A 99082). However, all the test entries found promising against early shoot borer as compared to the susceptible check, 93 A 145 (37.89 %). Internode borer incidence and intensity were also less in Co A 12 322 (26.67%, 1.83%) and more in Co A 12 323 (66.67%, 6.61%).

9. Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc., :

During 2015-16, among four Initial varietal trial (Early) entries, Co A 13 324 recorded significantly less incidence of early shoot borer (12.23%), internode borer (33.33%) as compared to the susceptible check, Co A 99082 (23.29% DH; 56.67%) and found least susceptible towards early shoot borer and moderately susceptible towards internode borer whereas the entry, Co A 13 322 with 63.33% incidence showed high susceptible reaction towards internode borer. However, very less incidence of scale insect was recorded on all test entries of IVT (early) which was ranged between 0 % on Co A 13324 to 6.67% on Co A 13322 compared to susceptible check, Co 92081 (96.67%). Among three IVT (mid-late) entries, Co A 13 327 (9.62% DH) and Co A 13 328 (10.69% DH) showed least susceptible reaction towards early shoot borer and Co A 13 328 showed moderate susceptible reaction towards internode borer (23.47%) compared to susceptible check, A 99082 (23.29% DH; 56.67%) whereas two entries Co A 13336 (0%) and Co A 13 337 (3.33%) showed less susceptible reaction towards scale insect compared to susceptible check, Co 92081 (96.67%) and found promising against scale insect (Table 1).

Table 1 Reaction of zonal varieties /genotypes(IVT - early &mid-late) against early shoot borer, internode borer and scale insect of sugarcane during 2015-16

| Genotype | Early shoot borer incidence (%DH) | | | | | | | Internode borer (%) | | | | Scale insect(%) | | | |
|-----------------------|-----------------------------------|--------|--------|---------|-------------------------|----------|------------------------|---------------------|---------------|-------------------|----------|-----------------|-----------|-------------------|----------|
| | 30 DAP | 60 DAP | 90 DAP | 120 DAP | Cumulative upto 120 DAP | Reaction | No. of bored plants/ha | Incidence (%) | Intensity (%) | Infestation index | Reaction | Incidence | Intensity | Infestation index | Reaction |
| IVT (early) | | | | | | | | | | | | | | | |
| Co A 13 321 | 11.02 | 3.86 | 3.07 | 0 | 15.95 | MS | 15827 | 52.83 | 3.80 | 2.01 | HS | 3.03 | 0.12 | 0.004 | LS |
| Co A 13 322 | 4.29 | 4.31 | 3.40 | 0 | 12.84 | LS | 10552 | 63.33 | 4.78 | 3.03 | HS | 6.67 | 0.29 | 0.19 | LS |
| Co A 13 323 | 7.57 | 4.55 | 3.20 | 0 | 14.74 | LS | 9113 | 35.76 | 2.49 | 0.89 | MS | 3.33 | 0.14 | 0.005 | LS |
| Co A 13 324 | 3.89 | 4.66 | 2.88 | 0 | 12.23 | LS | 7914 | 33.33 | 1.87 | 0.62 | MS | 0.00 | 0.00 | 0 | LS |
| IVT (mid-late) | | | | | | | | | | | | | | | |
| Co A 13 326 | 6.38 | 4.07 | 3.06 | 0 | 17.05 | MS | 15588 | 43.33 | 2.99 | 1.30 | HS | 0.00 | 0.00 | 0 | LS |
| Co A 13 327 | 2.93 | 4.32 | 2.25 | 0 | 9.62 | LS | 10552 | 51.82 | 3.32 | 1.72 | HS | 3.33 | 0.56 | 0.19 | LS |
| Co A 13 328 | 3.61 | 5.40 | 3.11 | 0 | 10.69 | LS | 11271 | 23.47 | 1.99 | 0.47 | MS | 49.63 | 8.17 | 4.05 | HS |
| Co A 99082* | 13.87 | 3.72 | 4.44 | 0 | 23.29 | MS | 22542 | 56.67 | 3.91 | 2.22 | HS | 18.79 | 2.65 | 0.50 | MS |
| Co A 92081** | 3.84 | 4.76 | 4.08 | 0 | 11.20 | LS | 9113 | 53.33 | 4.50 | 2.40 | HS | 96.67 | 20.14 | 19.47 | HS |
| SEd | 1.09 | 0.70 | 0.52 | | 1.33 | | | 6.93 | 0.58 | | | 7.61 | 0.94 | | |
| CD(0.05) | 2.29 | 1.47 | 1.08 | | 2.79 | | | 14.57 | 1.21 | | | 15.99 | 1.96 | | |
| CV% | 21.97 | 19.26 | 18.79 | | 12.08 | | | 18.14 | 21.16 | | | 25.99 | 21.1 | | |

** Susceptible check for ESB & INB

*** Susceptible check for scale insect &INB

| | | |
|--|---|---|
| Project No 1 | : | E 4.1 (2) |
| 1.Title | : | Evaluation zonal varieties / genotypes for their reaction against major insect pests [AVT (early)] |
| 2.Objective | : | To grade the entries in the trial for their behaviour towards damage by key pest in the area. |
| 3.Year of start | : | 1990-91 |
| 4.Duration | : | Long term |
| 5.Location | : | Regional Agricultural Research Station, Anakapalle |
| 6.Project leader and her associates | : | Dr. B. Bhavani, Senior Scientist (Entomology) Dr M. Charumathi, Senior Scientist (Plant Breeding) Dr. K. Veerabhadra Rao, Principle Scientist (Sugarcane) |

Experimental Details :

| | | |
|------------------------------------|---|---|
| A Date of Planting | : | 13/03/2015 |
| B Varieties - AVT (early) | : | Co A 12321, Co A 12322, Co A 12323, Co V 12356 |
| Susceptible checks | : | Co A 99082 (93 A 145) for ESB & INB; Co A 92081 (87 A 298) for scale insect & INB. |
| C Fertilizers | : | 112:100:120 NPK (Kg ha ⁻¹) |
| D Intercultural operations | : | Weeding as and when required and earthing up after 4 months after planting. |
| E Irrigation | : | At an interval of 10-15 days as per requirement |
| F Plant protection measures | : | Not applied. |
| G Plot size | : | Gross : 6m X 0.9 m X 4R = 21.6m ² |
| H Design | : | RBD |
| I Replications | : | Three |
| J Harvesting date | : | 30/01/2016 |

7. Methods of recording observations :

1 Early shoot borer :

The observations on the total number of shoots and number of dead hearts due to the early shoot borer were recorded at 30, 60, 90 and 120 days after planting and cumulative per cent infestation was worked out.

2 Internode borer and scale insect:

The observations were recorded at harvest on 25 canes in each genotype per replication. The per cent incidence and intensity of internode borer and scale insect were worked out.

8.Results of the previous year:

During 2013-14, among three test entries in IVT (early), Co C 10 336 (16.38% DH) recorded highest incidence of early shoot borer whereas Co A 11 321 (12.50%) and Co A 11 323 (11.33%) recorded less incidence of early shoot borer as against 17.22% DH in the susceptible check, 93 A 145 (Co A 99082) and found promising against early shoot borer. All the entries found susceptible to internode borer.

During 2014-15, In AVT (early), out of three entries, Co C 10 336 recorded less incidence of early shoot borer (10.15%) and highest incidence was recorded in Co A 11 323 (14.45%) as against 17.58% DH in susceptible check, 93 A 145 (Co A 99082). However, all the three entries showed least susceptible reaction towards early shoot borer and found promising. Among test entries, Co A 11 323 recorded less incidence of internode borer (36.67%) and showed moderate susceptibility whereas highest incidence was recorded in Co C 10 336 (46.67%). However, all the entries showed susceptible reaction towards internode borer. Incidence of scale insect was nil in Co A 12 323 and found less susceptible to scale insect. Remaining two test entries (Co C 10 336 & Co A 11321) recorded highest incidence and showed high susceptible reaction towards scale insect

9. Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc., :

During 2015-16, among four entries of Advanced varietal trial (early), Co V 12 356 (6.69 % DH) and Co A 12 322 (6.82% DH) recorded lowest cumulative incidence of early shoot borer compared to susceptible check, 93 A 145 (18.09% DH). However, all the test entries recorded <15 % DH and found least susceptible and promising against early shoot borer where as all the AVT entries showed high susceptible reaction towards internode borer (43.33 % to 76.67 %) and scale insect (30% to 83.33%) (Table 2).

Table 2 Reaction of zonal varieties /genotypes against early shoot borer, internode borer and scale insect of sugarcane during 2015-16

| Genotype | Early shoot borer incidence (%DH) | | | | | | | Internode borer (%) | | | | Scale insect (%) | | | |
|--------------|-----------------------------------|--------|--------|---------|-------------------------|----------|-------------------------|---------------------|---------------|-------------------|----------|------------------|-----------|-------------------|----------|
| | 30 DAP | 60 DAP | 90 DAP | 120 DAP | Cumulative upto 120 DAP | Reaction | No. of bored plants/ ha | Incidence (%) | Intensity (%) | Infestation index | Reaction | Incidence | Intensity | Infestation index | Reaction |
| Co A 12 321 | 1.68 | 1.84 | 4.66 | 0 | 9.95 | LS | 9970 | 43.33 | 2.48 | 1.07 | HS | 60.00 | 2.48 | 1.49 | HS |
| Co A 12 322 | 1.66 | 0.93 | 1.43 | 0 | 6.82 | LS | 6925 | 76.67 | 4.01 | 3.07 | HS | 30.00 | 4.01 | 1.20 | HS |
| Co A 12 323 | 1.70 | 1.40 | 2.89 | 0 | 10.28 | LS | 9609 | 76.67 | 7.09 | 5.43 | HS | 43.33 | 7.09 | 3.07 | HS |
| Co V 12 356 | 1.13 | 2.07 | 1.34 | 0 | 6.69 | LS | 6757 | 43.33 | 3.08 | 1.33 | HS | 83.33 | 3.08 | 2.57 | HS |
| Co 6907 | 3.44 | 4.92 | 4.45 | 0 | 11.57 | LS | 9922 | 80.00 | 3.76 | 3.01 | HS | 24.24 | 2.39 | 0.58 | HS |
| CoC01061 | 1.88 | 1.77 | 1.03 | | 5.98 | LS | 5691 | 66.67 | 4.66 | 3.11 | HS | 23.33 | 3.72 | 0.87 | HS |
| Co A 99082* | 6.09 | 6.00 | 3.95 | 0 | 18.09 | MS | 18125 | 80.00 | 4.78 | 3.82 | HS | 33.33 | 2.69 | 0.90 | HS |
| Co A 92081** | 3.84 | 4.76 | 4.08 | 0 | 11.20 | LS | 8284 | 53.33 | 4.50 | 2.40 | HS | 96.67 | 20.14 | 19.47 | HS |
| SEd | 0.74 | | 2.07 | | 2.38 | | | 6.02 | | | | 10.23 | 2.53 | | |
| CD (p=0.05) | 1.56 | NS | 4.38 | NS | 5.05 | | | 12.75 | NS | | | 21.68 | 5.36 | | |
| CV% | 14.83 | | 17.38 | | 16.79 | | | 12.4 | | | | 20.58 | 20.95 | | |

* Susceptible check for ESB& INB

** Susceptible check for scale insect & INB

II

- 1.Experiment No.2 : Project E 28**
2. Title : **Survey and surveillance of sugarcane insect pests.**
3. Objective : To identify key insect pests of sugarcane in the area.
4. Project leader and her associates : Dr. B. Bhavani, Senior Scientist (Entomology)
5. Year of start : 2003-04
6. Duration : Long term.
- Experimental Details :**
- a. Season : 2015-16

7. Methodology & observations recorded :

Roving survey of sugarcane fields at 5-8km distance and different sugar factory operational areas in Andhra Pradesh.

Observations on incidence of borers were recorded by examining 100 canes at five places (four corners and in the middle), sucking pests by examining 20 canes. Sucking pests were recorded by examining 20 canes

8.Results of the previous year :

During 2014-15, it was observed that due to hot weather and late onset of monsoon rains, the early shoot borer incidence was highest in February-April planted crop which was ranged from 6 to 48 per cent on all popular sugarcane varieties the during surveys. Maximum incidence was observed in March-April planted crop due to high day temperatures prevailed during the months of May and June, 2014. The per cent incidence of internode borer ranged from 20 to 80 per cent during June to October months on all popular varieties of sugarcane. Moderate to severe incidence of red mite (2 to 40 %) was observed during the months of April-July months due to high temperature and low relative humidity. *Pyrilla* incidence (3A&N/ plant) was recorded in month of August and reached its peak level of 17A & N/leaf in the month of September and thereafter the incidence was decreased in October due to Hud-hud cyclone. Earlier *Pyrilla* was an minor pest but in recent years it has attained major pest status in some pockets of Andhra Pradesh. It was observed mostly during the months of August to November on mature sugarcane crop. Along with *Pyrilla* population, *Epiricanea* parasitisation (1-5%) was also observed.

9. Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc., :

During 2015-16, it was observed that moderate to severe incidence of early shoot borer incidence during the months of April to June (6.00 to 47.00 %) on all popular sugarcane varieties viz., 87 A 298, 86 V 96, 83 V15, 2001 A 63, 2003 V 46 & Co 86032, . The per cent incidence of internode borer was more on early planted crop and it was ranged from 15 to 85 per cent on all popular sugarcane varieties (87 A 298, 2003 V 46, 2001 A 63 & Co 86032). Moderate to severe incidence of red mite (4 to 45%) was observed during the months of May, June and July months due to high temperature and late onset of monsoons. The incidence of scale insect ranged from 5 to 70 percent on varieties viz., 87 A 298, Co 7219, 83 V 15. *Pyrilla* population (4-18 N &A/ leaf) was observed from August month and continued up to November month. Parasitisation of *Epiricania melanoleuca* (1-5%) was observed on adults & on eggs during the months of August-September, 15.Remaining all other insect pests viz., whitefly, mealybug, leafhoppers and grasshoppers were observed in minor status during 2015-16 (Table 3).

Table 3 Survey and surveillance of sugarcane insect pests(E.28)

| S. No. | Variety | Location | Name of the pest | % incidence or population | | | Remarks |
|---------|---|--|--|---------------------------|---------|---------|---|
| | | | | Min. | Max. | Aver. | |
| 1 | 87 A 298, 86 V96, 2003 V 46 Co 86032 | Navabharat Ventures Pvt., Ltd., Samalkot, East Godavari district | Early shoot borer (<i>Chilo infuscatellus</i>) | 6.00 | 26.00 | 16.00 | Incidence of early shoot borer and internode borer were high on variety, Co 86032. Moderate to high incidence of scale insect was observed on variety, 87 A 298 (Viswa mitra) both on plant and ratoon crops. |
| | | | Root borer (<i>Emmalocera depressella</i>) | 1.00 | 3.00 | 2.00 | |
| | | | Top shoot borer (<i>Scirpophaga exrcptalis</i>) | 2.00 | 5.00 | 3.50 | |
| | | | Internode borer (<i>Chilo sacchariphagus indicus</i>) | 20.00 | 85.00 | 52.50 | |
| | | | <i>Pyrilla perpusilla</i> / leaf | 8.00 | 17.00 | 12.50 | |
| | | | <i>Epiricania melanoleuca</i> / plant | 3.00 | 5.00 | 4.00 | |
| | | | Whitefly (<i>Aleurolobus barodensis</i>) (N & P / 2.5sq.cm.) | 10.33 | 18.33 | 14.33 | |
| | | | Woolly aphid(<i>Ceratovacuna lanigera</i>) (Average grade) | 1 | 2 | 1.5 | |
| | | | Scale insect (<i>Melanaspis glomareta</i>) (%incidence) | 10.00 | 70.00 | 40.00 | |
| | | | Mealy bug (<i>Saccharicoccus sacchari</i>) (%incidence) | 8.00 | 19.00 | 13.50 | |
| | | | Red Mite (<i>Oligonychus indicus</i>) (% incidence) | 4.00 | 26.00 | 15.00 | |
| | | | Termite (<i>Odontotermes obesus</i>) (% incidence) | 15.00 | 30.00 | 22.50 | |
| | | | Derbid leafhopper (<i>Proutista moesta</i>) / leaf (number of adults/leaf) | 3.00 | 9.00 | 6.00 | |
| | | | Sugarcane grass hopper, <i>Hieroglyphus banian</i> | 1/clump | 4/clump | 2/clump | |
| 2 | Co7219, 87 A 298 , Co 62175, 2001 A 63 & Co7805 | Chodavaram sugar factory operational area, Visakhapatnam dt. | Early shoot borer | 16.00 | 44.00 | 30.00 | On variety, Co 62175 red rot incidence was observed along with severe incidence of internode borer. Moderate to severe incidence of Termite was more in red loamy soils in many pockets. |
| | | | Internode borer | 20.00 | 80.00 | 50.00 | |
| | | | <i>Pyrilla</i> /leaf | 4.00 | 11.00 | 7.50 | |
| | | | <i>Epiricania melanoleuca</i> /plant | 1.00 | 3.00 | 2.00 | |
| | | | Whitefly (N &P per 2.5sq.cm.) | 5.00 | 21.00 | 13.00 | |
| | | | Mealy bug | 5.00 | 10.00 | 7.50 | |
| | | | Woolly aphid | 1.00 | 1.00 | 1.00 | |
| | | | Scale insect | 5.00 | 30.00 | 17.50 | |
| | | | Red mite | 5.00 | 45.00 | 25.00 | |
| Termite | 23.00 | 37.00 | 30.00 | | | | |

| | | | | | | | |
|-------------------------|---|--|--|-------|-------|-------|---|
| 3 | 87 A 298, 2001 A 63, 93 A 145, Co7219, 81 V 48, Co 62175 & Co7805 | Thummapala Cooperative Sugar factory area, Anakapalle, Munagapaka villages of Visakhapatnam district | Early shoot borer | 13.00 | 47.00 | 30.00 | Due to delayed onset of monsoon, moderate to severe incidence of early shoot borer was observed on all popular varieties. |
| | | | Internode borer | 15.00 | 80.00 | 47.50 | |
| | | | <i>Pyrilla</i> /leaf | 5.00 | 13.00 | 9.00 | |
| | | | Whitefly | 13.33 | 16.67 | 15.00 | |
| | | | Termite | 8.00 | 15.00 | 11.50 | |
| | | | Derbid planthoppers/leaf | 7.00 | 17.00 | 12.00 | |
| | | | Mealybug | 4.00 | 10.00 | 7.00 | |
| | | | scale insect | 5.00 | 30.00 | 17.50 | |
| | | | Red mite | 5.00 | 36.00 | 20.50 | |
| 4 | 87 A 298, Co 62175, 2001 A 63 & 2003 V46, | Etikoppaka Cooperative sugar factory operational area, Visakhapatnam district | Early shoot borer | 12.00 | 48.00 | 30.00 | Early shoot borer and internode borer were the predominant species prevailed in the early stage of the crop period in Visakhapatnam district |
| | | | Internode borer | 20.00 | 70.00 | 45.00 | |
| | | | <i>Pyrilla</i> /leaf | 3.00 | 13.00 | 8.00 | |
| | | | Red Mite | 12.00 | 30.00 | 21.00 | |
| | | | Whitefly | 14.33 | 21.33 | 17.83 | |
| | | | White woolly aphid | 2 | 2 | 2 | |
| | | | scale insect | 5.00 | 30.00 | 17.50 | |
| | | | Termite | 20.00 | 40.00 | 30.00 | |
| | | | Leafhoppers(<i>Proutista moesta</i>)/ leaf | 5.00 | 11.00 | 8.00 | |
| <i>Pyrilla</i> per leaf | 2.00 | 12.00 | 7.00 | | | | |
| 5 | 87 A 298, 93 A 145, 2001 A 63 | Sri Sarvaraya sugars Ltd., Chelluru, East Godavari dt. | Early shoot borer | 11.00 | 34.00 | 22.50 | High incidence of early shoot borer and internode borer were observed on variety, Co 86032, 2003 V 46. & 87 as 298. Moderate to high incidence of scale insect was observed on variety 87 A 298 both on plant and ratoon crops. |
| | | | Root borer | 1.00 | 3.00 | 2.00 | |
| | | | Top shoot borer | 2.00 | 3.00 | 2.50 | |
| | | | Internode borer | 20.00 | 85.00 | 52.5 | |
| | | | <i>Pyrilla</i> /leaf | 8.00 | 18.00 | 13.00 | |
| | | | <i>Epiricania melanoleuca</i> /plant | 1.00 | 3.00 | 2.00 | |
| | | | Whitefly | 3.00 | 18.00 | 10.50 | |
| | | | Woolly aphid | 1 | 1 | 1 | |
| | | | Scale insect | 20.00 | 60.00 | 40.00 | |
| Red mite (%incidence) | 14.00 | 22 | 18.00 | | | | |

- 1.Experiment No.3** : **Project E 3**
- 3. Title** : **Monitoring of insect pests and bio-agents in agro ecosystem.**
- 4. Objective** : To monitor the key insect pests and natural enemies in the area.
- 5. Project leader and her associates** : Dr. B. Bhavani, Senior Scientist (Entomology)
6. Year of start : 2006-07
7. Duration : Long term.

- Experimental Details** :
- 1 Season : 2015-16
- 2 Plot size : 0.5ac
- 3 Design : Bulk plot
- 4 Date of planting : 17-3-2015
5. Date of harvest : 10- 4-2016

Observations recorded :

1.Observations on incidence of borers were recorded by examining 100 canes at five places (four corners and in the middle), sucking pests by examining 20 canes.

8.Results of the previous year :

Sugarcane variety, 93 A 145 (Co 99082) was planted in 0.2ha area on 17-3-15 with an objective to record insect pests and their natural enemies occurred during 2015. Early shoot borer incidence was observed from 13MW, i.e during the last week of March (4.0%) and the maximum incidence was noticed during the month of May (26.00%) and decreased thereafter due to scattered rainfall received during the crop period. Internode borer incidence was noticed from June month onwards (1.60%) and maximum incidence was observed in the month of November, 2014(48.90%).Sucking pest, red mite incidence was observed from March month (1.80%) and peak incidence was recorded in 31MW i.e in the last week of July (42.60%). Peak incidence of whitefly (19.25N & P/2.5sq.cm of leaf) was observed in 43rd MW in the month of October. Peak incidence of *Pyrilla* and *Proutista moesta* were observed during 43rd MW along with parasitisation of *Epiricania melanoluca* and *Tetrastichus pyrillae* (12%). Peak incidence of scale insect (18.0%) was observed at maturity stage i.e during January, 2015. Incidence of mealybug (3%) was recorded during 26MW and it was reduced due to scattered rainfall received during July month.

The bio-agent, *Euborellia annulipes*, an earwig (Ord. Dermaptera) was predatory on eggs and early instar larvae of early shoot borer was noticed on plant and ratoon crop in the early stage. Certain natural collections of *Trichogramma chilonis* (0.74- 3.80%) and *Stenobracon* sp. on early shoot borer, *Sturmiapsis inferens* and *Apanteles flavipes* on internode borer larvae, *Epiricania melanoluca* on cocoons and eggs of *Pyrilla* on underside of the sugarcane leaves and *Tetrastichus pyrillae* on egg stages of *Pyrilla* were observed. *Pharoscymus horni*, a coccinellid predator were also noticed in the leaf sheaths infested with pink mealy bug, *Saccharicoccus sacchari*. *Coccinella septempunctata* and *Cheilomenes sexmaculata* were found to be predating on aphids and mealybugs of sugarcane.

9. Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc., :

During 2015-16, the infestation of early shoot borer was ranged from 8.60% to 38.60% and peak incidence (38.60%) was noticed in 21st SW (i.e. 3rd week of May). Low to moderate incidence of red mite (3.0 to 42.60%) was observed from 12th SW (i.e. 2nd week of March) to 25th SW (4th week of June). Incidence of internode borer was noticed from 26th SW (2.6%) and the peak incidence was noticed in 35th SW i.e., last week of August (52%). Low to moderate incidence of scale insect was observed during September – December months (5- 50%). Peak incidence of scale insect was observed in 44th SW (50%). Peak incidence of *Pyrilla* was observed during 43rd SW and maximum parasitisation of *Epiricanea* was observed during 48th SW (Table 4a, 4b & 4c).

Parasitisation of *T. chilonis* was ranged between 1.0 - 4.2% on the eggs of *C. infuscatellus* and parasitisation of *Sturmiopsis inferens* on larvae of *C. infuscatellus* ranged between 0.6% and 3.80% from April to July months. Higher activity of *Euborellia annulipes* (5-6/clump) was observed during April month. On internode borer, parasitisation of *T. chilonis* (1-3.6%), *Sturmiopsis inferens* (0.4 -3.3%) and *Cotesia flavipes* (0.60 -5.40%) were observed during the months of September- January, 2016 (Table 4a). Higher activity of the parasitoid, *Encarsia flavoscutellum* was observed during the month of January (Table 4c).

Table 4a. Monitoring of insect pests and bio-agents in Sugarcane agro-ecosystem

| Period of observation | % incidence of early shoot borer | % parasitism (ESB), if any | | | % incidence of Internode borer | % parasitism (INB) | | |
|-----------------------|----------------------------------|----------------------------|---------------------|--------------------|--------------------------------|--------------------|--------------------|-------------------------|
| | | <i>T. chilonis</i> | <i>E. annulipes</i> | <i>S. inferens</i> | | <i>T. chilonis</i> | <i>S. inferens</i> | <i>Cotesia flavipes</i> |
| 23-4-15/18MW | 8.60 | 2.20 | 5-6/clump | - | - | - | - | - |
| 25-5-15/22MW | 38.60 | 3.10 | 4-3/clump | 0.60 | 2.60 | - | - | - |
| 22-6-15/26MW | 30.10 | 4.20 | 1-3/clump | 1.30 | 12.60 | - | - | - |
| 24-7-15/31MW | 11.50 | 1.00 | -- | 3.80 | 25.40 | -- | 0.40 | - |
| 22-8-15/35MW | - | - | -- | 0.60 | 52.00 | | 1.00 | - |
| 23-9-15/39MW | - | - | - | - | 38.00 | 1.00 | 2.60 | 0.60 |
| 23-10-15/43MW | - | - | 2-3/cane | - | 19.20 | 3.00 | 3.30 | 2.60 |
| 23-11-15/48MW | - | - | 2-3/cane | - | 18.60 | 3.60 | 1.80 | 2.20 |
| 23-12-15/52MW | - | - | - | - | 14.10 | 2.80 | - | 4.60 |
| 5-1-16/1MW | - | - | - | - | 4.33 | 1.00 | - | 5.40 |

Table 4b Monitoring of sucking pests and its bio agents in sugarcane agro-ecosystem

| Period of observation | % incidence scale insect | % Parasitism/Predator population per plant (Scale insect) | | | | % incidence Mealy bug | Predator population per plant (Mealy bug) | | |
|-----------------------|--------------------------|---|-----------------------|--------------------|-----------------|-----------------------|---|-----------------|--------------------------------|
| | | <i>Encarsia flavoscutellum</i> (%) | <i>A. mayurai</i> (%) | <i>C. nigrinus</i> | <i>P. horni</i> | | <i>Coccinella septempunctata</i> | <i>P. horni</i> | <i>Cheilomenes sexmaculata</i> |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 23-4-15/18MW | - | - | - | - | - | - | - | - | - |
| 25-5-15/22MW | - | - | - | - | - | 1.0 | - | - | - |
| 22-6-15/26MW | - | - | - | - | - | 3.0 | 1 | - | 1-2 |
| 24-7-15/31MW | - | - | - | - | - | 7.0 | 2-3 | 1-3 | 3-4 |
| 22-8-15/35MW | - | - | - | - | - | 1.0 | - | 1-2 | 1 |
| 23-9-15/39MW | - | - | - | - | - | - | - | 1 | - |
| 23-10-15/43MW | 5.00 | - | - | - | - | - | - | - | - |
| 23-11-15/48MW | 20.00 | 2.6 | 2.0 | 2-5 | 1-3 | - | - | - | - |
| 23-12-15/52MW | 30.00 | 8.6 | 4.6 | 5-6 | 2-5 | - | - | - | - |
| 5-1-16/1MW | 50.00 | 13.0 | 6.6 | 9-11 | 2-6 | - | - | - | - |

| Period of observation Date/SMW | Red mite incidence (% incidence) | White fly (population/ 2.5sq.cm) | <i>Ascharsonia</i> sp. (%) | <i>Pyrilla perpusilla</i> | | | Derbid leafhopper (<i>Proutista moesta</i>) Adults /leaf) | % Parasitization on <i>Pyrilla</i> | | | |
|-----------------------------------|-------------------------------------|--|-------------------------------|---------------------------|------------------------|--------------------------|--|------------------------------------|-------------|--------|----------------------------------|
| | | | | | | | | <i>Epiricania melanoleuca</i> | | | <i>Tetrastichus pyrillae</i> |
| | | | | No. of adults/ leaf | No. of Nymphs/ leaf | No .of egg mass/ leaf | | Cocoon | Egg mass | Adults | |
| 23-4-15/18MW | 11.00 | - | - | - | - | - | - | - | - | - | - |
| 25-5-15/22MW | 18.60 | - | - | - | - | - | - | - | - | - | - |
| 22-6-15/26MW | 33.00 | - | - | 1-2 | 3-6 | 1 | 2 | - | - | - | - |
| 24-7-15/31MW | 42.60 | - | -- | 1-2 | 1- 8 | 1-2 | 3-5 | - | - | - | - |
| 22-8-15/35MW | 6.50 | - | - | 2-4 | 7-10 | 2-3 | 3-8 | - | - | - | 2.0 |
| 23-9-15/39MW | -- | - | - | 4-7 | 6-16 | 3-4 | 5-11 | 1 | - | 1 | 3.0 |
| 23-10-15/43MW | - | 19.25N&P | - | 2-11 | 10-19 | 2-7 | 2-5 | 4-6 | 1 | 2 | 5.0 |
| 23-11-15/48MW | - | 13.30 N &P | - | 1-3 | 4-11 | 3-7 | - | 5-11 | 1-2 | 1 | 3.0 |
| 23-12-15/52MW | | | 2.80 | 1-2 | 2-3 | 1-4 | - | 1-3 | - | - | 1.0 |
| 5-1-16/1MW | | | 6.00 | 1 | 1 | - | - | - | - | - | - |

| | | |
|---|---|---|
| Expt No.5 | : | Project E.34 |
| 1.Title | : | Standardization of simple, cost effective techniques for mass multiplication of sugarcane bioagents (<i>Beauveria bassiana</i>). |
| 2.Objective | : | To develop simple and cost effective mass multiplication technique of promising bio- agents of the area <i>Beauveria bassiana</i> . |
| 3. Year of start | : | 2012-13 |
| 4 .Location | : | Regional Agricultural Research Station, Anakapalle |
| 5. Project leader and her associates | : | Dr. B. Bhavani, Senior Scientist (Entomology) Dr. N. Raj Kumar, Scientist (Plant Pathology) |

6.Experimental Details :

7. Methodology adopted :

Simple and cost effective host media for multiplication of insect pathogen, *Beauveria bassiana*

Mycelial discs of *Beauveria* were inoculated in PDA broth supplemented with 1% yeast extract and incubated at 26 °C for 48 h with shaking at 180 rev min⁻¹.

The mass culturing of *Beauveria* is being done on yeast broth as well as on solid medium (whole grains) supplemented with 1% yeast extract.

Yeast broth was made by mixing 20 g of brewer's yeast and 20g of sucrose in one liter of water. The mixture was dispensed into 250 ml conical flasks and three replications (flasks) maintained then plugged loosely with a bung of non-absorbent cotton wool and autoclaved at 121⁰ C, 15 psi for 40 minutes. After cooling, each flask was inoculated with loopful spores from *B. bassiana* culture and were then incubated at room temperature (25 ± 5⁰C), on a rotary shaker revolving at 150 rpm for 72 hours as described (Jenkins *et al.* 1998) for production of spores.

Whole grain media

Grains are cheap, easily available and act a best nutritive media for the mass multiplication of many micro and macro organisms. Hence, five whole grains *viz.*, rice, ragi, sorghum, pearl millet and maize are used for estimating the sporulation of *B. bassiana* at 28⁰ c. 100 g of each grain are washed well and soaked in water overnight except rice and pearl millet which are soaked for 2-3 hours prior to starting the experiment. The excess water is drained by decanting and shade drying it for half an hour to further remove the excess moisture. Three replications maintained for each grain. The grains are packed separately in individual 500 ml flask for *B. bassiana*. They are plugged with cotton wool and autoclaved at 15psi for 1 hour. After cooling, 1ml of the spore suspension of fungal pathogen is inoculated in to each bottle, separately. All these procedures are done under laminar air flow chamber. They are incubated in BOD incubator at 28⁰c for 15 days. To avoid clumping, after 7 days of inoculation, the flasks and bottles are shaken vigorously to separate the grain and to break the mycelia mat. After 15 days of incubation,10g homogenous grain sample drawn from each replicate uniformly sporulating bottle/ flasks are transferred to 100 ml sterilized distilled water containing Tween 80 (0.05%) solution in 250 ml conical flasks. The flasks are shaken in mechanical shaker for 10 min. The suspension is made after the serial dilution of the suspension using double ruled Neubauer hemocytometer for determining the number of conidia in 1 g of the cereal grains.

8. Results of previous year:

During 2013-14, among the whole grains tested, *B. bassiana* spore production was significantly higher on rice (11.28×10^8) and found to be the suitable media for the spore production followed by ragi (10.76×10^8) and sorghum (10.28×10^8) and lowest spore production was recorded in maize (9.48×10^8).

During 2014-15, mass culturing of *Beauveria bassiana* on different solid media was tried and the results indicated that among the solid media, par boiled rice produced highest spore count of 12.40×10^8 per 100 gm with less biomass (0.11g/ 100gm) and found as the best suitable medium for mass culturing of *Beauveria bassiana*.

9. Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc., :

During 2015-16, mass culturing of *Beauveria bassiana* on different solid media was tried and the results indicated that among the solid media, par boiled rice produced highest spore count of 13×10^8 per ml with less biomass (0.13g/ 100gm) followed by maize (12.1×10^8 /ml), rice (12×10^8 /ml) and found as the best suitable media for mass culturing of *Beauveria bassiana*. No fungal spores of *B. bassiana* were found in sugarcane bagasse + 1.0g dextrose whereas in press mud + 1g dextrose found considerably low spore yields as compared to food grains (Table 5).

Based on cost incurred for the production of spores, *Corcyra cephalonica* rearing waste (Rs. 0.20) and press mud + 1.0 dextrose (Rs. 0.26) were the best low cost substrates compared to PDA medium (Rs.0.45) if, *Corcyra* rearing waste (maize broken grains) or press mud are available on free of cost. Among *in vitro* produced cereal media for the production of spores, parboiled rice + 1.0g dextrose (Rs. 0.32), ragi + 1.0g dextrose (Rs. 0.33), rice + 1.0g dextrose (Rs. 0.36) and maize + 1.0g dextrose (Rs. 0.36) were the best low cost substrates for 1×10^8 spore production compared to PDA medium (Rs. 0.45) (Table 5).

Table 5. Spore ($\times 10^8$) and biomass production (g) of entomopathogenic fungi, *B. bassiana* on different whole grains.

| Media | Spore count ($\times 10^8$) per ml | Biomass (g) per 100 gm | Cost of production of 1×10^8 spores (Rs) |
|--|--------------------------------------|------------------------|---|
| Parboiled rice +1g Dextrose | 13.10 | 0.13 | 0.32 |
| Rice +1g Dextrose | 12.00 | 0.15 | 0.36 |
| Sorghum +1g Dextrose | 10.60 | 0.67 | 0.39 |
| Pearl millet +1g Dextrose | 9.20 | 0.70 | 0.49 |
| Ragi +1g Dextrose | 11.36 | 0.61 | 0.36 |
| Maize +1g Dextrose | 12.10 | 0.63 | 0.33 |
| Rice bran +1g Dextrose | - | - | - |
| <i>Corcyra</i> rearing waste (Maize) + 1g Dextrose | 11.10 | 0.70 | 0.20 |
| Press mud (Sugar mill) +1g Dextrose | 11.41 | 0.20 | 0.26 |
| Sugarcane bagasse+1g Dextrose | - | - | - |
| PDB | 14.60 | 0.11 | 0.45 |
| CD(p=0.05) | 0.06 | 0.03 | |
| CV% | 1.38 | 1.20 | |

- Expt No.6** : **Project E 36**
1.Title : **Management of borer complex of sugarcane through lures.**
- 2. Objective** : To manage sugarcane borers (early shoot borer, top borer, internode borer and stalk borer) through pheromone traps.
- 3.Year of start** : **2012-13**
- 4.Location** : Regional Agricultural Research Station, Anakapalle
- 5. Project leader and her associates** : Dr. B. Bhavani, Senior Scientist (Entomology)
- 6.Experiment details** :
- 1 Season : 2015-16
 - 2 Plot size : 0.5 acre each
 - 3 Variety : 93 A 145 (Co A 99082)
 - 4 Planting Date : 9/02/ 2015
 - 5 Harvesting Date : 2/02/2016

Treatment details : Pheromone lures of sugarcane early shoot borer and internode borer

Plot Size : Two blocks, each of minimum half acre. In first block, trap should be installed and the second be kept as such (control). In between both blocks, one acre sugarcane crop was taken to avoid the pheromone effect.

Methodology adopted :

- The test insect pests at RARS, Anakapalle were early shoot borer and internode borer.
- Five pheromone traps for ESB and internode borer were installed in the month of March till harvest of crop in half acre of sugarcane crop.
- The pheromone lures were changed after 21 days for ESB and 45 days for INB.

Observation recorded :

- Observations on number of moths trapped recorded at weekly interval.
- The mean number of moths captured was worked out.
- The correlations of moth captures were worked out with weekly meteorological parameters.
- Infestations of each borer were recorded in both blocks.

8. Results of the Previous year:

During 2013-14, the plot with pheromone traps installed @ 10 traps/acre for mass trapping of adult moths of ESB as well as INB (T1) recorded lowest cumulative incidence of early shoot borer (8.33%) as against 26.94% in untreated control. Low per cent incidence (11.30%) and intensity (5.40%) of internode borer was recorded T1 compared to untreated plot (84.2% incidence and 15.40% intensity of internode borer). Highest cane yield was recorded in plot with pheromone traps @10/acre (89.50t/ha) as compared to control plot (85.50t/ha).

During 2014-15, the plot with pheromone traps installed @ 10/acre (T1) recorded less incidence of early shoot borer (13.33%) and internode borer (19.0%) as compared to control plot (36.94%; 34.60%) resulting in 63.91 and 45.87 per cent reduction over control respectively. Highest per cent sucrose (16.60%) and cane yield (71.70 t/ha) were recorded in Plot with pheromone traps (T1) as against 15.98% and 68.50t/ha respectively, in plot without pheromone traps.

9. Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc.,

During 2015-16, Early shoot borer moth catch high during 17th SW (122 moths / 5 traps / week) whereas internode borer moth catches were high during 24th SW (119 moths/ 5 traps/week) (Table 6a). Maximum temperature showed negative correlation ($r = -0.48$) and morning relative humidity showed positive correlation ($r = 0.48$) with ESB moth catches whereas maximum temperature ($r=0.58$) morning RH ($r=0.46$) and evening RH ($r=0.60$) showed positive correlation with INB moth catches in pheromone traps (Table 6b).

The plot with pheromone traps @ 25 /ha reduced the incidence of early shoot borer and internode borer to an extent of 72.04 % and 49.60% respectively, and recorded high percent juice sucrose (20%) and cane yield (82.44t/ha) which resulted in 7.34% increase of cane yield over control (19.20%; 76.80t/ha) with a cost benefit ratio of 1 : 1.25(Table 6c & 6d).

| Standard week | Pheromone trap catches/week | | Temperature (°C) | | Relative humidity (%) | | Evaporation (mm) | Rainfall (mm) | Rainy days | Sunshine hours |
|---------------|-----------------------------|------------|------------------|-------------|-----------------------|-----------|------------------|---------------|------------|----------------|
| | ESB moths | INB moths | Max | Min | Morning | Evening | | | | |
| 5 | 0 | 0 | 31.7 | 16.6 | 87 | 44 | 3.6 | 0 | 0 | 7 |
| 6 | 1 | 0 | 33.2 | 14.1 | 81 | 36 | 4.6 | 0 | 0 | 8.3 |
| 7 | 0 | 0 | 33.2 | 18.1 | 93 | 49 | 4.2 | 0 | 0 | 7.7 |
| 8 | 3 | 0 | 34.3 | 20 | 87 | 39 | 5.3 | 0 | 0 | 8.1 |
| 9 | 7 | 0 | 34 | 21.4 | 84 | 47 | 5 | 0 | 0 | 8.7 |
| 10 | 21 | 0 | 34.9 | 22.9 | 86 | 46 | 5.6 | 0 | 0 | 7.3 |
| 11 | 49 | 0 | 36.7 | 20.5 | 86 | 34 | 6.1 | 0 | 0 | 8.8 |
| 12 | 41 | 0 | 37 | 24.3 | 85 | 46 | 5.6 | 0 | 0 | 7.4 |
| 13 | 32 | 0 | 35.3 | 25.5 | 86 | 51 | 5.6 | 0 | 0 | 6.6 |
| 14 | 23 | 1 | 36.7 | 27.2 | 81 | 50 | 7.1 | 0 | 0 | 8 |
| 15 | 40 | 0 | 35.6 | 26.1 | 77 | 59 | 5.8 | 0 | 0 | 5.9 |
| 16 | 43 | 2 | 35.3 | 25.9 | 84 | 60 | 6.1 | 32.2 | 2 | 7.5 |
| 17 | 122 | 2 | 35.7 | 24.1 | 85 | 66 | 5.6 | 54.2 | 3 | 7.3 |
| 18 | 63 | 5 | 35.9 | 27.8 | 84 | 56 | 5.6 | 0 | 0 | 7.9 |
| 19 | 43 | 13 | 36.5 | 26.7 | 84 | 56 | 5.8 | 021.8 | 1 | 6.4 |
| 20 | 29 | 25 | 36.1 | 26.9 | 83 | 55 | 5.8 | 004.2 | 1 | 8.1 |
| 21 | 24 | 40 | 40.9 | 28.7 | 79 | 45 | 6.9 | 001.6 | 1 | 8.7 |
| 22 | 18 | 63 | 37.6 | 27.8 | 88 | 61 | 5.8 | 033.8 | 1 | 5.7 |
| 23 | 13 | 88 | 31.7 | 25.6 | 87 | 73 | 2.4 | 67.8 | 4 | 2 |
| 24 | 11 | 119 | 33.1 | 25.8 | 89 | 76 | 2.7 | 65.6 | 4 | 3.8 |
| 25 | 9 | 56 | 31.1 | 25.4 | 90 | 77 | 3.3 | 112.2 | 6 | 2.3 |
| 26 | 4 | 32 | 35.9 | 26.6 | 84 | 56 | 5.3 | 32.4 | 1 | 4.6 |
| 27 | 1 | 31 | 36.7 | 27.5 | 76 | 48 | 6.1 | 0 | 0 | 6.8 |
| 28 | 0 | 17 | 36.7 | 26.5 | 84 | 56 | 5.2 | 81.2 | 4 | 4.8 |
| 29 | 0 | 17 | 35.7 | 26.1 | 89 | 60 | 3.9 | 44.4 | 3 | 4.1 |
| 30 | 0 | 13 | 32.4 | 26.2 | 87 | 65 | 2.6 | 32.2 | 2 | 1.7 |

| | | | | | | | | | | |
|----|----|----|------|------|----|----|-------|----|-----|-----|
| 31 | 0 | 20 | 35.5 | 25.9 | 82 | 50 | 17.0 | 1 | 3.8 | 4.6 |
| 32 | 0 | 10 | 34.8 | 25.6 | 87 | 73 | 106.8 | 2 | 5 | 3.6 |
| 33 | 0 | 13 | 32.7 | 26.1 | 88 | 69 | 87.0 | 3 | 4.9 | 3.7 |
| 34 | 0 | 17 | 35 | 25.3 | 87 | 63 | 80.4 | 3 | 5.3 | 4.2 |
| 35 | 0 | 10 | 32.9 | 26.3 | 87 | 67 | 16.2 | 1 | 3.9 | 2.8 |
| 36 | 0 | 21 | 34.9 | 26 | 89 | 63 | 71.2 | 3 | 3.1 | 3.1 |
| 37 | 0 | 17 | 33.2 | 25.1 | 92 | 76 | 185.0 | 5 | 2.6 | 2.7 |
| 38 | 0 | 13 | 32.9 | 26.3 | 90 | 68 | 08.8 | 01 | 3.4 | 2.6 |
| 39 | 0 | 18 | 35.1 | 25.1 | 90 | 68 | 27.4 | 2 | 5.5 | 3.4 |
| 40 | 0 | 11 | 34.6 | 25.9 | 89 | 59 | 2.8 | 1 | 5.6 | 3.2 |
| 41 | 0 | 10 | 36.8 | 24.6 | 84 | 51 | 0 | 0 | 6.7 | 3.8 |
| 42 | 0 | 11 | 35.2 | 25.1 | 89 | 67 | 16.4 | 2 | 6.1 | 3.7 |
| 43 | 0 | 8 | 35.1 | 24.4 | 85 | 48 | 0 | 0 | 6.9 | 4.2 |
| 44 | 0 | 5 | 30.8 | 24 | 89 | 69 | 101.2 | 3 | 4.8 | 2.7 |
| 45 | 0 | 9 | 31.8 | 23.9 | 81 | 54 | 0 | 0 | 6.1 | 2.5 |
| 46 | 0 | 3 | 30.9 | 21.9 | 85 | 58 | 37 | 1 | 5.3 | 3.4 |
| 47 | 0 | 3 | 30.9 | 23.3 | 85 | 55 | 3.6 | 1 | 5.2 | 3.4 |
| 48 | 0 | 3 | 31.3 | 21.7 | 84 | 54 | 0 | 0 | 4.3 | 3.1 |
| 49 | 0 | 1 | 30.7 | 25.3 | 90 | 47 | 0 | 0 | 6.3 | 3.2 |
| 50 | 0 | 1 | 31.4 | 25.1 | 93 | 58 | 0 | 0 | 7.2 | 3.3 |
| 51 | 0 | 1 | 30.9 | 25.9 | 95 | 58 | 0 | 0 | 6.5 | 3.1 |
| 52 | 0 | 1 | 30.8 | 22.2 | 93 | 45 | 0 | 0 | 7.3 | 3.5 |
| 1 | 0 | 1 | 31.2 | 20.3 | 92 | 50 | 0 | 0 | 6.5 | 3.1 |
| 2 | 3 | 0 | 31 | 19.5 | 92 | 44 | 0 | 0 | 7.3 | 3.3 |
| 3 | 2 | 0 | 30.3 | 21.5 | 86 | 45 | 0 | 0 | 6.3 | 3.3 |
| 4 | 2 | 0 | 29 | 21.5 | 91 | 50 | 0 | 0 | 4.6 | 3.2 |
| 5 | 6 | 0 | 32.8 | 23.2 | 96 | 51 | 0 | 0 | 7.2 | 3.8 |
| 6 | 9 | 0 | 31.7 | 24.5 | 93 | 55 | 0 | 0 | 5.7 | 3.8 |
| 7 | 10 | 0 | 33.2 | 21.7 | 88 | 36 | 0 | 0 | 8.1 | 4.8 |
| 8 | 9 | 0 | 34.9 | 23.1 | 87 | 43 | 0 | 0 | 8.3 | 4.9 |
| 9 | 11 | 0 | 33.1 | 22.9 | 91 | 54 | 0 | 0 | 5.9 | 4.2 |

Table 6b Association between weekly ESB & INB moth catches in pheromone traps and weather parameters

| Weather parameters | Early shoot borer moth catch | Internode borer moth catch |
|--------------------|------------------------------|----------------------------|
| Rainfall | -0.17 | 0.07 |
| No. of rainy days | -0.18 | -0.19 |
| Max. temp (°) C | 0.48 | 0.58 |
| Min. temp (°) C | 0.25 | 0.13 |
| Morning RH (%) | -0.14 | 0.46 |
| Evening RH (%) | -0.48 | 0.60 |
| Evaporation (mm) | 0.70 | -0.22 |

Table 6c Impact of pheromone traps on the incidence of early shoot borer (%DH) up to 120 DAP

| Treatment | Per cent incidence of ESB (%DH) | | | | | Per cent reduction over untreated control |
|--|---------------------------------|-----------|-----------|------------|--------------------------|---|
| | at 30 DAP | at 60 DAP | at 90 DAP | at 120 DAP | Cumulative up to 120 DAP | |
| Plot with pheromone traps @25 traps/ha | 3.48 | 1.33 | 3.99 | 0 | 9.08 | 72.04 |
| Plot without pheromone traps | 5.71 | 22.97 | 14.33 | 0 | 32.48 | - |

Table 6d Impact of pheromone traps on the incidence of internode borer, cane yield and per cent sucrose

| Treatment | Internode borer (%) | | | Per cent sucrose (%) | Cane yield (t/ha) | Per cent increase over control | Cost Benefit ratio |
|---------------------------------------|---------------------|----------|---|----------------------|-------------------|--------------------------------|--------------------|
| | Incidence | Intensit | Per cent reduction over untreated control | | | | |
| Plot with pheromone traps @10traps/ac | 28.00 | 3.99 | 49.6 | 20.00 | 82.44 | 7.34 | 1: 1.25 |
| Plot without pheromone traps | 55.56 | 16.40 | - | 19.20 | 76.80 | - | 1: 1.00 |

- Expt No.6** : **Project E 37**
- 1. Title** : **Bioefficacy of new insecticides for the control of sugarcane early shoot borer**
- 2. Objective** : To find out effective strategy for the management of sugarcane early shoot borer.
- 3. Year of start** : **2013-14**
- 4. Location** : **Regional Agricultural Research Station, Anakapalle**
- 5. Project leader and her Associates** : Dr. B. Bhavani, Senior Scientist (Entomology)
- 6 Experimental detail** :
- a. Design** : RBD
- b. Plot size** : 6 X 0.9m X6R (Gross plot size)
- c. Variety** : 93 A 145 (Co A 99082)
- d. Date of Planting** : 15/02/2015
- e. Date of harvesting** : 30/01/2016
- f. Treatments** : 8

1. Soil application of fipronil 0.3G @ 25 kg/ha at the time of planting and 60 DAP (75 g a.i./ha)
2. Soil application of chlorantraniliprole 0.4G @ 22.5kg/ha at the time of planting and 60 DA (90g a.i./ha)
3. Spraying of chlorantraniliprole 18.5 SC @ 375 ml/ha at 30 and 60 DAP (70 g a.i./ha)
4. Spraying of spinosad 45SC @ 90 ml/ha at 30 and 60DAP (40 g a.i./ha)
5. Spraying of flubendiamide 39.35SC @ 125 ml/ha at 30 and 60 DAP (50 g a.i./ha)
6. Soil application of phorate 10 G @ 15 kg/ha at the time of planting and 60 DAP (1500 g a.i./ha)
7. Soil application of carbofuran 3G @ 33kg/ha at the time of planting and 60 DAP (1000 g a.i./ha)
8. Untreated control.

7. Observation recorded:

- a. Data on germination recorded at 30 DAP
- b. Incidence of early shoot borer recorded at 30, 60, 90 and 120 days after planting.
- c. Tillering per cent at 120 DAP
- d. Data on single cane weight, cane height & girth were recorded.
- e. Data on cane yield and juice quality were also recorded at harvest.

8. Results of the previous year:

During 2013-14, among the test insecticides, soil application of chlorantraniliprole 0.4G (Ferterra) @ 22.5kg/ha at the time of planting and 60 DAP recorded less cumulative incidence of ESB (14.86%) as compared to untreated control (43.15%). Highest cane yield was recorded in chlorantraniliprole 0.4G @ 22.5kg/ha (99.10t/ha) followed by fipronil 0.3G @ 25kg/ha (97.76t/ha) and flubendiamide 20 SC @ 250ml/ha (97.64t/ha).

During 2014-15, incidence of early shoot borer (11.47%) was significantly reduced in chlorantraniliprole 0.4G @ 22.5 kg/ha applied at the time of planting and 60 DAP as compared to untreated control (32.67%) which was statistically on par with chlorantraniliprole 18.5SC @ 375ml/ha (12.76%), fipronil 0.3G @ 25 kg/ha (13.47%) and flubendiamide 20 SC @ 250 ml/ha (15.00%). Highest cane yield was recorded in chlorantraniliprole 0.4G @ 22.5kg/ha (71.04 t/ha) and it was statistically on par with chlorantraniliprole 18.5SC @ 375ml/ha (69.82 t/ha) and flubendiamide 20SC @ 250 ml/lt (70.10 t/ha) and fipronil (68.96t/ha) as compared to untreated control (63.20t/ha). Among the treatments soil application of chlorantraniliprole 0.4G @ 22.5kg/ha at planting and 60 days after planting found effective against early shoot borer and recorded highest cane yield.

9. Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc.,

During 2015-16, among eight treatments, soil application of chlorantraniliprole 0.4G @ 22.5kg/ha (2.31%DH), fipronil 0.3G @ 25kg/ha (5.40 %DH) at planting and 60 days after planting (DAP) significantly reduced the incidence of early shoot borer compared to untreated control (30.66%) and were statistically at par with each other.

The next best treatments in reducing the incidence of early shoot borer were spraying of chlorantraniliprole 18.5SC @ 375ml/ha (7.15%) and flubendiamide 39.35SC @ 125ml/ha (7.52%) at 30 and 60 DAP. Highest number of millable canes were recorded in soil application of chlorantraniliprole 0.4 G @ 22.5kg/ha (58951/ha) compared to untreated control (52778/ha). Highest cane yield was recorded in chlorantraniliprole 0.4G @ 22.5kg/ha (86.46 t/ha) compared to untreated control (75.65t/ha) and was statistically at par with fipronil 0.3G @ 25kg/ha (85.82 t/ha), chlorantraniliprole 18.5SC @ 375ml/ha (84.92 t/ha) and flubendiamide 39.35SC @ 125ml/ha (84.00/ha). However, no significant differences were observed among different treatments in case of growth parameter (Table 7a & 7b).

Table 7a. Bio-efficacy of new insecticides on the incidence of early shoot borer

| Treatment | Per cent incidence of Early shoot borer (%DH) | | | | |
|--|---|--------|--------|--------|-------------------------|
| | 30 DAP | 60 DAP | 90 DAP | 120DAP | Cumulative upto 120 DAP |
| T1- Fipronil 0.3G @ 25 kg/ha | 2.24 | 1.64 | 0.26 | 0 | 5.40 |
| T2- Chlorantraniliprole 0.4 G @ 22.5kg/ha | 1.04 | 0.55 | 0.36 | 0 | 2.31 |
| T3- Chlorantraniliprole 18.5 SC @ 375ml/ha | 2.88 | 1.94 | 0.48 | 0 | 7.15 |
| T4- Spinosad 45SC @ 90 ml/ha | 3.08 | 4.02 | 0.59 | 0 | 10.61 |
| T5- Flubendiamide 39.35 SC @ 125ml/ha | 2.80 | 2.59 | 0.85 | 0 | 7.52 |
| T6- Phorate 10G @ 15 kg/ha | 2.26 | 3.38 | 2.67 | 0 | 11.73 |
| T7- Carbofuran 3G @ 33 kg/ha | 4.83 | 4.51 | 1.34 | 0 | 11.50 |
| T8- Untreated control | 10.32 | 5.46 | 1.28 | 0 | 30.66 |
| SEd | 0.80 | 0.53 | 0.16 | NS | 1.72 |
| CD (p=0.05) | 1.72 | 1.17 | 0.36 | | 3.7 |
| CV % | 26.72 | 23.05 | 27.94 | | 23.5 |

Table 7b. Impact of new insecticides on the growth parameters , per cent sucrose , NMC and cane yield

| Treatment | Incidence of internode borer | Cane height (mt) | Cane weight (kg/cane) | Cane girth (cm) | Juice sucrose (%) | NMC/ha 000'/ha | Cane yield (MT/ha) |
|--|------------------------------|------------------|-----------------------|-----------------|-------------------|----------------|--------------------|
| T1- Fipronil 0.3G @ 25 kg/ha | 60.00 | 3.06 | 1.53 | 2.49 | 19.44 | 55967 | 85.63 |
| T2- Chlorantraniliprole 0.4 G @ 22.5kg/ha | 56.33 | 2.91 | 1.47 | 2.48 | 18.57 | 58951 | 86.66 |
| T3- Chlorantraniliprole 18.5 SC @ 375ml/ha | 69.26 | 3.03 | 1.50 | 2.45 | 18.39 | 56613 | 84.92 |
| T4- Spinosad 45SC @ 90 ml/ha | 63.33 | 3.03 | 1.50 | 2.38 | 18.55 | 52263 | 78.40 |
| T5- Flubendiamide 39.35 SC @ 125 ml/ha | 51.82 | 3.05 | 1.43 | 2.45 | 18.74 | 58745 | 84.00 |
| T6- Phorate 10G @ 15 kg/ha | 63.33 | 2.87 | 1.40 | 2.31 | 18.63 | 55144 | 77.20 |
| T7- Carbofuran 3G @ 33 kg/ha | 60.00 | 2.97 | 1.40 | 2.45 | 18.75 | 55453 | 77.63 |
| T8- Untreated control | 70.61 | 3.01 | 1.43 | 2.45 | 18.86 | 52778 | 75.65 |
| SEd | NS | NS | NS | NS | NS | 5.23 | 8.25 |
| CD(p=0.05) | | | | | | 3.50 | 3.83 |
| CV % | | | | | | 11.20 | 17.69 |

