

### 3. ENTOMOLOGY SECTION

As per approved programme of research work for the year 2014-15, experiments were conducted on Population Dynamics of cotton pest, Monitoring of bollworm and other lepidopterous insect through sex pheromones and light traps, Studies on Host Plant Resistance/tolerance towards different cotton Pests, Testing of Bt. and conventional cotton varieties against sucking and bollworm insect pests under unsprayed conditions, Studies on Mealy bug, National Coordinated Varietal Trials (NCVT), Screening of insecticides against cotton pests and coordination with other sections and organizations regarding the proper management of insect pests.

#### 3.1 Studies on Population Dynamics of cotton pest

The main objective of this trial was to monitor the activities of major sucking and bollworm insect pest complex and their natural enemies mainly predators. Experiment was conducted on one acre area under unsprayed condition in non replicated block. Variety CRIS-134 was planted on 30<sup>th</sup> May, 2014. All recommended cultural practices and inputs like thinning; inter-culturing, fertilizer and irrigation were applied as per requirement to the crop. Population of sucking insect pest was recorded on 20 leaves from the top, Middle and bottom portion of the plant at randomly. Bollworm pest complex and natural enemies were recorded by common stick method from four sampling points of 52.25” each, totaling of 209”, thus making 1/1000 of an acre.

The sucking insect pest i.e., thrips, jassid and whitefly are the major insect pests, attacking the crop at the early stage. Data are presented in Fig 3.1 showed that thrips started the emergence with the population of 0.13/leaf during the 2<sup>nd</sup> week of June and reached at economic threshold level during 1<sup>st</sup> week of August with the population 9.13/leaf. Jassid started its activities from 3<sup>rd</sup> week of June and its maximum population 1.87/leaf was observed in the 1<sup>st</sup> week of August. Whitefly appeared with 0.13/leaf during 4<sup>th</sup> week of June and its peak population 1.80/leaf was noted during 1<sup>st</sup> week October. Maximum population of thrips, jassid and whitefly was 9.13, 1.87 and 1.80/leaf was recorded during 1<sup>st</sup> week of August and 1<sup>st</sup> week of October when temperature was 36.0 °C and 35.7 °C and relative humidity % were 60.1% and 61.3% respectively.

Spotted bollworm started to damage the immature and mature fruiting parts with 0.50 % and 0.91 % during 1<sup>st</sup> and 3<sup>rd</sup> week of August, respectively. Maximum boll damage (1.36%) was recorded in immature when maximum temperature and relative humidity %age was 36.1 °C and 62.6% during 3<sup>rd</sup> week of August. Similarly maximum damage (6.64%) in mature fruiting parts were observed during 4<sup>th</sup> week of September when maximum temperature and relative humidity %age were 36.8 °C and 60.9% respectively.

Natural enemies (Predators) of cotton insect pests appeared in 3<sup>rd</sup> week of June, when thrips started to damage the crop. Maximum population of predators (102,000/acre) was recorded during 2<sup>nd</sup> week of August when maximum temperature and relative humidity was 37.0 °C and 61.9 % age, respectively. The main predators i.e., *Orius*, *Chrysoperla*, *Zanchius*, *Campylomma* and spider were recorded, however the *Orius* bug population was more the among predators during crop season. Crop was picked on 18-10-2014 and the total seed cotton yield of 1633 kg ha<sup>-1</sup> was obtained from unsprayed plot.

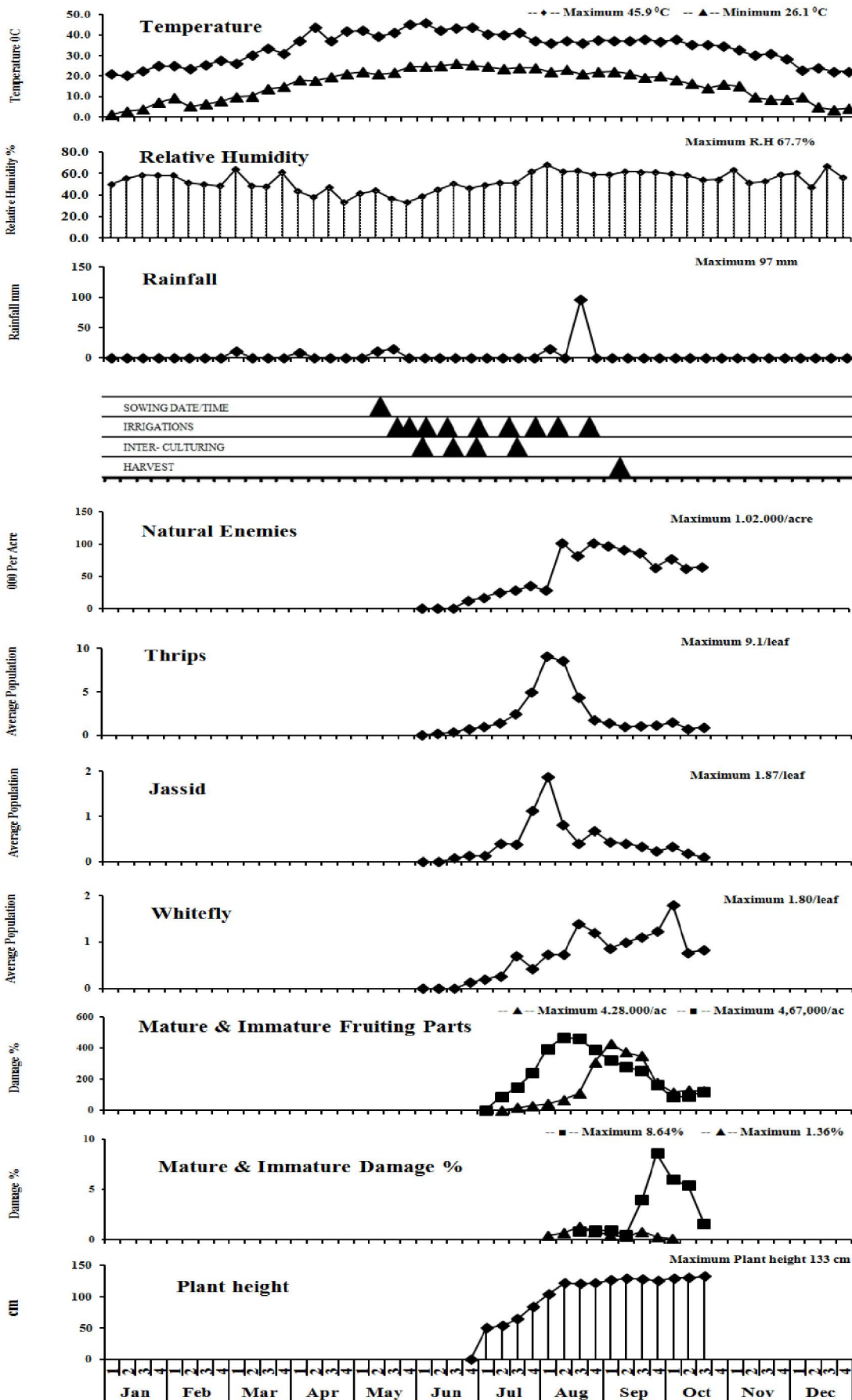


Fig.3.1: Cotton Agro-Eco-System during the year 2014-15.

### **3.2 Monitoring of bollworm and armyworm using Sex pheromone traps**

The adult male moth population of main *Lepidopterous* pest of cotton crop was being monitored throughout the year with installation of sex pheromone traps to observe the activity of the insects, daily observations were recorded. Funnel traps were installed in the field throughout the crop season and lure were changed after every three week intervals. Population of moth catches is presented in the Fig 3.2.

#### **3.2.1 Pink bollworm, *Pectinophora gossypiella***

Male moth activity of *Pectinophora gossypiella* was observed very low in pheromone traps from 1<sup>st</sup> week of January to 3<sup>rd</sup> week of May. Whereas from June to August their activities disappeared and once again then activities remained time from 1<sup>st</sup> week of September to 4<sup>th</sup> week of December. Highest moth catches 8.50/trap was recorded during 4<sup>th</sup> week of September.

#### **3.2.2 Spiny bollworm, *Earias insulana***

Male moth catches of spiny bollworm activities appeared during 1<sup>st</sup> week of January to 2<sup>nd</sup> week of May whereas its maximum population was 5.50/trap during 3<sup>rd</sup> week of September.

#### **3.2.3 Spotted bollworm, *Earias vittella***

The activity male moth of spotted bollworm was also started from 1<sup>st</sup> week of January to 1<sup>st</sup> week of May and disappeared from 1<sup>st</sup> week of June to 2<sup>nd</sup> week of July and again appeared from 3<sup>rd</sup> week of July to 4<sup>th</sup> week December. Maximum male moth catches was 6.70/trap note during 4<sup>th</sup> week of September.

#### **3.2.4 American bollworm, *Helicoverpa armigera***

The activity male moth of American bollworm started its activities from 1<sup>st</sup> week of March to 1<sup>st</sup> week of September whereas its activity was very low throughout the year however maximum number of moth catches was 0.90/trap observed in 1<sup>st</sup> week of June.

#### **3.2.5 Army worm *Spodoptera litura***

The population male moth army worm started to appear from 1<sup>st</sup> week of June to 2<sup>nd</sup> week of August. Whereas the maximum moth catches was 0.4/trap noted during 2<sup>nd</sup> week of June and 1<sup>st</sup> week of August.

### **3.3 Monitoring, moth population of *Lepidopterous* pests through Light traps**

The adult population of main *Lepidopterous* insect pests of cotton is being monitored throughout year with the installation of Mercury Bulb fitted in light trap to note its activity, daily observation were recorded and weekly moth population of *Earias vittella*, *Earias insulana*, *Helicoverpa armigera* and *Spodoptera litura* were calculated and presented in Fig 3.3.

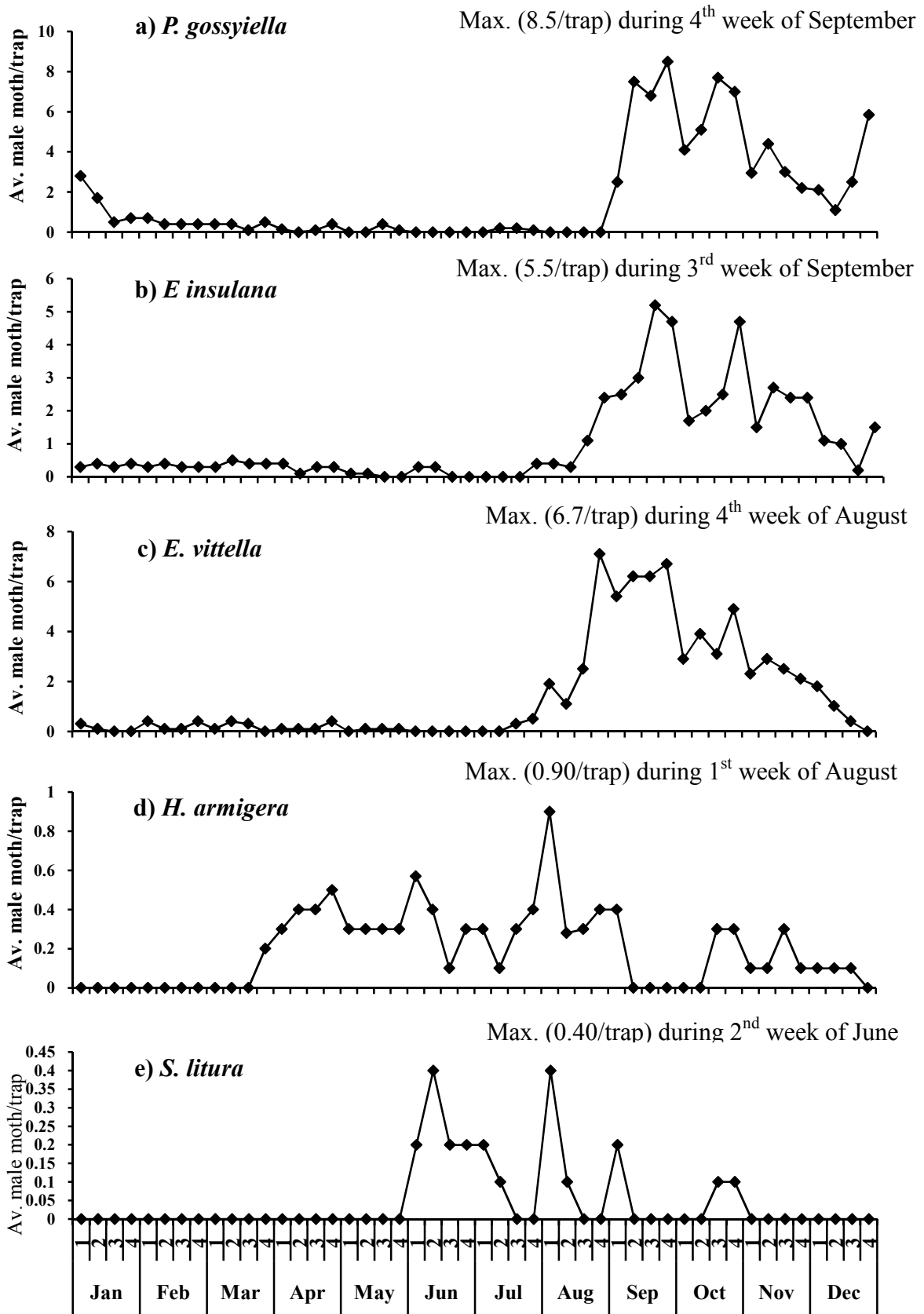


Fig. 3.2: Average weekly population of moth catches of *lepidopterous* insect pests caught in Sex Pheromone traps at CCRI-Sakrand, during 2014-15.

### 3.3.1 Spiny bollworm, *Earias insulana*

The moth catches of spiny bollworm was remained active from 1<sup>st</sup> week of January to 1<sup>st</sup> week of April but it was very low during the period. Maximum moth catches was 1.0/night in observed during 2<sup>nd</sup> week of December.

### 3.3.2 Spotted bollworm, *Earias vittella*

The activity of this species was also remained zero from 1<sup>st</sup> week of January to 4<sup>th</sup> week o July. Afterwards moth catches started to catch in the trap from 1<sup>st</sup> week of August and disappeared during 3<sup>rd</sup> and 4<sup>th</sup> of August and again started with low population from 3<sup>rd</sup> week of September. Maximum number of adult moths was 0.5/night in trap was recorded during 4<sup>th</sup> week of September.

### 3.3.3 American bollworm, *Helicoverpa armigera*

Moth catches of *H. armigera* started its activity from April to August. Maximum number of moth catches was 0.40/night recorded during 1<sup>st</sup> week of August.

### 3.3.4 Army worm, *Spodoptera litura*

The moth catches of *Spodoptera litura* started its activities from 1<sup>st</sup> weeks of June to 2<sup>nd</sup> week of July and from 2<sup>nd</sup> to 4<sup>th</sup> week of November. Maximum moth catches was 0.3/night recorded during 2<sup>nd</sup> week of June.

## 3.4 Studies on Host Plant Resistance/ tolerance towards different cotton Pests

The main objective of this experiment was to evaluate tolerance/susceptibility of new strains against insect pests. Two promising strains CRIS-533 and CRIS-585 were compared with standard CRIS-342. Experiment was carried out in three sets Set-1, sprayed against sucking insect pests, Set-2, Sprayed against bollworm and Set-3, unsprayed for all pests.

The experiment was laid out in Randomized Complete Block Design with three replications and plot size was 30' x 30'. Crop was planted sown on 30-05-2014 and picked on 01-10-2014. Pest population was recorded weekly intervals. For sucking insect pests, observations were recorded from 15 leaves per treatment randomly selected from top, middle and bottom portion of plant, whereas for bollworm the common stick method was adopted by using stick sample of 52.25'' per treatment. In Set-1, crop was sprayed once a season because after 1<sup>st</sup> spray sucking pest did not rebuilt. For bollworm, the spray was not done because in the season bollworm did not reach at economic threshold level (ETL).

In set Set-I, thrips reached at economic threshold level during 1<sup>st</sup> week of August. Crop was sprayed against sucking insect pest on 08-08-2014 with Acephate 75 SP @ 250 gm/acre + Diafenthuran 50 SL @ 200 ml/acre after first spray the pest did not rebuilt again. Table 3.1 indicates that CRIS- 342 produced maximum seed cotton yield with 3548 kg ha<sup>-1</sup> followed by CRIS-533 (3229 kg ha<sup>-1</sup>) and CRIS-585 (2710 kg ha<sup>-1</sup>). There was very low infestation of bollworm was recorded in all strains in Set-II, therefore the spray was not done. Maximum bollworm infestation was 6.85 % recorded on CRIS-342 during 1<sup>st</sup> week of September. Table 3.1 showed that maximum seed cotton yield was (3229 kg ha<sup>-1</sup>) obtained from CRIS-342 followed by CRIS-533 with (3149 kg ha<sup>-1</sup>) and CRIS-585 with (2272 kg ha<sup>-1</sup>).

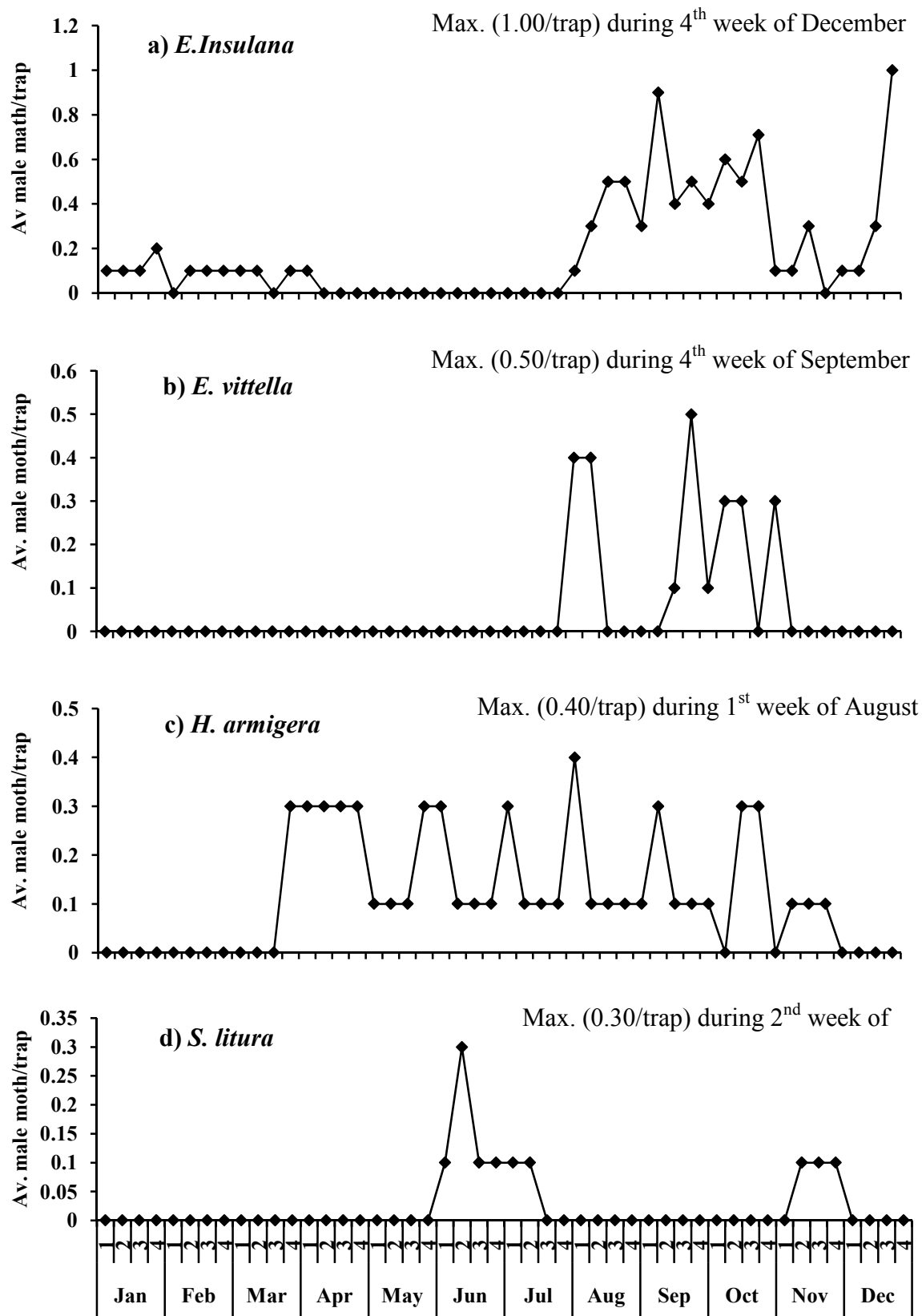


Fig.3.3: Average Weekly population of moth catches of *Lepidopterous* insect caught in light traps at CCRI-Sakrand, during 2014-15.

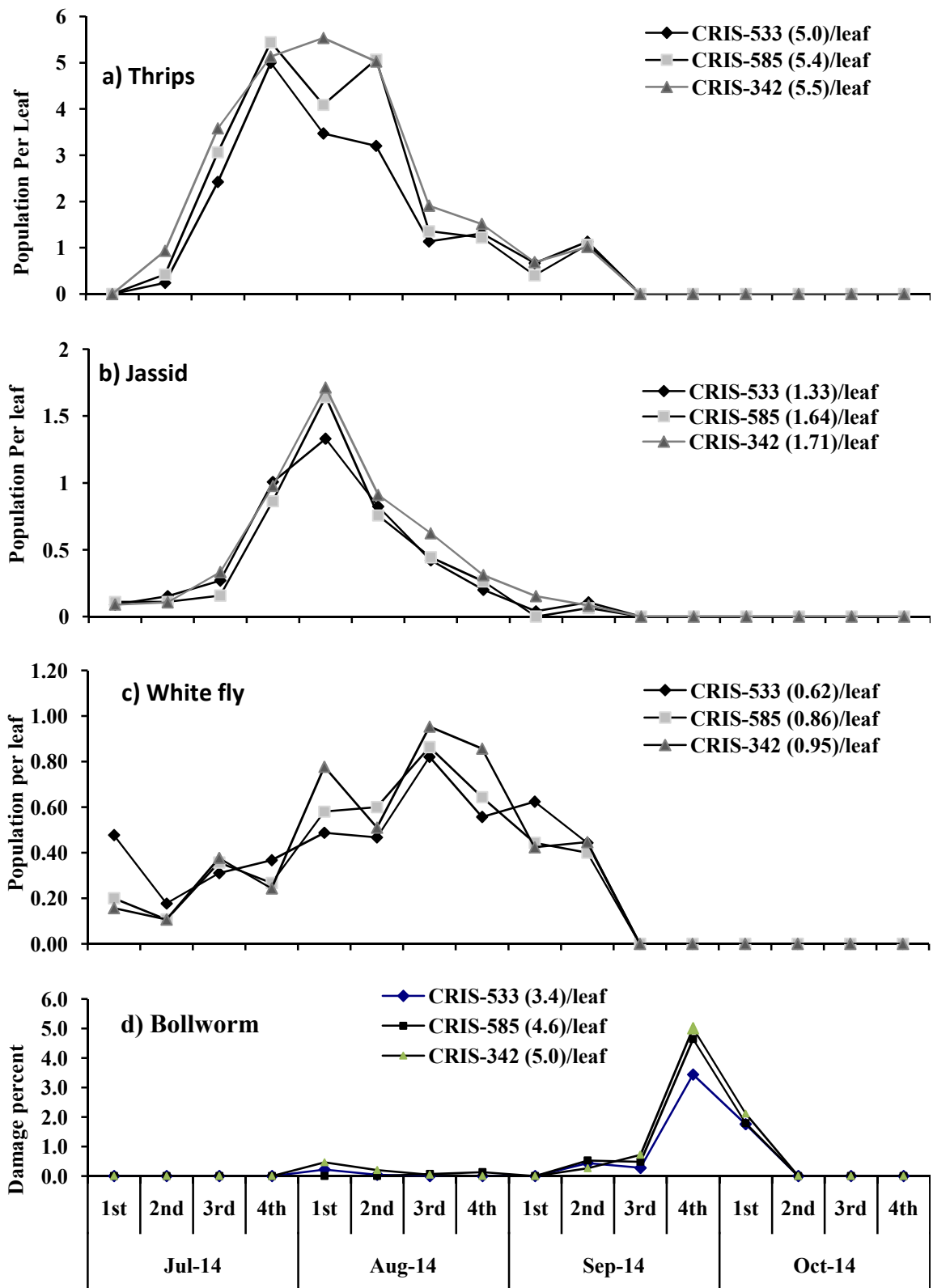


Fig. 3.4: Weekly population of trend of sucking pest per leaf and bollworm damage %age in Set-III recorded from (HPR) trial, unsprayed condition, during 2014.

Set-III (unsprayed) showed that, maximum thrips population was 5.50/leaf recorded from CRIS-342 during 1<sup>st</sup> week of August followed by CRIS-585 (5.40/leaf) and CRIS-533 (5.00/leaf) during 4<sup>th</sup> week of July. Maximum population of jassid was 1.7/leaf recorded during 1<sup>st</sup> week of August. Whitefly was (0.95/leaf) noted from CRIS-342 during 4<sup>th</sup> week of August. Bollworm infestation remained very low till harvesting of the crop. However maximum bollworm damage 5.00% was recorded from CRIS-342 during 4<sup>th</sup> week of September. In this set maximum seed cotton yield of 3149 kg ha<sup>-1</sup> was produced by CRIS-342 followed by CRIS-533 (2790 kg ha<sup>-1</sup>) and CRIS-585 (2710 kg ha<sup>-1</sup>).

**Table-3.1: Average insect pest population and Seed cotton yield in host plant resistance of different cotton pests, during 2014**

Sr. No.	Name of varieties	Average population of sucking insect pests (systems)			Bollworm damage %	Seed cotton yield Kg ha <sup>-1</sup>
		Thrips	Jassid	Whitefly		
<b>Set-I= Plant protection against sucking insect pests</b>						
V1	CRIS-533	1.67	0.35	0.49	0.23	3229
V2	CRIS-585	1.56	0.39	0.43	0.43	2710
V3	CRIS-342	2.19	0.43	0.46	0.64	3548
<b>LSD(P&lt;0.05)</b>		<b>0.42</b>	<b>N.S</b>	<b>N.S</b>	<b>N.S</b>	<b>N.S</b>
<b>Set-II= Plant protection against boll worm</b>						
V1	CRIS-533	1.84	0.43	0.44	1.09	3149
V2	CRIS-585	2.22	0.44	0.47	0.80	2272
V3	CRIS-342	2.41	0.46	0.49	1.34	3229
<b>LSD(P&lt;0.05)</b>		<b>N.S</b>	<b>N.S</b>	<b>N.S</b>	<b>N.S</b>	<b>N.S</b>
<b>Set-III= Unsprayed against all pests</b>						
V1	CRIS-533	1.86	0.49	0.47	0.69	2790
V2	CRIS-585	2.21	0.47	0.45	0.85	2710
V3	CRIS-342	2.53	0.56	0.49	0.98	3149
<b>LSD(P&lt;0.05)</b>		<b>N.S</b>	<b>0.03</b>	<b>N.S</b>	<b>N.S</b>	<b>N.S</b>

### 3.5 Testing of Bt. and conventional cotton varieties against sucking and bollworm insect pest under unsprayed conditions

The main objective of the trial was to determine the pest population level in different cotton varieties against different insect pests. Four Bt. Varieties (Bt.CRIS-603, Bt. CRIS- 600, Bt.CRIS-508 and IR-3701) and four conventional varieties (CRIS-533, CRIS-510, CRIS-129 and CRIS-342) were sown on 24-5-2014. The trial was conducted under unsprayed condition in Complete Randomized Block Design with three replications. The plot size was 30'x30' per treatment. All recommended cultural practices i.e., fertilizer, inter culturing and irrigations were applied according to the requirement of the crop. The population of sucking insect was monitored from 20 leaves selected randomly from top, middle and bottom portion of the plant in each treatment at weekly interval and the bollworm damage percent was recorded by common stick method. The crop was picked on 01-10-2014.



**Table-3.2: Mean pest population of sucking insect pest and bollworm damage percent and seed cotton yield**

Sr. No	Varieties	Mean population/leaf			Bollworm damage %	Predators 000/acre	Yield kg ha <sup>-1</sup>
		Thrips	Jassid	Whitefly			
1.	Bt.CRIS-603	3.89	1.18	1.19	0.27	39	2311
2.	Bt. CRIS-600	4.10	1.33	1.40	0.36	36	2471
3.	Bt.CRIS-508	4.04	1.37	1.55	0.47	31	1953
4.	IR-3701	3.87	1.44	1.71	0.42	35	1873
5.	CRIS-533	3.69	0.89	1.32	3.02	29	2391
6.	CRIS-510	4.22	1.13	1.13	3.19	35	2032
7.	CRIS-129	3.82	0.96	1.09	2.87	38	2311
8.	CRIS-342	4.33	0.99	1.13	3.38	33	2152
<b>LSD(P&lt;0.05)</b>		<b>N.S</b>	<b>0.32</b>	<b>N.S</b>	<b>1.08</b>	<b>N.S</b>	<b>N.S</b>

Table- 3.2 shows that maximum population of thrips (4.33/leaf) was recorded in CRIS-342 and minimum (3.69/leaf) was noted in CRIS-533. In case of jassid maximum population (1.44/leaf) was recorded in IR-3701 followed by Bt.CRIS-508 (1.37), Bt.CRIS-600 (1.33), Bt.CRIS-603 (1.18), CRIS-342 (0.99), CRIS-129 (0.99) and CRIS-533 (0.89/leaf) respectively. The population of whitefly remained very low throughout crop season. However, maximum whitefly population (1.71/leaf) was recorded in IR-3701. Bollworm damage was remained very low on all testing varieties; however maximum bollworm damage percent 3.38 was recorded in CRIS-342 and very low bollworm damage was observed in all Bt. Strains. Maximum population of predators (39,000/acre) was recorded from Bt.CRIS-603. Highest seed cotton yield (2471kg ha<sup>-1</sup>) was recorded from Bt.CRIS-600 followed by CRIS-533 (2391 kg ha<sup>-1</sup>), Bt.CRIS-603 (2311 kg ha<sup>-1</sup>), CRIS-129 (2311 kg ha<sup>-1</sup>), CRIS-342 (2152 kg ha<sup>-1</sup>), Bt.CRIS-508 (1953 kg ha<sup>-1</sup>) and IR-3701 (1873 kg ha<sup>-1</sup>).

### 3.6 Studies on Mealy Bug

The objective of trial was to determine the population dynamics of Mealy bug on cotton and alternate host plants throughout the crop season. Weekly observation was recorded by counting 15 cm long terminal shoot per plant. The data is presented in Table 3.3 and Fig 3.4 which indicated that the attack of mealy bug was remained very low throughout the crop season on cotton as well as on alternate hosts. Population of mealy bug appeared on cotton from March to December while on China rose their attack remained throughout the year. Maximum population 223/terminal shoot was recorded on Cotton during 1<sup>st</sup> week of September followed by China rose (150/ terminal shoot) during 2<sup>nd</sup> week of August, Okra (133/ terminal shoot) during 1<sup>st</sup> week of September and Holly hock (14/ terminal shoot) during 4<sup>th</sup> week of July.

**Table-3.3: Weekly Mealy bug population on different alternate hosts at Sakrand during 2014**

Month	Cotton	Okra	China rose	Holly hock
<b>January</b>				
1 <sup>st</sup> week	0	0	0	0
2 <sup>nd</sup> week	0	0	0	0
3 <sup>rd</sup> week	13	0	16	0
4 <sup>th</sup> week	10	0	20	0
<b>February</b>				
1 <sup>st</sup> week	12	0	18	0
2 <sup>nd</sup> week	10	0	12	0
3 <sup>rd</sup> week	15	0	12	0
4 <sup>th</sup> week	13	0	10	0
<b>March</b>				
1 <sup>st</sup> week	16	0	13	0
2 <sup>nd</sup> week	10	0	14	0
3 <sup>rd</sup> week	13	0	17	0
4 <sup>th</sup> week	15	0	11	0
<b>April</b>				
1 <sup>st</sup> week	19	0	12	0
2 <sup>nd</sup> week	17	2	9	0
3 <sup>rd</sup> week	16	3	8	0
4 <sup>th</sup> week	16	8	10	0
<b>May</b>				
1 <sup>st</sup> week	15	12	16	0
2 <sup>nd</sup> week	18	15	18	0
3 <sup>rd</sup> week	30	15	18	0
4 <sup>th</sup> week	18	13	35	0
<b>June</b>				
1 <sup>st</sup> week	15	10	22	0
2 <sup>nd</sup> week	13	15	20	0
3 <sup>rd</sup> week	10	13	15	2
4 <sup>th</sup> week	11	15	12	6
<b>July</b>				
1 <sup>st</sup> week	15	16	13	0
2 <sup>nd</sup> week	20	18	15	0
3 <sup>rd</sup> week	80	12	31	0
4 <sup>th</sup> week	148	15	44	0
<b>August</b>				
1 <sup>st</sup> week	181	48	95	2
2 <sup>nd</sup> week	185	25	150	5
3 <sup>rd</sup> week	128	18	129	12
4 <sup>th</sup> week	213	62	128	14
<b>September</b>				
1 <sup>st</sup> week	223	133	110	0
2 <sup>nd</sup> week	210	114	71	0
3 <sup>rd</sup> week	176	110	50	3
4 <sup>th</sup> week	149	76	90	0
<b>October</b>				
1 <sup>st</sup> week	205	64	41	0
2 <sup>nd</sup> week	190	31	48	0
3 <sup>rd</sup> week	121	20	54	0
4 <sup>th</sup> week	106	0	54	0
<b>November</b>				
1 <sup>st</sup> week	92	0	32	0
2 <sup>nd</sup> week	69	0	37	0
3 <sup>rd</sup> week	54	0	35	0
4 <sup>th</sup> week	50	0	33	0
<b>December</b>				
1 <sup>st</sup> week	51	0	46	2
2 <sup>nd</sup> week	30	0	26	4
3 <sup>rd</sup> week	10	0	30	9
4 <sup>th</sup> week	6	0	18	9

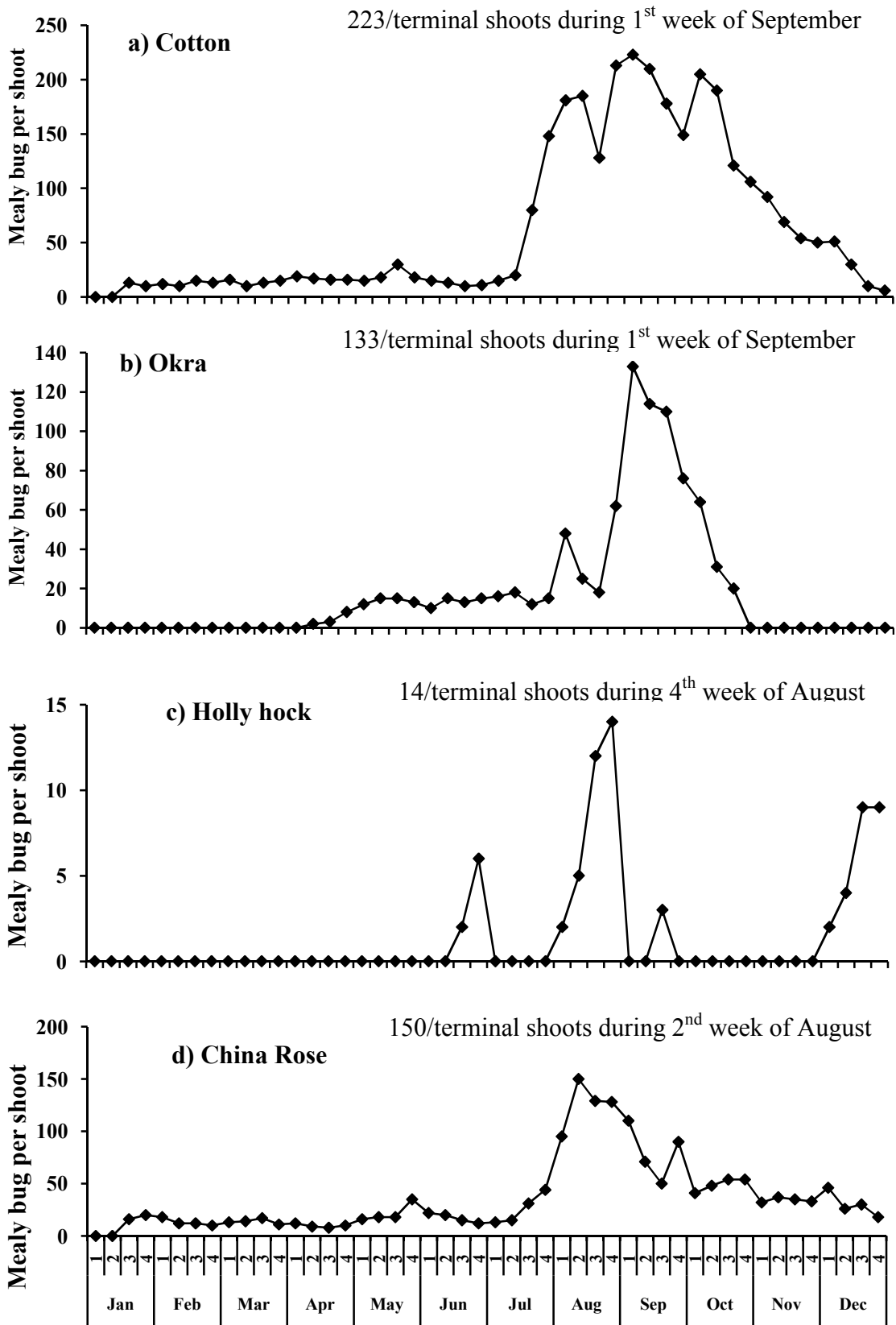


Fig. 3.5: Weekly population of Mealy bug on cotton and other host plants at CCRI-Sakrand during 2014.

### 3.7 Status of pink bollworm infestation and larval survival in left over bolls

The objective of the experiment was to note the survival of pink bollworm larvae in the left over bolls. In Sindh most of growers planted Bt., varieties so left over bolls were collected from Bt. varieties. Mature green bolls were collected from different location in the month of September and October during survey of cotton crop in Sindh and brought them in the laboratory for presence of mines and larvae.

Table-3.4 indicates that maximum number of mines (28.42) were recorded from bolls collected from district Mirpurkhas followed by Umerkot (21.53), Hyderabad (18.33), Badin (18.27), Shaheed Benazirabad (10.31), Saghar (9.19) and Matiyari (6.15).

Similarly highest live larvae % of pink bollworm (9.12) was noted bolls collected from Mirpurkhas district followed by Badin (8.97), Umerkot (8.61), Hyderabad (6.67), Shaheed Benazirabad (5.65) and minimum live larvae % (0.40) from Thatta.

**Table-3.4: Pink bollworm infestation and larval survival percentage in left over bolls of Bt. Varieties in Sindh during 2014-15**

Sr. No.	District	Variety/ Strains	No. of Bolls	No. of Bollworm	Pink bollworm larvae	Mines/ damage %	Pink bollworm larvae %
1.	Umerkot	Bt.	209	45	18	21.53	8.61
2.	Mirpurkhas	Bt.	285	81	26	28.42	9.12
3.	Sanghar	Bt.	272	25	7	9.19	2.53
4.	Tando Allahyar	Bt.	258	12	5	4.65	1.93
5.	Tando Muhammad Khan	Bt.	300	12	5	4.00	1.67
6.	Badin	Bt.	301	55	27	18.27	8.97
7.	Thatta	Bt.	250	4	1	1.60	0.40
8.	Hyderabad	Bt.	120	22	8	18.33	6.67
9.	Matiyari	Bt.	276	17	6	6.15	2.17
10.	Shaheed Benazirabad	Bt.	407	42	23	10.31	5.65
11.	Nauosharoferoze	Bt.	892	14	6	1.56	0.67
12.	Khairpur	Bt.	775	15	5	1.93	0.64
13.	Sukkur	Bt.	826	14	4	1.69	0.48
14.	Ghotki	Bt.	325	11	3	3.38	0.92

### 3.8 National Coordinated Varietal Trials (NCVT)

The main objective of this trial was to test the tolerance to sucking insect pests and bollworms in different promising Bt. and non-Bt. Strains developed by different institutes of Pakistan. The trial was conducted by Plant breeding Sections in four sets i.e., Set-A, Set-B, Set-C and Set-D. The Entomology section recorded pest population. In early season the crop was damaged by termites, Imidacloprid @ 500 gm/acre applied with irrigation water during 3<sup>rd</sup> week of July. The population of thrips and jassid reached on economic threshold level during 4<sup>th</sup> week of July, therefore the crop was sprayed with Acephate 75 SP @ 250 gm + Diafenthuran 50 SC @ 200 ml/acre against thrips and jassid during 2<sup>nd</sup> week of August, 2014.

### 3.8.1 National Coordinated Varietal Trial (Set-A)

In this set, twelve Non Bt. candidate strains were tested with one standard. The crop was planted on 19-5-2014 in randomized complete block design with four replications. The plot size was 30' x 10'. Table 3.4 indicates that Maximum population of thrips (1.45/leaf), Jassid (0.33/leaf), Whitefly (0.88/leaf) and Bollworm were (2.0 %) recorded from DNH-40, CIM-620, IUB-75, and GS-433 respectively.

**Table-3.4: Seasonal mean insect pest population recorded in NCVT (Set-A) at CCRI, Sakrand during 2014-15**

Sr. No.	Strains	Average sucking insect pest population/leaf			Bollworm Damage (%)
		Thrips	Jassid	Whitefly	
1.	CRIS-533	1.31	0.18	0.53	0
2.	TH-112/05	1.25	0.22	0.48	0
3.	BH-177	1.16	0.25	0.58	1.0
4.	MPS-27	1.24	0.18	0.54	0
5.	CRIS-585	1.2	0.26	0.55	1.0
6.	NIAB-414	1.35	0.24	0.48	1.0
7.	CRIS-342 (Std.)	1.26	0.21	0.52	1.0
8.	DNH-40	1.45	0.15	0.44	0
9.	TH-120	1.39	0.26	0.48	1.0
10.	IUB-75	1.42	0.15	0.88	0
11.	CIM-620	1.21	0.33	0.85	0
12.	AA-132	1.41	0.20	0.58	0
13.	GS-433	1.39	0.15	0.76	2.0
<b>LSD(P&lt;0.05)</b>		<b>0.18</b>	<b>0.04</b>	<b>0.08</b>	-

### 3.8.2 National Coordinated Varietal Trial (Set-B)

In Set-B, twenty two Bt. strains were tested with two standards. The crop was sown on 21-5-2014. Table 3.5 showed that the highest population of thrips (1.57/leaf), Jassid (0.33 /leaf) and Whitefly (0.98/leaf) were recorded from Baghdadi, IR-NIBGE-6, and SLH-8 respectively. For bollworms the maximum damage (2.0 %) was noted from SLH-8 and TH-21/09.

**Table- 3.5: Seasonal mean insect pest population recorded in NCVT (Set-B) at CCRI, Sakrand during 2014-15**

Sr. No	Strains	Average sucking insect pest population/leaf			Bollworm Damage (%)
		Thrips	Jassid	Whitefly	
1.	FH-142 (Std-2)	1.52	0.29	0.63	0
2.	IUB-13	1.52	0.23	0.71	0
3.	IR-NIBGE-6	1.31	0.33	0.86	0
4.	FH-Lalazar	1.50	0.30	0.90	1.0
5.	Cyto-177	1.32	0.18	0.71	0
6.	VH-305	1.19	0.25	0.69	0
7.	SLH-8	1.26	0.26	0.98	2.0
8.	BH-184	1.12	0.18	0.73	1.0
9.	MNH-988	1.24	0.30	0.73	0
10.	CIM-616	1.26	0.17	0.76	0
11.	CEMB-66	1.41	0.19	0.60	0
12.	CIM-622	1.35	0.26	0.75	0
13.	CEMB-77	1.30	0.28	0.57	0
14.	IR-NIBGE-7	1.20	0.22	0.80	0
15.	Cyto-178	1.53	0.19	0.71	0
16.	BH-185	1.12	0.29	0.42	0
17.	FH-Noor	1.05	0.16	0.72	0
18.	VH-327	1.17	0.25	0.71	0
19.	NIAB-8748	1.36	0.28	0.75	0
20.	Baghdadi	1.57	0.20	0.68	0
21.	RH-647	1.25	0.22	0.57	0
22.	TH-21/09	1.38	0.31	0.57	2.0
23.	CIM-602 (Std-1)	1.20	0.31	0.77	0
24.	IUB-63	1.14	0.25	0.68	0
<b>LSD(P&lt;0.05)</b>		<b>0.17</b>	<b>0.05</b>	<b>0.80</b>	-

### 3.8.3 National Coordinated Varietal Trial (Set-C)

In Set-C, sixteen Bt. strains were tested with two standards. The crop was sown on 21-5-2014. Table 3.6 showed that the highest population of thrips (1.98/leaf), Jassid (0.39/leaf) and Whitefly (1.13/leaf) was recorded from FH-142 (Std.-2), CIM-602 (Std.-1) and CA-926 respectively. The attack of bollworm remained zero in all strains.

**Table- 3.6: Seasonal mean insect pest population recorded in NCVT (Set-C) at CCRI, Sakrand during 2014-15**

Sr. No	Strains	Average sucking insect pest population/leaf			Bollworm damage (%)
		Thrips	Jassid	Whitefly	
1.	SAHARA-120	1.62	0.28	0.74	0
2.	Leader-3	1.97	0.27	0.62	0
3.	CIM-602 (Std-1)	1.82	0.39	1.08	0
4.	Eagle-1	1.75	0.31	0.90	0
5.	Tarzan-4	1.69	0.24	1.07	0
6.	AGC-999	1.91	0.35	0.96	0
7.	Sitara-13	1.84	0.29	1.06	0
8.	CA-926	1.79	0.34	1.13	0
9.	Leader-5	1.91	0.29	0.82	0
10.	FH-142 (Std-2)	1.98	0.30	1.05	0
11.	JS-733	1.62	0.27	0.88	0
12.	BS-70	1.92	0.22	1.07	0
13.	CRYSTAL -1	1.68	0.27	0.69	0
14.	Tahafuz-3	1.84	0.29	0.94	0
15.	SAHARA-150	1.87	0.29	0.73	0
16.	AGC-NAZEER-1	1.72	0.28	0.88	0
17.	Sitara-14	1.94	0.26	1.00	0
18.	Auriga-215	1.60	0.27	0.89	0
<b>LSD(P&lt;0.05)</b>		<b>0.19</b>	<b>0.04</b>	<b>0.09</b>	-

### 3.8.4 National Coordinated Varietal Trial (Set-D)

In Set-D, two Bt. Hybrid strains were tested with two standards. The crop was sown on 19-5-2014. Table 3.7 showed that the highest thrips population (1.61/leaf), Jassid (0.37/leaf) and Whitefly (0.56/leaf) were recorded from CIM-602 (Std.-1). The attack of bollworm damage observed zero in all strains.

**Table-3.7: Seasonal mean insect pest population recorded in NCVT (Set-D) at CCRI, Sakrand during 2014-15**

Sr. No	Strains	Average sucking insect pest population/leaf			Bollworm Damage (%)
		Thrips	Jassid	Whitefly	
1.	FH-142 (Std-2)	1.43	0.27	0.50	0
2.	Al Seemi HBt.209	1.42	0.22	0.35	0
3.	CIM-602 (Std-1)	1.61	0.37	0.56	0
4.	Bt. Hybrid-53	1.51	0.26	0.45	0
<b>LSD(P&lt;0.05)</b>		<b>0.12</b>	<b>0.05</b>	<b>0.08</b>	-

### 3.9 Screening of Insecticides

The main objective of this experiment was to test new candidate insecticides against cotton insect pests i.e., thrips, jassid, whitefly, mealy bug, plant bugs and bollworms. CRIS-134 was sown on 30-5-2014. The trial was conducted in randomized complete block design with three replications and plot size 30' x 30'. The pre-treatment observation was recorded one day before spray, whereas the post treatment observations were made at the intervals of 24 and 72 hours, one week and two weeks after the spray. The sucking insect pest reached on economic threshold level (ETL) on 4<sup>th</sup> week of July. The recommended dose of insecticide was sprayed on 27-07-2014. The population of sucking insect pests was recorded from 20 selected leaves from top, middle and bottom portion of the plant in each treatment.

#### 3.9.1 Screening of Insecticide against Thrips

Two new candidate insecticides Lasenta 80 WG and Confidor 200 SL (Std) were tested against thrips. Table 3.8 indicates that Lasenta 80 WG provided better control with 75.08 % mortality as compared with Confidor 200 SL (Std) against thrips up to one week of spray.

**Table-3.8: Screening of Insecticides against Thrips at CCRI, Sakrand during 2014-15**

Treatment	Dose/acre	Pre-Treatment Average Population /leaf	Post-Treatment average population/leaf				Mortality (Efficacy %)			
			48 hours	72 hours	1 week	2 weeks	48 hours	72 hours	1 week	2 weeks
Lasenta 80% WG	60 gm	12.29	3.78	2.44	5.33	9.12	79.28	88.08	75.08	62.25
Confidor 200 SL (Standard)	250 ml	14.26	5.30	4.11	7.26	11.36	70.95	79.92	66.05	52.98
Control (Untreated)	-	18.71	18.25	20.47	21.39	24.16	-	-	-	-
<b>LSD (P&lt;0.05)</b>	-	-	<b>5.80</b>	<b>5.49</b>	<b>4.88</b>	<b>3.71</b>	-	-	-	-



### 3.9.2 Screening of Insecticide against Jassid

One candidate insecticide lasenta 80 WG was tested against jassid whereas confidor 200 SL was kept as standard. Table 3.9 shows that Confidor 200 SL gave maximum mortality (87.71%) of jassid and candidate insecticide Lasenta 80 WG showed (84.79%) at one week of spray.

**Table-3.9: Screening of Insecticides against Jassid at CCRI, Sakrand during 2014-15**

Treatment	Dose/acre	Pre-Treatment Average Population /leaf	Post-Treatment average population/leaf				Mortality (Efficacy %)			
			48 hours	72 hours	1 week	2 weeks	48 hours	72 hours	1 week	2 weeks
Lasenta 80% WG	60 gm	1.36	0.43	0.39	0.26	0.66	70.34	75.47	84.79	61.84
Confidor 200 SL (Standard)	250 ml	1.46	0.39	0.41	0.21	0.71	73.10	74.21	87.71	58.95
Control/Untreated	-	1.31	1.45	1.59	1.71	1.73	-	-	-	-
<b>LSD (P&lt;0.05)</b>	-	-	<b>N.S</b>	<b>0.21</b>	<b>0.25</b>	<b>0.43</b>	-	-	-	-

### 3.9.3 Screening of Insecticide against Whitefly

One candidate insecticide was evaluated against whitefly and compared with Confidor 200 SL (standard). Table 3.10 shows that maximum mortality of whitefly was recorded from Confidor 200 SL (91.73%) than candidate insecticide Apploud 25 SC (87.79 %) at one week of spray.

**Table-3.10: Screening of Insecticides against Whitefly at CCRI, Sakrand during 2014-15**

Treatment	Dose/acre	Pre-Treatment Average Population /leaf	Post-Treatment average population/leaf				Mortality (Efficacy %)			
			48 hours	72 hours	1 week	2 weeks	48 hours	72 hours	1 week	2 weeks
Apploud 25 SC	60 gm	2.56	0.71	0.65	0.31	1.15	70.29	74.10	87.79	55.59
Confidor 200 SL (Standard)	250 ml	2.14	0.62	0.51	0.21	1.02	74.05	79.68	91.73	60.61
Control/Untreated	-	2.36	2.39	2.51	2.54	2.59	-	-	-	-
<b>LSD (P&lt;0.05)</b>	-	-	<b>1.02</b>	<b>0.29</b>	<b>0.27</b>	<b>0.42</b>	-	-	-	-

### 3.9.4 Screening of Insecticide against Dusky cotton bug

Lasenta 80 SC was tested against Dusky cotton bug and Chlorfenapyr 360 SC was kept as standard. Table 3.11 indicates that maximum mortality percentage was provided by lasenta 80 SC with (85.54%) than Chlorfenapyr 360 SC standard showed (79.97%) against dusky cotton bug at one week of spray.

**Table-3.11: Screening of Insecticides against Dusky cotton bug at CCRI, Sakrand during 2014-15**

Treatment	Dose/acre	Pre-Treatment Average Population /boll	Post-Treatment average population/boll				Mortality (Efficacy %)			
			48 hours	72 hours	1 week	2 weeks	48 hours	72 hours	1 week	2 weeks
Lasenta 80% SC	60 gm	16.33	7.28	5.41	3.71	9.22	69.12	78.45	85.54	65.02
Chlorfenapyr 360 SC (Standard)	225 ml	12.65	9.11	6.44	5.14	11.22	61.36	74.35	79.97	57.43
Control/Untreated	-	20.21	23.58	25.11	25.67	26.36	-	-	-	-
<b>LSD (P&lt;0.05)</b>	-	-	<b>3.67</b>	<b>2.07</b>	<b>3.09</b>	<b>1.54</b>	-	-	-	-

### 3.9.5 Screening of Insecticide against Red cotton bug

Lasenta 80 SC was tested against Red cotton bug and Chlorfenapyr 360 SC was kept as standard. Table 3.12 indicates that Lasenta 80 WG gave maximum mortality percentage with (93.88%) than Chlorfenapyr 360 SC standard (89.98%) against red cotton bug up to one week of spray.

**Table-3.12: Screening of Insecticides against Red cotton bug at CCRI, Sakrand during 2014-15**

Treatment	Dose/acre	Pre-Treatment Average Population /boll	Post-Treatment average population/boll				Mortality (Efficacy %)			
			48 hours	72 hours	1 week	2 weeks	48 hours	72 hours	1 week	2 weeks
Lasenta 80% SC	60 gm	4.66	1.23	1.0	0.36	2.34	77.17	82.81	93.88	61.63
Chlorfenapyr 360 SC (Standard)	225 ml	7.91	2.11	1.10	0.59	3.25	60.85	81.09	89.98	46.72
Control/Untreated	-	6.15	5.39	5.82	5.89	6.10	-	-	-	-
<b>LSD (P&lt;0.05)</b>	-	-	<b>1.23</b>	<b>0.75</b>	<b>0.61</b>	<b>1.44</b>	-	-	-	-