1. INSECT PESTS OF COTTON

1. SCREENING OF NEW COTTON GENOTYPES AGAINST INSECT PESTS

Five Cotton genotypes were sown in the research area of Entomological Research Institute, Faisalabad. The trial was laid out in RCB Design having three replications. The population of whitefly, jassid, aphid and thrips was recorded from 15 leaves of 15 plants selected at random from upper, middle and lower portions of plants. Percentage damage of Pink Bollworm was observed by disecting 25 randomly selected bolls per plot. The data recorded are as under:-

TABLE: SCREENING OF NEW COTTON GENOTYPES AGAINST INSECT PESTS

Cotton Genotypes	Jassid/Leaf	Whitefly /Leaf	Thrips/Leaf	PBW % Damage
IR-NIBGE 7	0.62 B	7.62	4.91 B	15.67 B
IR-NIBGE 8	0.50 C	7.34	4.86 B	14.33 B
FH-142	0.45 C	6.96	3.68 C	13.67 B
FH-Lalazar	0.60 B	7.41	5.283 B	16.33 B
MNH-886	0.85 A	6.66	6.66 A	20.67 A
LSD at 5%	0.09	N.S.	1.01	3.42

Whitefly population was non significant and it ranged from 6.66 to 7.62/leaf. Maximum population of jassid (0.85/leaf), thrips (6.66/leaf) and pink boll worm % damage (20.67%) was observed on V5 respectively. While minimum jassid (0.45/leaf), thrips (3.68/leaf) and pink boll worm % damage (13.67%) was observed on on V3.

2. STUDIES ON THE POPULATION DYNAMICS OF JASSID, THRIPS AND WHITEFLY ON BT COTTON.

Bt cotton crop FH-142 was kept under observation throughout the crop season at Entomological Research Institute, Faisalabad. Data regarding jassid, thrips and whitefly population/leaf were recorded fortnightly by observing 15 randomly selected upper, middle and lower leaves of 15 plants per plot. Temperature and Relative Humidity data was also recorded.

Maximum population of Whitefly (9.24/leaf) was observed in the First half of July, while minimum whitefly population (2.85/leaf) was observed in the 2nd half of October. Maximum population of jassid (3.340/leaf) was observed in the 1st half of August, while minimum jassid population (0.30/leaf) was observed in the 1st half of June. Maximum population of thrips (8.49/leaf) was observed in the 1st half of June, while minimum thrips population (1.01/leaf) was observed in the 2nd half of October.

TABLE: STUDIES ON THE POPULATION DYNAMICS OF WHITEFLY, JASSID AND THRIPS ON BT COTTON

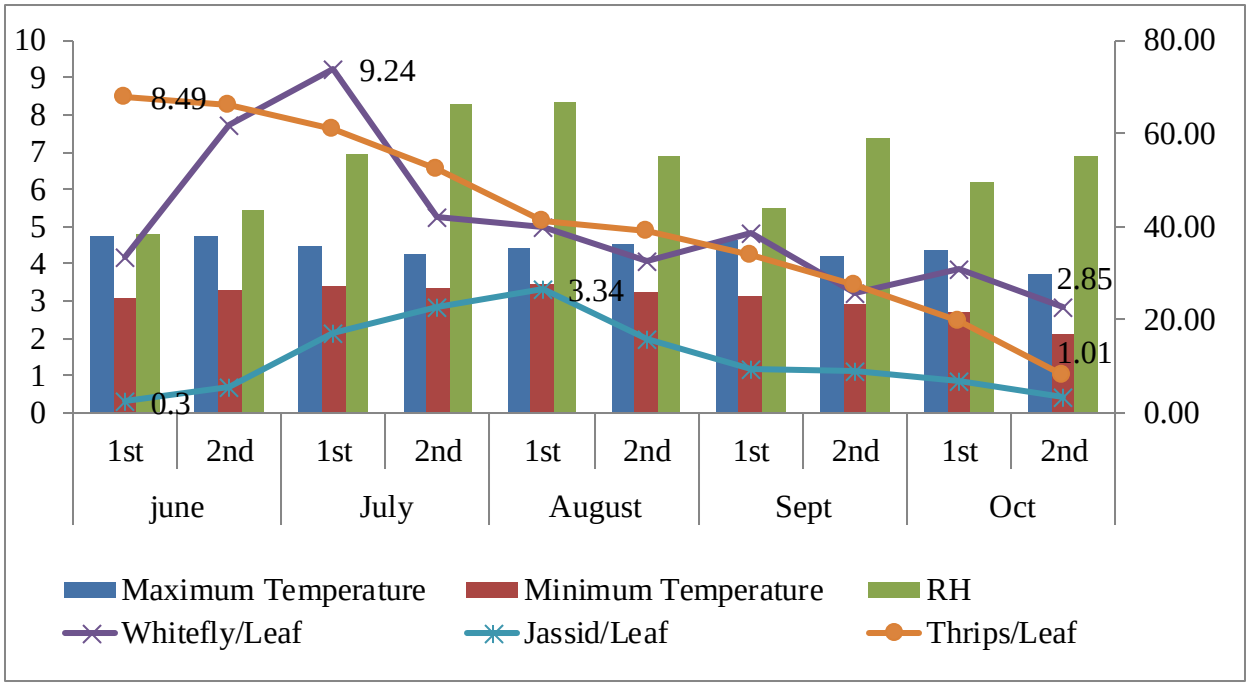


TABLE : CORRELATION BETWEEN WEATHER FACTORS AND INSECT PEST POPULATIONS

Weather Factors	Jassid/Leaf	Thrips/Leaf	Whitefly/Leaf
Maximum Temperature (°C)	-0.0046 (0.9899)	0.7499* (0.0125)	0.4682 (0.1724)
Minimum Temperature (°C)	0.6489* (0.0424)	0.7606* (0.0106)	0.6228 (0.0545)
Relative Humidity %	0.8054** (0.0049)	-0.2611 (0.4662)	-0.0645 (0.8596)

Jassid population showed significant and positive correlation with minimum temperature while positive and highly significant with percentage relative humidity. Thrips population showed significant and positive correlation with temperature while negative and non significant with percentage relative humidity. Whitefly population showed non-significant correlation with maximum and minimum temperature.

3. EFFICACY OF DIFFERENT INSECTICIDES AGAINST DUSKY COTTON BUG *(OXYCARENUS LAETUS)*

Twelve insecticides viz. Refree 5% SC (Fipronil); Karifos 40% EC (Chlorpyriphos); Lasenta 80% WG (Fipronil+Imidacloprid); Capital Plus 41.7% (Betacyfluthrin + Triazophos); Verdict 52 % EC (Profenofos + Lambda-cyhalothrin); Tyron 50% EC (Profenophos) + Lambda-Cyhalothrin; Picador 10% EC (Bifenthrin); Deltamax 36% EC (Deltamethrin+Triazophos); X-Tall 43.6% EC (Leufenuron+Indoxacarb+Triazophos); Karate 2.5 EC (Lambda-Cyhalothrin); Gallent 10% WP (Lambda-Cyhalothrin); Oshin 20% SG (Dinotefuran) were tested against Dusky cotton Bug (*Oxycarenus Laetus*) on cotton crop. The data were recorded from 15 leaves of 15 plants selected at random from upper, middle and lower portions of plants after 24, 48, 72hrs and 7 days of spray application. The data recorded were as under:

TABLE: EFFICACY OF DIFFERENT INSECTICIDES FOR THE CONTROL OF DUSKY COTTON BUG *(Oxycarenus laetus)*

Insecticides	Dose/acre	Mortality % of DCB After	
		72 HAA	7 DAA
Refree 5% SC (Fipronil)	480 ml	77.76 BC	73.29 E
Karifos 40% EC (Chlorpyriphos)	750 ml	75.77 C	73.10 E
Lasenta 80% WG (Fipronil+Imidacloprid)	600 g	85.54 A	83.89 A
Capital Plus 41.7% (Betacyfluthrin + Triazophos)	500 ml	83.34 A	82.65 A
Verdict 52 % EC (Profenofos + Lambda-cyhalothrin)	1000 ml	84.89 A	79.25 BC

Tyron 50% EC (Profenophos) + Lambda-Cyhalothrin	1000+330 ml	83.84 A	80.95 AB
Picador 10% EC (Bifenthrin)	330 ml	82.47 A	77.42 CD
Deltamax 36% EC (Deltamethrin+Triazophos)	600 ml	84.99 A	81.53 AB
X-Tall 43.6% EC (Leufenuron+Indoxacarb+Triazophos)	1000 ml	82.42 A	81.28 AB
Karate 2.5 EC (Lambda-Cyhalothrin)	330 ml	76.31 C	74.70 DE
Gallent 10% WP (Lambda-Cyhalothrin)	62.5 gm	81.42 AB	77.73 C
Oshin 20% SG (Dinotefuran)	100 ml	70.13 D	67.31 F
Check	__	0.00 E	0.00 G
LSD at 5%		4.24	2.97

Maximum mortality of dusky cotton bug was recorded in case of Lesenta 85% WG and Tyron 50% EC (85.54 % & 83.84%) respectively after 72 hrs of spray application. After 7 days of application maximum mortality was observed in the plot treated with Lesenta 85% WG & Capital Plus 41.7% (83.89% & 82.65%). Minimum mortality of dusky cotton bug 70.13% & 67.31 was recorded in the plot treated with Oshin 20% SG (Dinotefuran) after 72hrs and 7 days of spray application respectively.

4. EFFECT OF DIFFERENT TIMES OF SOWING ON INSECT PESTS INCIDENCE IN COTTON CROP (FH-114, FH-312 and FH-Noor).

Nine dates of Sowing viz:15 Feb, 01 March,15 March ,01 April, 15 April, 01 May,15 May, 01 June and 15 June-2016 were evaluated against insect pests complex on cotton varities viz: FH-114, FH-312 and FH-Noor. Whitefly, jassid, aphid and thrips population was recorded from 15 leaves of 15 plants selected at random from upper, middle and lower portions of plants. Attack of Pink Bollworm were observed by dissecting 25 randomly selected bolls per plot and % infestation were calculated, while bio-control population were recorded on per plant basis. The data recorded are as under:-

TABLE: EFFECT OF DIFFERENT TIMES OF SOWING ON INSECT PESTS ATTACK ON COTTON CROP (FH-312)

Date of sowing	Whitefly (pop/leaf)	Jassid (Pop/leaf)	Thrips (Pop/leaf)	PBW Infestation %	Bio-control pop/plant
15 Feb	4.32 B	0.91 C	3.74 C	21.60 A	4.13 A
01 March	4.20 BCD	0.98 C	3.43 C	18.26 AB	4.86 A
15 March	3.87 CDE	1.18 C	3.77 C	17.86 AB	4.36 A
01 April	3.73 E	1.28 C	3.88 BC	16.00 BC	4.20 A
15 April	3.76 E	1.79 B	3.75 C	17.60 AB	2.13 B
01 May	3.98 BCDE	2.65 A	3.85 BC	16.93 B	1.86 B
15 May	5.19 A	2.54 A	3.69 C	14.93 BC	1.00 B
01 June	4.23 BC	2.35 A	4.43 AB	14.66 BC	1.66 B
15 June	3.80 DE	2.48 A	4.83 A	12.33 C	1.12 B
LSD at 5%	1.40	0.39	0.65	4.01	1.30

Average whitefly population remained below ETL among all the dates of sowing except T7 (15th May) where maximum whitefly population (5.19/leaf) was observed while minimum whitefly population (3.73, 3.76 and 3.87/leaf) was observed on T4 (01 April), T5 (15 April) and T3 (15th March) respectively. Maximum jassid population (2.65, 2.54 and 2.48/leaf) was observed on T6 (1st May), T7 (15th May) and T9 (15th June) respectively while minimum jassid population (0.91/leaf) was observes on 15th February sowing. Thrips population remained below ETL among all the dates of sowing however maximum thrips population (4.83/leaf) was observed on T9 (15th June) while minimum thrips population (3.43/leaf) was observed on T2 (1st March). Maximum Pink bollworm infestation (21.60%) was recorded on T1 (15th February) sowing while minimum PBW infestation (12.33%) was observed on T9 (15th June). Maximum population of bio-control agents (4.86/plant) was recorded on T2 (1st March) while minimum population of biocontrol agents (1.00/plant) was found on T7 (15thMay) sowing.

TABLE: EFFECT OF DIFFERENT TIMES OF SOWING ON INSECT PESTS ATTACK ON COTTON CROP (FH-114)

Date of sowing	Whitefly (pop/leaf)	Jassid (Pop/leaf)	Thrips (Pop/leaf)	PBW Infestation %	Bio-control pop/plant
15 Feb	4.20 BC	0.93 DE	5.77 B	17.20 A	4.57 AB
01 March	4.67 B	1.13 CD	4.33 C	18.26 A	5.25 A
15 March	4.67 B	0.68 EF	6.95 A	17.86 A	4.42 ABC
01 April	5.76 A	1.37 BC	5.04 BC	16.00 AB	3.48 CD
15 April	3.86 BC	1.57 B	4.80 BC	15.80 AB	4.73 AB
01 May	4.93 AB	2.02 A	4.08 C	16.93 A	3.06 D
15 May	3.27 C	1.91 A	4.17 C	14.93 AB	3.13 D
01 June	5.93 A	0.57 F	2.95 D	15.00 AB	3.73 BCD
15 June	4.27 BC	0.53 F	2.26 D	12.33 B	3.00 D
LSD at 5%	1.07	0.29	0.99	3.79	1.05

Average whitefly population remained below ETL among all the dates of sowing except T8 (1st June) & T4 (1st April) where maximum whitefly population (5.93 & 5.76/leaf) respectively was observed while minimum whitefly population (3.27/leaf) was observed on T7 (15th May). Maximum jassid population (2.02/leaf) was observed on T6 (1st May) while minimum jassid population (0.93/leaf) was observes on T9 (15th June). Thrips population remained below ETL among all the dates of sowing however maximum thrips population (6.95/leaf) was observed on T3 (15th March) while minimum thrips population (2.26/leaf) was observed on T9 (15th June). Maximum Pink bollworm infestation (18.26%) was recorded on T2 (1st March) sowing while minimum PBW infestation (12.33%) was observed on T9 (15th June). Maximum population of bio-control agents (5.25/plant) was recorded on T2 (1st March) while minimum population of biocontrol agents (3.00/plant) was found on T9 (15th June) sowing.

TABLE: EFFECT OF DIFFERENT TIMES OF SOWING ON INSECT PESTS ATTACK ON COTTON CROP (FH-NOOR)

Date of sowing	Whitefly (pop/leaf)	Jassid (Pop/leaf)	Thrips (Pop/leaf)	PBW Infestation %	Bio-control pop/plant
15 Feb	5.54 AB	1.71 B	5.03 B	23.33 A	5.26 AB
01 March	6.14 A	1.31 C	5.23 B	19.33 BC	5.81 A
15 March	5.30 AB	0.84 D	6.36 A	11.11 F	5.75 A
01 April	5.80 AB	0.48 E	6.33 A	12.22 EF	4.61 ABC
15 April	6.60 A	0.75 D	4.53 BC	17.77 C	4.73 AB
01 May	6.22 A	2.08 A	5.17 B	14.44 DE	3.06 BC
15 May	6.47 A	2.02 A	3.73 CD	22.22 AB	3.13 BC
01 June	4.79 B	1.64 B	3.25 D	22.22 AB	3.73 ABC
15 June	3.36 C	0.60 E	2.09 E	16.66 CD	2.46 C
LSD at 5%	1.30	0.14	0.83	3.02	2.24

Average whitefly population remained above ETL among most of the dates of sowing except T9 (15th June) & T8 (1st June) where minimum whitefly population (3.36 & 4.79/leaf) respectively was observed while maximum whitefly population (6.14/leaf) was observed on T2 (1st March). Maximum jassid population (2.08/leaf) was observed on T6 (1st May) while minimum jassid population (0.48/leaf) was observed on T4 (1st April). Thrips population remained below ETL among all the dates of sowing however maximum thrips population (6.36/leaf) was observed on T3 (15th March) while minimum thrips population (2.09/leaf) was observed on T9 (15th June). Maximum Pink bollworm infestation (23.33%) was recorded on T1 (15th February) sowing while minimum PBW infestation (11.11%) was observed on T3 (15th March). Maximum population of bio-control agents (5.81/plant) was recorded on T2 (1st March) while minimum population of biocontrol agents (2.46/ plant) was found on T9 (15th June) sowing.

5. EFFICACY OF NEW INSECTICIDES AGAINST THRIPS (*Thrips tabaci*) ON COTTON CROP.

Twenty three new insecticides viz. Red Card 75 SP (Acephate), Commando Plus 97% DF (Acephate), Deltamax 36 EC (Deltamethrin+Triazophos), Tracer 240 SC (Spinosad), Deltaphos 36 EC (Deltamethrin+Triazophos), Pirox Super 50% WDG (Nitenpyram), Pyramid 50% WDG (Nitenpyram), Concept Plus 35 EC (Pyriproxyfen+Acephate+Fenpyroximate), Atrasan Super 43% WDG (Nitenpyram+Indoxacarb+Pymetrozine), Vapco 40% WDG (Acetamiprid), Rani 20 SL (Acetamiprid), Solvigo 108 SC (Abamectin+Thiamethoxam), Foxal 360 SC (Chlorfenapyr), Pirate 360 SC (Chlorfenapyr), Octane 20% SG (Dinotefuran), Alpine 20% SG (Dinotefuran), Marine 20% SC (Chlothianidin), Oshin 205 SG (Dinotefuran), Lanolex 30% WDG (Pyriproxyfen), Priority 10.8 EC (Pyriproxyfen), Coniflex 50% WP (Imidacloprid), Coniflex 20% SL (Imidacloprid) and Confidor 20 SL (imidacloprid) including check were tested against cotton thrips (*Thrips tabaci*).Thrips population was recorded 24 hours before and after 3 & 7 days of spray from 15 randomly selected upper, middle and lower leaves of 15 plants per plot. The data recorded are as under:-

TABLE : EFFICACY OF NEW INSECTICIDES AGAINST COTTON THRIPS

Treatments	Dose/hlw (ml/gm)	Mortality %age After	
		72 HAA	7DAA
Red Card 75 SP (Acephate)	250 gm	85.99 ABC	82.34 ABC
Commando Plus 97% DF (Acephate)	250 gm	86.71 ABC	83.10 A
Deltamax 36 EC (Deltamethrin+Triazophos)	600 ml	78.62 DEFG	71.62 GHI
Tracer 240 SC (Spinosad)	24 gm	88.83 A	84.78 A
Deltaphos 36 EC (Deltamethrin+Triazophos)	600 ml	77.17 FG	69.38 I
Pirox Super 50% WDG (Nitenpyram)	50 gm	84.91 ABCD	80.75 A-E
Pyramid 50% WDG (Nitenpyram)	200 ml	86.12 ABC	82.38 ABC
Concept Plus 35 EC (Pyriproxyfen+Acephate+Fenpyroximate)	750 ml	86.77 AB	81.01 ABCDE
Atrasan Super 43% WDG (Nitenpyram+Indoxacarb+Pymetrozine)	250 ml	83.59 A-F	80.24 ABCDE

Vapco 40% WDG (Acetamiprid)	100 gm	82.49 A-F	80.07 A-E
Rani 20 SL (Acetamiprid)	200 ml	84.58 ABCDE	81.76 ABCD
Solvigo 108 SC (Abamectin+Thiamethoxam)	250 ml	86.67 ABC	83.85 A
Foxal 360 SC (Chlorfenapyr)	100 ml	85.87 ABC	81.85 ABCD
Pirate 360 SC (Chlorfenapyr)	100 ml	84.39 A-E	82.75 AB
Octane 20% SG (Dinotefuran)	100 gm	79.25 DEFG	77.12 B-G
Alpine 20% SG (Dinotefuran)	100 gm	80.30 CDEFG	76.67 C-G
Marine 20% SC (Chlothianidin)	100 ml	84.91 ABCD	81.73 A-E
Oshin 205 SG (Dinotefuran)	100 gm	81.02 B-G	79.38 A-F
Lanolex 30% WDG (Pyriproxyfen)	100 gm	75.03 G	70.31 HI
Priority 10.8 EC (Pyriproxyfen)	500 ml	77.60 FG	73.68 FGHI
Coniflex 50% WP (Imidacloprid)	100 gm	78.67 DEFG	76.29 DEFG
Coniflex 20% SL (Imidacloprid)	250 ml	77.66 FG	75.82 EFGH
Confidor 20 SL (imidacloprid)	250 ml	78.26 EFG	76.30 DEFG
Check	_____	0.00 H	0.00 J
LSD at 5%		6.46	5.94

Tracer 240 SC (Spinosad) @ 24gm/acre gave the maximum thrips mortality (88.33% & 84.78%) after 72 hours and 7 days of spray application, while the minimum thrips mortality (75.03% & 70.31%) was observed in plots treated with Lanolex 30% WDG (Pyriproxyfen) @ 100 gm/acre after 72 hrs and 7 days of spray application.

6. EFFICACY OF NEW INSECTICIDES AGAINST COTTON WHITEFLY (*BEMISIA TABACI*).

The efficacy of forteen new chemistry insecticides viz. Kendo 24.7 SC (Thiamethoxam+Lambda); Octane 20 SG (Dinotefuran); Alpine 20 SG (Dinotefuran); Marine 20 SC (Clothianidin); Red Card 75% SP (Acephate); Lanolax 30% WDG (Pyriproxyfen); Vapco 40 % WDG (Acetamiprid); Coniflex 50 % WP (imidacloprid); Foxal 50 % WDG (Chlorfenapyr);

Coniflex 70 % WP (Imidacloprid); Priority 10.8 EC (Pyriproxyfen); Rani 20 % SL (Acetamiprid); Confidor 20 SL (Imidacloprid); Coniflex 20 % SL (Imidacloprid) along with check were tested against white fly (Bemisia tabaci) on cotton crop. Whitefly population was recorded 24 hours before and after 3 & 7 days of spray from 15 randomly selected upper, middle and lower leaves of 15 plants per plot. The data recorded are as under:-

TABLE- EFFICACY OF NEW INSECTICIDES AGAINST COTTON WHITEFLY (*Bemisia tabaci*).

Treatments	**Dose/hlw (ml/gm)**	**Mortality %age After**	
		72HAA	**7 DAA**
Kendo 24.7 SC (Thiamethoxam+Lambda)	250 ml	82.81 ABC	76.64 ABC
Octane 20 SG (Dinotefuran)	200 ml	77.81 EF	72.16 CDE
Alpine 20 SG (Dinotefuran)	100 gm	74.49 FG	69.77 DE
Marine 20 SC (Clothianidin)	100 gm	84.01 A	81.19 A
Red Card 75% SP (Acephate)	250 gm	73.38 G	66.98 E
Lanolax 30% WDG (Pyriproxyfen)	100 gm	81.65 ABCD	79.23 AB
Vapco 40 % WDG (Acetamiprid)	100 gm	83.10 AB	78.72 AB
Coniflex 50 % WP (imidacloprid)	100 gm	79.44 BCDE	77.19 ABC
Foxal 50 % WDG (Chlorfenapyr)	100 gm	72.49 G	68.05 E
Coniflex 70 % WP (Imidacloprid)	100 gm	80.65 A-E	78.72 AB
Priority 10.8 EC (Pyriproxyfen)	100 gm	79.24 CDE	76.51 ABC
Rani 20 % SL (Acetamiprid)	125 gm	77.73 EF	75.57 ABC
Confidor 20 SL (Imidacloprid)	250 gm	78.04 DEF	74.59 BCD
Coniflex 20 % SL	250 ml	78.41 DE	76.36 ABC
Check	---	0.00 H	0.00 F
LSD at 5%		3.81	5.72

Marine 20 SC (Clothianidin @ 100 gm/acre gave the maximum pest mortality (84.01% & 81.19%) after 72 hours and 7 days of spray application, while the minimum pest mortality (72.49%

& 68.05%) was observed in plots treated with Foxal 50 % WDG (Chlorfenapyr) @ 100 g/acre after 72 hrs and 7 days of spray application.

7. EFFICACY OF NEW INSECTICIDES AGAINST COTTON JASSID (*AMRASCA DEVASTANS*).

Thirteen new chemistry insecticides viz; Kendo 24.7% SC (Thiamethoxam+Lambdacyhalothrin); Octane 20% SG (Dinotefuran); Alpine 20% SG (Dinotefuran); Marine 20% SC (Chlothianidin); Oshin 205 SG (Dinotefuran); Lanolex 30% WDG (Pyriproxyfen); Vapco 40% WDG (Acetamiprid); Coniflex 50% WP (Imidacloprid); Coniflex 20% SL (Imidacloprid); Confidor 20% SL (Imidacloprid); Foxal 50% WDG (Chlorfenapyr); Pirate 360 SC (Chlorfenapyr); Rani 20 SL (Acetamiprid) along with check were tested for standardization of insecticides against cotton Jassid (*Amrasca devastans*) on cotton crop. Jassid population was recorded 24 hours before and after 3 & 7 days of spray from 15 randomly selected upper, middle and lower leaves of 15 plants per plot. The data recorded are as under:-

TABLE: EFFICACY OF NEW INSECTICIDES AGAINST COTTON JASSID (*Amrasca biguttula biguttula* ISHI.*).*

Treatments	Dose/hlw (ml/gm)	% mortality jassid after	
		72HAA	7DAA
Kendo 24.7% SC (Thiamethoxam+Lambdacyhalothrin)	250 ml/ac	84.80 A	81.01 A
Octane 20% SG (Dinotefuran)	100 gm	73.34 C	71.84 C
Alpine 20% SG (Dinotefuran)	100 gm	71.17 C	70.83 C
Marine 20% SC (Chlothianidin)	100 ml	82.30 AB	79.61 AB
Oshin 205 SG (Dinotefuran)	100 gm	83.11 AB	80.01 AB
Lanolex 30% WDG (Pyriproxyfen)	100 gm	69.53 C	66.37 D
Vapco 40% WDG (Acetamiprid)	100 gm	80.50 AB	77.04 B
Coniflex 50% WP (Imidacloprid)	100 gm	84.97A	82.64 A
Coniflex 20% SL (Imidacloprid)	250 ml	81.97 AB	80.31 AB
Confidor 20% SL (Imidacloprid)	250 ml	79.80 B	76.61 B

Foxal 50% WDG (Chlorfenapyr)	100 gm	83.01AB	79.33 AB
Pirate 360 SC (Chlorfenapyr)	100 ml	72.95 C	71.39 C
Rani 20 SL (Acetamiprid)	200 ml	70.91 C	69.49 CD
Check	_____	0.00 D	0.00 E
LSD at 5%		4.87	3.76

Kendo 24.7% SC (Thiamethoxam+Lambdacyhalothrin) @ 250 ml/ac gave the maximum jassid mortality (84.80% & 81.01%) after 72 hours and 7 days of spray application, while the minimum pest mortality (70.91% & 69.49%) was observed in plots treated with Rani 20 SL (Acetamiprid)@ 200ml/acre after 72 hrs and 7 days of spray application.

8. EFFICACY OF NEW INSECTICIDES AGAINST SPOTTED BOLLWORM ON COTTON CROP

Eight new insecticides Viz; Deltamax 36% EC (Deltamethrin+Triazophos); Timer 1.9 EC (Emmamectin benzoate); Boxer 2.5EC (Lamdda-Cyhalothrin); Staarfen 10% EW (Bifenthrin); Resham 10% EC (Bifenthrin); Jumper 10% WDG (Lambda-Cyhalothrin); Counter plus 36% EC (Deltamethrin+Triazophos); Checkworm 5% EC (Emmamectin benzoate) along with check were tested in order to find out the efficacy of new insecticides against spotted bollworm on cotton crop. The larval population was recorded 24 hours before and after 3 and 7 days of spray from 5 randomly selected plants per plot. The data recorded are as under:

TABLE: EFFICACY OF NEW INSECTICIDES AGAINST SPOTTED BOLLWORM ON COTTON

Treatments	Dose Rate (ml/ac)	Mortality % After	
		72 HAA	7 DAA
Deltamax 36% EC (Deltamethrin+Triazophos)	600	80.52 A	82.43 ABC
Timer 1.9 EC (Emmamectin benzoate)	200	75.70 A	77.84 D
Boxer 2.5EC (Lamdda-Cyhalothrin)	330	78.59 A	80.79 BCD

Staarfen 10% EW (Bifenthrin)	250	80.59 A	83.32 ABC
Resham 10% EC (Bifenthrin)	250	79.86 A	84.25 AB
Jumper 10% WDG (Lambda-Cyhalothrin)	200	78.72 A	82.04 ABCD
Counter plus 36% EC (Deltamethrin+Triazophos)	600	82.10 A	85.15 A
Checkworm 5% EC (Emmamectin benzoate)	80	77.69 A	79.05 CD
Check	--	0.00 B	0.00 E
LSD at 5%		6.49	4.3218

Counter plus 36% EC (Deltamethrin+Triazophos) gave the maximum mortality (82.10%) of spotted bollworm; while minimum mortality (75.70%) was observed in plot treated with Timer 1.9 EC (Emmamectin benzoate) after 72 hrs of spray application. After 7 days of spray application Counter plus 36% EC (Deltamethrin+Triazophos) gave maximum mortality (85.15%) of spotted bollworm while minimum mortality (77.84%) was observed in plot treated with Timer 1.9 EC.

9. **EFFICACY OF NEW INSECTICIDES AGAINST PINK BOLLWORM ON COTTON CROP**

Ten new insecticides Viz; Deltamax 36% EC (Deltamethrin+Triazophos); Counter plus 36% EC (Deltamethrin+Triazophos); X-Tall 43.6% EC (Leufenuron+Indoxacarb+Triazophos); Proclaim 1.9 EC (Emmamectin benzoate); Sozo 40% EC (Triazophos); Karatay 2.5% EC (Lamdacyhalothrin); Kando 24.7% SC (Thiamethoxam+ Lambda- Cyhalothrin) ; Diplomate 40% EC (Triazophos); Compass 25% WP (Bifenthrin+Nitenpyram); Blink 20% SC (Emmamectin benzoate+ Pyriproxyfen) were tested against spotted bollworm. The larval population was recorded 24 hours before and after 3 and 7 days of spray from 5 randomly selected plants per plot. Finally, pest mortality was calculated by dissecting 25 bolls/plot. The data recorded are as under:

TABLE: EFFICACY OF NEW INSECTICIDES AGAINST PINK BOLLWORM ON COTTON

Treatments	Dose/hlw (ml/gm)	Pre-Treatment PBW Infestation %	Post treatment PBW Infestation %		Reduction in PBW Infestation (%)	
			72 HAA	7 DAA	72 HAA	7 DAA
Deltamax 36% EC (Deltamethrin+Triazophos)	600 ml/ac	17.33	4.57	4.86	76.52 AB	81.42 AB
Counter plus 36% EC (Deltamethrin+Triazophos)	600 ml/ac	16.07	5.30	5.10	72.81 ABC	80.52 B
X-Tall 43.6% EC (Leufenuron+Indoxacarb+Triazophos)	1000 ml/ac	15.53	4.16	3.94	78.63 A	84.86 A
Proclaim 1.9 EC (Emmamectin benzoate)	200 ml/ac	18.60	7.67	8.85	60.56 D	66.20 DE
Sozo 40% EC (Triazophos)	1000 ml/ac	17.87	4.81	5.23	75.28 AB	80.08 B
Karatay 2.5% EC (Lamdacyhalothrin)	330 ml/ac	17.53	5.75	6.30	70.37 BC	75.90 C
Kando 24.7% SC (Thiamethoxam+ Lambda-Cyhalothrin	330 ml/ac	15.93	4.71	5.16	75.51 AB	80.34 B
Diplomate 40% EC (Triazophos)	1000 ml/ac	16.00	4.41	4.41	77.16 A	83.13 AB
Compass 25% WP (Bifenthrin+Nitenpyram)	250 gm/ac	17.60	6.17	7.92	68.08 C	69.77 D
Blink 20% SC (Emmamectin benzoate+ Pyriproxyfen)	200 ml/ac	21.60	8.07	9.45	58.35 D	63.98 E
Check	_____	15.00	19.40	26.27	0.00 E	0.00 F
LSD at 5%					6.54	3.81

X-Tall 43.6% EC (Leufenuron+Indoxacarb+Triazophos) gave the maximum mortality (78.63%) of pink bollworm; while minimum mortality (58.35%) was observed in plot treated with Blink 20% SC

(Emmamectin benzoate+ Pyriproxyfen) after 72 hrs of spray application. After 7 days of spray application X-Tall 43.6% EC (Leufenuron+Indoxacarb+Triazophos) gave maximum mortality (84.86%) of pink bollworm while minimum mortality (63.98%) was observed in plot treated with Blink 20% SC (Emmamectin benzoate+ Pyriproxyfen).

10. **EFFICACY OF DIFFERENT MITICIDES AGAINST MITES ON COTTON**

Sixteen new chemistry insecticides viz; Concept Plus 35% EC (Pyriproxyfen+ Acephate+Fenpyproximate); Unique-M 5% EC (Fenproximate); Vibrant Super 23 % SC (Chlorfenapyr 18%+ Fenpyroximate 5%); Virtual 10 % SC (Chlorfentizine + Azocyclotine); Orchid 13.3% EW (Abamectin+Imidacloprid); Style 22 % SC (Abamectin+Chlofenapyr); Coral 36% SC (Chlofenapyr); Pirate 36% SC (Chlorfenapyr); Temper 20 % EW (Bifenthrin+Pyridaben); Cherry (Chlorfenapyr+Emmamectin); Dolo Power 80% WDG (Diafenthuron); Patern 10 % WDG (Chlorfenapyr); Compass 25% WP (Bifenthrin + Nitenpyram); Foxal 36% SC (Chlorfenapyr); Fighter 13.3 EC (abamectin+ imidacloprid); Foxal 50% WDG (Chlorfenapyr) along with check were tested for the effective control of mites in cotton. Mite population was recorded 24 hours before and after 3 & 7 days of spray from 15 randomly selected leaves of 15 plants per plot. The data recorded are as under:-

TABLE: EFFICACY OF NEW ACARICIDES AGAINST MITES ON COTTON CROP

Treatments	Dose/hlw	Mortality %	
		72 HAA	7 DAA
Concept Plus 35% EC (Pyriproxyfen+ Acephate+Fenpyproximate)	750ml	82.94 EF	80.88 DE
Unique-M 5% EC (Fenproximate)	200ml	86.70 ABCD	82.87 BCD
Vibrant Super 23 % SC (Chlorfenapyr 18%+ Fenpyroximate 5%)	200 ml	87.59 AB	84.513 AB
Virtual 10 % SC (Chlorfentizine + Azocyclotine)	350 ml	88.14 A	83.69 ABC
Orchid 13.3% EW (Abamectin+Imidacloprid)	200 ml	81.20 F	79.74 E
Style 22 % SC (Abamectin+Chlofenapyr)	200 ml	83.31 DEF	81.58 CDE

Coral 36% SC (Chlofenapyr)	100ml	86.98 ABC	82.90 BCD
Pirate 36% SC (Chlorfenapyr)	75 ml	87.39 AB	85.55 A
Temper 20 % EW (Bifenthrin+Pyridaben)	250ml	84.13 B-F	83.95 ABC
Cherry (Chlorfenapyr+Emmamectin)	250ml	82.36 EF	80.79 DE
Dolo Power 80% WDG (Diafenthuron)	150 gm	83.78 CDEF	81.82 CDE
Patern 10 % WDG (Chlorfenapyr)	350 gm	85.51 A-E	83.13 ABCD
Compass 25% WP (Bifenthrin + Nitenpyram)	250 ml	73.21G	69.78 F
Foxal 36% SC (Chlorfenapyr)	100 ml	85.67 ABCDE	83.19 ABCD
Fighter 13.3 EC (abamectin+ imidacloprid)	200 ml	85.48 ABCDE	83.52 ABC
Foxal 50% WDG (Chlorfenapyr)	75 ml	87.09 ABC	82.61 BCD
Check	--	0.00 H	0.00 G
LSD at 5%		3.54	2.50

Maximum mortality (88.14%) was observed in case of Virtual 10 % SC (Chlorfentizine + Azocyclotine) followed by Vibrant Super 23 % SC (Chlorfenapyr 18%+ Fenpyroximate 5%) and Pirate 36% SC (Chlorfenapyr) with mortality 87.59% and 87.39%, respectively after 72 hours of treatment and the minimum (73.21%) was observed in case of Compass 25% WP (Bifenthrin + Nitenpyram). After 7 days of treatment maximum mortality (85.55%) was observed in Pirate 36% SC (Chlorfenapyr) and minimum (69.78%) was observed in Compass 25% WP (Bifenthrin + Nitenpyram).

11. COMPARATIVE EFFICACY OF DIFFERENT TYPES OF SPRAYERS AGAINST SUCKING INSECT PESTS OF COTTON

The trial was conducted in RCBD having 4 replications at Entomological Research Institute, Faisalabad. Spray machines i.e. Knapsack hand sprayer (Pb-20), Knapsack Battery operated, Knapsack power sprayer, Tractor Mounted Boom Sprayer were tested during month of August using hollow cone nozzle. Pre-treatment & post-treatment 24 hrs, 72 hrs & 7 days after application, population data of sucking insect pests were recorded on per leaf basis. Data so obtained were analyzed statistically.

Table: COMPARATIVE EFFICACY OF DIFFERENT TYPES OF SPRAYERS AGAINST COTTON JASSID

Treatments	Pre-treatment jassid pop/leaf	Post-treatment jassid pop/leaf		% Mortality jassid after	
		72 HAA	7 DAYS	72 HAA	7 DAYS
Knapsack hand sprayer (Pb-20)	1.10	0.50	0.68	77.30 C	76.12 B
Knapsack Battery operated	1.59	0.33	0.51	84.86 A	82.07 A
Knapsack power sprayer	1.94	0.40	0.57	81.72 AB	80.09 A
Tractor Mounted Boom Sprayer	1.10	0.47	0.61	78.48 BC	78.41 AB
Check	1.32	2.21	2.85	0.00 D	0.00 C
LSD at 5%				3.85	3.71

Maximum (84.86%) & (82.07%) percentage mortality of jassid was recorded in the plot treated with treatment T2 (Knapsack Battery operated) followed by (81.72%) & (80.09%) in T3 (Knapsack power sprayer) after 72 hours and 7 days of application respectively. Minimum (77.30%) & (76.12%) percentage mortality of jassid was recorded in T1 (Knapsack hand sprayer (pb-20) after 72 hours and 7 days of application respectively.

Table: COMPARATIVE EFFICACY OF DIFFERENT TYPES OF SPRAYERS AGAINST COTTON WHITEFLY

Treatments	Pre-treatment Whitefly pop/leaf	Post-treatment Whitefly pop/leaf		% Mortality Whitefly after	
		72 HAA	7 DAA	72 HAA	7 DAA
Knapsack hand sprayer (Pb-20)	6.87	1.60	2.47	76.84 B	72.00 D
Knapsack Battery operated	6.27	1.50	2.20	78.58 B	75.11 C
Knapsack power sprayer	7.07	1.34	1.96	80.80 AB	77.81 B
Tractor Mounted Boom Sprayer	6.80	1.18	1.64	83.13 A	81.49 A
Check	5.67	6.94	8.87	0.00 C	0.00 E
LSD at 5%				4.17	2.53

Maximum (83.13%) & (81.49%) percentage mortality of whitefly was recorded in the plot treated with treatment T4 (Tractor Mounted Boom Sprayer) followed by (80.80%) & (77.81%) in T3 (Knapsack power sprayer) after 72 hours and 7 days of application respectively. Minimum (76.84%) & (72.00%) percentage mortality of whitefly was recorded in T1 (Knapsack hand sprayer (Pb-20)) after 72 hours and 7 days of application respectively.

12. DETERMINATION OF RUN OFF LOSSES OF SPRAY MATERIAL IN DIFFERENT SPRAYERS

Trial was laid out in the research area of Entomological Research Institute Faisalabad having 4 repeats. Different kind of sprayers i.e. Knapsack hand sprayer (pb-20), Knapsack Battery operated, Knapsack power sprayer were used for runoff loses measurement. Polythene sheets will be spread between crop rows. After spray runoff water droplets accumulated on plastic sheets were collected and measured in the beaker then percentage runoff losses were calculated and statistically analyzed.

TABLE: DETERMINATION OF RUNOFF LOSSES OF SPRAY MATERIAL IN DIFFERENT SPRAYERS

Treatments/ Sprayers	Spray Material Volume Sprayed (liters)	Spray Material Collected on Plastic sheets (ml)	Spray Material Run Off Loses %
Knapsack hand sprayer (Pb-20)	5	253.33	5.06 A
Knapsack Battery operated	5	99.17	1.98 C
Knapsack power sprayer	5	151.67	3.03 B
LSD at 5%			0.79

Maximum run off losses of spray material (5.06%) were recorded in the plots treated with Knapsack hand sprayer (pb-20) while minimum (1.98%) in the plots treated with Knapsack Battery operated.

13. STUDIES ON VARIETAL RESISTANCE AND POPULATION DYNAMICS OF PINK BOLLWORM ON BT GENOTYPES OF COTTON

The trial was conducted with the coordination of Cotton Botanist, CRS Multan. The Bt genotypes (886, 992 and 142) were selected for this study. The data was recorded by observing 100 flowers (rosette, healthy and calculate percentage) from each variety, similarly population in bolls were recorded by plucking 20 bolls from randomly selected plants per plot at weekly intervals. The data was started on the appearance of flowers and continued till the harvest of crop. The collected data was compiled andcorrelations were calculated by Statistix version 8.1.

Table : VARIETAL RESISTANCE OF PINK BOLLWORM ON THREE BT GENOTYPES OF COTTON

Varieties	Total bolls plucked	No. of flowers checked	Percent rosette flowers recorded	% infested bolls due to PBW
Bt-886	20	100	**0.61**	**41.13**
Bt-992	20	100	**2.25**	**31.39**
Bt-142	20	100	**2.37**	**27.22**

Table : STUDIES ON POPULATION DYNAMICS OF PINK BOLLWORM OF Cotton

date obs	Percent damage PBW	Temperature Max	Temperature Mini	RH	rainfall
20.7.15	0.00	36.6	28.8	76.9	0
3.8.15	0.00	35.3	27	86.4	110
10.8.15	0.00	34.3	26.1	89.3	34
17.8.15	1.39	37.8	26.8	72.6	0
26.8.15	2.22	36.1	26.7	77.7	9
4.9.15	21.01	36.7	25.4	77.9	58
11.9.15	44.44	35.7	25.9	77	0
18.9.15	50.19	38	26.1	69.2	0
23.9.15	40.44	36.9	26.1	62.6	19
2.10.15	1.39	34.6	23.5	74.8	0
8.10.15	26.22	36.6	23.9	61.8	0
16.10.15	30.35	36.9	21.9	57.6	0
22.10.15	41.33	34.1	20.4	67.1	0
29.10.15	49.33	29.29	18.57	76.86	0
5.11.15	49.33	31.29	16	70.64	0
12.11.15	72.00	26.43	15.71	72.43	0

Table : STUDIES ON POPULATION DYNAMICS OF PINK BOLLWORM ON BT-886, 992 and 142 GENOTYPES OF COTTON

Early 4.4.15			**Weather factors**			
Bt-886	**% rosette**	**% damage bolls**	**Max ◦C**	**Mini ◦C**	**RH (%)**	**Rainfall (mm)**
7.6.15	0.00	0.00	38.70	25.70	44.30	0.00
15.6.15	0.00	0.00	40.50	27.90	44.10	10.00
22.6.15	0.00	0.00	40.40	29.40	45.60	0.00
29.6.15	0.00	0.00	38.60	27.10	54.60	20.00
3.7.15	0.00	0.00	36.70	28.30	74.90	5.00
13.7.15	0.00	0.00	35.90	26.50	77.10	48.00

20.7.15	0.20	0.00	36.60	28.80	76.90	0.00
3.8.15	0.00	0.00	35.30	27.00	86.40	110.00
10.8.15	0.00	4.17	34.30	26.10	89.30	34.00
17.8.15	0.00	0.00	37.80	26.80	72.60	0.00
26.8.15	0.00	36.36	36.10	26.70	77.70	9.00
4.9.15	0.67	66.67	36.70	25.40	77.90	58.00
11.9.15	5.63	78.57	35.70	25.90	77.00	0.00
18.9.15	1.35	73.33	38.00	26.10	69.20	0.00
23.9.15	1.35	4.17	36.90	26.10	62.60	19.00
2.10.15	0.00	66.67	34.60	23.50	74.80	0.00
8.10.15	0.00	47.06	36.60	23.90	61.80	0.00
16.10.15	0.00	52.00	36.90	21.90	57.60	0.00
22.10.15	0.00	44.00	34.10	20.40	67.10	0.00
29.10.15	0.00	72.00	33.70	21.00	65.50	9.00
5.11.15	0.00	72.00	29.80	16.00	72.00	0.00
seasonal 8.5.15	7	18	35.54	24.37	72.56	15.93
bt-992	**% rosette**	**% damage bolls**	**Max**	**Mini**	**RH**	**rainfall**
20.7.15	0.00	0.00	36.60	28.80	76.90	0.00
3.8.15	0.00	0.00	35.30	27.00	86.40	110.00
10.8.15	0.00	0.00	34.30	26.10	89.30	34.00
17.8.15	0.00	0.00	37.80	26.80	72.60	0.00
26.8.15	0.00	0.00	36.10	26.70	77.70	9.00
4.9.15	0.00	13.33	36.70	25.40	77.90	58.00
11.9.15	3.45	40.00	35.70	25.90	77.00	0.00
18.9.15	0.00	36.00	38.00	26.10	69.20	0.00
23.9.15	1.35	24.00	36.90	26.10	62.60	19.00
2.10.15	3.45	0.00	34.60	23.50	74.80	0.00
8.10.15	5.63	4.00	36.60	23.90	61.80	0.00
16.10.15	2.74	20.00	36.90	21.90	57.60	0.00
22.10.15	0.00	44.00	34.10	20.40	67.10	0.00
29.10.15	0.00	40.00	33.70	21.00	65.50	9.00

5.11.15	8.11	56.00	29.80	16.00	72.00	0.00
12.11.15	0.00	68.00	26.40	16.30	69.60	0.00
	2.25	31.39	34.49	22.41	68.65	7.82
Date of sowing						
seasonal8.5.15						
Bt-142	**% rosette**	**% damage bolls**	**Max**	**Mini**	**RH**	**Rainfall**
20.7.15	0.00	0.00	36.60	28.80	76.90	0.00
3.8.15	0.00	0.00	35.30	27.00	86.40	110.00
10.8.15	0.00	0.00	34.30	26.10	89.30	34.00
17.8.15	0.00	0.00	37.80	26.80	72.60	0.00
26.8.15	0.00	6.67	36.10	26.70	77.70	9.00
4.9.15	5.63	13.33	36.70	25.40	77.90	58.00
11.9.15	2.74	26.67	35.70	25.90	77.00	0.00
18.9.15	0.67	36.00	38.00	26.10	69.20	0.00
23.9.15	2.04	24.00	36.90	26.10	62.60	19.00
2.10.15	5.63	0.00	34.60	23.50	74.80	0.00
8.10.15	4.17	8.00	36.60	23.90	61.80	0.00
16.10.15	2.04	24.00	36.90	21.90	57.60	0.00
22.10.15	0.00	28.00	34.10	20.40	67.10	0.00
29.10.15	0.00	64.00	33.70	21.00	65.50	9.00
5.11.15	5.45	20.00	29.80	16.00	72.00	0.00
12.11.15	0.00	76.00	26.40	16.30	69.60	0.00
Average	**rosette**	**damage bolls**	**Max**	**Mini**	**RH**	**Rainfall**
20.7.15	0.07	0.00	36.6	28.8	76.9	0
3.8.15	0.00	0.00	35.3	27	86.4	110
10.8.15	0.00	1.39	34.3	26.1	89.3	34
17.8.15	0.00	0.00	37.8	26.8	72.6	0
26.8.15	0.00	14.34	36.1	26.7	77.7	9
4.9.15	2.10	31.11	36.7	25.4	77.9	58
11.9.15	3.94	48.41	35.7	25.9	77	0
18.9.15	0.67	48.44	38	26.1	69.2	0

23.9.15	1.58	17.39	36.9	26.1	62.6	19
2.10.15	3.03	22.22	34.6	23.5	74.8	0
8.10.15	3.27	19.69	36.6	23.9	61.8	0
16.10.15	1.59	32.00	36.9	21.9	57.6	0
22.10.15	0.00	38.67	34.1	20.4	67.1	0
29.10.15	0.00	58.67	33.7	21	65.5	9
5.11.15	4.52	49.33	29.8	16	72	0
12.11.15	0.20	61.71	26.4	16.3	69.6	0

Percent rosette flowers on different cotton genotypes on bt-886, 992 and 142 during 2015

Date of observation	Bt-886	Bt-992	Bt-142
17.8.15	0.00	0.00	0.00
26.8.15	0.67	0.00	0.00
4.9.15	5.63	0.00	5.63
11.9.15	1.35	3.45	2.74
18.9.15	1.35	0.00	0.67
23.9.15	0.00	1.35	2.04
2.10.15	0.00	3.45	5.63
8.10.15	0.00	5.63	4.17
16.10.15	0.00	2.74	2.04
22.10.15	0.00	0.00	0.00
29.10.15	0.00	0.00	0.00
5.11.15	50.00	8.11	45.45

12.11.15	0.00	0.00	0.00
Average	4.92	2.06	5.70
Percent damaged bolls on different cotton genotypes on bt-886, 992 and 142 during 2015			
Date of observation	Bt-886	Bt-992	Bt-142
17.8.15	4.17	0.00	0.00
26.8.15	0.00	0.00	6.67
4.9.15	36.36	13.33	13.33
11.9.15	66.67	40.00	26.67
18.9.15	78.57	36.00	36.00
23.9.15	73.33	24.00	24.00
2.10.15	4.17	0.00	0.00
8.10.15	66.67	4.00	8.00
16.10.15	47.06	20.00	24.00
22.10.15	52.00	44.00	28.00
29.10.15	44.00	40.00	64.00
5.11.15	72.00	56.00	20.00
12.11.15	72.00	68.00	76.00
Average	47.46	26.56	25.13

Maximum infestation was observed on variety Bt 886 41.13% followed by Bt 992 with 31.39% and least infestation was found on Bt 142 with 27.22% infestation. The results showed that Pink bollworm infestation started on 2nd week of August, it continue and maximum infestation in the 2nd week of September. Then it show decline. Maximum boll damage was observed on 2nd week of September i.e. 78.5% when maximum temperature (37.70 Cº), minimum temperature (25.9 Cº),

relative humidity (77.0%) and rainfall (0) mm, where as minimum boll damage was recorded on 2nd week of August i.e. 4.17% when maximum temperature (34.30 Cº), minimum temperature (26.10 Cº) relative humidity (89.3%) and rainfall 34mm. Maximum boll damage was observed on 2nd week of November i.e. 68 % when maximum temperature (26.40 Cº) minimum temperature, (16.30 Cº) relative humidity (59.60%) and rainfall (0) mm where as minimum damage was recorded on 2nd week of August i.e. 4.0% when maximum temperature (36.6 Cº), minimum temperature (23.90 Cº) relative humidity (61.80%) and rainfall 0mm was recoded.Maximum boll damage was observed on 2nd week of November i.e. 76 % when maximum temperature (26.40 Cº), minimum temperature (16.30 Cº), relative humidity (59.60%) and rainfall (0) mm, where as minimum damage was recorded on 4th week of August i.e. 6.67% when maximum temperature (36.10 Cº), minimum temperature (26.70 Cº), relative humidity (77.70%) and rainfall (9mm) was recoded

14. IMPACT OF PLANT SPACING ON INSECT PEST COMPLEX

The trial was conducted with the coordination of Cotton Botanist, CRS Multan. The bt cotton varieties i.e.were sown at p x p distance 6, 12, 18 and 24 inch. The sucking pests like Whitefly, Jassid and Thrips population were recorded from 15 leaves selected at random from 15 plants per plot. The leaves were selected from upper, middle and lower portion of randomly selected plants. The data regarding bollworms population were recorded from 10 plants per plot selected at random. There were three replications under RCBD.

The data were subjected to analysis of variance (ANOVA) using Statistix software (release 8.1; Lawes Agricultural Trust Rothamsted Experimental Station, Rothamsted, UK). The means were separated by HSD (Honestly Significant Differences). Non significant difference among the treatments.

Table . Data regarding sucking pest and bollworms on cotton variety-1 sown at different plant spacing during 2015

Spacing in inch	Average population of sucking pest per leaf (NS)			Average population of bollworm per plant		
	Jassid	Whitefly	Thrips	SBW	PBW	ABW
6	5.00 a	3.47 a	0.87 a	0.00	0.00	0.00
12	4.50 a	3.67 a	0.30 a	0.00	0.00	0.00

18	5.30 a	2.87 a	0.17 a	0.00	0.00	0.00
24	5.63 a	2.87 a	0.20 a	0.00	0.00	0.00
Tukey's HSD	1.60	1.32	0.26			
F-Value	2.17	2.34	37.29			

Table . Data regarding sucking pest and bollworms on cotton variety-2 sown at different plant spacing during 2015 V2

Spacing in Inch	**Average population of sucking pest per leaf (NS)**			**Average population of bollworm per plant**		
	Jassid	**Whitefly**	**Thrips**	**SBW**	**PBW**	**ABW**
6	5.27 a	3.07 a	0.10 a	0.00	0.00	0.00
12	4.63 a	3.23 a	0.13 a	0.00	0.00	0.00
18	4.43 a	2.63 a	0.23 a	0.00	0.00	0.00
24	5.63 a	2.00 a	0.33 a	0.00	0.00	0.00
Tukey's HSD	3.10	1.55	0.23			
F-Value	0.77	3.02	5.00			

Non significant difference among the treatments.

15. SCREENING OF CODED CONVENTIONAL GENOTYPES (NCVT) OF COTTON AGAINST INSECT PEST COMPLEX

The trial was conducted with the coordination of Cotton Botanist, CRS Multan. The NCVT trial having 10 coded non Bt. genotypes of cotton were sown in RCBD, replicated thrice at Cotton Research Station, Multan. The sucking pests like Whitefly, Jassid and Thrips population was recorded from 15 leaves selected at random from 15 plants per plot. The leaves were taken from upper, middle and lower portion of the selected plants. The data regarding live larvae of Spotted and American Bollworms was counted from 10 randomly selected plants per plot at weekly intervals whereas pink bollworms were detected from 50 unopened cotton bolls plucked per replication from these non bt cotton genotypes at the end of crop. Percent infestation was calculated. Finally, the data was compiled and analyzed with Statistix Version-9 and means were separated by Tukey HSD.

Table. DATA REGARING AVAERAGE POPULATION OF BOLLWORMS PER PLANT THROUGHOUT THE SEASON.

Coded cotton genotypes	Average population of sucking pests / leaf			BOLLWORMS		
	Jassid	Whitefly	Thrips	AV. No. Of larvae per plant of sbw	Percent infested bolls by PBW larvae	Av. No. Of larvae per plant of abw
V1	2.76AB	11.61AB	1.01BCD	0.13BC	25.00D	0.14AB
V2	2.59AB	7.57CDE	0.97BCD	0.14ABC	60.00AB	0.00E
V3	3.14AB	13.74A	0.84BCD	0.13BC	25.00D	0.00E
V4	3.30AB	8.19CDE	1.36BC	0.20ABC	20.00D	0.00E
V5	3.03AB	8.79BCDE	1.00 BCD	0.20ABC	50.00ABC	0.00E
V6	3.77A	9.44BCDE	1.07 BCD	0.04C	69.00A	0.03DE
V7	3.45AB	9.76ABCD	1.33BCD	0.25AB	36.00BCD	0.16AB
V8	3.16AB	7.20DE	3.08A	0.20ABC	30.00CD	0.21A
V9	3.06AB	9.95ABCD	0.79CD	0.38A	60.00AB	0.00E
V10	2.30B	8.60BCDE	0.81CD	0.21ABC	50.00ABC	0.00E
Tukey HSD At 5%	0.35	0.85	0.18	0.05	6.57	0.01
F-value	2.24	8.59	21.81	3.20	12.60	40.44

Means sharing similar letters are not significantly different by Tukey HSD at P = 0.05

The data in the table reveal that there was a significant difference among different varieties of non Bt. cotton regarding response of sucking pests and bollworms attack. The genotype V6 has maximum population of Jassid per leaf i.e. 3.77 followed by V7, V4, V8, and V3 with 3.45, 3.30, 3.16 and 3.14 while Minimum population of jassid per leaf was recorded on genotype V10 i.e. 2.30 jassid per leaf. The data in the table reveal that there was a significant difference among

different varieties of non Bt. cotton regarding response of whitefly. V3 has maximum population of whitefly per leaf i.e. 13.74 .Minimum population of whitefly was recorded on genotypes V8 i.e. 7.20 whiteflies per leaf. Regarding thrips there was a significant difference among the different genotypes of non Bt. Cotton as shown in Table 1. The genotype V8 has maximum population of thrips per leaf i.e. 3.08 thrips per leaf. Minimum population of thrips was recorded on genotype V9 with population 0.79 thrips per leaf. The data in the table 1 reveal that maximum number of larvae of spotted bollworm i.e. 0.38 per plant was recorded on genotype V9. Minimum larvae of spotted bollworm were recorded on genotype V6 having population 0.04 per plant. The data revealed that maximum numbers of infested bolls were recorded on genotype V6 i.e. 69.00 %. The minimum infestation of pink bollworm was recorded on genotype V4 i.e. 20.00 which is statistically similar to V1 and V3 having 25.00% infestation of pink bollworm. The data revealed that maximum numbers of infested bolls were recorded on genotype V8 i.e. 0.21 The minimum infestation of American bollworm was recorded on genotype V6 i.e. 0.03.while remaining genotype V2,V3,V4,V5,V9 and V10 show zero larvae American bollworm. To select the genotype of less attack of sucking and bollworms insect pest attack.

16. SCREENING OF NEW COTTON GENOTYPES AGAINST INSECT PESTS

Five Cotton genotypes were sown in the research area of Entomological Research Institute, Faisalabad. The trial was laid out in RCB Design having three replications. The population of whitefly, jassid, aphid and thrips was recorded from 15 leaves of 15 plants selected at random from upper, middle and lower portions of plants. Percentage damage of Pink Bollworm was observed by dissecting 25 randomly selected bolls per plot. The data recorded are as under:-

Table: Screening Of New Cotton Genotypes Against Insect Pests

Cotton Genotypes		Thrips/ Leaf	Whitefly /Leaf	Jassid/Leaf	PBW % Damage
V1	IR-NIBGE 7	4.91 B	7.62	0.62 B	15.67 B
V2	IR-NIBGE 8	4.86 B	7.34	0.50 C	14.33 B
V3	FH-142	3.68 C	6.96	0.45 C	13.67 B
V4	FH-Lalazar	5.283 B	7.41	0.60 B	16.33 B
V5	MNH-886	6.66 A	6.66	0.85 A	20.67 A
LSD at 5%		1.01	N.S.	0.09	3.42

Maximum population of Jassid (0.85/leaf), whitefly (7.62/leaf), thrips (6.66/leaf) and Pink boll worm % damage (20.67%) was observed on V5, V1, V5 and V5 respectively. Minimum whitefly (6.66/leaf) was observed on V5 while Jassid (0.45/leaf), thrips (3.68/leaf) and Pink boll worm % damage (13.67%) on V3.

17:MONITORING OF INSECTICIDES RESISTANCE IN WHITE FLY(BEMESIA TABACI)

From cotton fields whitefly individuals were collected and brought to the insecticides Resistance Laboratory, Entomological Research Institute, Faisalabad. Insecticides viz. Confidor 200SL, Confidor 70WS, Rani 20SL,Dimogreen 40EC ,Polo 500SC , Movento 240 SC , and Priority 10.8% AS were tested to evaluate the Insecticides Resistance. LC_{50} and LC_{90} values were calculated. The results are as under.

Table: INSECTICIDES RESISTANCE IN WHITE FLY

Sr.No.	**Chemicals**	**LC_{50}**	**LC_{90}**
1.	Confidor 200SL	514.07	7901.93
2.	Confidor 70WS	490.51	3319.90
3.	Rani 20SL	101.00	1410.81
4.	Dimogreen 40EC	35.18	198.00
5	Polo 500SC	88.78	341.77
6	Movento 240 SC	4.10	134.12
7	Priority 10.8% AS	3.56	109.45

The results showed that Confidor 200SL, Confidor 70WS, Polo 500SCand Rani 20SL had high LC50 value which depicts that theseinsecticides have high level of resistance

18: MONITORING OF INSECTICIDES RESISTANCE IN COTTON JASSID (*AMRASCA DEVASTANS*)

Cotton jassid was collected from cotton field and brought to the insecticides Resistance Laboratory, Entomological Research Institute, Faisalabad. Insecticides viz. Confidor 200SL, Confidor 70WS, Rani 20SL,Dimethoate 40EC. Oshin 20 SG and Pyramid10ASwere tested

to evaluate the Insecticides Resistance. LC50 and LC90 values were calculated. The results are as under.

Table: INSECTICIDES RESISTANCE IN COTTON JASSID (*AMRASCA DEVASTANS*)

Sr.No.	Chemicals	LC_{50}	LC_{90}
1.	Confidor 200SL	3167.45	25276.98
2.	Confidor 70WS	703.108	6342.42
3.	Rani 20SL	299.00	2789.10
4.	Dimethoate 40EC	56.17	341.29
5	Oshin 20 SG	41.17	123.06
6	Pyramid10AS	39.08	111.95

The results showed that Confidor 200SL, Confidor 70WS, and Rani 20SL andDimethoate 40EChad high LC50 value which depicts that theseinsecticides have high level of resistance

19.MONITORING OF INSECTICIDES RESISTANCE IN COTTON THRIPS *(Thrips tabaci*).

Thrips individual were collected from cotton field and brought to the insecticidesResistance Laboratory, Entomological Research Institute, Faisalabad. Insecticides viz. Confidor 200SL, Confidor70WS, Rani 20SL and Dimethoate 40EC, Tracer240 Sc andAcephate 25 WPwere tested to evaluate the In secticides Resistance. LC50 and LC90 values were calculated. The results are as under.

TABLE: INSECTICIDES RESISTANCE IN COTTON JASSID (*AMRASCA DEVASTANS*)

Sr.No.	Chemicals	LC_{50}	LC_{90}
1.	Confidor 200SL	1824.32	33249.00
2.	Confidor 70WS	980.71	9981.76
3.	Rani 20SL	191.19	2645.23
4.	Dimethoate40EC	64.10	299.13
5	Tracer240 Sc	51.18	99.10
6	Acephate 25 WP	71.17	167.00

The results showed that Confidor 200SL, Confidor 70WS, Rani 20SL and Acephate 25 WP had high LC50 value which depicts that these insecticides have high level of resistance

INSECT PESTS OF SUGARCANE

20:COMPARATIVE INCIDENCE OF BORERS AND PYRILLA ON DIFFERENT ADVANCE LINES OF SUGARCANE

The experiment was conducted in the research area of Sugarcane Research Institute, Faisalabad. The trial was laid out in RCBD with three replications. Different advanced lines of sugarcane were screened out against sugarcane borers and pyrilla. The data regarding the sugarcane borers' infestation was recorded from two central rows of each plot by counting all healthy and infested tillers and % infestation were calculated. At harvesting cumulative borers infestation was recorded by dissecting 10 randomly selected canes from each plot and internode damage was calculated. The pyrilla population was recorded on per leaf basis. Finally the data were analyzed statistically. The data recorded are as under;

Table:Varietal screening of different advanced lines of sugarcane against Borers.

Varieties/Lines	Tiller Infestation (%)	Top Borer	Stem Borer	Root Borer	Cumulative Borer % infestation	Response
V1=S2008- FD-19	2.5367 CD	0.4000 AB	4.387 DE	0.2033 CD	4.990 DE	R
V2=S2008-M34	4.2200 A	0.0000 B	6.303 CD	0.1633 D	6.467 CD	R
V3=S2008-M55	3.4867 AB	0.2200 AB	9.623 AB	0.4300 BCD	10.273AB	S
V4=S2008-AUS-1071	2.8600 BC	0.0000 B	5.557 D	0.4367 BCD	5.993DE	R
V5=S2008-AUS-1291	1.6400 EF	0.1800 B	7.730 BC	0.9333 ABC	8.843 BC	LS
V6=S2008-AUS-1301	1.4867 F	0.2133 B	5.400 D	0.4133 BCD	6.027 DE	R
V7=S2008-AUS-1331	1.5600 F	0.0000 B	4.537 DE	0.4033 BCD	4.940 DE	R
V8=S2008-AUS-1341	2.6067 CD	0.0000 **B**	5.210 DE	0.1833 CD	5.393 DE	R
V9=S2009-SA-8	2.6200 CD	0.0000B	5.010 DE	0.0000 D	5.010 DE	R
V10=S2009-SA-57	2.9267 BC	0.0000B	7.750 BC	1.4167 A	9.167 B	MS
V11=S2009-SA-79	2.5700 CD	0.0000B	5.517 D	1.1567 AB	6.673 CD	R
V12=S2009-SA-111	2.3433 CDE	0.6700B	8.010 BC	0.5767 BCD	9.257 B	MR
V13=S2009-SA-169	2.8300 BCD	0.3800B	10.843 A	1.3933 A	12.617 A	HS
V14=S2009-SA-171	2.9600 BC	0.5733B	7.660 BC	0.1867 CD	8.420 BC	LS
V15=CPF-247	2.1067 DEF	0.8500B	4.530 DE	0.0000 D	5.380 DE	R
V16=HSF-240	3.0500 BC	0.3100B	3.253 E	0.3600 CD	3.923 E	R

LSD 5%5	0.7351	0.8857	2.0654	0.7543	2.3798	

R=Resistant(0.00-8.00%),LS=Less Susceptible (above8.01-9.00%),MS=Moderately Susceptible (above9.01-10.00%),S= Susceptible (above10.01-11.00%),HS=Highly Susceptible (above11.00%)

The results show that in case of tiller infestation highest 4.22 % was observed on S-2008-M34 and it was statistically at par with S-2008-M55. The lower tiller infestation was observed on S2008-AUS-1301 (1.49) % at this was statically similar to S-2008 AUS 1331,S-2008AUS 1291,AND CPF -247.

Incase of cumulative borer attack highest infestation was observed on S2009-SA-169(12.62 %) and it was statiscally at par with S-2008-M55 and theses lines were rated as susceptible.

The lower cumulative borer attack was observed on HSF 240 with 3.92 % infestation and it was statistically similar with CPF-247 (5.38 %) S-2008-FD19 (4.99 %), S-2008-AUS (4.94 %) S 2009-SA-8 (5.38 %) and S2008AUS-1341(5.39 %). These lines were rated as resistant ones.

Table: Varietal screening of different advanced lines of sugarcane against Sugarcane Pyrilla

VARIETIES/LINES	**pyrilla/leaf**
V1=S2008- FD-19	7.603 GH
V2=S2008-M34	16.853 CD
V3=S2008-M55	9.767 G
V4=S2008-AUS-1071	18.650 BC
V5=S2008-AUS-1291	21.397 A
V6=S2008-AUS-1301	19.883 AB
V7=S2008-AUS-1331	20.010 AB
V8=S2008-AUS-1341	13.140 F
V9=S2009-SA-8	7.827 GH
V10=S2009-SA-57	12.383 F
V11=S2009-SA-79	16.167 DE
V12=S2009-SA-111	17.053 CD
V13=S2009-SA-169	16.053 DE
V14=S2009-SA-171	14.283 EF
V15=CPF-247	12.400 F
V16=HSF-240	6.780 H
LSD 5%5	2.4405

Minimum pyrilla attack 6.78 per leaf was observed on HSF-240 and it was statistically at par with S-2008-FD-19 (7.60) and S-2009-SA-8 (7.83). The highest pyrilla population was observed on S-2008-AUS-1291 (21.40) and it was statistically similar with S-2008-AUS-1331 (20.01) and S-2008-AUS-1301(19.88)

21.EFFICACY OF DIFFERENT GRANUALR/SPRAY INSECTICIDES AGAINST SUGARCANE BORERS

The experiment was conducted at farmer field to test the efficacy of different granular / spray insecticides against sugarcane borers. The trial was laid out in RCBD with three replications. Insecticides were applied at tillering stage and data regarding tillers infestation were recorded before treatment and then after 15 & 30 days of application of granular insecticides. Finally the data were analyzed statistically. The data recorded are as under;

Table:26.Sugarcane borer's infestation (%) after different time intervals

	Insecticides	dose/acre	PRETREATMENT	15 DAYS	30DAYS
T1	TARA GOLD 5G	14KG	22.02	2.20 C	2.59 BCD
T2	KWICK 3G	10KG	20.99	3.13 C	2.30 CD
T3	PRAVO 10 SC	300ML	23.80	4.80 BC	1.32 D
T4	REGENT 80 WG	30GM	21.56	4.00 BC	3.75 BC
T5	FURADAN 3G	14KG	21.25	5.19 BC	3.75 BC
T6	FERTERRA 0.4G	4KG	20.56	6.98 B	4.64 B
T7	CONTROL	0	20.86	19.47 A	22.00 A
	Lsd5%		NS	6.21	3.55

The pre-treatment borer infestation was recoded from 20.56% to 23.80% on all the treatments. After 15 days of application the lower borer infestation 2.20 % was recoded in the plots treatments with Tara Gold and it was statistically similar with Kwick (3.13 %) Pravo (4.80 %) and Regent (4.00 %) as against check with 19.47 % borer infestation.

After 30 days of application the lowest borer infestation 1.32 % was observed on PRAVO and it was statistically at par with KWICK 2.30 % and TARA GOLD (2.59 %) as against 22 % in control plots.

INSECT PESTS OF WHEAT

22:VARIETAL SCREENING OF WHEAT AGAINST APHID AND BENEFICIAL INSECT FAUNA

The experiment was conducted in the research area of Entomological Research Institute, Faisalabad to check the susceptibility/ resistance response of wheat varieties towards aphid and beneficial insects. The data regarding aphid population were recorded per tiller bases while the population of natural enemies was counted per five plants basis at weekly interval. Finally the data were analyzed statistically. The data recorded are as under.

At FAISALABAD

Table:Varietal screening of wheat against aphid

	VARIETIES	Mean aphid population per tiller		Predators/5plants	
		Crop season	Peak period	Coccinellids	Syrphid Fly
1	**Fsd-08**	7.67 CD	14.333 BC	0.39 ABC	0.64 BC
2	**V-11098**	7.62 CD	14.393 BC	0.43 AB	0.65 BC
3	**NIBGE Gandum-3**	8.06 BC	13.807 CD	0.36 ABC	0.60 BC
4	**Shafaq-2006**	10.22 A	18.627 A	0.43 AB	0.59 BC
5	**V-13372**	6.44 CD	11.307 CD	0.41 AB	0.72 AB
6	**Punjab-2011**	5.93 D	9.987 D	0.32 ABC	0.60 BC
7	**V-12304**	9.77 AB	18.227 AB	0.28 BC	2.52 BC
8	**11C023**	5.72 D	10.473 CD	0.22 C	0.51 C
9	**V-13005**	7.30 CD	13.040 CD	0.35 ABC	0.55 BC
10	**V-13016**	6.21 CD	11.060 CD	0.43 AB	0.63 BC
11	**V-12120**	9.90 AB	17.960 AB	0.49 A	0.87 A
LSD values	-	1.99	3.96	0.18	0.52

During the crop season the dominent population of *Rhopalosiphum padi* L. at tillering stage and *Sitobion avenae* F. during earing stage. The aphid population become visible in the last week of December and gradually increased on all the wheat genotypes. Data during crop season on average, aphid population reveals that shafaq 2006 and V-12120 had maximum aphid population 10.22 and 9.90 respectively while the minimum aphid population 5.72/tiller was recorded on 11C023 and it was statistically similar with FSD-08, V-11098, V-13005, V-13372, V-13016 and Punjab 2011.

During the peak period the maximum population (18.63/tiller) observed on the shafaq 2006 and (18.23/tiller) on V-12304 and minimum population on the variety Punjab-2011 and 11C023 that was 9.99 and 10.47 respectively .

23: **STUDIES ON THE POPULATION DYNAMICS OF WHEAT APHID IN RELATION TO WEATHER FACTORS**

A. Studies were carried out at Entomological Research Institute, Faisalabad. The collection of aphid was done by using three trays each measuring 59 x 46 x 75 cm, painted with yellow colour inside. These trays were placed at three spots, two and half feet (75 cm) above the ground level on wooden stands at a distance of 50m from each other. Data on wheat aphids trapped in trays were recorded daily from 9-11 a.m. from each spot. Weather data, i.e., maximum and minimum temperature, R.H %, rainfall and wind velocity of the coinciding dates were also collected from the meteorological observatory of Ayub Agricultural Research Institute, Faisalabad and correlated with aphid density. The data was analyzed and presented in Table 1.

B.An experiment was conduct to check the fluctuation in the population of wheat aphid in relation to weather factors. Wheat crop sown in the Entomological Research Institute, Ayub Agricultural Research Institute Faisalabad. Crop was grown according to the standerd agronomic practices. The data regarding aphid population was recorded on per tiller bases at weekly interval .There were three replications in the Plot. The data recording was started during the month of February and continued till maturity of crop.

TABLE-1 POPULATION OF APHID PER TRAY PER WEEK ALONG WITH DIFFERENT WEATHER FACTORS

Month	Week	Aphid pop.(per day/per tray)	Temperature C^0		Relative humidity %		Rainfall (mm)	Wind velocity (km/hour)	
			Maximum	Minimum	RH8 am	RH5 pm		Wv8am	Wv 5pm
December	4th week	1.66	21.75	4.85	86.75	47.63	0.00	0.25	0.75
January	1st week	11.54	22.95	7.41	88.00	50.63	0.00	0.75	1.13
	2nd week	4.29	19.09	8.16	90.14	68.14	6.50	0.43	1.71
	3rd week	1.33	13.51	6.71	89.00	79.00	0.00	0.86	1.57
	4th week	6.33	16.17	5.83	92.11	67.22	5.40	0.44	1.22
February	1st week	8.62	23.31	6.01	83.29	39.29	1.0	0.00	2.29
	2nd week	57.24	21.71	7.07	86.57	46.29	0.00	1.43	2.71
	3rd week	77.81	24.19	6.76	85.43	46.29	5.80	0.86	2.71

	4th week	275.42	28.63	11.20	81.63	42.63	0.00	1.0	2.75
March	1st week	570.08	28.64	14.55	77.50	54.00	0.13	1.38	2.50
	2nd week	288.48	25.6	15.13	83.14	64.14	29.40	2.00	3.14
	3rd week	23.10	28.6	14.81	66.57	50.14	45.60	2.00	2.57
	4th week	11.96	26.97	16.60	70.67	47.44	2.0	2.00	3.22

Table-1 shows that the average population of aphid per tray per week along with different weather factors which affect the aphid population during season. Aphid population was started trapping on yellow water traps during 4th week of December with aphid population 1.66 Per tray per week and aphid population gradually increase during subsequent weeks and its peak was observed 4th week of Feb. till 2nd week of March. During this period aphid population on yellow water trays varies from 275.42-570.08 aphid per tray per week. After that aphid population on traps suddenly decreased and it become negligible during last week of March and First week of April. Aphid population was found maximum when maximum Temperature was 24.19 C-28.640C and minimum Temperature was 6.76C with Relative Humidity ranging from 77.50% to 83.14%.

TABLE:2. Aphid population per tiller in relation to weather factors

Overall Season Date of Observation	Aphid population/tiller	Temperature C^0		Relative humidity %		Rainfall (mm)
		Maximum	Minimum	RH8 am	RH5 pm	
30/12/15	0	25.5	6.5	86	38	0
6/1/16	0	21.8	8	93	56	0
28/1/16	0	20	6	93	70	0
2/2/16	3.36	22	6.2	86	44	0
9/2/16	10.04	23	5.5	93	54	0
16/2/16	6.96	24	5.5	80	29	0
23/2/16	24.64	31.1	11.5	75	24	0
3/3/16	9.36	32	17.2	81	60	0
8/3/16	11.24	29.5	13.5	72	45	0
16/3/16	4.13	26	15	81	47	0
23-3-16	1.35	29.7	18.7	72	45	0
30-3-16	1.02	32.2	20.5	71	44	0
6-4-16	0	32.7	21.5	72	45	0

Aphid population on wheat crop appeared during the first week of February and gradually increased to its peak on 4thweek of February. The aphid population at that time was 24.64 per tiller when maximum temperature was 31.10 C° and relative humidity at 8 am was 75.0 %. when temperature increased and crop began to mature the aphid population vertically decreased to nil per tiller at that time the maximum temperature was 32.7 C° with relative humidity at 8 am was 72%.

The natural enemies (predators) appeared during 1st week of March and they began to increase as the aphid population developed. The highest Coccinellid, Chrysopids and Syrphid-fly were found during the 3rd and fourth week of March, and they controlled aphid population successfully and lowered it from 19.66 per tiller to 0.15 per tiller. At that time Coccinellid were 3.7 per plant, Chrysoperla 1.6 per plant and Syrphid-fly 1.4 per plant.

24: SCREENING OF SEED DRESSING INSECTICIDES AGAINST WHEAT APHID

The study was conducted at the research area of Entomological Research Institute, Faisalabad under RCBD with three replications to study the efficacy of different insecticides as seed dressers against wheat aphids. There were following five Insecticides with two doses each.

Table: Screening Of Seed Dressing Insecticides Against Wheat Aphid

Treatments	Insecticides	Dose	Price
T1	Hicap 70WS	2g	Rs. 290/50g pack
T2	Hicap 70WS	3g	Rs. 290/50g pack
T3	Hombre 186.25FS	2g	Rs. 1350/400g pack
T4	Hombre 186.25FS	4g	Rs. 1350/400g pack
T5	Confidor 70WS	2g	Rs. 500/50g pack
T6	Confidor 70WS	3g	Rs. 500/50g pack
T7	Actara 70WS	2g	Rs. 600/30g pack
T8	Actara 70WS	3g	Rs. 600/30g pack
T9	Husk 186.25FS	2g	Rs. 980/400g pack
T10	Husk 186.25FS	4g	Rs. 980/400g pack
T11	Control	Control	

The treatments were applied at time of sowing by mixing each insecticide with seed. Seed required for each treatment were mixed with some amount of water for easy application and absorption of pesticides into seed. Measured amount of each pesticide was sprinkled on seeds and mixed thoroughly with stick so that complete covering of seed with insecticide was ensured. For each treatment new stick was used to avoid the mixing of effect of previous insecticide.

Data regarding aphid population was recorded weekly started from first week of February till end

of March. Counting of aphid from wheat crop was done from 10 randomly selected tillers per plot by observing from base of tiller to top. Aphid from spike was counted by using white paper and aphids were separated from spike with camel hair brush gently. Also we took the data of Wheat aphid predators from each treatment from 5 randomly selected plants and check the effect of insecticides on predators.

Results table show that the average aphid population during season was minimum on T8 (1.67) and it was statistically at par with T7 (1.68) and T6 (2.43). The maximum aphid population was recorded in control plot having 6.53 aphid/tiller and it was statistically different from all other treatments. T9 (4.33), T3 (3.75), T1 (3.64), T4 (3.61), T5 (3.54) and T10 (3.53) also have high population of aphid as compare to other treatments.

On overall average aphid population basis T8, T7 and T6 proved the most effective insecticides as seed treatments while T9 proves least effective treatment for the control of aphid.

On the basis of peak population the results show that T7, T8 and T6 proves the more effective treatments and they were statistically different from all other treatments having aphid population 2.86, 3.04 and 3.83/tiller respectively. While the highest aphid population 9.65/ tiller was recorded in control plot. T9, T5 and T4 are statistically similar having aphid population 7.69, 6.84 and 6.75 /tiller respectively and have higher population of aphids.

Population of coccinalid on different treatments shows that the coccinalid beetle population was high where aphid population was high, while it's population was lower where aphid population was comparatively low.

Similar the case with Syrphid flies. It's obvious from the data of coccinalid and syrphid flies in different treatments that the insecticides which had better control of aphid have less population of aphids have less population of Natural enemies population is directly correlated with aphid population.

25: STUDIES ON THE POPULATION DYNAMISCS OF WHEAT APHID

The experiment was laid out at ERSS, Multan. The aphid data on wheat crop was recorded from 15 tillers selected at random and the population of aphid was counted. The predators data per plant basis was also recorded on weekly basis and correlated with the metrological data.

Table: POPULATION DYNAMISCS OF WHEAT APHID

Month	WeeK	Aphid/tiller	Beneficial insects/plant			METEROLOGICAL DATA			
			ChMonthrysoper [illegible]	Coccinellid/plant	Syrphidfly/plant	Maximum Temperature (C°)	Minimum Temperature (C°)	R.H (%)	Rainfall (mm)
JANUARY	1st	0.05	0.00	0.00	0.00	21.90	9.10	84.00	0.00
	2nd	0.18	0.00	0.00	0.00	21.40	9.10	85.90	2.00
	3rd	2.56	0.00	0.00	0.00	19.50	6.40	88.80	0.00
	4th	15.27	0.00	0.00	0.51	17.30	6.60	86.90	0.00
FEBRUARY	1st	30.33	0.47	0.00	0.47	22.90	6.28	81.70	0.00
	2nd	92.67	0.33	0.50	0.42	22.10	9.70	81.50	0.00
	3rd	73.26	0.53	0.64	0.52	24.90	9.10	76.10	0.00
	4th	57.46	0.21	0.82	0.33	29.30	13.70	73.90	0.00
MARCH	1st	24.38	0.00	0.92	0.58	25.90	9.71	75.30	0.00
	2nd	15.33	0.00	1.20	0.60	26.50	10.20	82.30	0.00
	3rd	2.78	0.00	1.52	0.32	27.80	11.10	81.70	1.00
	4th	1.22	0.00	1.30	0.21	30.60	18.57	79.50	0.00
APRIL	1st	1.13	0.00	0.00	0.00	33.10	19.00	76.60	7.00
	2nd	0.49	0.00	0.00	0.00	32.30	18.60	84.00	10.00
	3rd	0.00	0.00	0.00	0.00	36.40	20.10	70.50	0.00
	4th	0.00	0.00	0.00	0.00	39.00	24.10	58.70	0.00

Maximum aphid population was found on 2nd week of February (92.67)/tiller when maximum temperature was (22.10 C⁰), minimum temperature (9.70 C⁰), relative humidity (81.50 %) and rainfall (0.00mm). At that time beneficial insect population i.e. green lacewing 0.33, Coccinellid 0.50 and syrphid fly 0.42/plant. Whereas minimum population of aphid was recorded on 2nd week of april (0.49) when maximum temperature (32.30 C⁰), minimum temperature (18.60 C⁰), relative humidity (84.0%) and rainfall (10 mm). No beneficial insect was found at the month of April.

26: Comparative efficacy of different botanicals against aphid on wheat crop.

The experiment was conducted in the vegetable area of Ayub Agricultural Research Institute, Faisalabad during 2015. The aim of this study was to determine the efficacy of different botanicals and insecticides against wheat aphids. The experiment was conducted under field conditions in Randomized Complete Block Design (RCBD) with three replications. The results (from pretreatment data) showed that population of aphid (per plant) is similar in all treatments. However, the maximum population was recorded from amaltas treatment plot 61/tiller whereas minimum population was recorded from bakhra treatment plot 41.23/tiller. After 24 hour moringa extract found most the effective against aphid population and 13.13 aphids / tiller was recorded. The maximum population was prevalent in control treatment 21.633 aphids / tiller. The results after 2 days/48 hour showed that amaltas extract found most effective against aphid population and 7.1 aphids / tiller was recorded. The maximum population was prevalent in control treatment 12.867 aphids/tiller. The results after 7 days/168 hour showed that dhatura extract found most effective against aphid population and 5.8 aphids / tiller was recorded. The maximum population was prevalent in control treatment 20.467 aphids / tiller.

Table: Comparative efficacy of different botanicals against aphid on wheat crop

	Aphid Population/tiller	Aphid Population/tiller after		
	Pre-treatment data	After 24 hrs	After 48 hrs	After 168 hrs
Amaltas	61.633	15.333	7.100	7.700
Bakhra	41.233	17.400	8.033	6.833
Beeri patta	53.233	15.533	8.867	8.033

Dhatura	42.867	20.600	10.500	5.800
Moringa	47.800	13.133	11.067	6.900
Tuma	48.200	16.133	12.267	6.300
Control	49.300	21.633	12.867	20.467

27: The Impact of three wheat aphid species on life table parameters of Seven Spotted Lady Bird Beetle, *Coccinella septempunctata* (Coccinellidae: Coleoptera) under laboratory conditions

Development time: Male and female of *C. septempunctata* were kept in a small petri dish provided with mixed life stages (immatures and adults) of three aphid species (*Rhopalosiphum padi, Shizophis graminis* and *Sitobion avenae*) to serve as food in a growth chamber at 25±2°C, 70±5% RH under 16:8 (L:D) conditions . Data for development time of *C. septempunctata* immatures and adult male and female were recorded after 12 hours interval till adult emergence. Only females were processed further for fecundity studies while males obtained will be kept separately for longevity study. Adult male were allowed to mate once with the female and then removed. Thereafter, pre-oviposition, oviposition, post-oviposotion, daily and total fecundity data will be recorded after every 12 hours. Twelve specimens of adult female were kept under observation for the construction of life table by age specific fecundity and survivorship. Mean generation time, net reproductive rate, intrinsic rate of increase, finite rate of increase and doubling time were assessed following equations proposed by (Birch 1948). Lower developmental threshold (K) and degree days were estimated following (Campbell et al. 1974). Whole experiment will be replicated five times.

The Developmental period from egg to adult of *C. septempunctata* was shorter on *R. padi* and *S. graminum* where it was much longer on *Aphis craccivora*. Lowest pre-oviposition period was observed on *R. padi* (3.26 d) and *S. graminum* (3.47 d) whereas pre-oviposition period was much longer on *A. craccivor* and *L. erysimi*. Maximum daily and lifelong fecundities of 72 and 787 eggs were recorded when fed with *R. padi* when is greater than fecundities of 25 and 290 eggs when fed with *A. craccivora*. Net reproductive rate of *C. septempunctata* varied from 77.69 offspring on *A. craccivora* to 288.78 offspring on *R. padi*. Mean generation time (*T*) ranged from 29.02 d on *R. padi* to 52.94 d on *L. erysimi*. Highest to lowest values of intrinsic rate of increase (r_m) were recorded on *R. padi, S. graminum, S. avenae, M. persicae, R. maidis, L. erysimi* and *A. craccivora*

(0.194, 0.143, 0.140, 0.127, 0.117, 0.0839 and 0.0828d^{-1}, respectively). Highest finite rate of increase were observed on *R. padi* (1.214 d^{-1}) followed by *S. graminum* (1.154 d^{-1}) whereas lowest values were obtained on *L. erysimi* and *A. craccivora* (1.087 and 1.088 d^{-1}, respectively).

Table: Impact of three wheat aphid species on life table parameters of Seven Spotted Lady Bird Beetle, *Coccinella septempunctata* (Coccinellidae: Coleoptera) under laboratory conditions

Aphid spp	Sex	n	Egg	1st Instar	2nd Instar	3rd Instar	4th Instar	Pre Pupa	Pupa	Egg to Adult	Longevity	Life Span
S. avenae	♂	13	3.93±0.09	3.18±0.03	3.09±0.04	3.04±0.03	3.11±0.02	1.13±0.07	3.29±0.01	20.75±0.09	39.88±0.16	60.63±0.14
	♀	17	4.81±0.13	3.26±0.13	3.24±0.03	3.15±0.05	3.23±0.04	1.16±0.01	3.51±0.03	22.38±0.13	42.06±0.27	64.44±0.34
R. padi	♂	11	4.52±0.05	2.21±0.05	2.17±0.05	2.20±0.02	2.00±0.03	0.99±0.04	2.81±0.05	16.90±0.11	29.44±0.82	46.34±0.77
	♀	19	4.59±0.10	2.33±0.07	2.38±0.06	2.28±0.04	2.2±0.02	1.02±0.07	3.11±0.06	17.93±0.24	27.48±0.51	45.40±0.33
S. graminum	♂	11	5.44±0.05	2.30±0.02	2.29±0.02	2.20±0.01	2.16±0.01	1.10±0.07	2.89±0.28	18.37±0.38	31.25±1.06	49.62±1.23
	♀	19	5.88±0.06	2.49±0.07	2.57±0.06	2.41±0.03	2.85±0.03	1.15±0.02	3.5±0.06	20.86±0.14	33.32±0.66	54.17±0.63
M. persicae	♂	13	6.04±0.05	2.96±0.01	3.09±0.02	2.95±0.02	2.89±0.02	1.14±0.03	2.74±0.03	21.80±0.09	42.20±0.49	64.00±0.57
	♀	17	6.59±0.07	3.25±0.02	3.39±0.02	3.10±0.02	2.93±0.01	1.18±0.05	3.79±0.06	24.23±0.14	46.87±0.26	71.10±0.39

INSECT PESTS OF MAIZE

28:SCREENING OF MAIZE HYBRIDS AGAINST INSECT PESTS

Nine maize hybrids viz; FH-793, FH-810, FH-949, NK-8711, P15-M43, FH-985, FH-988, FH-1036, and FH-1046 were screened out against insect pests of maize. Attack of stem borer and shoot fly was recorded by examining 20 plants per plot. Physio-morphic characters were also examined. The data recorded are as under:-

Table:Screening Of Maize Hybrids against Insect Pests.

Maize hybrids		Shoot fly damage %	Stem borer damage %	Yield kg/ha
V1	FH-793	9.00 B	8.60 CD	7800.4 I
V2	FH-810	9.46 B	5.47 FG	8607.0 E
V3	FH-949	6.86 B	9.30 BC	7866.0 H
V4	NK-8711	7.17 B	0.20 H	9818.7 A
V5	P15-M43	7.80 B	6.71 EF	8767.1 D
V6	FH-985	9.64 AB	4.47 G	9627.0 B
V7	FH-988	8.44 B	7.13 E	8340.3 F
V8	FH-1036	13.36 A	11.63 A	9279.6 C
V9	FH-1046	7.20 B	7.60 DE	7976.9 G
LSD @ 0.05		3.82	1.4552	60.86

Maximum maize stem borer % infestation (11.63%) was recorded on hybrid FH-1036, while the minimum maize stem borer % infestation (0.20%) was recorded on hybrid NK-8711 followed by FH-985 with infestation 4.47%. Maximum Shoot fly infestation (13.36%) was recorded on hybrid FH-1036 while the minimum Shoot fly infestation (7.17%) was recorded on hybrid NK-8711.

TABLE:PLANT PHYSIO-MORPHIC CHARACTERS OF DIFFERENT MAIZE HYBRIDS

Maize hybrids		Leaf trichome density /cm^2	Stem diameter (cm)	Number of nodes/plant
V1	FH-793	53.63 EF	2.09 A	8.91 C
V2	FH-810	52.20 F	2.00 A	8.58 C
V3	FH-949	68.30 AB	1.78 A	8.39 C
V4	NK-8711	70.13 A	1.84 A	11.54 AB
V5	P15-M43	66.60 BC	2.27 A	12.72 A
V6	FH-985	64.23 C	2.44 A	11.18 AB
V7	FH-988	58.20 D	2.26 A	12.64 A
V8	FH-1036	51.46 F	2.18 A	10.17 BC
V9	FH-1046	56.20 DE	2.35 A	11.10 AB
LSD @ 0.05		3.53	0.8	1.9

Table: CORRELATION BETWEEN INSECT PESTS OF MAIZE AND PLANT PHYSIO-MORPHIC CHARACTERS

Physiomorphic characters	Shootfly %	Stem borer %
Number of nodes/Plant	-0.1520 (0.6963)	-0.1820 (0.6393)
Stem Diameter (cm)	0.2787 (0.4677)	-0.5363 (0.1366)
Yield (Kg/Ha)	-0.0265 (0.9461)	-0.0265 (0.001)
Leaf Trichome density /cm^2	-0.6362 (0.0655)	-0.0294 (0.9402)

Shoot fly infestation was found non-significantly and negatively correlated with physio-morphic character i.e. Number of nodes/Plant, Leaf Trichome density /cm2 and Yield (Kg/Ha). Maize stem borer infestation was found negatively but non-significantly correlated with physio-morphic character i.e. Number of nodes/Plant, Stem diameter, Leaf Trichome density /cm2 but significantly correlated with Yield (Kg/Ha).

29:EFFICACY OF DIFFERENT SEED DRESSING INSECTICIDES AGAINST SHOOT FLY ON SPRING MAIZE

The experiment was conducted in the research area of Entomological Research Institute, Faisalabad. The trial was laid out in RCBD with three replications. Five seed dressing insecticides viz: Confidor 70 WS (imidacloprid), Pronto 60 FS (imidacloprid), Hombre186.25 %(febuconazole+imidacloprid), Actara ST 70WS (thiamethoxam), Hi-cap 70WS (imidacloprid) Coniflex 70WS (imidacloprid)were tested on spring maize against shoot fly.Data regarding % reduction in shootfly infestation were recorded after 10, 20 and 30 days of germination. The data recorded are as under:-

Table: Efficacy of Seed Dressing Insecticides against Shoot Fly *Atherigona soccata* on Spring Maize.

Treatments		Dose/ kg seed	Shootfly infestation(%) after			Percentage reduction After		
			10 DAG	20 DAG	30 DAG	10 DAG	20 DAG	30 DAG
T1	Confidor 70 WS (Imidacloprid)	5 g	5.27	8.07	8.05	86.04 AB	74.09 B	71.22 A
T2	Hombre 18.625 FS (Imidacloprid+Tebuco nazole)	10 ml	4.82	6.44	8.76	87.50 A	79.68 AB	69.20 A
T3	Talent 480 SC(Thiacloprid)	4 ml	5.52	5.41	7.47	85.17 AB	83.01 A	73.20 A
T4	Cruser 350 FS (Thiamethoxam)	6 ml	7.42	7.73	6.86	80.45 B	75.32 AB	75.01 A
T5	Actara 70 WS (Thiamethoxam)	3 g	6.04	6.43	9.17	84.14 AB	79.48 AB	67.81 A
T6	Check	---	38.12	31.45	28.14	0.00 C	0.00 C	0.00 B
	LSD @ 0.05					6.2	8.82	15.88

All the treatments were found effective and statistically at par with one another as compared to check (0.00%) after 10, 20 and 30 days of germination. However, Talent 480 SC (Thiacloprid) with 85.17, 83.01 & 73.20% reduction was found the most effective against shoot fly on maize crop after 10, 20 and 30 days of germination. It was followed by Hombre 18.625 FS (Imidacloprid+Tebuconazole) which showed 87.50, 79.68 & 69.20% reduction in shoot fly infestation as compared to check.

30.EFFICACY OF DIFFERENT INSECTICIDES AGAINST CORN EARWORM (*Helicoverpa armigera.)* IN MAIZE SEED CROP.

Maize crop was sown in Maize section, Faisalabad having plot size 5m X 10m in randomized complete block design (RCBD) with three replications. Thirteen Insecticides viz; Chlorpyrifos 40 EC, Padan 4G (Cartap), Padan 4G (Cartap)+ Proclaim 1.9 EC (Emmamectin benzoate), Oncall 3G (Benfuracarb) + Proclaim 1.9 EC (Emmamectin benzoate), Oncall 3G (Benfuracarb) , Refree 3G (Fipronil) +Proclaim 1.9 EC (Emmamectin benzoate), Refree 3G (Fipronil) , Tracer 240 SC (Spinosid), Belt 480 SC (Flubendamide), Radiant 120 SC (Spinetoram), Coragen 20SC (Chlorantraniprole), Match 5 EC (Leufenuron), Proclaim 1.9 EC (Emmamectin Benzoate) along with check were tested after pest appearance. The percentage infestation was determined by counting the number of total cob and infested cob per plot before 24 hours and after 3 and 7 days of insecticide application. The data so recorded were compiled and analyzed statistically.

Table:EFFICACY OF DIFFERENT INSECTICIDES AGAINST CORN EARWORM (Helicoverpa armigera.) IN MAIZE SEED CROP

Treatments		Dose/acre	Pre-treatment CEW infestation	Post-treatment CEW infestation		% age Reduction in CEW Infestation	
				72HAA	7DAA	72HAA	7DAA
T1	Chlorpyrifos 40 EC	1000 ml/ac	4.67	3.79	4.49	53.51 F	77.53 AB
T2	Padan 4G (Cartap)	9 Kg + 200 ml/ac	5.07	3.84	7.36	56.65 DEF	66.21 DE
T3	Padan 4G (Cartap)+ Proclaim 1.9 EC (Emmamectin benzoate)	9 Kg + 200 ml/ac	5.04	4.07	7.88	53.75 F	63.22 E
T4	Oncall 3G (Benfuracarb) + Proclaim 1.9 EC (Emmamectin benzoate)	8 Kg + 200 ml/ac	5.02	3.11	6.34	64.52 ABC	70.63 CD

T5	Oncall 3G (Benfuracarb)	8 Kg + 200 ml/ac	4.89	2.71	6.16	68.351 A	70.37 CD
T6	Refree 3G (Fipronil) +Proclaim 1.9 EC (Emmamectin benzoate)	8 Kg + 200 ml/ac	4.08	4.26	5.96	40.19 G	66.12 DE
T7	Refree 3G (Fipronil)	8 Kg + 200 ml/ac	3.78	2.55	4.96	61.419 BCD	69.65 CD
T8	Tracer 240 SC (Spinosid)	60 ml	4.25	2.89	4.92	60.88 CDE	72.91 ABC
T9	Belt 480 SC (Flubendamide)	50 ml	4.38	2.31	4.37	69.65A	76.52 AB
T10	Radiant 120 SC (Spinetoram)	80 ml	3.87	2.17	4.62	68.04 AB	71.98 BCD
T11	Coragen 20SC (Chlorantraniprole)	50 ml	4.76	3.81	4.48	54.06 EF	77.86 A
T12	Match 5 EC (Leufenuron)	200 ml	4.33	2.34	4.93	68.69 A	73.25 ABC
T13	Proclaim 1.9 EC (Emmamectin Benzoate)	200 ml	4.81	4.93	6.05	40.98 G	70.18 CD
T14	Check	_____	5.11	8.93	21.97	0.00 H	0.00 F
	LSD @ 0.05					6.8493	5.8737

Belt 480 SC (Flubendamide) with 69.65% reduction was found the most effective against Corn earworm infestation on maize crop after 3 days of application followed by Match 5 EC (Leufenuron) which showed 68.69% reduction in Corn earworm infestation as compared to check. Coragen 20SC (Chlorantraniprole) with 77.86% reduction was found the most effective against Corn earworm infestation on maize crop after 7 days of application.

INSECT PESTS OF OILSEED CROPS

31. EFFICACY OF DIFFERENT ENTOMOPATHOGENIC MICROBES AGAINST SESAME POD BORER AND THEIR EFFECT ON POLLINATORS

Experiment was laid out in randomized complete block design (RCBD) with three replications in the research area of Entomological Research Institute, Faisalabad. Entomo-pathogenic microbes were applied individually and in integrated manners, at the insect pest appearance. Data were recorded from 15 randomly selected plants from each treatment. Percentage reduction in pod infestation and their pollinator was recorded and data were analyzed statistically. The data are recorded as under:

Table-: Efficacy of different entomo-pathogenic microbes against sesame pod borer and their effect on pollinators

Sr. #	Treatments	Pretreatment infestation (%)	Pod infestation reduction (%) after			% reduction of pollinators
			3 days	5 days	7 days	
1	*Bacillus* sp. @ 5 %	24.67	48.56 C	52.56 C	55.67 C	15.78 C
2	*Metarhizum* sp. @ 5 %	27.33	32.42 E	40.08 E	45.75 E	10.63 E
3	*Beauveriabassiana*@ 5 %	25.64	36.36 D	45.69 D	49.90 D	12.89 D
4	*Bacillus* sp. + *Metarhizum* sp. @ 5 %	28.72	53.11 B	56.24 BC	60.42 B	17.24 C
5	*Bacillus* Sp. + *Beauveriabassiana*@ 5 %	25.56	56.10 B	60.16 B	62.96 B	19.42 B
6	Spinosad 240 SC @ 40 ml/acre	26.64	71.34 A	83.07 A	69.03 A	74.33 A
7	Control	27.76	0.00	0.00	0.00	0.00
LSD value at 5%		-	3.8148	4.4875	3.8826	5.5173

After 7 days of application maximum reduction was recorded (69.03 %) in spinosad followed by *Bacillus*sp + *Beauveriabassiana*, *Bacillus*sp + *Metarhizum* sp. and *Bacillus* sp. they caused 62.96, 60.42 and 55.67 % reduction. Whereas, in case of pollinators, maximum reduction in pollinator population i.e. 74.33 % was recorded where Spinosad 240 SC was sprayed. While minimum reduction was observed where *Metarhizum* sp. was applied i.e. 10.63 %.

32:EFFECT OF WEATHER FACTORS ON POPULATION DYNAMICS OF BRASSICA APHID AND ITS BENEFICIAL INSECTS (LADYBIRD BEETLE, *CHRSOPERLA CARNEA* AND SYRPHID FLY)

The experiment was conducted in the research area of Oilseeds Research Institute,Faisalabad in randomized complete block design (RCBD) with three replications.The data regarding aphid population were recorded randomly from 10 central twig of 15 plants/plot at weekly interval. The data regarding beneficial insects (ladybird beetle, *chrsoperlacarnea*and *syrphid* fly were recorded on visual observation from 10 randomly selected plants/plot at weekly intervals. Meteorological data were recorded near AARI, Faisalabad observatory and data were analyzed statistically. The data are recorded as under:

Table:EFFECT OF WEATHER FACTORS ON POPULATION DYNAMICS OF BRASSICA APHID AND ITS BENEFICIAL INSECTS (LADYBIRD BEETLE, *CHRSOPERLA CARNEA* AND SYRPHID FLY)

Month/ week	Aphid/10cm twig	Temp. (^{0}C)		R.H (%)	Rain fall (mm)	Beneficial insects/plant		
		Max.	Min.			Coccinellids	Chrysoperla	Syrphid fly
December								
Week-1	0.00	25.59	8.83	73.71	0.00	0.00	0.00	0.00
Week-2	0.00	21.5	8.32	75.28	0.00	0.00	0.00	0.00
Week3	0.00	21.85	3.97	76.50	0.00	0.00	0.00	0.00
Week4	0.00	20.87	4.85	69.50	0.00	0.00	0.00	0.00
January								
Week1	0.00	22.71	7.40	69.07	8.00	0.00	0.00	0.00
Week2	8.47	20.57	8.01	76.71	3.60	0.00	0.00	0.00
Week3	18.02	13.81	7.07	85.64	8.80	0.00	0.00	0.00
Week4	26.44	14.00	4.78	79.57	0.00	0.00	0.00	0.00
February								
Week1	38.53	23.31	6.01	61.28	23.00	0.47	0.7	0.40
Week2	112.85	21.71	7.07	66.42	23.00	1.13	0.33	0.67
Week3	142.36	24.18	6.75	65.85	7.70	1.30	0.47	0.90

Week4	151.82	28.68	10.72	60.35	0.60	1.53	0.50	1.27
March								
Week1	178.42	28.51	14.70	66.78	52.50	1.83	0.63	1.27
Week2	256.64	24.45	15.07	73.07	5.00	1.97	0.60	1.60
Week3	118.29	26.47	15.05	62.35	1.20	2.27	0.93	2.43
Week4	70.49	29.27	15.34	62.00	0	3.10	1.20	1.57

Table: Correlation of weather factors with aphid population and beneficial insects

Insects	Max. temp.	Min. temp.	R.H.	Rainfall
Aphid	0.5905 *	0.6125*	-0.3707 ns	-0.5289*
Coccinellids	0.8385**	0.8631**	-0.6632*	-0.0081ns
Chrysoperla	0.8248**	0.7254*	-0.7925**	-0.0592ns
Syrphid fly	0.7805**	0.8585**	-0.6426*	-0.0423 ns

Aphid population was observed during the 2nd week of January i.e. 8.47/10cm twig. While during the 2nd week of February to 3rd week of March maximum population was recorded ranged from 11.85 to 256.64/10cm twig. In case of beneficial insects, coccinellids, *Chrysoperla* and syrphidfly population was observed during the 1st week of February and continuously increased and reached maximum during the 3rd week of march. Weather data revealed that maximum and minimum temperature showed positive and significant effect on aphid and beneficial insects. While R.H. showed negative and non-significant correlation with aphid population and negative and significant with beneficial insects. Rainfall showed negative and significant effect on aphid population and on beneficial insects it showed negative and non-significant effect.

33: EFFECTIVENESS OF DIFFERENT ENTOMOPATHOGENIC MICROBES AND PLANT EXTRACTS AGAINST SUNFLOWER HEAD MOTH AND THEIR EFFECT ON POLLINATORS

Experiment was laid out in randomized complete block design (RCBD) with three replication. Entomo-pathogenic microbes and plant extracts were applied @ 5% on pest appearance. Data were recorded from 15 randomly selected plants from each treatment. Percentage reduction in head infestation and pollinator's reduction was recorded and data were analyzed statistically. The data are recorded as under:

Table: Effectiveness of different entomo-pathogenic microbes and plant extracts against sunflower head moth and their effect on pollinators

Sr. #	Treatments	Pretreatment infestation (%)	Infestation Reduction (%) after			% reduction of pollinators
			3 days	5 days	7 days	
1	*Bacillus* sp. @ 5%	24.56	46.43 B	54.04 B	57.91 B	14.56 D
2	*Metarhizum* sp. @ 5%	27.16	35.16 C	40.12 D	47.20 D	10.72 E
3	*Beauveriabassiana* @ 5%	25.33	42.61 B	47.17 C	53.40 C	13.33 D
4	Neem leaf extract @ 5%	23.42	45.63 B	38.41 D	28.98 E	16.89 C
5	Dhatura @ 5%	25.56	43.46 B	35.62 D	23.98 F	20.27 B
6	Spinosad 240 SC @ 40 ml/acre	24.12	73.26 A	81.63 A	68.46 A	77.63 A
7	Control	26.33	0	0	0	0
LSD value at 5%		-	4.9679	4.7819	3.6143	2.0085

Results revealed that after 7 days of applicationmaximumreduction was recorded in spinosad (68.46%) followed by *Bacillus* sp., *Beauveriabassiana* and Metarhizum Sp. caused reduction i.e. 57.91, 53.40 and 47.20% respectively. While minimum reduction was recorded in Dhatura extract i.e. 23.98%. Whereas, in case of pollinators, maximum reduction in pollinator population i.e. 77.63 % was recorded where Spinosad 240 SC was sprayed. While minimum reduction was observed where *Metarhizum*sp was applied i.e. 10.72 percent.

INSECT PESTS OF PULSES

34. Screening Of Desi Gram Genotypes Against Insect Pests In Response To Physio-Morphic Characters

six desi gram genotypes viz; brc-390, 9029, 10036, 10004, 9013, pb-2008 were screened out against insect pests of gram. aphid population was recorded on per 30cm twig basis while beneficials on per plant basis. for pod borer, total number of pod and number of damaged pods were observed from randomly selected five plants. Data regarding physio-morphic characters like pod trichome length, pod trichome density, pod wall thickness, pod length, pod width and area were also calculated at pod setting stage of gram plants. the data recorded are as under:-

Table: Screening of desi gram genotypes against insect pests in response to physio-morphic characters

	Treatments	Gram pod borer damage %	Aphid/ branch	Termite %	Bio Control *Agents*	Gram pod wall thickness (mm)	Gram pod hair density (per cm^2)	Yield (Kg/ha)
V1	BRC-390	6.32 B	3.38 AB	1.37 A	1.38 ABC	0.25 B	123.77 BC	1698.4 D
V2	9029	6.81 AB	4.12 A	0.42 B	1.29 BC	0.34 A	129.50 AB	1928.5 B
V3	10036	5.92 B	3.94 AB	0.29B	1.23 C	0.33 A	96.92 BC	1564.9 E
V4	10004	5.67 B	2.82 B	0.45B	1.47 AB	0.37 A	94.09 C	1670.4 D
V5	9013	8.17 A	2.93 AB	0.37 B	1.37 ABC	0.35 A	128.73 AB	1877.6 C
V6	PB-2008	6.43 B	3.30 AB	0.24 B	1.49 A	0.30 AB	135.00 A	1967.6 A
LSD @ 0.05		1.59	1.22	0.33	0.19	0.07	33.05	33.46

Maximum aphid population (4.12/twig) was recorded on 9029 while minimum aphid population (2.82/twig) was observed on 10004. Maximum Pod borer damage (8.17%) was recorded on 9013

while minimum (5.67%) was found on 10004. Maximum population of beneficial insects (1.49/ plant) was recorded on PB-2008 while minimum (1.23/plant) was recorded on 10036.

Table: Correlation of insect pests of Desi gram with physio-morphic characters.

Characters	**Pod borer % infestation**
Gram Pod hair density (per cm2)	-0.8385*
Gram Pod Wall Thickness (mm)	-0.7803*

Gram Pod borer damage was found highly significant and negatively correlated with pod hair density pod wall thickness.

35.SCREENING OF KABULI GRAM (*CICER ARIETINUM L)* GENOTYPES AGAINST INSECT PESTS

The experiment was conducted in the research area of Pulses Research Institute, Faisalabad. The trial was laid in RCBD with three replications. Five Kabuli gram genotypes viz; K-012411, K-01309, K-1242, 1248, NOOR-2013 were screened out against gram insect pests. Aphid population was recorded on per twig basis while beneficial insects on per plant basis. For *Helicoverpa* sp., total number of pod and number of damaged pods were observed from randomly selected five plants to calculate pod damage percentage by using formula given below, Data regarding physio-morphic characters like pod Trichome length, pod Trichome density, pod wall thickness, pod length, pod width and area were calculated at podding stage of gram plants. Finally the data were statistically analyzed. The data recorded are as under:-

Table: Screening of Kabuli gram (*Cicer arietinum l)* genotypes against insect pests

Treatments		Gram pod borer damage %	Aphid/ branch	Termite infestation %	Cut worm infestation %	Bio Control *agents*	Gram pod wall thickness (mm)	Gram pod hair density (per cm^2)	Yield (Kg/ha)
V1	K-012411	5.22 C	2.49	0.88	4.02	1.17 AB	0.23 BC	109.65 BC	1755.8 C
V2	K-01309	4.02 D	2.67	1.06	3.50	1.06 BC	0.25 AB	112.30 B	1905.1 B
V3	K-1242	3.53 E	2.97	0.76	4.82	1.37 A	0.27 A	120.20 A	2020.5 A
V4	1248	8.45 A	2.54	0.69	3.72	1.15 ABC	0.21 C	99.65 D	1583.4 D
V5	NOOR-2013	7.05 B	2.40	0.68	3.57	0.91 C	0.22 BC	104.90 CD	1657.0 D
LSD @ 0.05		0.44	N.S	N.S	N.S	0.24	0.036	5.26	96.05

Aphid, termite and cutworm % infestation was found statistically non-significant among all the tested genotypes however maximum population of aphid (2.97/twig) was recorded on K-1242 while minimum aphid population (2.40/twig) was recorded on Noor-2013. Maximum termite percentage infestation (1.06%) was recorded on K-01309 while minimum (0.68/twig) was recorded on Noor-2013. Maximum cutworm % infestation (4.82%) was recorded on K-1242 while minimum (3.50%) on K-01309. Maximum pod borer percentage damage (8.45%) was recorded on genotype 1248 while minimum pod borer percentage damage (3.53%) was recorded on K-1242. Maximum population of beneficial insects (1.37/plant) was recorded on K-1242 while minimum (0.91/plant) was found on Noor-2013.

Table: Correlation between Pod Borer % Infestation and Plant Physio-morphic Characters of Kabuli gram

Physio-morphic Characters	Pod borer % infestation
Gram Pod hair density (per cm^2)	-0.8385*
Gram Pod Wall Thickness (mm)	-0.7803*

Gram Pod borer damage was significantly and negatively correlated with pod hair density and pod wall thickness.

36: **EFFICACY OF NEW INSECTICIDES AGAINST INSECT PESTS OF CHICK PEA.**

Nine insecticides viz; Uniron 10 EC (Novaluron), Belt 480 SC (Flubendiamide), Checkworm 5% EC (Emmamectin benzoate) and Timer 5% EC (Emmamectin benzoate) were tested against gram pod borer. The experiment was conducted in the research area of Pulses Research Institute, Faisalabad. The trial was laid in RCBD with three replications. Larval population of gram pod borer was recorded from 5 randomly selected plants/plot before and after 3 and 7 days of treatment application. The data recorded are as under:-

Table: Efficacy of New Insecticides against insect pests of chickpea.

Treatments		Dose/ acre	Pre-treatment GPB (# of larvae/Plant)	Post-treatment GPB (# of larvae/Plant		% age Mortality After	
				72 HAA	7 DAA	72 HAA	7 DAA
T1	Checkworm 5% EC (Emmamectin benzoate)	75 ml	3.40	0.93	0.87	76.67 CD	81.53 BC
T2	Timer 5% EC (Emmamectin benzoate)	50 ml	2.93	0.67	0.73	80.37 ABC	83.09 ABC
T3	Belt 48% SC (Flubendiamide)	50 ml	3.47	0.67	0.53	84.07 AB	90.08 A
T4	Coragen 200 SC (Chlorantraniprole)	75 ml	3.53	0.60	0.53	86.30 A	88.42 AB
T5	Spintor 480 SC (Spinosad)	30 ml	3.53	0.87	0.60	79.99 ABC	87.78 AB
T6	Voliam Flaxi 300 SC (Thiamethoxam + Chlorantraniprole)	80 ml	3.47	0.87	0.80	78.52 BCD	83.05 ABC

T7	Refree 5% SC (Fipronil)	500 ml	3.73	1.27	1.20	72.59 D	76.35 C
T8	Radiant 12 SC (Spintoram)	60 ml	4.00	0.80	0.60	86.29 A	89.01 AB
T9	Runner 20 EC (Methoxyfenzoid)	200 ml	3.40	0.73	0.93	76.67 CD	79.73 C
T10	Check	_____	3.07	3.80	4.53	0.00 E	0.00 D
	LSD at 5%					6.88	7.85

All the treatments were found effective. Belt 48% SC (Flubendiamide), Radiant 12 SC (Spintoram), Spintor 480 SC (Spinosad) provided more than 80% mortality ranging from 84.07% to 79.99% after 72 hours and 90.08% to 87.78% after 7 days of application.

37:EFFECT OF DIFFERENT DATES OF SOWING OFCHICKPEA ON POD BORER (*HELICOVERPA ARMIGERA*) INFESTATION

The experiment was conducted in the research area of Entomological Research Institute, Faisalabad. The trial was laid in RCBD with three replications. Different dates of sowing viz; 20-Oct, 30-Oct, 09-Nov and 19-Nov were evaluated against gram pod borer in chickpea crop. Gram pod borer infestation was calculated by observing total pods and damaged pods from 5 randomly selected plants per plot. The data recorded are as under:-

Table: Effect of different dates of sowing of chickpea on insect pests infestation.

Dates of sowing		Gram pod borer %	Aphids/ branch	Termite Damage %	Beneficials/ plant	Cut worm infestation %	Yield (Kg/ha)
T1	20th October	1.98 D	1.41 C	2.04	1.22 C	4.36 A	2095.2 A
T2	30th October	3.32 C	1.68 BC	2.17	1.33 C	2.52 B	1916.5 B
T3	9th November	4.52 B	2.21 B	1.29	1.64 B	1.33 C	1860.9 C
T4	19th November	7.64 A	3.55 A	1.45	1.80 A	0.56 D	1776.4 D
LSD at 5%		1.02	0.56	N.S	0.11	0.59	19.81

Early sowing of chickpea (20 Oct) was found more effective against pod borer with minimum infestation (1.98%) and higher yield (2095kg/acre) as compared to late sowing (19 Nov) with maximum pod borer infestation (7.64%) and minimum chickpea yield (1776kg/acre). Maximum aphid/branch (3.55/branch) was observed on T4 (19th November) while minimum (1.41/branch) on T1 (20th Oct). Maximum cutworm % (4.36) was observed on T1 (19th November) while minimum (1.41/branch).

INSECT PESTS OF VEGETABLES

38: COMPARATIVE EFFICTIVENESS OF VARIOUS INSECTICIDES FOR THE CONTROL OF BRINJAL FRUIT BORER

Eight insecticides viz. Timer1.9 EC(Emmamecten Benzoate) @ 200ml/acre, Tracer 240Sc (Spinoside) @ 60ml/acre, Lufenuron 2.00EC (lufenuron) @ 200ml/acre, Chlorfenapyr 360SC (Chlorfenapyr) @ 320ml/acre, Voliam Flexi 3.00SC (Thiamethaxim + Chlorantraniliprole) @ 80ml/acre, Radiant 120Sc (spintoram) @ 80ml/acre, Delegate 25 WG (spintoram) @ 30gm/acre and Belt 480 Sc (Flubendamide) @20ml/acre were sprayed on Brinjal. The experiment was conducted at the Farmer Field, Multan in RCB design with three repeats. The damaged fruits per plant due to fruit borer was counted and plucked. The formulation of conventional as well as new chemistry insecticides will be applied on the brinjal crop. The data regarding fruit damage will be recorded after 3-days, 5-days and 7-days of insecticides application. Finally the data will be subjected to statistical analysis.

Table: Data Regaring Prcentage Reduction Of Fruit Borer After 03, 0 5 And 07 Day Of Insecticide Application During The Season.

INSECTICIDES			Percentage Reduction of Brinjal Fruit Borer After		
TRADE NAME	**COMMON NAME**	**Dose/100 liter of Water**	**3 Days**	**5 Days**	**7 Days**
Timer 1.9 EC	Emamectin Benzoate	200ml/ Acre	61.38AB	70.06BC	63.93BC
Tracer 240 SC	Spinoside	60ml/Acre	38.41CD	73.81B	51.35CD
Lufenuron 2 EC	Lufenuron	200ml/ Acre	21.96D	15.10D	0.00E
Chlorfenapyr 360SC	Chlorfenapyr	320ml/Acre	49.86 BC	59.54C	50.27D
Voliam Flexi 3.00SC	Thiamethaxim + Chlorantraniliprole	80ml/Acre	76.33A	87.70A	83.54A

Radiant 120 SC	Spinetoram	80ml/Acre	66.86 AB	81.52AB	71.51AB
Delegate 25 WG	Spinetoram	30mg/Acre	35.58CD	15.60D	61.88BCD
Belt 480 SC	Flubendamide	20ml/Acre	66.22 AB	75.02B	71.85AB
Control			1.45E	1.15E	2.71E
Tukey HSD			5.26	3.26	3.57
F-value			42.84	206.77	139.35

Means sharing similar letters are not significantly different by Tukey HSD at P = 0.05

The data table reveals that there is a significant difference among all the insecticides. After 03 day of spray Voliam Flexi 3.00SC (Thiamethaxim +chlorantraniliprole) @ 80ml/acre proved to be most effective against brinjal fruit borer showing 76.00% reduction followed by Radiant 120Sc (spintoram) @ 80ml/acre (66.86%), Belt 480 Sc (Flubendamide) @20ml/acre (66.22%), Timer1.9 EC(Emmamecten Benzoate) @ 200ml/acre (61.38%), Chlorfenapyr 360SC (Chlorfenapyr) @ 320ml/acre (49.86%), Tracer 240Sc (Spinoside) @ 60ml/acre (38.41%) and Delegate 25 WG (spintoram) @ 30gm/acre (35.58%). Lufenuron 2.00EC (lufenuron) @ 200ml/acre gave the lowest reduction percentage i.e.21.96% of brinjal fruit borer after 03 day of spray. The data table reveals that there is a significant difference among all the insecticides. After 05 day of spray Voliam Flexi 3.00SC (Thiamethaxim +chlorantraniliprole) @ 80ml/acre proved to be most effective against brinjal fruit borer showing 87.70% reduction followed by Radiant 120Sc (spintoram) @ 80ml/acre (81.52%), Belt 480 Sc (Flubendamide) @20ml/acre (75.02%),Tracer 240Sc (Spinoside) @ 60ml/acre (73.81%), Timer 1.9EC(Emmamecten Benzoate) @ 200ml/acre (70.06%), Chlorfenapyr 360SC (Chlorfenapyr) @ 320ml/acre (59.54%).Delegate 25 WG (spintoram) @ 30gm/acre (15.60%) and Lufenuron 2.00EC (lufenuron) @ 200ml/acre gave the lowest reduction percentage *i.e.15.60 and 15.106*% respectively of brinjal fruit borer after 05 day of spray. The data table reveals that there is a significant difference among all the insecticides. After 07 day of spray Voliam Flexi 3.00SC (Thiamethaxim +chlorantraniliprole) @ 80ml/acre proved to be most effective against brinjal fruit borer showing 83.54% reduction followed by Belt 480 Sc (Flubendamide) @20ml/acre (71.85%),Radiant 120Sc (spintoram) @ 80ml/acre (71.51%), Timer 1.9EC(Emmamecten Benzoate) @ 200ml/acre (63.93%), Delegate 25 WG (spintoram) @ 30gm/acre (61.88%),Tracer

240Sc (Spinoside) @ 60ml/acre (51.35%),Chlorfenapyr 360SC (Chlorfenapyr) @ 320ml/acre (50.27%). and Lufenuron 2.00EC (lufenuron) @ 200ml/acre (0.00) gave the lowest reduction percentage of brinjal fruit borer after 07 day of spray. Voliam Flexi 3.00 SC gave the maximum percentage reduction after 3, 5, 7 days of spray 76.33, 87.70, 83.54 respectively while Lufenuron 2EC gave minimum percentage mortality after 3, 5, 7 days of spray 21.96, 15.10 and 0.00 respectively. Voliam Flexi 3.00SC (Thiamethaxim +chlorantraniliprole) @ 80ml/acre was give the maximum control against brinjal fruit borer in the field, so the farmer must used it against brinjal fruit borer to get maximum production.

39: STUDIES ON THE POPULATION DYNAMISCS OF ONION THRIPS

The experiment was laid out at Vegetable Research Sub Station, Multan. The data was recorded from 15 plants selected at random and the population of thrips (Black & Brown) was counted. The data was recorded on weekly basis and co related with the meteorological factors *i.e.*, temperature, relative humidity and rain fall.

Table: POPULATION DYNAMISCS OF ONION THRIPS

MONTH	WEEK	Thrips /leaf	METEROLOGICAL DATA			
			Maximum Temperature (C°)	Minimum Temperature (C°)	R.H (%)	Rainfall (mm)
FEBRUARY	1st	5.19	22.90	6.28	81.70	0.00
	2nd	13.10	22.10	9.70	81.50	0.00
	3rd	10.00	24.90	9.10	76.10	0.00
	4th	14.70	29.30	13.70	73.90	0.00
MARCH	1st	18.34	25.90	9.71	75.30	0.00
	2nd	17.80.	26.50	10.20	82.30	0.00
	3rd	14.00	27.80	11.10	81.70	1.00
	4th	22.34	30.60	18.57	79.50	0.00

APRIL	**1st**	10.34	33.10	19.00	76.60	7.00
	2nd	9.32	32.30	18.60	84.00	10.00
	3rd	5.00	36.40	20.10	70.50	0.00
	4th	3.54	39.00	24.10	58.70	0.00

There has been no significant correlation between the population of thrips and the meteorological factors. From table it is clear that the maximum population of onion thrips/plant was recorded during the 4th week of March (22.34) when the recorded maximum temperature, minimum temperature, relative humidity and rainfall was 30.60C°, 18.57C°, 79.50% and 0.00mm respectively.

40: EFFICACY OF BIO AND CHEMICAL INSECTICIDES AGAINST *Helicoverpa armigera* (HUBNER) ON TOMATO.

The experiment was laid out at Vegetable Research Sub Station, Multan. The data regarding percentage infestation was recorded from ten plants randomly collected from each plot, fruits from each plant were examined and percentage infestation of *H. armigera* was recorded by counting the healthy and infested fruits. Application of insecticides was carried out by a Hydraulic Back Pack sprayer. After 3, 5 and 7 days post spraying percentage mortality of larvae was recorded. The data was subjected to statistical analysis.

Table: Efficacy Of Bio And Chemical Insecticides Against *Helicoverpa armigera* (Hubner) On Tomato

	TREATMENTS		**Dose/ Acre**	**Mean Percent Reduction Of Larval Population After**		
	TRADE NAME	**COMMON NAME**		**3 DAYS**	**5 DAYS**	**7 DAYS**
Bio-insecticides	Radiant 12% SC	Spintoram	250ml	60.24a	72.71a	73.06a
	Tracer 240SC	Spinosad	80ml	54.12bc	64.71b	71.10a
	Emamectin benzoate 1.9EC	Emamectin	200ml	35.58e	61.75b	70.54a
Chemical insecticides	Lufenuron 5%EC	lufenuron	200ml	62.93a	62.32b	67.18ab
	Coragen 20SC	chlorantraniliprole	20ml	40.98de	50.44c	60.82b

	Challenger 36SC	chlorofenapyr	100ml	48.11d	67.77ab	59.21b
	Control			5.54f	6.08d	6.12c
	Tukey's HSD at 5%			7.48	6.19	9.04
	F-Value			167.46	327.64	166.48

Means sharing similar letters are not significantly different by Tukey HSD at P = 0.05

Lufenuron 5%EC (lufenuron) @200ml/acre and Radiant 12%SC (spintoram) @100ml/acre proved to be most effective insecticides after 24 hours of spray by exhibiting mortality of 62.93%, 60.24% whereas after 05 days of insecticides application Radiant 12%SC (spintoram) @100ml/acre and Challenger 36%SC (chlorofenapyr) @100ml/acre proved to be most effective insecticides exhibiting 72.71% and 67.77% mortality of the pest. After 07 days of treatment Radiant 12%SC (spintoram) @100ml/acre, Tracer 240SC (soinosad) @100ml/acre and Emamectin benzoate 5%SG (emamectin) @200ml/acre exhibited the maximum percentage mortality of the larvae of *Helicoverpa armigera* i.e.73.06%, 71.10% and 70.54% respectively.

41: COMPARATIVE RFFICACY OF VARIOUS INSECTICIDES AGAINST JASSID ON OKRA.

The experiment was laid out at farmer's field. The insecticides were sprayed on okra crop having maximum population of jassid. The data was recorded from 15 selected leaves at random per plot from 15 plants..The population of jassid was counted from upper, middle and lower leaves of fifteen plant selected at random from each treatment before spray and then after 24 hours,72 hours and 168 hours after spray..Calibration was done before spray for measuring the quantity of water to be used in each treatment. The data was compiled and percentage mortality was calculated by using the below mentioned formula:

$$\%\text{Mortality} = \frac{\text{Population before spray} - \text{Population after spray}}{\text{Population before spray}} \times 100$$

TABLE: COMPARATIVE RFFICACY OF VARIOUS INSECTICIDES AGAINST JASSID ON OKRA.

Sr.no	Insecticides		Dose/ Acre	Percentage mortality of jassid after		
	Common name	Trade name		24 hours	72 hours	168 hours
1.	Momentum	nitenpyram+chlorofenapyr	250ml	53.86b	65.01ab	68.49a
2.	Commondo 97%	Acephate	250gm	61.20a	68.79a	72.48a
3.	Lasenta 80%WG	imidacloprid+fipronil	60gm	66.32a	70.18a	76.55a
4	Imidacloprid 200SL	Imidacloprid	250ml	52.50b	42.74d	54.95b
5.	Pyramid 10%AS	Nytenpyram	200ml	48.48bc	56.70bc	54.98b
6	Bifenthrin 10EC	Talstar	100ml	41.65c	48.82cd	49.23b
7	Control			6.40	7.39	6.047
Tuckey's HSD at 5%.				7.05	9.14	11.21
F-Value				191.10	140.81	109.48

Means sharing similar letters are not significantly different by Tukey HSD at P = 0.05

Lasenta 80%WG@60gm/acre and Commondo97% (acephate)@250gm/acre proved to be most effective insecticides after 24 hours of application by exhibiting 66.32% and 61.20% mortality. After 72 hours of spray Momentum (nitenpyram+chlorofenapyr), Lasenta 80%WG@60gm/acre and Commondo97% (acephate)@250gm/acre proved to be most effective insecticides by exhibiting 70.18%, 68.79% and 65.01% mortality whereas the same insecticides also proved effective after 168 hours of spray by exhibiting 76.55%,72.48% and 68.49% mortality of the pest.

42: EFFECT OF DIFFERENT TIMES OF SOWING ON INCIDENCE OF LEPIDOPTEROUS PESTS AND CABBAGE APHID ON CAULIFLOWER

The Cauliflower crop was sown in area of VRI, Faisalabad, with RCB design and with four different times 1st Early (23-09-2015), 2nd Early(01-10-2015), Mid sown (20-10-2015) and Late sown(04-11-2015). There were three replicates in each treatment. To record the insect pest

complex infestation, 5 plants were selected at random from each plot. The data regarding pest infestation was recorded at 7 days interval. The cabbage aphid population was counted per leave basis.

Table: Insect pest incidence on cauliflower in relation to transplanting time

S.No	Transplanting time	Aphid pop. /leaf	Larvae of *pieris brassica*/plant	Larvae of army worm/plant
1	1st early sown crop	0.53 c	0.95 b	0.04 d
2	2nd early sown crop	2.43 b	0.09 c	0.57 c
3	Mid sown crop	3.21 b	1.24 b	1.61 b
4	Late sown crop	10.17 a	4.94 a	4.36 a
LSD@5%		1.44	0.69	0.38

The result revealed that population of aphid was low on early sown cauliflower (0.53/leaf) while it was high on late sown crop (10.17/leave). The population of *pieris brassica* was found low on the 1st early sown crop while it was found high on late sown crop. Similar results were obtained in case of armyworm which was found maximum in late sown crop while minimum with early sown crop.

43: EVALUATION OF BRINJAL GENOTYPES AGAINST BRINJAL FRUIT AND SHOOT BORER

The Experiment was conducted in research area of Vegetable Research Institute, Faisalabad. Different genotypes were sown in Randomize Complete Block Design with three replicates. Data regarding Brinjal fruit and shoot borer infestation were recorded at weekly interval from five randomly selected plants per plot.The data recorded are as under:-

Table- Mean comparison of data regarding the % infestation of brinjal fruit and shoot borer on brinjal genotypes

Sr. #	Genotypes	% Infestation
1	AB-377	13.19 f
2	DILNASHEEN	20.33 b
3	ADVANTA F1-326	15.82 cd
4	KHBR-201	17.74 c

5	KHBR-202	10.67 g
6	KHBR-203	7.02 h
7	KHBR-205	13.29 ef
8	KHBR-206	14.34 de
9	Sundar	13.33 ef
10	Sultan	23.89 a
11	Janak	20.84 b
12	Ravi	11.46 fg
13	Bemisal	9.63 g
LSD@5%		2.45

The results revealed that maximum infestation of Brinjal fruit and shoot borer was observed on the genotype SULTAN i.e. 23.89 % which was found susceptible against fruit borer. The genotype KHBR-203 was found to be resistant with minimum infestation i.e. 7.02 %.

44:IPM of Fruit Fly in Bitter Gourd

Trial was conducted in the area of Vegetable Research Institute, Faisalabad in RCBD with three replicates. Among treatments, T1= Hoeing and sanitation at 15-days interval, T2 = Bait sprays Protien Hydrolyzate(300ml) + Trichlorfon(30g), T3 = Male annihilation (Cue-lure + Spinosad 24 SC) (six traps/acre and septa will be changed at 15-days interval) , T4= Bait Spray(GF-120FN T5= T1+T2+T3,T6= T1+T2+T4,T7= Control, minimum fruit fly infestation was recorded in T6 (10.10 %) and T5 (12.79 %) followed by T4 (15.50 %),T2 (17.70 %), T3 (21.02 %) and T1 (21.91 %) as compared to check (24.70 %).

Table: % Fruit Fly Infestation in different IPM practices in Bitter gourd

Treatments	% Fruit Fly Infestation
T1= Hoeing and sanitation	21.91 ± 1.59 AB
T2 = Bait sprays Protien Hydrolyzate(300ml) + Trichlorfon(30g)	17.70 ± 2.32 ABC
T3 = Male annihilation (Cue-lure + Spinosad 24 SC)	21.02 ±1.42AB
T4=Bait spray (GF-120FN)	15.50 ±1.10 BCD
T5= T1+T2+T3	12.79 ±0.97 CD
T6= T1+T2+T4	10.10 ±0.52 D
T7= Control	24.70 ± 1.46 A
LSD	7.5300

Means sharing similar letters are not significantly different by Tukey HSD at P = 0.05

45.Varietal Screening Of Different Genotypes/Varieties Of Onion Against Thrips And Population Dynamics Of Thrips And Its Co-Relation With Weather Factors

The experiment was conducted in the research area of Vegetable Research Institute, Faisalabad in RCBD. The data regarding onion thrips was recorded from central whorl of 5 plants selected at random at weekly interval. The data were recorded on weekly basis and co- related with the meteorological factors *i.e.*, temperature, relative humidity and rain fall. The data recorded are as under;

Table- Mean population of thrips in different onion genotypes/varieties

Varieties/lines	Average thrips population
Red Moon	28.62 c
Red King	42.31 b
Kareem	47.88 b
Premium	48.95 b
Monica	53.01 b
KOS-HON	43.26 b
Phulkara	59.49 ab
Ruby	70.53 a
LSD	12.18

Results revealed minimum population of onion thrips was recorded (28.62) on Red moon followed by Red king, KOS-HON, kareem, Premium, Monica, Phulkara and Ruby and their mean population (42.31), (43.26), (47.88), (48.95), (53.01), (59.49), (70.53) respectively.

Table: Studies on the population dynamics of onion thrips

Months	Date of obs.	Thrips pop./plant	Weather Factors		
			Ave. Temp. (C°)	R.H (%)	Rainfall (mm)
February	10/02/2015	0.50	20.68	64.99	0.00
	17/02/2015	1.00	18.89	64.99	0.00
	24/02/2015	8.1	15.19	70.14	1.98
March	03/03/2015	13.05	14.06	65.28	5.74
	10/03/2015	30.12	17.79	70.07	0.74
	17/03/2015	43.01	21.32	65.71	0.00
	24/03/2015	52.69	24.10	62.92	0.00
	31/03/2015	69.61	22.94	61.99	0.17
April	07/04/2015	75.80	20.57	64.14	2.80
	14/04/2015	45.92	29.00	43.64	0.00
	21/04/2015	32.31	31.04	35.28	0.00
	28/04/2015	12.05	33.09	33.05	0.00
May	05/05/2015	7.93	33.00	32.85	0.00
Average of the season.		30.168	23.21	56.54	0.88

Table: Correlation of thrips population with Weather factors.

	Ave. Temp. (^{0}C)	Average % R.H	Average Rainfall (mm)
Ave. Thrips population	0.0556	0.0499	-0.0755
P-value	0.8568	0.8713	0.8062

Among varieties, thrips population was minimum in Red Moon and Red King i.e 31.11 and 31.78 respectively. However all varieties show non-significant difference. Maximum population was recorded in Ruby i.e. 43.31 thrips /plant. Data regarding the population abundance was first recorded on 10th February (0.508) and reached at its peak (75.804) population recorded on 7th of April. Later, the population declined to 7.929 during month of May as the crop started to mature. Weather variables monitored included: rainfall, temperature and relative humidity. Result showed that population of thrips is positively co-related with temperature and relative humidity but it is non-significant. Thrips population was negatively co-related with Average rainfall and the co-relation with rainfall is also non-significant.

46. STUDIES ON THE POPULATION DYNAMISCS OF ONION THRIPS

The experiment was laid out at Vegetable Research Sub Station, Multan. The data was recorded from 15 plants selected at random and the population of thrips was counted. The data was recorded on weekly basis and correlated with the meteorological factors *i.e.*, temperature (^{0}C), relative humidity (%) and rainfall (mm) respectively. The results are given as under;

Table: Studies on the population dynamics of onion thrips

Month	Week	Thrips/leaf	METEROLOGICAL DATA			
			Max. Temp. (C^0)	Mini. Temp. (C^0)	R.H (%)	Rainfall (mm)
February	**1st**	0.00	21.42	10.14	88.29	0.42
	2nd	0.00	21.57	9.85	83.14	1.21
	3rd	0.00	25.00	12.14	84.35	14.14
	4th	8.07	29.28	16.71	91.00	0.00
March	**1st**	11.41	20.42	9.71	85.84	0.48

	2nd	26.45	20.00	10.20	84.07	1.00
	3rd	29.33	25.14	11.10	81.10	14.14
	4th	12.12	31.85	18.57	83.42	0.00
April	**1st**	8.25	29.85	17.17	78.85	0.00
	2nd	3.23	29.71	17.00	84.00	1.57
	3rd	0.00	35.14	21.17	70.14	0.00
	4th	0.00	38.30	24.10	54.40	0.00

Table: Correlation coefficient values between onion thrips population and weather factors

Pest	**Temperature**		**Rel. Humidity (%)**	**Rainfall (mm)**
	Max. Temp. (^{0}C)	**Min. Temp. (◦C)**		
Thrips	-0.346	-0.362	0.244	0.297
p-value	0.271	0.248	0.445	0.348

*-Significant, **-Highly Significant

There has been no significant correlation between the population of thrips and the meteorological factors. The results revealed that maximum population of onion thrips/plant was recorded during the 3rd week of March when the recorded maximum temperature, minimum temperature, relative humidity and rainfall was 25.14^{0}C, 11.10 ^{0}C, 81.10 % and 14.14 mm respectively.

47:INTEGRATED PEST MANAGEMENT OF TOMATO FRUIT BORER

The experiment was conducted in the research area of Vegetable Research Institute Faisalabad. The trial was laid out in RCBD with three replications. Sanitation and Hoeing was done at 15 days interval starting from after transplanting the nursery to till harvest. *Trichogramma* egg cards were installed on appearance of egg of the pest and repeated at 7 days interval. Insecticide and plant extract was sprayed on the larval appearance of fruit borer. The data regarding fruit borer infestation were recorded at 7 days interval from randomly selected 5 plants/plot of each treatment. Finally % fruit infestation caused by tomato fruit borer was calculated. The data recorded are as under;

Table: Integrated pest management of tomato fruit borer

Sr.#	Treatments	% Fruit infestation
T1	Sanitation + Hoeing at15 Days interval	17.33 B
T2	Neem leaf extract @ 5 %	13.02 C
T3	*Trichogrammachilonis* eggs @ 60 cards /acre	11.84 CD
T4	chrysoperla larvae 2-3 instar @ 1/plant	11.18 DE
T5	T1 + T2	9.76 E
T6	T1 + T2 + T3+T4	6.92 F
T7	Spinosad 240 SC @80 ml/acre	5.34 G
T8	Check	29.42 A
LSD value at 5%		1.4692

Among the different treatments minimum fruit infestation was recorded where spinosad 240 SC was applied i.e. 5.34 % followed by T6 (Sanitation & Hoeing at 15 Days interval + Neem leaf extract @ 5 % + *Trichogrammachilonis* eggs @ 60 cards /acre + *Chrysoperla* larvae 2-3 instar @ 1/plant) and T5 (Sanitation + Hoeing at 15 Days interval + Neem leaf extract @ 5 %) that caused 6.92 and 9.76 % fruit infestation respectively. while maximum fruit infestation was recorded in control treatment i.e. 29.42 %.

48:**EVALUATION OF TOMATO GENOTYPES AGAINST INSECT PESTS**

The experiment was conducted in the research area of Vegetable Research Institute, Faisalabad. The trial was laid out in RCBD with three replications. Ten tomato genotypes including Litth-8505, Litth-790, Litth-793, Litth-795, Litth-799, Litth-801, Litth-803, Litth-682, Litth-611 and Litth-691 were screened out against insect pests. Aphid population was recorded from 15 randomly selected upper, middle and lower leaves of 15 plants per plot. Attack of fruit borer was recorded by examining all healthy and infested fruits of 5 randomly selected plants per plot. Physio-morphic characters as thickness of leaf lamina (mm), hair density on leaf (cm^2) and stem diameter (cm) were also recorded. The data recorded are as under:-

Table: SCREENING OF TOMATO GENOTYPES AGAINST INSECT PESTS

Treatments		Tomato Fruit borer %	Aphid/Leaf	Leaf hair density (per cm^2)	Leaf lamina thickness (mm)
V1	Litth-8505	6.18 B	2.42 D	211.33 A	0.21 ABC
V2	Litth-790	4.25 DE	2.82 CD	148.52 F	0.21 ABC
V3	Litth-793	4.57 CD	3.44 BC	179.19 D	0.24 A
V4	Litth-795	7.97 A	3.29 BCD	180.62 D	0.17 C
V5	Litth-799	5.57 BC	3.58 BC	202.69 B	0.22 AB
V6	Litth-801	5.15 BCD	4.12 AB	189.27 C	0.17 C
V7	Litth-803	6.40 B	3.68 BC	203.63 B	0.20 ABC
V8	Litth-682	5.14 BCD	3.42 BCD	155.11 E	0.23 A
V9	Litth-611	2.69 F	3.87 AB	186.93 C	0.23 A
V10	Litth-691	3.09 EF	4.88 A	206.81 AB	0.18 BC
LSD @ 0.05		1.28	1.01	5.43	0.04

Minimum fruit borer infestation (2.69%) was recorded on Litth-611 whereas maximum fruit borer infestation (7.97%) was recorded on Litth-795. Minimum aphid population (2.42/leaf) was recorded on genotype Litth-8505 followed by 2.82/leaf on genotype Litth-790. The Maximum aphid population (4.88/ leaf) was recorded on Litth-691

Table: CORRELATION OF TOMATO FRUIT BORER WITH PLANT MORPHOLOGICAL CHARACTERS

	Tomato Fruit borer % Infestation
Leaf Hair density (per cm^2)	-0.6942 (0.0259)
Leaf lamina thickness (mm)	-0.9675 (0.0001)

Fruit borer damage percentage infestation was negatively but significantly correlated with leaf hair density (per cm2) while negatively and highly significantly correlated with Leaf lamina thickness (mm) of tomato plants.

INSECT PESTS OF FRUITS

49: Taxonomic studies of different fruitflies emerging from infested fruits of citrus, guava and mango orchards

Infested fruits from different locations of Faisalabad were collected. Fruits collected from different orchards (citrus, mango, guava) were placed in separate cages in the laboratory. Fruitflies emerged from these fruits were identified under highly magnified microscope. Different species were separated on the basis of morphological and pictorial keys.

Table:No. Of fruitflies emerging from infested fruits of citrus, guava and mango orchards

Fruit Source	*Bactrocera zonata*	*Bactrocera dorsalis*	*Bactrocera cucurbitae*
Mango Orchards	845	1048	8
Guava Orchards	3650	142	0
Citrus Orchards	2234	1189	9

50: Exploration of parasitoid species of Citrus, Mango and Guava Fruitfly

Infested fruits, larvae and pupae of fruit fly from different locations of Faisalabad were collected and placed in separate of cages. Different types of parasitoids will emerge from already parasitoids adults, larvae and pupae. Emerged parasitoid species were isolated in small cages. Each spwere reared on its respective host stage. Most common found sp of parasitoids were selected for further mass rearing in the laboratory.

Table: Parasitoid species of Citrus, Mango and Guava Fruitfly

Host Fruit	Name of Parasitoid specie explored	Type of Parasitization	Sample Size	Time of Activity
Mango Fruits	*Diachasmi morphalongi cudata*	Larval	34	Summer fruit
Guava Fruits	*Diachasmi morphalongi cudata*	Larval	87	Summer fruit
	Trybliographa daci		53	Winter fruit
Citrus Fruits	*Trybliographadaci*	Larval	48	Summer fruit

51: SCREENING OF MANGO VARIETIES AGAINST FRUIT FLIES

The experiment was laid out at Farmers field located at Chah Fazilwala, Chah Namdarwala Mouza buch Mubarak and Mouza sairkharak in Tehsil and District, Multan. The fourteen Mango varieties i.e. Early varieties (Dusehri, Malda, Langra), Medium (Chaunsa, Fajri, Sensation) and late (Sanglakhi, Ratul-12, Mehmood Khan wala, Desi, Black Chaunsa, Sufaid Chaunsa, Dai Wala, Sohbawali Ting) were selected and screened against fruitfly damage. For recording data 60 fruits from 3 trees were observed carefully. There were three replications under RCBD. The fruits ooze small drop of juice on the skin was considered fruit fly damage fruit. Fruit fly damaged and healthy fruits were counted separately. The percent damage was calculated. The data were subjected to analysis of variance (ANOVA) using Statistix software (release 8.1; Lawes Agricultural Trust Rothamsted Experimental Station, Rothamsted, UK). The means were separated by LSD (Least Significant Differences).

Table: Data regarding average percent damage fruits by fruit flies weekly on different mango varieties .

Sr.#	Status	Varieties	Dates of observations								
			18.6.15	23.6.15	2.7.15	9.7.15	16.7.15	23.7.15	30.7.15	6.8.15	12.8.15
1	Early varieties	Dusehri	0.00	0.00	0.02	Harvested					
2		Malda	0.00	0.00	0.00	Harvested					
3		Langra	0.00	0.00	2.60	2.00 a	Harvested				
4	Medium varieties	Chaunsa	0.00	0.00	0.00	0.00 c	1.89 c	2.15 ef	3.27 d	Harvested	
5		Fajri	0.00	0.00	0.00	0.55 bc	1.65 c	4.12 e	2.57 d	Harvested	
6		Sensation	0.00	0.00	0.00	0.00 c	0.00 c	2.04 ef	2.19 d	2.51d	Harvested
7	Late varieties	Sanglakhi	0.00	0.00	0.19	0.20 bc	9.43 ab	25.13 a	37.14 a	37.33 a	53.14b
8		Ratul-12	0.00	0.00	0.00	0.60 bc	9.23 ab	12.32 bc	22.22 b	35.47 a	56.40b
9		Mehmood Khan	0.00	0.00	0.00	0.70 b	10.23 a	15.29 b	17.23 c	33.25ab	75.44a
10		Desi	0.00	0.00	0.00	0.10 bc	7.76 ab	8.39 d	13.92 c	27.65c	38.75c

11		**Black Chaunsa**	0.00	0.00	0.00	0.00 c	0.00 c	0.00 f	1.89 d	2.15d	3.27d
12		**Chita Chaunsa**	0.00	0.00	0.00	0.00 c	0.00 c	1.10 ef	2.50 d	3.33d	7.41d
13		**Dai wala**	0.00	0.00	0.00	0.00 c	6.34ab	0.91 ef	1.78 d	2.12d	7.11d
14		**Sohbawali Ting**	0.00	0.00	0.00	0.31 bc	8.40 ab	11.43 cd	15.97 c	29.56bc	55.65b
Tukey HSD Value						0.63	3.28	3.41	4.60	5.28	9.82
F-Value						18.72	43.97	139.47	164.03	236.41	198.18

Means sharing similar letters are not significantly different by Tukey's HSD at P = 0.05,
HSD = Honestly Significant Difference * = Significant at P < 0.05, ** = Significant at P < 0.01.

It is clear from the results that the maximum damaged fruits due to fruit flies were recorded on Langra mango (2.00%) cultivar followed by Mehmood khan wala 0.7% . The cultivars ratul-12 and Fajri has i.e. 0.60 and 0.55% which are statistically similar. The cultivar soba wali ting has 0.31% damage fruit . The minimum damage fruit was recorded on Sanglakhi and Desi cultivars i.e. 0.20 and 0.10. All other cultivars i.e. chaunsa, Sufaid chaunsa, Dai wala, Black chaunsa and sensation has zero damage fruit due to fruit flies on 9.7.15. It is clear from the results that the maximum damaged fruits due to fruit flies were recorded on Mehmoood khan wala mango (10.23%) cultivar statistically similar to Sanglakhi (9.43%) and Ratul-12 (9.23) followed by Sobaywali ting (8.40%) and desi (7.76%). The cultivar daiwala has 6.34%. The cultivars Chaunsa and Fajri has 1.89 and 1.65% damaged fruits. The cultivars Sufaid chaunsa, Black chaunsa and sensation has zero percent damaged fruits due to fruit flies on 16.7.15. It is clear from the results that the maximum damaged fruits due to fruit flies were recorded on Sanglakhi (37.14%) followed by Ratul-12 (22.22%). The cultivars Mehmoood khan wala, sohbaywali ting and dsei has 17.23, 15.97 and 13.92% fruit damage wahich are statistically similar. The minimum damaged fruits were recorded on Chaunsa, Fajri, Chita Chaunsa, Sensation, Black and daiwala has 3.27, 2.57, 2.50, 2.19, 1.89 and 1.78% damaged fruits due to fruit flies on 30.7.15.

Maximum damaged fruits due to fruit flies were recorded on Sanglakhi (37.33%), Ratul-12 (35.47%) and Mehmoood khan wala (33.25%) which are statistically similar followed by sohbaywali ting (29.56%) and statistically similar to desi (27.65%). The minimum damaged fruits were recorded on Chita Chaunsa, Sensation, Black and daiwala has 3.33, 2.51, 2.15 and 2.12% damaged fruits due to fruit flies on 6.8.15. Maximum damaged fruits due to fruit flies were recorded on Mehmoood khan wala (75.44%) followed by Ratul-12 (56.40%), sohbaywali ting (55.65%) and Sanglakhi (53.14%). The cultivar desi has (38.75%). The minimum damaged fruits were recorded on Chita Chaunsa, daiwala and Black 7.41, 7.11 and 3.27% damaged fruits due to fruit flies on 12.8.15.

Table : Data regarding fruit flies fauna of mango in Multan during 2015

Fruit flies species recorded in mango fruits	**Percentage of species emerged**	**Percent ratio of male and female fruit flies**	
		Male	**Female**
Bactrocera zonata	**81.36**	**39.83**	**41.53**
Bactrocera dorsalis	**18.65**	**7.63**	**11.02**
	Total=	**47.46**	**52.55**

The data in the Table showed that more population of *Bactrocera zonata* fruit fly was recorded ie 81.36% and less *Bactrocera dorsalis* i.e. 18.65%. In case of sex ratio *Bactrocera zonata* fruit fly male were 39.83 and female were 41.53 whereas in case of *Bactrocera dorsalis* fruit fly male were 7.63 and female were 11.02% .

52: INCIDENCE OF MANGO MIDGES (INFLORESCENCE) AT MULTAN ON DIFFERENT MANGO VARIETIES AND THEIR RELATION WITH ENVIRONMENTAL FACTORS.

The trial was conducted at research area of Mango research institute, Multan having 4 different varieties (Dusari, Anwar Ratol, Chonsa and Sensation) of mango. Three trees of each variety were selected and collect the inflorescence from three sides of each tree. Observations of mango midges were made at different plant parts i.e. Leaves inflorescence and young shoots by enveloping with polythene bags shaking and withdrawing with insects. Data regarding the population dynamics of mango midges was collected at weekly intervals and was subjected to the statistical analysis.

The table clearly shows that maximum average population of mango midges was found on Chonsa (11.57) during all the season followed by Anwar Ratol and Sensation i:e 9.10 and 8.44 respectively.

Where as he least average population of mango midges was observed at Dusari i:e 6.61 during the season.

Table: Average pop of midges on inflorescence at different Varieties of Mango

S/NO	Varieties	Average pop of midges on inflorescence
1-	**Dushari**	6.61
2-	**Anwar Ratul**	9.10
3-	**Chaunsa**	11.57
4-	**Sensation**	8.44

It was concluded that mango midges attack less on Dusari as compared with other varieties of mango.

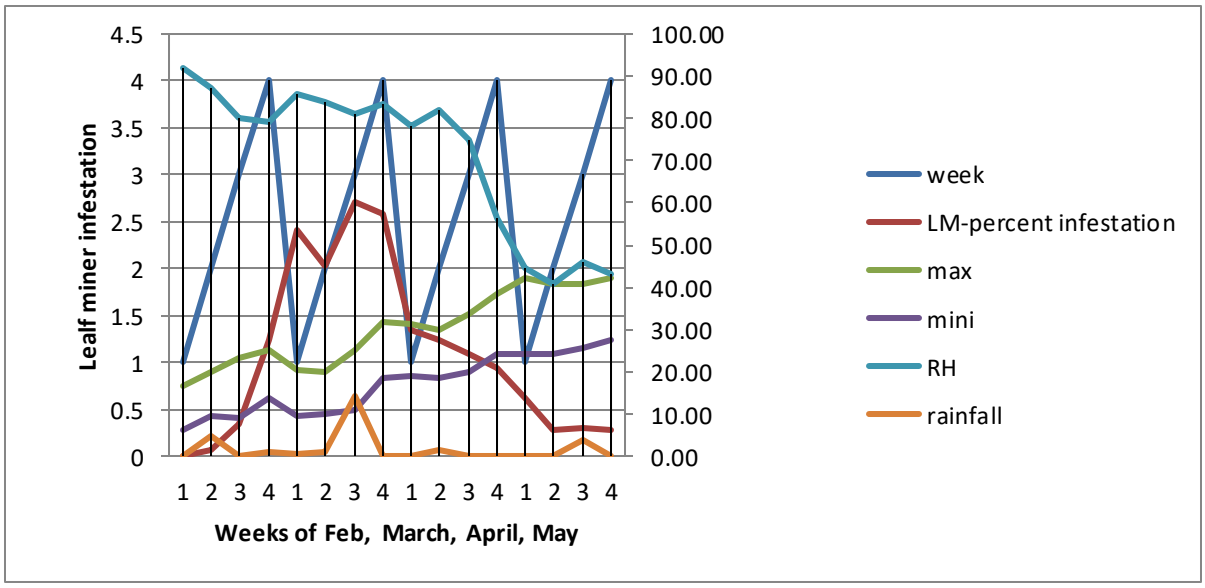
53: EFFECT OF WEATHER FACTORS ON THE POPULATION FLUCTUATION OF CITRUS LEAF MINER (Phyllocnistic citrella Stainton) ON KAGHZI LIME

The trial was conducted with the coordination of Farm Manager Extension, Multan. Data regarding population of leaf miner was recorded from 5 selected trees randomly from the month of February to April 2016. For this purpose four sides of the trees by putting one square feet on each side of the tree and count the infested and healthy leaves from total leaves and then further calculate the %age of infestation. The data was recorded at weekly interval and correlated with the abiotic factors i.e., temperature, relative humidity and rain fall. Finally, the data was compiled and was correlated with weather factors. The data in the table showed that percentage infestation of leaf miner started in the first week of February i:e (0.08%) when maximum temperature was 22.90 ºC and minimum temperature 6.28 ºC and relative Humidity and rainfall was 81.70% and 0.00mm respectively. Maximum percentage infestation was recorded in the 3rd and 4th week of March i:e 3.70% and 3.51% respectively when maximum average temperature was 29.20 ºC and minimum average temperature 14.83 ºC and average relative Humidity and rainfall was 80.60% and 1.00 mm respectively. The percentage infestation almost remain the low in the 2nd, 3rd and 4th week of April i:e (1.24),(1.10) and (0.20) respectively. When average of these week weather data maximum temperature was 29.23 ºC and minimum temperature 14.18 ºC and relative humidity and rainfall was 76.82% and 1.50 mm respectively.

Table: %age infestation of Citrus leaf Miner on Kaghzi Lime

Months	Week	LM-percent infestation	max	mini	RH	Rainfall
Feb	1	0.08	22.90	6.28	81.70	0.00

	2	0.11	22.10	9.70	81.50	0.00
	3	0.41	24.90	9.10	76.10	0.00
	4	1.29	29.30	13.70	73.90	0.00
March	1	2.90	25.90	9.71	75.30	0.00
	2	3.11	26.50	10.20	82.30	0.00
	3	3.70	27.80	11.10	81.70	1.00
	4	3.51	30.60	18.57	79.50	0.00
April	1	2.35	33.10	19.00	76.60	7.00
	2	1.24	32.30	18.60	84.00	10.00
	3	1.1	36.40	20.10	70.50	0.00
	4	0.2	39.00	24.10	58.70	0.00



From the experiment it was concluded that temperature (Maxi and Mini), Relative Humidity and Rainfall has impact on population fluctuation of citrus leaf miner.

53:SCREENING OF DIFFERENT BER VARIETIES AGAINST FRUIT FLIES

The experiment was laid out at Agriculture Extension Farm Old Shujabad Road, Multan. The commercial varieties of ber i.e. Kheeri, Umeri, Ayuba, dokil and Desi were selected for recording data.

Twenty five branches of each treatment were selected. From these branches whole number of berwere counted (damaged and healthy) from all sides. The percent damage fruits were calculated. Fifty damaged ber of fruit flies were plucked in the month of April,2016. Fruits were kept separately in polythene bags. The damaged fruits were brought to hot and cool chamber. The fruits were opened and counted the number of larvae. Hundred damaged fruits of ber were plucked from the trees. The plucked ber were kept in rearing cages in hot and cool chamber. The fruit flies emerged were identified. The maximum average number of fruits per one foot branch were recorded on desi (42.08) statistically similar to dokil (35.55) followed by Kheeri (32.92).The less number of fruits per foot branch were recorded on umeri and Ajooba i.e. 23.64 and 20.36. The means were compared by Tukey Test at P = 0.05 and the results are given in Table. It is clear from the results that the maximum damaged fruits due to fruit flies were recorded on ber cultivar umeri (16.18%) and Dokil (15.94%) in the month of November 2015 followed by Desi (0.59%). The minimum damaged fruits were recorded on cultivars Ajooba and Kheeri i.e. 3.70 and 3.57% which are statistically similar. The means were compared by Tukey Test at P = 0.05 and the results are given in Table 1. It is clear from the results that the maximum damaged fruits due to fruit flies were recorded on ber cultivar dokil (13.71%) followed by desi having 7.93% fruit damage in the month of December 2015. The umeri has 5.23 and Kheeri 3.43% damaged fruits. The minimum damaged fruits were recorded on cultivars Ajooba i.e. 1.97%.

Table:Data regarding average number of fruits per one foot branch and average percent damage recorded during different months 2015-16

Varieties of ber	Av number of fruits per one foot branch	Average percent damage recorded during different months 2015-16						Average
		Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	
Kheeri	32.92 b	3.57 c	3.43 d	7.59 c	2.41 d	3.86 c	43.18 b	10.67 c
Desi	42.08 a	9.59 b	7.93 b	8.41c	5.58 c	-	-	5.25 e
Umeri	23.64 c	16.18 a	5.23 c	31.54 a	38.50 a	32.72 a	54.55 a	31.45 a
Dokil	35.55 ab	15.94 a	13.71 a	13.81 a	10.43 b	-	-	8.98 d
Ajooba	20.36 c	3.70 c	1.97e	7.59 c	12.59 b	7.82 b	50.00 a	13.95 b
Tukey's HSD value at 5%	8.44	1.93	0.94	2.55	3.12	2.02	5.32	0.90
F-Value	26.26	194.25	494.03	303.36	394.0	974.79	18.81	1167.68

Means sharing similar letters are not significantly different by Tukey at P = 0.05,

It is clear from the results that the maximum damaged fruits due to fruit flies were recorded on ber cultivar umeri (31.52%) followed by dokil having 13.81% fruit damage in the month of January 2016. The cultivars Desi, Kheeri 3.43 and Ajooba have low damaged fruits i.e. 8.41, 7.59 and 7.59%.

It is clear from the results that the maximum damaged fruits due to fruit flies were recorded on ber cultivar umeri (38.50%) followed by Ajooba and dokil having 12.59 and 10.43% fruit damage in the month of February 2016. The cultivars Desi has 5.58 and Kheeri has 2.41% damaged fruits.

Maximum damaged fruits due to fruit flies were recorded on ber cultivar umeri (32.72%) followed by Ajooba having 7.82% fruit damage in the month of March 2016. The cultivar Kheeri has 3.86% damaged fruits. Maximum damaged fruits due to fruit flies were recorded on ber cultivar umeri (54.55%) statistically similar to Ajooba having 50.0% fruit damage in the month of April 2016. The cultivar Kheeri has 43.18% damaged fruits. Maximum damaged fruits due to fruit flies were recorded on ber cultivar umeri (31.45%) followed by Ajooba having 13.95% fruit damage during whole season . The cultivars Kheeri, dokil has 10.67 and 8.98% damaged fruits. The minimum damaged fruits were recorded on desi cultivar of ber i.e. 5.25%.

Minimum number of larvae per fruit in Kheeri, desi, Umeri, Dokil and Ajooba was one per fruit where maximum number of larvae were different i.e. Kheeri (7), Desi (4), Umeri (9), Dokil (3) and Ajooba (5) as shown in table below.

Table : Average number of larvae recorded per fruit and their range

Number of larvae recorded per fruit	**Av no of larvae /fruit found in different varieties of ber**				
	Kheeri	**Desi**	**Umeri**	**Dokil**	**Ajooba**
Minimum number of larvae per fruit	1	1	1	1	1
Maximum number of larvae per fruit	7	4	9	3	5
Range=	1-7	1-4	1-9	1-3	1-5

In the month of Nov, Dec and Jan only ber fruit fly *Carpomaya vesuviana* attack the fruits but in the month of Feb *Bactrocera zonata* attacked the ber fruits. Maximum parasites were recorded in the month of Feb and March 43.46%.

Table: Data regarding fruit flies recorded from ber fruits during 2015-16

Damaged ber collected during month	Percentage of fruit fly(*Carpomaya vesuviana)* species emerged		Parasites
	Male	**Female**	
Nov-15	33.33	66.67	0.00
Dec-15	47.06	52.94	0.00
Jan-16	33.33	66.67	0.00
Feb-16	0.00	60.00	43.48
Mar-16	0.00	0.00	43.48
Apr-16	0.00	0.00	13.04
Ratiomale&female	113.72	246.28	

Male and female ratio of *Carpomaya vesuviana* =1:2.17

54: STUDIES ON MANGO HOPPER'S PREFERENCE TO MANGO VARIETIES

The trial was conducted in farmer's field, in Tehsil and Distt. Multan. Eleven high value commercial mango varieties i.e.Ratul-12, Sohbawali ting, Black Chaunsa, Desi, Chaunsa, Sufaid Chaunsa, Dusehri, Langra, Sanglakhi, Anwar Ratul and Fajri were selected in Multan District. The data of mango hoppers populations were recorded from the inflorescence in the month of March. From each variety three inflorescences were selected and covered with polythene bags. A tag having name of variety and date were put in the polythene bags.The tags were written with lead pencil. The bags along with the inflorescence were put in the refrigerator to inactivate the hoppers for 3-4 hours. The data were subjected to analysis of variance (ANOVA) using Statistix software (release 8.1; Lawes Agricultural Trust Rothamsted Experimental Station, Rothamsted, UK). The means were separated by LSD (Least Significant Differences).

Maximum number of mango hoppers were recorded on Fajri Mango i.e. 55.00 per inflorescence followed by Sufaid Chaunsa having 36.00. The chaunsa and Black chaunsa has statistically similar population of mango hoppers i.e. 26.33 and 23.67 individuals per inflorescence. The cultivars desi, Langra, and sohbaywali ting has 19.67, 17.33 and 17.0 individuals per inflorescence which are also statistically similar. The cultivar sanglakhi and Ratul-12 has similar populations. The minimum

population of mango hoppers was recorded on Dusehri and Anwar Ratul i.e. 2.0 and 1.67 individuals per inflorescence which are statistically similar.

'Fajri' > 'Sufaid Chaunsa' > 'Chaunsa' > 'Black Chaunsa' > ''Tukhmi'' > 'Langra' > 'Sohbay wali ting' > 'Sanglakhi' > 'Ratul-12' > 'Dusehri' > 'Anwar Ratul' >

Table: Data regarding mango hoppers population on different varieties of mango

S. No	Mango cultivars	Average mango hopper's population per inflorescence
1	Ratul-12	5.67 e
2	Sohbawali ting	17.00 d
3	Black Chaunsa	23.67 c
4	Desi	19.67 d
5	Chaunsa	26.33 c
6	Sufaid Chaunsa	36.00 b
7	Dusehri	2.00 f
8	Langra	17.33 d
9	Sanglakhi	7.00 e
10	Anwar Ratul	1.67 f
11	Fajri	55.00 a
LSD value		3.48
F-Value		184.96

Means sharing similar letters are not significantly different by DMR Test at P = 0.05,

55:EVLUATION OF SOME NEW CHEMISTRY INSECTICIDES FOR THE CONTROL OF CITRUS LEAF MINER ON CITRUS NURSERY.

Six insecticides viz. Delegate (spintorom) @60gm/acre, Coragen (chlorantraniliprole) @ 20ml /acre, Lufenuron 50EC@ 50ml/acre, Bifenthrin 10EC@ 100ml/acre and Spinosad 240SC@ 50ml/acre were tested against citrus leaf miner.The trial was laid out in Randomized Complete Block Design (RCBD) with three replications at Nursery Area of Agriculture Extension Farm, Multan. Insecticides were applied when the maximum population/infestation of leaf miner was observed on the nursery plants . Five plants in citrus nursery (1-1.5 years old) were selected at random. The percentage

infestation of citrus leaf miner was recorded from 15 to 20 cm branch of each plant by counting the number of healthy and infested leaves. The data was subjected to statistical analysis.

Table: Efficacy Of Some New Chemistry Insecticides For The Control Of Citrus Leaf Miner On Citrus Nursery

Sr. No.	INSECTICIDES		DOSE/ ACRE	PERCENTAGE REDUCTION IN INFESTATION OF CLM AFTER		
	COMMON NAME	TRADE NAME		7 DAT	14 DAT	21 DAT
1.	Momentum	nitenpyram+chlorofenapyr	250ml	49.79cd	43.65d	42.61c
2.	Delegate	Spintoram	60ml	42.91d	46.78cd	44.07bc
3.	Coragen 20%SC	Chlorantraniliprole	20ml	50.93cd	55.93bc	51.11abc
4.	Bifenthrin 10EC	Talstar	100ml	67.81a	70.46a	64.03a
5.	Lufenuron 50EC	Lufenuron	50ml	62.28ab	68.87a	63.42a
6.	Spinosad 240SC	Tracer	50ml	54.73bc	61.61ab	57.65ab
7	Control			8.55e	7.33e	8.07d
Tuckey's HSD at 5%.				8.93	11.92	14.10
F-Value				114.12	80.70	45.72

Means sharing similar letters are not significantly different by Tukey HSD at P = 0.05

Bifenthrin 10EC@100ml/acre and Lufenuron 50EC@50ml/acre proved to be most effective insecticide against Citrus Leaf Miner (CLM) after 07, 14 and 21 days of insecticides application.

56:Evaluation of different plant extracts against fruit fly in guava.

Bio-insecticidal activity of different plant extracts viz *Ocimum basilicum , Mentha spicata,* Azadirachta *indica, Peganum harmal and Curcuma longa* were tested against *Fruit fly in guava,* Among plant extracts, *Peganum harmal and Curcuma longa* exhibited the highest repellency % against *fruit fly* (37.61 % and 30.11%) respectively followed by *Mentha spicata* (27.47 %), *Ocimum basilicum* (25.12 %) *and* Azadirachta *indica* (22.73 %) which were at par among each other.

Table: Efficacy of different plant extracts against fruit fly in guava

Plant	Untreated	Treated	% Rellelency
Basil	5.44± 0.25	3.25± 0.06	25.12± 2.10 b
Mint	6.21 ± 0.11	3.54 ±0.15	27.47± 1.14 b
Neem	2.88±0.075	1.82± 0.14	22.73 ±2.46 b
Harmel	7.37± 0.11	3.34 ± 0.07	37.61 ± 0.78 a
Turmeric	8.96±0.079	4.81± 0.13	30.11±0.90 ab
			LSD=7.561

57:POPULATION DYNAMICS OF FRUIT FLIES THROUGH PHEROMONETRAPS INSTALLED IN MANGO ORCHARD

The experiment was conducted with the coordination of Director Mango Research Institute, Multan. Five pheromones traps were installed in the orchard at five different places. Methyl-eugenol septa were placed in the traps. Fruit fly specimens were brought to hot and cool chamber at Entomological Research Sub-Station, Multan and were identified at species level with the help of identification keys under microscope. The captured fruit flies were counted weekly. The septa were changed fortnightly. The fruit flies species were counted and correlated with weather factors. The data recorded are as under;

Table:Population dynamics of fruit flies through pheromone traps installed in mango orchard

Year/Month	Week	Av pop of fruit flies			WEATHER FACTORS			
2014-15		*B.Zonata*	*B. Dorsalis*	*B. Cucurbitae*	Max (0C)	Mini (0C)	RH (%)	Rainfall (mm)
October-14	1st	207.00	0.00	0.00	35.14	24.50	75.60	0.00
	2nd	197.00	0.00	0.00	35.90	24.90	68.50	0.00
	3rd	151.00	0.00	0.00	31.80	19.85	72.14	18.00
	4th	132.00	0.00	0.00	28.00	18.70	78.00	0.00
Average		**171.75**	**0.00**	**0.00**	**32.71**	**21.98**	**73.56**	**4.50**
November-14	1st	147.00	0.00	0.00	31.30	19.20	69.70	0.00
	2nd	215.00	0.00	0.00	29.50	16.90	72.60	0.00
	3rd	197.00	0.00	0.00	28.20	12.00	76.00	0.00
	4th	115.00	0.00	0.00	30.00	9.51	76.71	0.00
Average		**168.50**	**0.00**	**0.00**	**29.75**	**14.40**	**73.75**	**0.00**
December-14	1st	3.00	0.00	0.00	27.30	9.40	77.90	0.00
	2nd	2.00	0.00	0.00	23.90	11.60	82.70	0.00

	3rd	3.00	0.00	0.00	15.90	6.90	92.70	0.00
	4th	4.00	0.00	0.00	14.10	6.10	90.20	0.00
Average		**3.00**	**0.00**	**0.00**	**20.30**	**8.50**	**84.43**	**0.00**
Jan-15	1st	0.00	0.00	0.00	15.40	4.00	87.20	0.00
	2nd	3.00	0.00	0.00	15.10	6.80	79.10	0.00
	3rd	0.00	0.00	0.00	19.00	8.40	87.40	5.00
	4th	4.00	0.00	0.00	17.90	9.10	80.20	0.00
Average		**1.75**	**0.00**	**0.00**	**16.85**	**7.08**	**83.48**	**1.25**
Feb-15	1st	7.00	0.00	0.00	16.42	6.28	92.00	0.00
	2nd	2.00	0.00	0.00	20.00	9.70	87.20	5.00
	3rd	0.00	0.00	0.00	23.10	9.10	80.10	0.00
	4th	0.00	0.00	0.00	25.10	13.70	79.20	1.00
Average		**2.25**	**0.00**	**0.00**	**21.16**	**9.70**	**84.63**	**1.50**
March-15	1st	11.00	0.00	0.00	20.42	9.71	85.84	0.48
	2nd	7.00	0.00	0.00	20.00	10.20	84.07	1.00
	3rd	6.00	0.00	0.00	25.14	11.10	81.10	14.14
	4th	15.00	0.00	0.00	31.85	18.57	83.42	0.00
Average		**9.75**	**0.00**	**0.00**	**24.35**	**12.40**	**83.61**	**5.21**
April-15	1st	95.00	0.00	0.00	29.85	17.71	78.85	0.00
	2nd	110.00	0.00	0.00	29.71	17.00	84.00	1.57
	3rd	117.00	0.00	0.00	35.14	21.71	70.14	0.00
	4th	134.00	0.00	0.00	38.30	24.10	54.40	0.00
Average		**114.00**	**0.00**	**0.00**	**33.25**	**20.13**	**71.85**	**0.39**
May-15	1st	315.00	0.00	0.00	42.00	24.00	44.70	0.00
	2nd	295.00	0.00	0.00	40.60	24.40	40.60	0.00
	3rd	357.00	0.00	0.00	40.80	25.80	45.80	4.00
	4th	311.00	0.00	0.00	42.30	27.40	43.30	0.00
Average		**319.00**	**0.00**	**0.00**	**41.43**	**25.40**	**43.60**	**1.00**
June-15	1st	231.00	0.00	0.00	42.90	26.30	42.60	0.00
	2nd	352.00	0.00	0.00	38.70	25.70	44.30	0.00
	3rd	293.00	0.00	0.00	40.50	27.90	44.10	10.00
	4th	307.00	0.00	0.00	40.40	29.40	45.60	0.00

Average		**295.00**	**0.00**	**0.00**	**40.63**	**27.33**	**44.15**	**3.33**
July-15	1st	207.00	0.00	0.00	37.42	26.28	65.00	6.42
	2nd	197.00	0.00	0.00	35.85	28.00	75.85	5.72
	3rd	229.00	0.00	0.00	37.28	27.71	74.28	1.14
	4th	201.00	0.00	0.00	36.57	28.57	77.57	0.00
Average		**208.00**	**0.00**	**0.00**	**36.78**	**27.63**	**73.18**	**3.32**
August-15	1st	207.00	0.00	0.00	35.30	27.00	86.40	77.00
	2nd	145.00	0.00	0.00	34.30	26.10	89.30	28.00
	3rd	197.00	0.00	0.00	37.20	28.40	72.40	9.00
	4th	124.00	0.00	0.00	36.00	26.20	77.40	0.00
Average		**168.00**	**0.00**	**0.00**	**35.70**	**26.93**	**81.38**	**28.50**
Total Average		**510.88**	**0.00**	**0.00**	**183.55**	**97.37**	**560.76**	**12.98**

In mango orchard the maximum population of *Bactrocera zonata* on an average basis (319.00/trap) was recorded during the month of May-2015 followed by 295/trap during June-2015, 208/trap during Jul-2015, 171.75/trap during October-2014 and 168.50/ trap during November-2014 respectively. No other species was observed on mango orchards.

58: EVALUATION OF CHEMICAL INSECTICIDES AGAINST CITRUS PSYLLA (*Diaphorina citri*).

Seven insecticides viz, Imidacloprid, Lufeneuron, Spinosad, Thiamethoxam 25WG, Bifenthrin and Chlorantraniliprole 20SC were evaluated against cirtus psylla. The trial was conducted to find out the effective insecticides for the control of citrus psylla at research area of Horticultural Research Institute, in RCB design, with three replicates. Among insecticides Imidacloprid, Lufeneuron, Spinosad, Thiamethoxam 25WG, Bifenthrin and Chlorantraniliprole 20SC. Data were recorded before treatment and then after 24hours,72hour and 7 days after treatment. Adult population was recorded from 5 randomly selected twigs/tree by enveloping the twigs with polythene bags and shaking the twig in bag and removed carefully along with insects. Among chemical insecticides, chlorantraniliprole gave 95.64% efficacy followed by Bifenthrin (86.51%), Imidacloprid (71.30%) and Lufeneuron (62.31%) after 3 days of interval against citrus psylla .

Table: Efficacy of different insecticides against citrus psylla, *Diaphorina citri*

Treatment	Pre-Treatment	% mortality		
		24-hours	3-days	7-days
Thiamethoxam	55.16	100.00 a	100.00 a	53.37 b
Clorantraniprole	43.28	76.12 a	59.10 b	64.07 b
Fipronil	37.31	80.34 a	69.24 b	72.13 ab
Thiacloprid	41.23	98.23 a	71.03 b	76.31 ab
Spirotetramate	48.22	89.33 a	66.23 b	79.14 ab
Emamectin Benzoate	42.12	81.37 a	78.37 ab	86.24 a
Carbosulfan	38.92	84.67 a	80.09 ab	78.13 b
Control	53.1	0.00 b	0.00 c	0.00 c
LSD @ 5%		23.5	17.00	20.4

58. SCREENING OF DIFFERENT BER VARIETIESAGAINST FRUITFLY

The experiment was conducted at Agri.(Ext.) Farm,Multan on four Ber varieties i.e. Kheeri, Desi, Umeri and Ayuba. The trial was laid out in RCBD with three replications. Three tree of each variety were selected in each replication. Total numbers of damage and healthy fruits were counted form one Sq. meter area of each tree and % damage was calculated. The data were compiled and analyzed statistically.

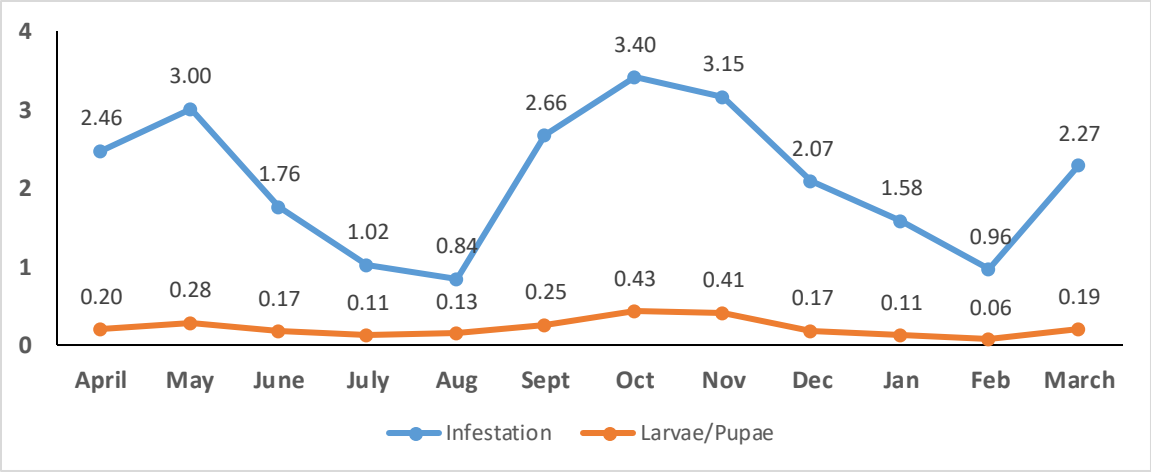
Table: Screening of different ber varieties against fruitfly

Sr.#	Varieties	Fruitfly infestation %age
1.	Kheeri	13.55 a
2.	Desi	6.16 b
3.	Umeri	6.16 b
4.	Dokil	15.95 a
5.	Ayuba	2.52 b
Tukey HSD value @5%		4.22
F- Value		42.43

Maximum fruits damaged percentage on per square meter were recorded on dokil and kheeri varieties of ber i.e. 15.95 and 13.55 followed by desi (6.17), umeri (6.16) and Ayuba (2.52) percent and were statistically at par with each other.

59: Incidence of fruit borer in guava orchards

The experiment was conducted in different guava orchards at Sharakpur during 2015. The aim of this study was to determine the infestation level of fruit borer on guava. The survey comprised of fifteen orchards. Results showed that the fruit borer incidence level was ranged from 0.84-3.4 % infestation.



INSECT PESTS OF FODDER

60:SCREENING OF NEW GUAR GENOTYPES AGAINST INSECT PESTS

Seven new genotypes Viz; S-4898, S-4994, S-5007, S-5009, S-5011, S-5013 and S-5014 supplied by the breeders were sown in the research area of Entomological Research Institute, Faisalabad. The experiment was laid out in RCB Design having three replications. Jassid, aphid and whiteflypopulation was recorded from 15 leaves of upper, middle and lowerportions of 15 randomly selected plants/plot. The data recorded are as under:-

Table: Screening of new guar genotypes against insect pests

Sr.#	Varieties	Jassid pop./leaf	Whitefly pop./Leaf	Aphid pop./Leaf
1.	S-5274	0.77 c	1.57 a	0.20 c
2.	S-5299	0.75 c	0.57 d	0.47 ab
3.	S-5394	0.93 bc	0.75 bcd	0.40 bc
4.	S-5548	0.92 bc	0.62 cd	0.53 ab
5.	S-5509	1.00 b	0.87 b	0.67 a
6.	BR-90	0.90 bc	0.85 bc	0.67 a
7.	BR-99	1.22 a	0.73 bcd	0.60 ab
	LSD @ 5%	0.19	0.21	0.12

Maximum jassid population (1.22/leaf) was observed on genotype BR-99 while the minimumjassid population (0.75/leaf) was observed on genotype S-5299. Maximum whitefly population (1.67/leaf) was observed on genotype S-5274 while the minimum whiteflypopulation(0.57/leaf) was observed on genotypes S-5299. In case of aphid maximum population (0.67/leaf) was observed on genotype S-5509 and BR-90 and statistically at par with each other followed BR-99 (0.60/leaf) while the minimum population (0.20/leaf) was observed on genotypes S-5274.

INSECT PESTS OF STORED GRAINS

61: DETECTION OF INSECT FRAGMENTS IN FLOUR BY DIFFERENT INFESTATION LEVELS OF *RHIZOPERTHA DOMINICA*

There were 5 treatments including control with five replications. Insect culture was prepared by adding 200 adults of Lesser grain borer in 200 gm. of wheat by adjusting moisture at 13.5% by adding distilled water in glass jars capped with screen lids. 20. 40, 60, 80, 100 and 120 infested grains with *Rhizopertha dominica* were released in 50 gram grains and ground to make flour. Insect integuments were counted by standard floatation method.

Table: Insect fragments in flour by different infestation levels of *rhizopertha dominica*

No. of infested grains	No. of framents
0	0.00f
20	12.0e
40	39.7d
80	96.0c
100	130.0b
120	178.33a
LSD at 5%	10.18

Maximum no.(178.33) of insect integuments were recorded in a sample containing 120 infested grains followed by 100 and 80 infested grains sample i.e., 130.0 and 96.0 integuments that are above the FDA approved limit of 75 integuments/50gm glour. Least 12 were recorded in a sample containing 20 infested grains.

62:CONTROL OF *TRIBOLIUM CASTANEUM* (COLEOPTERA: TENEBRIONIDAE) BY MODIFIED ATMOSPHERE CREATED BY PLANT MATERIAL COMBUSTION.

The trial was planned in CRD in stored grain laboratory ERI, Faisalabad. There were 5 treatments including control with five replications. 20 adults of *Triboliumcastanium*were obtained from same- age

rearing. Insects were released in jars having smoke generated by plant material combustion. Finally the data was be analyzed statistically.

Table: Mortality of *Tribolium Castaneum* (Coleoptera: Tenebrionidae) By Modified Atmosphere Created By Plant Material Combustion

Plant material	2 days	4 days	6 days
Dhatura	66.7a	76.7a	93.3ab
Neem	56.7b	73.3a	86.7ab
Akk	66.7a	73.3a	96.7a
Paddy husk	63.33ab	70a	80b
Control	0c	0b	0.33c
LSD at 5%	9.4	14.1	14.1

All the treatments were found to have a non-significant difference among themselves.

63:EFFICACY OF PLANT EXTRACTS AGAINST LESSER GRAIN BORER, *RHYZOPERTHA DOMINICA*

The trial was planned in CRD in stored grain laboratory ERI, Faisalabad. Ethanol based plant leaf extracts of Akk, Castor, Amaltas and Neem(20% and 10%) each including control with three replications. Insects of *R. dominica*were reared in the lab under ideal conditions of temperature 28C$\pm$2 and RH 65%$\pm$5. 20 adults *R. dominica*were released on filter paper treated with 20% and 10% conc. Of each plant extract for exposure periods of 2, 4 and 6 days.

Efficacy of plant extracts on mortality % of *R. dominica adults*

Plant extracts	conce	% mortality		
		2 days	4 days	6 days
Akk	20%	50 a	60 a	70 ab
Akk	10%	40 ab	50 ab	63.333 b
Neem	20%	40 ab	50 ab	80 a
Neem	10%	46.667 ab	46.667 ab	70 ab
Castor	20%	50 a	50 ab	76.667 ab
Castor	10%	33.333 b	40 b	70 ab
Amaltas	20%	40 ab	56.667 a	76.667 ab
Amaltas	10%	43.333 ab	60 a	73.333 ab
Control		3.3333 c	6.6667 c	16.667 c
LSD at 5%		14.39	15.13	14.76

After 6 days maximum mortality % were recorded in neem (20%) 76.67% followed by castor (20%) and amaltas with 70% and 63.33% mortality % respectively.

Plant Extract	Concentration %	Total no. of insects	No. of insects repelled	No. of insects not repelled
Ak k	20	10	6.6667 b	3.3333 b
Ak k	10	10	5.3333 c	4.6667 a
Neem	20	10	8.6667 a	1.3333 c
Neem	10	10	7.3333 b	2.6667 b
Amaltas	20	10	7.3333 b	2.6667 b
Amaltas	10	10	6.6667 b	3.3333 b
Castor	20	10	6.6667 b	3.3333 b
Castor	10	10	5.3333 c	4.6667 a
LSD			1.1718	1.1718

In a repellency test after 4 hours neem (20%) showed maximum repellency with 8.67 number of insects repelled followed by neem(10%) and amaltas (20%) with 7.33 and 6.67 insects repelled. Least no. of insects 5.33 were observed in castor (10%).

BEEKEEPING& HILL FRUIT PESTS

64: QUANTITATIVE ASSESSMENT OF POLLEN COLLECTED AT DIFFERENT TIME INTERVALS IN *APIS MELLIFERA L*.

The experiment was conducted at Rawalpindi to determine the efficient time during which the maximum pollen collected during blooming period of spring. Pollen traps were fitted/fixed at the entrance of three beehives during different time interval of a day i.e. 09:00 – 12:00, 12.00 – 14:00 and 14:00 - 16:00 hours. The experiment was conducted during March (spring season). The pollen collected at above mentioned time in a day, stored in plastic bottles and weighed. Quantity of pollen collected of each time interval weighed with an scientific balance and determine the best time interval that receive maximum pollen load.

Table:Average weight of pollen collected at different time interval.

Treatment	Average Weight of pollen collected during 9:00 am to 12:00 am(gram)	Average Weight of pollen collected during 12;00 to 2:00pm(gram)	Average Weight of pollen collected during 2:00 to 4:00 pm (gram)
T_1	12.00	4.50	2.50
T_2	14.00	5.50	3.50
T_3	12.50	6.00	2.00
Average:	12.80	5.30	2.60

The data revealed that time interval (9.00am to 12.00am) gave the best results and showed maximum, pollen collection at the time interval as compared to others.

65: EVALUATION OF DIFFERENT POLLEN SUPPLEMENT AND POLLEN SUBSTITUTE DURING DEARTH PERIOD.

The experiment was conducted at Rawalpindi to examine the most economic and effective pollen substitute during dearth period.Twenty one bee colonies were selected having equal strength. Different treatments i.e. T_1 (Soybean flour (200 gm)+pollen pellet(50 gm)+Sucrose syrup (200 ml), T_2 (Brewer yeast (200 gm)+pollen pellets(50gm)+Sucrose solution (200 ml),T_3 (Gram flour (200gm)+Pollen pellets(50gm)+Sucrose solution(200ml),T_4 (Brewer yeast (200 gm)+Sucrose solution (200 ml),T_5 (Soybean flour (200 gm)+Sucrose solution (200 ml),T_6 (Gram flour (200gm+Sucrose solution (200ml)(standard) &T_7 (Control) was also mentioned applied. Pollen substitute provided at fortnight interval except control. Each treatment except control before application provided the sugar syrup. The pre-treatment observation was recorded just before application and post treatment data was recorded at

15 days interval. The efficacy of each treatment was recorded on the basis of sealed brood area measurement in sq inches by using wire grid.

Table:Mean brood area (sq. inch) after the application of different treatments

Treatments	Brood Area(sq. inch)		Percentage increa over control
	Pre treatment (	Post treatment Data	
T1 = Soybean flour (200 gm)+pollen pellet(50 gm)+Sucrose syrup (200 ml)	335	590 a	68.57
T_2= Brewer yeast (200 gm)+pollen pellets(50gm)+Sucrose solution (200 ml))	340	430 bc	22.86
T_3= Gram flour (200gm)+Pollen pellets(50gm)+Sucrose solution(200ml)	335	460 b	31.43
T_4 = Brewer yeast (200 gm)+Sucrose solution (200 ml)	340	485 b	38.57
T_5 = Soybean flour (200 gm)+Sucrose solution (200 ml)	340	400b	14.28
T_6= Gram flour (200gm+Sucrose solution (200ml)(standard)	335	570 ab	62.85
T_7= Control	340	350 c	-
LSD @ 0.05	100.81		

The Result showed There are 3 groups (A, B, AB.) in which the means are not significantly different from one another.However that treatment T1= Soybean flour (200 gm)+pollen pellet(50 gm)+Sucrose syrup (200 ml) gave better results brood 590 sq inch (68.57%) and T6 Gram flour (200gm+Sucrose solution (200ml)(standard) gave brood 570 sq inch (62.85%) increase as compared to other treatments.

66: EFFICACY OF DIFFERENT PLANT LEAVES SMOKE AGAINST HONEYBEE MITE *Varroa destructor*

The experiment was conducted on sixteen *Apis mellifera* bee colonies of the same size naturally infested with *Varroa destructor* randomly selected and grouped for replication. In each treatment leaves (both dry & fresh) burnt in a standard stainless steel beekeeper's smoker. Beehives smoked treated in the late afternoon by blowing smoke into the hive entrance for one minute. The bottom boards of the hive covered with a sheet of white paper smeared with Vaseline; wire net used to separate combs and bottom board. The rate of bee mite infestation and treatment efficacy estimated by counting the dead mites in the sealed worker and drone brood cells before and after treatment. The final field efficacy estimated after the treatments using the formula developed by Jelinski et al 1994.

$E=100-I_1/I_0x100$

E=Field efficacy.

I_1=Rate of infestation after treatment.

I_0=Rate of infestation before treatment.

Table: EFFICACY OF DIFFERENT PLANT LEAVES SMOKE AGAINST HONEYBEE MITE *Varroa destructor*

Sr. No	Name of Different Plant material	Pre-treatment data (Io)	Post treatment data ((I_1))	Efficacy $E=100-I_1/Iox100$
T_1	Tobacco leaves (smoke	40.00 ab	21.25c	46.46b
T_2	Walnut leaves (smoke)	45.00 ab	34.50b	23.50c
T_3	Tobacco leaves + Walnut leave (smoke)	42.00 ab	15.50 d	63.10 a
T_4	Control	40.00 ab	44.00 a	-
	LSD @0.05	09.5		

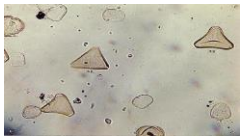
Tobacco leaves + Walnut leave smoke(25gm+25gm) was found the most effected which resulted 63.10% reduction bee mite followed by Tobacco leaves (smoke) (46.46%). Walnut leaves (smoke) (23.50%)

67: Title: Studies On The Presence Of Different Pollen Grains In Honey Samples Of Different Bee Flora For Purity Of Honey

The experiment conducted to determine the presence of different pollen grain for the purity of honey of different flora. Four honey samples of 250 gm each of different bee flora viz: Phulai, Bhaiker , Citrus and eucalyptus having pollen from different flowers have been collected. Identification of type of honey made according to the shape, size and ornamentation. Microscopical analysis of the pollen of plants foraged by bees is an established method to determine the source of honey in the area. The pollen honey samples prepared by water wash technique. The final residues obtained placed on slide with the help of glycerin gel, stain and mount the slides. The prepared slides studied under microscope for morphological studies and photomicrograph of pollen taken. The reference slides of above mentioned treatments prepared by taking direct samples of pollen from the flowers of said plants and comparative study of both sides have been done in order to ensure the results of the trails(the prepared slides of the pollen mentioned in treatment).

The studies were carried out with following available honeybee flora in the locality. Phulai, Bhaiker, eucalyptus, Citrus, Pollen of these plants flowers were collected directly and reference slides were prepared. The slides of honey samples of above mentioned treatments were also prepared after applying water wash technique .The prepared pollen slides of both types of slides were examined under W.S.Nicon Trinocular microscope at Biosystematics Laboratory, Department of Entomology PMAS Arid University, Rawalpindi. The results showed that there is a resemblance of both types of slides, Phulai, Bhaiker ,Sarsoon and Citrus.



1. Phuali 2. Citrus spp 3. Bhaiker 4. Eucalyptus spp.

68: QUANTITATIVE ASSESSMENT OF PROPOLIS COLLECTED AT DIFFERENT TIME INTERVAL IN BEE COLONIES *APIS MELLIFERA*.

Nine bee colonies of same population were selected. Propolis trap was fitted on the top bar of the frames in the beehive. Propolis traps have been removed after two months and put into the freezer for freezing of propolis. Propolis extracted from propolis traps and weighed for comparison.

TABLE: Quantitative Assessment Of Propolis Collected At Different Time Interval In Bee Colonies *Apis Mellifera*.

Month 2015	(R1)gm	(R2)gm	(R3)gm	Average Weight/ Trap(gm)
(April –May)	110.00	106.00	112.00	112.00a
(June-July)	60.00	75.00	67.00	67.00b
(August -September)	32.00	33.00	33.00	33.00c
LSD @0.05				14.5

Quantity of propolis collected during April-May is more i.e 112 gm/ trap as compared to other treatments during June-July (67gm) and August-September (33gm).

68. EFFECT OF DIFFERENT STIMULANT FEEDING ON COLONY STRENGTH OF *Apis mellifera* L.

Fifteen even populated bee colonies selected. Each treatment replicated three times. The feeding done at the week interval. Observation on brood rearing recorded 24 hours before the treatment and 15 days after the treatment application on per square inch basis with the help of wire grid.

TABLE: Effect Of Different Stimulant Feeding On Colony Strength Of *Apis mellfera* L.

S.No	Treatments	Pre treatment Brood Area(sq.inch)	Post treatment Brood Area (sq inch)	% increase over control
T1	500ml sugar syrup/week (Standard	3650	5025d	36.17
T2	500ml Glucose syrup/week	3600	5650c	53.11
T3	500ml High Fructose corn syrup/week	3600	6100a	65.31
T4	500ml High D corn syrup/week	3550	5900b	59.89
T5	Control.(No feeding).	3600	3690e	-
LSD @ 0.05			27.8	

The data revealed that T3 (500ml High Fructose corn syrup/week) gave best result 65.31 % more brood as compare to T4(500ml High D corn syrup/week) 59.89% T2 (500ml Glucose syrup/week)53.11% and T1 (500ml sugar syrup/week (Standard) 36.17% Increase of Brood Area (B.A) in different treatments

69.EFFICACY OF DIFFERENT METHODS FOR THE CONTROL OF HORNETS V*ESPA VELUTINA PRUTHII* AND *VESPA ORIENTALIS*

The experiment was conducted at Rawalpindi to find out the most effective method for the control of hornets. The trial was laid out in CRBD with three replications. Different treatments i.e T1 (Tripod with Tub along with poultry lever), T_2 (Tripod with plastic jar along with damaged Grapes), T_3 (Tripod with small bucket along with poultry lever damaged Grape), T_4 (Tripod with Plastic Jar containing vinegar), T_5 (Tripod with Jar without anything). All the treatments were filled with soapy water and piece of poultry lever and damaged Grape were suspended 1"-2" above the water with the help of tripod. Tripod will be covered with screen having inlet & outlet. Hornets fly were trapped in soapy water. The mortality of hornets was worked out by counting the number of hornets dropped in soapy water after 24 hours. The data recorded are as under;

Table: Efficacy of different methods for the control of hornets V*espa velutin pruthii* and *Vespa orientalis.*

Sr. #	Treatments	Population of Hornets dropped in soapy water
T_1	Tripod with Tub along with poultry lever	23.33 c
T_2	Tripod with plastic jar along with damaged Grapes.	54.00 a
T_3	Tripod with small bucket along with poultry lever+damaged Grape	33.00 b
T_4	Tripod with Plastic Jar containing vinegar.	1.50 d
T_5	Tripod with Plastic Jar alongwith yeast+Jam.	24.33 c
T_6	Tripod with Jar without anything.	0.00 d
	LSD	10.23

Maximum population of hornets (54) were attracted towards T_2 followed by T_3 (33) and T_5 (24.33) while in the control no hornet was attracted.

70.STUDIES ON THE SCENARIO OF AMERICAN FOUL BROOD & HONEYBEE MITE IN THE APIARIES.

Survey of different apiaries in the province of Punjab will be carried out. The infection and infestation of honey bee disease and mite will be recorded to ascertain the extent of damage done to the honey bees by inspecting bee colonies of the total stock. Advisory services will also be provided as per pest situation to beekeepers.

Table:- Data regarding infestation of honeybee mite & infection of American Foul Brood in the Apiaries

Sr. No	Name of Apiarist	Locality	No. of Bee Colonies owned.	%age infestation of bee mite.	%age infection of AFB
1.	Aslam Awan	Dhella	300	30.00	-
2.	Arshad Jamil Khan	Samli Dam	200	50.00	-
3.	Wali Khan	Lehtrar Road	175	35.00	-
4.	Gulfraz Khan	-do-	150	45.00	-
5.	Haji Jan Muhammad	Hasanabdal	125	08.00	-
6.	Aman Ullah	Tret(Murree)	60	20.00	-
7.	Naseem Abbasi	Malkot	109	10.00	-
8.	Professor saeed Ahmed.	Farooqabad	100	25.00	-
9.	Naveed Qureshi	Samli Dam	275	30.00	-
10.	Subtagheen Khan	Lehtrar Road	250	25.00	-
11.	Jamal Shah	Bahra Koh	150	25.00	-
12.	Muhammad Akram	Hasanabdal.	100	10.00	-
13.	Umer Khan	Tret(Murree)	120	15.00	-
14.	Muhammad Boota	Farooqabad	100	20.00	-
15.	Ayaz Khan	Tarli	150	07.00	-

16.	Agha Jan	Lehtrar Road.	100	10.00	-
17.	Akbar Ali	Pail	168	35.00	-
18.	Roshan Khan	Trait	160	15.00	-
19.	Shoukat Rafiq	Hasanabdal.	175	15.00	-
20.	Gul Jan	Lehtrar Road	150	25.00	-
21.	Muhammad Rafiq	Hasanabdal.	175	15.00	-
22.	Ghulab Khan	Chapper	100	30.00	-
23.	Hashim Khan.	Hasanabdal	130	26.00	-
24.	Kifayat Ullah	Tret(Murree)	174	20.00	-
25.	Ghulam Gul	Murree	175	25.00	-
26.	Muhammad Idrees	Farooqabad	200	35.00	-
27.	Ashraf Awan	Lahore	230	40.00	-
28.	Karim Ullah	Kallar Sayyadan	150	10.00	-
29.	Allah Dad Khan	-do-	200	13.00	1.00
30.	Naeem Ullah	-do-	100	15.00	2.00
31.	Shahzada Khan	Salgran(Murree)	120	20.00	0.50
32.	Shoukat Rafiq Ahmed.	Hasanabdal	250	12.00	0.90
33.	Ghulam Muhammad	Farooqabad	150	15.00	0.80
34.	Sarfraz Khan	Bajwal(Kohat road|)	150	10.00	-
35.	Mudassar Khan	-do-	100	20.00	-
36.	Junaid Iqbal.	Tahli Adda(Kohat road)	175	35.00	-

37.	Ghulam Nabi	Khunda Mor (Kohat road)	125	30.00	-
38.	Nazir Muhammad	Lahore.	120	25.00	-

The data revealed that 7.00% to 50% bee mite infestation and 0.50% to 2.00% American Foul Brood infection was observed in the private apiaries. The beekeepers were advised to clean the bottom board regularly and fumigate the bee colonies with Thymol 0.5mg/colony/week or Fluvalinate strip/colony/week against mite and apply 50,000 i.u/colony of any penicillin mixed with 1:1 ratio sugar syrup for prevention of American Foul Brood. In case of severe attack of A.F.B burn the colony to avoid its wide spread.

71.SURVEY OF EUCALYPTUS SPECIES WITH REGARDS HONEY & POLLEN PUNJAB PROVINCE.

The experiment was conducted to collect and identify the best Eucalyptus species as valuable to honeybees. Survey and collection of different Eucalyptus species were done in the province of Punjab. These were got identified from Quaid-i-Azam University, Islamabad and Punjab University. Lahore. Period of flowering was also noted. Three Eucalyptus species i.e. *Eucalyptus albens*, *Eucalyptus camaldulensis*, *Eucalyptus citriodora* were collected, preserved and identified as a source of nectar and pollen for honeybees.

72.CAPACITY BUILDING & TRAINING PROGRAM FOR THE BEEKEEPERS AND INTERESTED PERSONS.

Beekeepers and interested persons were trained in the enterprise of beekeeping to enhance the beekeeping skill of apiculture and trained them for the practice of the environment friendly and profitable cottage industry. Nine beekeeping training course of 05 days were organized,four at Rawalpindi , two at Murreeand two at Hassanabdal and one at Lahore.134 persons participated in these training courses. They were imparted theoretical and practical training in bee management and other related topics**.**

A. BEE MANAGEMENT PRACTICES ADOPTED DURING THE PERIOD UNDER REPORT.

The following bee management practices were under taken for better bee development at the sectional apiaries.

- ❖ The bee colonies were checked regularly and necessary manipulation of frames was made.
- ❖ The bottom boards were cleaned regularly and necessary manipulation of frames was made.
- ❖ Sugar feeding in 1:1 ratio w/v was provided as supplementary food to all bee colonies.
- ❖ Earthen cups filled with water were kept under the hive stands to avoid the attack of black ants.
- ❖ Inner tat coverings were dried during shiny days to provide the hygienic condition to honeybees.
- ❖ The cracks and crevices of beehives as well as open space at the junctions of different hive parts were closed with mud plaster to check the entry of wax moth. It was also helped in discouraging robbing instinct of honeybees.
- ❖ Supplementary feed of sugar syrup mixed with vitamin B-complex was done to the bee colonies facing starvation.
- ❖ Packing pads were provided to the bee colonies cope with cold weather.
- ❖ Wet packing was dried in the sun to provide hygienic condition in the beehives.
- ❖ The spare combs drawn out and fumigated in the fumigation chamber with Phostoxin tablets to protect against wax moth.
- ❖ The week and queen less bee colonies were united to strengthen the bee population in the bee colonies.
- ❖ Drawn combs were provided to the needy bee colonies for the storage of surplus honey and rearing of brood.
- ❖ Pollen substitutes of gram flour were provided to all the bee colonies as a bee food.
- ❖ Fluvalinate strips/ Thymol/ Formic acid were applied to the bee colonies to control the bee mite. Supers alongwith frames were provided to the needy bee colonies for expansion of bee colonies.
- ❖ Hive frames with comb foundation sheets were provided to the needy bee colonies for brood rearing and collection of honey.
- ❖ Brood frames from strong colonies were taken out and provided to the weak colonies.

B. MIGRATION OF BEE COLONIES.

The headquarter and sub-stations out apiaries were migrated from Mohri Sayyedan to Musafer Baba (Bahtar) on Miaze flora to Lilla (Kot Fateh) on Ber flora to Khanewal on Brassica flora to Chapper Dehla on Bhaikar and Phulai flora to Mohri Sayyedan (Lehtrar Road) on Grunda flora on wild bee flora for better bee development and experimental purpose.

C. BEE FLORA.

Major bee flora which remained available throughout the year as a source of bee food i.e. nectar and pollen is as under:

Sr.#	Crops	
	Common name	**Technical name**
1.	Maize	*Zea mays*
2.	Sorghum(Chari)	*Sorghum bicolor*
3.	Sarson	*Brassica campestris*
4.	Shaftal	*Trifolim repens*
5.	Toria/Raya	*B.juncea.*
6.	Lucern	*Medicago sativa.*
7.	Sweet clover.	*Melilotus spp.*
Ornamental Plants		
1.	Bottle brush	*Callistemon Citrinus*
2.	Coral ceaper	*Antigonon leptopus*
3.	Corn flower	*Centurea cyanus*
4.	Cosmos	*Cosmos bipinnatus.*
5.	Sunflower	*Helianthus annuus*
6.	Gul-i-Khaira	*Althaea rosea.*
7.	Rose.	*Rosa spp.*
Ever green fruits		
1.	Avocado	*Persea Americana.*
2.	Ber	*Zizyphus jujube*

3.	Grape fruit	*Citrus paradise*
4.	Jaman	*Eugenia jambolana*
5.	Kinno Mandrin.	*Citrus reticulate.*
6.	Lemon.	*Citrus limon.*
7.	Loquat,	*Eriobotrya japonica.*
8.	Sweet lime (Mitha)	*Citrus limettioides.*
9.	Sweet Oranges.	*Citrus sinensis.*
Vegetables		
1.	Brinjal	*Abelmoschus esculentus.*
2.	Cabbage	*Brassica oleracea.*
3.	Carrot	*Dacus carota*
4.	Shaljum	*Brassica napus*
5.	Sweet Potato	*Ipomea batatus.*
6.	Brinjal	*Abelmoschus esculentus.*
Forest Plants		
1.	Amaltas	*Cassia fistula*
2.	Asi-e-Amir	*Vitex negunda*
3.	Burna	*Crataeva addansonii.*
4.	Ipple Ipple	*Lucaena leucocephala*
5.	Keekar	*Accacia Arabica.*
6.	Mesquite	*Prosopis spp.*
7.	Phulai	*Accacia modesta.*
8.	Rubinia	*Rubinia pseudoacacia.*

9.	Sheshum	*Dalbergia sisso*
10.	Siris	*Albizia lebbek*.
11.	Sufaida.	*Eucalyptus spp.*
Deciduous fruits		
1.	Almond	*Prunus amygdalus.*
2.	Apple	*Pyrus malus.*
3.	Apricot.	*Prunus armeniaca.*
4.	Peach.	*Prunus persica.*
5.	Pear	*Pyrus communis.*
6.	Persian walnut.	*Juglans regia.*
7.	Persimon	*Diospyros kaki*
8.	Plum	*Prunus domestica.*
9.	Pomegranate.	*Punica granatum*.

D. BEE DISEASES.

No serious attack of any bee disease has been observed in any bee colony. However, Fluvalinate strips, formic acid (80%), menthol crystals and Thymol were used in the colonies to eliminate negligible infestation of bee mite. A water spray mixed with Ampicillin was done as precautionary measures against American Foul Brood in the bee colonies after fifteen days interval.

E. BEE ENEMIES.

The attack of bee enemies viz: hornets, black ants, green bee eater and wax moth were observed during period under report. The following control measures were adopted to control attack of bee enemy mentioned against each.

Sr.#	Name of Enemy	Control Measures.
1.	Hornet.	Killed by wooden stick and nests of hornets were burned.
2.	Black ants.	Earthen cups filled with water were put beneath the legs of beehives to avoid the attack of black ants.
3.	Green bee eater.	Shooting with air gun.
4.	Alpine Swift predatory bird.	Shooting with air gun.
6.	Wax moth.	Kept the beehives clean from debris and fumigated with Phostoxin tablets.

F. HONEY EXTRACTION.

Two hundred and Fifteen (215.00) Kg surplus honey was extracted from the headquarter and sub-station out apiaries camped at different bee flora as details below:

Kind of honey Flora	Honey production (Kg)
Ber	60.00
Phulai	40.00
Garunda	40.00
Citrus	15.00
Berseem	25.00
Total	180.00

G. BEEKEEPING ADVISORY SERVICES.

Beekeeping advisory services were regularly provided to 440 progressive and amateur beekeepers fallen within the jurisdiction of the Headquarter and its Substations located at Murree, Hasanabdal and Lahore. The problems faced by the beekeepers in the management of the apiaries were attended and necessary advice was given as and when it required. Moreover, persons who visited the Research Stations from far-flung areas of Punjab, N.W.F.P and Azad Jammu Kashmir were also attended and redressed their beekeeping problems.

HILL FRUIT PESTS

73: STUDIES ON PREVALENCE OF DIFFERENT RAT SPECIES AT MURREE IN WINTER SEASON

The experiment has been conducted at Murree. Different types of the traps used for capturing the rats. The observations recorded regarding prevalence of rats in orchard by the capture records. Two different cover methods by modifying Weihong 1999 method have been used for trapping.

T_1 = By trapping.

T_2 = By observing type of burrow.

Daily observations were made by trapping and observing type of borrows of rats during the fall season before snow fall. During the snowfall weekly observations for the capturing the rats by trapping have been made. The trapped specimens had identified.

Table: Rat species occurring in the study area

Treatments		October 2014			November			December			January 2015			February			March			April		
		Active	Rattus	R.norvegi	Active	Rattus	R.norvegi	Active	Rattus	R.norvegi	Active	Rattus	R.norvegi	Active	Rattus	R.norvegi	Active	Rattus	R.norvegi	Active	Rattus	R.norvegi
T_1	Site 1	05	+	-	03	+	-	04	+	-	02	-	-	0	-	-	0	-	-	03	+	-
T_2	Site 2	02	+	-	04	+	-	02	-	-	06	+	-	01	-	-	01	-	-	04	+	-
T_3	Site 3	03	+	-	06	+	-	03	-	-	03	-	-	0	-	-	02	+	-	01	-	-

It was observed that species occurring study area was common house *Rattus* rattus while there was no evidence of Norway rat *R.norvegicus.* it was observed that rat activity remains slow down during snow fall season very much. Also one rat may be having many burrows at same time.

74:EVALUATION OF DIFFERENT BAITS AND TRAPS FOR CAPTURING RATS AT MURREE

Experiment was conducted at Murree to find out effective type of trap and bait to capture the pest during winter season. Different baits and traps were used for capturing rats. The observations were recorded regarding the capture records. Four types of baits were used T1 = Dry fruits Nuts, T2 = Vegetables (tomato), T3 = Dry Bread Pieces and T4 = Oil Mix. The baits were offered to the pests in Spring-loaded bar mousetraps and Live-capture mousetraps. So that Rats can be captured. The observation on capture records revealed that Rats responded in different way to different baits.

TABLE.Average Number Of Rats Trapped By Various Treatments.

Treatment	October 2014	November 2014	December 2014	January 2015	February 2015	March 2015	April 2015
T_1	1.3	0.33	0.00	0.66	0.00	0.33	0.33
T_2	1.3	0.33	0.00	0.00	0.33	0.33	0.66
T_3	0.3	0.00	0.00	0.33	0.00	0.00	0.33
T_4	0.3	0.00	0.00	0.00	0.00	0.00	0.00

AVERAGE NUMBER OF RATS TRAPPED BY VARIOUS BAITS

Treatment	May 2015	June 2015	July 2015
T_1	0.33	1.66	1.33
T_2	1.00	2.3	1.66
T_3	0.33	0.33	1.00
T_4	0.00	0.00	0.00

Results in table 1 showed that Although there was not much significant numerical difference in rats allured to different baits but it was clear that they liked fresh vegetables (tomato) and dry fruit nuts more than any other baits. The results in table 2 showed that rats preferred most bait T_2(Vegetables (tomato) followed by dried fruits and nuts however other baits were less attractant.

75:POPULATION DYNAMICS OF COCCINELLID BEETLES *Coccinella septempunctata* and *Coccinella undecimpunctata* IN RELATION TO PESTS AND WEATHER PARAMETERS.

Experiment was conducted at Murree find out population fluctuation of Coccinellid viz *Coccinella septempunctata* and *Coccinella undecimpunctata* beetles in relation to pests and weather conditions.

Studies were conducted at different hill fruit trees i.e. Apple, Apricot, Peach etc nurseries. The weekly observations were made to know about pest and predator population build up. The data regarding pest and predator population was recorded in relation to temperature and rainfall.

Table: population of beetles and aphids, in relation to temperature, relative humidity and rainfall

Period	Aphid /plant	Beetle /plant	Rainfall (mm)	Humidity (%)	Temperature (C°)
March 2015	0	0	70	80	18
April 2015	2	0	50	40	22
May 2015	10.6	2.8	45	65	25
June 2015	9.2	0.8	25	45	32
July 2015	2.8	0.4	75	70	25
August 2015	22.2	2.6	110	85	24
September 2015	11.8	1.8	70	68	18

The studies revealed that There was positive correlation in beetles and aphid population (r = 0.87). Temperature, 0.806784 humidity -0.15959 (weak negative) and rainfall 0.459588

74: POPULATION FLUCTUATION OF SNAILS IN FRUIT PLANT'S NURSERY AT TRET (MURREE)

The experiment conducted at Tret (Murree). The observations have been recorded regarding population fluctuation of snails in hill fruit nursery plants (Apple, Apricot, Peach, Pear and Plum). Population recorded by using quadratic method from respective fruit plants nursery plots. For this purpose one m^2 quadrate ring thrown thrice randomly and number of live snails recorded.

TABLE:Table showing population of snail and rainfall 2015

Month	Snail/ m^2	Rainfall (mm)	Humidity (%)	Temperature (C°)
March 2015	0	70	80	18
April 2015	2.18	50	40	22
May 2015	7.4	45	65	25
June 2015	7.28	25	45	32
July 2015	11.6	75	70	25
August 2015	14.66	110	85	24
September 2015	5.56	70	68	18

The data showed that there was positive correlation between humidity and snail population (r = 0.444). The peak snail population (14.66) recorded in the month of August, 2015 when temperature was 24C*, humidity 85% and 110 mm rainfall was received.

77:STUDIES ON PREVALENCE OF DIFFERENT RAT SPECIES AT MURREE IN SUMMER SEASON

Experiment was conducted at Murree to find out effective type of trap and bait to capture the pest during Summer season. Different baits and traps were used for capturing rats. The observations were recorded regarding the capture records. Four types of baits were used T1 = Dry fruits Nuts, T2 = Vegetables (tomato), T3 = Dry Bread Pieces and T4 = Oil Mix. The baits were offered to the pests in Spring-loaded bar mousetraps and Live-capture mousetraps. So that Rats can be captured. The observation on capture records revealed that Rats responded in different way to different baits.

TABLE: Rat species prevailing in the study area

Treatments		May 2015			June 2015			July 2015		
		Active Burrows	**Rattus rattus**	**R.norvegicus**	**Active Burrows**	**Rattus rattus**	**R.norvegicus**	**Active Burrows**	**Rattus rattus**	**R.norvegicus**
T_1	**Site 1**	**05**	**+**	**-**	**03**	**+**	**-**	**04**	**+**	**-**
T_2	**Site 2**	**02**	**+**	**-**	**04**	**+**	**-**	**02**	**-**	**-**
T_3	**Site 3**	**03**	**+**	**-**	**06**	**+**	**-**	**03**	**-**	**-**

The species causing damage was identified as common house rat *Rattus rattus*. Hence it may be inferred that nearby dwellings are the main source of invading population of pest.

MISCELLANEOUS

78: SCREENING OF DIFFERENT ROSE VARIETIES AGAINST FLOWER THRIPS

The experiment was laid out at Horticultural Research Sub-Station for Floriculture and Scaping, Old Shujabad Road Multan, Punjab-Pakistan. The high value commercial varieties of rose i.e. Ice Berg, Indian Chief, Cardinal,and Surkha were selected for recording data. From each variety flower thrips were recorded from 15 buds, flowers and leaves, selected at random from 15 randomly selected plants per treatment monthly basis. The buds /flowers were shed on white paper individually and population of thrips was counted (Nymphs and adults).

Statistical analysis: The data were subjected to analysis of variance (ANOVA) using Statistix software (release 8.1; Lawes Agricultural Trust Rothamsted Experimental Station, Rothamsted, UK). The means were separated by LSD (Least Significant Differences).

Maximum population of thrips was found on Cardinal Variety on bud 80.3 and on flower 24.11 whereas minimum thrips population was recorded on variety Surkha at bud 5.40 while on flower 0.63 thrips on Indian chief. No population of thrips was recorded on leaves.

Table: Data regarding average population of flower thrips on buds

Varieties	**Average number of flower thrips recorded on buds during**							**Average**
	Nov-15	**Dec-15**	**Jan-16**	**Feb-16**	**Mar-16**	**Apr-16**	**May-16**	
	18.11.2015	**16.12.15**	**18.1.16**	**16.2.16**	**16.3.16**	**18.4.16**	**11.5.16**	
Ice burg	1.00 c	7.00 b	5.34 b	9.81 b	4.67 b	41.00 b	0.10 b	9.21 b
Indian chief	4.07 b	6.73 b	7.13 b	11.23 b	0.40 c	43.00 b	0.00 b	9.54 b
Cardinal	27.33 a	13.34 a	16.27 a	27.69 a	21.33 a	455.00 a	12.56 a	80.30 a
Surkha	0.00 c	5.07 c	4.29 b	5.97 c	1.13 c	23.00 b	0.00 b	5.40c
LSD value @ 5%	1.83	1.63	3.48	2.09	1.40	22.05	0.54	3.31
F-value	596.54	59.76	29.55	251.98	590.78	1086.89	1636	1427.25

Means sharing similar letters are not significantly different by LSD at P = 0.05,

Table : Data regarding average population of flower thrips on Flowers

Varieties	Average number of flower thrips recorded on flowers during							Average
	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	
	18.11.2015	16.12.15	18.1.16	16.2.16	16.3.16	18.4.16	11.5.16	
Ice burg	0.33 c	0.29 c	0.00 c	0.00 c	0.00 c	25.00 b	0.73 b	3.77 b
Indian chief	2.67 b	1.76 b	0.00 c	0.00 c	0.00 c	0.00 c	0.00 d	0.63 d
Cardinal	5.47 a	7.56 a	6.67 a	5.68 a	14.27 a	141.00 a	1.44 a	26.11 a
Surkha	0.20 c	2.31 b	1.23b	0.70 b	2.47 b	3.00 c	0.16 c	1.44 c
LSD value @ 5%	0.59	0.66	0.17	0.46	0.74	4.76	0.11	0.70
F-value	210.98	275.42	4421.72	424.17	1024.78	2383.54	456.67	3597.67

Means sharing similar letters are not significantly different by LSD at P = 0.05,

LSD =Least Significant Difference * = Significant at P < 0.05, ** = Significant at P < 0.01

Table : Data regarding average population of flower thrips on leaves

Varieties	Average number of flower thrips recorded on leaves during							Average
	Nov-15	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	
	18.11.2015	16.12.15	18.1.16	16.2.16	16.3.16	18.4.16	11.5.16	
Ice burg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indian chief	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cardinal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Surkha	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

76: Monitoring of acaricide resistance in *Tetranychus urticae* from field populations of different localities

Field collected populations was brought to laboratory and reared for one generation. Lab susceptible strain was collected from low chemical use area and reared for multiple generations. Seven acaricides of different chemical groups (Fenpyroximate 5 EC, Fenbutatin Oxide 55 SC, Pyridabin 15 EC, Chlorfenapyr 36 SC, Bifenthrin+Abamectin 56 EC, Azocyclotin 25 WP and Diafenthuron 500 SC)

were bio-assayed through leaf dip method for toxicity against 25 specimens of F1 generation for field population and lab susceptible strain. Data will be recorded after 48 hours. Immobile specimens were considered as dead. Whole experiment was replicated five times. Data recorded will be subjected to corrected mortality if needed and further LC 50 value was determined through Probit Analysis.

At 25°C, egg, larvae, protonymph, deutonymph and egg to adult stages were completed in 7.36, 3.00 2.44, 2.34 and 15.14 days, respectively for male, and 8.48, 3.98, 3.69, 3.52 and 19.67 days, respectively for the female. The development time was longer at other two temperatures.

Table: **Monitoring of acaricide resistance in *Tetranychus urticae* from field populations of different localities**

Strain	**LC50**	**Slope (SE)**	**Chi**	**DF**	**P**	**RR**
Lab-pk	1.20 (0.15-3.26)	0.32 (0.059)	6.22	4	0.18	1
Faisalabad	446.10 (331.83-672.54)	0.56 (0.58)	5.35	4	0.25	371.75
Toba Tek Singh	354.68 (279.87-484.85)	0.64 (0.061)	3.94	4	0.41	295.56
Multan	484.49 (361.94-728.70)	0.60 (0.060)	2.53	4	0.63	403.74
Khanewal	579.75 (414.38-943.53)	0.57 (0.063)	3.37	4	0.49	483.12
Vehari	700.16 (484.15-1216.43)	0.57 (0.067)	2.19	4	0.69	583.46
Layyah	451.76 (318.44-746.31)	0.45 (0.050)	1.18	4	0.88	376.46

1. Identification of pest problems and management strategies:

The samples of infested crop plants, fruits, vegetables and stored grain collected from the field or brought by the farmers were examined in the laboratory for identification of the pest problems and suitable management strategies were advised to the farmers.

2. Survey work:

The research staff of this Institute carried out survey of field crops, vegetables, orchards and godowns in the province to assess the nature and extent of damage caused by various insect pests. The role of cultural practices on insect pests' population was also assessed.

3. Participation in anti pests campaigns:

The technical staff of this Institute actively participated in anti-cotton pests campaigns in the Punjab province. The crops were examined and insect pests' problems were identified. The suitable management strategies were suggested to the farmers for controlling the pests.

4. Training/Refresher courses:

The technical staff of this Institute delivered lectures regarding seasonal history, biology, mode/ symptoms of damage of insect pests of field crops, vegetables, fruit orchards, stored grain etc. and their management strategies to the field staff of Agriculture Department (Ext. wing), farmers and other personnel related to agriculture in various seminars, refresher courses and field visits.

5. Radio/ Television Talks:

The Radio/ Television talks regarding insect pests' problems of field crops, vegetables, fruit orchards and stored grain etc. highlighting the identification of insect pests, nature / extent of damage, seasonal history and proper management strategies were delivered for the guidance of farmers and Agri. Extension staff.

6. Training to Internship Students:

Students from different Agriculture Universities/Colleges were trained in this Institute on different entomological aspects/issues of the field crops, vegetables, fruit orchards, stored grain etc.

LIST OF PUBLICATIONS

1. Babar, T.K., H. Karar, M. Hasnain, M. Arshad, A. Ahmad, A. Ali and M. Akram, 2016. Field evaluation of new insecticides against cotton thrips (*Thrips tabaci* Lind.) in District Multan. Pak. Entomol., 38(1):7-13.

2. Nawaz, M., S. Ali and Q. Abbas, 2016. High Pressure Water Spray Technique for Controlling Mustard Aphid (*Lipaphis erysimi*) on Brassica Crop. American-Eurasian J. Agric. & Environ. Sci., 16 (2): 224-228.

3. Abbasi, K.H., K. J. Ahmed, M. Shafiq, A. Razzaq, M. Saleem and M. A. Ullah.2015. Quantitative Assessment of Royal jelly collected at different time interval in Honey bees Apis mellifera.J. Entomol. 30(1): 91-94.

4. Abbasi, K.H., K. J. Ahmed, M. Shafiq, A. Razzaq, M. Saleem and M. A. Ullah.2015. Performance of Larval Grafted Queen VsbQueen Produced Through Natural Method of Apis mellifera. J. Entomol. Zool. Stud. 3(2): 47-49

5. Din, N., M. Ashraf and S. Hussain, 2016. Effect of different non-chemical and chemical measures against Onion Thrips. J. Ento. Zool. Studies. 5(4):10-12.

6. Saeed, N., N. Mori, A. Battisti and M. Ashraf, 2016. Effect of *Brassica napus*, *Medicago sativa*, *Trifolium alexandrinum* and *Allium sativum* strips on the population dynamics of *Sitobean avenae* and predators in wheat ecosystem. J. Entomol. and Zool. Stud., 4(2): 178-182.

7. Abbas M, F. Hafeez,M. Farooq andA. Ali. 2015. Dusky Cotton Bug *Oxycarenus* spp. (Hemiptera: Lygaeidae): Hibernating Sites and Management by using Plant Extracts under Laboratory Conditions. Polish Journal of Entomology, 84:127-136.

8. Abbas, G., N. Hassan, M. Farhan, I. Haq and H. Karar, 2015. Studies on the Role of Dusky Cotton Bug (*Oxycarenus hyalinipennis*) on Early Stages of Cotton and its Possible Effect on Shedding of Fruiting Parts. American-Eurasian J. Agric. & Environ. Sci., 15 (2): 170-176.

9. Abbas, G., N. Hassan, M. Farhan, I. Haq and H. Karar, 2015. Effect of Selected Insecticides on Helicoverpa armigera Hubner (Lepidoptera: Noctuidae) on tomato (*Lycopersicon esculentum*Miller) and their successful management. Advances in Entomology 3, 16-23.

10. Abbsi, K. H., M. Shafiq, K. J. Ahmed, A. Razzaq, I. Haq and M. A. Ullah. 2015. Quantitative Assessment of Royal Jelly collect at different time interval in honeybees *Apis mellifera*. J. Entomol., 30(1): 91-94.

11. Ali A, Z. Shah, M. Abbas, M. Saleem, F. Hafeez, M. Farooq and Z. Ullah. 2015.Influence of weather on the trapped population of Helicoverpa armigera under Bahawalpur agro ecological zone. Pak Entomol., 37(1): 55-60.

12. Ali A., N. Khalil, M. Abbas, R. Tariq, Zia-ullah and D. Hussain. 2015. Plant traits as resistance influencing factors in maize against *Chilo partellus* (Swinhoe). Journal of Entomology and Zoology Studies, 3 (2): 246-250.

13. Ali Z., M. Shah, A. Nawaz, M. Nadeem, M.R. Shahid, and M. Farooq. 2015. Base Line Susceptibility Of*Bemisia Tabaci* (Hemiptera: Aleyrodidae) To Pyriproxyfen Under Lab Conditions. Gomal University Journal of Research, 31(1): 1-8.

14. Hameed, A., M. S. Shahzad, S. Ahmad and H. Karar, 2015. Forecasting and Modeling of *Helicoverpa armigera* (Hub.) in Relation to Weather Parameter in Multan, Punjab, Pakistan. Pakistan J. Zool., vol. 47(1):15-20 (IF 0.400) (HEC-W).

15. Hussain D., M. Saleem, G. Ghouse and M. Abbas. 2015. Insecticide Resistance in Field Populations of *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae). Journal of Entomological Science, 50 (2): 119-128.

16. Karar, H., M. J. Arif, A. Ali, M. Arshad and Q. Abbas, 2015. Resistance/ susceptibility of different mango cultivars against mango mealybug (*Drosicha mangifera* G.). Pak. J. Agri. Sci., Vol. 52(2). 367-377 (IF 1.24) (HEC-Y).

17. Yousaf, M. J., I. Nadeem, T. Niaz, R. Ahmed, M. F. Akhtar and A. Raza 2015.Response of some new cotton genotypes against insect pests complex and cotton leaf curl virus. Journal of Entomology and Zoology Studies; 3 (2): 211-214.

18. S. Muhammad, D. Hussain, G. Ghouse, M. Abbas and S. W. Fisher, 2016.Monitoring of insecticide resistance in *Spodopteralitura*(Lepidoptera:Noctuidae) from four districts of Punjab, Pakistan to conventional and new chemistry insecticides. Crop Protection, 79: 177-184.

19. Ali A., F. Hafeez, M. Farooq, H. Karar, M.Abbas, T. K. Babar, 2016. Influence of weather factors on the trappedpopulation of pink bollworm (*Pectinophoragossypiella*) under Multan Agro-ecosystem. J Entomol. Zool. Stud., 4(1): 02-06.

20. Ali A., Z. Shah, M. Saleem, F. Hafeez, Zia-ullah, M.Abbas, M. Farooq and A.Ghaffar,2016. Influence of weather factors on the trappedpopulation of spotted bollworm (*E. Vittella*Fand *E. Insulana*B) under Bahawalpur agro-ecosystem. J Agric. Res., 54(3):477-485.

21. Khan B.S., M. Farooq, F. Hafeez, H. A. A. Khan, M. Abbasand A.Ghaffar, 2016. Temperature dependent life parameters and predatory potential of a Stigmaeid mite, *Agistemusbuntex*, Chaudhri against two spotted spider mite, *Tetranychusurticae*, Dufour. Pak. J. Agri. Sci., 53(1): 83-89.

22. Maqsood S., M.A. Sabri, A. Ali, M.Abbas, A. Aziz, 2017. Comparative toxicity of some insecticides against army worm, *Spodoptera litura* L. (Lepidoptera:Noctuidae) under laboratory conditions. J Entomol. Zool. Stud., 5(1): 770-773.

Abstracts

Akram, M., M. Hussain, M. Shahid, S. Ahmad, M.R. Shahid, A. Raza and Q. Abbas, 2016. Assessment of *Oxycarenus laetus* (kirby) damage in transgenic and non transgenic genotypes of cotton. International entomological congress December, 16-18 organized Pakistan Entomologist, Department of Entomology, University of Agriculture, Faisalabad.

Shahid, M.R., M..J. Arif, M. Akram, Q. Abbas ,M. Hussain and A. Raza, 2016. Genetic Diversity and morphological traits association in upland cotton in imparting resistance against insect pests. International entomological congress December, 16-18 organized Pakistan Entomologist, Department of Entomology, University of Agriculture, Faisalabad.

Abbas, Q., M.J. Arif, M. Hussain, H. Karar, M. Akram, M.R. Shahid, A. Raza and M. Shahid, 2016. Population distribution of aphids and their associated cnatural enemies in major canola growing areas of Punjab Pakistan. International entomological congress December, 16-18 organized Pakistan Entomologist, Department of Entomology, University of Agriculture, Faisalabad.

Abbas, Q., M.J. Arif, M. Hussain, H. Karar, M. Akram, M.R. Shahid, A. Raza and M. Shahid, 2016. Studies on Bionomics of aphids species on Canola crop sown under different farming systems. International entomological congress December, 16-18 organized Pakistan Entomologist, Department of Entomology, University of Agriculture, Faisalabad.

URDU ARTICALS

The following Urdu articles were got published / submitted for publication for the guidance of farmers and other stakeholders.

Farooq, M., F. Hafeez, N. Din, M. Ashraf and A,Ali. 2016. Gandam Ki Godaamon Mai Hifaazat. Zarat Nama. 55(9):8-10

Din, N., M. Ashraf, M. Farooq and T. Niaz. 2016. Aam Kay Phal Ki Makhi Marboot Tareeq-e-Insdaad. Zarat Nama. 55(12):13-14.

M. Ashraf, N. Din, M.Farooq and Q. Ali. 2016. Dhaan Kay Zarar Rissan Key Keeray or In Ka Insdaad. Zarat Nama. 55(14):8-11.

Din, N., M. Ashraf, M.Farooq and Q. Ali. 2016. Phool Ghobhi Kay Zarar Rissan Keeron Ka Insdaad. Zarat Nama. 55(16): 18-19.

Iqbal., Z., N. Din, M. Ashraf, Q.Ali and K.Jawad. 2016. Tunnal Mai Kaashta Sabziyon Key Zarar Rissan Keeron ka Insdaad. Zarat Nama. 55(24):9-11.

Cotton whitefly and Dusky bug and their management. Ziratnama, 15-29 Feb-2016.

Control of wheat aphid by Ladybird beetle, a biological control. Ziratnama, 01-15 March-2016.

Control of Leafminer and Thripsin citrus orchards. Ziratnama, 01-15 April-2016.