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**Saddam Hussain**  
Department of Plant Protection,  
The University of Agriculture  
Peshawar, Pakistan

**Zafrullah Khan**  
Department of Plant Protection,  
The University of Agriculture  
Peshawar, Pakistan

**Noor Muhammad**  
Department of Plant Protection,  
The University of Agriculture  
Peshawar, Pakistan

**Muhammad Kashif**  
Department of Agronomy,  
The University of Agriculture  
Peshawar

**Saifullah Khan**  
Department of Horticulture,  
The University of Agriculture  
Peshawar, Pakistan

**Babar Akbar**  
Department of Horticulture,  
The University of Agriculture  
Peshawar, Pakistan

**Correspondence**  
**Saddam Hussain**  
Department of Plant Protection,  
The University of Agriculture  
Peshawar, Pakistan

## Population dynamic of *Aphis gossypii* and Its associated ladybird beetle on sunflower genotypes at Swabi district

**Saddam Hussain, Zafrullah Khan, Noor Muhammad, Muhammad Kashif, Saifullah Khan and Babar Akbar**

### Abstract

The present experiment was conducted during 2015 to study the population trend of *Aphis gossypii* and its associated ladybird beetle on sunflower genotypes at district Swabi from 21<sup>st</sup> March to 26<sup>th</sup> April. Randomize Complete Block Design (RCBD) was used with four replications. Four genotypes (SFA 13003, SFA 13007, SFA 13011 and SFA 13015) of sunflower were used for experiment. The data was recorded on terminal leaves per ten plants per plot for *A. gossypii* and ladybird beetles at weekly interval. The results indicated that genotype SFA 13003 was severely infested (5.64 %) by *A. gossypii* while lower infestation (2.02 %) was observed in genotype SFA 13011. However infestation was higher (8.80%) during the second week on the genotype SFA 13003. The population of seven spotted beetle were higher (1.2%) on genotype SFA 13015 and lowest (0.52%) in genotype SFA 13011. In case of time interval the number of seven spotted beetle was higher during 1<sup>st</sup> three weeks (1.08%) of growth while it decreased (0.17%) later on. Population of zigzag beetle was higher (1.16%) on SFA 13015 and lowest (0.63%) on SFA 13003. Similarly at early stage of crop growth population of zigzag beetle was higher as compare to late stages of crop growth. Population of bromus was higher (0.82%) on SFA 13015 and the highest (0.79%) in the 3<sup>rd</sup> week of crop growth while it decreased (0.09%) with up to 6<sup>th</sup> week of crop stage. It was concluded that *A. gossypii* attack was higher on SFA 13007 and the natural predators of *A. gossypii* were seven spotted beetle, zigzag beetle and bromus in experimental area.

**Keywords:** Population, *Aphis gossypii*, natural enemy, Ladybird beetle

### Introduction

Sunflower (*Helianthus annuus* L.) belongs to the family Compositae and grown as oil producing crop in Pakistan [11]. It is one of the most important oilseed crops throughout the world and covers a larger area of 22 million hectares under its cultivation the worldwide production is 26 million tons [18, 19]. Oilseed crops are grown on large area in Pakistan under both irrigated and rain fed conditions [10]. The cultivation of sunflower was started during 1960's in Pakistan to overcome the difference between the consumption and production of edible oil [6]. Sunflower crop has the capability to increase the production of edible oil in the country [13]. Sunflower is an important oilseed crop for the growers as well as for the consumer because it can be grown twice a year, spring and summer compared to other oilseed crop. Sunflower is highly yielding crop which give more outcomes to the farmers in terms of money [17]. The causes of low yield of sunflower are intensive environmental conditions, unbalance nutrition, poor agronomic practices, low quality seeds, insect pest and diseases [12]. Some of these insect pests serve as vector for virus and other diseases. Leaf curling, chlorosis and premature senescence may be due to infestation of *Empoasca abrupta* [16]. Insect pests that attack on sunflower crop are Cutworms (*Agrotis Sp.*), American bollworm (*Helicoverpa armigera*), Aphids (*Aphis gossypii*), Head caterpillar (*Stathmopoda theoris*), Whitefly (*Bemisia tabaci*) and several species of armyworms, grasshoppers and beetles [4]. Sunflower is also attacked by jassids and loopers in Pakistan [14]. Keeping in view the economic importance of sunflower. The present following investigation was conducted to record different arthropods associated with various genotype of sunflower in Swabi district of Khyber Pakhtunkhwa.

### Materials and Methods

This present study was conducted at the University of Swabi from 21<sup>st</sup> March to 26<sup>th</sup> April. The seeds of four genotypes of sunflower (SFA 13003, SFA 13007, SFA 13011 and SFA

13015) were taken from NARC Islamabad. The design used was Randomize Complete Block (RCB). For this purpose one field was selected, which was divided into four equal plots. Plot size was 6 x 6 m with plant to plant and row to row distance was 25cm and 75cm respectively. The experiment was replicated four times. Planting was done by dibbling with four seeds per hill. After germination, one plant per hill was maintained by manual thinning. Agronomic practices including thinning, hoeing, weeding, earthing up and irrigation were same for all treatments. The data was recorded on terminal leaves and buds per ten plants per plot for aphid and ladybird beetles at weekly interval. Sunflower plants were observed with naked eyes and with the help of magnified glass for counting the number of insects and their predators. The leaves were turned upward through forceps carefully for aphids, to avoid any possible disturbance.

### Statistical Analysis

Data was analyzed by using Statistix 8.1 software. Analysis of variance (ANOVA) was constructed and for the differentiation of means the Least Significant Difference (LSD) was performed.

### Results and Discussion

#### Mean percent infestation of *Aphis gossypii*

Statistical analysis (Table-1) of the data showed that time interval and varieties had significant affect on infestation of *A. gossypii*. The interaction data of varieties and time interval

was also significant. The highest mean percent infestation was observed in SFA13003 (5.64%) followed by SFA13015 (4.08%) and SFA13007 (3.41%). whereas the lowest mean percent infestation (2.024%) of *A. gossypii* was found on SFA13011. It was also noted that the infestation of *A. gossypii* increased from 1<sup>st</sup> week up to 2<sup>nd</sup> week (21<sup>st</sup> March to 29<sup>th</sup> March) and slightly decreased with the passage of time. The *A. gossypii* density decreased in 5<sup>th</sup> week and onward. The highest infestation of aphids (5.63%) was observed in 2<sup>nd</sup> week followed by week 1<sup>st</sup> of (4.84%). The highest *A. gossypii* infestation (8.80 %) was recorded in genotype SFA13003 in 2<sup>nd</sup> week, while the lowest infestation (0.02 %) was recorded in SFA 13011 in 5<sup>th</sup> week. No aphid was recorded after 5<sup>th</sup> week, however plants were regularly observed up to harvesting, for aphids population density. It is suggested that *A. gossypii* completed its life cycle during 1<sup>st</sup> to 4<sup>th</sup> week interval and thus population reduction started afterwards. [15] Stated that newly born aphids becomes a reproducing adult within a week and then can produce up to 5 offspring per day up to 30 days. The data revealed that time intervals played a vital role in the reduction of pest infestation. The increase of aphids density from 1<sup>st</sup> week to 2<sup>nd</sup> week interval may be due to favorable environmental condition but unfavorable condition declined the population onward. Heavy rain during last week of March has also may cause reduction in *A. gossypii* population [7]. reported that total rainfall can reduce the *A. gossypii* population. These results are in agreement with the findings of [4, 3].

**Table 1:** Mean percent infestation of *Aphis gossypii* on different sun flower genotypes at different time intervals.

Weeks	Varieties				Means
	SFA13003	SFA13007	SFA13011	SFA13015	
1	7.275	4.175	2.275	5.65	4.843b
2	8.800	4.775	3.550	5.400	5.631a
3	6.00	3.800	2.300	4.850	4.237c
4	4.050	3.175	1.975	3.425	3.156d
5	2.100	1.125	0.020	1.075	1.080e
Means	5.645a	3.41b	2.024c	4.08b	

LSD value for genotypes = 0.110

LSD value for weeks = 0.199

LSD value for G X W = 0.39

#### Population trends of seven spotted beetle (*Coccinella septempunctata*)

Time interval and varieties significantly affected seven spotted ladybird beetle population. Significance was noted in interaction data of time interval and varieties. The highest mean percent population was noted in SFA13015 (1.282%) followed by SFA13003 (0.731%). And SFA13007 (0.726%) whereas the lowest mean percent population (0.528%) of seven spotted ladybird beetle was found in SFA13011. It was also observed that the population of seven spotted ladybird beetle increased from 1<sup>st</sup> week up to 3<sup>rd</sup> week (21<sup>st</sup> March to 4<sup>th</sup> April, 2015) and slightly decreased with the passage of time. The seven spotted ladybird beetle density decreased in 6<sup>th</sup> week onward, after this week no seven spotted ladybird beetle was observed on the plants. The highest population of (1.081%) was observed in 3<sup>rd</sup> week while the lowest was found in week 6<sup>th</sup> with population of (0.175%). The highest population (1.975 %) was recorded in genotype SFA13015 in 3<sup>rd</sup> week and the lowest population (0.125 %) was recorded in SFA 13007 in 1<sup>st</sup> week (21<sup>st</sup> March). These results are in agreement with the findings of Henry and Mass (1995), who reported that the most important aphid's predators are green lacewings and ladybird beetles [2]. stated that *A. gossypii* are attacked by a number of ladybird beetles, in which the seven

spotted lady bird beetle was the most various one.

#### Mean percent population of zigzag beetle (*Menochilus examaculatus*)

Data regarding time interval and varieties presented in Table-2 showed significantly affected zigzag beetle population. The interaction of time interval and varieties was also significant. The highest mean percent population was noted in SFA13015 (1.16%) followed by SFA13003 (0.63%), whereas the lowest mean percent population (0.64%) of zigzag beetle was found in SFA13011. It was also observed that the population of zigzag beetle increased from 1<sup>st</sup> week up to 3<sup>rd</sup> week (21<sup>st</sup> March to 4<sup>th</sup> April, 2013) and then slightly decreased with the passage of time. The zigzag beetle density decreased gradually in 6<sup>th</sup> week. None of the zigzag beetle was observed on SFA 13007, SFA 13011 and SFA 13015 except SFA 13003 at 6<sup>th</sup> week while none of the beetle was observed on tested genotype at 7<sup>th</sup> week and onward. The highest population of (0.97%) was observed in 3<sup>rd</sup> week followed by week 4<sup>th</sup> with population of (0.84%), however the lowest (0.02%) population was observed in week 6<sup>th</sup>. The highest zigzag beetle population (1.87 %) was recorded in genotype SFA13015 in 3<sup>rd</sup> week and the lowest value (0.09 %) was recorded in SFA 13007 in 1<sup>st</sup> week. These adult beetles are

bright yellow in color with black vertical zigzag lines on the dorsal side of both elytra. There are polymorphs of various coloration within the species. The average size of an adult is 2.00 mm [1]. *Menochiles sexmaculatus* is an efficient predator of many species of aphids. Peak population of zigzag beetles may be due to the increase in *A. gossypii* population from 1<sup>st</sup> to 2<sup>nd</sup> week intervals but the reduction of *A. gossypii* infestation caused decline in colonization of zigzag beetles. These results are in agreement with the findings of [8] who reported that the most important aphid's predators are green lacewings and ladybird beetles [2]. stated that *A. gossypii* is attacked by a number of ladybird beetles (Table-3).

**Table 2:** Mean percent population of seven spotted beetle in different sunflower genotypes at different time intervals.

Weeks	Varieties				Means
	SFA13003	SFA13007	SFA13011	SFA13015	
1	0.50	0.12	0.20	1.60	0.605e
2	0.70	0.30	0.12	1.82	0.731d
3	1.02	0.82	0.50	1.97	1.081a
4	1.52	1.00	0.80	0.50	0.956b
5	0.50	1.57	1.02	0.52	0.906c
6	0.15	0.55	0.00	0.00	0.175f
Means	0.731b	0.726b	0.528c	1.282a	

LSD value for genotypes = 0.020  
 LSD value for weeks = 0.036  
 LSD value for G X W = 0.072

**Table 3:** Mean percent population of zigzag beetle (*Menochiles sexmaculatus*) in different sunflower genotypes at different time intervals.

Weeks	Varieties				Means
	SFA13003	SFA13007	SFA13011	SFA13015	
1	0.40	0.09	0.32	1.47	0.573e
2	0.60	0.20	0.92	1.65	0.635d
3	0.90	0.72	0.40	1.87	0.975a
4	1.40	0.90	0.67	0.40	0.843b
5	0.40	1.40	0.92	0.42	0.787c
6	0.10	0.00	0.00	0.00	0.025f
Means	0.633c	0.662b	0.646bc	1.162a	

LSD value for genotypes = 0.029  
 LSD value for weeks = 0.536  
 LSD value for G X W = 0.107

#### Mean Percent Population trends of *Brumoides suturalis*

Table-4 data showed that time interval and varieties had significantly affected population density of *B. suturalis*. The time interval and varieties interaction was also found significant. The highest mean percent population was noted in SFA13015 (0.82%) followed by SFA13007 (0.44%). And SFA13003 (0.43%), whereas the lowest mean percent population (0.31%) of *B. suturalis* was noted in SFA13011. It was also found that the population of *B. suturalis* increased from 1<sup>st</sup> week up to 3<sup>rd</sup> week and slightly decreased with the passage of time. The *B. suturalis* density decreased in 6<sup>th</sup> week and onward there was no beetle was observed on the plants. The highest population of (0.787%) was noticed in 3<sup>rd</sup> week, while the lowest in week 1<sup>st</sup> with population of (0.162%). The highest population of *B. suturalis* (1.55 %) was recorded on genotype SFA13015 at 3<sup>rd</sup> week and the lowest (0.07 %) on SFA 13011 in 2<sup>nd</sup> week. None of the beetle was recorded after 6<sup>th</sup> week (26<sup>th</sup> April 2015) until maturity of the crop. *Brumoides suturalis* normally fed on mealy bug crawlers but certain study showed that *A. gossypii* are the host for *Brumoides suturalis*. [9] reported that *Brumoides suturalis* is one of the predators of *A. gossypii* in Pakistan. Similar results were reported by [7] who suggested that natural predators (spider and ladybird beetles) reduced the population

of aphids.

**Table 4:** Mean percent population of *Brumoides suturalis* in different sunflower genotypes at different time intervals.

Weeks	Varieties				Means
	SFA13003	SFA13007	SFA13011	SFA13015	
1	0.00	0.00	0.00	0.650	0.162d
2	0.40	0.097	0.075	1.425	0.499c
3	0.80	0.575	0.225	1.550	0.787a
4	1.050	0.650	0.450	0.225	0.593b
5	0.275	1.075	0.800	0.250	0.600b
6	0.092	0.275	0.00	0.00	0.091d
Means	0.436b	0.445b	0.31c	0.82a	

LSD value for genotypes = 0.047  
 LSD value for weeks = 0.085  
 LSD value for GXW = 0.170

#### Conclusions

Population of *A. gossypii* was higher on genotype SFA13003 and population was lower on genotype SFA13011. Population of ladybird beetle was higher on SFA13015 genotype of sunflower. Ladybird beetles (*Coccinella septempunctata*, *Menochilus sexmaculatus* and *Brumoides suturalis*) were natural enemies for *Aphis gossypii* in District Swabi. On the basis of lower infestation of aphids the genotype SFA 13011 is recommended for general cultivation in district Swabi. As the population of the three species of ladybird beetle was higher on SFA13015 therefore this genotype may be used for mass rearing of ladybird beetle. The natural enemies mostly contributed to aphid reduction therefore measure should be taken to encourage and protect their population.

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