POPULATION DYNAMICS OF INSECT PESTS OF COTTON AND THEIR NATURAL ENIMIES

SANA ASHFAQ*, IMTIAZ ALI KHAN*, MUHAMMAD SAEED***, AHMAD UR RAHMAN SALJOQI**, FARKHANDA MANZOOR****, KAMRAN SOHAIL*, KOMAL HABIB* and AMNA SADOZAI*****

* *Department of Entomology, Khyber Pakhtunkhwa Agricultural University Peshawar – Pakistan.*
** *Department of Plant Protection, Khyber Pakhtunkhwa Agricultural University Peshawar – Pakistan.*
*** *Department of Entomology, Hazara University, Mansehra – Pakistan.*
**** *Department of Zoology, Lahore College for Women University, Lahore – Pakistan.*
***** *Department of Entomology, Agriculture Research Institute, Tarnab, Pehsawar – Pakistan.*

ABSTRACT

The present research work aimed to study the population dynamics of different insect pests of cotton and their natural enemies at the Research Farm of Agricultural University, Peshawar, Pakistan during 2009. Whitefly, Bemisia tabaci (Gennadius); aphids, Aphis gossypii (Glover); leafhopper, Amrasca biguttula biguttula (Ishida); leaf beetle, Cerotoma trifurcate (Forster); red cotton bug, Dyesdercus koenigii (Fabricius) were the major insect pests while ladybird, beetle Coccinella septempunctata (Linnaeus); spider, Dictyna sp. (Linnaeus) and ants, Solenopsis invicta (Buren) were the natural enemies recorded on cotton. Densities of insect pests and natural enemies peaked from June to October. Highest density of 5.78 tabaci leaf^{-1} was recorded on 10th August, 2.61 gossypii leaf^{-1} on 20th June, 6.56 biguttula biguttula leaf^{-1} on 10th August, 0.89 trifurcate leaf^{-1} on 30th August and 1.58 koenigii leaf^{-1} on 9th October. The highest density of 1.42 C. septempunctata leaf^{-1} on 10th August, 0.56 Dictyna sp. leaf^{-1} on 19th September and 1.22 invicta leaf^{-1} on 20th June were recorded. The pest and natural enemies completely disappeared after mid-October.

Key Words: Insect pests, natural enemies, cotton, population dynamics

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INTRODUCTION

Cotton, *Gossypium hirsutum* L. (Family Malvaceae), is one of the most commercially important fiber crops in the world. It is a perennial semi-shrub grown as an annual crop in both tropical and warm temperate regions. In addition to textile manufacturing, it produces seeds with a potential multi product base such as hulls, oil, lint and food for animals (Ozyigit *et al.* 2007).

In Pakistan, cotton was grown on 3054.3 thousand ha in 2007-2008 with an average production of 649 kg/ha. In Khyber Pakhtoonkhwa, it was grown in 2007-2008 on 0.2 thousand ha that yielded on average 425 kg/ha (MINFAL, 2008).

Production of cotton is limited by various factors among which insect pests are also important. The key insect pests of cotton are termite, *Microtermes obesi*; cutworm, *Agrotis ipsilon*; thrips, *Thrips tabaci*; jassid, *Amrasca biguttula biguttula*; whitefly, *Bemisia tabaci*; aphid, *Aphis gossypii*; leaf-roller, *Sylepta derogate*; red cotton bug, *Dyesdercus koenigii*; mite, *Tetranychus macfarlanei*; grey weevil, *Myllocerus undecimpustuletus maculosus*; spotted bollworm, *Earias insulana*; pink bollworm, *Pectinophora gossypiella* and American bollworm, *Helicoverpa armigera* (Dhaka and Pareek, 2007). In cotton, the insect pests infestation caused deterioration in lint quality and 10–40% losses in crop production (Gahukar, 2006).

Chelonus blackburni Cameron, *Trichogramma achaeae* Nagraja, *T. brasiliensis* (Ashmead), *Chrysoperla carnea* Stephens, *Coccinella septempunctata* Linnaeus, *Menochilus sexmaculatus* Fabricius and spiders have been observed as potential natural enemies of key pests of cotton and play an important role in the cotton ecosystem (Dhaka and Pareek, 2007). Keeping in view the importance of the crop and losses caused by different insect pests to it, the present research was aimed at studying population dynamics of insect pests and their natural enemies on cotton.

MATERIALS AND METHODS

The experiments on population dynamics of insect pests on cotton and their natural enemies were conducted at the Research Farm of KPK Agricultural University, Peshawar during 2009. For the experiment, Cotton variety CM473, was sown on May 15, 2009 in plot, measuring 34 x 54 m^2. Cotton was sown @ 7/hole at soil depth of 2.5 cm. Plant to plant and row to row distances were kept at 45 cm and 90 cm, respectively. Normal agronomic practices were applied throughout the growing period of the crop. No pesticides were applied to the crop.

Density of insect pests and their natural enemies was recorded on ten days interval on randomly selected leaves from top, middle and bottom of the 36 plants. For counting the insect pests and their natural

enemies, the leaf was gently held at the petiole by thumb and fore finger and turned until the entire underside of leaf was clearly visible. Data were recorded at morning hours (8-10 am) because at that time winged pests were sluggish and easily counted. The insects were recorded from 3rd week of May till 2nd week of October. The data recorded was subjected to mean values of individual leaf^{-1} for ten days interval.

RESULTS AND DISCUSSION

The results of the experiment on population dynamics of insect pests and their natural enemies on cotton are reported and discussed as under:

Population Dynamics of Insect Pests of Cotton

Density of *tabaci* on cotton on 20th June was 0.19 individuals leaf^{-1} (Table I). Its density gradually increased in the subsequent months and peaked on 10th August to a highest of 5.78 individuals leaf^{-1}. Density of the pest gradually declined in the subsequent weeks and reached to a minimum number of 0.53 individuals leaf^{-1} on 9th October. The density of *gossypii* was highest (2.61 leaf^{-1}) on 20th June but abruptly declined in the subsequent two weeks. The pest disappeared from 20th July to 9th Sept. The pest appeared again on 19th Sep. but its density remained lower. Density of *biguttula* remained minimum from 20th to 30th June, but increased abruptly in the subsequent weeks and peaked (6.56 individuals leaf^{-1}) on 10th August. Density of the pest declined and fluctuated till the end of the cropping season. *trifurcate* appeared on 10th August and its density abruptly increased to 0.86 leaf^{-1} on 20th August. Its density peaked to 0.89 leaf^{-1} on 30th August. *Trifurcate* disappeared in the following week but reappeared and fluctuated in the subsequent weeks. *koenigii* appeared on cotton late in the season on 09th September. Its density gradually increased and peaked (1.58 leaf^{-1}) on 9th October.

Table-I ***Mean density of insect pests/leaf on cotton during 2009.***

Insect pests	20th June	30th June	10th July	20th July	30th July	10th Aug	20th Aug	30th Aug	9th Sep	19th Sep	29th Sep	9th Oct
B. tabaci	0.19	0.28	1.03	1.75	2.31	5.78	3.00	1.67	1.53	0.92	0.97	0.53
A. gossypii	2.61	1.31	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.64	0.42
A. biguttula	0.11	0.00	1.69	4.50	5.44	6.56	4.81	5.00	1.72	1.75	1.75	1.28
C. trifurcate	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.89	0.00	0.83	0.83	0.75
D. koenigii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72	0.92	1.06	1.58

B. tabaci, *A. gossypii* and *A. biguttula biguttula* appeared from mid-June while *C. trifurcate* in August *and D. koenigii* in September. Some previous workers have also reported that *B. tabaci* appeared in mid-June and reached to highest no. in August (Abro *et al.* 2004; Hanumantharaya *et al.* 2008; Solangi *et al.* 2008 and Godhani *et al.* 2009). Hanumantharaya *et al.* (2008) and Godhani *et al.* (2009) had reported population of *A. gossypii* throughout the cotton growth period. But in the present study, *A. gossypii* continuously decreased from June till September. The overall mean of *A. biguttula biguttula* in the present research was 2.88/leaf which was comparable to those of Abro *et al.* (2004) and Solangi *et al.* (2008). They had reported that the mean maximum population of *A. biguttula biguttula* (3.93/plant) was found in last week of August. According to Biedermann (2005) and Nathan *et al.* (2006) mean and maximum density of *C. trifurcate* was 4.4 and 24.4 individuals/ m^2, respectively, in the end of July/beginning of August. Our finding about *D. koenigii* are at par with the work of Sharma and Pampapathy (2006) who recorded the mean population of *D. koenigii* as 12.7/5 plants and 0.00/5 plants in unprotected and completely protected cotton variety L604, respectively while 1.0/5 plants and 0.00/5 plants in unprotected and completely protected cotton variety LK861, respectively.

Population Dynamics of Natural Enemies on Cotton

Septempunctata appeared on cotton on 30th June. It disappeared in the following week but appeared again on 20th July. Its density gradually increased in the subsequent weeks and peaked (1.42 individuals leaf^{-1}) on 10th August. Density of *C. septempunctata* declined afterwards and disappeared on 9th October. *Dictyna* sp. appeared on 10th July. Its density increased in the subsequent weeks and reached to a maximum no. of 0.47 individuals leaf^{-1} on 10th August. It disappeared from August 20 to 30, but appeared again afterwards. Density of the *Dictyna* sp. was highest from 9-29th Sept, and declined abruptly afterwards. *Invicta* was 1.22 individuals leaf^{-1} on 20th June. Its density gradually decreased and disappeared on 10th August. It appeared again on 20th August and gradually increased in the subsequent three weeks to a maximum no. of 1.08 leaf^{-1} on 9th Sept. Its population declined and remained low afterwards.

Table-II ***Mean density of natural enemies/leaf on cotton during 2009.***

Natural enemies	20th June	30th June	10th July	20th July	30th July	10th Aug	20th Aug	30th Aug	9th Sep	19th Sep	29th Sep	9th Oct
Septempunctata	0.00	0.11	0.00	0.28	0.36	1.42	0.33	0.36	0.00	0.14	0.06	0.00
Dictyna sp.	0.00	0.00	0.03	0.33	0.44	0.47	0.00	0.00	0.53	0.56	0.56	0.28
S. invicta	1.22	0.92	0.83	0.22	0.22	0.00	0.19	0.22	1.08	0.36	0.28	0.44

Septempunctata peaked in Aug, *Dictyna* sp. In Sept while *S. invicta* in June. Some earlier researchers had also found higher population of *Septempunctata* in August (Godhani *et al.* 2009) and *Dictyna* sp. in September. Dhaka and Pareek (2007) had reported maximum population of *Dictyna* sp in July. The present result of *S. invicta* are also comparable to those reported by Kaplan and Micky (2002) and Jennifer and Sharon (2010).

CONCLUSION AND RECOMMENDATIONS

In the present research work, *Tabaci* peaked (5.78 individuals leaf^{-1}) on 10th August, *Gossypii* (2.61 leaf^{-1}) on 20th June, *Amrasca biguttula biguttula* (6.56 individuals leaf^{-1}) on 10th August, *Cerotoma trifurcate* (0.89 individuals leaf^{-1}) on 30th August, *Dyesdercus koenigii* (0.72 individuals leaf^{-1}) on 9th September, *Septempunctata* (1.42 individuals leaf^{-1}) on 10th August, *Dictyna* sp.(0.56 individuals leaf^{-1}) on 19-29th Sept, *Invicta* (1.22 individuals leaf^{-1}) early in season on 20th June. Future work should focus on correlation of natural enemies with the insect pests and effect of environmental conditions of the population abundance of pests and their natural enemies.

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