Seasonal Abundance of Piercing Sucking Insect Pests Associated with Cotton Plant and their Relation to Natural Enemies

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ABSTRACT

The cotton aphid, Aphis gossypii (Glover.) had four peaks during the first season and three peaks during the second season, the cotton thrips, Thrips tabaci Lindeman had two peaks during both seasons, the sweet potato white By, Bemisia tabaci (Genn.) had two peaks during the first season and four peaks in the second season and Empoasca spp. exhibited three peaks during the first season and two peaks in the second season. Also, the lady bird beetle, Coccinella undecimpunctata L. had seven peaks during both seasons. Whereas the green lacewing, Chrysoperla carnea (Steph.) had seven peaks during 2018 season and eight peaks during 2019 season. The parasitoid, A. colemani had three peaks during 2018 season and five peaks during 2019 season on the cotton aphid. There was a correlation between insect pests and the natural enemies, insignificant positive correlation was observed between C. undecimpunctata and both of A. gossypii and T. tabaci in both seasons. However, C. undecimpunctata has highly significant positive correlation with B. tabaci in the first season only, but it has a significant positive correlation with Empoasca spp. in the first season only. C. carnea, has a highly positive significant correlation with the aphid and the whitefly numbers in the season 2018, whereas during the second season 2019 the correlation was highly positive significant with the whitefly and the green leafhoppers only. The correlation between the parasitoids A. colemani and the aphid was highly significant during both seasons.

Keywords: Cotton, Aphid, Thrips, Whithfly, predators, parasitoid, fluctuation, correlation.

INTRODUCTION

Cotton, Gossypium barbadence L. is one of the most important crops in Egypt and all over the world where it is employed in several industrial productions, i.e. textile, ginning, food, oil, furniture, soap and many other industries, as well as a source of foreign coin when it exported (Al-Shannah and Hegah, 2010).

In tropical and sub-tropical countries a cultivated area of cotton is about 2.4% of the aridable land. Twenty million farmers are those which totally dependent on cotton production (Taqi et al., 2019)

In almost all cotton producing countries, insect pests and crop diseases consider the major factors affecting cotton production, (Masood et al., 2011). Cotton plants are attacked by insect pests starting from germination of seedlings till harvest, causing several damages to the vegetation, flowers, fibers, and seeds, (Afazal et al., 2003). Among all the pests, sucking pests are many and they cause a huge loss by affecting the vegetative growth of the plants, by directly retarding the production of bolls to a large extent (Sahu and Samal, 2020).

In balance ecosystems, insect pests are kept under economic threshold by their natural enemies (predators and parasitoids), (Nirmala et al., 1996). During the last few years, populations of certain sap sucking insect species which were known as unimportant organisms, started to increase reaching pest status on cotton plants. This might be due to the heavy use of pesticides applications which destroyed a large number of natural enemies, causing upset of the natural balance and the previously known as secondary pests became a major pest (Fayad et al., 1990). Therefore, the aim of this work found out the changes that occurred in the numbers of these pests and their natural enemies, and the extent to which these pests are related to the presence of their natural enemies.

MATERIALS AND METHODS

The present study was carried out at the cotton fields in El-Maragha district, Sohag Governorate, during the two successive growing seasons of 2018 and 2019. An area of about 1/4 feddan was assigned for the current study. By the beginning of April in the two seasons, the recommended cotton variety Giza 95 was sown for the experimentation. Experimental plots received regular cultural practices as recommended, except the use of pesticides.

1- The seasonal abundance of piercing sucking insect pests infesting cotton :

From April, 17th to October, 16th during 2018 and 2019 seasons respectively, weekly samples, each of 10 leaves were examined in the field to record the numbers of A. gossypii, B. tabaci (adult) and T. tabaci. The immature stages of B. tabaci were examined in the laboratory using the Stereomicroscope.

2- The seasonal abundance of certain insect predators associated with cotton pests:

During 2018 and 2019 seasons, weekly samples of cotton plants were taken randomly beginning from April, 17th to October, 16th respectively. Each sample consisted of
The current results are in accordance with those of Dewy (2006) and El Hadary, W. A. and Shimaa Y. Ahmed (2020) who mentioned that T. tabaci peaked twice on cotton plants during May and June and El-Ghobary, (2011) found that seasonal abundance of thrips was high during May, moderate during June and July, but rare in August and September. The thrips exhibited three peaks in each of 2005 and 2007 seasons. The peaks of 2005 season occurred on May 30th, July 4th and September 8th, while those of 2007 season occurred on June 6th, June 27th and September 8th. Two peaks were recorded in the 2006 season on May 30th and July 4th, Bashir et al. (2020) in Pakistan who found that in Pakistan the incidence of thrips was observed from 10 days after sowing (DAS). The peak incidence of thrips was observed after (64 days) with a population of 8.26 thrips / trifoliate leaf / plant.

The current results agree partially with the findings of El Hadary, W. A. and Shimaa Y. Ahmed (2020) who mentioned that T. tabaci peaked twice on cotton plants during May and June and El-Ghobary, (2011) found that seasonal abundance of thrips was high during May, moderate during June and July, but rare in August and September. The thrips exhibited three peaks in each of 2005 and 2007 seasons. The peaks of 2005 season occurred on May 30th, July 4th and September 8th, while those of 2007 season occurred on June 6th, June 27th and September 8th. Two peaks were recorded in the 2006 season on May 30th and July 4th, Bashir et al. (2020) in Pakistan who found that in Pakistan the incidence of thrips was observed from 10 days after sowing (DAS). The peak incidence of thrips was observed after (64 days) with a population of 8.26 thrips / trifoliate leaf / plant.

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and late September. Thereafter, a sharp decline was recorded towards the end of cotton season. El-Ghobary (2011) at Kafr El-Sheikh, found that B. tabaci had two peaks of abundance in 2005 season, June 20th and August 23rd, also it had two peaks in 2006 season, June 25th and August 28th. However, it had one peak in 2007 season in August 16th. Mazeed (2014) recorded B. tabaci in a low numbers during April, May and June and in a high numbers during July and August. Bashir et al. (2020), in Pakistan found that the incidence of whiteflies was observed 15 days after sowing and peak incidences of whitefly population was observed during the 5th standard week (64 DAS) with a population of 1.4 nymph/trifoliate leaf/plant.

Fig. 3. The seasonal abundance of B. tabaci during the two cotton growing seasons, 2018 and 2019 at Sohag Governorate.

4 - The green leafhoppers, Empoasca spp.:  
During 2018 season Empoasca spp. exhibited three peaks and two peaks in 2019 season (Fig. 4). The peaks of Empoasca spp. during 2018 were detected on May 29th, August 21st and September 25th with values of 25.0, 46.3 and 32.7 nymphs and adults per 10 leaves, respectively. As for 2019 season, the peaks were recorded in June 5th and August 14th with population densities of 33.0 and 52.7 nymphs and adults, respectively.

Fig. 4. The seasonal abundance of Empoasca spp. during the two cotton growing seasons, 2018 and 2019 at Sohag Governorate.

These results are partially in agreement with those of El-Ghobary (2011) reported that Empoasca spp. had multiple peaks throughout the experimental period. Three peaks were detected in 2005 season, four peaks in 2006 season and four peaks in 2007. Mazeed (2014) found that Empoasca spp. had three peaks in 2010 season, and four peaks in 2011 season.

2 - The seasonal abundance of the insect predators associated with cotton pests:

1 - The lady bird beetle, Coccinella undecimpunctata (Linnaeus):
The lady bird beetle, had seven peaks during 2018 season, in May 8th, 29th, June 19th, July 3rd, 24th, August 14th and September 11th with 3.7, 6.7, 8.0, 7.7, 8.7 and 6.7 individuals/ 10 cotton plants respectively. The peaks of 2019 season were detected on May 8th, June 12th, 26th, July 10th, August 7th, 28th and September 11th with 2.7, 5.7, 8.0, 10.7, 5.7, 6.7 and 4.3 individuals/ 10 cotton plants, respectively.

These results are in agreement with Abou-Elhagag (1998), at Assuit who found that the predators; C. undecimpunctata, was starting to appear in cotton fields in April reaching their peak during June and July and then decreased gradually by migrating to other host plants (maize and sorghum) surrounding cotton fields. Samhan (2003) stated that the highest seasonal abundance of C. undecimpunctata was recorded in cotton in Egypt in May-October 2000. Mazeed (2014) found that C. undecimpunctata was presented throughout the season on cotton plants.

2. The green lacewing, Chrysoperla carnea (Steph.):
Over the two cotton seasons, C. carnea eggs, larvae and adults were recorded Fig. (5) the peaks were obtained in the 2018 season on May 15th, June 5th, 26th, July 10, August, 14th, September 11th and September 25th with 2.3, 5.7, 4.3, 4.3, 9.0, 5.3 and 4.0 individuals/ 10 cotton plants, respectively. The peaks were found during 2019 in May 8th, 29th, June 26th, July 10th, 24th, August 14th, 28th and September 11th with 2.0, 3.7, 5.0, 5.0, 5.0, 9.0, 5.3 and 5.0 individuals/ 10 cotton plants, respectively.

These results partially agree with Khattab (2003) who found that the high numbers of C. carnea were observed on mid-May and late July. El-Ghobary (2011) found that C. carnea had three peaks during 2005 season; June 6th, July 25th and September 1st, two peaks during 2006 season on June 13th and July 18th. However, five peaks were recorded in 2007; on May 17th, May 30th, June 13th, July 25th and August 9th. Mazeed (2014) found that C. carnea appeared on cotton fields during May and increased gradually tell the end of the season.
The present results are generally in agreement with Bolckmans and Tetteroo, (2002), Van Lenteren, (2003) and Yano (2006) who were described A. colemani Viereck as the main parasitoid of cotton aphid. Mazeed (2014) found that The parasitoid, A. colemani had three peaks during 2010 season in May 4th, July 20th and August 17th and had five peaks during 2011 season in, April 27th, May 11th, July 27th, August 10th and August 24th.

4-The relationships between the piercing sucking insect pests infesting cotton plants and associated natural enemies:-

Data in Table (1) present the simple correlation between the insect pests infesting cotton plants and its associated insect natural enemies in 2018 and 2019 seasons.

Insignificant positive correlation was observed between C. undecimpunctata and both of A. gossypii and T. tabaci in both seasons. However, C. undecimpunctata has highly significant positive correlation with B. tabaci in the first season only but it has a significant positive correlation with Empoasca spp. in the first season only. The correlation values between the coccinellid predator with A. gossypii, T. tabaci, B. tabaci and Empoasca spp. were 0.5391, 0.2116, 0.5116 and 0.4394 respectively, during the first season, and 0.0038, 0.2516, 0.2535 and 0.2609 respectively, during the second season.

Concerning, C. carnea, the correlation coefficients (r) with the aphid, the whitefly and The green leafhoppers numbers was highly positive significant in the season 2018, whereas during the second season 2019 the correlation was highly positive significant with whitefly and The green leafhoppers only. The correlation values between the chrysoperlid predator with A. gossypii, T. tabaci, B. tabaci and Empoasca spp. were 0.5328, -0.1997, 0.7809 and, 0.7888 respectively, during the first season, and 0.3994, 0.0954, 0.6681 and 0.7224 respectively, during the second season.

The correlation between the parasitoids A. colemani and the aphid was highly significant during all seasons with r values 0.7820 and 0.7678 during 2018 and 2019 seasons respectively.

In accordance with these results, Abo-Shola (2001) indicated that C. carnea, C. undecimpunctata, P. alferii, Orius spp. and Scymnus spp. were correlated with aphid, jassids , whitefly and bollworms.

Table 1. The simple correlation between natural enemies and certain sucking insect pests infesting cotton plants at Sohag Governorate during 2018 and 2019 seasons.

<table>
<thead>
<tr>
<th>Natural enemies</th>
<th>Parameter</th>
<th>Insect pests 2018 season</th>
<th>Insect pests 2019 season</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Aphis gossypii</td>
<td>Thrips tabaci</td>
</tr>
<tr>
<td>C. undecimpunctata</td>
<td>r value 0.3491</td>
<td>0.2116</td>
<td>0.5116</td>
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<tr>
<td></td>
<td>P-value 0.0743</td>
<td>0.2894</td>
<td>0.0064</td>
</tr>
<tr>
<td>C. carnea</td>
<td>r value 0.5328</td>
<td>-0.1997</td>
<td>0.7809</td>
</tr>
<tr>
<td></td>
<td>P-value 0.0042</td>
<td>0.3181</td>
<td>0.0000</td>
</tr>
<tr>
<td>A. colemani</td>
<td>r value 0.7820</td>
<td>------</td>
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<tr>
<td></td>
<td>P-value 0.0000</td>
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</tbody>
</table>

r= Simple correlation  P= probability

Karaman et al. (2007) reported that the highest density of predators was recorded earlier or later than the peaks of their preys. This may be due to the differences in the developmental life cycle of the predators and their preys. They added that the population of the predators always lagging behind the preys and thus having only a limited chance in suppressing its activity. El-Khawas and Salwa (2010) mentioned that a positive correlation appeared among the three common predators, C. carnea Steph., C. undecimpunctata L. and Scymnus interruptus (Goeze) in relation to their main prey (A. gossypii) on paper plants.

REFERENCES


