Monitoring the fluctuations of certain piercing sucking pests infesting cucumber plants at Sohag governorate, Egypt


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Abstract

The population fluctuations of five piercing sucking pests; melon aphid, *Aphis gossypii* (Glover); cotton whitefly, *Bemisia tabaci* (Genn.); potato leafhopper, *Empoasca decipiens* (Paoli); onion thrips, *Thrips tabaci* (Lind.) and two-spotted spider mite, *Tetranychus urticae* (Koch) were investigated on Hail cucumber variety during autumn and spring plantation from 2014 to 2016 seasons. As a result in autumn plantation, population of aphid and whitefly had one peak during 2014 and 2015 seasons, meanwhile, thrips population recorded three peaks in the same seasons. Otherwise, in spring plantation in 2015 and 2016 seasons, the populations of aphid and thrips recorded three peaks and one peak, respectively. In the meantime, the whitefly's population showed three and two peaks, respectively. Leafhopper was the lowest sucking insect attacked cucumber during the two plantations throughout 2014, 2015 and 2016 growing seasons. The two-spotted spider mite only observed on spring plantation 2015 and 2016 and recorded one peak through the growing seasons. It could be concluded that planting date is effective on population fluctuations of piercing sucking pest and can be avoided by planting in late planting date.

**Keywords:** fluctuation, piercing- sucking pest, cucumber plants, autumn plantation, spring plantation.

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Introduction

Cucumber *Cucumis sativus* L. is one of the most important cucurbitaceous vegetable crops in Egypt, as it is grown under different environmental conditions, open fields and greenhouses for local consumption and exportation purposes. It is cultivated in many areas included the old and new reclaimed lands (Hanafy et al., 2014). In this interim, cucumber plants are attacked by many piercing-sucking arthropod pests such as the cotton aphid, *Aphis gossypii* (Glover); tomato whitefly, *Bemisia tabaci* (Genn.); onion thrips, *Thrips tabaci* (Lind.); potato leafhopper, *Empoasca decipiens* (Paoli) and the two-spotted spider mite, *Tetranychus urticae* (Koch). (Hussein et al., 2015; Oltean et al., 2012; Hanafy, 2004; Jan et al., 2003; Abdel-Hafiz, 2002; Higgins, 1992; Nozato, 1988; Coudriet et al., 1985). Further, these pests were mainly known as field crop pests in tropical and subtropical countries. They are broadly polyphagous causing both direct and indirect damage on cucumber plants for instance; excessive piercing removal, promoting the growth of sooty mold, vectoring plant viruses (Van Lenteren & Noldus, 1990; Cock, 1986; Perkins, 1983) and appreciable reduction in yield (Varma et al., 2013; El-Lakawah et al., 2011; Tomczyk & Pilko 1996; Kherebe et al., 1984). It could be observed that, the cucumber plants cultivated in the late planting date harboured a relatively higher number of piercing sucking pest as thrips (*T. tabaci*). Meanwhile, the plants of the early planting date harboured relatively lower numbers of the pest (Mohamed, 2012). Other researchers reported, the infestation rate of *T. tabaci* increased by delaying planting date (Abd El-Karim, 2010; Emam et al., 2006; Bairwa et al., 2005; Hanafy, 2004; ElRefai & Emam, 1994; Rizk et al., 1990). However, planting season is very important factor in the culture control, whereas many researchers pay attention to investigate the effect of planting season on population fluctuations of different piercing sucking pests all over the world. Otherwise, climate changes may affect population dynamics directly or indirectly through shifting survival, behaviour, and life cycles of insects (Boggs & Inouye, 2012). Whereas, increasing temperature could facilitate physiology and reproduction of insects at an individual level (Ullé et al. 2010). However, whether climate changes could affect pest damage and population dynamics at a community level is still largely unknown. Increasing temperature may positively affect development, longevity, and fecundity. Please here write the the effect on planting on population and used a references. The the relationship between the importance of peak population and IPM the weather condition especially the temperature as a main factor influencing the population dynamics. Then write the importance of your study in Sohag region, especially Sohag is one promised in vegetable production. Herein, the goal of this research is to study the population fluctuations of piercing sucking pests on cucumber varieties during autumn and spring cultivations to predict the outbreaks of these pests which could be a good point in case of piercing sucking pest control at Sohag region, especially Sohag is one of promised vegetable production in Egypt.

Materials and methods

**Cucumber cultivations:** The experiments were carried-out from September 2014 until February 2016 in a new private reclaimed farm at a Awlad-Azzaz village, about 18 kilometers West
of Sohag governorate, Egypt. How about the other traditional treatments like fertilization and irrigation and herbicides if used, all these factors affects the population dynamics. All the agriculture practices were done as recommended for recent reclaiming lands.

**Autumn plantation:** Cucumber variety Hail (PS 410832) was cultivated in area of 400 m², which divided to 4 replicates (plots) with a randomized complete block design (RCBD), each plot about 100 m². Seeds were sown on September 13th and 15th during 2014 and 2015, respectively. This area was utilized for determination of the population fluctuations of piercing sucking pests.

\[ SV = \frac{4}{3} \pi r^3 \]

**Spring plantation:** To compare the population fluctuations of piercing sucking pests in spring plantation in the Hail (PS 410832) a cultivated area of 400 m² for each variety was divided into 4 replicates. Seeds were sown on February 14th and 16th during 2015 and 2016, respectively.

**Sampling collection and data analysis:**
Leaf sampling was started on September 22nd, 2014 and 2015 for autumn cultivation, while for spring cultivation, leaves were started to be sampled on February 22nd, 2015 and 2016 with 3 days intervals until harvest or until the crop was discarded. Ten leaves were collected randomly that representing different stages of the canopy from each replicate. Samples were collected in the early morning in the field and the number of adults were counted, then kept in a paper bags after that and transferred to the laboratory to inspect the immature stages of piercing-sucking pests with the aid of light microscope. Direct count technique was done according to Southwood (1978) and Gusmao et al. (2006). Statistical analysis was conducted using ANOVA-one way, followed by LSD Test by using Co-stat 6.4 computer program according to Steel and Torrie (1981).

**Results and Discussion**

**Population fluctuations of piercing sucking pests in autumn and spring plantations:** Survey studies on cucumber plants cultivated in Sohag revealed that the *A. gossypii*, *B. tabaci*, *E. decipiens*, *T. tabaci* and *T. urticae* were the key of important piercing sucking pests that infesting Hail variety during autumn and spring plantations throughout three successive years of 2014, 2015 and 2016.

**Autumn plantation of A. gossypii:** Data indicated that (Figure 1a), the population density of *A. gossypii* had one peak during the 2014 and 2015 seasons. In 2014 season, the aphid infestation started early 7 days after sowing on September 22nd with mean numbers of 1.5 individuals /10 leaves). However, in 2015 season aphid infestation occurred late 12 days after sowing with mean numbers of 2.3 individuals /10 leaves on September 25th. Then aphids increased sharply to reach the maximum as 207.5 and 202.3 individuals /10 leaves on October 29th and 23rd, then, it decreased gradually to reach values of 150.3 and 97.5 individuals /10 leaves on November 17th and 13th the two successive seasons.
Spring plantation of *A. gossypii*: Data revealed that, *A. gossypii* appeared on February 22\textsuperscript{nd} during 2015 and 2016 seasons and recorded 49.8 and 11.5 individuals/10 leaves. Then, the populations increased gradually to record three peaks in 2015 and one peak 2016 season. The mean numbers were 285.5, 139.3 and 93.8 individuals /10 leaves, which recorded as peaks on March, 27\textsuperscript{th} and April, 3\textsuperscript{rd} and 12\textsuperscript{th} respectively, in the first season. However, the mean number was 187.8 individuals /10 leaves that recorded as a peak on March 30\textsuperscript{th} in the second season. After that, the population decreased gradually until the end of each season (Figure 1b).

Figure 1: Population fluctuations of aphid infesting cucumber plants (Hail variety) during autumn plantation 2014 and 2015 seasons and spring plantation 2015 and 2016 seasons.
Autumn plantation of *B. tabaci*: Data presented in Figure (2) a showed that *B. tabaci* was recorded after one week from sowing for 2014 season, while in 2015 season it appeared in the second week. Whitefly population (nymphs and adults) increased gradually to reach the highest record (236 and 133.5 individuals /10 leaves) on October 26th and 23rd during 2014 and 2015 seasons, before the insect population dropped gradually to reach 157 and 113.8 individuals / 10 leaves on November 17th and 15th through 2014 and 2015 seasons.

Spring plantation of *B. tabaci*: Data showed that the whitefly, *B. tabaci* was recorded on spring on cucumber throughout the first inspection in both seasons of the study with mean numbers of 36.8 and 10.0 individuals / 10 leaves (adults plus nymphs), (Figure 2b). In 2015 growing season, the peaks were observed on March 6th and 27th and April 12th with mean numbers of 92.5, 134.5 and 167.8 individuals / 10 leaves, respectively. While in 2016 season, two peaks were spotted on March 24th and April 18th with mean numbers of 206.3 and 206.5 individuals / 10 leaves, before it decreased gradually to the end of 2015 season. In contrast, the population mean increased to reach its maximum by the end of 2016 season.

![Figure 2: Population fluctuations of whitefly infesting cucumber plants (Hail variety) during autumn plantation 2014 and 2015 seasons and spring plantation 2015 and 2016 seasons.](image-url)
Autumn plantation of *T. tabaci*: Cucumber leaves infestation started one week after sowing 2014 season and 9 days in 2015 season with mean numbers of 0.5 and 9.8 individuals/10 leaves, (Figure 3a). Three peaks were observed in both growing seasons of 2014 and 2015. The mean numbers were 12.5, 25 and 20.8 individuals /10 leaves which recorded as peaks on September 28th, October 11th and 20th, respectively during the first season. Meanwhile the mean numbers of 85, 63.3 and 43.3 individuals / 10 leaves were recorded as peaks on October 20th, 26th and November 8th, respectively during the 2015 season.

Spring plantation of *T. tabaci*: The onion thrips, *T. tabaci* began to attack leaves in the first inspection with mean numbers of 98.3 and 15.0 individuals / 10 leaves in both 2015 and 2016 seasons, (Figure 3b). The population of thrips demonstrated three peaks in first season, on February 28th, March 9th and April 9th with mean numbers of 110.5 m 256.3 and 91.8 individuals / 10 leaves, respectively. In 2016 season, the maximum number was recorded on March 27th with mean number of 261 individuals / 10 leaves. Then the population decreased gradually to the end of the season.

Figure 3: Population fluctuations of thrips infesting cucumber plants (Hail variety) during autumn plantation 2014 and 2015 seasons and spring plantation 2015 and 2016 seasons.
Autumn plantation of *E. decipiens*: Leaf hopper population was slightly abundant on cucumber plants. However, the first appearance was recorded on October 8th during 2014 and October 5th through 2015 season. The maximum leaf hopper numbers on October 29th was 5.8 individuals / 10 leaves during 2014 growing season compared with an average of 5.0 individuals / 10 leaves on November 11th during 2015 growing season (Figure 4a).

Spring plantation of *E. decipiens*: Regarding to the leafhopper, *E. decipiens* infestation started on March 12th and 3rd in 2015 and 2016 growing seasons, with mean numbers of 0.5 and 2.0 individuals / 10 leaves. The maximum numbers of leaf hopper were recorded on March 27th and 24th (41.0 and 45.5 individuals / 10 leaves in 2015 and 2016 seasons,). It worth mentioned that, the last three sampling dates cleared completely from leaf hopper in the first season. Meanwhile, the population decreased gradually to the end of the second season. Furthermore, the population increased gradually and maximized one time in both seasons (Figure 4b).

![Figure 4: Population fluctuations of leaf hopper infesting cucumber plants (Hail variety) during autumn plantation 2014 and 2015 seasons and spring plantation 2015 and 2016 seasons.](image-url)
**Autumn plantation of T. urticae:** Spider mite pest was not observed during autumn plantation for both seasons 2014 and 2015.

**Spring plantation of T. urticae:** The mite infestation began to appear on February 28th and 22nd with mean numbers of 28.5 and 7.8 individuals / 10 leaves in the both studied seasons, (Figure 5). It is evident that this pest was the dominant piercing sucking pest on cucumber in the spring plantation throughout both seasons. One peak was shown on April 18th of 2015 and 2016 seasons with mean numbers of 217 and 288.3 individuals / 10 leaves, Significantly, B. tabaci recorded the highest number on cucumber leaves followed by A. gossypii during 2014 season, 134.2 and 121.3 individuals/ 10 leaves, (Table 1). Otherwise, the aphid was the greatest through 2015 season followed by the whitefly (101.7 and 97.6 individuals/ 10 leaves,). Meanwhile, T. tabaci was the less abundant pest in both seasons (9.9 and 42.7 individuals/ 10 leaves). However, E. decipiens was the lowest sucking insect infesting cucumber in both studied growing seasons of 2014 and 2015 (1.1 and 0.7 individuals/ 10 leaves).

![Figure 5: Population fluctuations of spider mite infesting cucumber plants (Hail variety) during spring plantation 2015 and 2016 seasons.](image)

In this respect, Aly (1990) reported that, aphid and whitefly are considered as a main sucking pest infesting cucumber and other vegetables in Minia governorate, Egypt. Also, Abdel-Rahman et al. (2016) stated that, B. tabaci was the most abundant and seemed to be the major pest followed by T. urticae. They appended that, the piercing sucking insects such as A. gossypii; T. tabaci and E. decipiens were the most numerous pests infesting cantaloupe in Upper
Egypt. El-Khawalka et al. (1992) investigated the infestation level of vegetable crops by cotton aphid, *A. gossypii* in Egypt. They found that the infestation levels were varied from high on cucumber moderate on summer squash and low on vegetable marrow. In addition, there was a positive correlation between the infestation rate by *A. gossypii* and plant stage. Additionally,

<table>
<thead>
<tr>
<th>Piercing sucking pests</th>
<th>Significance</th>
<th>Autumn plantation</th>
<th>Spring plantation</th>
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<tbody>
<tr>
<td><em>A. gossypii</em></td>
<td>Mean*</td>
<td>121.3 b</td>
<td>101.7 a</td>
</tr>
<tr>
<td></td>
<td>L.S.D. at 5%</td>
<td>10.3</td>
<td>6.8</td>
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<tr>
<td>Whitefly <em>B. tabaci</em></td>
<td>Mean*</td>
<td>134.2 a</td>
<td>97.6 b</td>
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<td></td>
<td>L.S.D. at 5%</td>
<td>16.9</td>
<td>4.5</td>
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<tr>
<td>Thrips <em>T. tabaci</em></td>
<td>Mean*</td>
<td>9.9 c</td>
<td>42.7 c</td>
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<tr>
<td></td>
<td>L.S.D. at 5%</td>
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<td>5.6</td>
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<tr>
<td>Leaf hopper <em>E. decipiens</em></td>
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<td>0.7 d</td>
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<tr>
<td></td>
<td>L.S.D. at 5%</td>
<td>1.2</td>
<td>0.8</td>
</tr>
<tr>
<td>Spider mite <em>T. urticae</em></td>
<td>Mean*</td>
<td>-</td>
<td>-</td>
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<tr>
<td></td>
<td>L.S.D. at 5%</td>
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*Means within a column followed by the same letter are not significantly different from each other*

Abdel-Khalek (2005) inspected the population fluctuation of *B. tabaci* infesting cucumber plants in new reclaimed land and mentioned that whitefly population was low in early September and gradually increased to reach its maximum on October 16th before declined in the end of the season on December 18th. Our results for spring plantation are in agreement with El-Sayed et al. (1991), Fouda and Mohammed (1994), Abdel-Khalek (2005) and Mohamed (2012) where, they reported that the infestation rate of *B. tabaci* increased by delaying planting date. In contrast with our results, Farrag et al. (1982) recorded that, the highest population density of *T. urticae* occurred in summer plantation. While, our results showed that the two-spotted spider mite has not been observed in early planting dates of autumn plantation. Also, our results agreed with El-Khayat et al. (1994) who stated that, the highest whitefly population occurred during September in autumn plantation form one peak; meanwhile there were two peaks of whitefly population in June during summer plantation. In contrast with our results, Kim et al. (1996) who mentioned that *A. gossypii* population was higher during autumn plantation than it during spring plantation. Also, Adam et al. (1997) studied the population fluctuation of *B. tabaci* during autumn and spring. They recorded that the highest infestation level occurred during autumn plantation while, the low infestation level was in spring plantation.
El-Saad and Embarak (2009) found that, *T. urticae* exhibited one peak on cucumber in Egypt. El-Lakawah et al. (2011) revealed that, infestation of jassid started after 15 days of sowing and reached maximum at 22 days after sowing before it gradually decreased by the end of season. Results also indicated that the young plants had higher biological activity and more suitable for leafhopper reproduction than old ones. In addition, Kanika et al. (2013) recorded that, there was a peak of two-spotted spider mite during the second week of August 2011 and last week of May in 2012. It could be concluded that population fluctuation of piercing sucking pests were obvious in spring plantation more than autumn plantation. So we can recommend growers for earlier planting date (autumn plantation) to avoid high pest densities and their fluctuations.

**Acknowledgments**

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