Medicon Agriculture & Environmental Sciences
Volume 2 Issue 4 April 2022
Research Article

Monitoring of Piercing-Sucking Insects and their Associated Predators as well as their Relationship with Weather Factors, in Egyptian Soybean Fields

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Received: : March 27, 2022; **Published:** : March 31, 2022

DOI: 10.55162/MCAES.02.035

Abstract

A field experiment was carried out in Nubaria and Kafr El-Sheikh regions to predict the main piercing-sucking insects and their associated predators, the impact of certain weather factors on them, the partial correlation on these studies and the role of predators in the control of *Bemsia tabaci* were discussed in Egyptian soybean fields during the 2020 and 2021 seasons. Results showed the distribution of population density and frequency of occurrence for piercing-sucking insects that included (*Bemisia tabaci* Genn.; *Aphis gossypii* Glover; *Nezara viridula* L. and *Empoasca* app.) and predators that included (*Chrysoperla carnea* Steph.; *Coccinella undecimpunctata* L., *Paederus alfierii*, *Orius* sp. and True spiders) on soybean plants. The mean number of piercing-sucking insects and associated predators was less in Nubaria than Kafr El-Sheikh region and *Empoasca* app. disappeared in Nubaria region. The highest frequency of occurrence was *Bemisia tabaci* insect and *Chrysoperla carnea* predator during the study. The best time to implement the role of integrated pest management was in August, when the predator/*B. tabaci* ratio was highest. The partial correlation coefficient value was highly significant between temperature and *B. tabaci* and C. *undecimpunctata* in Nubaria while *N. viridula* and *Empoasca* in Kafr El-Sheikh during 2020 but 2021 season, it was highly significant with *B. tabaci*, *A. gossypii*, *N. viridula*, *P. alfierii* and *Orius sp*. in Nubaria whereas *Ch. carnea* and True spiders in Kafr El-Sheikh during 2021. Relative humidity was highly significant with *Empoasca* spp. and true spiders, in Kafr El-Sheikh during 2020 while wind speed was highly significant with *B. tabaci* in Kafr El-Sheikh during 2020 and with Nubaria during 2021. The role of the main insect predators in the control of piercing-sucking insects was highly significant between *P. alfierii* and *N. viridula* in Nubaria, while Kafr El-Sheikh was *Ch. Carnea* with *B. tabaci* and *N. viridula*, then *C. undecimpunctata* with *A. gossypii* and *N. viridula* and True spiders with *B. tabaci*, and *N. viridula* during 2020, next 2021 season, *P. alfierii* with *B. tabaci* in Nubaria region then Kafr El-Sheikh was *Ch. Carnea* and True spiders with *B. tabaci*, *N. viridula* and *Empoasca* spp. these means that there are another factors effect on the relationship between insects and predators population.

Keywords: Soybean; *Glycine max* (L.); piercing-sucking insects; predators; integrated pests' management

Introduction

Soybean, Glycine max (L.), is one of the most important legume crops in Egypt and the world, it contains 18-24% oil, 30-50% protein, and significant amounts of main amino acids, particularly lycine, as well as phosphorus, calcium, and vitamins (A, C, B1, B2, B6, B12, and B19) that are important for human and animal feeding (Netam et al. 2013). Soybean fields attacked by several insects, one of the most harmful insects are piercing-sucking insects. Cotton whitefly, *Bemisia tabaci* (Genn.); cotton aphid, *Aphis gossypii* (Glov.);

the green stink bug, *Nezara viridula* L. and leafhoppers, *Empoasca* spp. are among the many harmful arthropod pest species that attack soybean fields in Egypt (El-Samahy and Saad, 2010; Abd El-Samad et al., 2011 and Khattab et al., 2012). These insects attack all soybean plants parts, with a preference for growing shoots and developing fruits (Boethel et al., 2000). They cause serious damage to plant quality and quantity by sucking plant juice or indirectly by transmitting disease-causing agents (El-Srand, 2005, Iqbal et al., 2008, Eissa, 2018 and El-Dessouki et al. 2022). The associated predators attacked the piercing-sucking insects such as *Chrysoperla carnea* Steph.; *Coccinella undecimpunctata* L., *Paederus alfierii*, *Orius* sp. and True spiders (Yadav et al., 2015 and khayat Eissa, 2018).

The investigation of environmental conditions (abiotic and biotic factors) and the correlation between the population sizes of the most serious insect pests and those of their associated natural enemies is well known to be an essential ecological process required for insect population regulation (Kogan and Herzog, 1980 and El-khayat et al. 2018). The goal of this study was to predict the main piercing-sucking insects and their associated predators as well as the impact of certain weather factors on the main piercing-sucking insects and associated predators. Also, the partial correlation coefficient values between the population density of the main piercing-sucking insects and associated predators in Egyptian soybean fields and finally the role of the main predators in the control of *Bemsia tabaci* were tested in Nubaria and Kafr El-Sheikh regions during the 2020 and 2021 seasons.

Materials and Methods

Experimental design

A field survey for the main piercing-sucking insects and their associated predators on soybean plants was conducted in Nubaria and Kafr El-Sheikh regions, Egypt during 2020 and 2021 seasons. The experimental area was divided into 4 block (1/4 feddan as an area) as replicate for each region in a randomized complete block design (RCBD). In both seasons of 2020 and 2021, the experimental area was planted with Giza 111 cultivar on 20th and 21th May in 2020 and 2021 seasons in both regions, respectively. *Bradyrizobium Japonicum* (mixture of several active strains) was obtained from the Agricultural Research Center and used to inoculate soybean seeds before sowing. Throughout two growing seasons, all plots were subjected to standard agricultural practices without spraying insecticides and Nitrogen, Phosphorus, and Potassium fertilizers were applied as the recommendations of Egyptian Ministry of Agriculture.

Field sampling method

60 leaflets from 10 random plants were taken weekly approximately after one month from sowing date (2 leaflets for each upper, middle and lower levels) for each plot until the end of soybean growing season. The numbers of the considered piercing-sucking insects and predators were directly counted in the field on both leaflets surfaces early in the morning by hand lens. The seasonal abundance of the considered piercing-sucking insects in this investigation was based on summation number of nymphs and adults of each insect species. As for, the green stink bug, *N. viridula* L. such as the common associated predators, weekly sample of 10 plants were randomly selected from each replicate completely investigated after one month from sowing date.

Effect of weather factors and predators

The weather factors were studied on population density of the piercing-sucking insects and associated predators. The daily records of temperature; relative humidity and wind speed were obtained from Meteorological department at Sakha Agricultural Research Station for Kafr El-Sheikh region while Nubaria region the climate data were obtained from NASA power web at Latitude 31:12, longitude 29:57 and elevation 3.4 during 2020 and 2021 seasons. Weekly means of three considered weather factors during the week preceding the sampling dates were used to calculate the partial correlation coefficient value between these factors, insect species population and predators.

Predators and their role in the control of Bemsia tabaci

The inspection was visual weekly from 21th June until the harvest, the total numbers of piercing-sucking insects versus total numbers of the predators to evaluate the main role of predators on IPM program as a main agent of biological control according to Hamid (2015) as follows:

$$\text{Predator/}\textit{Bemsia tabaci}\text{ ratio (P: P ratio)} = \frac{\text{Total number of injurious insects}}{\text{Total number of predacious insects}}$$

Statistical analysis

Weekly means of temperature, relative humidity, and wind speed were used to calculate the partial correlation coefficients value between these factors and the population density of piercing-sucking insects and predators by using SPSS (2006).

Results and discussion

Distribution of population density and frequency of occurrence for piercing-sucking insects in Nubaria and Kafr El-Sheikh regions

Results show the distribution of population density and frequency of occurrence for piercing-sucking insects that infesting soybean plants/sample in relation two different localities at Nubaria and Kafr El-Sheikh regions during 2020 and 2021 seasons. The piercing-sucking insects causing direct damage by feeding on leaves and indirect damage by transmission of viruses.

Results in Table (1) showed that *Bemsia tabaci* was the common species and appeared from the end of June until the harvest in both regions during 2020 and 2021 seasons. The Mean numbers population density were (62.35±1.68 and 145.88±2.93) with occurrence frequency (88% and 51%) at Nubaria and Kafr El-Sheikh regions, respectively in 1st season while in the 2nd season it gave (60.53±1.44 and 133.96±0.47) population density with occurrence frequency (85.55% and 50.36%) at Nubaria and Kafr El-Sheikh regions, respectively. *Aphis gossypii* ranked the second order with population density of (6.71±0.33 and 67.24±1.05) formed (9% and 23%) at Nubaria and Kafr El-Sheikh regions, respectively in 1st season while in 2nd season it ranked the second and third order with population density of (8.50±0.37 and 55.10 ±0.81) and occurrence frequency (12.01% and 20.71%) at Nubaria and Kafr El-Sheikh regions, respectively. Also, *Nezara viridula* recorded the least mean number of population density (1.81±0.25 and 16.88±0.69) with for occurrence frequency (3 and 6%) in the 1st season (2020) at Nubaria and Kafr El-Sheikh regions, respectively, while in 2nd season, it gave population density with mean (1.72±0.20 and11.13 ±0.30) and occurrence frequency (2.43 and 4.18%) at Nubaria and Kafr El-Sheikh regions, respectively. *Empoasca spp*. disappeared at Nubaria region in both seasons and it gave mean number of population density (58.82±0.67 and 65.81±0.52) and occurrence frequency (20% and 24.74%) in the 1st and 2nd seasons, respectively.

Piercing-sucking insects	***1st season (2020)***				***2nd season (2021)***			
	Nubaria		***Kafr El-Sheikh***		***Nubaria***		***Kafr El-Sheikh***	
	Mean ± SE*	***F. O. %*****	***Mean ± SE***	***F. O.%****	***Mean ± SE****	***F. O. %*****	***Mean ± SE****	***F. O.%*****
Bemsia tabaci	62.35±1.68	88	145.88±2.93	51	60.5 3±1.44	85.55	133.96 ±0.47	50.36
Aphis gossypii	6.71±0.33	9	67.24±1.05	23	8.50 ±0.37	12.01	55.10 ±0.81	20.71
Nezara viridula	1.81±0.25	3	16.88±0.69	6	1.72±0.20	2.43	11.13 ±0.30	4.18
Empoasca spp.	0.00	0	58.82±0.67	20	0.00	0	65.81±0.52	24.74
Total	70.87±2.26	100	288.82±5.34	100	70.75±2.01	100	266.00±2.10	100
Mean ± SE	17.72±0.57	-	72.21±1.34	-	17.79 ±0.50	-	65.50±0.52	-

* Standard error **F.O.: Frequency of occurrence.

Table 1: Distribution of population density and frequency of occurrence for piercing-sucking insects that infesting soybean plants/sample in Nubaria and Kafr El-Sheikh regions during 2020 and 2021 seasons.

Generally, the mean number of population density was less at Nubaria region about Kafr El-Sheikh region; it recorded (72.21±1.34 and 17.72±0.57) in the 1st and 2nd seasons in both regions, respectively.

The listed results in Figure (1) indicated that in 2020 season, the whitefly population (nymphs and adults) started to appear on 21th June with total number of 64 and 118 individuals /sample in Nubaria and Kafr El-Sheikh regions, respectively. Judging by the

population it's increased gradually forming two peaks of abundance on 2nd and 23th August by 258 and 484 individuals /sample in Nubaria region while, Kafr El-Sheikh region, recorded peaks on 2nd and 30th August by 518, 1825 individuals /sample, respectively. Then, population tended to decline until the end of the growing season. In the second season, data revealed that the first appearance of the whitefly, nymphs and adults on soybean plants took place in the fourth week of June (80 and 97 individuals /sample) in Nubaria and Kafr El-Sheikh regions, respectively. After that, the population increased gradually recording two peaks of abundance at the same time on 16th and 30th August by 484 and 435 individuals /sample in Nubaria region. As well as, Kafr El-Sheikh region, the population recorded one peak on 30th August by 1281 individuals /sample, In general, the population was higher than Kafr El-Sheikh region about Nubaria region during the two study seasons.

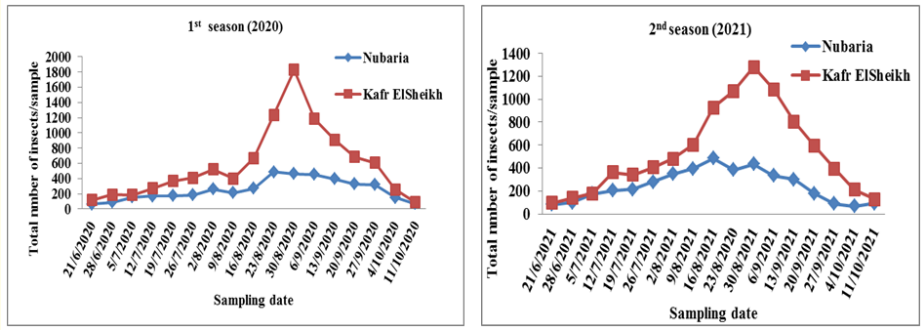

Figure 1: Population fluctuations of *Bemisia tabaci* on soybean plants during the two seasons of 2020 and 2021.

The listed results in Figure (2) indicated that in 2020 season, *Aphis gossypii* population (nymphs and adults) started to appear on 19th July and 21st June with total number of 51 and 9 individual /sample in Nubaria and Kafr El-Sheikh regions, respectively. Judging by the population it's increased gradually forming one peak of abundance on 2nd August by 140 insects /sample in Nubaria region while, Kafr El-Sheikh region, recorded also one peak on 27th September by 1329 individuals /sample, respectively. Then, population tended to decline until the end of the growing season. In the second season, data (Fig.2) revealed that the first appearance of *Aphis gossypii*, nymphs and adults on soybean plants took place on 2nd August and 5th July with total number of 60 and 3 individuals /sample in Nubaria and Kafr El-Sheikh regions, respectively. After that, the population increased gradually recording one peak of abundance at the same time on 9th August by 149 individuals /sample in Nubaria region. As well as, Kafr El-Sheikh regions, the population recorded one peak on 27th August by 775 individuals /sample; In general, the population was higher than Kafr El-Sheikh about Nubaria regions during the two study seasons.

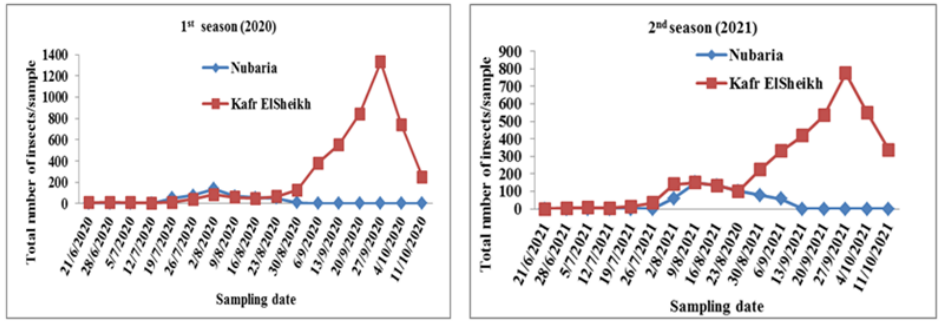

Figure 2: Population fluctuations of *Aphis gossypii* on soybean plants during the two seasons of 2020 and 2021.

The listed results in Figure (3) indicated that in 2020 season, *Nezara viridula* population started to appear on 19th July and 21st June with total number of 5 and 7 individuals /sample for in Nubaria and Kafr El-Sheikh, regions, respectively. Judging by the population it's increased gradually forming two peaks of abundance on 23rd August and 6th September by 33 and 23 individuals / sample in Nubaria region while, Kafr El-Sheikh region, also recorded two peaks on 26th July and 6th September by 90 and 169 individuals / sample, respectively. Then, population tended to decline until the end of the growing season. In the second season, data (Fig.3) revealed that the first appearance of *Nezara viridula* on soybean plants took place in the fourth week of June (5 and 4 individuals /sample) in Nubaria and Kafr El-Sheikh regions, respectively. After that, the population increased gradually recording two peaks of abundance at the same time on 9th August and 13th September by 29 and 11 individuals / sample in Nubaria. As well as, Kafr El-Sheikh regions, the population recorded also two peaks on 16th August and 13th September by 79 and 99 individuals / sample, In general, the population was higher than Kafr El-Sheikh about Nubaria regions during the two study seasons.

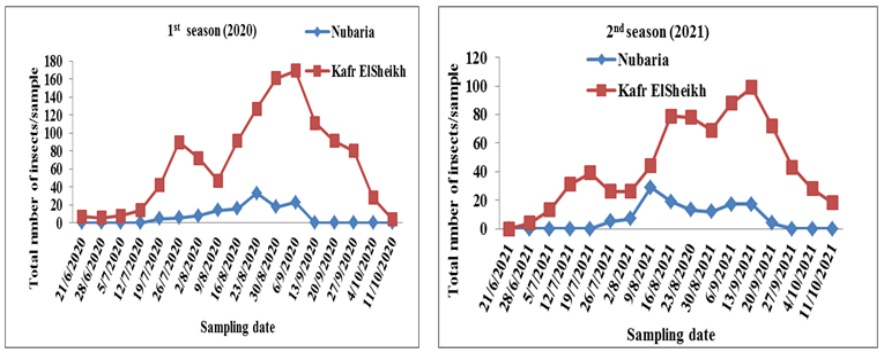

Figure 3: Population fluctuations of *Nezara viridula* on soybean plants during the two seasons of 2020 and 2021.

The listed results in Figure (4) indicated that in 2020 season, *Empoasca* spp. population started to appear on 21st June with total number of 44 and 40 individuals /sample on 1st and 2nd seasons, respectively in Kafr El-Sheikh region. Judging by the population it's increased gradually forming three peaks of abundance on 2nd, 30th August and 13th September by 501, 368 and 396 individuals /sample in 1st season, respectively while in the 2nd season, it recorded also three peaks on 26th July, 16th August and 13th September by 238, 437 and 439 individuals /sample, respectively. In general, *Empoasca* spp. recorded three peaks in Kafr El-Sheikh region and disappeared in Nubaria region in both seasons.

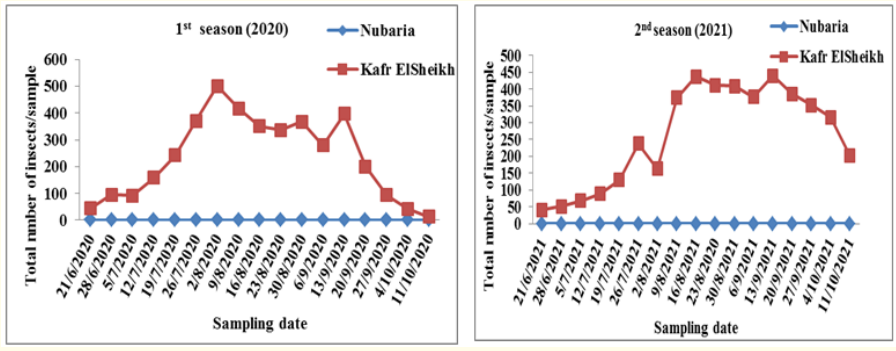

Figure 4: Population fluctuations of *Empoasca* app. on soybean plants during the two seasons of 2020 and 2021.

These results are in agreement with those found by Eissa (2018) who found that *B. tabaci*, *Empoasca* spp., *A. gossypii* and *N. viridula* populations appeared in the 2nd week of June and *B. tabaci* recorded two peaks in the 1st season and one peak in the 2nd season while *Empoasca* spp. and *N. viridula* recorded two peaks in two seasons. El-Sarand et al. (2018) stated that *B. tabaci* infestation started low by the beginning of June and formed two peaks in both seasons. *Empoasca* spp. started in June and recorded two peaks while *A. gossypii* and *N. viridula* started also in June and recorded one peak. El-khayat et al. (2020) found that, *B. tabace* appeared in the end of June and recorded the highest infestation in the end of July. The infestation by *Aphis* appeared earlier on third week of June and increased gradually until had one peak in July.

Distribution of population density and frequency of occurrence for predators' insects in Nubaria and Kafr El-Sheikh regions

Data presented in Table (2) referred to the distribution of population density and frequency of occurrence for predators' insects that infesting soybean plants/sample in relation two different localities at Nubaria and Kafr El-Sheikh regions during 2020 and 2021 seasons. *Chrysoperla carnea*, was the common species and appeared from the end of June until the harvest in both regions during 2020 and 2021 seasons. The Mean numbers population density were (5.29±0.12 and 5.15±0.18) with occurrence frequency (61.73% and 42.95%) at Nubaria and Kafr El-Sheikh regions, respectively in 1st season while in the 2nd season it gave (6.19±0.19 and 6.25±0.13) population density with occurrence frequency (57.69% and 41.72%) at Nubaria and Kafr El-Sheikh regions, respectively.

Also, *Coccinella undecimpunctata* ranked the second and third order with population density (2.26±0.02 and 2.18±0.15) formed (26.37% and 18.18%) at Nubaria and Kafr El-Sheikh regions, respectively in 1st season while in the 2nd season, it gave population density of (3.04 ±0.08 and 2.76±0.30) with occurrence frequency (28.33% and 18.42%) at Nubaria and Kafr El-Sheikh, respectively.

Paederus alfierii recorded the population density (0.13±0.04 and 0.29±0.06) formed (1.52% and 2.42%) at Nubaria and Kafr El-Sheikh region, respectively in the 1st season while it recorded (0.25±0.06 and 0.57±0.08) formed (2.33 and 3.81%) at Nubaria Kafr El-Sheikh region, respectively in the 2nd season.

Orius sp. recorded the population density (0.26±0.08 and 0.16±0.07) formed (3.03 and 1.33%) at Nubaria and Kafr El-Sheikh region, respectively in the 1st season while it recorded (0.43±0.11 and 0.31 ±0.10) formed (4.01 and 2.07%) at Nubaria Kafr El-Sheikh region, respectively in the 2nd season.

True spiders ranked the third and second order with population density (0.63±0.08 and 4.21±0.18) formed (7.35% and 35.11%) at Nubaria and Kafr El-Sheikh regions, respectively in the 1st season while in 2nd season, it ranked the third order in both regions with population density of (0.82 ±0.08 and 5.09±0.11) formed (7.64% and 33.98%), respectively.

Generally, Kafr El-Sheikh region gave the highest population density about Nubaria region, where the mean number of population's density were (2.40±0.25 and1.71±0.07) in the 1st season, while in the 2nd season, it was (3.00±0.14 and 2.15±0.10) at Kafr El-Sheikh and Nubaria regions, respectively.

The listed results in Figure (1) indicated that in 2020 season, the whitefly population (adults and nymphs) started to appear on June 21th with total number were 64 and 118 individual /sample in Nubaria and Kafr El-Sheikh regions, respectively. Judging by the population it's increased gradually forming two peaks of abundance on August 2nd and 23th by 258 and 484 insects /sample in Nubaria while, Kafr El-Sheikh regions, recorded peaks on August 2nd and 30th by 518, 1825 individuals /sample, respectively. Then, population tended to decline until the end of the growing season. In the second season, data revealed that the first appearance of the whitefly, adults and nymphs on soybean plants took place in the fourth week of June (80 and 97 insects /sample) at Nubaria and Kafr El-Sheikh regions, respectively. After that, the population increased gradually recording two peaks of abundance at the same time in August (1st and 15th) by 484 and 435 individuals /sample in Nubaria. As well as, Kafr El-Sheikh regions, the population recorded peak on August 30th by 1281 individuals /sample, In general, the population was higher than Kafr El-Sheikh about Nubaria regions during the two study seasons.

The listed results in Figure (2) illustrated that in 2020 season, *Aphis gossypii* population (adults and nymphs) started to appear on 19th July and 21st June with total number were 51 and 9 individual /sample in Nubaria and Kafr El-Sheikh regions, respectively. Judging by the population it's increased gradually forming one peak of abundance on August 2nd by 140 insects /sample in Nubaria while, Kafr El-Sheikh regions, recorded two peaks on August 2nd and September 27th by 84 -1329 insects/sample, respectively. Then, population tended to decline until the end of the growing season. In the second season, data (Fig.2) revealed that the first appearance of *Aphis gossypii*, adults and nymphs on soybean plants took place in August 2nd and 28th June (60 and 3 insects /sample) in Nubaria and Kafr El-Sheikh regions, respectively. After that, the population increased gradually recording peak of abundance in August 9th by 149 and 435 insects /sample in Nubaria. As well as, Kafr El-Sheikh regions, the population recorded two peaks on August 9th and October 4th by 149-551 insects/sample.

The listed results in Figure (3) indicated that in 2020 season, *Nezara viridula* population (adults and nymphs) started to appear on 19th July and 21st June with total number were 5 and 7 individual /sample in Nubaria and Kafr El-Sheikh regions, respectively. Judging by the population it's increased gradually forming 2 peaks of abundance on August 23rd and September 6th by 33 -23 insects/sample, respectively insects /sample in Nubaria while, Kafr El-Sheikh regions, recorded 2 peaks on July 26th and September 6th by 90 -169 insects/sample insects/sample, respectively. Then, population tended to decline until the end of the growing season. In the second season, data (Fig.3) revealed that the first appearance of *Nezara viridula*, adults and nymphs on soybean plants took place in 26th July and 28th June (5 and 4 insects /sample) in Nubaria and Kafr El-Sheikh regions, respectively. After that, the population increased gradually recording two peaks of abundance at the same time in August 9th and September 13th by 29 and 11 insects /sample in Nubaria. As well as, Kafr El-Sheikh regions, the population recorded two peaks on August 16th and September 13th by 79 - 99 insects/sample, in general, the population was higher than Kafr El-Sheikh about Nubaria regions during the two study seasons.

The listed results in Figure (4) indicated that in 2020 season, *Empoasca app* population (adults and nymphs) started to appear on 21st June with total number were 44 - 40 individual /sample in Kafr El-Sheikh region during the two seasons, respectively. Judging by the population it's increased gradually forming four peaks of abundance on 28th June, August 2nd, August 30th and September 13th by 95 – 501- 368 -396 insects/sample, respectively. Kafr El-Sheikh region. Then, population tended to decline until the end of the growing season. In the second season, data (Fig. 4) revealed that the first appearance of *Empoasca app*, adults and nymphs on soybean plants took place in the fourth week of June (40 insects /sample) in Kafr El-Sheikh region. After that, the population increased gradually recording three peaks of abundance at in 26 July, August 16th and September 13th by 238 – 437 – 439 insects/sample Kafr El-Sheikh region.

These results are in accordance that the obtained by El-Sarand (2005) who observed that the *Ch. carnea* was the most dominant predator on soybean in 1999 and 2000 seasons. Desneux et al. (2006) who reported that the anthocorid, *Orius insidious* (Say) represented the dominant predator collected in soybean and other predators coccinellidae, spiders, syrphid larvae and lacewing appeared in low numbers during the two seasons. Cortez- Mondaca et al. (2008) showed that four species of Chrysoperla, and one of Ceraeochrysa in three semi commercial fields of soybean highly preferred whiteflies. *Chrysoperla ruflilabris* was the dominant species followed by *Chrysoperla externa* (together comprising more than 88% of the specimens obtained). Also, Chun et al. (2009) found *Orius minutes* (L.) and *P. japonica* was the main mortality factors of aphids during the early stages of soybean. Yadav et al. (2015) found that the predatory beetles began to appear on soybean field during 2010 season in the 2nd week of August and its population slightly increased and peaked at 63 days after sowing. The maximum population of spiders appeared at 35 days after sowing, in the second week of August and its population increased up to 49 days after sowing in the field. Eissa (2018) stated that *Ch. carnea* (Steph.) was the most abundant predators during the two seasons. El-Sarand et al. (2018) stated that *Ch. carnea* (Steph.) was the most dominant one followed by *P. Alfierii* (Koch.), *C.undecimpunctata* L., true spiders and *Scymnus* spp during the two seasons.

Predators	1st season (2020)				2nd season (2021)			
	Nubaria		Kafr El-Sheikh		Nubaria		Kafr El-Sheikh	
	Mean ± SE*	F. O. %**	Mean ± SE*	F. O. %**	Mean ± SE*	F. O. %**	Mean ± SE*	F. O. %**
Chrysoperla carnea	5.29±0.12	61.73	5.15±0.18	42.95	6.19±0.19	57.69	6.25±0.13	41.72
Coccinella undecimpunctata	2.26±0.02	26.37	2.18±0.15	18.18	3.04 ±0.08	28.33	2.76±0.30	18.42
Paederus alfierii	0.13±0.04	1.52	0.29±0.06	2.42	0.25±0.06	2.33	0.57±0.08	3.81
True spiders	0.63±0.08	7.35	4.21±0.18	35.11	0.82 ±0.08	7.64	5.09±0.11	33.98
Orius sp.	0.26±0.08	3.03	0.16±0.07	1.33	0.43±0.11	4.01	0.31 ±0.10	2.07
Total	8.57±0.34	100	11.99±1.27	100	10.73±0.52	100	14.98 ±0.72	100
Mean ± SE	1.71±0.07	-	2.40±0.25	-	2.15±0.10	-	3.00±0.14	-

* Standard error **F.O.: Frequency of occurrence.

Table 2: Distribution of population density and frequency of occurrence for predators that infesting soybean plants/sample in Nubaria and Kafr El-Sheikh regions during 2020 and 2021 seasons.

The optimum time in controlling of Bemsia tabaci

The predator/*Bemsia tabaci* ratio as a decision-making basis is a critical component in integrated pest management, where the optimal time of insecticidal application is limited to increase predator population density. Based on biotic and abiotic factors, each insect population density has an optimal time to grow and develop, as shown in Table (3). The predator/*B. tabaci* ratio on soybean fields at Nubaria and Kafr El-Sheikh regions during the 2020 and 2021 seasons, where the wide gap between *B. tabaci* population density and predators was (13.44 and 30.42) to one predator at Nubaria and Kafr El-Sheikh regions, respectively on 23rd and 30th August (2020), while it was (9.68 and 18.57) at Nubaria and Kafr El-Sheikh regions, respectively on 16th and 30th August (2021). This time in Nubaria region is easy to interfere with the control about Kafr El-Sheikh region to reach the limit of natural balance and reduce the both of the insects and insecticides so that insects doesn't acquire the resistance. These results are highly in agreement with those obtained by Rana et al. (2012) who found that the effect of line graphs of predator-prey ratio (p/p) were appositively significant correlation. Youssif et al. (2017) evaluated predators/prey ratio during seasons study with means 1:61.62 and 1:118.73 respectively and the correlation values were highly positive significant correlation.

Dates	1st season (2020)						2nd season (2021)					
	Nubaria			Kafr El-Sheikh			Nubaria			Kafr El-Sheikh		
	Bemsia tabaci	Predators	B./P. Ratio	Bemsia tabaci	Predators	B./P. Ratio	Bemsia tabaci	Predators	B./P. Ratio	Bemsia tabaci	Predators	B./P. Ratio
21st June	64	12	5.33	118	8	14.75	80	18	4.44	97	20	4.85
28th June	88	20	4.40	188	26	7.23	100	29	3.45	138	23	6.00
5th July	155	17	9.12	185	36	5.14	174	41	4.24	179	39	4.59
12th July	169	42	4.02	272	47	5.79	203	50	4.06	363	63	5.76
19th July	175	34	5.15	368	78	4.72	213	45	4.73	339	74	4.58
26th July	185	29	6.38	410	84	4.88	281	47	5.98	406	86	4.72
2nd August	258	31	8.32	518	89	5.82	349	40	8.73	482	106	4.55
9th August	213	42	5.07	400	59	6.78	395	43	9.19	604	117	5.16
16th August	269	42	6.40	671	55	12.20	484	50	9.68	927	89	10.42
23rd August	484	36	13.44	1237	54	22.91	385	47	8.19	1072	85	12.61
30th August	464	40	11.60	1825	60	30.42	435	50	8.70	1281	69	18.57

6th September	454	52	8.73	1184	59	20.07	333	61	5.46	1085	70	15.50
13th September	395	49	8.06	909	61	14.90	302	42	7.19	807	53	15.23
20th September	329	57	5.77	683	47	14.53	177	42	4.21	597	43	13.88
27th September	320	33	9.70	607	29	20.93	89	46	1.93	393	24	16.38
4th October	150	23	6.52	257	15	17.13	68	47	1.45	210	41	5.12
11th October	68	25	2.72	88	8	11.00	91	32	1.50	129	17	7.59
Mean	249.41	34.35	7.10	583.53	47.94	12.89	242.12	43.35	5.46	535.8 2	59.94	9.15

Table 3: Predator/*Bemsia tabaci* ratio on soybean fields in Nubaria and Kafr El-Sheikh regions during 2020 and 2021 seasons.

Influence of main abiotic factors on main soybean insect

Results in Table (4) showed that partial correlation coefficient values for the population density of main piercing-sucking insects, associated predators and main abiotic factors (Temperature, relative humidity and wind speed), in Egyptian soybean fields during 2020 and 2021 seasons, intend to forecast the optimum time of insect pests' appearance, limits the emergency time to insect pests' control on Integrated pest management control.

Influence of Temperature

Correlation coefficient values for insect pests were positive with temperature in both regions except *Ch. carnea* and *P. alfierii* in Kafr El-Sheikh region was negative correlation. The relationship between soybean insect pests and temperature were studied, and noticed that soybean insects could divided into three groups, as data presented in Table (4). The first group was highly significant with temperature that included *B. tabaci* and *C. undecimpunctata* at Nubaria region while *N. viridula* and *Empoasca* at Kafr El-Sheikh. The second group was significant with temperature that included *N. viridula* and *Ch. carnea* at Nubaria region while *B. tabaci* at Kafr El-Sheikh region. The third group was not significant with other insect pests in both regions during 2020. In the second season of 2021, the partial correlation coefficient values for insect pests were positive with temperature in both regions except *Aphis gossypii* in Kafr El-Sheikh region was correlated negatively. The relationship between soybean insect pests and temperature were studied, and divided into three groups, as data presented in Table (4). The first group was highly significant with temperature that included *B. tabaci*, *A. gossypii*, *N. viridula*, *P. alfierii* and *Orius* sp. at Nubaria region whereas *Ch. carnea* and True spiders at Kafr El-Sheikh region. The second one included these species *Ch. carnea* and *C. undecimpunctata* that were significant with temperature at Nubaria region but *B. tabaci*, *N. viridula*, *Empoasca spp.* and *C. undecimpunctata* were significant with temperature at Kafr El-Sheikh region. The third group included true spiders at Nubaria, *Aphis gossypii P. alfierii* and *Orius sp*. at Kafr El-Sheikh region were not significantly.

Influence of relative humidly

In the first season of 2020, relative humidity limits the activation and development of many soybean insect pests and partial correlation coefficient values where positive correlations with all insect pests expect *Orius* sp. and *A. gossypii* were negatively correlation at Nubaria and Kafr El-Sheikh regions. The significantly was highly with *Empoasca spp*. and true spiders, significantly with *Ch. carnea* and non-significantly with other insect pests in two regions.

In the second season of 2020, relative humidity limits the activation of many soybean insect pests and Partial correlation coefficient values at Nubaria region were positive with all insect pests except *Aphis gossypii* was negatively correlation while Kafr El-Sheikh region all insect pests had negative correlation expect *C. undecimpunctata* was positive and non-significant in both regions.

Influence of wind speed

In the first season of 2020, the partial correlation coefficient values were positive correlation with all insect pests and not significant expects *Orius sp*. was negatively correlation and *Aphis gossypii* was significant at Nubaria region, whereas Kafr El-Sheikh region was positive correlation with *B. tabaci*, *N. viridula*, *Empoasca spp*., *Ch. carnea*, *P.alfierii* and true spiders and negative correlation with *A. gossypii*, *C. undecimpunctata* and *Orius sp*. The significantly was highly with *Empoasca spp*. and true spiders, significantly with *A. gossypii* and *Chr carnea* and non-significantly with other insect pests at Kafr El-Sheikh region.

In the second season of 2021, partial correlation coefficient values at Nubaria region were positive with all insect pests except *Chr. carnea*, *C. undecimpunctata*, *Orius sp*. and true spiders were negatively correlation while Kafr El-Sheikh region all insect pests had negative correlation expect *Ch. carnea*, *Orius sp*. and true spiders were negative correlation. The significantly with wind speed and insect pests was highly significant with *B.tabaci*, significant with *P. alfierii* at Nubaria region and non-significant with other insect pests in both regions.

The obtained results agree with those of Khanzada et al., (2013) who observed a highly positive correlation between whitefly, temperature and relative humidity on soybean during 2005 season. In contrast, Magouz et al. (2006) showed that temperature and relative humidity had insignificant effect on the population density of *B. tabaci* on soybean, but the combined effect of the two weather factors was less pronounced. Eissa (2018) and El-Sarand et al. (2018) revealed that the three weather factors (temperature, relative humidity and wind speed) were within the optimal range activity of the insect as, its effect was insignificant.

Factors / Insect pests	1st season (2020)						2nd season (2021)					
	Nubaria region			Kafr El-Sheikh region			Nubaria region			Kafr El-Sheikh region		
	Temp (C°)	R.H (%)	W.S (km/h)	Temp (C°)	R.H (%)	W.S (km/h)	Temp (C°)	R.H (%)	W.S (km/h)	Temp (C°)	R.H (%)	W.S (km/h)
Bemsia tabaci	0.697**	0.324	0.397	0.630 *	0.026	0.105	0.801**	0.303	0.656**	0.602*	-0.085	0.132
Aphis gossypii	0.339	0.245	0.534*	0.263	-0.267	-0.523*	0.739**	-0.127	0.359	-0.241	-0.383	0.273
Nezara viridula	0.581*	0.134	0.199	0.723**	0.093	0.293	0.826**	0.085	0.503	0.531*	-0.348	0.202
Empoasca spp.	0.00	0.00	0.00	0.689**	0.650**	0.745**	0.00	0.00	0.00	0.454*	-0.364	0.253
Chrysoperla carnea	0.523*	0.298	0.128	-0.012	0.548*	0.630*	0.519*	0.441	-0.014	0.818**	-0.040	-0.253
Coccinella undecimpunctata	0.702**	0.328	0.245	0.451	0.148	-0.128	0.552*	0.025	-0.323	0.557*	0.334	0.044
Paederus alfierii	0.369	0.346	0.269	-0.186	0.496	0.060	0.664**	0.363	0.633*	0.402	-0.397	0.189
Orius sp.	0.188	-0.002	-0.458	0.108	0.384	-0.079	0.645**	0.157	-0.146	0.111	-0.388	-0.094
True spiders	0.312	0.254	0.435	0.481	0.684**	0.676**	0.257	0.173	-0.146	0.870**	-0.237	-0.312

** Correlation is significant at 0.01 probability level.

* Correlation is significant at 0.05 probability level.

Table 4: Partial correlation coefficient values for the population density of main piercing-sucking insects, associated predators and main abiotic factors, in Egyptian soybean fields during 2020 and 2021 seasons.

The role of the main insect predators in controlling some soybean piercing-sucking insects

Results in Table (5) showed the partial correlation coefficient values between the main predators and piercing-sucking insects in Egyptian soybean fields during 2020 and 2021 seasons as follows:

The main predators included *Chrysoperla carnea*, *Coccinella undecimpunctata*, *Paederus alfierii*, *Orius sp*. and True spiders but the piercing-sucking insects included (*Bemsia tabaci*, *Aphis gossypii* and *Nezara viridula*) in both regions and Empoasca spp. appeared in Kafr El-Sheikh region only.

The green lacewing, Chrysoperla carnea (Stephens)

In 1st season (2020), the green lacewing, *Ch. carnea* correlated positively with *B. tabaci* and *N. viridula* with correlation values 0.566* and 0.496, respectively, negatively correlation with *A. gossypii* (-0.382) in Nubaria region while in Kafr El-Sheikh region, the correlation values were positive with *N. viridula* and *Empoasca spp*. with correlation values 0.729** and 0.341, respectively in the first season and negative with *B. tabaci* (-0.681**) and *Aphis gossypii* (-0.140).

In 2nd season (2021), the green lacewing, *Ch. carnea* correlated positively with *B. tabaci* with correlation value 0.194, negatively correlation with *N. viridula* and *A. gossypii* (-0.025 and -0.042) in *Nubaria region* while in Kafr El-Sheikh region, the correlation values were negatively with *B. tabaci*, *Aphis gossypii*, *N. viridula* and *Empoasca spp*. with correlation values (-0.803**, -0.609*, -0.819** and -0.856**), respectively.

The eleven spotted ladybird, Coccinella undecimpunctata

In 1st season (2020), the eleven spotted ladybird, *C. undecimpunctata* correlated positively with *B. tabaci*, *A. gossypii* and *N. viridula* with correlation values 0.347, 0.164 and 0.035 respectively, in Nubaria region while in Kafr El-Sheikh region, the correlation values were positive with *B. tabaci*, *Aphis gossypii*, *N. viridula* and *Empoasca spp*. with correlation values (0.498, 0.862**, 0.729** and 0.153), respectively.

In 2nd season (2021), the eleven spotted ladybird, *C. undecimpunctata* correlated positively with *Aphis gossypii* and *N. viridula* with correlation values 0.129 and 0.298, negatively correlation with *B. tabaci* (-0.026) in *Nubaria region* while in Kafr El-Sheikh region, the correlation values were positively with *B. tabaci* with correlation value (0.383) and negatively correlation with *A. gossypii*, *N. viridula* and *Empoasca spp*. with correlation values (-0.188, -0.068 and -0.272) respectively.

The rove beetle, Paederus alfierii

In 1st season (2020), the rove beetle, *P. alfierii* correlated positively with *B. tabaci*, *A. gossypii* and *N. viridula* with correlation values 0.679*, 0.369 and 0.792** respectively, in Nubaria region while in Kafr El-Sheikh region, the correlation values were negative with *B. tabaci*, *Aphis gossypii*, *N. viridula* and *Empoasca spp*. with correlation values (-0.334, -0.328, -0.538* and-0.064), respectively.

In 2nd season (2021), the rove beetle, *P. alfierii* correlated positively with *Aphis gossypii* and *N. viridula* with correlation values (0.683**, 491 and 0.639*), respectively in Nubaria region while in Kafr El-Sheikh region, the correlation values were positively with *Aphis gossypii*, *N. viridula* and *Empoasca spp*. with correlation values (0.182, 0.074 and 0.125), respectively and negatively correlation with *B. tabaci* with correlation value (-0.142).

Orius sp.

In 1st season (2020), *Orius sp*. correlated negatively with *B.tabaci*, *Aphis gossypii* and *N. viridula* with correlation values (-0.329, -.507 and -0.414) respectively, in Nubaria region while in Kafr El-Sheikh region, the correlation values were positive with *A. gossypii*, *N. viridula* and *Empoasca spp*. with correlation values (0.265, 0.109 and 0.140), respectively and negatively correlation with *B. tabaci* with correlation value (-0.167).

In 2nd season (2021), *Orius sp*. correlated negatively with *B. tabaci*, *Aphis gossypii* and *N. viridula* with correlation values (-0.097, -0.129and -0.277) respectively, in Nubaria region while in Kafr El-Sheikh region, the correlation values were negative with *B. tabaci*, *A.gossypii*, *N. viridula* and *Empoasca spp*. with correlation values (-0.096, -0.110, -0.006 and -0.372), respectively.

True spiders

In 1st season (2020), True spiders correlated positively with *A. gossypii* with correlation value 0.710*, and negatively with *B. tabaci* and *N. viridula* with correlation values (-0.476 and -0.529), respectively in Nuibaria region while in Kafr El-Sheikh region, the correla-

tion values were positive with *B. tabaci*, *N. viridula* and *Empoasca spp*. with correlation values (0.786**, 0.884** and 0.660*), respectively and negative with *A. gossypii* with correlation value (-0.612*).

In 2nd season (2021), True spiders correlated positively with *B. tabaci* and *A. gossypii* with correlation values 0.283 and 0.026, negatively correlation with *N. viridula B. tabaci* (-0.131) in Nubaria region while in Kafr El-Sheikh region, the correlation values were positively with *B. tabaci A. gossypii*, *N. viridula* and *Empoasca spp*. with correlation values (0.817**, 0.474, 0.831** and 0.871**), respectively.

The obtained results agree with those of Taha et al. (2001) revealed that these was a significant relationship between the infestation of soybean sucking pests and the climatic factors, temperature and relative humidity. Younes et al. (2001) found that, there was a Significant positive correlation between the tested weather factors and aphid population density in two seasons, but whitefly exhibited negative correlation with R.H in both seasons. Magouz et al. (2006) revealed that, the population of whitefly affected insignificantly by temperature and relative humidity on Giza 21, 22 and 111) during 2003 and 2004 seasons. Ali et al. (2013) found highly positive significant correlation between population of *A. craccivora* and maximum, minimum temperature and mean relative humidity. Eissa (2018) who found that the effect of the predators on *B. tabaci* population in soybean fields was positive and insignificant during the studied. El-Sarand et al. (2018) found that there was a highly significant and positive correlation between predators and considered insects in two seasons. El-khayat et al. (2020) revealed that, the statistical parameters for the three selected weather factors minimum and maximum temperature and percentage of relative humidity on population density of *B. tabaci* had insignificant negative effects on this insect except Maximum temperature in the second season had significant positive effects on the seasonal fluctuations and Aphis had insignificant negative effects in both seasons for all varieties except in the first season, temperatures had significant positive effects 2015 and 2016 seasons.

In contrast, Khattab (2003) reported that the temperature had positive significant effect on the green stink bug, *N. viridula* L. population in soybean fields in 1st season, while the effect was insignificant in the second season.

Conclusions

Soybean fields attacked by piercing-sucking insects from July to September, and predators increased during the study. As a result, in general, the population was higher than Kafr El-Sheikh about Nubaria regions during the two study seasons., research measures are critical in the control of insects to safe environment and the enhancement of natural enemies on these human nutrition crops particularly admits the harvest.

Predators / Piercing-sucking Insects	1st season (2020)										2nd season (2021)									
	Nubaria region					Kafr El-Sheikh region					Nubaria region					Kafr El-Sheikh region				
	Chrysoperla carnea	Coccinella undecimpunc-tata	Paederus alfierii	Orius sp.	True spiders	Chrysoperla carnea	Coccinella undecimpunc-tata	Paederus alfierii	Orius sp.	True spiders	Chrysoperla carnea	Coccinella undecimpunc-tata	Paederus alfierii	Orius sp.	True spiders	Chrysoperla carnea	Coccinella undecimpunc-tata	Paederus alfierii	Orius sp.	True spiders
Bemsia tabaci	0.566*	0.347	0.679*	-0.329	-0.476	-0.681**	0.498	-0.334	-0.167	0.786**	0.194	-0.026	0.683**	-0.097	0.283	-0.803**	0.383	-0.142	-0.096	0.817**
Aphis gossypii	-0.382	0.164	0.369	-0.507	0.710*	-0.140	0.862**	-0.328	0.265	-0.612*	-0.042	0.129	0.491	-0.129	0.026	-0.609*	-0.188	0.182	-0.110	0.474
Nezara viridula	0.496	0.035	0.792**	-0.414	-0.529	0.729**	0.729**	-0.538*	0.109	0.884**	-0.025	0.298	0.639*	-0.277	-0.131	-0.819**	-0.068	0.074	-0.006	0.831**
Empoasca spp.	0.00	0.00	0.00	0.00	0.00	0.341	0.153	-0.064	0.140	0.660*	0.00	0.00	0.00	0.00	0.00	-0.856**	-0.272	0.125	-0.372	0.871**

** Correlation is significant at 0.01 probability level.

* Correlation is significant at 0.05 probability level.

Table 5: Partial correlation coefficient values for the population density of main piercing-sucking insects and associated insect predators in Egyptian soybean fields during 2020 and 2021 seasons.

References

1. Abd El-Samad AA, AZN Al-Habshy and MA Ahmed. "Survey and population density of some dominant homopterous insects attacking soybean plants". J. Plant Prot. and Path., Mansoura Univ 2.7 (2011): 707-719.
2. Ali SHAM, AAA Saleh and Nadiae E Mohamed. "Aphis craccivora Koch. and predators on faba bean and cowpea in newly reclaimed areas in Egypt". Agric. Res 91.4 (2013): 1423-1438.
3. Boethel DJ., et al. "Delayed maturity associated with southern green stink bug (Heteropetra: Pentatomidae) injury at various soybean phonological stages". J. Econ. Entom 93.3 (2000): 707-712.
4. Chun CD., et al. "Community structure of natural enemies of the soybean aphid in soybean field". China Journal. et. Cn (2009): 452-455.
5. Cortez-Mondaca E, FJ Orduno-Cota and M Lopez-Buitimea. "Species of Chrysopidae associated with whiteflies in soybean in northern Sinaloa, Mexico". Southwestern Entomologist 33.2 (2008): 153-155.
6. Desneux N, RJO Neil and HJS Yoo. "Suppression of population growth of the soybean aphid, Aphis glycines Matsumura, by predators: the identification of key predators and the effects of prey dispersion, predator abundance, and temperature". Environmental Entomology 35.5 (2006): 1342-1349.
7. Eissa Ghada MF. "Studies on certain piercing-sucking insects infesting soybean plants at Kafr El-Shiekh governorate". Ph. D thesis (Agric.), Tanta University, Tanta University (2018): 112.
8. El-Dessouki WA, Mohsena RK Mansour and Nevein L Eryan. "Effects of Certain Weather, Biotic Factors and Chemical Components on The population of Aphids in Egyptian Wheat Fields". Egypt. Acad. J. Biolog. Sci 15.1 (2022): 1-13.
9. El-khayat EF., et al. "Population Density of Soybean Piercing Sucking Pests in Relation to Varieties, Chlorophyll and Some Weather Factors". J. of Plant Protection and Pathology, Mansoura Univ 11.2 (2020): 115-119.
10. El-Samahy MFM and IAI Saad. "Population density of certain piercing sucking pests on three soybean varieties in relation to some leaf characteristic". Plant Prot. and Path., Mansoura Univ 1.10 (2010): 767-773.
11. El-Sarand EA. "Integrated management of certain piercing sucking insects on soybean and faba bean plants at Kafr ElSheikh Governorate". Ph. D. Thesis, Fac. of Agric. Tanta Univ (2013): 194.
12. El-Sarand EA., et al. "Population dynamics of certain piercing-sucking insects and the common associated predators in soybean fields at Kafr El-Sheikh governorate, Egypt". J. Plant Pro. Res 6.2 (2018): 54-70.
13. El-Sarand EA. "Ecological and biological studies on some leafhoppers (Homoptera: Cicadellidae)". M.Sc. Thesis, Fac of Agric. Tanta Univ (2005): 99.
14. El-Srand EA. "Ecological and biological studies on some leafhoppers (Homoptera: Cicadellidae)". M. Sc. Thesis, Fac. of Agric. Tanta Univ (2005): 99.
15. Hamid OF. "Integrated pest management of certain insect pests infesting cowpea plantation at Mansoura district, Dakahlia governorate". Ph. D Thesis, Fac. Agric. Mansoura Univ., Egypt (2015): 197.
16. Iqbal J., et al. "Diagnosis of important insect pests of soybean in Peshawar, Pakistan". J. Biol. Sc 3.6 (2008): 1017-1019.
17. Khanzada SR., et al. "Relative resistance of soybean cultivars against sucking insect pests". Pakistan J. Sci 65.2 (2013): 197-201.
18. Khattab MAA. "Ecological and biological studies on the green bug, Nezara viridula L. (Pentatomidae: Hemiptera)". Ph.D. Thesis, Fac. Agric., Tanta Univ (2003): 147.
19. Khattab MAA, AM Nassef and EME Khalafalla. "Relative susceptibility of some soybean varieties to the main piercing-sucking insects' infestation in Kafr El- Sheikh Governorate". J. Plant Prot. and Path., Mansoura Univ 3.7 (2012): 751-756.
20. Kogan M and DC Herzog. "Sampling methods in soybean". Entom., Springer Verlag, New York (1980): 507.
21. Magouz RIE, SE Saadoon and SAA Kassem. "Population density of Tetranychus cucurbitacearum (Sayed) and Bemisia tabaci (Genn.) on certain soybean varieties in relation to some weather factors and leaf chemical contents". Agric. Res. Tanta Univ 32.1 (2006): 95-102.
22. Netam HK, R Gupta and Sh Soni. "Seasonal incidence of insect pests and their biocontrol agents on soybean". J. Agric. and Veter. Sci 2.2 (2013): 7-11.

23. Rana SA., et al. "Predator-prey association among selected arthropod species in the cropland of mixed–crop zone (mcz) and cotton-wheat Zone (cwz)". J. of animal and plant sci 22.4 (2012): 1019-1023.
24. SPSS. Statistical Package 1-56827-390-8 SPSS 15.0 Command Syntax Reference, SPSS Inc., Chicago (2006).
25. Taha HA., et al. "Susceptibility of ten soybean varieties to some sucking pests with respect to certain climatic factors ineffectiveness". J. Agric. Mansoura Univ 26 .8 (2001): 5059-5066.
26. Yadav P., et al. "Effect of Weather Factors on Seasonal Incidence of Insect-Pests of Soybean". J. Multidisciplinary Advance Res 4.1 (2015): 46-51.
27. Younes AA, SM Soliman and SE Saadooon. "Ecological studies on some sucking insects and mites associated with certain soybean cultivars". J. Agric. Sci. Mansura Univ 26.7 (2001): 4551-4558.
28. Youssif MAI, SHAM Ali and WMM Helaly. "Cereal aphid's species (Homoptera: Aphididae) infesting wheat plants and their ahidophagous insects at El-Khattaara distric. El-Sharkia governorate, Egypt". J. Plant Protec. And Path., Mansoura Univ 8.11 (2017): 581-589.

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