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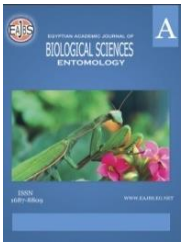

Effects of Certain Weather, Biotic Factors and Chemical Components on The population of Aphids in Egyptian Wheat Fields.

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ABSTRACT

Aphid is assumed one of the most severe pests attacking wheat causing harm to the plants either directly by sucking juice or indirectly as a vector of diseases. Host plant resistance is a sturdy component in Integrated Pest Management (IPM) to decrease the injury of aphid insects. We studied the population abundance and susceptibility of two Egyptian wheat cultivars (Misr 1 and Misr 3) to Aphid spp infestation. The results indicated that the total number of Aphids on wheat Misr 1 variety during the seasons, 2019-2020 and 2020- 2021 were 536 and 191 respectively whereas, on Misr 3 variety were 1274 and 1388 respectively. The results of the simple-correlation during 2020 season, aphid density was insignificantly correlated with a daily mean of maximum temperature, daily mean of minimum temperature, daily mean of rainfall and R.H%, whereas, the relationship was significant with predatory insects. In 2021, a significant relationship with a daily mean of maximum temperature, daily mean of minimum temperature and predatory insects were found. For the effect of plant age, simple correlation showed a positive and significant effect with Age^1 and Age^2 with (r) values were 0.58 and 0.48 respectively, whereas the second season was negative and insignificant with Age^2 and Age^3 and positive insignificant effect with Age^1. Here, we tested the susceptibility of two wheat varieties to the infested with Aphid density, the highest infestation of aphid species on wheat Misr 3 variety associated with highest total protein (12.2%) and total phenols content (0.95±0.04 mg/gm), whereas, the least infestation by aphid species on wheat Misr 1 variety associated with least total protein and phenols content.

INTRODUCTION

Many pests attack the wheat plants result in great loss in goodness and proportion of the yield. However, there is a gap between the production and consumption of wheat in Egypt. The major insect pests in cereal crops in Egypt are the greenbug, *Schizaphis graminum* (Rondani), *Rhopalosiphum padi* L., to a losser extent the corn leaf aphid, *Rhopalosiphum maidis* (Fitch) and *Sitobion avenae* (Fab). The greenbug (*Schizaphis graminum*) (Homoptera: Aphididae) is a major aphid species attacking cereal crops and responsible for viral disease transmission of the plant. The yield losses due to infestation

with aphids have differed from 7.5 to 18.7% (Tantawi 1985; EL-Rawy 2013). **S**urveyed that wheat plants confirmed the presence of two aphid species, *R. padi* and *S. graminum* attacking the wheat plants *R. padi* was the dominant aphid species during the tested seasons (Mansour 2012**).** *R. padi*, *R. maidis*, *S. graminum* and *S. avenae*. Were limited as the main cereal aphid species on wheat plants (Ghanim and El-Adl 1983; Tantawi *et al*. 1986; Sobhy *et al*. 2004; Adly *et al*. 2006).

Insect predators are widely distributed and considered as important component in biological control and integrated pest management programs (IPM) as they prey on a range of pests including aphids, scale insects, mealy bugs and larvae of some species of Lepidoptera and Coleoptera (Mousa 2009; Mansour 2012). *Syrphus spp* in the third predators status after *C. undecimpunctata* and *C. carnea* (Samad 2004**;** El- Heneidy and Rizk 2004; Yigit *et al*. 2007).

Most IPM pest control techniques have been used, i.e. biological, cultural, mechanical, physical, chemical, and the resistance of the host plant has been shown to be the best tools in the world to reduce and decrease aphid damages (Junaid *et al*. 2016). Aphid feeding can lead to variation in host plants, including changes in morphology, modification of resource allocation, and local and systemic symptom evolution (Walling 2008). Phenolic components earnestly affect the behaviour and metabolism of pests, resulting in descending in resistant plants' pest populations (Alba *et al*. 2015; Tripathi *et al*. 2019).

Wheat (*Triticum aestivum* L.) is the most important grain crop all over the world. In Egypt, it is the main winter cereal crop that gained particular importance for human consumption According to the Food and Agriculture Organization (FAO) of the United Nations (Alsahary 2014). The wheat variety Misr 3 has some advantages, for example, wheat bread profuse branching, and the latest varieties of high yield wheat, wide adaptation and adaptability to climatic conditions.

In this study, we investigated the seasonal abundance of species aphid (Hemiptera: Aphididae): the green cereal bug aphid (*Schizaphis gramium*), the bird cherry-oat aphid (*Rhopalosiphum padi),* the corn leaf aphid (*Rhopalosiphum maidis*), and the english grain aphid (*Sitobion avenea*) and their predatory insects, *Scymnus* spp (Coleoptera-Coccinellidae), the eleven spotted lady- beetle (*Coccinella undecimpunctata*), the green lacewing (*Chrysoperla carnea*), the rove beetle (*Paederus alfierii*), Syrphus fly *(Syrphus corolla*). We studied the effect of certain biotic and biotic factors on the population of Aphids spp. Compare the susceptibility of two wheat varieties to the infested with Aphid density were tested through the information of chemical contents of wheat plants.

MATERIALS AND METHODS

Field Study:

We conducted field experiments during two seasons; 2019-2020 and 2020 -2021 at Kafr El-Sheikh Governorate, in Sakha Agricultural Research Station. The wheat variety Misr 1 and Misr 3 were seeded in mid of November during the two successive seasons 2019-2020 and 2021. The experimental area was about 672 m^2. Each planting variety was about 336 m^2 divided into four replicates, each replicate was 84 m^2 and the replicates were arranged in a Completely Randomized Design. The examination started 30 days after seeding till the end of the season (harvesting of the crop). The normal agricultural practices were carried out without any insecticidal treatments throughout the seasons. To determine the population density (Nymphs and adults) of Aphids spp and their insect predators, weekly samples of 10 wheat tillers/ replicate were picked up randomly, and the number Aphids spp and their associated predators were carefully identified and counted.

The predatory species were counted per plant; larvae and adults of *Scymnus* spp

(Coleoptera- Coccinellidae), and the eleven spotted lady- beetle, *Coccinella undecimpunctata*, (F.1758) (Coleoptera- Coccinellidae), adults of the rove beetle, *Paederus alfierii* Koch (Coleoptera- Staphylinidae), eggs and larva of the green lacewing, *Chrysoperla carnea* (Stephens) and larvae of Syrphus fly, *Syrphus sp* (F.,1794) (Diptera-Syrphidae). The weather factors: temperature, relative humidity and rainfall were obtained from the Meteorological Station of Sakha, Egypt.

Laboratory Experiments:

Relationship of Wheat Leaves Constituents and Aphid Insects Population Infestation:

To study the relationship between the chemical contents of wheat plants and their infestation rate by the tested aphid insects we collected weekly fresh leaves of the tested plant varieties (Misr 1 and Misr 3). The mean total of phenols was determined on component of chemical analysis accurate - plant Protection Research Institute, Giza. The number of total Phenols in extracts was determined by Folin- Ciaocateu method as modified by (Singelton and Rossi 1965).

To determine if the total protein and total carbohydrates we dried and milled of tested plant varieties (Misr 1 and Misr 3 varieties) and analyzed by electromagnetic spectrum, using Near-InfraRed (NIR) Spectroscopy apparatus, model DA1650, which was manufactured by FOSS corporation at the central laboratory. Fac. Agric. AL-Azhar univ. The data were tabulated and subjected to statistical analysis.

Statistical Analysis:

Simple correlation and regression coefficient between the weather factors, third-degree plant age and population of Aphids spp were done with SAS 9.1 (Anonymus 2003). Data were suited to the polynomial model, where plant age (as weeks) was offered as the third degree of the polynomial (i.e. Age, Age^2 and Age^3), this would simulate the change in the host plant nutritional value for the pest. Results of the number of aphids and some plant content are reported as means ±SE.

RESULTS AND DISCUSSION

Seasonal abundance of Aphids spp in wheat varieties, Misr 1 and Misr 3 during first season 2019-2020 and second season 2020- 2021:

The Green Cereal – Bug Aphid, *Schizaphis graminum* Rondani:

Data illustrated in Fig. (1a) clarified the population fluctuation of *S. graminum* on Misr1 variety during the first season 2019- 2020 the number of *S. graminum* began with 2 insects / 40 plants in the 4th week of December 2019 and two peaks were recorded on 1st and 2nd week of March 2020 and represented by 103 and 155 insects., respectively. As for Misr 3 variety, *S. graminum* recorded two peaks in the 4th week of February and the 1st week of March 2020 (106 and 185 insects/40plants), respectively. The highest peak of 233 insects / 40 plants was recorded in the 2nd week of March Fig. (1b) Then, the population decreased to disappear at the end of the season. The greenbug, *S. graminum* (Rondani), is a major pest of wheat worldwide (Bouktila *et al.,* 2012).

Our observations recorded that in the 2021 season, the nymphs and adults of *S. graminum* started firstly in low numbers (10 insects/ 40 plants) in the 4th week of January 2021, the population increased to 84 insects/ 40 plants in the 4th week of March 2021 Fig. (1c). For Misr 3 variety, data arranged in Fig. (1d) showed the *S. graminum* were observed in the 4th week of December 2020 with a low number (1 insect / 40 plant). Then the population began to increase recording a peak in the 4th week of February (218 insects/ 40 plants.

The Bird Cherry-Oat Aphid, *Rhopalosiphum padi* Linnaeus:

In the first season, *R. padi* aphids began with 2 insects/ 40 plants on (variety, Misr

1) recorded in 1st week of January 2020 and three peaks were recorded in 2nd week of Feb., 2nd and 4th week of March 2020 and represented by 60, 204 and 250 insects, respectively, Fig. (1a). As for Misr 3 variety, *R. padi* aphids started firstly in low numbers (2 insects /40plants) in 3rd week of December and three peaks were recorded in 4th week of Jan., 1st and 4th week of March 2020 and represented by 52, 174 and 373 insects, respectively, Fig. (1b). *R. padi* was the most abundant aphid species in Egypt (El-Heneidy 1994).

In the 2020- 2021 season, the first occurrence of *R. padi* aphids on Misr 1 variety was recorded in the 3rd week of January 2021(6 insects/ 40 plants) and the highest peak of 82 insects was recorded in the 1st week of March 2021 Fig. (1c). For Misr 3 variety, Fig. (1d) showed the numbers of *R. padi* began with low numbers (2 insects) in 3rd week of December and the highest peak of (319 insects/40plants) was recorded in 4th week of February 2021.

The Corn Leaf Aphid, *Rhopalosiphum maidis* (Fitch):

Results in Fig. (1a) clarified the population density of *R. maidis* on Misr 1 variety in the 2019- 2020 season, the number of *R. maidis* began with 2 insects/ 40 plants in 3rd week of Jan. 2020 and two peaks were recorded in the 4th week of February and 2nd week of March 2020 and represented by 50 and 90 insects, respectively. For Misr 3 variety, the number of *R. maidis* started to appear with 3 insects/40 plants in 1st week of January 2020 and two peaks were recorded in 4th week of February and 2nd week of March 2020 and represented by 66 and 114 insects Fig. (1b).

Regarding the 2020- 2021 season, the highest peak of *R. maidis* 3 insects / 40 plants was recorded in the first week of March 2021. Afterward, the population decreased to disappear at the end of the season Fig. (1c). For Misr 3 variety, data in Fig. (1d) showed the number of *R. maidis* that were observed in the 4th week of December 2020 with a low number (3 insects / 40 plants). Two peaks were recorded in the 1st and 3rd week of February 2021 and represented by 57 and 93 insects, respectively.

The English Grain Aphid, *Sitobion avenea* Fabricius:

In the first season, the number of *S. avenae* aphid started to appear with low numbers (7 insects/40 plants) in the 2nd week of January 2020 and then it increased to reach its peak 144 insects/ 40 plants in 3rd week of March Fig. (1a). As for Misr 3 variety, the number of *S avenae* began with low numbers 2 insects/40 plants in 3rd week of December 2019 and then it increased to reach a peak 327 insects/40 plants in 3rd week of March 2020 Fig. (1b).

Our result cleared that in the 2021 season, the first occurrence of *S. avenea* aphids on wheat Misr 1 variety was recorded in the 2nd week of February 2021 (15 insects/ 40 plants). The highest beak was recorded in the 3rd week of March (19 insects/40 plants) Fig. (1c). For Misr 3 variety, the first occurrence of *S. avenea* aphids was recorded in the 3rd week of December 2020 (2 insects/40 plants). The highest number of *S. avenea* was recorded at the 3rd week of February 365 insects Fig. (1d). The mean number of *S. avenea* /10 tillers reached 43.32% of mean insect pests in the 2016 season, and 79.4% in the 2017 season (Awadalla *et al*., 2018).

Data in Fig. (2) recorded the weekly mean of maximum temperature, minimum temperature, relative humidity and rainfall during the 2019- 2020 and 2020-2021 seasons.

Data presented in Table (2) showed the total numbers of Aphids on wheat varieties during two seasons. The results indicated that the total number of Aphids on wheat Misr 1 variety during the seasons, 2019-2020 and 2020- 2021 were 536 and 191 respectively, whereas, on Misr 3 variety were 1274 and 1388 respectively.

Our study showed that the common species during the two seasons was *S. avenae* which attacked wheat plants from February to the 3rd week of April causing damage due to direct nutrition on spikes. Slman (2006) reported that *R. padi* was the most dominant cereal

aphid followed by *S. graminum*, *R. maidis*, and *S. avenae* during the 2004 and 2005 seasons, the population of aphids peaked on 26- 27 March and synchronized with the highest number of *C. undecimpunctata***.** Three aphids' species; *R. maidis*, *R. padi* and *S. avenae* were instituted infesting three cultivars of wheat (Gemiza-9; Giza-168; Sakha-93). *R. maidis* was the most numerous species followed by *R. padi* and *S. avenae*, wheat plants that were sown in early December had significantly infested by aphids (Helmi *et al*., 2013). *R. padi* was the most abundant aphid species in Egypt (El-Heneidy, 1994). The first occurrence of the aphid infestation on wheat plants in the 1991 and 1992 seasons was in mid-January and the population reached its peak in March. Then, the aphid population decreased slowly at the end of the season (El-Ansary 1993).

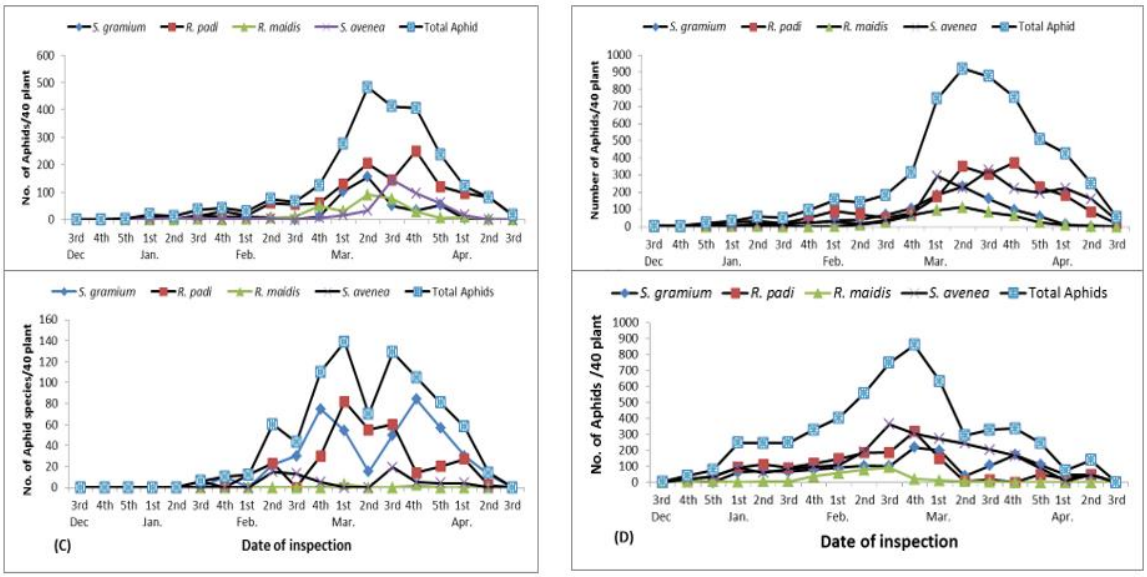

Fig. 1: Population density of aphid species on wheat plants during the first season (2019-2020) varieties, Misr 1(A) and Misr 3 (B) and the second season (2020- 2021) varieties, Misr 1(C) and Misr 3 (D) at Kafr El-Sheikh Governorate.

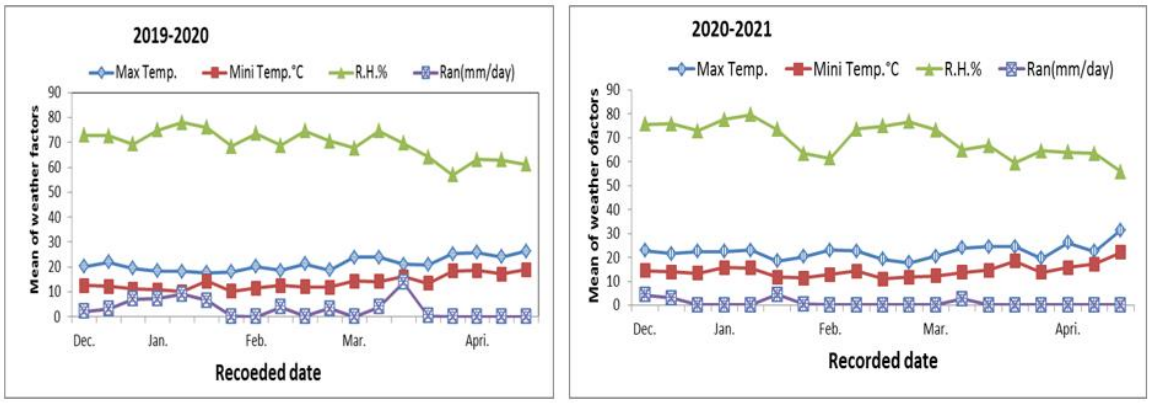

Fig. 2: Mean of maximum temperature, minimum temperature (ºC), R.H. (%) and ran fall (mm/day) in Kafr El-Sheikh Governorate during 2019- 2020 and 2020-2021 seasons.

Seasonal Abundance Of Insect Predators Associated with Aphid spp in Wheat Varieties, Misr 1 and Misr 3 During First Season 2019-2020 and Second Season 2020-2021:

The Eleven Spotted Lady- Beetle, *Coccinella undecimpunctata* L.:

Results in Fig. (3a) showed the population abundance of C. *undecimpunctata*, on Misr 1 variety in 2019- 2020 season, the number of *C. undecimpunctata* began with 3 individual/ 40 plants was recorded at 2nd week of January 2020 then it increased to reached

its peak (7 individual) at 1st week of April. For Misr 3 variety, the number of *C. undecimpunctata* began with 1individual was recorded at 2nd week of January 2020 then it increased to reach a peak (59 individual/ 40 plants) at 4th week of March Fig. (3b).

The results cleared that in the 2021 season, the number of *C. undecimpunctata* began with 1 individual in the first week of March 2021 then it rose to reach a peak of 6 individuals in the 2nd week of April 2021 Fig. (3c). (Sabbour 2007) found that predators of *C. undecimpunctata* were the most aphidophagous predator laboratory and field case against the cereal aphids, *R. padi* L. and *R. maidis*. For Misr 3 variety, the number of *C. undecimpunctata* started to appear with low numbers (5 insects/40 plants) in 1st week of January 2021, then it increased to reach a peak (44 individual) in 3rd week of February. Afterward, the population decreased to disappear at the end of the season Fig. (3d). Similar trends were found by (Ghanim and El-Adl 1983; El- Heneidy and Rizk 2004; Slman and Ahmed 2005; Slman 2006) who mentioned that *C. undecimpunctata* was the most specific aphid predator.

Ladybirds, *Scymnus* spp Muslant**:**

Results in Fig. (3a) showed the number of *Scymnus* spp began with 3 individuals in the 3rd week of January 2020 then it increased to reach its highest number of 9 indiv. in 3rd week of March in the 2020 season. For Misr 3 variety, the number of *Scymnus* spp began with 2 individuals in the 3rd week of January 2020 then it increased to reach a peak number of 11 indiv. in the 2nd week of March 2020 Fig. (3b).

In the second season of 2021, for Misr 1 variety the number of *Scymnus* spp, began with a low number 1 individual in the 3rd week of January 2021 and the highest peak was recorded in the 1st week of April (9 individual) Fig. (3c). As for Misr 3 variety, the number of *Scymnus* spp, began with 3 indiv. in the 1st week of February 2021 and the highest number was recorded in the 2nd week of March and represented by 15 individual Fig. (3D). *Scymnus sp.* was found associated with aphids species on wheat plants with a percentage of 10.14% of mean insect predators in the 2016 season, while, there were 2.5 ±0.29 indiv. with a percentage of 11.23% in the 2017 season (Awadalla *et al*. 2018).

The Green Lacewing, *Chrysoperla carnea* (Stephens)**:**

In the 2019-2020 season, the number of *C. carnea* (eggs and larvae) began with 3 individual /40 plants in the 2nd week of January and the highest number was recorded at the 3rd week of March 2020 and represented by 40 individual Fig. (3a). For Misr 3 variety, the number of *C. carnea*, started with low numbers (1 individual/40 plants) in the 4th week of December 2019 and the highest number was recorded at 4th week of March 2020 (66 individual) Fig. (3b).

During the second season 2021on wheat Misr 1 variety, the number of *C. carnea* began with 3 individuals in the 2nd week of January 2021 and the highest number was recorded at 4th week of February and represented by 9 individual/ 40plants Fig. (3C). For Misr 3 variety, *C. carnea* insects began with number 5 individual in 4th week of December and the highest number was noticed at 4th week of March 2021 and represented by 70 individual /40 plants Fig. (3d).

Syrphus Fly, *Syrphus* sp**:**

In the 2019-2020 season, the number of *Syrphus* sp began with 1 larva in the 3rd week of January 2020 and the highest population was recorded at the 3rd week of March 2020 (7 larvae/40 plants) Fig. (3a). For Misr 3 variety, the number of *Syrphus* sp began with 3 larvae in 1st week of January 2020 and three peaks were recorded in 2nd week of Feb. 2020, 3rd and 5th week of March and represented by 36, 55 and 72 larvae/40 plants, respectively Fig. (3b).

In the 2020- 2021season, the highest numbers were recorded in the 4th week of

March 2021(8 larvae/40 plants) on Misr 1 variety Fig. (3C). As for Misr 3 variety, *Syrphus* sp started to appear with low numbers (6 larvae/40 plants) in the 4th week of December 2020 and the highest number (47 larvae) was recorded at 4th week of Mar. 2021 Fig. (3d). The mean numbers of the hover-fly, *Metasyrphus corollae* (Fab.) were 1.5± 0.50 individuals formed 8.70% in the 2016 season of the mean recorded predators, and 3 ±0.41 indiv., formed13.48% in 2017 season (Awadalla *et al.* 2018).

The Rove Beetle, *Paederus alfierii* Koch:

Our study recorded that in the 2019-2020 season, the number of *P. alferii* began with 1adult in the 2nd week of January and the highest beak was recorded (2 adult/40 plants) at the 3rd week of March Fig. (3a). For Misr 3 variety, the number of *P. alferii* began with 1adult in the 1st week of Feb. 2020 and the highest beak was recorded (6 adult/40 plants) at 5th week of March Fig. (3b).

In the 2020- 2021 season, *P. alferii* insects started with low numbers (1adult/ 40 plants) in the 3rd week of February 2021 then it increased to reach the highest numbers (5 adults/40 plants) in the 3rd week of March Fig. (3C). For Misr 3 variety, the first occurrence of *P. alferii* began with 3 adults in the 3rd week of February 2021, then it increased to reach the highest numbers (9 adults/40plants) at 4th week of March Fig. (3d). The current results are in agreement with (Hafez 1994; Megahed 2000; El-Heneidy and Abdel-Samad 2001; El-Fatih 2006; El- Gapaly 2007) they reported that *Paederus alfierii* was listed as associated with different cereal aphid species.

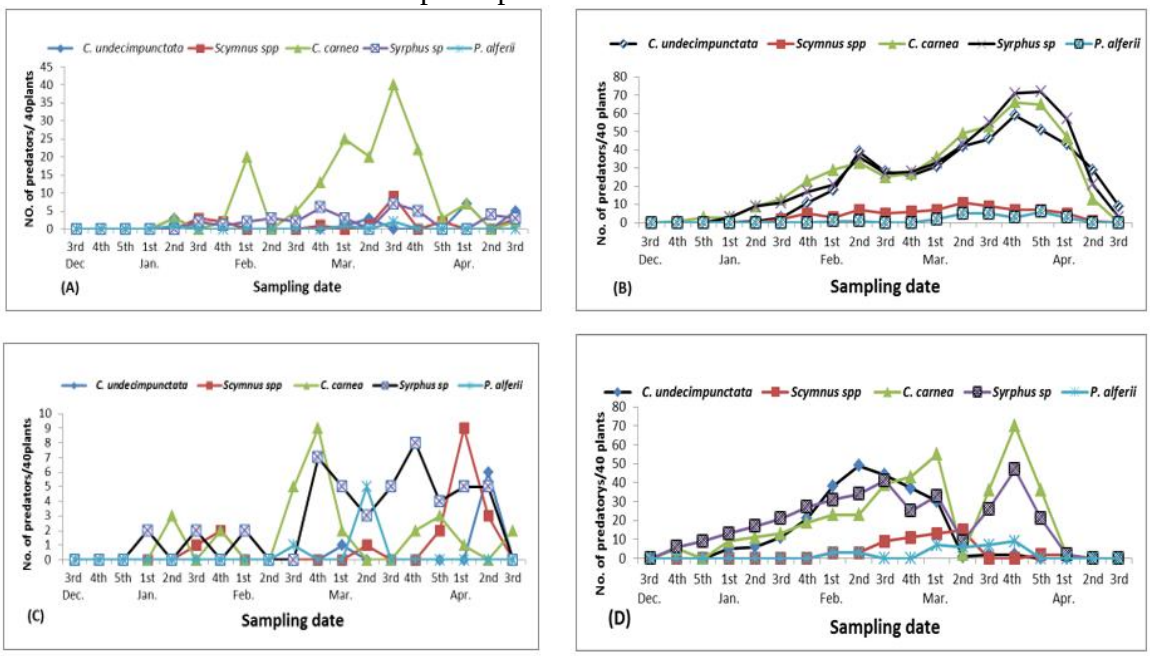

Fig. 3: Seasonal abundance of predatory insects on wheat plants during the first season (2019- 2020) varieties, Misr 1(A) and Misr 3 (B) and the second season (2020- 2021) varieties, Misr 1(C) and Misr 3 (D) at Kafr El- Sheikh Governorate.

The results of the Population fluctuations of insect predators associated with Aphid spp in wheat Misr 3 variety indicated that in the 2020 season, *Syrphus* sp was high abundance population of predatory insects flowed by *C. carnea*; *C. undecimpunctata* Fig (3b), whereas in 2021 season, *C. carnea* insects was high population flowed by *Syrphus* sp**;** *C. undecimpunctata* Fig (3d). Syrphids disappeared before the first sampling date, also observed that syrphids insects at most associated with *D. plantaginea* and *Rhopalosiphum fitchii* (Sanderson), colonies of which build up earlier than those of *A. pomi* in Ohio apple orchards (Bruno *et al*. 2008). This paper is very important to avoid the harmful of aphid

insects through a reduction in the abundance by using appropriate control method according to Integrated Pest Management (IPM).

Effect of Biotic and Biotic Factors on the Population Density of Aphids spp.

Table (1) shows the statistical analyses of factors affecting the population density of Aphids spp during the studied years (2019-2020& 2020-2021).

Previous studies took into consideration many abiotic factors (such as temperature, relative humidity and rainfall) and biotic factors (such as plant age and presence of predators) that affect the population density of Aphids spp.

In the first season (2019- 2020), the data of simple correlation table (1) showed that the relationship was insignificant for the 4 weather factors tested in the aphid population (daily mean of maximum temperature, r = 0.41; daily mean of minimum temperature, r = 0.38; daily mean of rainfall, r = 0.04; R.H%, r =0.27), whereas, the relationship was significant with predatory insects, r = 0.84.

For the effect of plant age, simple correlation showed a positive and significant effect in Age^1 r =0.58; Age^2 r =0.48 and positive and insignificant effect with Age^3. Furthermore, the regression analysis indicated that the relationship was insignificant with a daily mean of maximum temperature, daily mean of minimum temperature, daily mean of rainfall and R.H% and significant with predatory insects, $Age^{1,}$ Age^2 and Age^3 respectively.

The combined effect of the climatic factors, predators and the insect population was 25%, whereas, the combined effect of the plant age and the insect population was 82%. The combined effect of all studied factors on the Aphid population was 90%.

Mansour (2012) found that predatory insects were most persistent during March and April that was especially obvious with *C. undecimpunctata, S. interruptus, P. alfierii,* correlations were positive and highly significant between *R. padi*. Population and C. *undecimpunctata, C. vicina isis, C. vicina nilotica, P. alfierii, S. interruptus,* and *C. carnea*. Simple correlation with the population of *S. graminum* and predatory insects were positive in two seasons.

In 2021 season, for the simple correlation, the relationship was a negative and significant relationship between the insect population two weather factors tested in aphid population (daily mean of maximum temperature, r =- 0.55; daily mean of minimum temperature, r = - 0.54), whereas, insignificant relationship with a daily mean of rainfall, r = -0.32; R.H% r = 0.27 (Table 1).

For the effect of plant age, simple correlation showed negative and insignificant with Age^2 and Age^3 and insignificant positive effect in Age^1.

The partial regression values. Table (1) shows that all values were insignificant except predatory insects, b = 0.181.

The combined effect of the climatic factors, predators and the insect population was 45%, whereas, the combined effect of the plant age and the aphid population was 72%. The combined effect of all studied factors on the Aphid population was 84%.

Possible causes of the reduction in the abundance of Aphids out of the joint effects of weather factors and changes in agricultural practices. The current results are in agreement with Solangi *et al*. (2008) who cleared that a positive correlation between insect predators and piercing-sucking insect populations. The second wheat plantation (mid of November) were a positive and significant effect between insect predators, C. *undecimpunctata, C. vicina isis, C. vicina nilotica, P. alfierii, S. interruptus,* C. *carnea*. and *R. padi,S. graminum, S. avenea* (Mansour 2012). These results agree partially with those of Mohamed et al. (2019) who found that the variances in levels of cereal aphids infestation between the seasons might be attributed to the variation in weather factors (temperature and RH) and the common natural enemies.

Our results indicated that the obtained values for plant age (presenting the change in the nutritional value of the host plant) which was explained variance (E.V.) 82% in the first season and 72 % in the 2nd studied season. The compiled effect of weather factors was not more significant than plant age. This indicated that the change in the nutritional value of the host plant was more effective on Aphid population dynamics than weather factors. The results of the current study agree with those of Abou–Setta (2020) who recorded that the change in available nutritional value (which is changed during the growing season) becomes the major factor effects on the population of *Tetranychus urticae*, this factor is affected by host plant biological phenomena (various stages of growth and their nutritional contents). Most research has been performed in plants and has offered a range of positive, neutral, or negative effects on growth, produce, and constructional resource distribution (Niklas 1998; Appel and Cocroft 2014). The population of aphids increased remarkably by the advance of wheat plant growth to maturity and the maximum population of aphids recorded when the plant age was in an average of 93 days in (mid-February) concurs with a maximum temperature from 25.71 to 26.71°C and maximum R.H ranged from 72.43 to 73.57%., these conditions pose to be the suitable range for the reproduction of the cereal aphids on wheat plants (Mohamed *et al*., 2019)**.**

Table 1: Simple correlation and Partial regression values of two biotic and three abiotic factors on the variability of the population fluctuation of Aphids spp on wheat Misr 3 variety during 2019-2020 and 2020-2021.

Seasons	Factors	Simple correlation		Partial regression		E.V%
		R	P	B	p	
2019 - 2020	Daily mean max. temperature	0.417	0.075	1.080	0.127	25
	Daily mean mini. temperature	0.384	0.104	-0.75	0.308	
	Daily mean rainfall	0.041	0.86	0.663	0.030	
	R.H	-0.272	0.258	0.029	0.909	
	predators	0.841	0.0001	0.18	0.0001	
	Age^1	0.585	0.0008	-4.92	0.022	82
	Age^2	0.481	0.03	0.866	0.001	
	Age^3	0.364	0.120	-0.032	0.0004	
	Combined effect	-	-	-	-	90
2020 - 2021	Daily mean max. temperature	-0.557	0.013	-0.488	0.366	45
	Daily mean mini. temperature	-0.541	0.016	0.242	0.736	
	Daily mean rainfall	-0.328	0.169	-0.746	0.261	
	R.H	0.271	0.260	0.268	0.159	
	predators	0.891	<.0001	0.181	<.0001	
	Age^1	0.085	0.726	2.55	0.14	72
	Age^2	-0.116	0.635	-0.05	0.787	
	Age^3	-0.247	0.306	-0.003	0.583	
	Combined effect	-	-	-	-	84

EV=explained variance RH= relative humidity, Age^1 to Age^3 = Age of plants

Relationship of Wheat Plant Constituents and Insect Population Infestation:
Effect of Total Protein and Total Carbohydrates:

Data in Table (2) shows the highest total protein was found in Misr 3 variety (12.2%) with the highest infestation of aphid species and the least total protein was found in Misr 1 variety (11.6%) with the least infestation by aphid species. The total carbohydrates showed the highest value in Misr 1 variety (74.2 %) with the least infestation by aphid species whereas, the least carbohydrates levels showed the highest infestation degree by aphid population.

Table 2: Relationship of wheat plant constituents and insect population infestation.

Parameters	Varieties	
	Misr 1	Misr 3
Total aphid in 1st season	536	1274
Total aphid in 2nd season	191	1388
Mean no. of aphids during 2 seasons	363.5 ±172.5	1331 ± 57
Total protein %	11.6	12.2
Total carbohydrates %	74.2	73.9
Mean total phenols mg/gm fresh weight	0.84 ± 0.03	0.95±0.04

Effect of Mean Total Phenols:

The total phenols content occurred in Misr 3 variety (0.95±0.04 mg/gm) with the highest infestation of aphid species and the lowest values of phenols showed lower infestation levels of aphid population.

Our results summarized that most infestation of aphid species associated with the highest total protein and lower total carbohydrates in wheat variety Misr 3. Although total phenols content occurred in Misr 3 variety with the highest infestation of aphid species.

Previous studies stated that there are important factors influencing host choice by other physical plant defenses; toughness, and optical stimuli characters which limit insect orientation to the food plants (Juniper and Jeffree 1983). Three wheat verities; Misr 2, Giza 168 and Gemmeiza 7 had minimal infestation by cereal aphids (37.3, 62.2 and 65.2 aphids/10 plants, respectively) (EL-Rawy 2013). Aphid feeding differed by the plant host species and the resistance mechanism shown by the plants (Shah et al. 2015; Iqbalet al. 2018). Three tested phenolic elicitors (Aspirin, benzoic and salicylic acids) resulted in reducing *Tetranychus urticae* Koch populations at an average of 36.94, 32.1 and 25.24%, respectively compared with the control (Alakhdar *et al*. 2021).

Conclusion

This study is very important to avoid the harmful of aphid insects through a reduction in the abundance by using appropriate control method according to Integrated Pest Management (IPM). The change in the nutritional value of the host plant was more effective on Aphid population dynamics than weather factors. Results provide evidence indicating that the chemical contents of wheat plants affect the rate of infestation by tested aphid insects.

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ARABIC SUMMARY

تأثيرات بعض العوامل الجوية والحيوية والمحتوى الكيميائى على تعداد المن فى حقول القمح المصرى

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يعد منّ القمح من الافات الخطيرة التى تهاجم محاصيل الحبوب النجيلية ومسؤول عن إنتقال الأمراض الفيروسية والفطرية للنبات. وتعتبر مقاومة النبات للإصابة الحشرية ركيزة أساسية فى الإدارة المتكاملة للآفات (IPM) للحد من أضرارها.

تمت دراسة حساسية صنفين من القمح المصرى مصر1 ومصر 3 وكذلك الكثافة العددية لحشرات المن على الصنفين،اشارت النتائج الى ان التعداد الكلى لحشرات المن على صنف القمح مصر1 خلال موسمى الدراسة 2020و 2021 كان 536و 191على الترتيب،وبالنسبة لصنف مصر3 كان التعداد الكلى 1274و 1388على الترتيب.

وفى الموسم الأول أوضحت النتائج وجود علاقه ارتباط غيرمعنوية التأثير بين تعداد المن ومتوسط درجات الحراره العظمى ومتوسط درجات الحراره الصغرى ومتوسط قطرات المطروالرطوبه النسبيه بينما كان الارتباط معنوى التأثيرمع تعداد المفترسات الحشرية.

فى الموسم الثانى كانت العلاقة معنوية التأثيرمع متوسط درجات الحراره العظمى ومتوسط درجات الحراره الصغرى والمفترسات الحشرية.

كما اشارت النتائج الى وجود علاقة ارتباط موجبة ومعنوية مع عمرالنبات باليومAge1 وضعف العمرAge2 وذلك فى الموسم الاول، بينما فى الموسم الثانى2021 فكانت علاقة الارتباط سالبة وغيرمعنوية مع ضعف العمر Age2 وثلاثة اضعاف عمر النبات باليوم Age3 وكانت علاقة الارتباط موجبة غيرمعنوية التأثيربالنسبة لعمرالنبات Age1

اما عند دراسة التركيب الكيميائى لمكونات صنفين القمح النبات وعلاقته بالإصابة بحشرات المن وجد ان نسبة الإصابة الأعلى على صنف القمح مصر3 كانت مرتبطة مع اعلى قيمة لمحتوى النبات من البروتين(12.2%) ومحتوى كلى للفينول(0.9مجم/جم) بينما كانت الإصابة الاقل بأنواع المن على الصنف مصر1 مع محتوى بروتين اقل للنبات ونسبة اقل من محتوى الفينول.