# Ecological Studies on Aphid Species Infesting Main cereal Crops

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**Abstract**

The present work was conducted during 2012/2013 and 2013/2014 seasons to survey aphid species infesting maize, wheat and barley at Abo-Hammad district, Sharkia Governorate, Egypt. Effects of some climatic factors on population of the dominant aphid species were also studied. The aphids, *Rhopalosiphum maidis* (Fitch), *Rhopalosiphum padi* (L.), *Schizaphis graminum* (Rond.) and *Sitobion avenae* (F.) were collected from wheat and barley plants, while *R. maidis* (Fitch), *R. padi* (L.) and *Aphis gossypii* (Glov.) were collected from maize plants. Plant sample proved to be efficient method to collect and survey aphid species during the two successive seasons of investigation. Regarding the seasonal abundance on maize, *R. maidis* (Fitch) recorded one peak at the 2nd week of August in both seasons 2012 and 2013 (1640 and 1250 individuals/sample, respectively), also *R. padi* (L.) and *A. gossypii* (Glov.) had one peak in the 3rd week of August in 2012 and 2013 seasons (978 & 95 and 815 & 91 individuals/sample, respectively). On wheat, *R. padi* (L.) and *R. maidis* (Fitch) were represented by one peak at the last week of February in 2012/2013 and 2013/2014 seasons (320 & 285 and 450 & 266 individuals/sample, respectively), while *S. graminum* (Rond.) recorded one peak on the first week of March in 2012/2103 and 2013/2014 seasons (87 and 79 individuals/sample, respectively). *S. avenae* (F.) recorded one peak on the 2nd week of April in both studies seasons (199 and 710 individuals/sample, respectively). On barley, *R. padi* (L.) was represented by one peak at the third week of February in 2012/2013 and 2013/2014 seasons (238 & 271 individuals/sample, respectively) but the only peak of *R. maidis* (Fitch) was at the third and fourth week of February in 2012/2013 and 2013/2014 seasons (246 & 174 individuals/sample), respectively. *S. graminum* (Rond.) recorded one peak on the 3rd and 4th week of February in 2012/2103 and 2013/2014 seasons (34 and 35 individuals/sample), respectively. The results indicated that the tested meteorological factors play a great role in regulating the population density and seasonal abundance of these aphid species.

**Keywords:** Maize, Wheat, Barley, aphids, Climatic Factors

## Introduction

Maize (***Zea mays* L.**), Wheat (***Triticum aestivum* L.**) and barley (***Hardeum vulgare* L.**) are considered the most important crops used as human food in Egypt. As a result of the expansion of cultivated graminaceous crops the problems of insect pests have been increased in the last years subjected to attack by a large number of insect pests throughout the growing seasons, **Hashem, (2005)**. Aphids cause serious damage either directly by sucking plant juice or indirectly as vectors of virus diseases (**Hashem, 1997** and **Abd– Elsamed, 2006**).

The aphid species, *Rhopalosiphun padi* (L.), *Schizaphis graminum* (Rond.), *R. maidis* (Fitch), *Sitobion avenae* (F.) and *A. gossypii* infested maize and wheat plants {in Egypt, **Abou El-Hagag** and **Abdel-Hafez**, **(1998)**; **Hegab, (2001)** and **Abd-Elsamed**, **(2006)**; in Kenya, **Wangal *et al.*, (2000)**; in Pakistan, **Akhtar, (2002)**; in USA, **Hadi *et al.*, (2011)** and in Iran**, Nassab *et al.*, (2013)**}. They found that the average daily temperature and relative humidity played important role in controlling aphid populations in wheat and maize fields. Aphid density peaked on wheat in the end of February (**Akhtar,**

**2002** in Pakistan). Also**,** in Pakistan, aphid individuals appeared on all cultivars/lines at the 3rd week of January and reached its peak on the middle of March on all the cultivars/lines and totally eliminated at the 1st week of April (**Muhammad *et al.,* 2004**). In Egypt, *R. maidis* and *R. padi* peaked at the mid of August and at the first week of March on maize and wheat plants, respectively, while *S. graminum* (on wheat) and *A. gossypii* (on maize) was represented at mid of March and at the third week of August, respectively (**Abd-Elsamed, 2006).**

The present study is contributed towards a better knowledge about dominant aphid species infesting maize, wheat and barley crops, the efficiency of the different sampling techniques and effects of certain climatic factors on the population density of these aphid species.

## Material and methods

Ecological studies on the important common aphid species were carried out at Abo-Hammad district, Sharkia Governorate. The area of experiments (1450 m²) planted with maize, wheat and barley plants during the two successive seasons 2012/

2013 and 2013/ 2014. The experimental area was divided into nine equal plots. Each crop has been represented by three replicates (plots). Randomized Complete Block design was the used design in all growing seasons of maize, wheat and barley.

Date of maize sowing was in the 2nd week of May 2012 and 2013 seasons, while wheat and barley sowing dates were at the mid of November in both seasons (2012/2013 and 2013/2014). Normal agricultural practices were timely followed. Sampling started when the age of maize, wheat and barley plants reached about 21 days and continued at weekly intervals throughout the period of growth until the end of September for maize and the first week of May for wheat and barley.

Two sampling methods were used to survey the aphid species infesting maize, wheat and barley plants:-

**1- Plant samples**

Weekly maize samples of 10 leaves and 5 tassels were taken randomly from 5 plants, whereas the weekly wheat and barley samples were 25 tillers. The infested leaves and tassels were kept in paper bags .The samples were examined in the laboratory and the number of individuals of alatae, apterous and nymphs were separately counted and recorded by using a hand lens (5 X). A simple apparatus was used for this purpose, which consistes of a wooden desk, a white card board paper divided into 4 cm. A part column put in the bottom on which a glass plate was placed and the upper surface of the glass plate was allowed to be wet with fine droplets of water to reduce the movement of counted aphid, **(Hegab et al., 1987)**. The plants were carefully shaken on the plate and the aphid insects were counted using a small brush in each column. The aphid species were preserved in 90% ethyl-alcohol and identified according to **Habib and El-kady, (1961) and Blackman and Eastop, (2000).**

**2-Yellow sticky board traps**

Three yellow sticky board traps were used for each crop in this experiment. The weekly counts of captured aphid species were counted and recorded for each trap. The aphid species were identified according to **Habib and El-kady, (1961) and Blackman and Eastop, (2000).**

The daily recorded of both maximum and minimum temperature degrees along with relative humidity during 2012/2013 and 2013/2014 seasons were obtained from the Agrometeorological station at Zagazig city.

The relationship between the weekly mean numbers of collected aphid species and the corresponding weekly means of maximum, minimum temperatures and relative humidity were estimated. Partial regression was applied to show the effect of each factor on the population density of the aphid species under investigation.

The obtained results were statistically analyzed; correlation coefficient, explained variances and partial regression values were estimated according to **Costat, (1990)**.

**Results and Discussion**

**I. Survey of aphid species on maize, wheat and barley plants**

In the present work, five aphid species were surveyed by two methods of collection (Plant samples and yellow sticky board traps) on maize, wheat and barley (Table, 1):

1) Corn leaf aphid, *Rhopalosiphum maidis* (Fitch)
2) Bird cherry-oat aphid, *Rhopalosiphum padi* (L.)
3) Greenbug, *Schizaphis graminum* (Rond.)
4) English grain aphid, *Sitobion avenae* (F.)
5) Cotton aphid, *Aphis gossypii* (Glover)

Plant sample and yellow sticky board traps were effective to survey aphid species during 2012/2013 and 2013/2014, but the plant sample is more efficient. These results agreed with those of **Hegab et al., (1987),** who mentioned that yellow sticky board and plant sample seemed to be the most efficient to evaluate aphid species in maize and wheat fields in newly reclaimed sandy areas. They collected *A. gossypii* from maize crop only. **Abd-El-samed, (1999 and 2006)** mentioned that sticky trap is one of the best sampling methods available for estimating winged aphids population in wheat and maize fields, therefore sticky traps could be used to determine the relative winged aphid density.

The most extensive infestation by *R. maidis* (F.) was recorded on maize plants, followed by wheat and barley plants. Concerning the total number of *S. avenae* (Fabr.), it was found that *S. avenae* was rarely existence on barley. In the first season, the population on wheat plants was about 9 folds the population on the barley, but it recorded around 40 folds in the second season.

**II. Seasonal abundance of aphid species on maize, wheat and barley plants**
**1-Maize**
**a. The corn leaf aphid, *Rhopalosiphum maidis* (Fitch)**

During both seasons the corn leaf aphid were found during the period from the 1st week of July to the 3rd week of September. The mean numbers of aphid collected from maize plants during 2012 and 2013 seasons were graphically illustrated in Figs., (1, 2). The highest population density of *R. maidis* individuals occurred in the 2nd week of August with a total number, 1640 and 1250 individuals/sample in 2012 and 2013 seasons, respectively at mean temperature of 31.79 ˚C with 44.79% R.H. and 29.00 ˚C with 50.36% R.H. for the two seasons, respectively. The population of *R. maidis* was greater

in the first season (approximately 1.5 folds) than in the second season (Table, 1).

**b. The bird cherry-oat aphid, *Rhopalosiphum padi* (L.)**

The first sample of *R. padi* were collected in the mid of July from maize plants during the two seasons (2012 and 2013). The mean numbers of aphid, *R. padi* infesting maize plants were graphically illustrated in Figs., (1, 2). The obtained data show one peak of *R. padi* activity on maize plants in the 3rd week of August with a total number of 978 and 815 individuals/sample in 2012 and 2013 seasons, respectively at mean temperature of 29.64 ˚C with 50.71 % R.H. and 29.00 ˚C with 56.08 % R.H. for the two seasons, respectively. Regarding the weekly counts of *R. padi*, it is clear that this species

**Table 1.** Total number of aphid species infesting main cereal crops at Abo-Hammad, Sharkia Governorate collected by using plant sample and yellow sticky board traps during 2012/2013 and 2013/2014 seasons

| Aphid Species | Cereal Crops | Total no. of aphids collected by | | | |
| | | Plant sample | | yellow sticky board traps | |
| | | 2012/2013 | 2013/2014 | 2012/2013 | 2013/2014 |
|---|---|---|---|---|---|
| *Rhopalosiphum maidis* | Maize | 20791 | 14173 | 1300 | 1061 |
| | Wheat | 3899 | 4267 | 615 | 647 |
| | Barley | 3362 | 3643 | 426 | 418 |
| *Rhopalosiphum padi* | Maize | 10547 | 8710 | 1215 | 883 |
| | Wheat | 7937 | 8611 | 1058 | 1170 |
| | Barley | 3617 | 3832 | 811 | 625 |
| *Sitobion avenae* | Wheat | 801 | 5465 | 88 | 1359 |
| | Barley | 88 | 136 | 14 | 29 |
| *Schizaphis graminum* | Wheat | 1571 | 1764 | 144 | 94 |
| | Barley | 581 | 442 | 85 | 65 |
| *Aphis gossypii* | Maize | 1269 | 1132 | 88 | 89 |
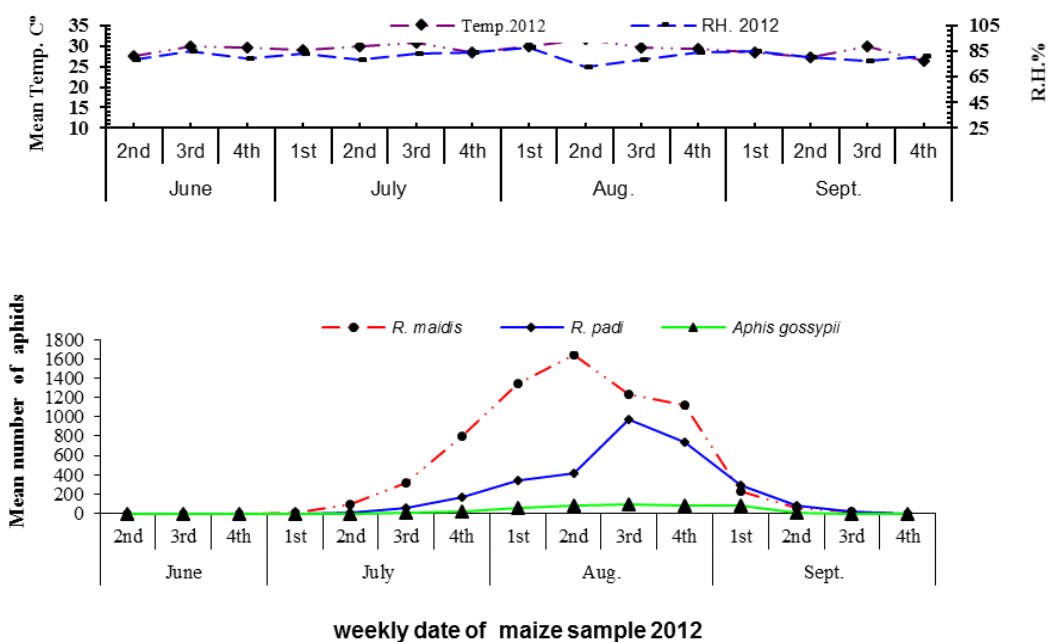


**Fig. 1:** Population density of aphids infesting maize plants at Abo - Hammad, Sharkia   Governorate during 2012.
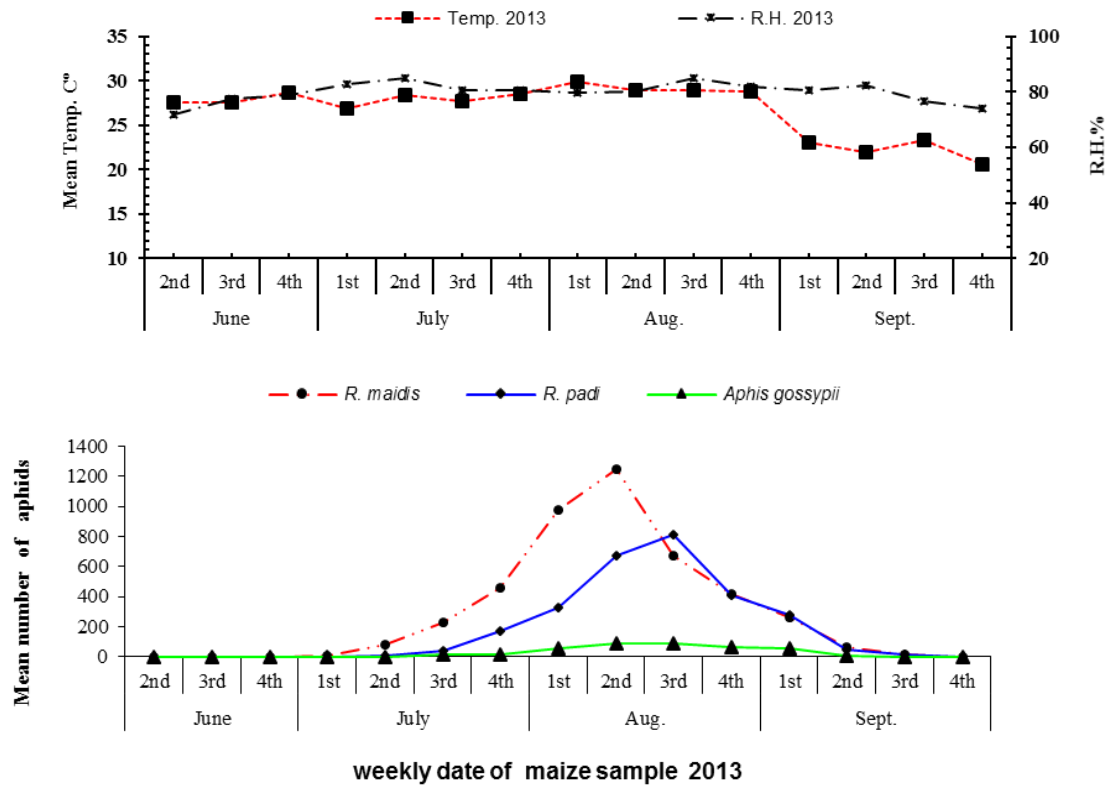
**Fig. 2:** Population density of aphids infesting maize plants at Abo - Hammad, Sharkia   Governorate during 2013.

was 1.2 folds in 2013 more than in 2012 (Table, 1). The population of *R. maidis* was about twice and 1.6 *R. padi* population in the first and second seasons, respectively (Table, 1).

**c. The cotton aphid, *Aphis gossypii* (Glover)**

The cotton aphid was found for the first time in the 3rd week of July (2012 and 2013 seasons). The mean numbers of *A. gossypii* collected from maize by plant sample during 2012 and 2013 seasons were graphically represented in Figs., 1, 2. The mean number of *A. gossypii* on maize plants increased until it reached its peak in the 3rd week of August of 95 and 91 individuals/ sample in 2012 and 2013 seasons, respectively at mean temperature of 29.64˚C with 50.71% R.H. and29.00˚C with 56.08% R.H. for the two seasons, respectively. Generally, the weekly counts of *A. gossypii* on maize plants appeared that the population during 2012 equal 1.2 folds in 2013 season (Table, 1). The cotton aphid was the least aphid population on maize. In the first season, *R. maidis* and *R. padi* populations more 16 and 8 folds than *A. gossypii* population, but during the second season *R. maidis* and *R. padi* populations more 13 and 8 folds than *A. gossypii* population.

Results in general concerning the population density of *R. padi*, *R. maidis* and *A. gossypii* on cereal crops showed clearly that these species have one peak on maize plants. This result agreed with the findings of **Abd-Alla, (1985) and Abd-Elsamed, (1999 and 2006),** who showed that the activity of *R. maidis*, *R.*

*padi* and *A. gossypii* have one peak on maize plants during summer plantation.

**2. Wheat**

**a. The bird cherry-oat aphid, *Rhopalosiphum padi* (L.)**

In both seasoans, the bird cherry-oat aphid occurred in early December to the end of April. The mean numbers of *R. padi* on wheat plants during 2012/2013 and 2013/2014 seasons by plant samples were graphically represented in Figs., (3, 4). The mean numbers of *R. padi* on wheat plants increased until it reached the peak at the end of February of 320 and 450 individuals/sample in 2012/2013 and 2013/2014 seasons, respectively at mean temperature of 18.43 ˚C with 50.57 % R.H. and 16.90 ˚C with 57.00% R.H. for the two seasons, respectively. In both seasons, the population of *R. padi* was almost equal, but it was on a par with double the population of *R. maidis* (Table, 1). The population of *R. padi* on maize greater (1.3 folds) than on wheat during the first season, while they were around equal in the second.

**b. The corn leaf aphid, *Rhopalosiphum maidis* (Fitch)**

During the two seasons of study, the corn leaf aphid existed from the 3rd week of December to the 3rd week of April. The mean numbers of *R. maidis* collected
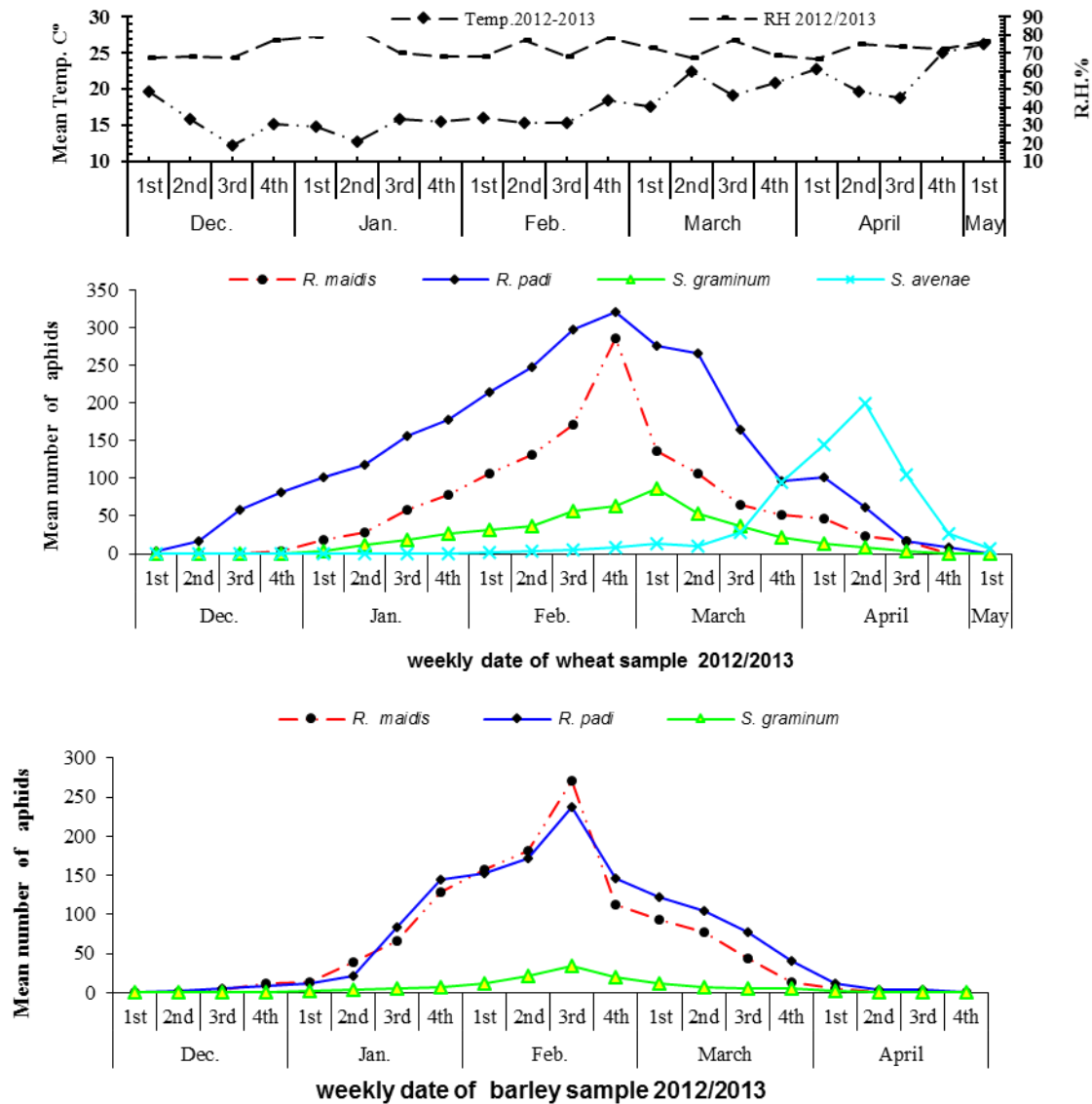
**Fig. 3.** Population density of aphids infesting wheat and barley plants at Abo - Hammad, Sharkia   Governorate during 2012/2013 season.

From wheat plants during the both seasons, using plant samples were graphically illustrated in Figs., (3, 4). One peak occurred at the end of February with a total number, 285 and 266 individuals/sample at mean temperature of 18.43 ˚C with 50.57% R.H. and 16.90 ˚C with 57.00% R.H. for the two seasons, respectively (Figs. 3, 4). The population of *R. maidis* on maize plants recorded 5 and 3 folds more than on wheat plants during 2012/2013 and 2013/2014, respectively.

**c. The greenbug, *Schizaphis graminum* (Rond.)**

The greenbug was found during the period from the 4th week of December to the 3rd week of April along both study seasons. The weekly mean numbers of *S. graminum* on wheat plants during 2012/2013 and 2013/2014 seasons were graphically illustrated in Figs., (3, 4). The number of individuals fluctuated on wheat plants with general increase reaching its

peak. One peak only occurred at the 1st of March during 2012/2013 and 2013/2014 seasons with a total number of 87 and 79 individuals /sample at mean temperature of 17.57 ˚C with 47.50% R.H. and 21.00 ˚C with 56.29% R.H. for the two seasons, respectively. Regarding the weekly counts of *S. graminum* on wheat plants, it was nearly equivalent during 2012/2013 and 2013/2014 seasons.

**d. English grain aphid, *Sitobion avenae* (F.)**

From the 1st and 2nd week of February to early May, the English grain aphid existed in the first and second seasons, respectively. The weekly mean numbers of *S. avenae* on wheat plant during 2012/2013 and 2013/2014 seasons were graphically illustrated in Figs., (3, 4). The number of individuals fluctuated and increased gradually to reach its peak. This peak occurred during 2012/2013 and 2013/2014 seasons at the mid of April with a total number of

199 and 710 individuals/sample at mean temperature of 19.57°C with 48.79 % R.H. and 23.60°C with 45.57 % R.H. for the two seasons (Figs., 3, 4), respectively. Regarding the weekly counts of *S. avenae* on wheat plants, it was evaluated around 7 folds during 2013/2014 compared with the population during 2012/2013.

According to the obtained results on the population density of *R. padi*, *R. maidis* and *S. graminum*, it is obvious that these species had one peak on wheat plants. These results agreed with the findings of **Hegab, (1997 and 2001) and Abd-Elsamed, (2006),** who showed that the activity of *R. maidis*, *R. padi* and *S. graminum* had one peak on wheat plants during winter plantation.

**3. Barley**
**a. The bird cherry-oat aphid, *Rhopalosiphum padi* (L.)**

In both seasons, the bird cherry-oat aphid occurred in the second week of December to the mid of April. The mean number of *R. padi* counted on barley during 2012/2013 and 2013/2014 seasons by using plant samples are graphically represented in Figs., (3, 4). Population of *R. padi* on barley plants increased until it reached the peak at the 3rd week of February with a mean number of 238 and 246 individuals/sample in 2012/2013 and 2013/2014 seasons, respectively at mean temperature 15.43°C with 44.93 % R.H. and 15.70°C with 68.00% R.H. for the two seasons, respectively (Figs., 3 & 4). The population of *R. padi* on barley plants approximately had no changes during both seasons, whereas it was greater on wheat (about 2.0 and 2.3 folds during the first and second seasons, respectively) than on barley plants.
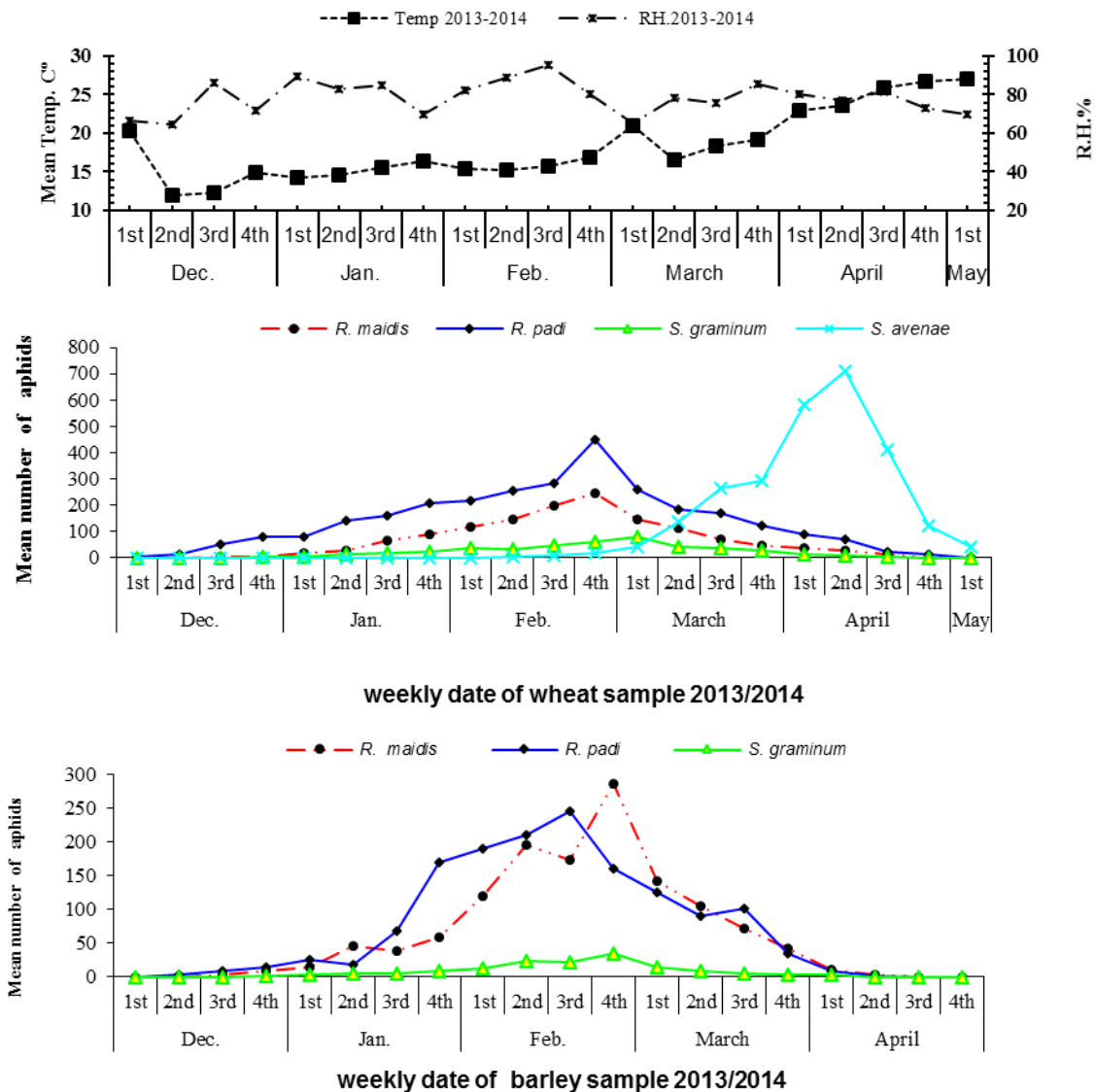


**Fig. 4: Population density of aphids infesting wheat and barley plants at Abo - Hammad, Sharkia Governorate during 2013/2014 season.**

**b. The corn leaf aphid, *Rhopalosiphum maidis* (Fitch)**

During the two seasons of study, the corn leaf aphid existed from the 3rd week of December to the 1st week of April. The mean numbers of *R. maidis* collected from barley plants during 2012/2013 and 2013/2014 seasons using plant samples are graphically illustrated in Figs., (3, 4). One peak on barley plants occurred in the 3rd week of February with a total number 271 and 285 individuals/sample at mean temperature of 15.43 °C with, 44.93% R.H. and 15.70°C with 68.00% R.H. during 2012/2013 and 2013/2014 seasons, respectively (Figs. 3, 4). In the second season, the population of *R. maidis* on barley increased slightly, but it was equal with the population on wheat during the both seasons.

**c. The greenbug, *Schizaphis graminum* (Rond.)**

The greenbug was found during the period from the 4th week of December to the 1st week of April along both study seasons. The weekly mean numbers of *S. graminum* collected from barley plants during 2012/2013 and 2013/2014 seasons were graphically illustrated in Figs., (3, 4). The number of individuals fluctuated and increased reaching its peak (Figs., 3 & 4). The only .peak occurred at the 3rd and 4th week of February with a total number of 34 and 35 individuals/sample at mean temperature of 15.43°C with 44.93 % R.H. and 15.70 °C with 68.00 % R.H. in the 2012/2013 and 2013/2014 seasons, respectively. Regarding the weekly counts of *S. graminum* on barley plants, the population was little more during 2012/2013 (1.3 fold) than during 2013/2014. In the first season, the population of *S. graminum* on the wheat was 2.7 folds its population on the barley, but it recorded 4.0 folds in the second season.

**III. Effect of certain climatic factors, (maximum temperature, minimum temperature and mean relative humidity) on the population of the dominant aphid species infesting maize, wheat and barley plants.**

**1. The corn leaf aphid, *Rhopalosiphum maidis* (Fitch)**

The correlation coefficient between activity of *R. maidis* population and maximum temperature ($r_1$), minimum temperature ($r_2$) or relative humidity ($r_3$) was positive and insignificant ($r_1 = 0.3140$ & $0.3130$, $r_2 = 0.2549$ & $0.3070$ and $r_3 = 0.3162$ & $0.3033$ in 2012/2013 and 203/2014 seasons, respectively). The partial regression between *R. maidis* population activity and maximum temperature ($b_1$), minimum temperature ($b_2$) or relative humidity ($b_3$) was positive and insignificant ($b_1 = 2.5980$ & $3.6450$, $b_2 = 5.4720$ & $4.1728$ and $b_3 = 0.0021$ & $0.3750$ in 2012/2013 and 203/2014 seasons, respectively) (Table, 2).

**2. The bird cherry-oat aphid, *Rhopalosiphum padi* (L.)**

The results obtained in Table, (2) reveal that the correlation coefficient between *R. padi* population and maximum temperature was positive insignificant ($r_1 = 0.3156$) in 2012/2013 but positive and significant ($r_1 = 0.5630^*$) in 2013/2014 seasons. The numbers of *R. padi* correlated positively and significantly with minimum temperature ($r_2 = 0.5769^*$ and $0.5114^*$) in 2012/2013 and 2013/2014 seasons, respectively. The correlation between *R. padi* population and relative humidity was positive and insignificant ($r_3 = 0.3162$ and $0.3071$ in 2012/2013 and 2013/2014 seasons, respectively). The partial regression between *R. padi* population and maximum temperature ($b_1$), minimum temperature ($b_2$) or relative humidity ($b_3$) was positive and insignificant ($b_1 = 0.0015$ & $0.0023$, $b_2 = 0.0021$ & $0.0014$ and $b_3 = 0.0037$ & $0.0042$ in2012/2013 and 2013/2014 seasons, respectively), Table, (2).

**3. The greenbug, *Schizaphis graminum* (Rond.)**

The mean numbers of *S. graminum* population had positive and insignificant correlation with maximum temperature ($r_1 = 0.2638$ and $0.2661$) and relative humidity ($r_3 = 0.2651$ and $0.2657$) in 2012/2013 and 2013/2014 seasons, respectively, it was positive and insignificant ($r_2 = 0.2672$) with minimum temperature in 2012/2013 and negative and insignificant ($r_2 = -0.0941$) in 2013/2014 season. The same trend was recorded with the partial regression between *S. graminum* population and maximum temperature ($b_1 = 0.0302$ and $0.0264$), minimum temperature ($b_2 = 0.0182$ and $- 0.0055$) and relative ($b_3 = 0.0490$ and $0.0425$) in 2012/2013 and 2013/2014 seasons, respectively (Table, 2).

**4. The cotton aphid, *Aphis gossypii* (Glov.)**

The mean numbers of *A. gossypii* had positive and insignificant correlation with maximum temperature and minimum temperature ($r_1 = 0.3082$ and $r_2 = 0.4207$) in 2012/2013 season, respectively, while it was positive and significant ($r_1 = 0.6186^*$ and $r_2 = 0.5623^*$) in 2013/2014 season, respectively. The correlation coefficient was positive and insignificant between the population density of *A. gossypii* and relative humidity ($r_3 = 0.3071$ and $0.4267$) in 2012/2013 and 2013/2014 seasons, respectively (Table, 2). The partial regression between *A. gossypii* population and maximum temperature, minimum temperature or relative humidity was positive and insignificant ($b_1 = 0.0043$ & $0.0225$, $b_2 = 0.0061$ & $0.1500$ and $b_3 = 0.0143$ & $0.5410$ in 2012/2013 and 2013/2014 seasons, respectively), Table, (2).

**5. English grain aphid, *Sitobion avenae* (F.)**

The mean numbers of *S. avenae* had positive and significant correlation with maximum temperature ($r_1 = 0.5629^*$) in 2012/2013 season, while it was positive and high significant ($r_1 = 0.6250^{**}$) in 2013/2014

season. The relationship between the numbers of *S. avenae* and minimum temperature was positive and significant ($r_2 = 0.5263^*$ and $0.5106^*$ in 2012/2013 and 2013/2104 seasons, respectively). The correlation coefficient was positive and insignificant between the population density of *S. avenae* and relative humidity ($r_3 = 0.2661$) in 2012/2013, but it was negative and insignificant ($r_3 = -0.2653$) in 2013/2014 season, respectively (Table, 2). In the first season, the partial regression was positive and insignificant between *S. avenae* population and maximum and minimum temperature ($b_1 = 0.0681$ and $b_2 = 0.0798$, respectively). In the second season,

the partial regression was insignificant but positive with maximum temperature ($b_1 = 0.0064$) and negative with minimum temperature ($b_2 = -0.0899$). The partial regression was positive and insignificant between *S. avenae* population and relative humidity ($b_3 = 0.7562$ and $0.2935$ in 2012/2013 and 2013/2014 seasons, respectively), Table, (2).

**III. Combined effects of meteorological factors and path analysis**

The effect of maximum, minimum temperatures and mean relative humidity on aphid population was estimated by calculating the partial regression analysis (Least square regression equation).

**Table 2.** Partial regression and simple correlation coefficients between maximum temperature, minimum temperature and relative humidity and total number of aphid species infesting maize, wheat and barley plants at Abo - Hammad district, Sharkia Governorate during 2012/2013 and 2013/2014 seasons

| Aphid species | Simple correlation | | | | | |
|---|---|---|---|---|---|---|
| | 2012/2013 | | | 2013/2014 | | |
| | $r_1$ | $r_2$ | $r_3$ | $r_1$ | $r_2$ | $r_3$ |
| *Rhopalosiphum maidis* | 0.3140 | 0.2549 | 0.3162 | 0.3130 | 0.3070 | .3033 |
| *Rhopalosiphum padi* | 0.3156 | $0.5769^*$ | 0.3162 | $0.5630^*$ | $0.5114^*$ | 0.3071 |
| *Schizaphis graminum* | 0.2638 | 0.2672 | 0.2651 | 0.2661 | -0.0941 | 0.2657 |
| *Aphis gossypii* | 0.3082 | 0.4207 | 0.3071 | $0.6186^*$ | $0.5623^*$ | 0.4267 |
| *Sitobion avenae* | $0.5629^*$ | $0.5263^*$ | 0.2661 | $0.625^{**}$ | $0.5106^*$ | -0.2653 |
| Aphid species | Partial regression | | | | | |
| | 2012/2013 | | | 2013/2014 | | |
| | $b_1$ | $b_2$ | $b_3$ | $b_1$ | $b_2$ | $b_3$ |
| *Rhopalosiphum maidis* | 2.5980 | 5.4720 | 0.0021 | 3.6450 | 4.1728 | 0.3750 |
| *Rhopalosiphum padi* | 0.0015 | 0.0021 | 0.0037 | 0.0023 | 0.0014 | 0.0042 |
| *Schizaphis graminum* | 0.0302 | 0.0182 | 0.0490 | 0.0264 | -0.0055 | 0.0425 |
| *Aphis gossypii* | 0.0043 | 0.0061 | 0.0143 | 0.02245 | 0.15002 | 0.541 |
| *Sitobion avenae* | 0.0681 | 0.0798 | 0.7562 | 0.00639 | -0.0899 | 0.2935 |

$r_1, b_1$ = correlation coefficients and partial regression between maximum temperature
        and number of insects, respectively
$r_2, b_2$ = correlation coefficients and partial regression between minimum temperature
        and number of insects, respectively
$r_3, b_3$ = correlation coefficients and partial regression between relative humidity
        and number of insects, respectively

The values of explained variance by the three aforementioned meteorological factors showed that the considered factors have played a conspicuous role in detecting the activity of these pests during the seasons of studies (Table, 3).

These results indicated that the tested meteorological factors play a great role in regulating the population density of aphid species. Many authors reported similar findings, which greatly correspond with the present results **(Hegab, 1997 & 2001; El-Gindy, 1997 & 2002; Hashem, 1997 & 2005 and Abd-Elsamed, 1999 & 2006)**.

The method of path coefficient included the independent variable i.e. maximum temperature, minimum temperature and mean relative humidity. Path analysis was practiced in order to find out the relative importance of these variable in contributing numbers of insects Table, (3) presented the relative importance in contributing numbers of insects as recorded in percentage of variation of maximum temperature; minimum temperature and mean relative humidity in 2012/2013 and 2013/2014 seasons.

**Table 3.** Explained and unexplained variance and the effects of maximum, minimum temperature and mean relative humidity on the total numbers of aphids infesting maize, wheat and barley plants during 2012/2013 and 2013/2014 seasons at Abo-Hammad, Sharkia, Governorate

| Aphid species | Explained variance | | Unexplained variance | |
|---|---|---|---|---|
| | **2012** | **2013** | **2012** | **2013** |
| *Rhopalosiphum maidis* | 0.2620 | 0.1175 | 0.7380 | 0.8825 |
| *Rhopalosiphum padi* | 0.3879 | 0.4017 | 0.6103 | 0.5983 |
| *Schizaphis graminum* | 0.1584 | 0.1992 | 0.8416 | 0.8008 |
| *Aphis gossypii* | 0.2978 | 0.5599 | 0.7022 | 0.4401 |
| *Sitobion avenae* | 0.7562 | 0.2935 | 0.2438 | 0.7065 |

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# بعض الدراسات الإيكولوجية على أنواع المنْ التي تصيب بعض المحاصيل النجيلية

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1- كلية الزراعة – جامعة بنها

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أجريت هذة الدراسة فى مركز أبوحماد – محافظة الشرقية خلال موسمي 2012/2013–2013/2014 على أنواع المنْ التى تصيب الذرة والقمح والشعير.

و قد تضمنت الدراسة حصر وتقدير الكثافة العددية لأنواع المنْ و كذلك تم دراسة الوفرة الموسمية للأنواع السائدة و دراسة تأثير العوامل المناخية (الحرارة العظمى و الحرارة الصغرى و الرطوبة النسبية ) على نشاط وتعداد الحشرات موضع الدراسة.

تم أخذ العينات أسبوعياً وَ جُمعت حشرات المنْ من محاصيل الذرة، القمح والشعير بطرق مختلفة وهى كالتالي :–

أ– العينات النباتية   Plant samples

ب– المصائد الصفراء اللاصقة   Yellow sticky board traps

وقد أوضحت الدراسة أن العينات النباتية أفضل طريقة استخدمت لحصر وجمع أفراد المنْ، أما أنواع المنْ التى تم حصرها وجمعها من نباتات الذرة ، القمح والشعير فهي:

1– منْ أوراق الذرة                        *Rhopalosiphum maidis* (Fitch)

2– منْ الشوفان                            *Rhopalosiphum padi* (L.)

3– منْ القمح                              *Schizaphis graminum* (Rond.)

4– منْ الغلال                              *Sitobion avenae* (F.)

5– منْ القطن                              *Aphis gossypii* (Glov.)

وقد أوضحت الدراسة أن الأنواع الثلاثة الأولى هى الأنواع السائدة على نباتات القمح والشعير بينما النوع الأول و الثانى و الخامس هى الأنواع السائدة على نبات الذرة الشامية.

أوضحت نتائج دراسة الوفرة الموسمية للأنواع السائدة أن منْ الذرة سجل على نباتات الذرة قمة نشاط واحدة (1640 و 1250 فرد/العينة) فى الأسبوع الثانى من أغسطس خلال موسمي الدراسة 2012 و 2013، على التوالي. أما منْ الشوفان سجل قمة نشاط واحدة على الذرة (978 و 815 فرد/العينة) فى الأسبوع الثالث من أغسطس خلال موسمي الدراسة 2012 و 2013. وقد سجل منْ القطن قمة نشاط واحدة على نباتات الذرة (95 و 91 فرد/العينة) خلال الأسبوع الثالث من أغسطس خلال موسمي الدراسة 2012 و2013،على التوالي. أما على نباتات القمح فقد سجل منْ الذرة قمة نشاط واحدة (285 و 266 فرد/العينة) خلال الأسبوع الرابع من فبراير خلال موسمي الدراسة 2012/2013 و2013/2014، على التوالي. كما سجل منْ الشوفان قمة نشاط واحدة (320 و 450 فرد/العينة) فى نهاية شهر فبراير خلال موسمي الدراسة 2012/2013 و2013/2014، على التوالي. أيضاً سجل منْ القمح قمة نشاط واحدة (87 و 79 فرد/العينة) فى الأسبوع الاول من شهر مارس خلال موسمي الدراسة 2012/2013 و2013/2014، على التوالي. أما منْ الحبوب الإنجليزي فقد سجل قمة نشاط واحدة(199 و 710 فرد/العينة) فى الأسبوع الثانى من أبريل خلال موسمي الدراسة 2012/2013 و2013/2014، على التوالي. بالنسبة لنباتات الشعير فسجل منْ الذرة قمة نشاط واحدة (271 و 285 فرد/العينة) فى الأسبوع الثالث والرابع من شهر فبراير خلال موسمي الدراسة 2012/2013 و2013/2014، على التوالي. وكذلك سجل تعداد حشرة منْ الشوفان قمة نشاط واحدة (238 و 246 فرد/العينة) فى الأسبوع الثالث من فبراير خلال موسمي الدراسة 2012/2013 و2013/2014، على التوالي. وكذلك سجل منْ القمح قمة نشاط واحدة (34 و 35 فرد/العينة) فى الأسبوع الثالث والرابع من شهر فبراير خلال موسمي الدراسة 2012/2013 و2013/2014، على التوالي.

بدراسة تأثير كلا من الحرارة العظمى والحرارة الصغرى ومتوسط الرطوبة النسبية على كثافة المجموع للأنواع السائدة من حشرات المنْ محاصيل الذرة، القمح والشعير خلال موسمي 2012/2013 و 2013/2014 أوضحت النتائج أن كل من درجة الحرارة العظمى ودرجة الحرارة الصغرى و الرطوبة النسبية لهم تأثير إيجابي أوسلبي وإما معنوي أوغير معنوي على تعداد تلك الحشرات سالفة الذكر.