

## EFFECT OF BARLEY VARIETIES AND POTASSIUM FERTILIZATION LEVELS ON THE POPULATION OF APHID AND LEAFHOPPER IN RELATION TO PLANT CHEMICAL AND ANATOMICAL CHANGES

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**ABSTRACT:** *Susceptibility of three varieties of barely plants (Giza-123, Giza-2000 and Giza-132) were evaluated toward infestation by aphids and leafhoppers. Also, the effect of potassium fertilization on the chemical content and anatomical compositions in relation to homopterous insect population at Diarb Nigm locality Sharkia Governorate during 2013/14 and 2014/15 growing seasons. Results showed that Giza-123 is the lowest variety in terms of chemical content (total protein and carbohydrates content) and also found there was a shortage in the thickness of the anatomical traits measured. These results led to that Giza-123 is considered as the sensitive variety toward infestation by insects with the lowest crop yield. On contrary, Giza-132 records the longest thickness cell wall, lowest infestation insects and the highest crop yield. Chemical analysis showed a positive relationship between total protein, carbohydrate contents and aphids, leafhoppers infestation in different barley varieties, while reverse relationship between pH values and insect infestation. Potassium fertilization by 100 kg potassium sulfate/feddan greatly increased the thickness of the anatomical traits [cuticle and upper epidermis thick. ( $\mu$ ), cuticle and lower epidermis thick. ( $\mu$ ), mesophyll tissue thick. ( $\mu$ ) lamina thick. ( $\mu$ )] It is noted that, increasing the thickness of upper and/or lower epidermis and their cuticle layers decreased the population density of piercing sucking insects in blade leaf and increasing mesophyll tissue thickness improve the photosynthesis process which lead to decreasing the adverse effect of insects. which associated with lowering the number of piercing - sucking insects. Thus, potassium fertilization by 100 kg potassium sulfate/feddan is recommended in the integrated pest management control (IPM) on barely plants.*

**Key words:** *Barley plants, varieties, fertilization, chemical analysis, leafhopper, aphid, anatomical structure.*

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### INTRODUCTION

The homopterous insects (aphids and leafhoppers) are economic pests of many agricultural crops in Egypt. Barley plants are infested by these insect pests which affect the quantity of yield as results of their direct feeding on plant, in addition, these insects are responsible for natural spread of several virus diseases to barley plants Hegab, Ola (2001). The fauna of these insects on maize fields was studied in Egypt by Hashem, (2005) who mentioned that the population density of the piercing-sucking insects were affected with the of epidermal cell size and sub epidermis cells wall. Increasing the

epidermal cells thickness wall was decreased the population of aphids and leafhoppers. Therefore, it was necessary to perform the present work for studying the effects of barley varieties, along with certain chemical constituents of barley plants on the population density of aphids and leafhoppers. The effects of tested agricultural practices were all taken in consideration collectively and quantity of the resulted yield was recorded.

### MATERIALS AND METHODS

An area about 2100 m<sup>2</sup> was chosen to carry out this investigation in Diarb-Nigm

district, Sharkia Governorate, the experimental design was a split plot with three replications (700 m<sup>2</sup>). The sowing date of barley plants was during the last week of November, in 2013 and 2014 seasons. The normal agricultural practices were followed in due time and all plots were kept free of any pesticide treatments. In such experiments, the following three barley varieties were used (Giza 123, Giza 2000 and Giza 132).

Four potassium fertilization rates of 100, 75, 50 and zero kg/feddan. were applied in these experiments in the form of potassium sulphate 48% K<sub>2</sub>O when plants become 20 days old. Sampling started when the age of barley plants reached about 28 days after sowing and continued at weekly intervals throughout the growing seasons until harvest time during 2013/2014 and 2014/2015 season. The following procedures of sampling were adopted:

1) Direct counting : 20 tiller representing different were taken randomly from replicates of each variety. These tillers were examined in the laboratory using a binocular microscope and the total number of existing of aphids on both surfaces of the leaves and tassels were recorded.

2) Sweep net (30 cm diameter and 65 cm deep). Each sample consisted of 100 double strokes were taken from both diagonal directions of the experimental area. Each sample was kept in a tight closed paper bag and transferred to the laboratory for inspection by binocular microscope and the collected leafhoppers were killed by cyanide, sorted into species and identified according to the work of Hegab *et al.*(1987). Counts of collected leafhoppers were recorded for each sample.

### **Chemical analysis:**

Chemical analysis of the tested barley leaves were carried out in central laboratory, Faculty of Agriculture, Moshtohour, Banha University to determine the total protein, carbohydrate contents, pH value,

phosphorous, calcium and potassium contents, according to Barrowes and Simpson (1962), Bremmer and Mulvaney (1982).

### **Anatomical studies:**

Samples of three tested barley varieties were collected from the blades of flag leaves at booting stage through the second growing season (2014/2015) for inspection which showed remarkable differences between tested varieties and the response to potassium sulfate fertilization on leaf blade certain histological features. These specimens were cut into pieces of 1.0 cm length, then killed and fixed for 24 hours at least in plant fixative which is known as FAA (formalin acetic alcohol) represented by the following formula: 50 ml. ethyl alcohol (95%), 5ml. glacial acetic acid, 10 ml. formaldehyde (37- 40%), 35ml. distilled water. Then the specimens were washed and dehydrated in ascending concentrations of ethyl alcohol series, then cleared in transferring concentrations of xylene and absolute alcohol. Specimens were embedded in pure paraffin wax of melting point 52-54 0C. Sections were prepared using EPMA a rotary microtome at 14 microns ( $\mu$ ). Paraffin ribbons were mounted on slides and sections were stained in safranin and light green. Sections were mounted in Canada balsam (Nassar and El-Sahhar 1998). Selected sections were examined to detect histological manifestations of the chosen treatments using light microscope (Olympus) with digital camera (Canon power shot S80) connected to computer; the photographs were taken by Zoom Browser Ex Program. The dimensions of stem and leaf blade sections were measured by using Corel Draw program ver.11.

### **Statistical Analysis :**

The data collected were subjected to proper statistical analysis of variance according to Snedecor and Cochran (1980) and the differences among treatment means

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were compared using Duncan's multiple range test (CoStat 1990), where means had the different letters were statistically significant, while means followed by the same letters were statistically insignificant.

### **RESULTS AND DISCUSSIONS**

#### **Effect of barley varieties and potassium fertilization on the population density of certain homopterous insects infesting barley plants.**

##### **1. Effect of barley varieties:**

###### **1-1. Aphid insects:**

Statistical analysis of the obtained data revealed that the highest significant differences between mean numbers of aphid, *Rhopalosiphum padi* on the three tested barley varieties were noticed during 2013/2014 and 2014/2015 seasons. The most susceptible varieties was Giza 123 (1127.75 and 1237.25) insects/sample in both seasons, respectively, while the least susceptible variety was Giza 132, (847.42 and 934.67 insects/sample) in both seasons, respectively.

Statistical analysis of results in Table (1) showed that, the highest significant differences between mean numbers of aphid, *Rhopalosiphum maidis* on the three tested barley varieties were noticed during the two seasons. The most susceptible variety was Giza 123 followed by Giza 2000, whereas Giza 132 variety was the least susceptible with a mean number of 1013.67, 982.25 and 869.08 insects/sample in 2013/2014 season and 1048.5, 1036.25 and 950.83 insects/sample in 2014/2015 season, respectively.

Statistical analysis of results in Table (1) showed that, the highest significant differences between mean numbers of aphid, *Schizaphis graminum* on the three tested barley varieties were noticed during the two seasons. Giza 132 was the least susceptible for aphid infestation with a mean numbers of 124.58 and 124.0 insects /sample, while the Giza 123 appeared to be the most susceptible barley variety (215.08

and 175.5 insects/sample) during two seasons, respectively.

###### **1-2. Leafhopper insects:.,**

As shown in Table (1) the differences between the mean numbers of leafhoppers, *Empoasca decedens* and *Empoasca decipiens* infested the three barley varieties, were highly significant during 2013/2014 and 2014/2015 seasons. The most susceptible variety to *E. decedens* was Giza 123 followed by Giza 2000, and Giza 132 with mean numbers of 150.0, 138.92 and 129.25 insects/sample, respectively, in 2013/2014 season, and 170.33, 168.08 and 142.92 insects/sample in 2014/2015 season for the three varieties, respectively. The most susceptible variety to *Empoasca decipiens* was Giza 123 followed by Giza 2000, and Giza 132 varieties with a means of 193.42, 173.92 and 138.08 insects/sample in 2013/2014 season and 196.67, 181.25 and 138.67 insects/sample in 2014/2015 season for the three varieties, respectively

###### **Yield quantity (kg/plot):**

With regard to the influence of barley varieties on yield quantity, data presented in Table (1) show that Giza 132 variety recorded the highest mean yield of 21.85 and 22.64 kg / plot in two seasons, respectively, followed by Giza 2000 producing 20.52 and 22.10 kg/plot for the two seasons, respectively. Giza 123 was the lowest mean yield of 19.65 and 19.99 kg /plot in two seasons, respectively.

From the obtained results, it could be concluded that, Giza 123 variety was the most susceptible one to the infection with aphids and leafhoppers, whereas Giza 132 variety was the least susceptible one.

The obtained results are in agreement with those of Akbar *et al.* (2000), Hegab, Ola (2001) and Pherson *et al.* (2009) who reported that the varieties of maize plants had a great effect on the incidence of some homopterous insects.

Table (1): Effect of barley varieties on the population density of aphid and leafhopper at Diarb- Nigm, Sharkia Governorate during 2013/2014 and 2014/2015 seasons.

Varieties	Mean no of aphids / 20 tiller					
	<i>Rhopalosiphum padi</i>		<i>R. maidis</i>		<i>Schizaphis graminum</i>	
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
Giza 123	1127.75 <sup>a</sup>	1237.25 <sup>a</sup>	1013.67 <sup>a</sup>	1048.5 <sup>a</sup>	215.08 <sup>a</sup>	175.5 <sup>a</sup>
Giza 2000	1015.083 <sup>b</sup>	1152.25 <sup>b</sup>	982.25 <sup>b</sup>	1036.25 <sup>a</sup>	179.58 <sup>b</sup>	129.33 <sup>b</sup>
Giza 132	847.42 <sup>c</sup>	934.67 <sup>c</sup>	869.08 <sup>c</sup>	950.83 <sup>b</sup>	124.58 <sup>c</sup>	124.0 <sup>c</sup>
F	129.22 <sup>**</sup>	49.34 <sup>**</sup>	63.64 <sup>**</sup>	47.6 <sup>**</sup>	850.6 <sup>**</sup>	384.96 <sup>**</sup>
	mean no of leafhoppers /20 tiller				Mean yield kg/plot	
	<i>E. decedens</i>		<i>E. decipiens</i>			
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
Giza 123	150.0 <sup>a</sup>	170.33 <sup>a</sup>	193.42 <sup>a</sup>	196.67 <sup>a</sup>	19.65 <sup>c</sup>	19.99 <sup>b</sup>
Giza 2000	138.92 <sup>b</sup>	168.08 <sup>a</sup>	173.92 <sup>b</sup>	181.25 <sup>b</sup>	20.52 <sup>b</sup>	22.10 <sup>a</sup>
Giza 132	129.25 <sup>c</sup>	142.92 <sup>b</sup>	138.08 <sup>c</sup>	138.67 <sup>c</sup>	21.85 <sup>a</sup>	22.64 <sup>a</sup>
F	65.97 <sup>**</sup>	141.37 <sup>**</sup>	38.45 <sup>**</sup>	368.51 <sup>**</sup>	**	*

means in each column followed by different letter(s) are significantly different at 5% level

## 2.Effect of potassium fertilization.

### 2-1. Aphid insects:

The obtained results in Table (2) showed that the effect of different potassium fertilization levels on the mean number of aphid, *Rhopalosiphum padi* infesting barley plant was highly significant during the two seasons of study 2013/2014 and 2014/2015. The highest mean number was recorded with Fert.1 treatment (zero potassium fertilization/feddan) 1205.89 and 1272.56 insects/sample, while the lowest one was occurred with Fert.4 treatment (100 kg potassium sulfate /feddan) as 849.67 and 951.85 insects/sample during two seasons, respectively.

Results in Table (2) recorded that the highest mean number of *R. maidis* was occurred with Fert.1 treatment (zero potassium fertilization /feddan) as 1116.67 and 1214.56 insects/sample for the two seasons, respectively, while the lowest mean numbers of *R. maidis* were 830.89

and 871.00 insects/sample , with Fert.4 treatment (100 kg potassium sulfate /feddan) during the two seasons, respectively.

The mean number of aphid, *Schizaphis graminum* infesting barley varieties Table (2) was highly significant during two seasons. The highest mean number of *S. graminum* was 193.89 and 158.22 insects/sample with Fert.4 treatment, while the lowest mean number was 157.67 and 129.22 insects/sample with Fert.1 treatment during the two seasons, respectively.

### 2-2. Leafhopper insects:

According to Table (2) the highest mean number of *Empoasca decedens* was occurred with Fert.1 treatment, 153.56 and 175.56 insects/sample , and the lowest mean number was recorded with Fert.1 treatment (100 kg potassium sulfate /feddan) as 127.22 and 147.56 insects/sample during the two seasons,

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respectively. while the highest mean number of *E. decipiens* was 179.2 and 189.11 insects/sample with Fert.4 treatment, while the lowest mean number was 155.78 and 158.0 insects/sample for Fert.4 treatment (100 kg potassium sulfate /feddan) during the two seasons, respectively,

In general, it may be concluded that the potassium fertilization levels influenced pronouncedly on the insect infestations and yield quantity, where the obtained results show that the highest number of insects was recorded with the least level of potassium fertilization treatment (zero kg potassium

sulfate/feddan) and the lowest quantity of yield, while increasing this level to 100 kg potassium fertilization/feddan led to decrease insect infestations and markedly increased the yield quantity. These results are in agreement with finding of Baghour *et. al.* (2001) , Hegab Ola (2001), El Gindy (2002), Hashem (2005); Scott and Gratton (2006) and Gulluoglu Leyla *et al.* (2010) who mentioned that the occurrence of homopterous insects on wheat, maize and leguminous plants varied greatly according to the applied fertilizers.

**Table (2): Effect of potassium fertilization levels on infestation of barley Giza 2000 with aphid and leafhopper insects at Diarb Nigm, Sharkia Governorate during 2013/2014 and 2014/2015 seasons.**

fertilization level	Ave. no of aphids / 20 tiller					
	<i>Rhopalosiphum padi</i>		<i>Rhopalosiphum maidis</i>		<i>Schizaphis graminum</i>	
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
Fert. 1	1205.89 <sup>a</sup>	1272.56 <sup>a</sup>	1116.67 <sup>a</sup>	1214.56 <sup>a</sup>	193.89 <sup>a</sup>	158.22 <sup>a</sup>
Fert. 2	1031.33 <sup>b</sup>	1164.00 <sup>b</sup>	978.44 <sup>b</sup>	1037.33 <sup>b</sup>	175.89 <sup>b</sup>	146.22 <sup>b</sup>
Fert. 3	900.22 <sup>c</sup>	1043.78 <sup>c</sup>	894.00 <sup>c</sup>	924.55 <sup>c</sup>	164.89 <sup>c</sup>	138.11 <sup>c</sup>
Fert. 4	849.67 <sup>b</sup>	951.85 <sup>d</sup>	830.89 <sup>d</sup>	871.00 <sup>d</sup>	157.67 <sup>d</sup>	129.22 <sup>d</sup>
F	123.19 <sup>**</sup>	29.73 <sup>**</sup>	126.03 <sup>**</sup>	290.86 <sup>**</sup>	76.25 <sup>***</sup>	54.69 <sup>**</sup>
	Ave. no of leafhoppers /20 tiller				Mean yield kg/plot	
	<i>Empoasca decedens</i>		<i>Empoasca decipiens</i>			
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
Fert. 1	153.56 <sup>a</sup>	175.56 <sup>a</sup>	179.2 <sup>a</sup>	189.11 <sup>a</sup>	17.82 <sup>d</sup>	20.09 <sup>b</sup>
Fert. 2	142.22 <sup>b</sup>	162.56 <sup>b</sup>	173.67 <sup>ab</sup>	178.44 <sup>b</sup>	18.94 <sup>c</sup>	20.48 <sup>b</sup>
Fert. 3	134.56 <sup>c</sup>	156.11 <sup>c</sup>	165.22 <sup>ab</sup>	163.22 <sup>c</sup>	21.89 <sup>b</sup>	21.76 <sup>b</sup>
Fert. 4	127.22 <sup>d</sup>	147.56 <sup>d</sup>	155.78 <sup>b</sup>	158.0 <sup>c</sup>	24.05 <sup>a</sup>	23.96 <sup>a</sup>
F	58.147 <sup>**</sup>	63.72 <sup>**</sup>	3.834	61.98 <sup>**</sup>	**	**

Fert. 1 , Fert. 2 , Fert. 3 , Fert. 4 = 0, 50, 75, 100 kg potassium sulfate / feddan means in each column followed by different letter(s) are significantly different at 5% level

### **3.Relationship between chemical contents of barley plants and insect infestations.**

#### **3-1.Total protein, Carbohydrate "C.C." and pH value:**

##### **- Aphid insects:**

The obtained results Table (3) show reverse relationship between protein content, carbohydrate content and pH value and aphid infestation in all barley varieties.

Leaf samples of Giza 123 variety at the treatments of 0, 50, 75 and 100 kg of potassium sulfate contain (12.51, 12.90, 13.86 and 14.10 %, protein), (30.8, 32.10, 34.6 and 36.6 carbohydrate) and (4.18, 4.96, 5.30 and 5.46 pH value), with mean numbers of aphid/sample as (139.07, 120.34, 115.4 and 99.38 individuals/insect) , respectively.

Samples of Giza 2000 variety at the zero level of fertilization, gave (13.50 % protein, 32.4 carbohydrates, and 4.61 pH value), with mean numbers of aphid as 129.19 aphid/sample. The mean numbers of aphid was decreased to 114.09, 102.73 and 96.3 individuals /sample , while protein content was increased to 13.86, 15.14 and 16.67% , and carbohydrates also increased to 35.2, 38.4 and 41.4 C.C. and 4.98, 5.61 and 5.98 pH value , respectively for the other fertilization treatments 50, 75 and 100 kg.

Samples of Giza 132 variety, with mean numbers of aphid/sample 108.73 individuals at zero level of potassium treatment resulted (12.06% protein content, 29.40 carbohydrates and 4.16 pH. value), where it was decreased to 95.8, 84.75 and 80.07 individuals/sample by increasing the protein content to 14.76, 15.81 and 16.90 % , 31.8, 34.9 and 39.8 carbohydrates and 5.09, 5.44 and 5.76 pH value for the treatments of 50, 75 and 100 kg potassium sulfate/feddan, respectively.

##### **- Leafhopper insects :**

Samples of, Giza 123 variety at 0, 50, 75 and 100 kg potassium sulfate treatments,

resulted (12.51, 12.90, 13.86 and 14.10 %, protein), (30.8, 32.10, 34.6 and 36.6) carbohydrate content and (4.18, 4.96, 5.30 and 5.46 pH value), with 19.09 17.95, 17.04 and 16.12 individuals/insect as a mean numbers of leafhopper /samples.

Samples of Giza 2000 variety at zero level of fertilization, gave 13.50 % protein content, 32.4 C.C., and 4.61 pH value), with 17.13, individuals/sample as a mean numbers of leafhopper insects which was decreased to 16.22, 15.54 and 14.7 individuals/sample with the increase of protein content to 13.86, 15.14 and 16.67% , 35.2, 38.4 and 41.4 C.C. and 4.98, 5.61 and 5.98 pH value, respectively for 50, 75 and 100 kg potassium sulfate treatments.

Samples of, Giza 132 variety at zero level of potassium treatment resulted 16.13 individuals/sample as a mean numbers of leafhopper, (12.06% protein content, 29.40 C.C. and 4.16 pH. value). These values were decreased to 13.6, 12.77 and 11.8 individuals/sample by increasing the protein content to 14.76, 15.81 and 16.90 % protein content, 31.8, 34.9 and 39.8 C.C. and 5.09, 5.44 and 5.76 pH value for the treatments of 50, 75 and 100 kg potassium sulfate/feddan, respectively.

#### **3-2.Potassium (K) and Phosphorous (P):**

Results in Table (3) show the effect of Potassium and phosphorous percentages in barley leaves in addition to the mean numbers of aphid and leafhopper insects. Statistical analysis of the obtained data revealed that there were no significant differences on the values of Potassium and Phosphorous and aphid and leafhopper numbers.

From the obtained results, Giza123 variety, proved to be the least total protein and carbohydrate contents and the highest pH value, the least susceptible to insect infestation and the highest yield.

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**Table (3): Effect of potassium fertilization levels on Protein, Carbohydrate, K, Ca, P and pH values in three barley varieties in relation to aphid and leafhopper numbers during 2014/2015 season.**

Barley variety	Fert.	Carb.	Protein	pH	K	Ca	P	Aphid	Leafhoppers	Yield/sub-sub plot (kg.)
<b>Giza 123</b>	Zero	30.8	12.51	4.18	2.70	1.90	0.73	139.07	19.09	17.93
	50 kg	32.10	12.90	4.96	3.10	2.20	0.71	120.34	17.95	18.44
	75 kg	34.60	13.86	5.30	3.41	1.30	0.74	115.4	17.04	21.61
	100 kg	36.60	14.10	5.46	3.58	1.96	0.66	99.38	16.12	23.65
<b>Giza 2000</b>	Zero	32.4	13.50	4.61	2.74	2.28	0.81	129.19	17.13	20.80
	50 kg	35.20	13.91	4.98	3.31	2.97	0.84	114.09	16.22	21.50
	75 kg	38.40	14.50	5.61	3.48	1.41	0.75	102.73	15.54	23.20
	100 kg	41.40	14.80	5.98	3.91	2.71	0.76	96.3	14.70	25.40
<b>Giza 132</b>	Zero	29.40	12.06	4.16	2.90	1.80	0.57	108.73	16.13	19.88
	50 kg	31.80	13.01	5.09	3.21	2.31	0.61	95.8	13.60	20.77
	75 kg	34.90	13.80	5.44	3.36	2.11	0.74	84.75	12.77	22.44
	100 kg	39.80	14.90	5.76	3.68	2.98	0.77	80.07	11.80	24.94

Generally, it is worth to notice that the aphid and leafhopper infestations were correlated with the chemical constituents of barley varieties and also with quantity of yield.

Hashem (2005) and Hegab (2015) pointed out that the chemical constituents of some graminaceous and leguminous plant varieties affect the population density of the aphids, leafhoppers and plant hopper insects.

**4. Anatomical Studies:**

This point of study aimed to examine and explain the differences between tested barley varieties fertilized by 4 potassium sulfate levels on leaf blade. Examination of certain histological features showed a remarkable differences between tested

varieties fertilized by four potassium sulfate levels, on leaf blade and infestation of aphid and leafhopper insects.

The obtained findings in Table (4) concerning the morphological characters of vegetative growth, physiological and yield characters in the first growing season of barley cultivars exhibited that fertilization with 100 kg potassium sulfate /feddan reflected high increasing in the studied characters among various tested concentrations for fertilization, therefore this level of fertilization (100 kg potassium sulfate /feddan) was chosen for studying the internal structure of barley plants cultivars. Trans sections made in flag leaf at booting stage (Fig. 1) and data tabulated in Table 4 exhibited that dimension of lamina [cuticle and upper epidermis thick. (μ), cuticle and

lower epidermis thick. ( $\mu$ ), mesophyll tissue thick. ( $\mu$ ) lamina thick. ( $\mu$ )] great differences were observed in dimension of lamina between the studied cultivars. Giza 132 c v. exhibited that the dimension of lamina apparently thicker compared to the other cultivars (Giza 2000 and 123) while Giza 123 c v. exhibited thinner of lamina dimension.

Potassium fertilization by 100 kg potassium sulfate/feddan greatly increased the thickness of the anatomical traits [cuticle and upper epidermis thick. ( $\mu$ ), cuticle and lower epidermis thick. ( $\mu$ ), mesophyll tissue thick. ( $\mu$ ) lamina thick. ( $\mu$ )] It is noted that, increasing the thickness of upper and/or lower epidermis and their cuticle layers

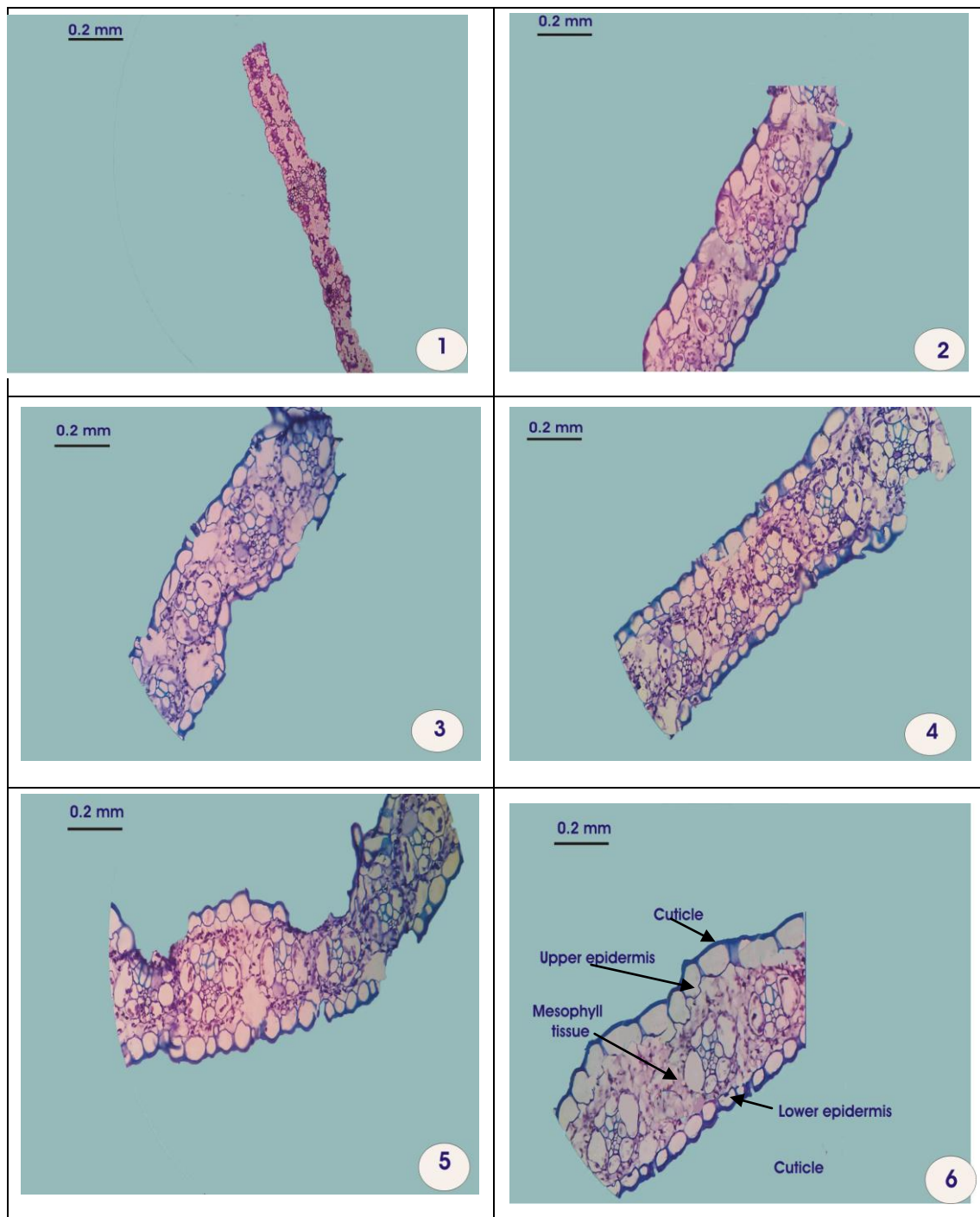
delay the invasion of piercing sucking insects in blade leaf and increasing mesophyll tissue thickness improve the photosynthesis process which lead to decreasing the adverse effect of insects. which associated with lowering the number of piercing sucking insects. Thus, potassium fertilization by 100 kg potassium sulfate/feddan is recommended in the integrated pest control on barely plants. The obtained results are agreement with these obtained by Saeed (1992); Hashem (2005) and Youssef (2006), they mentioned that population density of the piercing-sucking insects were affected the epidermal cell size and sub epidermis cells wall.

**Table (4): Mean values of some anatomical features of barley cultivars and mean numbers of aphid and leafhopper numbers as influenced by potassium sulfate fertilization (100 kg / fed.) during 2014/2015 season**

Characters	Barley cultivars								
	Giza 123			Giza 2000			Giza 132		
	Control	treatment	$\pm$ % to control	Control	treatment	$\pm$ % to control	Control	treatment	$\pm$ % to control
Cuticle and upper epidermis thick ( $\mu$ )	42.23	72.07	+70.66	81.40	102.50	+25.92	84.00	118.13	+40.63
Cuticle and lower epidermis thick ( $\mu$ )	35.87	63.27	+76.39	71.37	107.57	+50.72	73.00	97.73	+33.88
Mesophyll tissue thick ( $\mu$ )	103.87	318.40	+206.55	276.97	359.70	+29.87	329.47	388.37	+17.88
Lamina thick ( $\mu$ )	181.97	453.73	+149.35	429.73	569.77	+32.59	486.47	604.23	+24.21
Aphids mean number	46.36	33.13	-39.94	43.06	32.10	-34.14	36.24	26.69	-35.78
Leafhoppers mean number	9.55	8.06	-18.49	8.57	7.35	-16.60	8.07	5.90	-36.78



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**Fig. 1: Transverse sections of representative barley cultivars leaf lamina (Scale bars 0.2 mm) fertilized by 100 kg potassium sulfate / feddan during 2014/2015 season**  
**1: Control ( 0 fertilization) of Giza 123    2: Treatment of Giza 123**  
**3: Control ( 0 fertilization) of Giza 2000    4: Treatment of Giza 2000**  
**5: Control ( 0 fertilization) of Giza 132    6: Treatment of Giza 132**

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## تأثير أصناف الشعير ومعدلات التسميد البوتاسى على الكثافة العددية للمن ونشاطات الاوراق وعلاقة ذلك بالتغيرات الكيميائية والتشريحية لنبات الشعير

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### الملخص العربي

أجريت هذه الدراسة في منطقة ديرب نجم بمحافظة الشرقية وذلك خلال موسمي 2013/2014 ، 2014/2015 وذلك لتقييم حساسية ثلاثة أصناف من نباتات الشعير وهي جيزة 123 و جيزة 2000 و جيزة 132 للإصابة بحشرات المن ونشاطات الأوراق وكذلك تأثير التسميد البوتاسى على التركيب الكيماوى والتشريحي وعلاقة ذلك بتعداد الحشرات نصفية الاجنحة (المن ونشاطات الأوراق). لقد أوضحت النتائج أن الصنف جيزة 123 هو أقل الأصناف من حيث المحتويات الكيماوية ( البروتين والكربوهيدرات) وكذلك وجد به نقص فى سمك الصفات التشريحية المقاسة مما أدى إلى أنه يكون أكثر الأصناف حساسية للإصابة بالحشرات وزيادة تعداد الحشرات عليه واقلهم محصولا وعلى العكس من ذلك كان الصنف جيزة 132 هو أقل الأصناف إصابة وأكثرهم محصولا. وأوضحت النتائج أن التسميد البوتاسى بمعدل 100 كجم سلفات بوتاسيوم/فدان إلى النباتات تحت الدراسة كان له تأثير كبير على زيادة المحتوى البروتينى والكربوهيدراتى وكذلك زيادة سمك الصفات التشريحية المقاسة مما أدى الى نقص تعداد الحشرات الثاقبة الماصة موضع الدراسة. لذلك يوصى باختيار الأصناف المناسبة مع الاهتمام بالتسميد البوتاسى بمعدل 100 كجم سلفات بوتاسيوم/فدان ووضعها ضمن برنامج مكافحة المتكاملة للآفات على نباتات الشعير. كما لوحظ وجود ارتباط سالب بين نسبة البروتين الكلى و الكربوهيدرات و تعداد الحشرات الثاقبة الماصة و عكسى مع قيم pH . لوحظ ان زيادة سمك البشرة العلوية والكيوتكل او البشرة السفلية والكيوتكل يقلل تعداد الحشرات على الاوراق كذلك زيادة سمك النسيج المتوسط يزيد من عملية التمثيل الضوئى ويزيد من قوة النبات ويقلل التأثير الضار للحشرات

أثبتت الدراسة ان التسميد البوتاسى بمعدل 100 كجم سلفات بوتاسيوم للفدان يزيد من سمك التراكيب التشريحية تحت الدراسة (سمك الكيوتكل وسمك كل من البشرة العليا والسفلى والنسيج المتوسط والنصل) مما يؤدي الى قلة تعداد الحشرات على الاوراق وتقليل الاثر الضار لها.