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Efficiency of Phenolic Contents and some Field Factors on the Population Abundance of Aphid Species and Onion Thrips Infesting Bread Wheat Cultivars under Irrigation Conditions

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ABSTRACT

The study was conducted during (2015/ 2016 and 2016/ 2017) at the farm of Plant Protection Department, Faculty of Agriculture, Assiut University, Assiut, Egypt on five wheat cultivars: Sahel 1, Seds 4, Gemaza 9, Giza 168, and Misr 2). To study the effects of phenolic contents (free and bound phenols), climatic factors (daily maximum (DMxT) and minimum temperatures (°C) (DMnT), soil maximum and minimum temperatures (°C) (SMxT and SMnT) at 5 cm depth, and the natural enemies (N. E.) on the population density of onion thrips, *Thrips tabaci* Lindeman and aphid species (*Mayzus persicae* Sulz., *Brivecoryne brassicae* Linnaeus, and *Rhopalosiphum padi* Linnaeus) infesting bread wheat cultivars under irrigation conditions, with references to the yields of wheat cultivars. The invasions started in February during the 1st season and in January for the 2nd season on all of wheat cultivars. The invasions of thrips individuals were higher than aphids in almost of wheat cultivars during the two seasons of the study. In the 1st season, aphid's populations showed three peaks on all cultivars in the 31th of March, 15th of April, and in the 30th of April. Meanwhile, thrips individuals registered two peaks: the 1st peak was in the 15th of March and the second were occurred in the 31th of March. Respect to the 2nd season, aphids recorded three peaks in 15th, 28th of February and 15th of March on all wheat cultivars and thrips recorded two peaks of fluctuations in the 28th and 15th of March. All of the considered factors were contributed together in forming the patterns of the population density (R^2) by 53.62, 60.44, and 71.65%; respectively for aphids, thrips and the grand total of pests during the two seasons of the study. In case of Aphids, (DMnT) was the highest participated factor in regulating the population (16.906 out of 53.62%), the free phenol contents showed that the only negative correlation and ranked the second efficient factor by (16.62 out of 53.62%), afterwards the third efficient factor was (DMxT) which shared with (11.073 out of 53.62%), and finally the natural enemies showed the least efficient factor by (0.026 out of 53.62%) on all wheat cultivars. The population for both thrips and grand total were mostly under controlled by the same factors, (DMnT) was the highest efficient factor (18.614 out of 60.48% and 24.525 out of 71.65%; respectively for thrips and the grand total of pests). Then, (N. E.) played the second role with (13.337 out of 60.44%) for thrips and (15.032 out of 71.65%) for the grand total. Afterwards, (DMnT) ranked the third factor (12.794 out of 60.44% and 14.800 out of 71.65%; respectively for thrips and the grand total of pests). The least efficient factor for thrips was (SMxT) which participated by (0.240 out of 60.44%) and for the grand total of pests were bound phenol contents (0.129 out of 71.65%). Top yields were gained from Giza 186 and Misr 2 (218.0, 213.4 and 207.3, 198.8 GY/10 plants; respectively during the 1st and 2nd seasons. Afterwards, Gemeza 9 ranked the third cultivar in the 1st season (182.7 GY/10 plants) and Sahel 1 for the 2nd season (192.8 GY/10 plants)

Keywords: Irrigation condition, Phenolic content, wheat aphids, Onion thrips, wheat resistance

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the most economic and nutritious food among various cereal crops which globally cultivated on 23% for its importance in world food safety (Istvan, 2006). It participated by 20% of world food calories for about 40% of world population and contains13% of protein (Ahmad and Shaikh, 2003).

Aphid's species and thrips are the great challenge facing the production of wheat around the world. Insect pests cause an obvious negative reduction in the yield. On the other hand, the intensive use of insecticides has become non acceptable for human hazard toxicity and expensive costs due to insects-resistance to various insecticides as the total cost of pesticides reached to approximately $40 billion spent worldwide for chemical control (FAO, 2011; Lewis *et al.*, 1997).

The aphids are sucking insect pests which capable of infesting various wheat cultivars and cause distortion, chlorosis, curling of leaves and the damage are not easy managed (Geza, 2000; Dedryver *et al.*, 2010). Aphids infestation reduce the numbers of wheat heads and the lost could be reached up to 35 - 40% as direct loss, and 20-80% of the indirect loss occurs due to the excretions of aphids honeydew which followed by fungi and moulds growth then shortage in photosynthesis process (Rossing *et al.*, 1994).

Thrips tabaci Lindeman, is a minor insect pest on more than 300 species of host plant groups and adapt to infest various species of plants (Ghabn, 1948; Ahmed *et al.*, 2016). Thrips is very difficult pest to be controlled due to its behaviour in escaping from direct sunlight and high temperatures by sheltering in flowers and folded leaves where insecticides could not eternally reach to such parts (Palumbo, 2000).

In this regard, most of plants developed the defence reaction due to the continuous attacks of the same kind of insect pests or organisms by using various mechanisms of defence such as producing numerous of chemical compounds in order to deter or prevent insect pests attack to protect their tissues (Kamila, 2016). The plant chemicals classified into several categories such as phenols, repellent, toxins, tannins. Phenolics are the major chemical group released for its primary function in the defence system of the plant species self-protection (Marta and Sarah, 2011). Several of these compounds are repellent to haematophagous insects which could be an evolutionary relict from plant-feeding ancestor, as many of these compounds evolved as repellents to phytophagous insects (Harrewijn *et al.*, 1995).

The aim of this study is to investigate the effect of free and bound phenols contents, plant age, climatic factors of daily maximum and minimum temperature in Celsius degrees, soil temperature at 5 cm depth in Celsius degrees, and the natural enemies of aphids and thrips on the fluctuation of onion thrips, *T. tabaci* and aphid species (*M. persicae*, *B. brassicae,* and *R. padi*); respectively on five wheat cultivars under irrigation condition with references to the yields of the examined cultivars.

MATERIALS AND METHODS

1. The design of the experimental:

The experiment was conducted on five bread wheat cultivars: Sahel 1, Seds 4, Gemaza 9, Giza 168, and Misr 2 throughout two seasons (2015- 2016 and 2016- 2017) at the farm of Faculty of Agriculture, Assiut University, Assiut, Egypt. The five cultivars were allowed for irrigation and each cultivar was planted in three plots (replicates), with total number of 15 replicates for all cultivars. The plot size was 3m x 4m and contains ten rows. 40 plants in each row, with 30 cm spacing the rows, and 30 cm within plants and the experiment was maintained free from using pesticides or weedicides.

2. The estimation of population density of aphids and thrips:

The weekly random collection was done for three plants/ cultivar/ replicate. The plants (samples) were transferred in polyethylene bags 45 samples/ week from the selected cultivars and the plants were kept in refrigerator at The Laboratory of Economic Entomology/ Plant Protection Research centre at the Faculty of Agriculture Farm, Assiut University, Assiut, Egypt for examination. The whole plants (heads, stems, leaves: upper and lower surfaces) were well examined by binocular, and the numbers of mature and immature stages of aphids and thrips were registered and the unknown samples of aphids species were maintained on glass slides and sent to the specialist Dr. Amal Hamed Ahmed Atta, at Plant Protection Department, Faculty of Agriculture, Assiut University, Assiut, Egypt for identification according to Atta, (1989).

3. The meteorological date:

The daily maximum (DMxT) and minimum (DMnT) temperatures of weather and soil in Celsius degrees (SMxT and SMnT) in 5 cm depth were obtained from the meteorological station of Assiut University, Faculty of Agriculture Farm, Assiut, Egypt.

4. Determination of phenolics in the wheat cultivars:

The determination of free and cell wall-bound were determined according to Kofalvi and Nassuth (1995).

-Reagents: 50% methanol, Folin-Ciocalteu's, 0.5 N NaOh, 2 N HCL, and 20% Na2Co3.

-Procedure: The fresh leaves (0.3 g) were extracted in 50% methanol (10 ml) for 90 min. at 80 °C. The extract was centrifuged at 14,000 rpm for 15 min. and the supernatant taken for free phenolics determination using the Folin-Ciocalteu's phenol reagent. The pellet was sponified with 2 ml of 0.5 N NaOH for 24 h at roomtemperature to release the bound phenolics, neutralized with 0.5 ml 2 N Hcl and centrifuged at 14,000 rpm for 15 min. The supernatant was taken for bound phenolics determination using the Folin-Ciocalteu's assay. One hundred microliters of the methanol and NaOH extracts were diluted to 1 ml with water and mixed with 0.5 ml 2 N Folin-Ciocalteu's reagent and 2.5 ml of 20% Na2 Co3. After 20 min. at room temperature, absorbance of samples was measured at 725 nm with a unico UV-2100 spectrophotometer. Phenolic concentration in the extract was determined from standard curve prepared with gallic acid.

5. Statistical analysis:

The multi-regression analyses (Table: 2) was done by ASAP (Advanced Statistical Analysis Package) to present the efficiency of each variable by dropping one of each variable, step by step from the input analysed data. The statistical analysis was run for 2016 and 2017 seasons together between the numbers of aphid species, thrips, the grand total (sums of aphids and thrips); separately with phenolic contents (free and bound), daily maximum and minimum temperature in Celsius degrees, soil temperature in 5 cm depth Celsius degrees and the natural enemies on all cultivars.

RESULTS AND DISCUSSION

1. The fluctuation of Aphids and thrips during the seasons of the study (2015/ 2016 and 2016/ 2017):

The means of thrips populations (Table: 1; Fig. 1 and 2) were higher than the means of aphid species on all of wheat cultivars during the two seasons of the study.

In the beginning of the season the cultivars were not attacked by aphids and thrips, because the vegetative growths of the cultivars were not completed yet. Therefore, the population fluctuations of both pests were (0.0 individuals/ 9 plants/ 3 replicates) during the months of December and January.

The abundance of aphids and thrips during the first season (2015/ 2016):

The population of both pests (Table: 1; Fig. 1 and 2) were in low fluctuations in the 15th of February and the density of aphids reached to moderate levels of abundance in the 29th of February. This could be occurred because the cultivars were not mature enough and the vegetative growth was lake to attract insect pests.

Aphids individuals were registered three peaks (Table: 1; Fig. 1 and 2) on all of wheat cultivars in the 31th of March, 15th of April, and in the 30th of April as the last one recorded the highest numbers of individuals among all peaks (averages 292.7, 311.0, 284.3, 206.0, and 178.0 individuals/ 9 plants/ 3 replicates; respectively for Sahel 1, Seds 4, Gemaza 9, Giza 186, and Misr 2) when the temperatures were (Max. temp. 37.2 °C, Min temp. 15.4 °C, Soil max. temp. 44.6 °C, Soil min. temp. 28.6 °C) under the respect order of free and bound contents of phenol as following (0.4, 1.0; 0.4, 1.4; 0.4, 1.0; 1.5, 1.7; 0.5, and 0.8 mg/g fresh weight; respectively in Sahel 1, Seds 4, Gemaza 9, Giza 186, and Misr 2). These results are similar to the findings of Sayed and Teilp (2013) in Egypt, Ismailia whom demonstrated that the highest numbers of *B. brassica* individuals were observed on the 1nd week of March and the 2nd week of April. Besides, there are other similar results has been occurred with Aslam *et al.* (2007) in Pakistan, whom found that the population of *B. brassica* was in moderate levels from the end of February to early or mid. of March.

The population of thrips recorded two peaks: the first one was in the 15th of March and the second were occurred in the 31th of March with mean averages (215.0, 231.7; 213.0, 247.0; 192.0, 221.3; 167, 205.0; 143.3, and 200.0 individuals/ 9 plants/ 3 replicates; respectively for Sahel 1, Seds 4, Gemaza 9, Giza 186, and Misr 2) where the temperature degrees were (Max. temp. 26.2 °C, Min temp. 13.4 °C, Soil max. temp. 36 °C, Soil min. temp. 19 °C, in the 15th of March, and Max. temp. 31.6 °C, Min temp. 11 °C, Soil max. temp. 38.6 °C, Soil min. temp. 18.4 °C in the 31th of March respectively for Sahel 1, Seds 4, Gemaza 9, Giza 186, and Misr 2) and the free and bound phenol contents were found in the previous order of cultivars as following: 0.5, 1.2; 0.4, 1.2; 0.5, 1.1; 1.8, 2.0; 0.6, and 0.9 mg/g fresh weight in 15th of March, while in the 31th of March were 0.4, 1.0; 0.4, 1.2; 0.4, 0.9; 2.0, 1.4; 0.4, and 0.7 mg/g fresh weight; respectively for Sahel 1, Seds 4, Gemaza 9, Giza 186, and Misr2).

At the end of the season, the populations of both pests were decreased on all cultivars with mean averages (145.3, 74.3; 299.0, 86.0; 136.0, 73.3; 95.7, 52.3; 77.7, and 61.0 individuals/ 9 plants/ 3 replicates; respectively for aphids and thrips on Sahel 1, Seds 4, Gemaza 9, Giza 186, and Misr 2), during the following degrees of temperatures which reached to (Max. temp. 45 °C, Min temp. 24 °C, Soil max. temp. 53.2 °C, Soil min. temp. 34 °C) under the same respect order of cultivars the free and bound contents of phenol reached to (0.4, 1.2; 0.4, 1.3; 0.5, 1.1; 1.6, 2.0; 0.5, and 0.9 mg/g fresh weight; respectively in Sahel 1, Seds 4, Gemaza 9, Giza 186, and Misr 2). These results are in agreement with the findings by Sayed and Teilp (2013) who reported in Egypt, Isamilia that the population of the individuals of *B. brassica* / plant recorded law numbers in February and May.

The highest grand total numbers of aphids and thrips were recorded on Seds 4 (1472.0 and 1183.3 individuals/ season; respectively for aphids and thrips), and the lowest were occurred on Misr 2 (648.0 and 812.7 individuals/ season; respectively for aphids and thrips). The highest yield was obtained from Giza 186 (218.0 GY/10 plants), and the lowest one was found from Sahel 1 (181.3 GY/10 plants). These variations in the numbers of insect pests among the studied cultivars might be ascribed to certain morphological characteristics among the selected cultivars, because the type of mouth parts in both aphids and thrips which not only affected with the density of plant hairs, but also with the type of hairs on leaves and stems. These results were stated before by Metcalf and William (1975) as they emphasized that the plant resistance to insect attack mainly derives from morphological characteristics which affect the behavior of insect pests and influence the relative damage degrees.

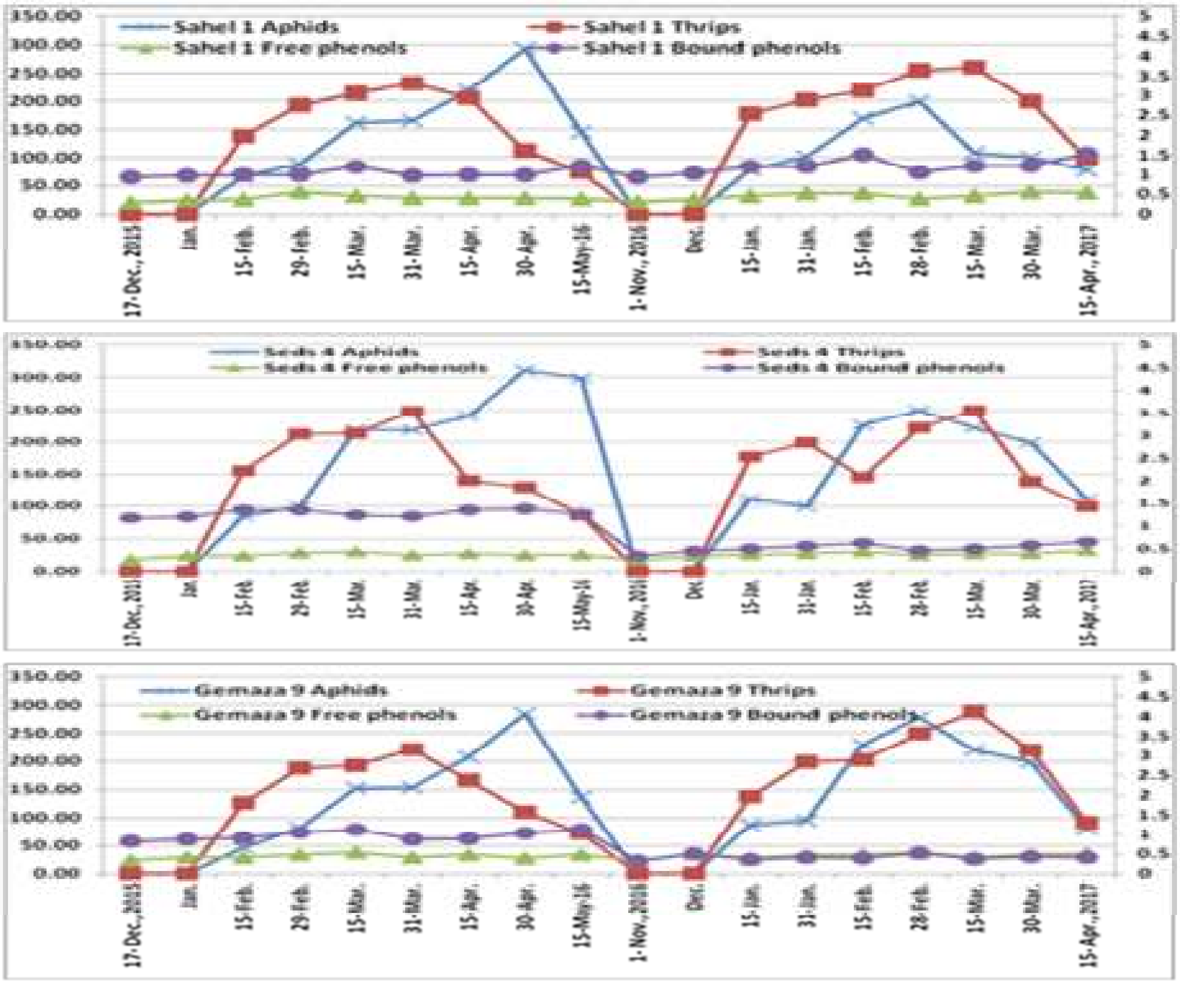

Fig. 1. The fluctuations of aphid species and thrips with the amounts of free and bound phenols under the considered meteorological data in some wheat cultivars during (2015/ 2016 and 2016/ 2017) at the farm of Plant Protection Department, Faculty of Agriculture, Assiut University, Assiut, Egypt under irrigation condition.

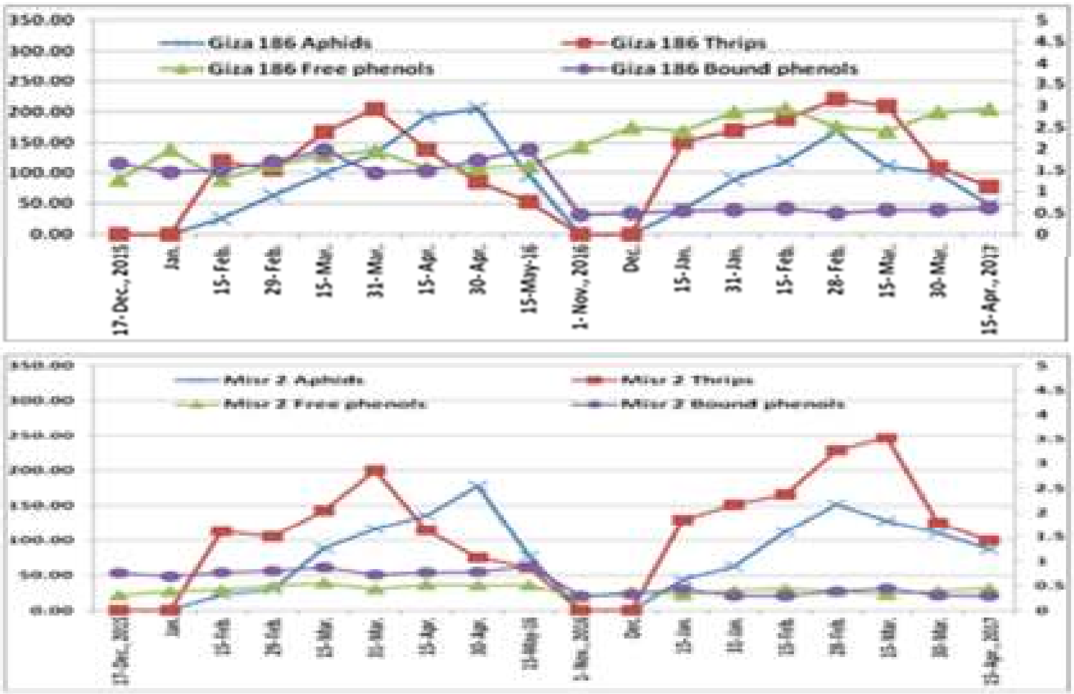

Fig. 2. The fluctuations of aphid species and thrips with the amounts of free and bound phenols under the considered meteorological data in some wheat cultivars during (2015/ 2016 and 2016/ 2017) at the farm of Plant Protection Department, Faculty of Agriculture, Assiut University, Assiut, Egypt under irrigation condition

Table 1. Mean numbers of #aphid species and onion^ thrips on some *wheat cultivars and their phenolic contents under irrigation conditions during (2015/ 2016 and 2016/ 2017) at the farm of Plant Protection Department, Faculty of Agriculture, Assiut University, Assiut, Egypt.

Season	Months	Mean numbers of individuals/ 3 plants/ replicate										Free and bound phenols contents										Temp. in °C			
		Sahel 1		Seds 4		Gemaza 9		Giza 186		Misr 2		Sahel 1		Seds 4		Gemaza 9		Giza 186		Misr 2		Weather °C		Soil T (5 cm)	
		Aph.	*Th.*	*Aph.*	*Th.*	*Aph.*	*Th.*	*Aph.*	*Th.*	*Aph.*	*Th.*	*F*	*B*	*F*	*B*	*F*	*B*	*F*	*B*	*F*	*B*	Mx.T	Min.T	Mx.T	Min.T
First season (2015/ 2016)	17- Dec., 2015	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.9	0.3	1.2	0.4	0.8	1.3	1.7	0.3	0.8	0	0	0	0
	Jan.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.0	0.3	1.2	0.4	0.9	2.0	1.4	0.4	0.7	0	0	0	0
	15- Feb.	66.3	138.7	84.3	155.3	46.3	126.7	26.3	120.3	22.7	113.3	0.4	1.0	0.3	1.3	0.4	0.9	1.3	1.5	0.4	0.8	23.8	8	34	12.2
	29- Feb.	88.3	192.3	99.7	212.0	81.0	187.7	63.0	106.0	29.3	105.0	0.6	1.0	0.4	1.3	0.5	1.1	1.6	1.7	0.5	0.8	32.4	12.2	37.8	16.2
	15- Mar.	162.0	215.0	218.3	213.0	152.0	192.0	98.0	167.3	88.3	143.3	0.5	1.2	0.4	1.2	0.5	1.1	1.8	2.0	0.6	0.9	26.2	13.4	36	19
	31- Mar.	165.3	231.7	219.0	247.0	153.7	221.3	132.7	205.0	116.0	200.0	0.4	1.0	0.4	1.2	0.4	0.9	2.0	1.4	0.4	0.7	31.6	11	38.6	18.4
	15- Apr.	218.3	205.7	240.7	140.3	207.7	166.0	192.7	138.7	136.0	114.7	0.4	1.0	0.4	1.3	0.5	0.9	1.6	1.5	0.5	0.8	33.4	12.4	45.8	23.6
	30- Apr.	292.7	112.7	311.0	129.7	284.3	110.3	206.0	84.3	178.0	75.3	0.4	1.0	0.4	1.4	0.4	1.0	1.5	1.7	0.5	0.8	37.2	15.4	44.6	28.6
	15-May, 2016	145.3	74.3	299.0	86.0	136.3	73.3	95.7	52.3	77.7	61.0	0.4	1.2	0.4	1.3	0.5	1.1	1.6	2.0	0.5	0.9	45	24	53.2	34
	Grand total	1138.3	1170.3	1472.0	1183.3	1061.3	1077.3	814.3	874.0	648.0	812.7	3.8	9.3	3.3	11.4	4	8.7	14.7	14.9	4.1	7.2	-----	-----	-----	-----
	Grand mean	126.5	130.0	163.6	131.5	117.9	119.7	90.5	97.1	72.0	90.3	0.4	1.0	0.4	1.3	0.4	1.0	1.6	1.7	0.5	0.8	-----	-----	-----	-----
	The yield	181.3		156.7		182.7		218.0		207.3		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Second season (2016/ 2017)	1- Nov., 2016	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.9	0.2	0.3	0.3	0.3	2.1	0.5	0.3	0.3	0	0	0	0
	Dec.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.0	0.3	0.4	0.5	0.5	2.5	0.5	0.4	0.3	0	0	0	0
	15- Jan.	79.0	178.0	112.0	177.0	88.0	138.0	41.0	152.0	44.0	130.0	0.5	1.2	0.4	0.5	0.4	0.4	2.4	0.5	0.3	0.4	22.6	7.8	28.2	12
	31- Jan.	102.0	202.0	99.0	199.0	95.0	199.0	88.0	170.0	63.0	152.0	0.5	1.2	0.4	0.6	0.5	0.4	2.8	0.6	0.4	0.3	20	3	28.4	8.8
	15- Feb.	170.0	219.0	226.0	146.0	230.0	202.0	120.0	188.0	112.0	166.0	0.5	1.5	0.4	0.6	0.5	0.4	2.9	0.6	0.4	0.3	19.2	4.6	34	12.2
	28- Feb.	199.0	255.0	249.0	222.0	278.0	250.0	169.0	220.0	152.0	228.0	0.4	1.0	0.4	0.5	0.5	0.5	2.5	0.5	0.4	0.4	28.8	7.6	36.6	16
	15- Mar.	108.0	260.0	222.0	249.0	220.0	288.0	112.0	209.0	128.0	246.0	0.5	1.2	0.4	0.5	0.4	0.4	2.4	0.6	0.3	0.4	26.4	9.8	36	19
	30- Mar.	99.9	199.0	199.0	139.0	199.0	220.0	99.0	110.0	111.0	125.0	0.6	1.2	0.4	0.6	0.5	0.4	2.9	0.6	0.4	0.3	31	14.8	37.6	17.8
	15- Apr., 2017	78.0	98.0	112.0	99.0	80.0	91.2	48.0	78.0	87.0	100.0	0.5	1.5	0.5	0.6	0.5	0.4	2.9	0.6	0.5	0.3	28.6	10	45.8	23.6
	Grand total	835.9	1411.0	1219.0	1231.0	1190.0	1388.2	677.0	1127.0	697.0	1147.0	4.2	10.7	3.4	4.6	4.1	3.7	23.4	5	3.4	3	-----	-----	-----	-----
	Grand mean	92.9	156.8	135.4	136.8	132.2	154.2	75.2	125.2	77.4	127.4	0.5	1.2	0.4	0.5	0.5	0.4	2.6	0.6	0.4	0.3	-----	-----	-----	-----
	The yield	192.8		182.2		132.0		213.4		198.8		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

#= *Mayzus persicae*, *Brivecoryne brassicae*, and *Rhopalosiphum padi*   ^= *Thrips tabaci* lindeman   Aph.= Aphid   Th.= Thrips
***= Sahel 1, Seds 4, Gemaza 9, Giza 168, and Misr 2   F= Free phenol   B= Bound phenol**

The abundance of aphids and thrips during the second season (2016/ 2017):

The population of both pests recorded low levels of fluctuations (Table: 1) during the 15th of January. Afterwards, the individuals increased gradually increased to moderate levels of abundance during the 31th of January for aphids and the moderate levels extended to 15th of February for thrips.

The populations of aphids showed that three peaks in 15th, 28th of February and 15th of March on all wheat cultivars were occurred. The highest peaks on all wheat cultivars where occurred in the 28th February (mean averages 199.0; 249.0; 278.0; 169.0, 152.0 individuals/ 9 plants/ 3 replicates; respectively for Sahel 1, Seds 4, Gemaza 9, Giza 186, and Misr 2) during the temperatures degrees of factors (Max. temp. 28.8 °C, Min temp. 7.6 °C, Soil max. temp. 36.6 °C, Soil min. temp. 16 °C) under free and bound contents of phenol in the following order (0.4, 1.0; 0.4, 0.5; 0.5, 2.5; 0.5, 0.4, 0.4 mg /g fresh weight; respectively for Sahel 1, Seds 4, Gemaza 9, Giza 186, and Misr 2).

However, thrips recorded two peaks of fluctuations in the 28th of February and the 15th of March. The greatest peaks where observed in the 15th of March (averages 260.0; 249.0; 288.0; 209.0; 246.0 individuals/ 9 plants/ 3 replicates; respectively for Sahel 1, Seds 4, Gemaza 9, Giza 186, and Misr 2), while the temperature degrees where (Max. temp. 26.4 °C, Min temp. 9.8 °C, Soil max. temp. 36 °C, Soil min. temp. 19 °C) and the phenols contents were (0.5, 1.2; 0.4, 0.5; 0.4, 0.4; 2.4, 0.6; 0.3, 0.4 mg/ g fresh weight; respectively for Sahel 1, Seds 4, Gemaza 9, Giza 186, and Misr 2).

Afterwards, the numbers of individuals of both pests were gradually decreased till the end of the season in the 15th of April, 2017. There are similar results reported that the individuals of *T. tabaci* were not found in the beginning of the season in canola, then population was in law numbers afterwards increased to reach to their peaks in the mid. of March and late April (Sayed and Teilp, 2013).

The grand total of aphid numbers was occurred on Seds 4 (1219.0 individuals/ season), and the lowest one was observed on Giza 186. Respect to thrips, the grand total was found on Sahel 1 (1411.0 individuals/ season), and Giza 186 was ranked the lowest grand total (1127.0 individuals/ season). According to the yield of cultivars, it has been showed that Giza 186 ranked the first cultivar (213.0 GY/10 plants) and Gemaza 9 was the last cultivar (132.0 GY/10 plants) among all of wheat cultivars. These differences between the population of invasive aphid species and thrips on the cultivars could be returned to the variations in the botanical prosperities, which may be played the role in appearing some resistance to insect attack. These results was reported by Kavitha and Reddy (2012) in an intensive study for resistant, tolerant, and susceptible varieties as a main component of Integrated Pest Management (IPM) and found that using of resistant or less suscebtible cultivar is important to keep the population of insect pests below the Economic Threshold Level (ETL).

2. The efficiency of factors in regulating the fluctuations of pests during (2015/16 and 2016/17):

The R^2 of the studies factors (Table: 2) in changing the fluctuation were 53.62, 60.44, 71.65%; respectively for aphids, thrips, and the grand total (sums of both aphids and thrips together).

The efficiency of factors on the population density of aphids during (2015/16 and 2016/17):

The populations of aphids (Table: 2) were highly affected with all considered factors together by 53.62%. The highest participated factor in this portion was the minimum temperatures (16.906 out of 53.62%), with little difference between the free phenol contents which ranked the second factor affected the abundance with (16.62%). The third factor was the maximum temperatures which shared with (11.073 out of 53.62%). The least efficient factor was the natural enemies (0.026 out of 53.62%) on all wheat cultivars. These results are in agreement with the findings of (Ajmal *et al*., 2017), where the biological control agents of aphids didn't present any correlation with aphid individuals. Likewise, these results are stated by Naser *et al*., (2001) who stated a non-significant correlation between the individuals of aphids and the natural enemies of Coccinelidae, lacewing, and Syrphid fly.

Table 2. Multiple correlations between the considered independent variables and the changes in the population density of # aphids species and ^onion thrips on various *bread wheat cultivars under irrigation conditions during (2015/16 and 2016/17) at the farm of Plant Protection Department, Faculty of Agriculture, Assiut University, Assiut, Egypt.

Cv.	Treatment	*Irrigation Condition*								
	Variable removed	*Aphids*			*Thrips*			*Grand total (Aphids + Thrips)*		
		r	*R^2 × 100*	*Efficiency*	*r*	*R^2 × 100*	*Efficiency*	*r*	*R^2 × 100*	*Efficiency*
*Sahel 1, Seds 4, Gemaza 9, Giza 168, and Misr 2	None	------	53.62	------	------	60.44	------	------	71.65	------
	Plant age	0.593	53.75	0.666	0.605	59.42	7.992	0.661	70.9	4.082
	Free phenols	- 0.204	47.91	16.62	- 0.127	59.65	6.224	- 0.169	69.43	12.012
	Bound phenols	6.112	53.86	3.166	- 0.384	60.40	0.618	- 1.623	71.64	0.129
	N.E.	0.461	53.98	0.026	0.60	60.47	13.337	0.647	71.66	15.032
	Max. Temp.	0.638	49.94	11.073	0.661	58.78	12.794	0.726	68.91	14.800
	Min. Temp.	0.520	47.81	16.906	0.495	58.01	18.614	0.553	67.11	24.525
	Soil Max. Temp.	0.636	53.1	2.428	0.690	60.45	0.240	0.749	71.56	0.543
	Soil Min. Temp.	0.611	52.99	2.732	0.592	60.40	0.625	0.660	71.57	0.527

 # = *Mayzus persicae*, *Brivecoryne brassicae*, and *Rhopalosiphum padi* ^ = *Thrips tabaci* lindeman N.E= Natural enemies
Min.Temp. = Minimum Temperature; Max. Temp. = Maximum Temperature
r = Simple correlation coefficient R^2 = Coefficient of determination.
Significant at > 0.001 level of probability

The efficiency of factors on the population density of thrips and the grand total of pests (aphids and thrips) during the seasons of the study (2015/16 and 2016/17):

Almost of the considered factors (Table: 2) showed some similar efficiencies in regulating both of the population of thrips and the grand total of pests. The negative correlations between the selected factors were found by the phenolic contents with thrips (- 0.127 and - 0.384; respectively for free and bound phenols) and also with the grand totals of pests (-0.169 and -1.623; respectively for free and bound phenols). The highest efficient factor was recorded by the minimum temperature (18.614, 24.525; respectively for thrips and the grand total of pests), followed by the natural enemies which played the second role with efficiency of (13.337 and15.032 out of 71.62%; respectively for thrips and the grand total). These results was confirmed by Wratten *et al*. (2003) as they reported that, the natural enemies is one of the best efficient alternatives to serve the agricultural ecosystem to suppress the population of insect pests. Additionally, it has been stated that the predators of natural enemies are important to regulate the fluctuation of aphids and minimize the chance of occurring outbreaks (Symondson *et al*., 2002). In respect to the efficiency of natural enemies to *T. tabaci*, there are agreements between the obtained results by Fok *et al*., (2014) who found positive relationship between the fluctuation of predators and *T. tabaci* abundance in both of large and small scale ecosystem with observation of a strong positive significant relationship in case of large scale system than the small and found between predators and *T. tabaci* ($P < 0.001$) under free insecticides plots.

Afterwards, the maximum temperature ranked the third factor (12.794, r = 0.661 and 14.800, r = 0.726); respectively for thrips and the grand total of pests). These findings was in agreement with Li *et al*., (1992) and Patel & Rote (1995) whom found that, minimum temperature didn't significantly affect the population of thrips. In this regard, Sayed and Teilp (2013) stated that the maximum temperature showed significant positive effect on arranging the population of thrips by simple correlation and partial regression analysis.

The least efficient factor for thrips was the soil maximum temperature (0.240 out of 60.44%). The obtained results were in the same line of Mohamed (2016) who concluded that, the peaks of *T. tabaci* were coincided with high levels of soil temperature degrees under 5 cm depth from soil surface. Respect to the grand total of pests, bound phenol contents were the least efficient factor (0.129 out of 71.65%). These findings are similar to the results of Scholtz, (1989) who found that, the plant phenolics influence food preference and performance for insects and various herbivores. Besides, another study emphasized that, detoxified phenolics showed a positive impacts and played the defence role on insects and other herbivores (Bernays *et al*., 1983).

In general, the same influence of both thrips and the grand total populations could be occurred due to the obvious high numbers of thrips than aphid species, which directly affect in the sums of the grand total and makes both of them take the same trend under the efficiency of the considered factors.

CONCLUSION

The invasion of thrips individuals was higher than aphids during the two seasons of the study. Respect to aphid species, the individuals recorded three generations per season and the population were strongly affected and controlled by the minimum temperatures and free phenols, but the natural enemies were the least efficient factor on their population. For thrips and the grand total of pests, the minimum temperatures ranked the first factor followed by the natural enemies and then the maximum temperatures in regulating the individuals of thrips and the grand total of pests, while the soil maximum temperatures and bound phenols; respectively were the weakest factors affect the population of thrips and grand total of pests. In the 1st season, the highest yield was obtained from Giza 186 (218.0 GY/10 plants), and the lowest one was recorded from Sahel 1 (181.3 GY/10 plants), while in the 2nd season Giza 186 ranked the first cultivar (213.0 GY/10 plants) and Gemaza 9 was the last cultivar (132.0 GY/10 plants) among all of wheat cultivars.

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كفاءة المحتوي الفينولي وبعض العوامل الحقلية علي تذبذب عشائر أنواع المن وتربس البصل التي تصيب بعض اصناف قمح الخبر تحت ظروف الري

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أجريت الدراسة خلال موسمي (2016/2015 و 2017/2016) بمزرعة قسم وقاية النبات ، كلية الزراعة ، جامعة أسيوط ، أسيوط ، مصر على خمسة أصناف من قمح الخبز: (الساحل 1 ، سدس 4 ، جميزة 9 ، جيزة 168 ، ومصر 2). لدراسة تأثير كل من محتويات الفينول (الفينولات الحرة والمرتبطة) ، والعوامل المناخية (درجات الحرارة العظمي اليومية ودرجات الحرارة الصغري اليومية (بالدرجات المئوية)، وكذلك درجات الحرارة العظمي والصغري للتربة بالدرجة المئوية عند عمق 5 سم من سطح التربة، بالأضافة الي تأثير الأعداء الحيوية على تذبذب عشائر تربس البصل *Thrips tabaci* Lindeman وبعض انواع المن التي تم حصرها من علي جميع اصناف القمح سالفة الذكر موضع الدراسة تحت ظروف الري وهي: (*Mayzus persicae* Sulz., *Brivecoryne brassicae* Linnaeus, and *Rhopalosiphum padi* Linnaeus) بدأ ظهور الأصابة في بداية شهر فبراير خلال الموسم الأول وفي يناير للموسم الثاني علي جميع أصناف القمح. كان من الملاحظ ان غزوات واعداد التربس أعلى من حشرات المن تقريباً علي معظم اصناف القمح خلال خلال مواسمي الدراسة. في الموسم الأول: أظهرت النتائج ثلاث فورانات لحشرة المن على جميع الأصناف في 31 مارس ، 15 و 30 من شهر أبريل. بينما سجل التربس فورانين: القمة الأولى كانت في 15 من مارس والثانية في 31 مارس. وفيما يتعلق بالموسم الثاني، فقد أوضحت النتائج عن وجود ثلاث فورانات لعشائر المن في 15 و 28 فبراير و 15 مارس على جميع أصناف القمح، بينما في حالة التربس سجلت الافراد فوران في الاعداد في 28 و 15 مارس. حيث اكدت النتائج علي أن جميع العوامل المدروسة شاركت معاً في تشكيل أنماط لتذبذب أفراد المن(R2) بنسبة 53.62 و 60.44 و 71.65٪ على التوالي للمن، التربس والمجموع الكلي للآفات خلال موسمي الدراسة. في حالة المن: فقد ساهمت درجات الحرارة الصغري بأعلى عامل مشاركة في تنظيم الاعداد (16.906 من 53.62٪) ، وأظهرت المحتويات الفينولية الحر نتائج الارتباط السلبي الوحيدة وسجلت ثاني عامل من حيث الكفاءة بنسبة (16.62 من 53.62٪)، ثم بعد ذلك كانت درجات الحرارة العظمي هي العامل الثالث من حيث الفعالية والذي شارك بنسبة (11.073 من 53.62٪) ، وأخيرًا أظهرت الأعداء الحيوية أقل عامل من حيث الكفاءة (0.026 من 53.62٪) على جميع أصناف القمح. كما أشارت النتائج الي أن معظم العشائر الخاصة بالتربس والمجموع الكلي للأفات خضعوا للسيطرة تحت تأثير نفس العوامل، وسجلت درجات الحرارة الصغري أعلى عامل من حيث الكفاءة (18.614 من 60.48 ٪ و 24.525 من 71.65 ٪ ، على التوالي بالنسبة للتربس والمجموع الكلي للآفات)، ثم لعبت الاعداء الحيوية الدور الثاني بنسبة للتربس (13.337 من 60.44 ٪) وكذلك بالنسبة للمجموع الكلي للأفتين (15.032 من 71.65 ٪). اما درجات الحرارة الصغري احتلت العامل الثالث (12.794 من أصل 60.44 ٪ و 14.800 من 71.65 ٪ ، على التوالي للتربس والمجموع الكلي للآفات). ثم كان العامل الأقل كفاءة في التأثير علي مجاميع التربس هي درجات الحراة العظمي للتربة والتي شاركت بنسبة (0.240 من 60.44٪)، وبالنسبة للمجموع الكلي للحشرات كانت محتوى الفينولات المرتبطة (0.129 من 71.65٪). تم الحصول على أعلى العوائد المحصولية من صنف الجيزة 186 و مصر 2 (218.0 ، 213.4 و 207.3 ، 198.8محصول الحبوب/ 10 نباتات على التوالي خلال الفصلين الأول والثاني. ثم بعد ذلك سجل جميزة 9 المركز الثالث في الموسم الأول (182.7محصول الحبوب/ 10 نباتات) والساحل 1 للموسم الثاني (192.8 محصول الحبوب/ 10 نباتات).