Zagazig J. Agric. Res., Vol. 44 No. (6B) 2017 2685-2694

Plant Protection Research

http:/www.journals.zu.edu.eg/journalDisplay.aspx?Journalld=1&queryType=Master

POPULATION FLUCTUATIONS OF THE DOMINANT PESTS AND THEIR ASSOCIATED PREDATORS ON BARLEY PLANTS

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Received: 11/09/2017 ; Accepted: 19/11/2017

ABSTRACT: The present work was conducted in order to study the population density of aphids, leafhoppers and mites infesting barley plants and their associated predators and its relation to the prevailing temperature and relative humidity at Salhia District, Sharkia Governorate, Egypt during the two successive seasons of 2013/2014 and 2014/2015. The obtained results showed that the main pests on barely plants were the aphid species, *Rhopalosiphum padi* (L.), *Rhopalosiphum maidis* (Fitch), *Schizaphis graminum* (Rondani) and *Sitobion avenae* (Fabr.). Leafhoppers included *Empoasca decipiens* (Paoli) and *E. decedens* (Paoli) in addition to the mite *Petrobia tritici* Kandeel, El-Naggar and Mohamed. The associated predators were *Coccinella undecimpunctata* (L.), *Chrysoperla carnea* (Stephens), *Syrphus* sp. and *Orius* sp. The aforementioned pests and predators were collected by two different methods from barley plants as follows: using plant sample and insect sweep net. The plant sample proved to be better to collect aphids, mite and associated predators of the present work, while sweep net proved to be better for the leafhoppers. The seasonal abundance of *R. padi* and *R. maidis* on barley plants showed one peak (354,178 and 210,189 insects/sample) occurred at the 2nd week of February in 2013/ 2014 and 2014/2015 seasons, respectively. Also, *S. graminum* appeared one peak (134 and 114 insects/sample) at the 1st week of February during the two seasons of study, respectively. On the other hand, one peak occurred at the 1st week of March for both *E. decipiens* (38 and 27 insects/sample) and *E. decedens* (31 and 24 insects/sample) during the two seasons of study, respectively. The most abundant species of predators were *C. undecimpunctata* showing three peaks at the 4*th* week of January, 1*st*, 4*th* weeks of February, the 2*nd* week of March, the 1*st* week of April and *C. carnea* appearing one peak in the 4*th* week of February during the two seasons of study, respectively. Obvious relationships between the population density of pests, associated predators and prevailing weather factors including the effect of mean temperature and relative humidity as well as their total combined effect on the numbers of certain investigated pests was recorded.

Key words: Population fluctuations, aphids, leafhoppers, mite, predators, barley plants, temperature, relative humidity.

INTRODUCTION

Barley, *Hordeum vulgare* (L.) is one of the most important cereal crops in the world. It is widely grown as fourth cereal and among top ten crop plants in the world. Barley was mainly cultivated and used for human food supply in the last century but nowadays it is significantly grown as animal feed, malt products and human food respectively. In addition, barley is very well known as a model crop for plant breeding methodology, genetics, cytogenetics, pathology, virology and biotechnology studies (Hockett and Nilan, 1985; Hagberg, 1987).

Barley is mainly produced in unfavorable climate and soil conditions of the world. According to the excavations, barley was domesticated in the River Nile Valley of Egypt

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at least 17.000 years ago (Wendorf *et al*., 1979).

As a result of the expansion of cultivated barley plants the problems of insect pests have been increased in the last years and barley has been subjected to be attacked by a large number of pests throughout the growing season. Among these pests, certain homopterous insects (aphids and leafhoppers) and mites which are of great economic importance which cause serious damage either directly by sucking plant juice or indirectly by transmission of several virus diseases and that widely affect the grain yield. However, scattered records of insects associated with barley plants were reviewed by Hegab *et al*. (1987), Hegab (1997) and Belliure *et al*. (2009).Therefore, the present investigation was planned for studying the population dynamic of the main homopterous insects, mites and their associated predators on barley plants in relation with the prevailing temperatures and relative humidity.

MATERIALS AND METHODS

Experimental Design

The investigation was carried out in the experimental field of Salhia District, Sharkia Governorate, Egypt, during 2013/2014 and 2014/2015 seasons. Sowing dates were on 15 November in both seasons.

Normal agricultural practices were followed in time of experimental period. Since the insects under investigation differed in their living habits, activities and distribution on various parts of the host plants, it was necessary to use different sampling methods for each group of the tested insect pests and their associated predators.

The weekly sampling started after four weeks of cultivation date and continued until the harvest (end of April). To survey the aphid species, leafhoppers, mites and associated predators on barley plants the following two procedures of sampling were used:

Plant sample

Weekly samples, each of 45 tillers of barley plants were taken randomly from an area about 1050 m^2 which was divided into three replicates (each replicate about 350 m^2, 15 tillers). Samples were put in paper bags and transferred to the laboratory in the same day for examination and counting the number of pests and their predators by the aid of stereoscopic microscope. This method is more suitable to collect aphids, mite and accompanied predators.

Insect sweep net

To estimate population fluctuation activity, a sweep net technique was applied. For this purpose a sweep net 30 cm diameter, 60 cm deep of the conical fine muslin and long wooden handle (90 cm) was used. Each sample represented by 50 double strokes was taken randomly at weekly intervals from both diagonal directions of the experimental area. This method is more suitable for leafhoppers. Captured insects were transferred in well tied plastic sacs to the laboratory for examination and counting. The collected leafhoppers were identified according to Herakly (1980).

The daily mean temperature and relative humidity was obtained from the Agro-meteorological Station at Zagazig city during 2013/2014 and 2014/2015 seasons. The relationship between the weekly mean numbers of the dominant pests, associated predators and the corresponding weekly mean temperature and relative humidity was calculated. Simple correlation coefficient (r), partial regression values (b) and coefficient of determination (CD%) were used to describe the relationship between population fluctuation of pests, associated predators and each of temperature and relative humidity in natural conditions on barley plants according to Costat Software Microcomputer Program (Anonymous, 1990).

RESULTS AND DISCUSSION

Effect of Sampling Techniques on the Population Density of Pests and Associated Predators

The results in Table 1 show the total numbers and the percentage of the main pests and associated predators estimated by using two different sampling techniques on barley plants at Salhia District, Sharkia Governorate during the two successive seasons of 2013/2014 and 2014/ 2015.

Plant sample

Results given in Table 1 clear that the population density of aphids arranged descendingly

Table 1. Total number of pests and their associated predators on barley plants at Salhia distict, Sharkia Governorate collected by using plant sample and sweep net in 2013/2014 and 2014/2015 seasons

Order	Family	Species	Stage	Feeding behaviour	Total no. of individuals				Total	(%)
					2013/2014		2014/2015			
					PS	SN	PS	SN		
Homoptera	Aphididae	*R. padi*	Adult and nymph	Phytophagous	1478	24	1150	35	2687	32.20
		R. maidis	Adult and nymph	Phytophagous	1273	55	1086	41	2455	29.42
		S. graminum	Adult and nymph	Phytophagous	632	3	499	10	1144	13.71
		S. avenae	Adult and nymph	Phytophagous	47	10	35	8	100	1.20
	Cicadellidae	*E. decipiens*	Adult and nymph	Phytophagous	17	250	10	211	488	5.85
		E. decedens	Adult and nymph	Phytophagous	9	199	8	182	398	4.77
Prostigmata	Tetranychidae	*P. tritici*	Moving stages (adult, larva and nymph)	Phytophagous	524	0	548	0	1072	12.85
Grand total					3980	541	3336	487	8344	100
Coleoptera	Coccinellidae	*C. undecimpunctata*	Adult	Predator	67	7	80	5	159	43.44
Neuroptera	Chrysopidae	*C. carnea*	Adult	Predator	44	3	48	5	100	27.32
Diptera	Syrphidae	*Syrphus* sp.	Adult	Predator	24	4	22	5	55	15.03
Hemiptera	Anthocoridae	*Orius* sp.	Adult and nymph	Predator	22	2	27	1	52	14.21
Grand total					157	16	177	16	366	100

PS: Plant sample. SN: Sweep net.

according their abundance as follows: *R. padi* (1478 and 1150 insects/sample), *R. maidis* (1273 and 1086 insects/sample), *S. graminum* (632 and 499 insects/sample) and *S. avena*e (47 and 35 insects/sample) during 2013/2014 and 2014/ 2015 seasons, respectively. While, the total number of mite *P. tritici* was 524 and 548 individuals/sample during the two seasons, successively.

As for leafhoppers, the total number was 17, 10 and 9, 8 insects/ sample for *E. decipiens* and *E. decedens* during the two seasons of the study, successively.

Also, for the associated predators, Table 1 showed that the highest total number was 67, 80; 44, 48 ; 24, 22 and 22, 27 individuals/ sample for *C. undecimpunctata*, *C. carnea*, *Syrphus* sp. and *Orius* sp. in the two seasons, successively.

Insect sweep net

It is clearly shown in Table 1 that the total number of leafhoppers was 250, 211 and 199, 182 insects/ sample for *E. decipiens* and *E. decedens* during the two seasons of the study, respectively.

As for aphids, they arranged descendingly according to their abundance as follows: *R. maidis* (55 and 41 insects/ sample), *R. padi*, (24 and 35 insects/sample), *S. avena*e (10 and 8 insects/ sample) and *S. graminum* (3 and 10 insects/ sample) during 2013/2014 and 2014/2015 seasons, respectively. While, in case of mite *P. tritici* disappeared completely during the two seasons of the study.

Also, for the associated predators, Table 1 showed that the highest total number was 7, 5 ; 4, 5 ; 3, 5 and 2 , 1 individuals/ sample for *C. undecimpunctata*, *Syrphus* sp., *C. carnea* and

Orius sp. in the two seasons, successively.

It could be mentioned that the plant sample technique was better than insect sweep net for estimating the population density of aphids, mite and the associated predators. While, in case of leafhoppers, it was opposite. Such findings agree with those of Abd El-Megid *et al.* (2007) who reported that *S. graminum* Rondani, *Macrosiphum avenae* (Fabricius), *R. maidis* (Fitch) and *R. padi* (L.) were the main insect pests on wheat plants. They also indicated that *C. undecimpunctata* L., *C. carnae* (Steph.) and *Metasyrphus corollae* (Fabr.) were the most dominant insect predators associated with wheat plants. Also, Macharia *et al.* (2016) recorded the rose wheat aphid (*Metopolophium dirhodum* Walker), oat-bird-cherry aphid (*R. padi* Walker) and corn leaf aphid (*S. graminum* Rondani) as the major insect pests on wheat in East Africa.

Seasonal Population Fluctuations of the Dominant Pest Species

The results given in Table 2 show the weekly and total numbers of the main pest species on barely collected by plant sample technique during the two successive seasons of 2013 /2014 and 2014/2015 and the obtained results can be summarized as follows:

Aphid insects

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

The results presented in Table 2 show that the weekly number of *R. padi* was increased gradually until reached its peak during the 2nd week of February recording 354 and 178 individuals/ sample then decreased gradually until the end of the experiment during the two seasons of the study, respectively. These results are in agreement with those obtained by Hegab (1997) and Belliure *et al.* (2009) who mentioned that *R. padi* had one peak on barley plants.

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

The results illustrated in Table 2 show that the weekly number of *R. maidis* was increased gradually until reached its peak during the 2nd week of February exhibiting 210 and 189 individuals/sample then decreased gradually until the end of the experiment during the two seasons of the study, respectively. These results are in harmony with those obtained by Shibabaw *et al.* (2013) who surveyed the main insect pests of several cereal crops as wheat, barley and maize in Ethiopia and found that aphids, thrips, cutworm were the most important insect pests.

The green cereal aphid, *Schizaphis graminum* (Rondani)

The results in Table 2 show that *S. graminum* had one peak occurred in the 1st week of February with the weekly number of 134 and 114 insects/sample for the two seasons of the study, respectively. These results agree with those obtained by Aheer *et al.* (2007) who reported that the population of *S. graminum* on wheat plants varied from year to year and it had one peak in both seasons of the study (2001 and 2002).

The phytophagous mite, *Petrobia tritici* Kandeel, El-Naggar and Mohamed

As shown in Table 2, the weekly number of *P. tritici* was appeared with a number of 6 and 3 individuals/sample during the 3rd week of December in both seasons of the study, respectively. The number of individuals fluctuated with increasing until reached its peak four times in the first season of investigation. The first one and the lowest was at the 4*th* week of December by 10 individuals/sample, the second one occurred at the 3*rd* week of February by 52 individuals/sample, the third peak occurred at the 1*st* week of March by 51 individuals/sample and the fourth one and the highest was at the 4*th* week of March by 71 individuals/sample, respectively. While in the second season, three peaks were observed at the 4*th* week of December by 12 individuals/sample, at the 2*nd* week of February by 33 individuals/ sample and at the 4*th* week of March by 90 individuals/sample, respectively. On the contrary, Mohamed (2004) mentioned that *P. tritici* had one peak on barley plants.

Leafhopper insects

The weekly numbers of leafhoppers collected from barley were shown in Table 3. *E. decipiens* and *E. decedens* were found on barley plants during both 2013/2014 and 2014/2015 seasons. Only one peak was recorded for *E. decipiens* and *E. decedens* during the two seasons on

Table 2. Weekly number of the dominant aphid species and mite, *P. tritici* infesting barley plants by using plant sample at Salhia District, Sharkia Governorate during 2013/2014 and 2014 /2015 seasons

Date (week)		*R. padi*		*R. maidis*		*S. graminum*		*P. tritici*	
		2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
Dec.	3rd	3	2	0	0	0	0	6	3
	4th	8	12	0	0	8	2	10	12
Jan.	1st	12	31	2	4	34	17	0	6
	2nd	21	34	10	7	41	25	2	0
	3rd	100	68	76	48	55	31	0	9
	4th	141	121	114	72	97	85	6	16
Feb.	1st	161	154	194	97	134	114	32	17
	2nd	354	178	210	189	101	84	46	33
	3rd	190	124	188	155	76	54	52	10
	4th	126	112	175	145	55	42	46	56
Mar.	1st	112	97	112	120	11	14	51	71
	2nd	104	90	95	105	7	12	47	77
	3rd	78	75	43	71	6	10	63	86
	4th	41	34	19	45	5	4	71	90
Apr.	1st	17	10	15	11	2	3	52	31
	2nd	10	5	12	10	0	2	25	24
	3rd	0	3	8	7	0	0	10	6
	4th	0	0	0	0	0	0	5	1
Total		1478	1150	1273	1086	632	499	524	548

Table 3. Weekly number of the leafhoppers, *E. decipiens* and *E. decedens* infesting barley plants by using sweep net at Salhia District, Sharkia Governorate during 2013/2014 and 2014 / 2015 seasons

Date (week)		*E. decipiens*		*E. decedens*	
		2013/2014	2014/2015	2013/2014	2014/2015
Dec.	3rd	0	0	0	0
	4th	3	2	2	1
Jan.	1st	5	6	3	5
	2nd	9	7	8	7
	3rd	12	11	12	10
	4th	15	12	14	13
Feb.	1st	18	14	15	16
	2nd	20	22	18	17
	3rd	25	24	20	19
	4th	29	25	22	21
Mar.	1st	38	27	31	24
	2nd	30	21	22	16
	3rd	14	16	12	11
	4th	13	13	10	8
Apr.	1st	10	8	6	7
	2nd	9	3	4	7
	3rd	0	0	0	0
	4th	0	0	0	0
Total		250	211	199	182

barley plants. The peak occurred at the 1st week of March with the numbers of 38, 27 and 31, 24 insects for *E. decipiens* and *E. decedens* during the two seasons of the study, respectively. These results coincide with the findings of Hegab (1997) who reported that *E. decipiens* and *E. decedens* had one peak of activity on wheat plants.

Seasonal Population Fluctuations of the Dominant Predators Associated with Pests Infesting Barley Plants

Eleven- spotted lady beetle, *C. undecimpunctata* (L.)

Results presented in Table 4 indicate that the first presence of *C. undecimpunctata* was at the 1st week of January in the first season while in the second one the occurrence was at the 4th week of December. There were three peaks recorded at the 4th week of January (5 individuals/ sample), at the 4th week of February (13 individuals/sample) and at the 2nd week of March (6 individuals/sample) in the first season of study. In the second one, the predator was firstly observed at the 4th week of December then the number fluctuated showing three peaks of activity at the 1st and the 4th weeks of February and at the 1st week of April by 6, 14 and 4 individuals/ sample, respectively. The percentages of occurrence of *C. undecimpunctata* were 60.36% and 62.50% during the two studied seasons, respectively. These results take the same trend with those of Adugna and Tesema (1987) who reported that *C. undecimpunctata* is known to prey on cereal aphid on wheat and barley in Ethiopia.

The green lacewing, *Chrysoperla carnea* (Stephens)

Results summarized in Table 4 show that *C. carnea* was firstly recorded at the 2nd and 3rd weeks of January in 2013/2014 and 2014/2015, respectively. The population density of *C. carnea* increased gradually until reached its peak during the 4th week of February recording 10 and 9 individuals/sample during the two seasons of the study, respectively. Then, it decreased until reached the 2nd week of April during the two seasons. The percentages of occurrence of *C. carnea* were 39.64 and 37.50% in the two growing seasons, respectively. These results agree with those obtained by Macharia *et al.* (2004) who stated that the green lacewings (*Chrysoperla* spp.) were the generalist predators occurring at low density beginning from tiller of wheat plants and continues until the crop reached heading stage.

Effect of Temperature and Relative Humidity on Pests and Their Associated Predators on Barley Plants

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

The correlation between the population of *R. padi* and the mean temperature (r_1) was insignificantly and negative (r_1= -0.4007 and -0.1357), while in case of relative humidity (r_2) it was insignificantly and positive (r_2= 0.2482 and 0.0467) during the two growing seasons, respectively. The partial regression between *R. padi* population activity and the mean temperature (b_1) or relative humidity (b_2) were (b_1= 0.0993, 0.5912 and b_2= 0.3207, 0.8541) in the first and second seasons, respectively (Table 5).

The corn leaf aphid *R. maidis* (Fitch)

The results obtained in Table 5 clear that the correlation coefficient between *R. maidis* population and mean temperature was negative and insignificant (r_1 = -0.3667 and -0.2202) during both seasons of the study, respectively. The number of *R. maidis* was positively correlated and insignificantly with the relative humidity (r_2= 0.3604 and 0.1676) in the first and second growing seasons, respectively. The partial regression between *R. maidis* population and mean temperature or the relative humidity were (b_1= 0.1345 , 0.3800 and b_2 = 0.1418 , 0.5061) in the two seasons, respectively.

The green cereal aphid, *S. graminum* (Rondani)

The correlation between the population activity of *S. graminum* and the mean temperature as well relative humidity was positive and significant where, r_1= 0.5891* and r_2 = 0.4686* in first season, respectively. While in the second one, it was positive and insignificant (r_1= 0.0242) with the mean temperature and in case of the relative humidity it was negative and insignificant (r_2=-0.1738). The partial regression between *S. graminum* population and the mean temperature (b_1) or relative humidity (b_2) were (b_1 = 0.0101, 0.9240

Table 4. Weekly number of the dominant predators associated with pests infesting barley plants by using plant samples at Salhia District, Sharkia Governorate during 2013/2014 and 2013/2015 seasons

Date (week)		*C. undecimpunctat*		*C. carnea*	
		2013/2014	2014/2015	2013/2014	2014/2015
Dec.	3rd	0	0	0	0
	4th	0	1	0	0
Jan.	1st	1	2	0	0
	2nd	2	2	1	0
	3rd	3	3	2	1
	4th	5	4	2	3
Feb.	1st	4	6	3	3
	2nd	3	4	4	4
	3rd	6	8	6	5
	4th	13	14	10	9
Mar.	1st	10	12	5	7
	2nd	6	8	3	5
	3rd	6	6	3	4
	4th	3	3	2	3
Apr.	1st	2	4	1	3
	2nd	2	2	2	1
	3rd	1	1	0	0
	4th	0	0	0	0
Total		67	80	44	48
Ro %		60.36	62.50	39.64	37.50

Ro% = Relative occurrence percentages.

Table 5. Simple correlation, partial regression and coefficient of determination between each of temperature, relative humidity and weekly number of pests and their associated predators on barley plants at Salhia District, Sharkia Governorate during 2013/2014 and 2014/2015 seasons

Pest and predator	Simple correlation				Partial regression				CD (%)	
	2013/2014		2014/2015		2013/2014		2014/2015		2013/2014	2014/2015
	r_1	r_2	r_1	r_2	b_1	b_2	b_1	b_2		
R. padi	-0.4007	0.2482	-0.1357	0.0467	0.0993	0.3207	0.5912	0.8541	16.32	12.28
R. maidis	-0.3667	0.3604	-0.2202	0.1676	0.1345	0.1418	0.3800	0.5061	15.46	10.19
S. graminum	0.5891*	0.4686*	0.0242	-0.1738	0.0101	0.0498	0.9240	0.4943	35.25	31.09
E. decipiens	-0.1889	0.4339*	-0.1329	0.3124	0.4529	0.0720	0.5990	0.2069	23.63	15.43
E. decedens	-0.2907	0.4815*	-0.1074	0.2712	0.2429	0.0430	0.6713	0.2763	13.73	11.29
P. tritici	0.1616	0.3602	-0.2392	0.1089	0.5232	0.8872	0.3389	0.6671	17.15	19.35
C. undecimpunctata	0.1264	0.4183	-0.2106	0.4498*	0.7660	0.1207	0.4330	0.0925	27.14	36.09
C. carnea	-0.1821	0.2819	-0.3384	0.4127	0.5160	0.3085	0.2173	0.1263	18.26	43.21

r_1, b_1= Correlation coefficients and partial regression between mean temperature and number of species.
r_2, b_2 = Correlation coefficients and partial regression between relative humidity and number of species.
CD = Coefficient of determination.

and b_2 = 0.0498 , 0.4943) in the two seasons, respectively (Table 5). These results confirm the findings of Chen *et al.* (1994) who indicated that population dynamics of wheat aphids was affected by temperature and relative humidity.

The potato leafhopper, *E. decipiens* (Paoli)

The obtained results in Table 5 show that the correlation between *E. decipiens* population and mean temperature was negative and insignificant (r_1= - 0.1889 and - 0.1329) in the two seasons, respectively. While, the correlation respecting relative humidity proved to be positive and statistically significant (r_2 = 0.4339*) during the first season and insignificantly positive (r_2= 0.3124) in the second one. The partial regression between *E. decipiens* population and the mean temperature or relative humidity were (b_1= 0.4529 , 0.5990 and b_2= 0.0720 , 0.2069) during the two growing seasons, respectively.

The green leafhopper, *E. decedens* (Paoli)

The relationship between *E. decedens* population and mean temperature was negative and insignificant (r_1 = - 0.2907 and - 0.1074) in the two experimented seasons, respectively. But relative humidity showed positive and significant correlation (r_2 = 0.4815*) in the first season, while it was positive and insignificant in the second season (r_2= 0.2712). The partial regression between *E. decedens* population and the mean temperature or relative humidity were (b_1= 0.2429 , 0.6713 and b_2= 0.0430 , 0.2763) during the two growing seasons, respectively (Table 5).

The phytophagous mite, *P. tritici* Kandeel, El-Naggar and Mohamed

The results obtained in Table 5 clear that the correlation between *P. tritici* population and mean temperature was insignificantly positive in the first season (r_1= 0.1616), while it was insignificantly negative in the second season (r_1= - 0.2392). The number of *P. tritici* correlated positively and insignificantly with the relative humidity in both seasons of the study (r_2= 0.3602 and 0.1089), respectively. The partial regression between *P. tritici* population and the two studied weathering factors were (b_1= 0.5232, 0.3389 and b_2 = 0.8872 , 0.6671) for the two seasons, respectively.

Eleven- spotted lady beetle, *C. undecimpunctata* (L.)

Results given in Table 5 indicate that the correlation coefficient between *C. undecimpunctata* population and mean temperature was insignificantly positive (r_1= 0.1264) in the first season, while it was negative and insignificant (r_1= -0.2106) in the second season. While in case of relative humidity it was positive and insignificant (r_2= 0.4183) in the first season, while it was positive and significant (r_2= 0.4498*) in the second one. The partial regression between *C. undecimpunctata* population and mean temperature or the relative humidity were (b_1= 7660 , 0.4330 and b_2= 0.1207, 0.0925) in the two seasons, respectively. These results partially agree with those of Ghanim *et al.* (2015) and Amer (2016) who found that temperature positively affected the population of *C. undecimpunctat*a.

The green lacewing, *C. carnea* (Stephens)

The results obtained in Table 5 show that the number of *C. carnea* had negative and insignificant correlation with the mean temperature, where r_1= -0.1821 and -0.3384 in the two seasons, respectively. While in case of relative humidity it was positive and insignificant (r_2= 0.2819 and 0.4127) for the two seasons, respectively. The partial regression between *C. carnea* population and the mean temperature (b_1) or relative humidity (b_2) were (b_1= 0.5160 , 0.2173 and b_2= 0.3085 , 0.1263) in the two seasons, respectively.

The values of coefficient of determination by the two aforementioned weather factors showed that the considered factors have played a conspicuous role in detecting the activity of these pests and their associated predators during the aforementioned investigated seasons (Table 5).

These results indicated that the tested weather factors play a great role in regulating the population density and seasonal abundance of such pests and their associated predators. Similar findings were reported by Hegab (1997 and 2001), El-Gindy (2002), Hashem (1997 and 2005) and Abd-Elsamed (1999).

According to the obtained results, it could be concluded that the total number of the main pests on barley plants for the two sampling

techniques during the second season was less than the first one. On the other hand, in case of associated predators it was opposite. The decreasing in the population density of main pests in the second season may be due to the variation in the weather factors and increasing the associated predators.

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تقلبات التعداد للآفات السائدة والمفترسات المصاحبة لها على نباتات الشعير

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تم إجراء هذا البحث بهدف دراسة الكثافة العددية للمن، نطاطات الأوراق، الأكاروسات التي تصيب نباتات الشعير والمفترسات المصاحبة لها وعلاقتها بدرجات الحرارة و الرطوبة النسبية السائدة في منطقة الصالحية – محافظة الشرقية – مصر خلال موسمي الزراعة ٢٠١٣/٢٠١٤ و ٢٠١٤/٢٠١٥، وقد أظهرت النتائج المتحصل عليها أن أنواع المنّ هى منّ الشوفان *Rhopalosiphum padi* (L.) ، منّ أوراق الذرة *R. maidis* (Fitch) ، منّ النجيليات الأخضر *Shizaphis graminum* (Rondani)، منّ الغلال الإنجليزي *Sitiobion avenae* (Fabr.) وأيضًا أنواع نطاطات الأوراق *Empoasca decipiens* (Paoli) و *E. decedens* (Paoli) و كذلك أكاروس *Petrobia tritici* Kandeel, El-Naggar and Mohamed هي الآفات الرئيسية على نباتات الشعير، وأن المفترسات المصاحبة لها هي أبو العيد ذو الإحدى عشر نقطة *Coccinella undecimpunctata* (L.) ، أسد المن *Chrysoperla carnea* (Stephens) ، ذبابة السيرفس *Syrphus* sp. وبقة الأوريس *Orius* sp.، تم حساب تعداد تلك الآفات والمفترسات السابقة باستخدام طريقتين لجمع الحشرات وهما العينة النباتية وشبكة كَنْس الحشرات، أوضحت النتائج أن طريقة العينة النباتية هي الأفضل في جمع حشرات المنّ والأكاروس والمفترسات المصاحبة لها خلال هذه الدراسة بينما كانت شبكة كَنْس الحشرات هي الأفضل في جمع نطاطات الأوراق، كما تم دراسة الوفرة الموسمية للآفات محل الدراسة ولوحظ أن كل من حشرتي منّ الشوفان ومنّ الذرة لهما قمة نشاط واحدة (٣٥٤، ١٧٨ و٢١٠ ، ١٨٩ حشرة/العينة) في الأسبوع الثاني من فبراير خلال موسمي الزراعة ٢٠١٣/٢٠١٤ و٢٠١٤/٢٠١٥، على التوالي، أيضاً تم تسجيل قمة نشاط واحدة (١٣٤ و١١٤ حشرة/ العينة) لحشرة منّ النجيليات الأخضر في الأسبوع الأول من فبراير خلال موسمي الزراعة ٢٠١٣/٢٠١٤ و ٢٠١٤/٢٠١٥، على الترتيب، على الجانب الأخر، تم تسجيل قمة نشاط واحدة لكل من *E. decipiens* (٣٨ و ٢٧ حشرة/ العينة) و *E. decedens* (٣١ و ٢٤ حشرة/ العينة) في الأسبوع الأول من مارس خلال موسمي الدراسة، لوحظ أن أكثر أنواع المفترسات تواجداً هي: أبو العيد ذو الإحدى عشر نقطة والذي سجل ثلاث قمم من النشاط في الأسبوع الرابع من يناير والأسبوعين الأول والرابع من فبراير والأسبوع الثاني من مارس والأسبوع الأول من أبريل وأسد المن الذي سجل قمة واحدة من النشاط في الأسبوع الرابع من فبراير خلال موسمي الدراسة، أوضحت الدراسة أيضًا أن درجات الحرارة والرطوبة النسبية كان لها أثرها الواضح على تعداد الآفات والمفترسات المصاحبة لها.

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