Population Fluctuation of the Main Prevailing Insects on Potato Plants, at El-Nobaria Region, El-Behiera Governorate, Egypt

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ABSTRACT

In the present field trials were conducted to survey the main prevailing insect-pests and /or beneficial ones on potato plants at El-Nobaria, district, El-Behiera Governorate, Egypt during the elapsing period from December 2014 up to April 2016. It was found that Potato plants are mainly attacked by a large number of insect pests such as *Myzus persicae* (Sulzer*), Aphis craccivora* Koch, *Aphis gossypii* Glover, *Trichoplusia ni* (Hübner), *Liriomyza trifolii* (Burgess), *Phthrorimaea operculella* (Zeller), *Thrips tabaci* Lind,and *Empoasca lybica* Beg. Besides, numerous species of Natural Enemies particularly*, Chrysoperla Carnea* (Stephens), *Paederus alfierii* Koch, *Syrphus corolla* Fabricius and *Coccinella undecimpunctata* Linnaeus. The major abundant insect pest during both of the first and second winter growing seasons was *Myzus persicae* (31.6 and 106.8/15 plants, respectively) as well as both the first and second summer seasons (59.6 and 28.8/15 plants, respectively). Also, a positive relationship between *Myzus persicae* or/and *Phthrorimaea operculella* ,with temperature was detected, versus a negative inspected relationship with the relative humidity.

Key words: Potato, prevailing insects, population fluctuation

INTRODUCTION

Potatoes are a highly nutritious food. It provides carbohydrates, proteins, minerals, vitamin C, B group vitamins and high quality dietary fibers. Potatoes gave about 97 Kilo calories per 100 gm fresh weight, which is much less than cereals. The net protein utilization or biological value of potato protein (about 71% that of whole egg), is better than that of wheat (53%), maize (54%), peas (48%), beans (46%) and is comparable to cow's milk (75%) (Anonymous http://sikkimagrisnet.org/General/en/Potato.aspx).

Potatoes are the fifth most economically important crop in the world. Egypt produces 2.6 million metric tons of potatoes and exports 411.000 metric tons to Europe and the Arab countries .(Abd El-Gawad *et al.*, 2010).

Potato tuber moth (PTM), *Phthrorimaea operculella* (Zeller), (Lepidoptera:Gelechiidae) is one of the serious pests of potato and other solanaceous crops,i.e. tomato, pepper and eggplant. (Schreiber *et al.*, 2014 Rodriguez *et al*., 1993 and Mascarin & Delalibera, 2012), It causes serious damage to potato plant leaves and to tubers either in field or in storage. Its larvae bore leaves making irregular mines, leaving excreta, behind and led to a considerable weight loss. In storage, up to 90% weight loss in case of the pest outbreak (Joshi, 1989 and El-Sinary, 2002).

The aim of this study is to detect the insect pests and their predators on potato and their population fluctuation throughout the period from December 2014 to April 2016.

MATERIALS AND METHODS

Experimental site and design:

Field experiments were carried out at the research farm of Agrofood Company, El-Nobaria, district, El-Behiera Governorate 60 km, southwest Alexandria city, during the elapsing period from December 2014 up to April 2016. The field of potato plantation chosen for this work was 80 feddan, It was cultivated with the "valor" potato, *Solanum tuberosum L.* (Solanaceae) "grade A" which were imported from Scotland. The tubers were sown at a distance of 20 cm.

The recommended agriculture practices were followed according to the recommendations of the Egyptian Ministry of Agriculture.Further , N and K fertilization of the experiments were standardized to suit the type of soil (sandy) as recommended by experts of the Agrofood Company.

Five experimental areas plots (4×4 m^2) were selected within this field for performing the inspections of the abundant potato insect pests each plot included 100 plants .The distribution of these selected areas was done to enhance the possible determination of the role of cardinal directions on the distribution of insect-pests infestation in the experimented potato plantation.

On field, survey of the pests and predators were performed every ten days by examining 15 randomizely chosen plants from each plot. The identification of inspected pests and predators was done and the numbers of individuals were counted at the upper, medium and lower parts of each plant. The collected pest species and

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their predators were identified and counted in laboratory; the fragile species were classified and counted by means of a stereoscopic binocular microscope.

The population of *Liriomyza trifolii* (Burgess), *Phthrorimaea operculella* (Zeller), were recorded by counting the number of larvae inside their miners. Population of aphids jassid and thrips were recorded by counting the number of nymphs and adults while the predators *C. Carnea*, *P. alfierii* and *C. undecimpunctata* were counted as adults while *S. corolla* were recorded by counting the number of larvae.

Statistical analysis:

Data of the present investigation were subjected to the analysis of variance test (ANOVA) as randomized complete blocks design (RCBD) and the comparisons among the means of different treatments were carried out using the revised L.S.D test as described by Duncan (1955). Correlation coefficient was calculated to determine the relation between the prevailing temperature and relative humidity and the population of the studied insects.

RESULTS AND DISCUSSION

Survey of insects infesting the Potato plant *Solanum tuberosum L*. (Solanaceae)

Potato is liable to be attacked by several insect pests. A preliminary survey was done during the winter and summer growing seasons along a lasted period from December 2014 up to April 2016 to identify the prevailing insects infesting the potato plants.

From table (1) it can be seen that the mean calculated number of the counted individuals of *Myzus persicae* (Sulzer*)*/15 plants was gradually increased from the 8th of December (5.8) up to the 3rd inspection date (11.8) then showed a gradual decrease during the period lasted from 7th of January(3.4) to the 6th February(0.2) . Table (5) it can be seen that the statistical analysis showed a positive weak relationship between the mean number of the counted *M. persicae* individuals and temperature (r = 0.114), versus the positive moderate relationship with the relative humidity (r= 0.569).

The calculated mean numbers of *Aphis craccivora* Koch and *Aphis gossypii* Glover /15 plants were low or negligible all over the winter growing season. In Table (5) statistical analysis showed the positive and the negative weak relationship between the prevailing temperature or/and the R.H. and the number of *A. craccivora* (r = 0.042) and (r =-0.323) in respect.

While, for *Aphis gossypii* there were positive weak relationship,with either the temperature or the relative humidity since r = 0.130 and 0.460, respectively.

Similary, it can be seen also that the number of individuals *Trichoplusia ni* (Hübner) /15 plants was very low all over the inspection periods of winter growing season. Statistical analysis showed a positive weak relationship (r = 0.423) with temperature and a positive strong relationship (r =0.726) with the relative humidity in Table (5).

The mean number of the inspected individuals of *Liriomyza trifolii* (Burgess)/15 plants was obviously low during December then increased to 6.0±1.6 in January .It reached a peak on 27th of January (6.0±1.6) then declined on 6thFebruary. Table (5) it can be seen that There was a positive weak relationship between the prevailing temperature (r =0.109), while it was a negative medium with the relative humidity (R.H.%) (r =-0.505) and the number of inspected *L. trifolii*.

The main potato insect-pest *Phthrorimaea operculella* appeard in low numbers during the period of winter season, indicating a positive weak relationship between the prevailing temperature(r= 0.135) and the number of *Ph. operculella* while this relationship was negative weak with relative humidity (R.H.%)(r=-0.284) in Table (5).

The calculated mean number of the individuals of the rarely prevailed predatory insects *Chrysoperla Carnea* (Stephens), *Paederus alfierii* Koch, *Syrphus corolla* Fabricius and *Coccinella undecimpunctata* Linnaeus on potato plants were ratherly low or absent all over the inspection periods of winter growing season .,and rarely appeared during the end of January and the beginning February. As shown in Table (5) the performed correlation analysis showed a positive weak relationships between the mean number of the prementioned predators and the prevailing temperature (r=0.283, 0.320, 0.040 and 0.040 respectively) and a negative weak relationship with the relative humidity (r =- 0.324, - 0.311, -0.509 and -0.509 respectively).

As shown in Table (1) statistical analysis showed that there were highly significant differences between the inspection periods and the rates of detected insects all over the 1st winter season.

As shown in Table (2) the calculated mean number of *M. persicae* was gradually increased from 1.4 to 2.2 on the 7th and 17th of April, respectively. It was absent during the rest of the season .Statistical analysis showed a positive weak relationship with the temperature and the relative humidity (r = 0.083 and 0.264 respectively) in Table (5).

Table 1. Mean numbers of insect-pests and predator-species/15 plants on the leaves of potato plants under the prevailing weather factors during the elapsed period from Dec. 2014- Feb.2015 (1st Winter season)

Date of inspection	Mean No. of insect-pests and predators/15 plants ±S.D (range)										Weather conditions	
	Insect-pests						Predators				Temp.°C Mean	R.H. Mean
	Aphid			*T.ni*	*L. trifolii*	*Ph. Operculella*	*C. carnea*	*P. alfierii*	*S. corollae*	*C. Undecimpunctata*		
	M. persicae	*A. craccivora*	*A.gossypii*									
	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD		
8/12/2014	5.8^{bc} ±3.07 (2-18)	0.0^{b} ±0.0	1.4^{ab}±0.93 (0-5)	0.6^{a}±0.24 (0-1)	0.0^{b}±0.0	0.0^{b}±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	17	58
18/12/2014	6.8^{b} ±2.22 (3-15)	0.6^{ab}±0.39 (0-2)	0.0^{b}±0.0	0.0^{b}±0.0	0.4^{b}±0.24 (0-1)	0.6^{ab}±0.39 (0-2)	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	15	49
28/12/2014	11.8^{a}±1.39 (9-16)	0.2^{b}±0.19 (0-1)	0.0^{b}±0.0	0.2^{ab}±0.19 (0-1)	0.2^{b}±0.19 (0-1)	0.0^{b}±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	15	42
7/1/2015	3.4^{bcd}± 1.50 (0-7)	0.6^{ab}±0.59 (0-3)	0.0^{b}±0.0	0.0^{b}±0.0	1.6^{b}±0.93 (0-5)	0.0^{b}±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	12	30
17/1/2015	2.6^{bcd}±0.93 (1-6)	0.0^{b}±0.00	2.2^{a}±0.97 (0-5)	0.4^{ab}±0.97 (0-1)	0.4^{b}±0.24 (0-1)	0.0^{b}±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	14	41
27/1/2015	1^{cd}±0.45 (0-2)	1.6^{a}±0.39 (0-2)	0.0^{b}±0.00	0.0^{b}±0.0	6.0^{a}±1.64 (2-11)	0.2^{ab}±0.19 (0-1)	0.2±0.19 (0-1)	0.2±0.19 (0-1)	0.0±0.0	0.0±0.0	16	32
6/2/2015	0.2^{d}±0.19 (0-1)	0.0^{b}±0.0	0.0^{b}±0.00	0.0^{b}±0.0	1.0^{b}±0.63 (0-3)	0.8^{a}±0.37 (0-2)	0.2±0.19 (0-1)	0.0±0.0	0.2±0.19 (0-1)	0.4±0.39 (0-2)	15	27
Total mean	31.6	3	3.6	1.2	9.6	1.6	0.4	0.2	0.2	0.4		
$L.S.D_{0.05}$	4.604	0.981	1.523	0.422	2.043	0.656	-	-	-	-		

* Means followed with the same letter(s) within each column are not significantly different at P=0.05.

Table 2. Mean numbers of insect-pests and predator-species/15 plants on the leaves of potato plants under the prevailing weather factors during the elapsed period from Mar. 2015-May.2015 (1st summer season)

Date	Mean No. of insect-pests and predators/15 plants ±S.D (range)												Weather conditions	
	Insect-pests							Predators						
	Aphid			*T. ni*	*L. trifolii*	*Ph. operculella*	*T.tabaci*	*E.lybica*	*C.carnea*	*P.alfierii*	*S. corolla*	*C. undecim punctata*	Temp.°C	R.H.
	M. persicae	*A. Craccivora*	*A. gossypii*										Mean	Mean
	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD		
18/3/2015	0.8^{ab}±0.58 (0-3)	0.0±0.0	0.4^{bc}±0.39 (0-2)	0.0±0.0	2.4^{a}±0.59 (1-4)	6^{b}±1.79 (1-11)	1.4^{b}±0.98 (0-2)	0.0±0.0	0.8±0.79 (0-3)	0.0±0.0	0.2±0.39 (0-2)	0.0±0.0	14	52
28/3/2015	0^{b}±0.00	0.2±0.19 (0-1)	0.6^{bc}±0.39 (0-2)	0.2±0.19 (0-1)	0.6^{b}±0.39 (0-2)	4.6^{b}±1.59 (2-9)	0. 0^{b}±0.0	0.0±0.0	0.0±0.0	0.2±0.20 (0-1)	0.0±0.0	0.0±0.0	15	14
7/4/2015	1.4^{ab}±0.75 (0-4)	0.2±0.19 (0-1)	8^{a}±2.23 (3-15)	0.0±0.0	0.0^{b}±0.00	8.6^{b}±3.07 (2-19)	6.8^{a}±2.65 (0-13)	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	0.2±0.19 (0-1)	27	11
17/4/2015	2.2^{a}±0.97 (0-5)	0.0±0.0	5.8^{ab}±4.08 (0-22)	0.0±0.0	0.4^{b}±0.39 (0-2)	11.6^{b}±1.08 (9-15)	1.8^{ab}±1.20 (0-6)	0.0±0.0	0.0±0.0	0.4±0.24 (0-1)	0.4±0.40 (0-2)	0.4±0.40 (0-2)	20	27
27/4/2015	0^{b}±0.00	0.0±0.0	0^{c}±0.00	0.2±0.20 (0-1)	0.6^{b}±0.40 (0-2)	19.6^{a}±4.88 (6-33)	7^{a}±1.51 (3-11)	0.4±0.24 (0-1)	0.0±0.0	0.2±0.20 (0-1)	0.2±0.20 (0-1)	0.2±0.20 (0-1)	27	8
7/5/2015	0.8^{ab}±0.58 (0-3)	0.0±0.0	0^{c}±0.00	0.6±0.40 (0-2)	0.8^{b}±0.17 (0-2)	9.2^{b}±1.28 (6-13)	4.2^{ab}±2.13 (0-11)	0.6±0.40 (0-2)	0.6±0.40 (0-2)	0.2±0.20 (0-1)	0.0±0.0	0.0±0.0	25	18
Total mean	5.2	0.4	14.8	1	4.8	59.6	21.2	1	1.4	1.6	0.8	0.8		
L.S.D $_{0.05}$	1.61	-	5.261	-	1.148	7.459	4.863	-	-	-	-	-		

* Means followed with the same letter(s) within each column are not significantly different at P=0.05.

Table 3. Mean numbers of insect-pests and predator-species/15 plants on the leaves of potato plants under the prevailing weather factors during the elapsed period from Dec. 2015- Feb.2016 (2ndWinter season)

Date	Mean No. of insect-pests and predators/15 plants ±S.D (range)										Weather conditions	
	Insect-pests						Predators					
	Aphid			*T. ni*	*L. trifolii*	*Ph. operculella*	*C.carnea*	*P. alfierii*	*S.corollae*	*C undecimpunctata*	Temp.°C	R.H.
	M. persicae	*A. craccivora*	*A. gossypii*									
	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	Mean	Mean
11/12/2015	$31^{a}\pm9.70$ (15-69)	$2.2^{b}\pm0.58$ (1-4)	$0.0^{b}\pm0.0$	$0.0^{b}\pm0.0$	$3.2^{ab}\pm1.07$ (2-6)	$2.0^{b}\pm0.89$ (0-5)	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	15	44
21/12/2015	$17.6^{ab}\pm4.59$ (3-32)	$12.8^{a}\pm6.30$ (1-37)	$0.4^{b}\pm0.24$ (0-1)	$0.0^{b}\pm0.0$	$2.0^{b}\pm1.05$ (0-6)	$4.2^{ab}\pm1.49$ (2-10)	0.2±0.20 (0-1)	0.0±0.0	0.0±0.0	0.0±0.0	13	58
31/12/2015	$21.4^{a}\pm7.14$ (8-42)	$10.8^{ab}\pm5.78$ (0-29)	$1.6^{b}\pm1.36$ (0-7)	$0.0^{b}\pm0.0$	$3.2^{ab}\pm0.66$ (1-5)	$2.6^{ab}\pm1.64$ (0-7)	0.2±0.20 (0-1)	0.0±0.0	0.0±0.0	0.0±0.0	16	40
10/1/2016	$4^{b}\pm1.38$ (1-9)	$0.8^{b}\pm0.49$ (0-2)	$0.0^{b}\pm0.0$ (0-0)	$0.4^{a}\pm0.24$ (0-1)	$1.2^{b}\pm0.79$ (0-4)	$3.4^{ab}\pm0.98$ (2-7)	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	16	51
20/1/2016	$24.8^{a}\pm4.72$ (15-41)	$2.2^{b}\pm0.97$ (0-5)	$6.6^{a}\pm2.48$ (1-15)	$0.2^{ab}\pm0.20$ (0-1)	$0.4^{b}\pm0.40$ (0-2)	$0.8^{b}\pm0.37$ (0-2)	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	11	35
30/1/2016	$4.8^{b}\pm1.88$ (1-12)	$0.6^{b}\pm0.40$ (0-2)	$0.4^{b}\pm0.40$ (0-2)	$0.0^{b}\pm0.0$	$5.6^{a}\pm1.43$ (1-9)	$5.6^{a}\pm0.81$ (4-8)	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	12	57
9/2/2016	$3.2^{b}\pm0.86$ (1-6)	$0.6^{b}\pm0.59$ (0-3)	$0.0^{b}\pm0.0$	$0.0^{b}\pm0.0$	$2.0^{b}\pm0.71$ (0-4)	$2.2^{ab}\pm1.07$ (0-6)	0.0±0.0	0.0±0.0	0.0±0.0	0.0±0.0	13	28
Total mean	106.8	30	9	0.6	17.6	20.8	0.4	0	0	0		
$L.S.D_{0.05}$	15.30	9.51	3.16	0.331	2.74	3.16	-	-	-	-		

* Means followed with the same letter(s) within each column are not significantly different at P=0.05.

A.craccivora was absent all over the inspection period of summer season while appeared very low in second period of March up to the 1st period of April (0.2). There was a negative weak relationship with the temperature the relative humidity (r=-0.044 and -0.437 respectively) and the number of *A. craccivora* in Table (5).

The maximum number of *A. gossypii* /15 plants were recorded on 7th and 17th of April (8 and 5.8 respectively) then disappeared until the end of the season. In Table (5) Statistical analysis showed a positive relationship between the prevailing temperature and the number of *A. gossypii* (r =0.299) while this relationship was negative weak with R.H %(r = -0.164).

The mean number of *Trichoplusia ni* /15 plants was very low all over the inspection periods of the summer growing season. Statistical analysis showed a positive weak relationship between the prevailing temperature and the number of *T. ni* (r =0.300) while this relationship was negative weak with R.H% (r =-0.340) in Table (5).

The maximum number of *L. trifolii*/15 plants was recorded on the 8th of March (2.4) while it was low or negligible all over the 1st summer growing season. Table (5) it can be seen that the statistical analysis showed a negative strong relationship between the prevailing temperature and the relative humidity and the number of *L. trifolii* (r =-0.639 and r =-0.878 respectively).

The calculated mean number of *Ph.operculella* was found gradually increased from 2nd week up to the end of April (8.6,11.6,19.6) then decreased to reach 9.2 on 7th May. The lowest number was found in the second inspection period of March (4.6). Table (5) it can be seen that the statistical analysis showed a positive strong relationship between the prevailing temperature and the number of *Ph. operculella* (r =0.668), while the correlation coefficient was a negative weak with the relative humidity R.H% (r=-0.426).

The number of *Thrips tabaci* Lind was increased on 7th and 27th of April (6.8and 7) respectively. Low or absent in the two inspection dates of March. In Table (5) statistical analysis showed a positive between the prevailing temperature and the number of *T. tabaci* (r =0.936) while it was negative strong relationship with R.H%(r=-0.551) This agree with Muhamed *et al*. (2016) who found that maximum thrips population was observed at the end of March till mid of April and the correlation between temperature and thrips population was highly positive but with the relative humidity it was poorly positive relationship.

The *Empoasca lybica* Beg was almost absent during the summer season then appear at the end of April and begining of May (0.4±0.6 and ,0.6respectively). Table (5) it can be seen that the statistical analysis showed a positive medium relationship between the prevailing temperature and the mean number of *E. lypica* (0.571), versus with the negative weak relationship (-0.355) with the relative humidity and this is agree with Shuaib *et al*. (2008).found that temperature had positive correlation with Jassid while humidity had negative correlation.

The predators *C. carnea*, *P. alfierii*, *S. corolla* and *C.undecimpunctata* / 15 plants were low or nill all over the 1st summer growing season. The correlation between the mean number *C. carnea* and the prevailing temperature was negative weak relationship (r =-0.339) while it was positive strong relationship (r =0.740) with R.H%. It was positive weak relationship between the prevailing temperature and the number of *P. alfierii* and *C. undecimpunctata* (r =0.015 and 0.360 respectively), while it was negative weak with (R.H%)(r =-0.234 and -0.206 respectively).While the correlation between the mean number of *S. corolla* was negative medium relationship with temperature(r =-0.510) while it was highly positive relationship (r =0.856) with the relative humidity in Table (5).

As shown in Table (2) Statistical analysis showed that there were significant differences between the inspection periods and the rates of detected insects all over the 1st winter season.

Table (3) revealed that the mean number of *M. persicae* /15plants was high in the beginning of the season and on 20th of January (31&24.8 respectively) then decreased till the end of inspection (3.2). Table (5) it can be seen that statistical analysis showed a positive weak relationship of *M. persicae* with temperature (r= 0.056) while it was negative weak relationship (r=-0.130) with the relative humidity.

The maximum number of *A. craccivora* /15 plants was noticed on 21st and 31st of December (12.8 and 10.8 respectively then decreased during January and the first week of February (0.6). Table (5) it can be seen that there was a positive weak relationship with either the temperature or the relative humidity (r= 0.207 and 0.279 respectively) and the number of *A. craccivora*.

Infestation of *A. gossypii* started at the third week of December .It increased on 20th of January to 6.6 individual /15 plants then decreased at the end of January and disappeared in February. Table (5) it can be seen that statistical analysis showed a negative medium relationship between the prevailing temperature and the number of *A. gossypii* (r =-0.533),

Table 4. Mean numbers of insect-pests and predator-species/15 plants on the leaves of potato plants under the prevailing weather factors during the elapsed period from Mar. 2016-Apr.2016 (2nd summer season)

Date	Mean No. of insect-pests and predators/15 plants ±S.D (range)												Weather conditions	
	Insect-pests								Predators					
	Aphid													
	M. persicae	*A. craccivora*	*A. gossypii*	*T. ni*	*L. trifolii*	*Ph. Operculella*	*T. tabaci*	*E. lybica*	*C.carnea*	*P. alfierii*	*S. corollae*	*C. undecimpunctata*	Temp. °C	R.H.
	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	M.±SD	Mean	Mean
12/3/2016	$0.2^{a}\pm0.20$ (0-1)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	$1.8^{b}\pm0.37$ (1-3)	$4^{a}\pm1.38$ (1-8)	$0.0^{c}\pm0.0$	$0.0^{b}\pm0.0$	$0.4^{a}\pm0.24$ (0-1)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	25	12
22/3/2016	$0^{a}\pm0$ (0-0)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	$1.2^{b}\pm0.58$ (0-3)	$3.4^{a}\pm0.93$ (1-6)	$5.8^{a}\pm1.90$ (1-12)	$0.6^{b}\pm0.24$ (0-1)	$0.4^{a}\pm0.39$ (0-2)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	18	27
1/4/2016	$0.4^{a}\pm0.24$ (0-1)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	$1.0^{b}\pm0.45$ (0-2)	$7.4^{a}\pm1.63$ (3-13)	$4.4^{ab}\pm0.98$ (3-8)	$0.8^{b}\pm0.37$ (0-2)	$0.8^{a}\pm0.37$ (0-2)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	20	22
11/4/2016	$0.2^{a}\pm0.20$ (0-1)	0.0 ± 0.0	0.0 ± 0.0	$0.2^{a}\pm0.2$ 0 (0-1)	$2.8^{b}\pm0.37$ (2-4)	$6^{a}\pm1.05$ (4-9)	$2.4^{bc}\pm1.16$ (1-7)	$6.2^{a}\pm3.03$ (2-18)	$1.4^{a}\pm0.51$ (0-3)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	24	16
21/4/2016	$0.6^{a}\pm0.24$ (0-1)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	$4.6^{a}\pm0.81$ (2-7)	$8^{a}\pm1.69$ (4-13)	$0.4^{c}\pm0.24$ (0-1)	$0.0^{b}\pm0.0$	$0.8^{a}\pm0.37$ (0-2)	0.0 ± 0.0	0.0 ± 0.0	0.0 ± 0.0	26	9
Total mean	1.4	0	0	0.2	11.4	28.8	13	7.6	3.8	0	0	0		
L.S.D $_{0.05}$	0.58	-	-	0.27	1.77	4.29	3.15	4.17	-	-	-	-		

* Means followed with the same letter(s) within each column are not significantly different at P=0.05.

Table 5. The relationship between inspected insect-pests and prevailing higro-thermic condition at El-Nobaria region, during the growing winter & summer season from 2014 up to 2016

Growing season	Winter season				Summer season			
	2014- 2015		2015-2016		2015		2016	
Insects	r value		r value		r value		r value	
	Tc°	RH	Tc°	RH	Tc°	RH	Tc°	RH
Myzus persicae	0.114	0.569	0.056	-0.130	0.083	0.264	0.562	-0.640
Aphis craccivora	0.042	-0.323	0.207	0.279	-0.044	-0.437	-	-
Aphis gossypii	0.130	0.460	-0.533	-0.377	0.299	-0.164	-	-
Trichoplusia ni	0.423	0.726	0.199	0.054	0.300	-0.340	0.228	-0.092
Liriomyza trifolii	0.109	-0.505	0.031	0.421	-0.639	0.878	0.778	-0.784
Phthrorimaea operculella	0.135	-0.284	-0.003	0.820	0.668	-0.426	0.371	-0.417
Thrips tabaci	-	-	-	-	0.936	-0.551	-0.970	0.977
Empoasca lybica	-	-	-	-	0.571	-0.355	0.106	0.029
Chrysoperla Carnea	0.283	-0.324	0.272	0.260	-0.339	0.740	0.305	-0.213
Paederus alfierii	0.320	-0.311	-	-	0.015	-0.234	-	-
Syrphus corolla	0.040	-0.509	-	-	-0.510	0.856	-	-
Coccinella undecimpunctata	0.040	-0.509	-	-	0.360	-0.206	-	-

while the correlation coefficient was negative and weak with the relative humidity (R.H%) (r =-0.377).

The mean number of *Trichoplusia ni* /15 plants was very low or negligible all over the inspection periods of winter growing season. Table (5) it can be seen that statistical analysis showed a positive weak relationship with either temperature (0.199) or the relative humidity (R.H%)(r =0.054).

The numbers of *L.trifolii* and *Ph.operculella* /15 plants were small at the begining of inspection then increased on 30th of January (5.6 to both). Table (5) it can be seen that the correlation between the mean number of *L. trifolii* were positive weak with either the temperature or the relative humidity (r = 0.031 and 0.421 respectively) while the correlation between the mean number of *Ph. operculella* was a negative weak relationship with Temperature (- 0.003) while relative humidity showed a positive strong relationship (r =0.820).

The mean numbers of the counted individuals of *C. carnea* , *P.alfierii*, *S. corolla* and *C.undecimpunctata* / 15 plants were low or negligible all over the inspection periods of winter season. Table (5) it can be seen that the statistical analysis showed a positive weak relationship with either the temperature or the relative humidity (r = 0.272 and 0.260 respectively).

As shown in Table (3) statistical analysis showed that there were significant differences between the numbers all over the 2nd winter season.

As shown in Table (4) the mean number of the counted individuals of *M. persicae* was very low or negligible all over the 2nd summer growing season then slightly increased at the end of April (0.6). Table (5) it can be seen that the statistical analysis showed a positive and a negative strong relationship between the prevailing temperature and the relative humidity and the number of *M. persicae* (r= 0.562),(r=-0.640).

A.craccivora and *A. gossypii* were negligible all over the 2nd summer season.

The mean number of counted individuals *T. ni* /15 plants was very low all over the inspection periods of winter growing season. Table (5) it can be seen that the statistical analysis showed a weak positive relationship between the prevailing temperature and the number of *T. ni* (r= 0.228) while it was negative weak with R.H.% (r= - 0.092)

The mean number of *L.trifolii*/15 plants gradually increased in the 2nd and the 3^{d} inspection dates of April (2.8and 4.6). In Table (5) statistical analysis showed a positive strong relationship between the prevailing temperature and the number of *L. trifolii* (r =0.778) while it was negative strong with R.H.%(r= - 0.784). Doss *et al*.(1992) found that leafminer infestation began with low numbers in December, then increased gradually till March and declined by the end of April.

The number of the counted individuals of *Ph. operculella* /15 plants gradually decreased from first to second inspection dates of March (4 and 3.4) then increased during 1st up to the end of April (7.4,6,8 respectivily) Foot,(1979) observed that the populations of *Ph. operculella* larvae peak between February and April and are particularly prevalent in hot, dry summer. In Table (5) statistical analysis showed the positive relationship between the prevailing temperature and the number of *Ph. operculella* (r =0.371) while it was negative medium with R.H.%, (r= - 0.417) .

The number of the counted individuals of *T. tabaci* /15 plants was negligible at the begining of March then increased in the following three inspection dates then declined at the end of the season. Table (5) it can be seen that the statistical analysis showed a negative strong relationship between the prevailing temperature and the number of *T. Tabaci* (r = - 0.970) while it was positive strong, (r = 0.977).

The maximum number of the counted individuals of *E. lybica* /15plants was on 11 of April (6.2) but low or negligible all over the 2nd summer season. In Table (5) Statistical analysis showed a positive weak correlation of the number of *E. lybica* and both of temperature and relative humidity (r =0.106 and 0.029 respectively).

The maximum mean number of the counted individuals of *C.carnea* /15 plants was on 11 of April (1.4) but low or negligible all over the 2nd summer season. Table (5) it can be seen that the Statistical analysis showed a positive relationship between the prevailing temperature and the number of *C.carnea* (r =0.305) while it was negative weak with R.H.% , (r = - 0.213). khan *et al* .(2015) found that there was positive correlation between the aphid lion and temperature while it had negative correlation with humidity which is in agreement with the present result.

P. alfierii, *S. corolla* and *C. undecimpunctata* were negligible all over the inspection periods of 2nd summer season.

As shown in Table (4) statistical analysis showed that there were significant differences between the inspection periods and the rates of insects all over the 2nd summer season.

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الملخص العربي

الآفات شائعة الإنتشار على نباتات البطاطس فى منطقة النوبارية– محافظة البحيرة-جمهورية مصر العربية

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تم إجراء تجربة لحصر اهم الآفـات الحـشرية التـى تصيب نباتات البطاطس فى منطقـة النوباريـة بمحافظـة البحيرة خلال الفترة من ديسمبر ٢٠١٤ الى ابريـل ٢٠١٦ ولقد اوضحت النتائج المتحصل عليها أن نباتات البطـاطس تهاجم بالعديد من الآفات الحـشرية الـضارة منهـا المـن (*Myzus persicae, Aphis craccivora, Aphis gossypii*) والدودة نصف قياسة *Trichoplusia ni* وصانعات الانفاق *Liriomyza trifolii* وفراشة درنات البطاطس *Phthrorimaea operculella* والجاسيد *Empoasca lybica* والتربس *Thrips tabaci*. بالإضافة الى بعض الحشرات النافعة ومنها أسـد المـن *Chrysoperla carnea* وذبابـة الـسرفس *Syrphus corolla* والرواغـة *Paederus alfierii* وابـو العيـد *Coccinella undecimpunctata*. ووجد ان الآفة الرئيـسية خلال العروة الشتوية للموسم الأول والثانى كانت من الخوخ الاخضر(٣١,٦ و١٠٦,٨لكل ١٥ نبات على التـوالى) أمـا خلال العروة الصيفية فى الموسـم الاول والثـانى فالافـة الرئيسية كانت فراشة درنات البطاطس (٥٩,٦ و ٢٨,٨ لكل ١٥ نبات على التوالى). ووجد ان هناك علاقة طردية بـين الحرارة وتعداد كلا من من الخوخ الأخضر وفراشة درنات البطاطس وعلاقة عكسية بينهما وبين الرطوبة.