

SEASONAL ABUNDANCE OF POTATO APHIDS AND ASSOCIATED NATURAL ENEMIES

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Abstract

Studies were carried out at El-Badrshien, Giza Governorate during two successive years (1995 & 1996). Obtained results showed that infestation of potato plants by potato aphids was much higher in summer plantation than in nili plantation in both years of study. On potato summer plantation, the infestation increased and fluctuated from the beginning of the season till the end of March, then decreased rapidly until crop harvesting in May. In nili plantation, on the other hand, aphid infestation was much lower at the time of plant sprouting, it then increased with the growing season from late October to the end of harvesting time.

Statistical analysis of the obtained data showed high partial negative correlations between aphid population density and each of temperature, wind velocity, photoperiod and rainfall in summer and nili plantations in both years.

A positive correlation was found between plant age and aphid population density in the nili plantation, while negative correlation was found in summer plantation.

The predaceous and parasitic insects found associated with aphids were *Coccinella undecimpunctata* L.; *Chrysoperla carnea* Steph.; *Syrphus corollae* F.; *Aphidoletes meridionalis* Felt.; *Orius albidipennis* Reuter; *Aphelinus* sp., *Spilomicrus* sp. and an unidentified species (Chalcidae).

INTRODUCTION

The potato, *Solanum tuberosum* L. is an important Solanaceous crop in many parts of the world. During the last twenty years, the potato cultivated area has steadily increased in Egypt, rendering potatoes the second most important vegetable crop after tomatoes. In the field, potato plants are attacked by several insect pests, such as aphids, white flies and potato tuber moth. Seasonal abundance of aphids was studied in different parts in world, i.e. El-Saadany *et al.* (1976) in Egypt, Robert (1981) in France, Zuransa *et al.* (1992) in Korea.

MATERIALS AND METHODS

Three feddans at El-Badrshain region, Giza Governorate, was cultivated with Nicola potato variety during the two successive years 1995 and 1996. The experimental area was divided into three equal plots. Forty days after planting, weekly samples of 100 plants were collected at random from each plot in paper bags and taken to the laboratory for examination. The number of aphids and their associated natural enemies per 100 leaves were counted and recorded. Parasitoids and predators were identified according to Richards and Davies (1977) and Mani (1982). The prevailed weather conditions as well as the plant age were recorded during sampling and their effects on the fluctuation of potato aphid populations were evaluated through the estimation of the correlation coefficient (r) according to Dowine and Heath (1985).

RESULTS AND DISCUSSION

Fluctuation of seasonal abundance of potato aphids

The three aphid species *Myzus persicae* Sulzer, *Aphis gossypii* Glover and *Macrosiphum pisi* Harris were collected from the experimental potato plantations. Data presented in Tables 1 & 2 show that the population of aphids attacking potato plants in summer plantation during two successive years (1995 and 1996) increased gradually until almost the last week of March (1995) or the first of April (1996), and then decreased rapidly until harvesting. In the nili plantation, during the same successive years, aphid population increased from the first week of November and continued at high density during November and December until harvesting, Tables 3 & 4. El-Saadany *et al.* (1976) reported that the infestation with aphids on potato plant in Kalubia Governorate was high in March and rapidly increased reaching a peak towards the end of that month, then decreased gradually until it almost disappeared during the second half of May.

It was noticed that, aphids were found in large numbers on the mature middle leaves as well as on immature upper leaves of potato plants. This is in accordance with the findings of Inaizumi (1968), but in contrast with those of schreier (1953), who found that the density of aphids population was not related to the position of the leaves on the stalk of potato plant.

In both summer and nili plantations *Myzus persicae* was the most dominant

aphid species, while *Aphis gossypii* was much less abundant during the whole season. *Macrosiphum pisi*, on the other hand, was scarce in summer plantation and completely absent in the nili plantation.

Results on the relationship between aphid numbers and climatic factors in summer plantation, Tables 1 & 2, showed that there was negative correlation between the population density of aphids and each of temperature ($r=-0.6$ and -0.5), wind velocity ($r=-0.7$ and -0.2), photoperiod ($r = -0.5$ and -0.4) and rainfall ($r = -0.5$ and -0.4) in both years, respectively.

In potato nili plantation, Tables 3 & 4, a high negative correlation was found between the population density of aphids and each of temperature, wind velocity, rainfall and photo-period ($r=-0.8$ and -0.7 ; -0.2 and -0.5 ; -0.4 and 0 ; -0.7 and -0.6) in both years, respectively. These results agree with that reported by Oliveira (1971) who found that the size of aphid populations was negatively correlated with the amount of rainfall and temperature, while migration of aphids was aided by wind.

On the other hand, a positive correlation was found between aphid population density and plant age of nili plantation ($r=+0.5$ and $+0.6$ in 1995 and 1996, respectively), but the opposite occurred in summer plantation ($r=-0.6$ and -0.6) in both year. This may be due to the interference of weather conditions which vary considerably in both seasons of plantations.

Associated natural enemies of aphids

Five predaceous natural enemies of aphids attacking potato crop were collected during the present study. These are *Coccinella undecimpunctata* L., *Chrysoperla carnea* Steph., *Syrphus corollae* F., *Aphidoletes meridionalis* Felt. and *Orius albidipennis* Reuter. The most abundant species was *C.undecimpunctata*, while the least abundant one was *A.meridionalis*. Three Hymenopterous endoparasitoids were also found attacking potato aphids; *Aphelinus* sp. (Aphelinidae) a common parasitoid of aphids in Egypt, *Spilomicrus* sp. (Diapriidae) and another unidentified species which probably belongs to the family Chalcidae. The last two hymenopterous parasitoids are recorded for the first time as a new parasitoids of aphids in Egypt. Harakly (1975), however, recorded three different hymenopterous endoparasitoids of *Myzus persicae* in Egypt. Obrycki and Touber (1985) in U.S.A., found that the most abundant predators of aphids on potatoes were, *Coccinella transversoguttata* Richardsoni, *Coleomegilla* sp., *Hippodamia convergens*, *H.tredecimpunctata* and

H. glacialis and three species of chrysopidae. They also found two parasitoids, *Aphidius* sp. and *Praon* sp.

The population of detected natural enemies of aphids in the present study increased gradually with aphid infestation and fluctuated due to changes in weather conditions and fluctuations in aphids population during both summer and nili plantations, Table 5.

In potato nili plantation, Tables 3 & 4, a high negative correlation was found between the population density of aphids and each of temperature, wind velocity, rainfall and photo-period ($r = -0.8$ and -0.7 ; -0.5 and -0.2 ; -0.4 and 0 ; -0.7 and -0.6) in both years, respectively. These results agree with that reported by Davies (1971) who found that the size of aphid populations was negatively correlated with the amount of rainfall and temperature, while migration of aphids was aided by wind.

On the other hand, a positive correlation was found between aphid population density and plant age of nili plantation ($r = +0.2$ and $+0.6$ in 1982 and 1986, respectively), but the opposite occurred in summer plantation ($r = -0.6$ and -0.6) in both years. This may be due to the interference of weather conditions which vary considerably in both seasons of plantations.

Associated natural enemies of aphids

Five predaceous natural enemies of aphids attacking potato crop were collected during the present study. These are *Coccinella undecimnotata* L., chrysopidae, *Cymus* sp., *Syrphus* sp., *Aphidius* sp. and *Chrysopa* sp. The most abundant species was *Coccinella undecimnotata*, while the least abundant one was *Aphidius* sp. Three Hymenoptera endoparasitoids were also found attacking potato aphids: *Aphelinus* sp. (Aphelinidae), a common parasitoid of aphids in Egypt, *Spilomicrus* sp. (Dacnidae) and another unidentified species which probably belongs to the family Chalcidae. The last two Hymenoptera parasitoids are recorded for the first time as new parasitoids of aphids in Egypt. Harkly (1972), however, recorded three different Hymenoptera endoparasitoids of *Myzus persicae* in Egypt. Oshycki and Toubet (1982) in U.S.A., found that the most abundant predators of aphids on potatoes were *Coccinella transversopunctata* Richardson, *Colletes* sp., *Hippodamia convergens*, *H. tredecimnotata* and

Table 1. Seasonal abundance of aphids in summer plantation in El-Badrshain, Giza, during 1995 together with the prevailing weather conditions and plant age.

Date of collection	Aphids/100 leaves of potato						Total	Temperature (°C)			Wind velocity at 2m (m/sec)	Amount of rain fall (mm)	Photo period (h)	Plant age days		
	<i>Myzus persica</i>		<i>Aphis gossypii</i>		<i>Macrosiphum pisi</i>			Max.	Min.	Avg.					R.H %	
	No.	%	No.	%	No.	%										
18-02	475	89.6	53	10	2	0.4	530	22.5	10.6	16.6	70	0	11.1	40		
25-02	1333	90	155	10	0	-	1550	23.5	10.1	16.8	64	0	11.4	47		
03-03	2175	90	241	9.96	1	0.04	2417	26.7	12.7	19.7	63	0.1	11.7	54		
10-03	567	89.7	65	10.3	0	-	632	26.7	12.7	19.7	63	0	11.7	61		
17-03	1461	91	141	8.8	5	0.2	1607	25.2	12	18.6	55	0	12.1	68		
24-03	2141	90.96	212	9	1	0.04	2354	24.5	10.6	17.6	60	0.4	12.3	75		
01-04	0	-	0	-	0	-	0	27.3	15.3	21.3	58	0.4	12.6	82		
08-04	0	-	0	-	0	-	0	30	20	25	58	0.1	12.6	89		
15-04	59	80.8	7	0.1	7	0.1	73	27	14.1	20.6	58	0.3	12.7	96		
22-04	281	93.4	19	6.3	1	0.3	301	30.2	15.9	23.1	54	0	13.2	103		
29-04	64	88.9	7	9.7	1	1.4	72	30.2	15.9	23.1	54	0	13.2	110		
06-05	19	100	0	-	0	-	19	35.5	19.3	27.4	57	0	13.9	117		
Correlation coefficient (r)											-0.6	0.3	-0.7	-0.5	-0.5	-0.4

Note: Weather information were obtained from the General meteorological Authority.

Table 2. Seasonal abundance of aphids in summer plantation in El-Badrshain, Giza, during 1996 together with the prevailing weather conditions and plant age.

Date of collection	Aphids/100 leaves of potato						Total	Temperature (°C)			R.H %	Wind velocity at 2m (m/sec)	Amount of rain-fall (mm)	Photo period (h)	Plant age days	
	Myzus persica		Aphis gossypii		Macrosiphum pisi			Max.	Min.	Avg.						
	No.	%	No.	%	No.	%										
20-02	1503	91.5	139	8.5	0	-	1642	21.2	10.1	15.7	72	106	0.1	11.1	40	
27-02	1843	90.9	181	8.9	3	0.2	2027	22.6	9.3	16	55	2.8	0	11.4	47	
06-03	0	-	0	-	0	-	0	22.8	10.8	16.8	71	2	0.3	10.9	54	
13-03	2684	90.55	279	9.4	1	0.05	2964	25.5	12.2	18.9	63	1.8	0	12.1	61	
20-03	1978	91	193	8.9	2	0.1	2173	25.2	12.2	18.7	63	1.3	0	12.1	68	
27-03	0	-	0	-	0	-	0	24.8	12.1	18.5	63	1.8	0.5	12.3	75	
03-04	1095	90.7	111	9.2	1	0.1	1207	27.6	13.8	20.7	58	1.8	0	12.6	82	
10-04	126	92	11	8	0	-	137	27.2	13.5	20.4	58	2.8	0	12.6	89	
17-04	0	-	0	-	0	-	0	26.8	13.2	20	57	2.2	0.3	12.7	96	
24-04	56	94.9	3	5.1	0	-	59	29	14.3	21.7	55	1.9	0	13.2	103	
01-05	27	100	0	-	0	-	27	35.3	18.2	26.8	50	2.5	0	13.4	110	
08-05	6	100	0	-	0	-	6	34.6	18.6	26.6	51	2.3	0	13.5	117	
Correlation coefficient (r)											-0.5	0.3	-0.2	-0.2	-0.4	-0.4

Note: Weather information were obtained from the General Meteorological Authority.

Table 3. Seasonal abundance of aphids in nili plantation in El-Badrshien, Giza, during 1995 together with the prevailing weather conditions and plant age.

Date of collection	Aphids/100 leaves of potato						Total	Temperature (°C)			R.H %	Wind velocity at 2m (m/sec)	Amount of rain-fall (mm)	Photo period (h)	Plant age days	
	Myzus persica		Aphis gossypii		Macrosiphum pisi			Max.	Min.	Avg.						
	No.	%	No.	%	No.	%										
07-10	185	90.7	19	9.3	0	-	204	31.2	19.2	25.2	67	1.7	0	11.7	40	
14-10	499	9.1	55	9.9	0	-	554	30.9	18.3	24.6	70	1.2	0	11.4	47	
21-10	614	91.2	59	8.8	0	-	673	30.8	17.7	24.3	70	1.2	0	11.4	54	
28-10	0	-	0	-	0	-	0	30.6	17.1	23.9	67	1.5	0.6	11.2	61	
04-11	2864	91.1	281	8.9	0	-	3145	27.8	13.8	20.8	56	1.1	0	11	68	
11-11	929	92.2	79	7.8	0	-	1008	25.2	13.2	19.2	67	1.4	0	10.6	75	
18-11	1644	90.1	181	9.9	0	-	1825	26.5	13.5	20	67	1.4	0	10.6	82	
25-11	3313	91.6	303	8.4	0	-	3616	21.2	11.2	16.2	65	2	0	10.4	89	
01-12	2125	91	210	9	0	-	2335	22.3	10.7	16.5	73	1.1	0	10.3	96	
08-12	2250	90.1	224	9.9	0	-	2474	21	9.6	15.3	73	1.1	0	10.3	103	
15-12	3036	90.7	313	9.3	0	-	3369	19.6	8.5	14.1	73	0.9	0	10.2	110	
22-12	1909	90.1	197	9.9	0	-	2106	21.2	9.4	15.3	78	0.7	0	10.2	117	
Correlation coefficient (r)											-0.8	0.7	-0.2	-0.4	-0.7	0.5

Note: Weather information were obtained from the General Meteorological Authority.

Table 4. Seasonal abundance of aphids in nili plantation in El-Badrsheln, Giza, during 1996 together with the prevailing weather conditions and plant age.

Date of collection	Aphids/100 leaves of potato						Total	Temperature (°C)			R.H %	Wind velocity at 2m (m/sec)	Amount of rain-fall (mm)	Photo period (h)	Plant age days
	<i>Myzus persica</i>		<i>Aphis gossypii</i>		<i>Macrosiphum pisi</i>			Max.	Min.	Avg.					
	No.	%	No.	%	No.	%									
08-10	196	94.7	11	5.3	0	-	207	33	20.4	26.7	67	2	0	11.7	40
15-10	479	91.8	43	8.2	0	-	522	31	20.4	25.7	67	1.5	0	11.4	47
22-10	611	90.9	61	9.1	0	-	672	29	17.6	23.3	64	1.2	0	11.2	54
29-10	818	90.2	89	9.8	0	-	907	27	16.7	21.9	64	1.2	0	11.2	61
05-11	2349	93	213	7	0	-	2562	26.5	14.3	20.4	72	1.5	0	11	68
12-11	755	91	75	9	0	-	830	27.8	15.8	21.8	73	1.5	0	10.6	75
19-11	947	90.5	99	9.5	0	-	1046	26.9	14.8	20.9	73	1.5	0	10.6	82
26-11	2477	90.7	253	9.3	0	-	2730	25.9	13.7	19.8	73	1.3	0	10.4	89
02-12	1479	89.9	167	10.1	0	-	1646	23.4	10.9	17.2	67	1	0	10.3	96
09-12	1843	90.6	191	9.4	0	-	2034	23	10	16.5	67	1	0	10.3	103
16-12	1747	89.6	202	10.4	0	-	1949	22.5	10.1	15.8	74	0.6	0	10.2	110
23-12	1309	91.2	127	8.8	0	-	1436	22.1	10.2	16.2	69	0.8	0	10.2	117
Correlation coefficient (r)															
-0.7															
-0.5															
-0.6															

Note: Weather information were obtained from the General Meteorological Authority.

Table 5. Relative abundance of aphids and their associated natural enemies collected from potato plants at El-Badrshain, Giza, during two successive plantation seasons (1995 & 1996).

Aphids and their natural enemies	Average number/100 leaves of potato			
	1995		1996	
	Summer Plantation	Nili Plantation	Summer Plantation	Nili Plantation
1- Aphids	796.3	1774	854	1378
2- Natural enemies				
I- Predators:				
Coccinella undecimpunctata	7.8	13.5	8	5.8
Chrysoperta carnea	1.6	4.2	1.9	4.4
Syrphus corollar meridionalis	5.3	4.4	4.2	4.5
Aphidletes Orius albidipennis	0.75	0.92	0.67	0.9
II-Parasitoids	2.3	2.1	1.3	1.7
Hymenopterous Parasitoids	8.2	9.8	7.8	9.2

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الكثافة الموسمية لحشرة من البطاطس والأعداء الطبيعية المصاحبة له

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تمت هذه الدراسة في منطقة البدرشين، محافظة الجيزة وأوضحت النتائج أن أصابة نباتات البطاطس بالمن كانت عالية في الزراعات الصيفية عنها في الزراعات الشتوية خلال سنتي الدراسة (١٩٩٥ - ١٩٩٦). ولقد إزدادت الإصابة في الزراعات الصيفية وتأرجحت كثافتها من بداية الموسم حتى نهاية شهر مارس، ثم تناقصت في أوج موسم الحصاد في مايو. أما في الزراعات الشتوية فقد بدأت الإصابة قليلة علي البادرات عنها في الزراعات الصيفية، ثم إزدادت خلال الموسم الزراعي إعتباراً من أواخر أكتوبر وحتى نهاية موسم الحصاد.

وقد أثبت التحليل الأحصائي للنتائج وجود إرتباط جزئي سالب بين كثافة المن وبين كل من درجات الحرارة وسرعة الريح وفترة الإضاءة وكمية الأمطار في كل من الزراعات الصيفية والشتوية وذلك خلال سنتي الدراسة. كما كان الإرتباط الجزئي موجبا بين كثافة المن وعمر النبات في الزراعات الشتوية، بينما كان الإرتباط سلبيا في الزراعات الصيفية.

وجدت المفترسات والمتطفلات الحشرية التالية مصاحبة للمن الذي يصيب البطاطس في الحقل: أبو العيد ذو الأيدي عشرة نقطة، أسد المن، ذبابة السرفس، ذبابة الأفيدوليتس، بقعة الأوريس، نوع من جنس الأفيلينيس، ونوع من جنس سبييلوميكرس ومتطفل من عائلة (كالسيدي) غير معروف حالياً.