

HORIZONTAL DISTRIBUTION PATTERN AND POPULATION DYNAMIC OF APHIDS AND ASSOCIATED PREDATORS ON MAIZE PLANTS.

Hafez, S.F.M. and O. A. El - Sebai

Plant Protection Department, Faculty of Agriculture. Al-Azhar University.
Nasr City, Cairo, Egypt.

ABSTRACT: The distribution patterns and population dynamics of maize aphids *Rhopalosiphum maidis* (Fitch.), *Aphis gossypii* (Glov.) as well as the associated predators *Coccinella undecimpunctata* and *Paederus alfieri* were conducted during 2001 year through middle and 4 cardinal directions of maize-field.

Aphids infestation started at the second week of August and reached its maximum at the second week of September (110.64 insects / plant), then decreased to the lowest rate at the end of the same month (4.86 insects / plant).

Density of the associated predators *C. undecimpunctata* and *P. alfieri* increased from the first week of August and attained the maximum at the first week of September and 24th of August for *C. undecimpunctata* and *P. alfieri*, respectively. The maximum mean number of *C.undecimpunctata* and *P.alfieri* were 3.72 and 5.38 insects / plant, respectively, finally these values decreased to the minimum (0.2 insect/plant and 0.58 insects / plant, respectively) at the end of maize season.

West direction significantly harboured the highest number of insects followed by north direction. East and south directions followed the north, while middle harboured the lowest numbers of aphids. The correlation analysis showed that the relationship between aphid population numbers and the predators numbers was positive at the middle and four cardinal directions of maize plants.

THE INTRODUCTION

Cereals are usually attacked by aphids *Rhopalosiphum padi*, *Schizaphis graminum*, *R. maidis* and *Sitobion avenae* and the main associated predators were coccinellids *Coccinella undecimpunctata* and *Paederus alfieri* (Ghanim, 1984, El-Heneidy and Attia, 1988, Al-Hag, et al. 1996, Abdel-Rahman 1997, El-Lathy 1999, and Abdel-Rahman et al. 2000). *Rhopalosiphum maidis* followed by *Aphis gossypii* were the main aphids infest maize plants in Egypt and the highest rate of damage was found in young plants in August, early September and October, while *Paederus alfieri* dominated in August and followed by *C. undecimpunctata* (El-Heneidy and Abbas, 1984).

The aphid numbers reduced by 31.75% to 32.80% by 1 larva of *coccinella undecimpunctata* per 80-100 aphids, whereas, 1 larva of the predator per 40-50 aphids obtained 89.71% to 91.28% reduction of aphid numbers, furthermore the data showed 88.19% to 89.77% reduction by 1 predator to 20-50 aphids. (Ghanim and El-Adl, 1991).

The associated natural enemies *C. undecimpunctata*, *Scymnus sp.*, *Paederus alfieri*, *Orius sp.* *Chrysoperla sp.* and *Syrphus corollae*, were dominant in cereal fields. Temperature, (maximum and minimum) and relative humidity play the most important role in controlling cereal aphid populations in wheat fields (AbouEl-hagag and Abdel-Hafez, 1998). However, the increasing of temperature increased predation on *Rhopalosiphum padi* by *C. undecimpunctata* (Eraky and Nasser, 1993) and suggested that *Coccinella undecimpunctata* has greater potential for population increase due to its higher survivorship and faster preadult development time in laboratory conditions than *H. variegata* and *C. novemnotata* (El. Hag and Zaitoon, 1996).

MATERIAL AND METHODS

The experiment was conducted in the Research Farm of Al-Azhar university at Mostorod region, Qalubia Governorate north east of Cairo, in the summer season of 2001 in an area about 713 m² planted with hybrid maize cultivar "S.C.10 sown at 29th of June in 2001 season. The normal agricultural practices were carried out as recommended. Aphid population infested maize plants in the four cardinal directions and middle of the field was counted and recorded at weekly intervals. In the same directions and middle the associated predators were counted and recorded. The predators recorded

were the ladybird beetle *Coccinella undecimpunctata* and the rove beetle *Paederus alfieri*. Both of the pest and their associated predators were counted randomly on "ten" plants in each direction from the four cardinal directions and middle and the mean numbers were calculated / one plant. Specimens of the aphids in 70% ethyl alcohol were taxonomized in the Plant Protection Institute (Aphid Department). Aphids were taxonomized as the cereal aphid *Rhopalosiphum maidis* (Fitch) and cotton aphid *Aphis gossypii* (Glov.). The data were subjected to the simple variance of analysis (F-test) to obtain the difference of the mean number of aphids on the cardinal directions and middle, and the same time, partial regression was conducted to study correlation between the aphid numbers and the predators.

RESULTS AND DISCUSSION

The horizontal distribution Pattern and the population fluctuation of cereal aphids *Rhopalosiphum maidis* and cotton aphid *Aphis gossypii* on maize plants were conducted from the second week of August to the end of September of the tested 2001 season (Table 1).

Infestation in eastern site started on 10th of August by mean number of 5.6 insects / plant and increased to the maximum number (89.40 insects / plant) in the third week of September. The western site harboured the highest mean number of aphids and ranked the highest infested site among the all sites of the field (227 insects / plant). Infestation in the northern site started by 7.3 insects / plant and increased to reach its maximum in 8th of September with mean number of 150.2 insects / plant, and decreased to 1.0 insect / plant at the end of the season.

The southern site showed 6.2 insects / plant at the beginning of the season and the population increased to reach the maximum number (93.1 aphids/plant) in the 8th of September as the two previous sites (west and north).

Plants located in the middle site were attacked by aphid insects at the first week of August (1.8 insects / plant) and increased to 18.1 insects / plant at 8th of september similarly to west, north and south sites. Aphid numbers gradually decreased till 22nd of September which averaged 1.3 insects / plant. These results agreed with El-Henidy and Abbas (1984) who cleared that the main infestation to maize plants occurred in August. Early September and October.

Table (1): Weekly mean numbers of aphids / plant on 5 tested sites of maize field at Mostorod region, Qalubia Governorate, 2001 season.

Directions Date	East	West	North	South	Middle	Total	Mean
2-8-2001	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10-8-2001	5.60	9.10	7.30	6.20	1.80	30.00	6.00
17-8-2001	22.50	30.20	23.20	21.30	5.80	103.00	20.60
24-8-2001	31.60	92.40	71.20	52.00	13.00	260.2	52.04
1-9-2001	62.00	210.10	101.40	90.30	15.10	478.9	95.78
8-9-2001	64.80	227.00	150.20	93.10	18.10	553.2	110.64
16-9-2001	89.40	54.30	40.00	30.30	11.20	225.20	45.04
22-9-2001	29.00	23.10	3.20	12.20	1.30	68.8	13.76
29-9-2001	10.20	8.10	1.00	5.00	0.00	24.30	4.86
7-10-2001	0	0	0	0	0	0	0
Total	315.10	654.3	397.50	310.40	66.30		
Mean	31.51 ^a	65.43 ^a	39.75 ^a	31.04 ^a	6.63 ^a		

F-value = 4.28

L.S.D (0.05) = 29.25

P. = 0.006

Infestation started in the second week of August in the all test sites however, the west site significantly harboured the highest mean numbers of aphid followed by north. The east and south sites had the same level of infestation and harboured lower number of aphids than north site.

Middle site had the lowest number of the pest population. The different field sites could be arranged in the following order 65.43, 39.75, 31.51, 31.04, and 6.63 insects/plant to west, north, east, south and middle, respectively (L.S.D value = 29.25).

The data in tables 2 & 3 show the horizontal distribution pattern and population fluctuation of the associated predators *Coccinella undecimpunctata* and the rove beetle *Paederus alfieri* on maize plants located as a main natural enemies at the different five sites of maize field. The mean numbers of *Coccinella undecimpunctata* and *Paederus alfieri* were 1.98 and 4.52 at 3rd week of August and drastically reached to the maximum numbers in the first week of September for *Coccinella undecimpunctata* and 24th of August for *Paederus alfieri*. The mean numbers were 3.72 and 5.38 for the two predators, respectively. These mean numbers gradually decreased to 0.2 insects/plants and 0.58 insects/plant for *C. undecimpunctata* and *P. alfieri*,

respectively, at the 7th of October. The weekly mean numbers of associated predators *Coccinella undecimpunctata* in the cardinal directions were 2.24, 1.9, 1.75, 1.64 and 1.14 insects/plant in west, north, east, south and middle respectively, whereas *Paederus alfieri* total numbers were 2.68, 2.5, 2.0, 1.9 and 1.65 in the north, west, east, south and middle respectively.

Infestation level of the pest and its associated predators numbers cleared that there is a relationship between the aphid numbers and the number of the two predators from the first week of infestation till the end of the season.

These agreed with El-Heneidy and Attia, (1998); Al-Hag et al., (1996); Ghanim (1984), who stated that the main predators to cereal aphids were *Coccinella undecimpunctata* and *Paederus alfieri* and Abou-El-Hagag and Abdel-Hafez (1988) cleared that the associated natural enemies *C.undecimpunctata* and *Paederus alfieri* and the other predators and the environmental conditions played the most important role in controlling cereal aphid populations.

Table (2) : Weekly mean number of *Coccinella undecimpunctata* insects/plant in 5 tested sites of maize field at Mostorod region, Qalubia Governorate, 2001 season.

Directions Date	East	West	North	South	Middle	Total	Mean
2-8-2001	0	0	0	0	0	0	0
10-8-2001	0	0	0	0	0	0	0
17-8-2001	1.3	3.0	2.2	2.3	1.1	9.9	1.98
24-8-2001	3.1	4.3	3.1	3.0	1.0	14.5	2.70
1-9-2001	4.2	4.6	3.7	2.9	3.2	18.6	3.72
8-9-2001	3.4	4.0	3.8	3.5	2.2	16.9	3.38
16-9-2001	2.7	3.8	2.8	1.3	2.3	12.9	2.58
22-9-2001	2.8	3.1	2.7	2.5	1.8	12.9	2.58
29-9-2001	1.7	1.8	2.2	2.2	0.9	8.8	1.76
7-10-2001	0.1	0.1	0.3	0.4	0.1	1.0	0.2
14-10-2001	0	0	0	0	0	0	0
Total	19.30	24.7	20.8	18.1	12.6		
Mean	1.75	2.24	1.90	1.64	1.14		

Table (3): weekly mean number of *paederus afliesii* insects / plant in 5 tested sites of maize field at Mostorod region, Qalubia Governorate, 2001 season.

Directions Date	East	West	North	South	Middle	Total	Mean
2-8-2001	0	0	0	0	0	0	0
10-8-2001	0	0	0	0	0	0	0
17-8-2001	5.3	4.8	6.6	2.9	3.0	22.60	4.52
24-8-2001	5.1	4.1	7.2	5.4	5.1	26.90	5.38
1-9-2001	4.1	5.0	5.4	5.1	4.2	23.80	4.76
8-9-2001	2.0	4.1	4.8	2.8	1.8	15.50	3.10
16-9-2001	2.1	2.3	2.3	2.1	1.9	10.70	2.14
22-9-2001	1.7	3.1	1.6	1.9	1.2	9.50	1.90
29-9-2001	1.6	2.2	0.9	0.8	1.0	6.50	1.30
7-10-2001	0.2	2.0	0.7	0	0	2.9	0.58
14-10-2001	0	0	0	0	0	0	0
Total	22.1	27.6	29.5	21.0	18.2		
Mean	2.00	2.50	2.68	1.90	1.65		

The relationship between the population numbers of the cereal aphids and the associated predators on the four cardinal directions and middle was discussed statistically to obtain significantly the regression values between the pest population and the two predators on these different sites.

The correlation analysis (Table 4) showed a positive correlation between the number of aphids and *Coccinella undecimpunctata* numbers in the four cardinal directions and middle and "r" value amounted 0.823, 0.727, 0.749, 0.748 and 0.749 in east, west, north, south and middle respectively. Similarly, positive relationship between aphid mean number and *Paederus alferii* was found and "r" value equaled 0.398, 0.658, 0.660, 0.782 and 0.720 in East, west, north, south and middle.

Table (4): Regression values of the relationship between cereal aphids and their associated predators in different sites of maize field 2001 Season.

Aphids mean no. in 5 sites	<i>C.undecimpunctata</i>		<i>P.alfierii</i>	
	r	p.	r	p.
East	0.8236**	.003	0.398	0.254
West	0.727*	.017	0.658	0.38
North	0.749*	.012	0.660*	0.03
South	0.748*	.012	0.782**	.007
Middle	0.749*	.012	0.720*	0.018

**=highly significant

*= significant

P. = Probability

From the data obtained from the statistical analysis it is evident that the predator mean numbers in the four directions and middle behaved similarly to the trend of aphid population numbers.

ACKNOWLEDGEMENT

The author would like to express their thanks to Prof. Dr. Mohammad Ali Mohammad Ali (Department of Plant Protection, Faculty of Agriculture, Al-Azhar University) for his assistance and reviewing the manuscript.

REFERENCES

- Abdel- Rahman, M.A.A.**(1997): Biological and ecological studies on cereal aphids and their control in Upper Egypt. Ph. D. Thesis Fac. of Agric., Ass., Univ., 231pp.
- Abdel- Rahman, M.A.A. ; Nasser, M.A.K. and Ali , A.M.** (2000): Insedence of hymenopterous parasitoids attacking cereal aphids in wheat field in Upper Egypt. Ass. J. Agric . sci., 31:317-328.

- Abou-Elhagag, G.H., N.A. Abdel-Hafez.** (1998): Cereal Aphids (Homoptera: Aphididae) Factors affecting their populations on wheat in upper Egypt. *Assiut-Journal of Agricultural- sciences*, 29 (3): 24 1-252.
- Al-Hag, E.A., A.A. Al-Rokaibah and A.A. Zaitoon.** (1996): Natural enemies of cereal aphids in sprinkler-irrigated wheat in central Saudi Arabia. *Bulletin of faculty of Agriculture, University of Cairo*. 47 (4): 649-663.
- El-Hag E.T.A., A.A. Zaitoon.** (1996): Biological parameters for four coccinellid species in central Saudi Arabia. *Bulletin of Faculty of Agriculture, University of Cairo*. 7 (3): 316-319.
- El-Heneidy, A.H., M.S.T. Abbas** (1984): population dynamics of certain insect predators associated with aphids in maize field in the Giza region. *Beitrag Zur Tropischen landwirtschaft und veterinarmedizin*- 22 (4): 407-413.
- El-Heneidy, A-H.; A.A. Attia** (1988): Evaluation of the role of parasitoids and predators associated with aphids in wheat fields, Egypt. *Bulletin of the Entomological society of Egypt, Economic series. publ*, (17): 137-147.
- El-Lathy, K.H.** (1999): Integrated management of aphids on wheat crop. Ph. D. Thesis Fac. Agric., Ain Shams Univ., 123pp.
- Eraky, S.A., M.A.K. Nasser** (1993): Effect of constant temperatures on the development and predation prey efficiency of the ladybird beetle, *Coccinella undecimpunctata* L. (Coleoptera: coccinellidae). 24 (12): 223-23 1.
- Ghanim, A.E.B,** (1984): Studies on the occurrence of cereal aphids and their predators in a winter wheat stand in Mansura (Arab Republic of Egypt). 20 (3): 26 1-267.
- Ghanim, A.A.; M.A. El-Adl** (1991): The role of *Coccinella undecimpunctata* L. in suppressing the population level of *Schizaphis graminum* (Rond) and increase the yield of wheat plantation at Dakahlia Governorate, Egypt. 41(1): 277-286.

التوزيع الافقى وتحركات المجموع لحشرات المن ومفترساتها على نباتات الذرة

شريف فاروق - أسامة السباعى
قسم وقاية النبات - كلية الزراعة - جامعة الأزهر

التذبذبات الموسمية لمن الغلال (النجليات) من القطن ومفترساته المرتبطة به (أبو العيد ١١ نقطة ، الحشرة الرواغة) تمت دراستها فى الأربعة اتجاهات الرئيسية والوسط بنباتات الذرة الهجين من صنف "S.C.10" و فى قطعة أرض مساحتها ٢م٧١٣ كانت أعلى أعداد للمن فى الأسبوع الثانى من سبتمبر ١١٠,٦٤ حشرة / نبات . كانت الأعداد الأولى للمفترسات والمرتبطة بحشرات المن ٣,٧٢ ، ٥,٣٨ حشرة / نبات لكل من أبو العيد ١١ نقطة والحشرة الرواغة على التوالى بينما كانت أقل الأعداد ٢,٠٨ ، على التوالى كانت اتجاه الغرب الأكثر اصابة بحشرات المن يليه اتجاه الشمال ثم الشرق ثم الجنوب وأخيراً الوسط . من التحليل الإحصائى يتبين أن الفروق بين اتجاه الغرب والاتجاهات التى تليه كانت معنوية وان الشمال اتخذ موقعاً متوسطاً بين الاتجاهات بينما كانت الوسط أقلهم فى الاصابة بحشرات المن .

ومن التحليل الإحصائى ظهر أن هناك ارتباطاً موجباً بين المن ومفترساته فى الاتجاهات المختلفة .