

EVALUATION TO THE ROLE OF PARASITIDS AND PREDATORS ASSOCIATED WITH APHIDS IN WHEAT FIELDS, EGYPT

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INTRODUCTION

Wheat is the most important cereal crop in Egypt. Aphids and their damages to wheat plantations have been reported by several authors in many parts of the world (Kolbe and Linke, 1974; Rautapaa, 1976; Frier, 1978; Wetzel et al., 1981; Ghanim and El-Adl, 1983 b and Stoetzel, 1987).

In Egypt, aphids began to be a problem in wheat fields only in the last few years, particularly in middle and upper Egypt; this may be attributed to the extensive and misuse of insecticides for the control of aphids in wheat and other field crops.

No sufficient studies concerning the role of natural enemies in wheat fields have been done in Egypt (Ghanim and El-Adl, 1983 a), therefore, the present study is an approach to evaluate the role of parasitoids and predators associated with aphids in wheat fields.

MATERIALS and METHODS

The study was carried out in wheat fields located at Seds Agricultural Research Station (Beni-Suef Governorate) and at Itsa district (Fayoum Governorate) for two successive growing seasons, 1987 and 1988. The studies were carried out in an area of about 10 feddans cultivated with wheat in each of the two locations. The surrounding crops were Egyptian clover and vegetables. Sampling was undertaken weekly at Seds and bi-weekly at Itsa for the two seasons, starting from February till the end of April.

Aphid population

a — Survey of aphid species :

Infested samples of wheat plants were collected throughout the season from the two experimental areas, kept in paper bags and taken to the laboratory for identification.

b — Estimation of aphid population :

The estimation was conducted under field conditions according to the following scale (Hafez, 1964) :

0 — = No aphid infestation could be seen.

1 = A few scattered nymph colonies present on the stem and leaves.

2 = Large numbers of aphids are present in unrecognizable colonies but diffused to infest large proportions of leaves and stems.

3 = Aphids are present in very dense numbers, accompanied by winged forms, infesting all leaves and stems of the plants.

c — Seasonal abundance :

In the season 1988, experimental area of wheat at Seds was examined weekly, starting from end of January, to follow up population fluctuations of different aphid species throughout the season. Fifteen infested wheat plants were picked up at random and examined weekly. Actual numbers of different forms and stages of aphid species were counted and recorded.

Natural enemies

The sweeping-net method (100 double net-strokes / area) was used for counting the main predators associated with aphids on wheat plants. Also random samples from infested wheat plants were collected and transferred to the laboratory in order to :

a — estimate parasitism % by dissecting 100 living aphids / sample.

b — identify emerged parasitoid species by keeping the rest of the infested sample in glass jars till the possible emergence of parasitoid adults.

RESULTS and DISCUSSION

Aphid infestation

a — Survey of aphid species :

The present work revealed that wheat plantations are liable to be infested with five aerial aphid species; *Rhopalosiphum padi* L., *R. maidis* Fitch, *Shizaphis graminum* Rond., *Macrosiphum (Sitobion) avenae* Fab. and *Diuraphis noxia* Mordvilko at Seds, while the first three species only were recorded at Ilsa. *D. noxia* (identified by the Natural History Museum in 1986) was recently recorded infesting wheat plants in Giza and Beni-Suef Governorates during 1985 season (Attia and El-Kady, under publication).

b — Estimation of aphid population :

According to the given relative categories (0-3) of estimating the aphid population, field observations indicated that rates of aphid infestation didn't exceed category 2 (Tables I, II, III) in the two seasons and locations of study. Data presented in the tables show that highest rates of infestation were observed during March and early April when the rates were mostly within category 1-2. They decreased to category 0-1 during the second half of April just before harvesting. It was also observed that rates of infestation in season 1987 were higher than those of season 1988, when category 1-2 was recorded only for 2-3 weeks by mid-March.

c — Seasonal abundance :

Seasonal abundance of different aphid species associated with wheat plants at Seds during 1988 season is illustrated in Fig. (I).

R. padi dominated the other four species of aphids all over the infestation season (about 13 weeks). The mean number of this aphid species ranged between 5 and 140 individuals / plant. The peak of 140 individuals / plant was recorded during the last week of March. The species population represented 42.7% of the total numbers of counted aphids.

S. graminum was observed on wheat plants for a period of about 12 weeks which started from the end of January to the end of April. The mean number of this species ranged between 3 and 92 individuals / plant. The peak of 92 individuals / plant was recorded during the last week of March. Its population represented 26.5% of the total numbers of counted aphids.

R. maidis was observed on wheat plants for a period of about 9 weeks which started from mid-February till mid-April. The mean number of this species ranged between 3 and 51 individuals / plant. The peak of 51 individuals / plant was recorded by mid-March. Its population represented 10.6% of the total numbers of counted aphids.

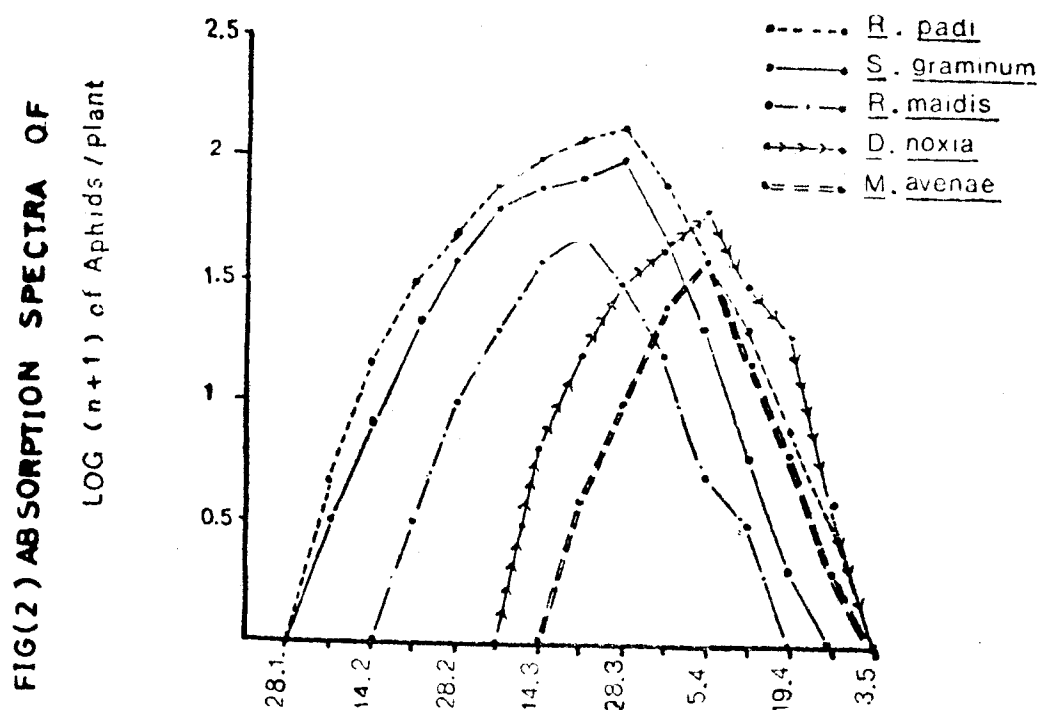


Fig. 1. Weekly mean numbers of the five species of aphids infesting wheat plants at Seds in season 1987/1988.

D. noxia was observed on wheat plants for a period of about 8 weeks started from early March till the end of April. The mean number of this species ranged between 6 and 70 individuals / plant. The peak of 70 individuals / plant was recorded during the first week of April. Its population represented 14.1% of the total numbers of counted aphids.

M. avenae was observed on wheat plants for a period of about 7 weeks started from mid-March till the end of April. The mean number of this species ranged between 4 and 40 individuals / plant. The peak of 40 individuals / plant was recorded during the first week of April. Its population represented 6.1% of the total numbers of counted aphids.

TABLE I

Numbers of predator species/100 double net-strokes, % aphid parasitism and rates of aphid infestation in wheat fields at Seds (Beni-Suef Governorate), season 1987.

Date of sampling	C. undecim- punctata	Scym- nus spp.	C. carnea	Orius spp.	Syrphus spp.	P. alfieri	True spiders	Total no. of predators	% para- sitism	Rate of infestation (0-3)
4.2.1987	1	0	0	0	0	0	0	1	0	0
11.2	3	1	0	0	0	0	1	5	0	0
18.2	15	4	0	1	0	1	6	27	2	0-1
25.2	12	2	0	0	0	1	1	16	0	0-1
4.3	41	0	0	0	0	0	1	42	16	1-2
*11.3	7	0	0	1	0	0	4	12	9	1-2
18.3	17	0	1	1	3	3	5	30	14	1-2
25.3	32	0	0	2	3	0	1	38	15	1-2
1.4	28	0	0	8	1	2	1	40	18	1-2
8.4	57	1	0	8	2	0	0	68	14	0-1
15.4	59	0	1	3	7	0	0	70	13	0-1
22.4	10	2	0	0	3	0	1	16	7	0-1
Total	282	10	2	24	19	7	21	365	x' = 9.0	

* sprayed with Malathion on 6.3.1987.

TABLE II

Numbers of predator species/100 double net-strokes, % aphid parasitism and rates of aphid infestation in wheat fields at Seds (Beni-Suef Governorate), season 1988.

Date of sampling	<i>C. undecim-</i> <i>punctata</i>	<i>Scym-</i> <i>nus</i>	<i>C. carnea</i>	<i>Orius</i> <i>spp.</i>	<i>Syrphus</i> <i>spp.</i>	<i>P. alfieri</i>	True spiders	Total no. of predators	% para- sitism	Rate of infestation (0-3)
14.2.1988	1	0	0	0	2	0	1	4	3	0-1
21.2	1	0	0	0	5	0	4	10	12	0-1
28.2	2	0	0	0	1	0	2	5	15	0-1
7.3	3	0	0	0	0	0	0	3	19	0-1
14.3	4	3	0	0	3	0	3	13	14	1-2
21.3	8	1	1	0	3	0	2	15	17	1-2
28.3	15	1	0	0	9	0	2	27	11	0-1
5.4	34	1	2	0	7	0	2	46	8	0-1
12.4	23	2	2	4	5	0	1	37	0	0-1
19.4	28	1	3	6	3	0	0	41	4	0-1
26.4	30	1	3	3	4	0	1	42	5	0-1
Total	149	10	11	13	42	0	18	243	x' = 9.1	

TABLE III

Number of predator species/100 double net-strokes, % aphid parasitism and rates of aphid infestation in wheat fields at Itsa (Fayoum Governorate), season 1987 and 1988.

Date of sampling	C. undecim. punctata	Scym. nus spp.	C. carnea	Orius spp.	Syrphus spp.	P. aljirii	True spiders	Total no. of predators	% para-sitism	Rate of infestation (0-3)
6.2.1987	3	0	1	0	0	2	0	7	0	0-1
20.2	12	0	6	0	4	6	1	29	10	0-1
6.3	12	0	8	0	2	0	0	22	8	1-2
21.3	15	1	10	4	0	2	0	32	9	1-2
3.4	34	3	6	6	1	1	1	52	5	1-2
17.4	19	0	8	3	3	0	2	35	4	0-1
Total	95	4	39	13	11	11	4	177	x' = 6.0	
24.2.1988	5	0	0	0	0	0	0	3	15	0-1
4.3	3	0	0	0	1	0	0	4	11	1-2
18.3	11	0	0	0	1	0	1	13	10	1-2
2.4	13	1	2	0	2	0	2	20	7	1-2
19.4	17	1	2	3	5	2	8	38	5	0-1
Total	47	2	4	3	9	2	11	78	x' = 9.6	

It was observed that *Rh. padi* and *S. graminum* appeared together during the whole period of aphid infestation (from end of January to the end of March, approximately).

Ghanim and El-Adl (1983 b) stated that *S. graminum* was the most dominant aphid species (about 50%) in wheat fields at Mansoura district followed by *Rh. padi* (29%) and *M. avenae* (21%).

Natural enemies

Predators :

The most common aphidophagous predators surveyed in this study were:

<i>Coccinella undecimpunctat</i> L.	(Coccinellidae	: Coleoptera)
<i>Scymnus</i> spp.	(Coccinellidae	: Coleoptera)
<i>Paedrus alfieri</i> Koch.	(Staphylinidae	: Coleoptera)
<i>Chrysopela carnea</i> Steph.	(Chrysopidae	: Neuroptera)
<i>Orius</i> spp.	(Anthocoridae	: Hemiptera)
<i>Syrphus</i> spp.	(Syrphidae	: Diptera)

In addition, true spiders were taken in consideration during the study.

Obtained data illustrated in Tables I, II, III revealed that :

1. In wheat fields, number of predators started low and increased gradually towards the end of the season when it reached its maximum.
2. Monthly averages of the total number of predators at Sedss were 12.3, 30.5 and 48.5 individuals in the season 1987 and 6.3, 14.5 and 41.5 individuals in the season 1988 in February, March and April, respectively. The respective averages at Itsa were 16.5, 27.0 and 43.5 individuals in the season 1987 and 3.0, 8.5 and 29.0 individuals in the season 1988.
3. Highest numbers of predators in wheat fields were recorded during April in the two seasons and areas of work. These results about the active period of predators coincided with the findings of El-Heneidy et al. (1978).
4. Total number of predators in season 1987 was higher than that of season 1988. It reached 365 and 243 individuals at Seds in 1987 and 1988 seasons, respectively. The same observation occurred at Itsa, where the number in season 1987 was about two-fold that of season 1988. It was 177 in

1987 and 78 in 1988. The relative high numbers of predators in season 1987 seemed to be coincided with the relative high population of aphid observed at the same season compared with their numbers in season 1988.

5. Highest numbers of predators was recorded in mid- and late April and in early- and mid-April in the two seasons of study at Seds and Itsa, respectively.
6. The species *C. undecimpunctata* (larvae and adults) was dominant in the two seasons and areas of work. Its numbers exceeded the total numbers of the other predator species together. On the other hand, *C. carnea* and *P. alfieri* were the least predator species in numbers at Seds, while *Scymnus* spp. was the least at Itsa.
7. On the 6th of March 1987, experimental area at Seds was sprayed against aphids, therefore, sharp decline in the total number of predators (from 42 to 12 individual / 100 double net-strokes) was recorded in the next counting.

Parasitism

Obtained results (Tables I, II, III) seem to indicate that :

1. Monthly averages of the percentages of parasitism at Seds reached 0.5, 13.5 and 13% in season 1987 and 10.0, 15.3 and 4.3% in season 1988 in February, March and April, respectively. The respective averages at Itsa were 5.0, 8.5 and 4.5% in season 1987 and 7.5, 10.5 and 6.0% in season 1988. Therefore, March represented the highest month in the recorded percentages of parasitism in the two seasons and locations of work. At Seds, the trend of parasitism in season 1988 seemed to be reversed compared with that in season 1987.
 2. Highest percentage of parasitism at Seds was recorded by early April (18%) in season 1987 and by early March (19%) in season 1988. The respective figures at Itsa were 10% and 15%, approximately, at the same timing (last week of February).
 3. Generally, total averages of the percentages of parasitism were equal in the two seasons and areas of study (about 9%) except for season 1987 at Itsa, it was relatively lower (6%).
 4. Two hymenopterous species, *Diaeretiella rapae* M. and *Aphidius* spp. (Fam.
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: Aphidiidae), were identified as parasitoids on wheat aphids, regardless to the aphid species, in the two districts of work.

It was noticed that the highest period of aphids infestation in wheat fields (mainly March) coincides with the highest rates of parasitism (mostly March), but infestation was earlier than the active period of aphidophagous predators (mostly April). This might be due to the fact that the parasitoids have specific and much correlated characters with their hosts than the predators.

In conclusion, diversity and population of parasitoids and predators seem to be low to play a significant role for the aphid management. Additional work should be done to make the agro-ecosystem more favourable to the natural enemies.

SUMMARY

The role of natural enemies of aphids in wheat fields was evaluated for two seasons, 1987 and 1988, in Beni Suef and Fayoum Governorates. Five species of aphids; *Rhopalosiphum padi* L., *R. maidis* Fitch., *Shizaphis graminum* Rond., *Macrosiphum (Sitobion) avenae* Fab. and *Diuraphis noxia* Mord. were recorded associated with wheat plantations during the study. *D. noxia* was recently recorded infesting wheat plants in Egypt. *R. padi* dominated the other aphid species throughout the two seasons of work.

Highest rates of aphid infestation were observed during March in the two seasons. Populations of aphidphagous predators increased gradually towards the end of the season and reached their maximum during April. Dominant occurrence of *Coccinella undecimpunctata* L. was quite clear in the two seasons and areas of study. Highest percentages of parasitism were estimated during March in the two seasons. *Diaretiella rapae* M. and *Aphidius* spp. were identified as hymenopterous parasitoid species of aphids in wheat fields.

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