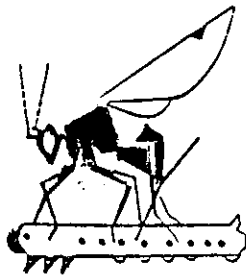


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**EFFICACY OF APHIDOPHAGOUS INSECTS
AGAINST APHIDS AT WHEAT FIELDS IN
EGYPT, A 5-YEAR EVALUATION**

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EFFICACY OF APHIDOPHAGOUS INSECTS AGAINST APHIDS AT WHEAT FIELDS IN EGYPT, A 5-YEAR EVALUATION

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ABSTRACT

This study was carried out through the Nile Valley Project for the five successive seasons 1988/89 - 1992/93 to evaluate the efficacy of natural enemies against aphids at wheat fields in Egypt. Sampling of aphids and their natural enemies were taken weekly from experimental fields located at Sohag, Beni-Suef and Sharkia Governorates. Studies on seasonal abundance of aphids showed that the highest population of the pest was recorded during booting and heading growth stages of wheat plant (mostly in March), the same trend was estimated for parasitism (%), while the highest population of predators was counted few weeks later during ripening stage (around mid-April). Role of the predators and parasitoids seems to be relatively low to meet the rapid increase of aphid population. Harmful effect (was recorded after insecticidal treatments) that caused 71 and 66% decline in the population of predators and percentage of parasitism, respectively. Timing and efficacy of insecticidal applications are very critical factors concerning resistance building in aphids. Therefore, an integrated pest management program for aphid control is required to minimize dependence on currently used schedules of chemical insecticides in wheat fields in Egypt.

Key Words: Wheat, aphids, aphidophagous insects, insecticides, evaluation.

INTRODUCTION

Wheat is the most important cereal crop in Egypt and aphids are the major insect pests of it. Aphids and their damage to wheat plantations have been reported by several authors in many parts of the world (Wetzel *et al.*, 1981; Stoetzel, 1987 and Kindler and Springer, 1989).

In Egypt, El-Hariry (1979) and Tantawi 1985 a, b) surveyed four species of aphids; *Rhopalosiphum padi* L., *R. maidis* F., *Schizaphis graminum* R. and *Sitibion avenae* Fab. attacking wheat plants. Attia and El-Kady (1988) added the Russian species, *Diuraphis noxia* Mord. to the aphid fauna in wheat fields in Egypt. Ghanem *et al.* (1984), Tantawi (1985 b) and El-Heneidy *et al.* (1991) estimated the wheat yield loss due to aphid infestation with 7-23% in middle and upper Egypt, where the highest infestation mostly occurs.

Few studies concerned with the role of natural enemies against wheat aphids have been done in Egypt (Ghanim and El-Adl, 1963 a & b; El-Heneidy and Attia, 1989; El-Heneidy, 1991; El-Heneidy *et al.*, 1991 and El-Heneidy and Fayad, 1994).

The present study reveals an evaluation to the impact of natural enemies on aphids in wheat fields in Egypt for five successive seasons (1988/89 - 1992/93). Such evaluation is essential for any IPM programs against the pest in wheat fields. This work was carried out through the Nile Valley Project, Phase One (1988- 93), financed by ICARDA Organization.

MATERIALS AND METHODS

This study was carried out in wheat fields located at Shandaweel Research Station (Sohag Governorate, Upper Egypt) for the five successive seasons 1988/89 - 1992/93, at Sids Research Station (Beni-Suef Governorate, Middle Egypt) for two seasons (1991/92 and 1992/93) and at Zagazig district (Sharkia Governorate, Lower Egypt) for only one season (1992/93). Samples were collected weekly from an area of about 5 feddans or more in each location throughout different growth stages of wheat plants, starting from early January (mostly during tillering stage) to the end of April (mostly ripening stage) annually. Surrounding crops were Egyptian clover, Faba bean and vegetables.

Aphids Infestations

Infested samples of wheat plants were collected throughout the five working seasons for identifying aphid species and their ratios to each others. Rate of infestation was estimated weekly throughout different wheat plant growth stages by examining 100 randomized wheat plants/location under field conditions, giving the following relative categories (Hafez, 1964):

N = No infestation

L = Light infestation (scattered nymph colonies:10 individuals/colony, present on leaves)

- M = Moderate infestation (relatively big colonies:10-25 individuals/colony, present on leaves and stems)
- S = Severe infestation (dense numbers of colonies, accompanied by winged forms infesting all leaves and stems of the plant, honey-dew may present)

Twenty-five wheat plants/location were picked up weekly at random and transferred to the laboratory for actual count of aphids/plant/location. This study was undertaken in the last two seasons 1991/1992 and 1992/93 only in the three sites of work.

Natural Enemies

Weekly direct count of predatory species occurred on 100 wheat plants/location at different plant growth stages. Samples of infested wheat plants were also collected weekly and transferred to the laboratory for:

- a. Estimation for the percentage of parasitism by dissecting 100 randomized living aphids/location/week.
- b. Identification for emerged parasitoid species by confining infested samples in glass jars until emergence of adult parasitoids.

Insecticidal Applications

Malathion 57% was sprayed annually according to the program of each station. Influences of insecticidal application on aphid populations and their natural enemies were evaluated.

RESULTS AND DISCUSSION

Target Pest

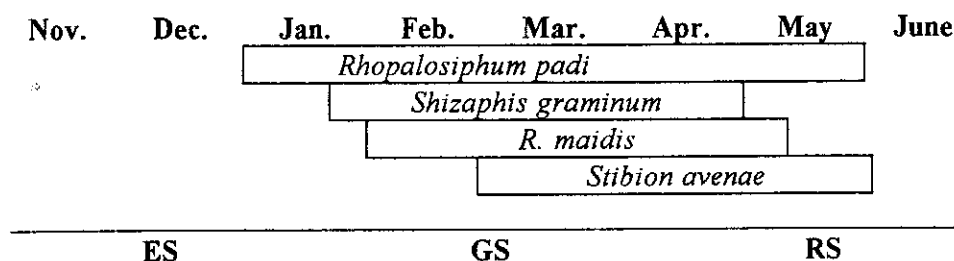
a. Survey of Aphid Species

Wheat plantations in the experimental fields were liable to be infested mainly by four cereal aphid species; *Rhopalosiphum padi* L., *R. maidis* Fitch., *Schizaphis graminum* Rond. and *Sitibion avenae* Fab.

b. Aphid Species Incidence and Abundance

Initial incidence and abundance of certain aphid species on wheat plants were estimated from early January until end of April. This study was done only for the samples collected from Sohag experimental field for the five seasons of work. As digramed on Fig. (1). obtained data showed that: *R. padi* started by the tillering

stage (early January) and lasted until the ripening stage (end of April, 16-18 weeks); *S. graminum* by the late tillering stage (mid January) and lasted until the late heading stage (early April, 12-14 weeks); *R. maidis* by the stem elongation stage (early February) and lasted until the ripening stage (mid- April, 10-12 weeks); and *S. avenae* by the booting stage (early March) and lasted until the ripening stage (end of April, 8-10 weeks).



Wheat plant growth stages

ES (Establishing Stage)	GS (Growing Stage)	RS (Ripening Stage)
- Germination	- Late tillering	- Late heading
- Seedling	- Stem elongation	- Ripening
- Tillering	- Booting	- Harvesting
	- Heading	

Fig. (1): Seasonal incidence of aphid species throughout the growth stages of the wheat plant at Sohag governorate.

As illustrated in Fig. (2), *R. padi* dominated the other species of aphids forming 47.9% of estimated aphid population; *S. graminum* (35.1%), *R. maidis* (13.6%) and *S. avenae* (3.4%) in wheat fields of Sohag all over the considered five seasons. These results are in agreement with the findings of Tantawi (1985 a), while Ghanim and El-Adl (1983 b) stated that *S. graminum* was the most dominant species (50%) at Mansura district (in Delta) followed by *R. padi* (29%) and *S. avenae* (21%).

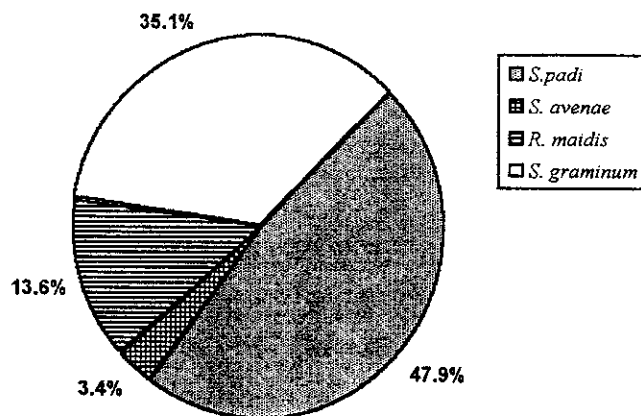


Fig. (2): Abundance of certain aphid species in wheat fields at Sohag governorate over the five seasons.

c. Rate of Aphid Infestation

According to the four relative categories of aphid infestation (Hafez, 1964), highest infestation period was recorded during the growing stage (GS), particularly during boating and heading stages (late February to late March) and followed by the ripening stage (RS) during April (Fig. 3). Rates of infestation were nearby in the first four seasons ranged between 14-23 and 10-16% during the GS and RS stages, respectively, while it declined sharply in the last season 1992/93 to reach 7.5 and 4% at correspondant ages.

d. Number of Aphids/Plant

This study was carried out for two seasons (1991/92 and 1992/93) in Sohag and Beni-Suef Governorates and for only one season (1992/93) in Sharkia Governorate. Sharkia was added in the last season because of the recently obvious increase of aphid infestation on wheat plants in Delta region, that was relatively confined in Upper and Middle Egypt in the last decade.

Obtained data (Table 1) proved the previous observation of exceeding number of aphids/plant in Sharkia (Delta) than that of Sohag and Beni-Suef. Highest number of aphids/plant (85.5) was recorded in Sharkia during the boating stage by mid March, while it reached 28.2 and 25.0 aphids/plant in Beni-Suef and Sohag around the same date.

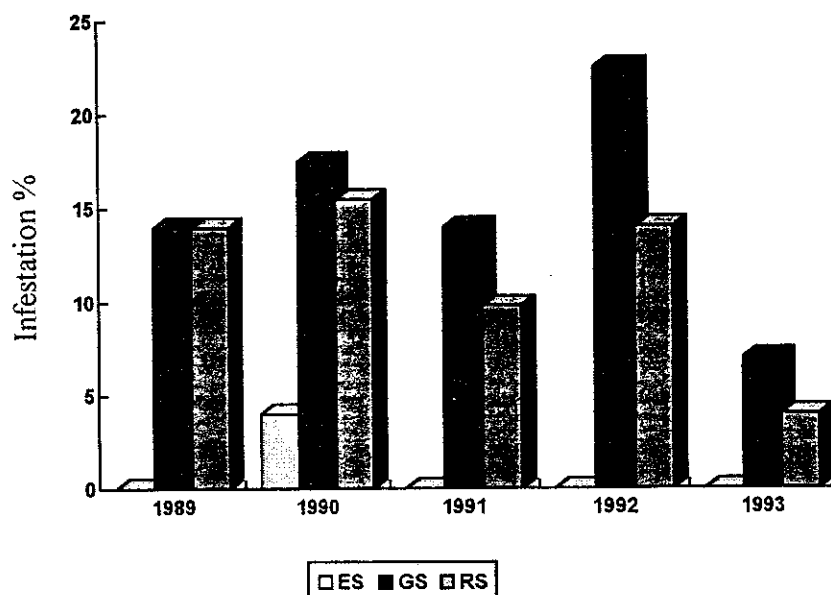


Fig. (3): Mean rates of aphid infestation/100 wheat plants in different growth stages at Shandaweek Research Station (Sohag governorate) in the five successive seasons (1988/89-1992-93)

Table (1): Number of aphids/wheat plant in different growth stages at Sohag, Beni-Suef and Sharkia Governorates (Upper, Middle and Lower Egypt, respectively) during 1991/92 and 1992/93 seasons.

Season	Governorates & growth stages								
	Sohag			Beni-Suefi			Sharkia		
	ES	GS	RS	ES	GS	RS	ES	GS	RS
1991/92	0	12.6	3.8	0	10.4	4.6	-	-	-
1992/93	0	11.1	5.5	0	10.2	3.6	0	16.5	10.5

The phenomenon of increasing aphid infestation than before in wheat fields in Delta will require wide use of insecticides creating more problems through disturbing the natural balance between aphids and their natural enemies, which already exist in many wheat fields of the Delta.

Natural Enemies

Predators and parasitoids were the biocontrol agents taken in consideration during the present study because no insect pathogen diagnosis was observed on aphids during this work.

Predators

The most common aphidophagous predatory species surveyed in the study were the coccinellids *Coccinella undecimpunctata* L. and *Scymnus interruptus* L.; the staphylinid *Paederus alfieri* (Koch); the chrysopid *Chrysoperla carnea* Steph.; the anthocorids *Orius* spp.; syrphids *Syrphus* spp.; and the true spiders.

Numbers of the aforementioned predator species/100 wheat plants/location in wheat fields were counted weekly during the five successive seasons in Sohag, two seasons in Beni-Suef and only one season in Sharkia. Data summarized in Fig. (4) and Table (2) represent total numbers of predatory species associated with aphids on wheat plants throughout different growth stages at studied localities.

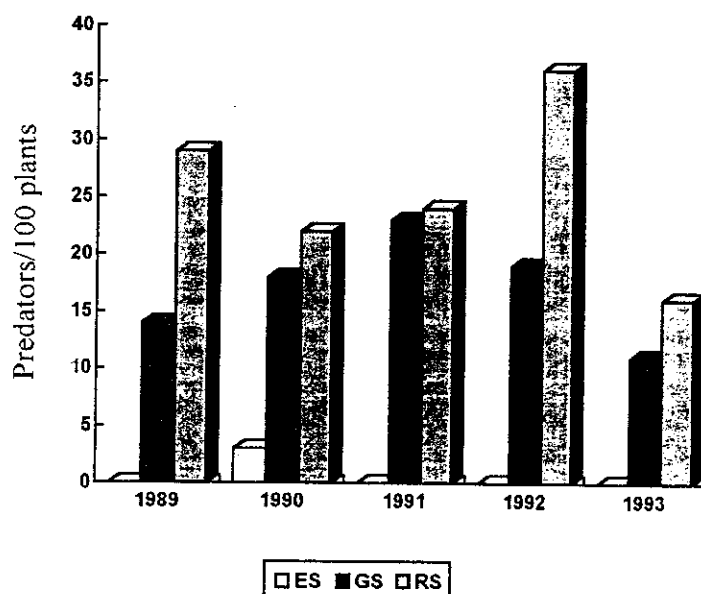


Fig. (4): Mean numbers of aphid predators/100 wheat plants in different growth stages at Shandaweel Research Station (Sohag Governorate) in the five successive seasons (1988/89-1992/93).

Table (2): Number of aphid predators/100 wheat plants at Beni-Suef and Sharkia Governorates (Middle and Lower Egypt, respectively) during 1991/92 and 1992/93 seasons.

Season	Governorates & growth stages					
	Beni-Suef			Sharkia		
	ES	GS	RS	ES	GS	RS
1991/92	0	14.0	28.8	-	-	-
1992/93	0	6.2	14.0	0	5.9	13.7

Number of predators increased gradually towards end of the season to reach its peaks during the ripening stage (almost during April). Highest number was found in season 1991/92 (36 predators/100 plant). Numbers declined drastically in season 1992/93 according to lack of preys. Among the counted predator species, *C. undecimpunctata* and true spiders were the most abundant species on wheat plants in all areas of investigation.

Parasitoids

Four hymenopterous braconid species, i.e. *Diaeretiella rapae* M., *Aphidius matricariae*, *Trioxys* sp. and *Pracon* sp. were recorded parasitizing wheat aphids.

Percentages of parasitism were estimated weekly by dissecting 100 living aphids/location. Obtained data are summarized in Table (3) and Fig. (5).

Highest percentages of parasitism were estimated during the booting and heading growth stages of wheat plant (almost between late February and mid-April) to coincide more or less with the high population of aphids. While the lowest percentages were estimated in season 1991/92.

Table (3): Parasitism (%) on wheat aphids at Beni-Suef and Sharkia Governorates (Middle and Lower Egypt, respectively) during 1991/92 and 1992/93 seasons.

Season	Governorate & growth stages					
	Beni-Suef			Sharkia		
	ES	GS	RS	ES	GS	RS
1991/92	0	3.9	0.5	-	-	-
1992/93	0	2.8	2.2	0	6.5	10.0

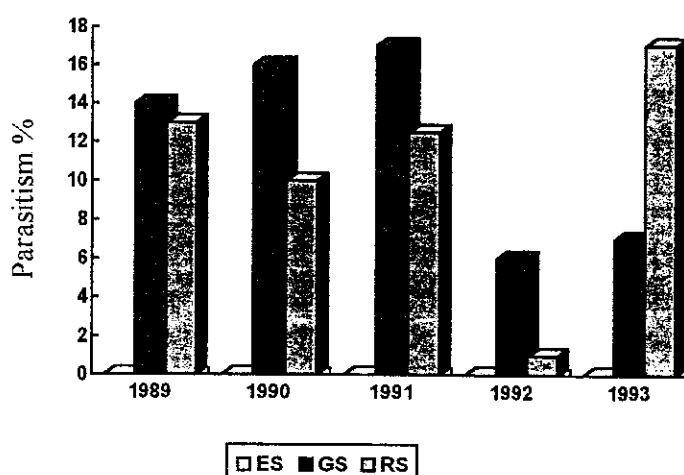


Fig. (5): Parasitism (%) on wheat aphids at different plant growth stages at Shandaweel Research Station (Sohag Governorate) in five successive seasons

Influence of Malathion 57%

1. Number of the insecticidal applications in the experimental fields ranged between one and three sprays/season applied during March according to the rate of aphid population in each area. Obtained results and field observations after insecticidal applications indicated that:
2. Some fields that received three sprays during the season showed rapid resurgence of aphid population, infestation lasted longer and continued relatively with high population throughout the season compared to that sprayed only once in the right timing.
3. Fields that received one spray in the infested spots early in the season, maintained relatively low aphid population throughout the season and on the other hand, with relatively high population of natural enemies.
4. Insecticidal application was always followed by sharp decline in natural enemies, reached up to 71 and 66% in the population of predators and percentages of parasitism, respectively (El-Heneidy *et al.*, 1991).

CONCLUSION

The rapid resurgence of aphid population may be attributed to the result of developing resistance in aphid mostly because of receiving sub-lethal doses of the insecticide due to ineffective applications and/or depending on a single recommended insecticide (Malathion 57%) for several years.

It was noticed that the high rates of aphid infestation in wheat fields (mainly in March) coincide with the highest rates of parasitism, while the infestation was earlier than the active period of the aphidophagous predators (mostly in April).

Diversity and population of parasitoids and predators seem to be very low to play a significant role for aphid control management. Additional efforts should be done to make the agroecosystems much favourable to attract natural enemies.

However, an integrated pest management program for aphid control in wheat fields depending on the positive role of predators and parasitoids is needed to reduce dependence on currently used programs of chemical insecticides in Egypt.

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