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Summary

The present studies were carried out at the Experimental Farm of Assiut University during 1999-2003 seasons. The main objectives were to survey the cereal aphids infesting wheat plants and associated predator and parasitoid species, evaluate the population growth of the common aphids species in relation to some abiotic and biotic factors, determine the impact of the parasitoid species on the cereal aphid populations, and assess the damage in grain yield due to cereal aphids infestation. The obtained results could be summarized as follows:

1. Survey :

1.1. Cereal aphid species:

- Five different aphid species namely, the rose grain aphid, *Metopolophium dirhodum* (Walker), the corn leaf aphid, *Rhopalosiphum maidis* (Fitch), the bird cherry-oat aphid, *R. padi* L., the greenbug *Schizaphis graminum* (Rondani) and the English grain aphid, *Sitobion avenae* (Fab.) were found attacking wheat plants in the area.

1.2. Predator species:

- The survey of the predators revealed to the presence of 13 predator species belong to seven families of four orders.

- The ladybird beetles, *Coccinella* spp. were the most common predator species represented 78.44% of the recorded predators.

- The predators, *Syrphus corollae* Fab., true spiders, *Scymnus* spp. and *Orius* spp. were observed in relatively low population densities represented 5.44, 5.24, 3.90 and 2.57% of the grand total, respectively.

- Damsel bug, *Nabis viridis* Kock, *Paederus alfieri* Kock, *Chrysoperla carnea* Steph. and *Geocoris pallidipennis* (Rossi) were recorded in

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scarcely numbers represented 1.95, 1.13, 1.03 and 0.31% of the grand total, respectively.

- The coccinellids, *Coccinella novemnotata* Muls., *Cydonia vicina* var *nilotica* Muls. and *Hippodamia tredecimpunctata* Goet.. were recorded for the first time as predators associated with cereal aphids in wheat plantations in Assiut Governorate.

1.3.Parasitoid species:

- The recovered primary parasitoid species were: *Aphidius colemani* Viereck, *Diaeretiella rapae* (M'Intosh), *Ephedrus plagiator* (Ness) and *Praon necans* Mackauer (Hymenoptera: Aphidiidae).

- The primary parasitoid species represented 91.52% of the total collected parasitoid species.

- The primary parasitoid, *D. rapae* was the most dominant species represented 81.04% of the recorded parasitoids.

- The parasitoids, *Aphi. colemani*, *E. plagiator* and *P. necans* represented 1.43, 0.62 and 3.24% of the total parasitoids , respectively.

- The recorded hyperparasitoid species were: *Alloxysta* sp. (Fam. Cynipidae), *Chalicds* sp. (Fam. Chalcididae) and *Dendrocercus* sp. (Fam. Megaspilidae) represented 3.32, 0.84 and 4.32 % of the total parasitoid species, respectively.

-The hyperparasitoid species represented 8.48% of the total parasitoid species.

2. Seasonal abundance:

2.1. Seasonal abundance of cereal aphid species:

- Cereal aphids appeared on wheat plants during the end of December when the plants were in the tillering stage (ZGS 20-25), corresponded with a plant age of 27.33 ± 2.89 days.

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- The population attained a peak of abundance of 120.36 ± 55.75 aphids/tiller during the end of February when the plants were in the flowering stage (ZGS 61-69), correlated with a plant age of 92.00 ± 7.00 days.
- The disappearance of the aphids from the field was recorded during the end of March when the plants were in the ripening stage (ZGS > 70), when the plants were 124.67 ± 4.04 days old.
- The greenbug, *S. graminum* was the dominant cereal aphid in the wheat field followed by *R. padi*.
- From about 1484 aphids/tiller recorded during the whole study periods, there were 54.36% for *S. graminum*, 44.61% of *R. padi* and 1.03 for *R. maidis*.

2.2. Simultaneous effects of some weather factors, predators and parasitoids on the population changes of cereal aphids:

- The multiple regression analysis show that the eight selected variables (plant age, max. and min. temperature, max. and min. relative humidity, effective temperatures (day-degrees), predators and parasitoids) were together responsible for about 83% of the increase in cereal aphid populations during the wheat growing season.
- The efficiencies of the most effective variable, plant age, min. temperature min. relative humidity ,parasitoids and effective temperatures were 22.07, 18.98, 18.08, 12.45 and 6.12%, respectively.
- The eight studied variables were together responsible for about 80% of the decline in aphid populations later in the growing season.
- The efficiencies of the most important factors, effective temperatures, plant age and parasitoids in reducing the aphid population later in the season were 31.90, 18.59 and 14.69%, respectively.

2.3. Incidence of parasitoids in relation to cereal aphids:

2.3.1. In the field:

- The first mummies were recorded in the field later than the onset of aphid infestation with about four weeks.
- Maximum parasitism of 53.27, 24.73 and 85.23% were observed during the end of March, coincided with the collapse in aphid population in 1999, 2001 and 2002 seasons, respectively.
- Rate of parasitism in 1999, 2001, and 2002 were 6.83, 2.23 and 4.50% with an overall average of 4.52%.

2.3.2. In the laboratory:

- The common primary parasitoids, *Aphi. Colemani*, *D. rapae*, *E. plagiator* and *P. necans* accepted all developmental stages of the greenbug and bird cherry-oat aphid.
- The parasitoids attack with preference older nymphal instars (3rd and 4th) and apterae than the early nymphal instars (1st and 2nd).
- The percentage of parasitism in the early nymphal instars (1st and 2nd) was 20.08% for *S. graminum* and 15.44% for *R. padi* with an average of 17.76%.
- The percentage of parasitism in the late nymphal instars (3rd and 4th) was 38.45% for *S. graminum* and 24.23% for *R. padi* with an average of 31.34%.
- The percentage of parasitism in the adult stage was 43.71% for *S. graminum* and 26.21% for *R. padi* with an average of 34.96%.
- The greenbug was the most often subject to attack by parasitoids (34.08% parasitism) and bird cherry-oat aphid suffered less mortality (21.96% parasitism) than the greenbug.

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- Rates of parasitism during 1999, 2001 and 2002 were 31.64, 9.43 and 42.99 with an overall percentage of parasitism of 28.02%.

2.3.3. Relation of field and laboratory parasitism:

- The parasitism frequencies in the field for any given date was always low as compared with those reared from the field collected aphids.

- During the peak of aphid population, the rates of parasitism in the field were 1.68, 1.92 and 0.90 as compared with 27.17, 20.58 and 41.67% in the laboratory during 1999, 2001 and 2002 seasons, respectively.

- There is a significant correlation between the number of mummies/100 aphids on wheat plants in the field and the corresponding numbers taken from 100 live, field-collected aphids and reared in the laboratory ($r = 0.71$). The regression model that provide the best fit of the data was:

$$y = 5.20 + 13.52 x + (-0.80 x^2), \text{ where}$$

y = Number of the expected (real) parasitized aphids.

x = Number of the observed mummies in the field.

3. Damage in grain yield due to aphid infestation:

- There is no significant difference between the number of spikelets/m² in the unsprayed and sprayed plots during both seasons (2001 and 2002).

- The number of spikelets/m² were 536.10 ± 51.12 and 539.30 ± 54.02 spikelets with an average of 537.70 ± 2.26 in the unsprayed plots.

- In the sprayed plots the numbers of spikelets/m² were 507.88 ± 103.75 and 545.10 ± 88.64 with an average of 526.45 ± 26.38 .

- There was a significant difference between the 1000-kernel weight in the unsprayed and sprayed plots ($F = 10.92$ and $L.S.D. = 1.51$).

- The mean weight of 1000-kernel was 45.41 ± 1.90 and 43.78 ± 2.15 gm with a mean of 44.60 ± 1.15 gm in the unsprayed plots, meanwhile it

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was 46.45 ± 3.12 and 47.51 ± 2.46 gm with a mean of 46.98 ± 0.75 in the sprayed plots.

- The reduction in 1000-kernel weight ranged from 2.24 to 7.85% with an average of 5.08%.
- There was a significant difference in weight of grain yield/m² between unsprayed and sprayed plots ($F = 20.53$ and L.S.D. = 82.63).
- The mean weight of grain yield/m² was 856.56 ± 72.53 and 833.82 ± 67.53 gm with an average of 845.19 ± 16.08 in the unsprayed plots, whereas it was 1012.11 ± 169.95 and 1036.09 ± 182.02 gm with an average of 1024.10 ± 16.96 in the sprayed plots.
- The reduction in grain yield/m² due to aphid infestation ranged from 15.37 and 19.52% with an average of 17.47%.