

Population dynamics of certain insect predators associated with aphids in maize fields in the Giza region

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Rhopalosiphum maidis FITCH. and occasionally also *Aphis gossypii* GLOVER infected maize plants directly and are also vectors for plant pathogenous viruses. During the experimental period (13 weeks) the rate of infestation by aphids and of several predators on maize was investigated. The highest rate of damage was found in young plants in August and early September and October. The number of predators and aphids was lowest in September. While *Paederus alferii* dominated in August, *Oruis* spp. and *Coccinella undecimpunctata* mainly occurred in September and October in maize fields. Parasitism of the aphids was, however, 0% during the period of investigation.

1. Introduction

Field observation in Egypt has shown that the maize aphid *Rhopalosiphum maidis* FITCH. occurs all the year round and that its distribution is not limited. Besides its damage to a wide range of host plants (mainly maize, sorghum, barley, and wheat), it is considered as a carrier of virus diseases (HASSAN, 1957). The association of pests with numerous beneficial species on corn plants (TAWFIK et al., 1974a, b, 1976) still requires much information on the abundance of these pests in relation to the population dynamics of their enemies. Therefore, the present investigation aimed to study the population dynamics of certain predators associated with aphids in maize fields.

2. Procedure

The study of the seasonal abundance of insect predators in maize associated with aphids was carried out in the Agricultural Research Station at Giza between August and November 1982 (13 weeks). An area of about 4200 m² was cultivated in three plots with three different sowing dates (1.4, 1.6, and 1.7. 82). These areas received the usual agricultural treatments, but no chemical control applications. One hundred maize plants were examined randomly at nearly weekly intervals to estimate the degree of infestation of the aphids and determine the numbers of predators per plant. For estimating the degree of infestation of the aphids, the infestation was classified into four grades:

zero (0): no aphids detectable

light (L): from one aphid to several aphid colonies present on the inner side of the leaf sheaths or the bracts of the panicle

medium (M): large numbers of aphids present not in recognizable colonies but diffused to infest large proportions of leaves, tassels, and bracts of the panicle

heavy (H): aphids present in very dense numbers, infesting leaves, tassels, cob husks, and silks, the inner side of the bracts of the panicle, and the panicle itself.

Direct counting of predators per plant was used (HAFEZ, 1960). Besides, the available numbers of aphids (not less than 25 individuals) were dissected weekly in the laboratory to estimate the percentage of parasitism.

3. Results and discussion

3.1. Aphid infestation

Two species of aphids were observed during the study: *Rhopalosiphum maidis* FITCH. and *Aphis gossypii* GLOVER, but the latter not in noticeable numbers. As the infestation of aphids begins prior to the appearance of the tassels (HASSAN, 1957), the date of sowing in our experimental plots played a role in the rate of infestation of aphids, which was observed to be high with the appearance of new tassels and cobs, and then decreased gradually with plant senescence and followed by migration of aphids to younger plots (fig. 1).

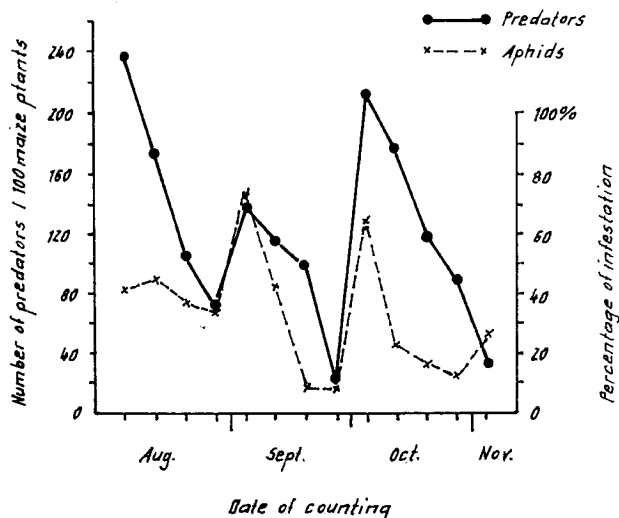


Fig. 1. Weekly number of certain predators and percentage of aphid infestation per 100 maize plants during the 1982 season in the Giza region

The highest rate of infestation was recorded during August (39.3%; sowing date 1.4) and stayed approximately constant (34–45%). In September and October (the other two plots and sowing dates 1.6. and 1.7.) the rate of infestation started high (73% and 64%), because of aphid migration to these plots, and then decreased rapidly from the second week up to the minimum. The average infestation during the whole period was $33.1 \pm 5.65\%$. It was observed that the high infestation of aphids was associated with the attendance of ants, which feed on honeydew, but it was also associated with the lowest numbers of predators. The role of ants in this respect may be negative or positive for predatism and parasitism (STARY, 1966).

3.2. Predators

The following 10 species of predators were observed during the study on maize plants:

Oruis spp. (Anthocoridae, Hemiptera)
Paederus alferii KOCH. (Staphylinidae, Coleoptera)
Coccinella undecimpunctata L. (Coccinellidae, Coleoptera)
Cydonia vicina nilotica MULS. (Coccinellidae, Coleoptera)
Scymnus interruptus GEOZE. (Coccinellidae, Coleoptera)
Chrysopa carnea STEPH. (Chrysopidae, Neuroptera)
Syrphus spp. (Syrphidae, Diptera)
Labidura riparia PALL. (Labiduridae, Dermaptera)
Sphodromantis viridis B. (Mantidae, Dictyoptera)
 Different species of spiders

As it is known that the first seven species are aphidphagous (HASSAN, 1957; TAWFIK et al., 1974a,b; TAWFIK and ABOZEID, 1977) these species and the spiders were taken into consideration during the whole period of study. Since the peak abundance of natural enemies almost always lags behind that of the prey (HAGEN and VAN DEN BOSCH, 1968), the numbers of predators were closely related to the rate of infestation of aphids not only in each plot, but with aphid-migration to the other plots as well (fig. 1). The lowest number of predators was recorded in September, while in August and October their numbers were high (tab. 1, fig. 1).

Seasonal abundance of the predator species was as follows:

Table 1. Weekly rate of infestation, number of certain predators, and percentage of parasitism/100 maize plants during 1982 season in the Giza region

Month	Samp- ling No.	Infestation				Number of predators						Percentage	
		Rating				Paede- rus	Oruis	Cocci- nella	Chry- sopa	Scym- nus	Spi- ders	Total	of para- sitism
		O	L	M	H								
Aug	1	59	40	1	0	41	176	16	3	0	32	11	238 0
	2	55	43	2	0	45	92	46	4	0	27	4	173 0
	3	63	36	1	0	37	57	18	6	1	18	6	106 0
	4	66	34	0	0	34	41	12	0	0	11	10	74 0
	Total	243	153	4	0	39.4	366	92	13	1	88	31	591 0
Sept	1	27	60	11	2	73	5	36	63	0	34	2	140 0
	2	58	39	2	1	42	3	70	22	0	17	1	113 0
	3	92	8	0	0	8	9	48	26	0	15	2	100 0
	4	92	8	0	0	8	0	3	11	1	5	0	20 0
	Total	269	115	13	3	32.8	17	157	122	1	71	5	373 0
Oct	1	36	61	3	0	64	3	45	72	2	93	0	215 0
	2	76	23	1	0	24	6	111	34	1	19	4	175 0
	3	84	16	0	0	16	6	74	34	1	4	2	121 0
	4	88	12	0	0	12	6	40	28	2	8	4	88 0
	Total	284	112	4	0	29.0	21	270	168	6	124	10	599 0
Nov	1	74	26	0	0	26	8	3	6	2	8	6	33 0
	Total	870	406	21	3	430	412	522	309	10	291	52	1596 0
$\bar{x}$						33.1	31.7	40.2	23.8	0.8	22.4	4	122.8 0

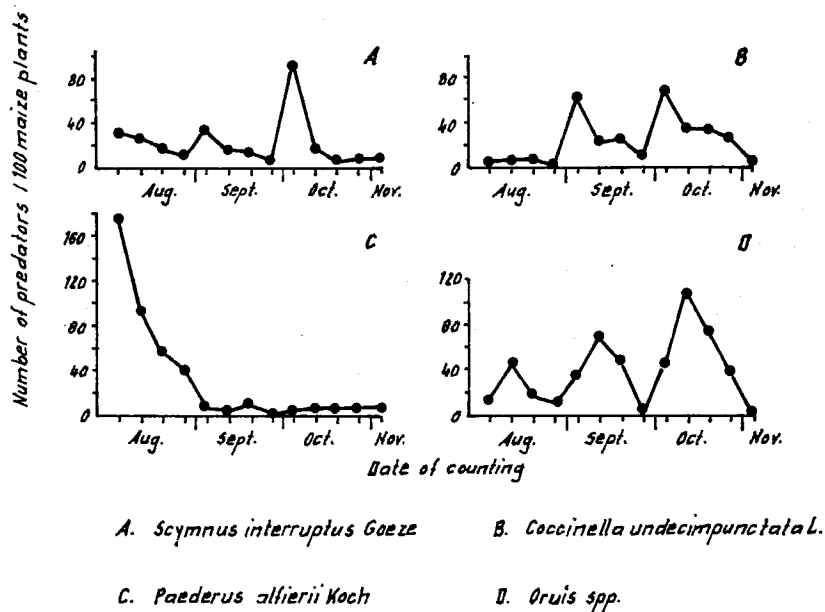


Fig. 2. Weekly number of dominant predators per 100 maize plants during the 1982 season in the Giza region

Ornis spp.

Weekly numbers of nymphs and adults of *Ornis* spp. counted from the experimental maize field during the period of study are shown in fig. 2, indicating that these species were represented in high numbers during the whole period of study. The lowest numbers were recorded during August, thereafter they gradually increased during September to reach the peak in October. They were in general the most abundant predator species in the study (tab. 1).

P. alferii

Fig. 2 shows that the initial occurrence of the beetle was in early August with the highest numbers. Although it decreased during the month, it remained the dominant predator, while in September and October it decreased extremely.

C. undecimpunctata

As shown in fig. 2, very few numbers of *C. undecimpunctata* larvae and adults were obtained during August, while it started to increase from early September. It reached 122 and 168 individuals during September and October, respectively. The low numbers in August are a natural phenomenon due to seasonal abundance (EL-HENEIDY et al., 1978).

S. interruptus

This predator species was recorded during the whole period of investigation in fluctuating moderate numbers (fig. 2). The highest number of beetles occurred during October.

C. carnea

As the species occurred in very few numbers and irregularly (tab. 1), no distinct pattern of seasonal abundance could be obtained from the data. It was the lowest species in number among the predators.

Spiders

They occurred in small numbers. The highest number was 31 individuals during August, while in September and October they were 5 and 10 individuals, respectively.

The other predator species such as *Syrphus* spp., *C. vicina nilotica*, *L. riparia*, and *S. viridis* were observed only once or twice during the whole period of study.

3.3. Parasitism

Although many authors (HASSAN, 1957, Final report, 1979) reported many hymenopterus parasites of *R. maidis* in Egypt, none were observed among the aphid colonies during the plant examination, and the percentage of parasitism by dissecting (not less than 25 individuals weekly) was 0% during the whole period of investigation (tab. 1) which may be due to the low rate of infestation in general.

4. Conclusions

The results of the seasonal abundance of predator species in maize fields associated with aphids seem to suggest the following:

- a) The date of sowing played a role in the rate of infestation of aphids. It was relatively high in August, thereafter it decreased during September and October. The formation of new tassels and cobs in addition to plant senescence encouraged the aphids to migrate to younger plants.
- b) The population of predator species follows that of the prey. This was observed not only in each plot, but also with the movement of aphids to the younger plots.
- c) The abundance of insect predators in maize fields had two maxima. The first was in the first week of August and the second by early October.
- d) The relative dominance of the predators especially in August and October may be responsible for reducing the rate of infestation with aphids.
- e) In general, the data obtained were in agreement with those of TAWFIK et al. (1974a,b) and TAWFIK and ABOZEID (1977).

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A. H. EL-HENEIDY und M. S. T. ABBAS: Populationsdynamik bestimmter mit Aphiden vergesellschafteter Prädatoren in Maisfeldern der Giza-Region

Rhopalosiphum maidis FITCH. und vereinzelt auch *Aphis gossypii* GLOVER schädigen Maispflanzen direkt und sind außerdem Vektoren für pflanzenpathogene Viren. Während einer Untersuchungszeit von 13 Wochen wurde die Abundanz der Blattläuse und zahlreicher Prädatoren an Maispflanzen untersucht. Die höchste Schädigung wurde an jungen Pflanzen im August und Anfang September sowie im Oktober beobachtet. Im September war die geringste Anzahl an Prädatoren und an Blattläusen festzustellen. Während *Paederus alferii* im August dominierte, traten *Oruis* spp. und *Coccinella undecimpunctata* vorwiegend im September und Oktober in den Maisfeldern auf. Die Parasitierung der Blattläuse während der Untersuchungszeit betrug jedoch 0%.

A. H. EL-HENEIDY и M. S. T. АББАС: Популяционная динамика некоторых афидов, находящихся в сообществе с predators, на кукурузных полях в регионе Гиза

Rhopalosiphum maidis FITCH. и в единичных случаях также *Aphis gossypii* GLOVER повреждают кукурузные растения непосредственно и является, кроме того, векторами патогенных для растений вирусов. Во время опыта в течение 13 недель изучалось количество особей тли и многочисленных predators на растениях кукурузы. Максимальное поражение наблюдалось на молодых растениях в августе, начале сентября и октябре. В сентябре обнаружена минимальная численность predators и тли. Если на кукурузных полях в августе преобладали *Paederus alferii*, то в сентябре и октябре встречались преимущественно *Oruis* spp. и *Coccinella undecimpunctata*. Паразитирование же тли в период исследования составило 0%.

A. H. EL-HENEIDY et M. S. T. ABBAS: Dynamisme de population de certains prédateurs associés avec des aphides dans les champs de maïs de la région de Giza

Rhopalosiphum maidis FITCH. et partiellement aussi *Aphis gossypii* GLOVER portent directement atteinte aux plantes de maïs et sont en plus les vecteurs des virus phytopathogènes. Pendant une période d'examen de 13 semaines a été examinée l'abondance des pucerons et de nombreux prédateurs sur des plantes de maïs. L'endommagement le plus élevé a été observé sur les plantes jeunes en août et début septembre ainsi qu'au mois d'octobre. En septembre on constatait le moins de prédateurs et de pucerons. Alors que *Paederus alferii* dominait en août, *Oruis* spp. et *Coccinella undecimpunctata* sont apparus surtout en septembre et octobre dans les champs de maïs. Le parasitage des pucerons, pendant la durée d'examen, était cependant de zéro %.

A. H. EL-HENEIDY y M. S. T. АББАС: La dinámica de población de determinados predators en comunidad con afidos sobre campos de maíz de la región de Giza

Rhopalosiphum maidis FITCH. y en parte también *Aphis gossypii* GLOVER danifican las plantas de maíz directamente siendo además vectores para virus fitopatógenos. Durante un periodo de experi-

mentos de 13 semanas se analizó la abundancia de los pulgones y de numerosos predadores en plantas de maíz. El mayor daño se constató entre las plantas jóvenes en agosto, principios de setiembre como también en octubre. En el mes de setiembre se constató el mínimo número de predadores y de pulgones. Mientras que *Paederus alferii* dominaba en agosto, *Oruis* spp. y *Coccinella undecimpunctata* se presentaban sobretodo en setiembre y octubre en los campos de maíz. La parasitación de los pulgones durante el período de las investigaciones era, no obstante, de 0%.