

On the Migration of Common Predatory Species from Egyptian Clover to Adjacent Maize Fields in Egypt

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ABSTRACT

A study aimed at monitoring the migration of common predatory species from the Egyptian clover fields to adjacent maize fields was carried out at Giza region, Egypt during the two successive seasons 2007 and 2008. Sampling was undertaken using a standard insect sweeping net in case of Egyptian clover and direct counts on maize plants. Migration rate (m. r.) from Egyptian clover field to maize field was calculated as a ratio between the difference in populations due to migration and the recorded populations in experimental fields. Coccinellids were the most important group (highest m. r. 43.4 - 94.7 %) migrated from Egyptian clover fields into adjacent maize fields; particularly *Coccinella undecimpunctata* L. and *Scymnus interruptus* Goez. followed by *Chrysoperla carnea* (Steph.) but with relatively less m. r. value (11.5 - 58.3 %), then came *Orius* spp., *Paedrus alferii* Koch. and the true spiders.

Key Words: Migration, predators, Egyptian clover, Maize.

INTRODUCTION

Egyptian clover (*Trifolium alexandrinum* L.) is the main fodder crop for animals' feeding. Throughout its whole period of plant growth stages, it harbors numerous insect species being either pests or beneficial insects (Tawfik *et al.*, 1976b, El-Husseini *et al.*, 1996 and El-Mezayyen, 2001). Their populations grow up and reach their peaks mostly during May at flowering stage, particularly the predatory insects *i.e.* coccinellids, anthocorids, chrysopids, syrphids and soil inhabitants like staphylinids and labidurids. In Egypt, these effective predators usually feed on lepidopterous eggs and newly hatched larvae, aphids, thrips, whitefly as well as on tetranychid mites (Tawfik *et al.*, 1976b). As well, corn (*Zea mays* L.) is one of the most important grain crops in the tropics and subtropics of the world (Ismail *et al.*, 1993). The crop is attacked by many insect pest species, mainly corn borers, cotton leaf worms and aphids. Therefore, it attracts numerous parasitoid and predatory species (Guevara *et al.*, 1979 and El-Heneidy and Abbas, 1984).

Predators as one of the major groups of natural enemies which play a noticeable role against different insect pests, so, researchers in the field of biological control have diverted their efforts to encourage this role by maintaining proper habitats in the agro-ecosystems to attain their efficiency. Darwish and Ali (1991) reported that predators comprised about 88% of the total natural enemies recorded in maize fields in Upper Egypt.

The status of dryness in clover fields in May enforces the harbored predatory arthropods to migrate to the adjacent green crops such as cotton,

maize (corn) and vegetables. El-Heneidy *et al.*, 1978 and El-Husseini *et al.*, 1996 studied the migration of the predators from Egyptian clover fields to adjacent cotton fields and reported that *Orius* spp. populations were the highest among the other predatory species in adjacent cotton fields. They were about 4.5 times those in distanced cotton fields. The present study aims at monitoring the migration of common predatory species from the Egyptian clover fields to the adjacent maize fields at Giza region, Egypt.

MATERIALS AND METHODS

A trial to monitor the migration of common predatory species from Egyptian clover to maize fields was carried out at the district of Badrashine, Giza Governorate, Egypt during the two successive seasons 2007 and 2008. An area of about one feddan/crop was selected for the study. Experimental maize field was chosen adjacent to a clover field, left for seed production. Maize field in the area but located away (about 300 m) from clover fields was used as control. Selected fields received all regular agricultural practices except absence of any chemical insecticidal treatments.

Sampling was carried out using a standard insect sweeping net (D 15) in case of Egyptian clover and direct counts on maize plants. Fifty double net strokes in the clover fields and direct counts on 50 maize plants were practiced weekly. In case of the Egyptian clover, catches were placed in paper bags and transferred to the laboratory for classification and counting. Sampling and counting were undertaken twice a day every sampling date; in the morning around 9:00 am (A) and in the afternoon

around 4:00 pm (P) in both crops. Sampling dates for the Egyptian clover started from mid-January to end of May, and for maize from mid-May to end of August.

The migration rate (m. r.) from Egyptian clover field to maize field was calculated as a ratio between the difference in populations due to migration (D) and the recorded populations in experimental field (C). Migration rate was calculated using the equation of Mansour *et al.*, 1994:

$$\text{m. r.} = \frac{R - C (= D)}{C} \times 100$$

Where:

R = recorded population in experimental field.

C = corresponding population in control field.

D = difference due to migration (D = R - C).

Obtained data were statistically analyzed using ANOVA.

RESULTS AND DISCUSSION

The coccinellids; *Coccinella undecimpunctata* L., *Scymnus interruptus* Goetz. and *Cydonia vicina nilotica* L. as well as the chrysopid, *Chrysoperla carnea* (Steph.), the anthocorids, *Orius* spp., the staphylinid, *Paederus alferii* Koch. and the true spiders were the most common and abundant predatory species found in Egyptian clover and maize fields at the district of Badrashine, Giza Governorate throughout the present study in seasons 2007 and 2008. Migration rates of the abovementioned predatory species were estimated by following up the population numbers of the selected predators in clover fields and consequently after their migration into the adjacent experimental maize field starting the month of May when the two crops existed together beside each other.

Generally, the population of all the predatory species in the two studied crops started with low numbers then their populations increased towards the end of the growing season. Coccinellids peaked during end of April and relatively dropped during May in the experimental clover fields, while they peaked during August in maize fields (to coincide with the flowering period of maize plants and high infestation with aphids, the favored preys for most of the predators). Regarding the other groups of predators, they increased during April and May with relative increase in May, in case of *Orius* spp. and *P. alferii* in the clover fields. Their populations peaked during August in maize fields as well were the coccinellids (Table 1).

As shown in Table (1), the populations of the

studied predators were generally higher in the morning sampling (9:00 am (A)) than in the afternoon sampling (4:00 (P)) in both crops and seasons but with some exceptions. The increases in the morning sampling (A) ranged between 2.1 and 25.2 and 24.0 – 34.4 % in the clover and maize fields, respectively. Statistical analysis showed significant differences between the populations of each of the studied predatory species at the two different sampling times (A & P) in both seasons, except the populations of *Scymnus*, *Cydonia* and the true spiders in 2007.

As shown also in Table (1), in the experimental clover fields, the coccinellids, were represented by 58.2, 75, 66 and 74.2% out of the total numbers of predators collected in season 2007 (A & P) and 2008 (A & P), respectively. Among the coccinellids, *C. undecimpunctata* was the most common by 62.3–68.9% in season 2007 and by 69.7–78.8% in season 2008. *C. vicina nilotica* ranked second by 14–26% and then *S. interruptus* by 7.2 –14.9%. Regarding the other groups of the predators, *P. alferii* came first, represented by 4.1 –19.3%, followed by *Orius* spp. 5.1–12.3% and true spiders by 0 –12% while the least was *C. carnea* 0.7 –8.1%.

In the experimental maize fields, the coccinellids were represented by 45.4, 44, 44.2 and 45.4% out of the total numbers of predators collected in season 2007 (A & P) and 2008 (A & P), respectively. Among the coccinellids, *C. undecimpunctata* was also the most common by 50.0 - 56.7% in season 2007 and by 38.5 – 44.9% in season 2008. *S. interruptus* ranked second by 43.3–54.1% and then was *C. vicina nilotica* by 5.5 – 7.3%. Regarding other groups of the predators, *Orius* spp. came first, represented by 17.6 – 19.7%, followed by the true spiders 10.9 – 18.8% and then *P. alferii* by 10.0 – 15.6% while the least was *C. carnea* by 7.9 – 11.9%. Statistical analysis showed significant differences between the populations of each of the studied predatory species in the two seasons and in the two crops.

Data of the maize control experimental field are summarized in Table (2). As shown in the table, the coccinellids represented 38 and 35.4% out of the total numbers of predators collected in season 2007 (A & P), respectively. Correspondent percentages in season 2008 were 34.9 and 39.4%. Among the coccinellids, *C. undecimpunctata* and *S. interruptus* numbers were relatively equivalent in both timings (A & P) and also in 2007 and 2008 seasons. Regarding the other predatory species, *Orius* spp. came first, representing a range of 20.6–25.5%,

Table (1) : Total monthly numbers of common predatory species in Egyptian clover fields/50 double net strokes and in maize fields/50 maize plants ,at two different sampling times, at the district of Badrashan, Giza Governorate, during the two growing seasons 2007 and 2008.

Crop	Month	<i>Coccinella undecimpunctata</i>		<i>Scymnus interruptus</i>		Total coccinellids		<i>Chrysoperla carnea</i>		<i>Orius</i> spp		<i>Paederus alfieri</i>		True spiders		Grand total				
		A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P			
Egyptian Clover	Jan.	07	6	9	0	0	1	3	7	12	3	0	3	1	3	1	0	0	16	14
		08	8	13	0	0	0	0	8	13	0	0	0	0	0	0	0	0	8	13
	Feb.	07	9	11	3	2	1	0	13	13	0	0	0	0	5	2	0	0	18	15
		08	5	3	2	0	0	0	7	3	0	0	0	0	0	0	0	0	7	3
	Mar.	07	22	19	4	4	8	7	34	30	6	0	0	0	13	14	3	0	56	44
		08	33	41	5	3	3	2	41	46	4	0	0	0	14	11	9	11	68	68
	Apr.	07	75	63	6	5	24	16	105	84	13	0	24	9	17	14	14	0	173	107
		08	98	117	9	6	37	25	144	148	15	9	20	17	19	6	17	12	215	192
	May	07	53	51	18	22	35	10	106	83	15	2	29	5	28	26	8	0	186	116
		08	79	68	20	13	21	16	120	97	12	7	23	20	0	0	14	7	169	131
Total	07	165	153	31	33	69	36	226	222	37	2	56	15	72	57	25	0	455	296	
	08	223	242	36	22	61	43	320	307	31	16	43	37	33	17	58	37	485	414	
Mean	07	33	30.6	6.5	6.6	13.8	7.2	53	44.4	7.4	0.4	11.2	3	14.4	11.4	5	0	91	59.2	
	08	44.6	48.4	7.2	4.4	12.2	8.5	64	61.4	6.2	3.2	8.6	7.4	6.6	3.4	11.6	7.4	97	82.8	
Maize	May	07	10	19	10	15	0	0	20	34	3	5	0	4	11	10	0	0	34	53
		08	15	10	12	8	0	0	27	18	2	0	5	3	3	0	15	11	52	32
	Jun.	07	23	18	9	9	0	0	32	27	12	15	6	8	7	4	2	0	59	54
		08	22	18	18	21	0	0	40	39	14	9	19	9	6	0	19	17	98	74
	Jul.	07	34	14	25	15	0	8	59	37	17	10	22	22	18	16	9	11	125	96
		08	21	11	20	15	0	0	41	26	11	10	24	18	12	7	16	13	104	74
	Aug.	07	34	22	33	26	0	0	67	48	10	9	41	25	23	19	33	25	174	126
		08	8	3	23	15	8	8	39	26	2	0	24	13	36	17	11	14	112	60
	Total	07	101	73	77	65	0	8	178	146	42	39	69	59	59	49	44	36	392	329
		08	66	42	73	59	8	8	147	109	29	19	72	43	57	24	61	45	366	240
Mean	07	25.3	18.3	19.3	16.3	0	2	44.5	36.5	10.5	9.8	17.3	14.8	14.8	12.3	11	9	98	82.3	
	08	16.5	10.5	18.3	14.8	2	2	36.8	27.3	7.3	4.8	18	10.8	14.3	6	15.3	11.3	91.5	60	

A=9:00 am P=4:00pm

Table (2) : Total monthly numbers of common predatory species in Control maize fields/50 maize plants ,at two different sampling times, at the district of Badrashan, Giza Governorate, during the two growing seasons 2007 and 2008.

Month		<i>Coccinella undecimpunctata</i>		<i>Scymnus interruptus</i>		Total coccinellids		<i>Chrysoperla carnea</i>		<i>Orius</i> spp.		<i>Paederus alfieri</i>		True spiders		Grand total	
		A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P
May	07	13	0	7	0	20	0	0	8	6	12	6	0	0	0	32	20
	08	12	10	10	0	22	10	4	0	8	5	0	1	8	3	42	19
Jun.	07	23	16	13	8	36	24	10	8	21	14	6	3	4	2	77	51
	08	17	11	13	10	30	21	9	3	14	11	0	0	17	11	70	46
Jul.	07	14	20	11	8	25	28	11	5	15	7	9	3	7	5	57	48
	08	12	13	12	9	24	22	10	7	15	18	16	11	14	5	79	73
Aug.	07	3	0	21	23	24	23	8	4	13	21	20	23	25	22	100	93
	08	7	1	15	22	22	23	3	2	21	11	33	15	11	4	90	55
Total	07	53	36	51	39	105	75	29	25	55	54	41	29	46	29	276	212
	08	48	35	50	41	98	76	26	12	58	45	49	27	50	33	281	193
Mean	07	13.3	9	12.8	9.8	26.3	18.8	7.3	6.3	13.8	13.5	10.3	7.3	11.5	7.3	69	53
	08	12	8.8	12.5	10.3	24.5	19	6.5	3	14.5	11.3	12.3	6.8	12.5	8.3	70.3	48.3

Table (3): Migration rates of common predatory species from egyptian clover fields to maize fields, at two different sampling times, at the district of Badrashan, Giza Governorate, during the two growing seasons 2007 and 2008.

Parameter		<i>Coccinella undecimpunctata</i>		<i>Scymnus interruptus</i>		Total coccinellids		<i>Chrysoperla carnea</i>		<i>Orius</i> spp.		<i>Paederus alfieri</i>		True spiders		Grand total	
		A	P	A	P	A	P	A	P	A	P	A	P	A	P	A	P
Migration rates.	07	90.6	102.8	51	66.7	69.5	94.7	44.8	56	25.5	9.3	43.9	69	-4.3	24.1	42	55.2
	08	37.5	20	46	43.9	50	43.4	11.5	58.3	24.1	4.4--	16.3	-11.1	22	36.4	30.2	24.4

A=9:00 am P=4:00pm

followed by the true spiders 13.7–17.8%, then *P. alferii* 13.7–17.4% and *C. carnea* was the least 6.2–11.8%.

To evaluate the migration of the common predators from the experimental clover field into adjacent maize field, a comparison between the population densities of the studied predatory species in the experimental maize field adjacent to the clover field and the maize field far from any clover field (control) was made. Data summarized in Tables (1 and 2), showed obvious increases in most of the populations of the identified predators in the maize field adjacent to the clover experimental field compared with the control one. In season 2007, 36.3 and 35.6% increases were found in the experimental maize fields in the morning (A) and in the afternoon (P), respectively. Correspondent increases in season 2008 were 23.2 and 19.6% at A & P, respectively. Statistical analysis showed significant differences between the populations of each of the studied predatory species at the two maize fields (experimental and control).

As shown also in Tables (1) and (2), coccinellids increased in the experimental maize field by 69.5 and 94.2% in season 2007 (A & P), respectively. Correspondent values were 50 and 43.4% in season 2008. Among the coccinellids, *C. undecimpunctata* ranked first with a range of increase reached 20–102.8%, followed by *P. alferii* 16.3–69%, then *S. interruptus* 43.9–66.7%, *C. carnea* 11.5–58.3%, true spiders 22–36.4% and the least was *Orius* spp. 9.3–25.5%.

Generally, total numbers of the studied predatory species were higher in season 2008 than 2007 by 19.7% in the clover field while they were vice versa in maize. In season 2007, they outnumbered by 18.9%. In the control maize fields, almost there was no significant difference between the two seasons as season 2008 was higher by only 2.9%.

According to the equation of Mansour *et al.* (1994), the calculated migration rates (m. r.) of the studied predatory species are presented in Table (3). The migration rates ranged between 20–102.8, 43.9–66.7, 43.4–94.7, 11.5–58.3, -4.4–25.5, -11.1–69, -4.3–36.4 and 24 -55.2 % for *C. undecimpunctata*, *S. interruptus*, total coccinellids, *C. carnea*, *Orius* spp., *P. alferii*, true spiders and total predators, respectively (Table 3). As indicated, some of the m. r. were negative as in case of *Orius* spp., *P. alferii* and true spiders, particularly in the afternoon time (P) which could be interpreted as they seemed to be not affected by the existence of the two crops

adjacent or following each other.

In conclusion, the coccinellids were the most important group (highest m. r.) migrated from Egyptian clover fields into adjacent maize fields; particularly *C. undecimpunctata* and *S. interruptus* followed by *C. carnea* but with relatively less m. r., then came *Orius* spp., *P. alferii* and true spiders.

Obtained results agree with most of the previous studies on the predators in Egyptian clover and maize fields, particularly in Egypt, Ali *et al.* (1975), Tawfik *et al.*, 1976a, El-Heneidy and Abbas (1984), Darwish and Ali (1991) and El-Husseini *et al.* (1996). Afifi *et al.* (1976) reported that in general, predators' populations were largest in May in clover fields in Egypt. This result agreed with those reported by Shalaby *et al.*, (2008) who recorded highest population of predators in May in the Egyptian clover fields and in August in maize fields in Qaluobia Governorate. El-Heneidy *et al.* (1978) studied the migration of 6 groups of predators from Egyptian clover to adjacent cotton at Fayoum Governorate. They reported that the populations of predators peaked by late April and the migration to adjacent cotton fields was recorded in May and June when they peaked later in the month of June. *Orius* spp. were the dominated predators in both clover and cotton fields. Almost the same results were obtained by El-Husseini *et al.* (1996) who stated that *Orius* spp. populations were the highest among the other predatory species in cotton fields adjacent to Egyptian clover fields in Sharkia governorate. They were about 4.5 times those in distanced cotton fields.

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