Results and Discussion

IV-RESULTS AND DISCUSSION

IV-1-Biological aspects of *Bracon hebetor* and *Dibrachys* sp.

Experiments were carried out to study the effect of temperature and host feeding on the biology of the two hymenopterous parasitoids, ***Bracon hebetor*** (Fam. Braconidae) and ***Dibrachys*** **sp.** (Fam. Pteromalidae) under controlled conditions of 22, 26 and 30°C associated with (65 – 70) % R. H.

IV-1-1-*Bracon hebetor* Say

IV-1-1-1-Durations of immature stages.

Egg (incubation period).

As shown in Tables (5 and 6), the eggs hatched after a period of 2.5 ± 0.03 (2.5 – 2.63), 1.17 ± 0.17 (1.12 – 1.2) and 0.78 ± 0.08 (0.72 – 0.88) days at 22, 26 and 30 ± 1°C associated with (65 – 70) % R. H., respectively, when reared on ***P. gossypiella*** fullgrown larvae. While, by rearing on ***E. insulana*** full-grown larvae, the incubation periods were 2.86 ± 0.01 (1.8 – 1.9), 1.28 ± 0.03 (1.2 – 1.29) and 0.97 ± 0.1 (0.9 – 1) days, respectively at the same temperatures.

These data indicated that the incupation period of ***B. hebetor*** eggs decreased by increasing temperature from 22 to 30°C. The shortest incubation periods (0.78 and 0.97) were obtained at 30°C, while the longest (2.5 and 2.86) were recorded at 22°C when reared on ***P. gossypiella*** and ***E. insulana*** larvae, respectively.

Table (5): Durations of immature stages of *Bracon hebetor* reared on *P. gossypiella* larvae at different constant temperatures

Developmental stage / Periods		Temperatures					
		22°C		26°C		30°C	
		Mean ± S.E.	Range	Mean ± S.E.	Range	Mean ± S.E.	Range
Egg		2.50 ± 0.030	(2.50 – 2.63)	1.17 ± 0.170	(1.12 – 1.20)	0.78 ± 0.080	(0.72 – 0.88)
Larva	1st instar	1.80 ± 0.007	(1.79 – 1.90)	0.87 ± 0.020	(0.80 – 0.97)	0.79 ± 0.008	(0.70 – 0.83)
	2nd instar	1.52 ± 0.004	(1.50 – 1.54)	0.79 ± 0.001	(0.80 – 0.79)	0.65 ± 0.003	(0.62 – 0.66)
	3rd instar	1.69 ± 0.001	(1.66 – 1.71)	0.48 ± 0.006	(0.54 – 0.45)	0.49 ± 0.001	(0.45 – 0.54)
	4th instar	1.95 ± 0.010	(1.88 – 2.00)	1.82 ± 0.003	(1.79 – 1.83)	1.57 ± 0.006	(1.54 – 1.63)
Total larval period		6.67 ± 0.080	(6.10 – 7.00)	4.03 ± 0.010	(3.9 – 4.10)	3.53 ± 0.020	(3.30 – 3.70)
Pre-pupa		1.54 ± 0.016	(1.30 – 1.60)	0.77 ± 0.004	(0.71 – 0.79)	0.77 ± 0.004	(0.75 – 0.80)
Pupa		5.90 ± 0.030	(5.50 – 6.00)	4.87 ± 0.030	(4.70 – 5.00)	3.75 ± 0.010	(3.70 – 3.90)
Total developmental period		16.75± 0.100	(14.99– 17.0)	10.79 ± 0.04	(10.3– 10.94)	8.72 ± 0.030	(8.30 – 8.83)

Table (6): Durations of immature stages of *Bracon hebetor* reared on *E. insulana* larvae at different constant temperatures :

Developmental stage / Periods		Temperatures					
		22°C		26°C		30°C	
		Mean ± S.E.	Range	Mean ± S.E.	Range	Mean ± S.E.	Range
Egg		2.86 ± 0.010	(1.80 – 1.90)	1.28 ± 0.030	(1.20 – 1.29)	0.97 ± 0.100	(0.90 – 1.00)
Larva	1st instar	1.86 ± 0.010	(1.80 – 1.90)	0.94 ± 0.001	(0.83 – 0.95)	0.80 ± 0.006	(0.75 – 0.83)
	2nd instar	1.92 ± 0.070	(1.90 – 2.00)	0.73 ± 0.005	(0.70 – 0.83)	0.60 ± 0.005	(0.59 – 0.71)
	3rd instar	1.80 ± 0.070	(1.75 – 1.87)	0.76 ± 0.003	(0.70 – 0.79)	0.53 ± 0.004	(0.50 – 0.58)
	4th instar	2.17 ± 0.004	(2.16 – 2.20)	1.92 ± 0.006	(1.80 – 1.96)	1.67 ± 0.003	(1.66 – 1.70)
Total larval period		7.78 ± 0.009	(7.70 – 7.90)	4.30 ± 0.020	(4.20 – 4.40)	3.70 ± 0.020	(3.30 – 4.20)
Pre-pupa		1.54 ± 0.020	(1.50 – 1.58)	0.95 ± 0.010	(0.80 – 1.20)	0.78 ± 0.005	(0.70 – 0.80)
Pupa		7.67 ± 0.100	(4.00 – 6.00)	4.84 ± 0.160	(4.00 – 5.00)	3.58 ± 0.080	(3.00 – 4.00)
Total developmental period		19.5 ± 0.200	(18.9 – 20.0)	10.78 ± 0.04	(9.50 – 11.3)	8.97 ± 0.100	(7.30 – 9.20)

Previous studies indicated that the egg stage of ***Bracon brevicornis*** lasted 89.1, 28.0 and 20.1 hours at 18, 27 and 35°C, respectively **(Tawfik, 1977)**, while it ranged from 192 hours at 15°C to less than 24 hours at 35°C **(Temerak, 1981)** and averaged 31.7 and 25.5 hours at 25 and 30°C, respectively **(Abbas, 1980)**. It was also reported that this period averaged 70.8, 31.6, 21.5 and 19.5 hours at 20, 25, 30 and 35°C, respectively, **(Hekal *et al*, 1987)**.

The larval stage:

The larva of ***Bracon hebetor*** completed its duration through four instars. The duration of each instar was estimated under the same mentioned conditions.

The first instar larva:

The duration of the first instar larva, when reared on ***P. gossypiella*** larvae at (22, 26, 30°C) lasted 1.8 ± 0.007 (1.79 – 1.9) , 0.87 ± 0.02 (0.8 – 0.97) and 0.79 ± 0.008 (0.7 – 0.83) days at the three temperatures, respectively (Table, 5). On the other hand, when the parasitoid was reared on ***E. insulana*** larvae, the durAtion of first instar was 1.86 ± 0.01 (1.8 – 1.9), 0.94 ± 0.001 (0.83 – 0.95) and 0.8 ± 0.006 (0.75 – 0.83) days with a minimum of 17 and a maximum of 20 hours, respectively, (Table, 6).

The second instar larva:

Data in (Table, 5) show that this instar occupied 1.52 ± 0.004 (1.5 – 1.54), 0.79 ± 0.001 (0.8 – 0.79) and 0.65 ± 0.003 (0.62– 0.66) days when' reared on ***P. gossypiella*** fullgrown

larvae, respectively. While on fullgrown larvae of ***E. insulana*** this stadium elapsed 1.92 ± 0.07 (1.9 – 2) , 0.73 ± 0.005 (0.7 – 0.83) and 0.63 ± 0.005 (0.6 – 0.71) days, respectively, under the same laboratory conditions, (Table, 6).

The third instar larva:

This instar occupied 1.69 ± 0.001 (1.66 – 1.71), 0.84 ± 0.006 (0.82 – 0.85) and 0.49 ± 0.001 (0.45 – 0.54) days at (22, 26 and 30 °C) and 65 -**70** % R. H., respectively, when reared on ***P. gossypiella*** Table (5). But on ***E. insulana*** this period lasted 1.8 ± 0.007 (1.75 – 1.87), 0.76 ± 0.003 (0.7 – 0.79) and 0.53 ± 0.004 (0.5 – 0.58) days at 22, 26 and 30 °C associated with 65 % R. H., respectively, (Table, 6).

The fourth instar larva:

This stadium elapsed 1.95 ± 0.01 (1.88 – 2), 1.82 ± 0.003 (1.79 – 1.83) and 1.57 ± 0.006 (1.54 – 1.63) days at the three temperatures, respectively by rearing on ***P. gossypiella*** larvae (Table, 5). While, on ***E. insulana***, this period lasted 2.17 ± 0.004 (2.16 – 2.2), 1.92 ± 0.006 (1.8 – 1.96) and 1.67 ± 0.003 (1.66 – 1.7) days, respectively, Table (6).

The total larval period.

At the aforementioned conditions, the total larval period of ***B. hebetor*** occupied 6.67 ± 0.08 (6.1 – 7), 4.03 ± 0.01 (3.9 – 4.1) and 3.53 ± 0.02 (3.3 – 307) days when reared on ***P. gossypiella***, while on ***E. insulana*** the total larval period lasted 2.17 ± 0.004 (2.16 – 2.2) , 1.92 ± 0.006 (1.8 – 1.2) and

1.67 ± 0.003 (1.66 – 1.7) days, respectively under 22, 26 and 30 °C (Tables, 5 & 6).

These data indicated that, there was a negative relationship between temperature and duration. i. e. the shorter in the larval duration associated with the higher temperature and vice versa. Also, the total duration of larval stage of the parasitiod was shorter by rearing on ***P. gossypiella*** than on ***E. insulana***.

In similar studies, **Tawfik (1977)** found that the larval stage of ***B. brevicornis*** reared on ***H .armigera*** lasted 185.3, 95.6 and 63.7 hours at 18, 27 and 35°C, respectively. **Abbas (1980)** stated that the larval period averaged 107.0 and 86.4 hours at 25 and 30°C respectively. Also, **Hekal *et al.* (1987)** found that the shortest larval period of ***B. brevicornis*** on ***P. gossypiella*** was 55.6 hours at 35°C and increased to 69.8, 122.7 and 168.3 hours at 30, 25 and 20°C, respectively.

Pre–pupal stage.

Data in Tables (5 & 6) show that the pre – pupal period of ***B. hebetor*** lasted 1.54 ± 0.016 (1.3 – 1.6), 0.77 ± 0.004 (0.71 – 0.79) and 0.77 ± 0.004 (0.75 – 0.8) days on ***P. gossypiella*** and 1.5 ± 0.02 (1.5– 1.58), 0.95 ± 0.01 (0.8 – 1.2) and 0.78 ± 0.005 (0.7 – 0.8) days on ***E. insulana*** at 22, 26 and 30°C, respectively.

According to **Abbas (1980)**, the prepupal duration of ***B. brevicornis*** reared on ***P. gossypiella*** lasted 26.1 and 22.2 hours at 25 and 30°C respectively. **Hekal *et al.* (1987)** found that this period averaged 60.7 ± 0.58, 26.5 ± 0.46, 20.1 ± 0.29 and 18.1 ± 0.25 at 20, 25, 30 and 35°C respectively.

Also, **Tawfik (1977)** recorded that the pre-pupal period of the same parasitoid was 70.2, 24.1 and 18.0 hours at 18, 27 and 35°C, respectively, when reared on ***H. armigera***.

Pupal stage (/day)

At a constant temperatures of 22, 26 and 30°C and 65 - 70% R.H., the pupal duration of ***B. hebetor*** lasted 5.9 ± 0.03 (5.5 – 6), 4.87 ± 0.03 (4.7 – 5) and 3.75 ± 0.01 (3.7 – 3.9) days when rearing on ***P. gossypiella***. On the other hand, when reared on ***E. insulana*** this period averaged 7.67 ± 0.1 (4 – 6), 4.84 ± 0.16 (4 – 5) and 3.58 ± 0.08 (3 – 4) days, respectively, (Tables 5 & 6). These data showed also that the pupal duration was also shortened as the temperature became higher.

Abbas (1980) stated that the pupal duration of the parasitoid ***B. brevicornis*** reared on ***P. gossypiella*** occupied 99.1 and 86.4 hours at 25 and 30°C, respectively. **Hekal (1987)** found that the cocoon period of ***B. brevicornis*** reared on ***P. gossypiella*** lasted 191.4, 111.3, 64.8 and 52.7 hours at 20, 25, 30 and 35°C, respectively. **Tawfik (1977)** reported that the pupal stage of ***B. brevicornis*** reared on ***H. armigera*** averaged 217.0, 89.2 and 60.1 hours at 18, 27 and 35°C, respectively. **Temerak (1981)** found that the cocoon period of the same parasitoid reared on ***S. cretica*** lasted 271.2, 160.8, 124.8 and 96.0 hours at 20, 25, 30 and 35°C, respectively.

Total developmental period:

Tables (5 & 6) show that the shortest total developmental period of ***B. hebetor*** is 8.72 ± 0.03 (8.3 – 8.83)

hours at 30°C when reared on ***P. gossypiella***. This period progressively increased, by decreasing the temperature, to reach 10.79 ± 0.04 (10.3 – 10.940) days at 26°C and 16.75 ± 0.1 (14.99 – 17) days at 22°C, by rearing on the same host species. When the parasitoid was reared on the spiny bollworm larvae, this period averages 19.5 ± 0.2 (18.9 – 20), 10.78 ± 0.04 (9.5 – 11.3) and 8.97 ± 0.1 (7.3 – 9.2) days.

Previous studies showed that the total developmental period of ***B. brevicornis*** averaged 23.4, 9.9 and 6.7 days at 18, 27 and 35°C, respectively on ***H. armigera***. **Tawfik (1977)**; 20.2, 13.4, 10.1 and 8.0 days on ***S. cretica*** at 20, 25, 30 and 35°C, respectively **(Temerak, 1981)**; 11.0 and 9.1 days on ***P. gossypiella*** at 25 and 30°C, respectively **(Abbas, 1980),** and 20.5, 12.3, 7.2 and 6.1 days on the same host species at 20, 25, 30 and 35°C, respectively **(Jackson and Butler, 1984)**.

IV-1-1-2-The relationship between the kind of food offered to *Bracon hebetor* adults, and different constant temperatures and thir longevity and fecundity.

The effect of each of the 3 constant temperatures; 22, 26 and 30°C and 65 - 70 % R.H. and three kinds of food; i. e., (protein + 10 % sucrose, 10 % sucrose solution and water only) on fecundity and longevity of the parasitoid, ***B. hebetor;*** when reared on ***P. gossypiella***, was investigated.

Oviposition periods

Pre-oviposition period:

Table (7) shows the pre-oviposition period for ***B. hebetor*** mated female to be shortened, as the temperature became higher. The pre-oviposition period was 1.0 ± 0.0 (0 - 2), 0.86 ± 0.09(0 - 1) and 0.3 ± 0.08 (0 - 1) day at 30°C when fed on protein +10% sucrose, 10% sucrose and only water respectively. It was progressively prolonged to reach 0.57 ± 0.11 (0 - 1), 2 ± 0.13 (1 - 3) and 1.44 ± 0.12 (1- 2) day at 26°C and 2.35 ± 0.3 (1- 4), 2.3 ± 0.12 (2 - 3) and 2.14 ± 0.3 (1 - 4) days at 22°C when fed on protein + 10% sucrose, 10% sucrose and water only.

Previous studies showed that the female of ***B. brevicornis*** reared on ***P. gossypiella*** oviposited on the day of emergence at 30°C. The pre-oviposition period averaged 1.8 and 2.6 days at 23 - 26 and 17- 19°C, respectively **(Skoblo, 1944),** 0.8 and 0.3 days on the same host at 27 and 35°C, respectively, **Tawfik (1977)** and recorded one day on ***P. gossypiella*** at 30°C **(Abbas, 1980).**

Oviposition period:

The oviposition period averaged 10.46 ±0.44 (7 - 13), 8.33 ± 0.22(7 - 10) and 1.0 ± 0.12 (1 - 5) days at 30°C when adults were fed on 10% sucrose + protein, 10% sucrose solution and water, respectively. While, at 26°C these periods were 12.5 ± 0.45 (8 - 15), 12.38 ± 0.4 (9 -15) and 1.78 ± 0. 17 (1 - 3) days, respectively. At 22°C, the oviposition period lasted 17.15 ± 0.7 (12 - 23), 12.13 ± 0.43 (11 - 14) and 2.93 ± 0.3 (1 - 4) days when fed on 10% sucrose + protein, 10% sucrose and water respectively. Table (7).

Table (7): ovipstition periods and number of eggs per mated female of *Bracon hebetor* when fed on threekinds of food at different constant temperatures.

Temperature	Different foods	Oviposition periods (days) Mean +S.E.			No. of eggs/female	
		Pre-ovipositon	Ovipositon	Post-ovipositon	Daily	Total
22°C	Type (1)	2.35 ± 0.3 (1 - 4)	17.15 ± 0.7 (12 - 13)	1.4 ± 0.13 (1 - 2)	11.468± 0.05 (8.76 - 16.82)	197.4 ± 12.36 (107 - 206)
	Type (2)	2.3 ± 0.12 (2 - 3)	12.13 ± 0.43 (11 - 14)	2.26 ± 0.12 (2 - 3)	8.1 ± 0.25 (6.07 - 9.4)	98.9 ± 4.05 (68 - 107)
	Type (3)	2.14 ± 0.3 (1 - 4)	2.93 ± 0.3 (1 - 4)	1.57 ± 0. 14 (1 - 2)	1.4 ± 0.23 (1 - 3)	3.57 ± 0.46 (3 - 6)
F. value			254.28	11.436		253.567
L. S. D. 5%			1.345	0.366		18.603
26±2°C	Type (1)	2.57 ± 0.11 (0 - 1)	12.5 ± 0.45 (8 - 15)	1.5 ± 0. 13 (1 - 2)	15.73 ± 0.85 (8 - 18.9)	197.125 ± 14.4 (64 - 265)
	Type (2)	2.0 ± 0.13 (1 - 3)	12.375 ± 0.4 (9 - 15)	1.68 ± 0.12 (1 - 2)	9.56± 0.27 (7.8 - 10.7)	117.8 ± 4.8 (86 - 141)
	Type (3)	1.44 ± 0.12 (12 - 2)	1.78 ± 0.17 (1 - 3)	1.43 ± 0.13 (1 - 2)	3.68 ± 0.2 (1 - 3)	7.0 ± 0.5 (1 - 6)
F. value		0.125	431.9	376.22		620.704
L. S. D. 5%						
30±2°C	Type (1)	1.0 ± 0.0 (0 - 2)	10.46 ± 0.44 (7 - 13)	0.86 ± 0.08 (0 - 1)	18.73 ± 0.64 (15 - 24.7)	199.9 ± 4.07 (173 - 286)
	Type (2)	0.86 ± 0.09 (0 - 1)	8.33 ± 0.22 (7 - 10)	0.8 ± 0.14 (0 - 1)	12.13 ± 0.48 (10.22 - 17.5)	120.53 ± (81 - 140)
	Type (3)	0.3 ± 0.08 (0 - 1)	1.0 ± 0.12 (1 - 5)	0.2 ± 0.02 (0 - 1)	5.3 ± 0.13 (5.3 - 7)	20.0± 0.38 (3 - 9)
F. value		4.0147	238.76			706.36
L. S. D. 5%		0.3424	1.279			9.545

type 1= protein + 10% sucros
type 2= 10% sucrose
type 3= water

It is clearly evident that the higher the temperature, the shorter was the oviposition period and vice versa.

Tawfik (1977) found that the oviposition period of ***B. brevicornis*** reared on ***H. armegera*** averaged 30.4 and 13.9 days at 27 and 35°C, respectively.

Post-oviposition period:

The shortest post-oviposition periods were 0.86±0.08 (0 - 1), 0.8 ± 0.14 (0 - 1) and 0.2 ± 0.02 (0 - 1) at 30°C when fed on protein + 10% sucrose, 10% sucrose and only water. But the longest periods were 1.4 ± 0.13 (1 - 2) 2.26 ± 0.12 (2 - 3) and 1.57 ± 0.14 (1 - 2) days/female at 22°C and on the same three foods, respectively, (Table, 7).

These data indicated negative correlation between temperature.

In this respect, the post-oviposition period of ***B. brevicornis*** reared on ***H. armigera*** lasted 1.2 and 1.0 days at 27 and 35°C, respectively **(Tawfik, 1977)**, and averaged 1.2 days on ***P. gossypiella*** at 30°C **(Abbas, 1980).**

Number of deposited eggs / female:

Data in Table (7) show that the mean daily and total number of eggs laid per female are affected by the type of food offered to adult females. At either of the three temperatures (22, 26 and 30°C), the highest daily means in number of eggs/female were recorded with females fed on protein + 10% sucrose solution being 18.73 ± 0.64 (15 - 24.7), 15.73 ± 0.85 (8 - 18.9) and 11.47 ± 0.05 (8.76 - 16.82) eggs/female, at 30, 26 and 22°C, respectively. Feeding the

adult females on 10% sucrose solution laid fewer means in mumbers of eggs than in the former food (12.13± 0.48, 9.56 ±0.27and 8.10 ±0.25eggs /female, respectively. While, the lowest daily number of eggs/female was obtained when water was offered as the only food for females, where the daily mean numbers were 5.30 ± 0.13 (5 - 7), 3.68 ± 0.2 (3 - 7) and 1.4 ± 0.23 (1 - 3) at 30, 26 and 22°C, respectively (Table, 7).

The total number of eggs/female has taken the same trend;. i.e. the highest total number of eggs being associated with females fed on protein +10%sucrose solution showing, 199.9 ± 4.07 (173 - 286), 197.13 ± 14.38 (64 - 265) and 197.4 ± 12.4 (107 - 206) eggs/female at 30, 26 and 22°C, respectively. While the lowest total number of deposited eggs were 20.0± 0.38 (9 - 25), 7.0 ± 0.5 (5 - 17) and 3.57 ± 4.6 (2 - 6) when fed on water only. From these results it could be concluded that protein is very important material in diet of parasitoid females for reproduction of eggs.

Adult longevity:

Data in Table (8) reveal that the longevity of ***B. hebetor*** females averaged 21.0 ± 0.4 (12 - 18), 16.75 ± 0.48 (10 - 17) and 12.46 ± 0.4 (9 -14) days at 22, 26 and 30°C, respectively, when fed on protein + 10% sucrose solution. While were 18.1 ± 0.3 (15 - 20), 16.06 ± 0.7 (12 - 19) and 10.0 ± 0.2 (9 - 12) days at the same temperatures, respectively when offered 10% sucrose solutions as a food for female adults. But when females were supplied with water only, this period lasted 5.78 ± 0.23 (4 - 7), 4.57 ± 0.13 (4 - 5) and 1.3 ± 0.12 (3 - 6) at 22, 26 and 30°C, respectively.

Table (8): Longeivity of ***Bracon hebetor adults*** reared on different food types and at different constant temperatures.

Temperature	Different foods	Longevity (days) Mean ±S.E.	
		Male	Female
22°C	Type (1)	14.8 ± 0.48 (12 - 18)	21.0 ± 0.44 (12 - 18)
	Type (2)	12.4 ± 0.3 (11 - 14)	18.1 ± 0.2 (15 - 20)
	Type (3)	5.78 ± 0.23 (4 - 7)	5.78 ± 0.23 (4 - 7)
26°C	Type (1)	12.3 ± 0.13 (7 - 13)	16.75 ± 0.48 (10 - 17)
	Type (2)	11.75 ± 0.4 (9 - 14)	16.06 ± 0.77 (12 - 19)
	Type (3)	3.357 ± 0.16 (2 - 4)	4.57 ± 0.13 (4 - 5)
30°C	Type (1)	9.6 ± 0.03 (7 - 13)	12.46 ± 0.4 (9 - 14)
	Type (2)	7.53 ± 0.17 (7 - 9)	10.0 ± 0.2 (9 - 12)
	Type (3)	0.7 ± 0.025 (3 - 5)	1.3 ± 0.12 (3 - 6)

type 1= protein + 10% sucros
type 2= 10% sucrose
type 3= water

The corresponding values for males showed the same trend under the same types of food and laboratory conditions, although generally, the life–span of male was shorter than female.

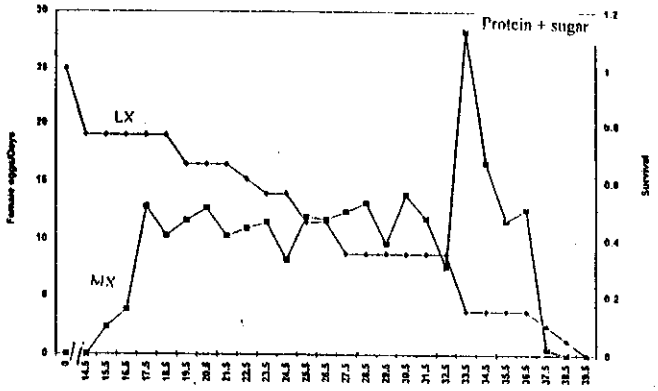
It is evident that the higher the temperature, the shorter was the adult longevity and vice versa. Temperature had a significantly negative effect on adult life - span. Irrespective of the tested temperature, the female lived for a longer period than the male. Also, it could be concluded that adding protein to the offered sucrose solution caused prolongation of the adult's longevity. According to, **Temerak (1981)** the mated male of ***B. brevicornis*** lived for 6.1, 4.9, 3.9 and 2.4 days with ***S. cretica*** at 20, 25, 30 and 35°C, respectively. The respective longevities for mated female averaged 13.5, 9.3, 7.4 and 6.0 days. **Abbas (1980)** reported that mated male and female of the same parasite survived for 18.0 and 29.4 days with ***P. gossypiella*** at 30°C. From the above results and data persented in Tables (22, 23 & 24), it could be concluded that the optimum conditions for successful mass rearing of the parasitoid, ***Bracon hebetor*** are at 30°C and the nourshiment of the parasitoid adults on protein added to 10 % sucrose solution.

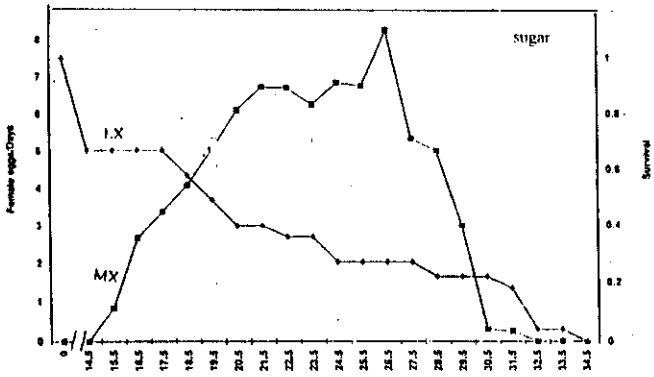
IV-1-1-3.Reproduction potential and life table parameters:

Data in Table (9) and (Figs. 1, 2 &3) represents the effect of different food on life table parameters of ***Bracon hebetor*** Say. at 22, 26 and 30°C and 75 - 80% R.H., respectively.

Table (9): Effect of different food source on life table Parameters of *Bracon hebetor.* at 22, 26 and 30°C and 65-70%R.H.

Temperature / Parameters	22°C			26°C			30°C		
	Water	Sugar	Protein	Water	Sugar	Protein	Water	Sugar	Protein
Netre production rate(Ro)	0.57	28.408	108.578	0.817	50.32	65.393	0.92	29.79	62.36
Mean Generation Cine (T)	18.46	21.08	21.74	13.87	18.48	18.105	10.84	13.48	13.61
Intrinsic rateof increase (rm)	-3.026	0.158	0.215	1.45	0.212	0.231	-7.29	0.252	0.304
Finite rateof increase (exprm)	0.97	1.17	1.24	0.985	1.236	1.26	0.993.	1.286	1.35
Sex ratio	0.5	0.50	0.50	0.58	0.58	0.58	0.40	0.40	0.40
Time to 50% mortality days	-	19.50	25.00	_	22.00	27.00	9.00	14.00	19.00





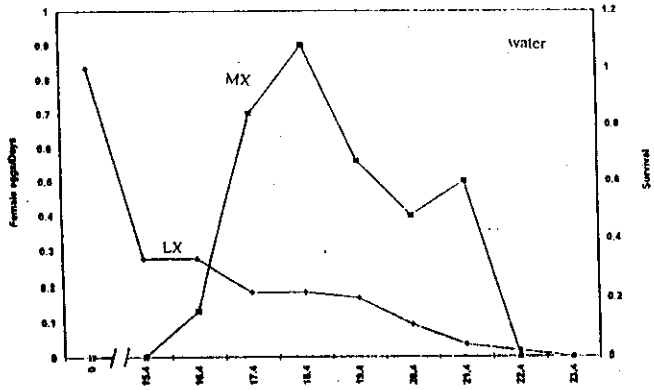


Fig. (1): Age specific fecundity and survivals of *Bracon hebetor* feeding on different foods at 22 °C

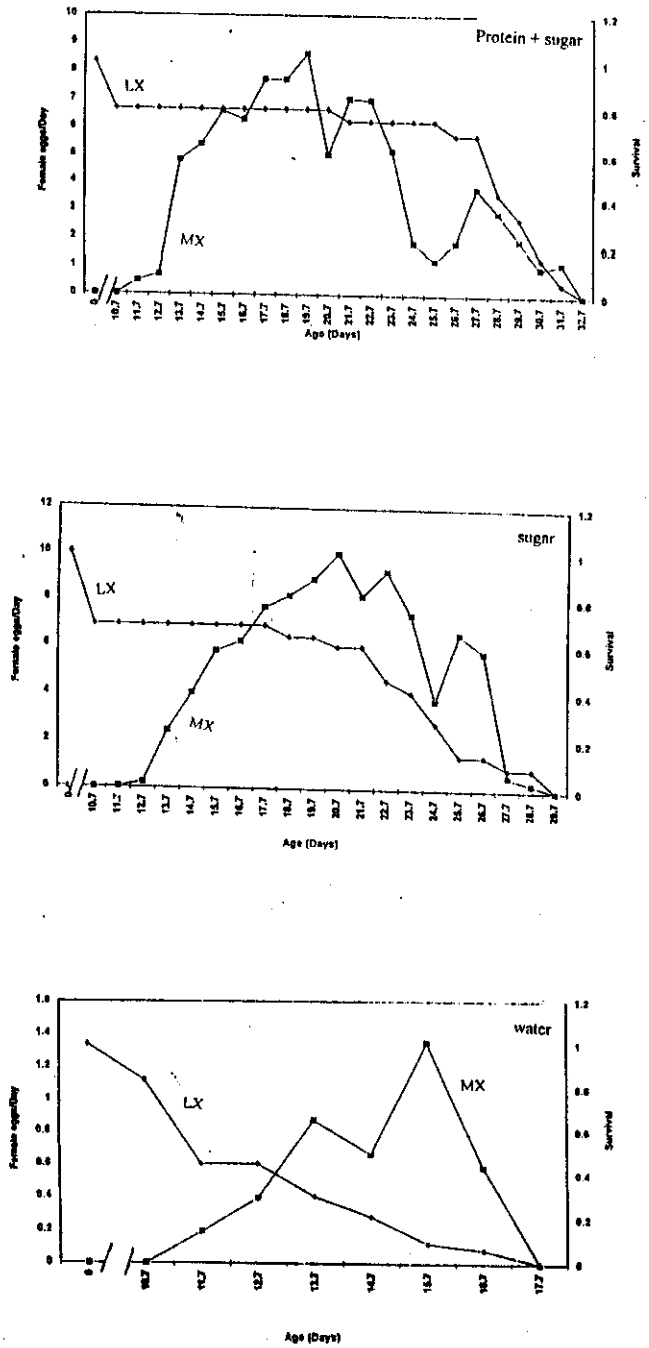


Fig. (2): Age specific fecundity and survivals of *Bracon hebetor* feeding on different foods at 26 °C

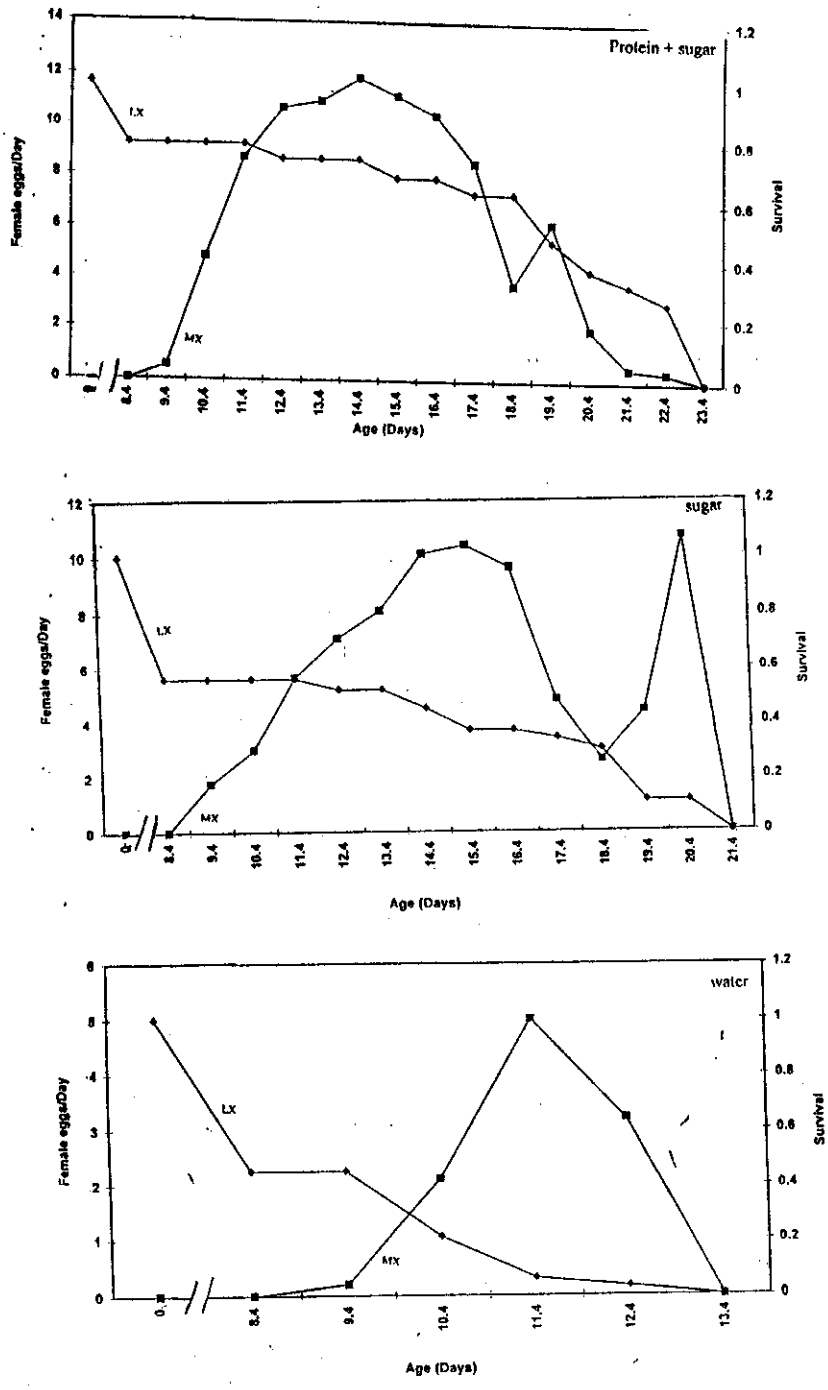


Fig. (3): Age specific fecundity and survivals of *Bracon hebetor* feeding on different foods at 30 °C

Data show that the multiplication per generation (Ro) increased as temperature was increased from 22°C to 30°C when ***Bracon*** fed on water, sugar and protein. At 22°C (Ro) values were 0.572, 28.408 and 108.578 when ***Bracon hebetor*** fed on the three mentioned foods, respectively. At 26°C the same values were 0.817, 50.32 and 65.393 while at 30°C the values were 0.92, 29.79 and 62.36. In contrary, the mean generation time (T) decreased when temperature was increased, these values were 10.84, 13.48 and 13.61 at 30°C and 13.87, 18.48 and 18.105 at 26°C and 18.46, 21.08 and 21.74 at 22°C, when ***Bracon hebetor*** adults were fed on water, sugar and protein, respectively.

The (rm) values were -3.026, 0.158 and 0.215 at 22°C and were –1.45, 0.212 and 0.231 at 26°C, while they were –7.29, 0.252 and 0.304 at 30°C when ***Bracon hebetor*** adults were fed on water, sugar and protien, respectively. The finite rate of increase (exprml values) was approximately similar at 22, 26 and 30°C (Table 9). These values were 0.97, 1.17 and 1.24 at 22°C and 0.987, 1.188 and 1.259 at 26°C while they were 0.993, 1.286 and 1.35 at 30°C when ***Bracon hebetor*** fed on water, sugar and protein, respectively.

The sex ratio did not differ when the parasitoid fed on water, sugar and protein, values were 0.5, 0.58 and 0.4 at 22, 26 and 30°C.

Time to 50% mortality (days) decreased when temperature was increased from 22°C to 30°C. These values were 25.0, 27.0 and 19.0 days when ***Bracon hebetor*** adults were fed on protein at 22, 26 and 30°C, respectively (Table,

9). These values were 19.5, 27.0 and 14.0 when the parasitoid fed on sugar solution at 22, 26 and 30°C, respectively.

It is clearly obvious that feeding ***Bracon hebetor*** on protein gave a remarkable reproduction potential at 30°C followed by 26°C and 22°C. Sugar solution is considered a moderate source of food affecting reproduction while water probably considered as low source of food to the reared parasitoid under the three experimental constant temperatures.

IV-1-2-*Dibrachys* sp. (Fam: Pteromalidae)

IV-1-2-1-Duration of immature stages: -

The durations of various immature stages of the parasitoid, ***Dibrachys*** sp. reared on larvae of ***P. gossypiella*** and ***Earias insulana*** were estimated when rearing took place at 22, 26 and 30°C. The obtained data are presented in Tables (10 & 11). Data recorded in these tables show the following:

Incubation period :

Incubation period of eggs averaged 3.14 ± 0.03 (3 – 3.3), 1.54 ±0.001(1.5 - 1.6) and 0.71 ± 0.001 (0.7 - 0.79) days (Table, 10) when the parasitoid was reared on ***P. gossypiella*** larvae. On the other hand, when reared on the larvae of ***E. insulana*** the incubation periods were 3.01 ± 0.01 (3 - 3.04), 1.98 ± 0.01 (1.9 – 2) and 0.73 ± 0.001 (0.71 – 0.79) days, at 22, 26 and 30 ± 1°C respectively (Table, 11). These data indicate that the incubation period of the parasitoid eggs decrease with increasing temperature from 22 to 30 °C Fig (4).

Table (10): Durations of immature stages of *Dibrachys* sp. reared on *P. gossypiella* larvae at different constant temperatures.

Developmental stage / Periods		Temperatures					
		22°C		26°C		30°C	
		Mean ± S.E.	range	Mean ± S.E.	range	Mean ± S.E.	range
Egg		3.14 ±0.03	(3 – 3.3)	1.54± 0.001	(1.5 – 1.6)	0.71 ± 0.001	(0.7 – 0.79)
Larva	1st instar	2.1 ± 0.004	(2.1 – 2.2)	1.6 ± 0.01	(1.6 – 1.8)	0.67 ± 0.004	(0.66 – 0.75)
	2nd instar	1.95 ± 0.006	(1.9 – 2)	1.64 ± 0.08	(1.6 – 1.65)	0.62 ± 0.2	(0.58 – 0.66)
	3rd instar	2.47 ± 0.2	(2.45 – 2.5)	1.7 ± 0.01	(1.6 – 1.75)	0.85 ± 0.004	(0.83 – 0.87)
	4th instar	2.6 ± 0.008	(2.6 – 2.8)	2.38 ± 0.007	(2.3 – 2.4)	1.54 ± 0.01	(1.5 – 1.66)
Total larval period		8.79 ± 0.03	(5.6 – 9.1)	7.5 ± 0.01	(7.4 – 7.6)	3.72 ± 0.009	(3.7 – 3.9)
Pre-pupa		2.14 ± 0.07	(2 – 3)	1.44 ± 0.014	(1.3 – 1.5)	0.73 ± 0.09	(0.7 – 0.75)
Pupa		8.09 ± 0.06	(8 – 9)	6.2 ± 0.05	(6 – 6.5)	3.4 ± 0.01	(3.4 – 3.6)
Total developmental period		22.07 ± 0.07	(21.6 – 23)	16.7 ± 0.05	(16.4 – 17)	8.37 ± 0.2	(7.9 – 8.99)

Table (11): Durations of immature stages of *Dibrachys* sp. reared on *E. insulana* larvae at different constant temperatures

Developmental Stage / Periods		Temperatures					
		22°C		26°C		30°C	
		Mean ± S.E.	range	Mean ± S.E.	range	Mean ± S.E.	range
Egg		3.01 ± 0.004	(3.00 - 3.04)	1.98 ± 0.008	(1.90 – 2.00)	0.73 ± 0.001	(0.71 – 0.79)
Larva	1st instar	2.46 ± 0.010	(2.40 – 2.50)	1.70 ± 0.005	(1.60 – 1.72)	0.81 ± 0.002	(0.79 – 0.83)
	2nd instar	1.87 ± 0.000	(1.79 – 1.80)	1.57 ± 0.009	(1.50 – 1.60)	0.87 ± 0.005	(0.83 – 0.90)
	3rd instar	1.77 ± 0.004	(1.75 – 1.80)	1.85 ± 0.004	(1.83 – 1.87)	0.86 ± 0.020	(0.79 – 0.95)
	4th instar	2.72 ± 0.020	(2.60 – 2.80)	2.43 ± 0.020	(2.40 – 2.46)	1.50 ± 0.008	(1.50 – 1.60)
Total larval period		9.27 ± 0.012	(9.21 – 9.37)	7.42 ± 0.013	(7.20 – 7.50)	3.74 ± 0.007	(3.71 – 3.87)
Pre-pupa		1.44 ± 0.001	(1.40 – 1.50)	1.20 ± 0.010	(1.20 – 1.30)	0.74 ± 0.004	(0.71 – 0.75)
Pupa		7.30 ± 0.190	(5.00 – 8.00)	5.90 ± 0.150	(5.00 – 7.00)	3.40 ± 0.010	(3.40 – 3.60)
Total developmental period		20.98 ± 0.060	(18.73–21.83)	16.48 ± 0.14	(15.5 – 17.6)	8.63 ± 0.015	(8.52 – 8.93)

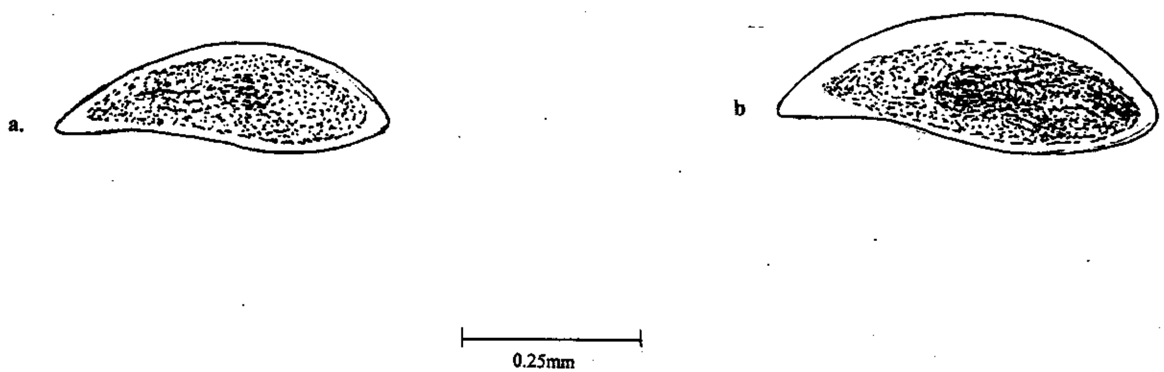


Fig (4): Egg stage of *Dibrachys* sp.
a. deposited egg.
b. Egg before hatching.

Larval developmental period

At 22, 26 and 30°C (± 1°C) and 65 - 70 % R.H., four larval instars were recorded for the parasitoid, ***Dibrachys* sp.** on ***P. gossypiella*** and ***E. insulana*** larvae.

The first instar larva:

Larva of this instar lasted 2.14 ± 0.01 (2.1 – 2.2), 1.7± 0.01 (1.6 – 1.8) and 0.67 ± 0.01 (0.66 – 0.75) days when reared on ***P. gossypiella*** at 22, 26 and30 °C (Table, 10) and 2.46 ± 0.01 (2.4 – 2.5), 1.7 ± 0.01 (1.6 – 1.72) and 0.81 ± 0.002 (0.79 – 83) days when rearing on ***E. insulan*** at the same temperatures, respectively (Table, 11 & Fig, 5).

The second instar larva:

This instar occupied 1.95 ± 0.01 (1.9 – 2), 1.64 ± 0.08 (1.6 – 1.65) and 0.62 ± 0.2 (0.58 – 0.66) days when reared on ***P. gossypiella*** full-grown larvae at 22, 26 and 30°C, respectively (Table, 10). While on full-grown larvae of ***E. insulana*** , the period of this instar lasted 1.87 ± 0.01 (1.79 - 1.8), 1.57 ± 0.009 (1.5 - 1.6) and 0.87 ± 0.005 (0.88 - 0.9) days at the same temperatures, respectively (Table, 11 & Fig, 5).

The third instar larva :

Data in Table (10) show that this instar occupy 2.47 ± 0.02 (2.45 - 2.5), 1.7 ± 0.01 (1.6 – 1.75) and 0.85 ± 0.004 (0.83 – 0.87) days by rearing on ***P. gossypiella*** larvae, respectively. When the parasitoid is reared on ***E. insulana*** this stadium elapses 1.77 ± 0.01 (1.75 – 1.8), 1.85 ± 0.01

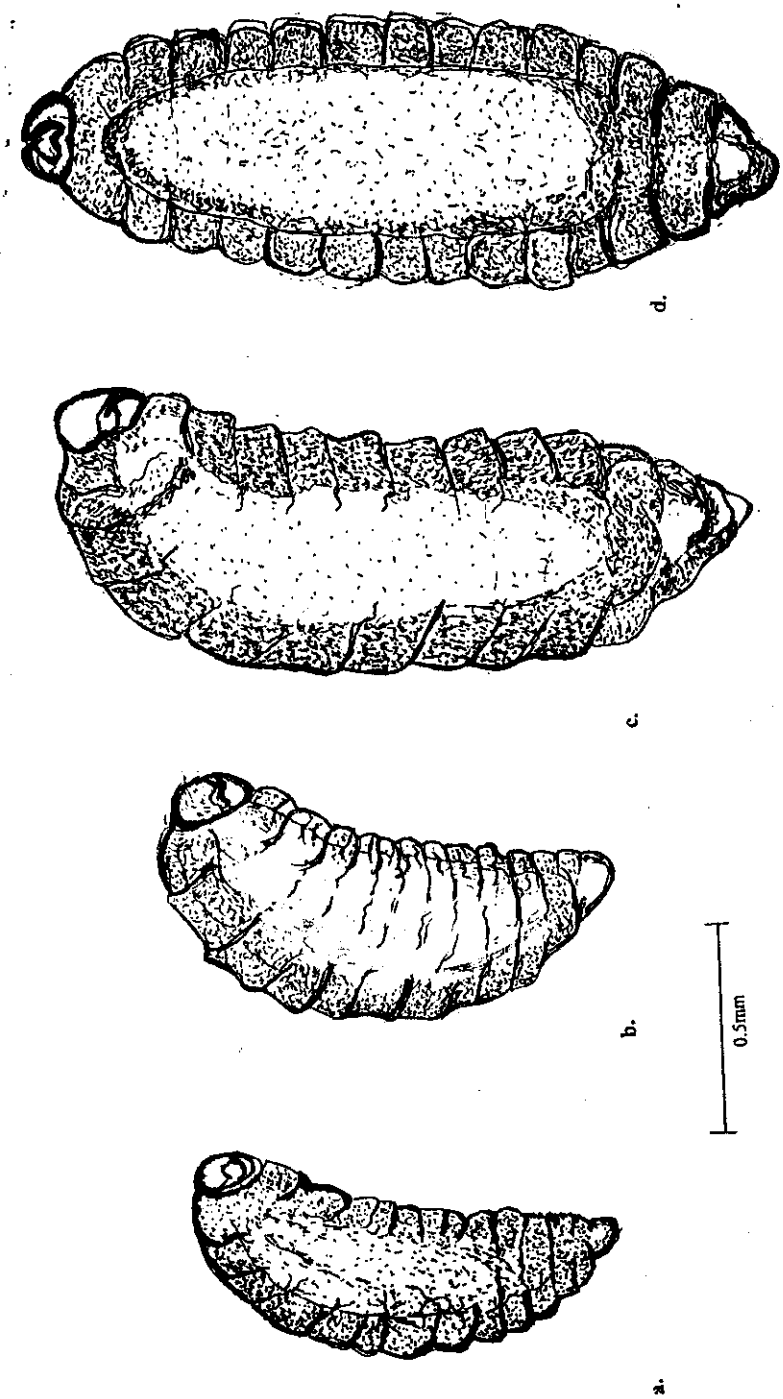


Fig (5): **Immature stage of *Dibrachys* sp.**
a- 1st instar larva.
b- 2nd instar larva.
c- 3rd instar larva.
d- 4th instar larva.

(1.83- 1.87) and 0.86 ± 0.02 (0.79 – 0.95) days, respectively, (Table 11) and Figs, 5 & 6.

The fourth instar larva

Under the same laboratory conditions, this instar has a duration of 2.6 ± 0.01 (2.6 – 2.8), 2.38 ± 0.01 (2.3 – 2.4) and 1.54 ± 0.01 (1.5 – 1.66) days on ***P. gossypiella*** as a host larva (Table,10)while on full-grown larva of ***E. insulana,*** this stadium elapses 2.72 ± 0.02 (2.6 – 2.8) , 2.43 ± 0.02 (2.4 – 2.46) and 1.5 ± 0.008 (1.5 – 1.6) days , respectively Table, 11 and Figs 5 & 6.

The total larval period

Data in Table (10) clarify the total larval period of ***Dibrachys* sp.** to last 8.79 ± 0.03 (8.6 – 9.11), 7.5 ± 0.01 (7.4 – 7.6) and 3.72± 0.01 (3.7 – 3.9) days when reared on pink bollworm larvae at 22, 26 and 30°C, respectively (Table, 10). But on ***E. insulana*** fullgrown larvae, the total larval period of the parasitoid has a duration of 9.27 ± 0.012 (9.21 – 9.37), 7.42± 0.013 (7.2 – 7.5) and 3.74 ± 0.001 (3.71 – 3.87) days, respectively, (Table, 11).

From these data, a negative correlation may be observed between the total larval period and temperature. i. e. with the two hosts , this period was decreased by increasing temperature from 22 to 30°C.

Pre–pupal period

At constant temperatures of 22, 26 and 30°C and 65 - 70 % R.H., the duration of pre–pupal stage lasted 2.14 ± 0.07 (2

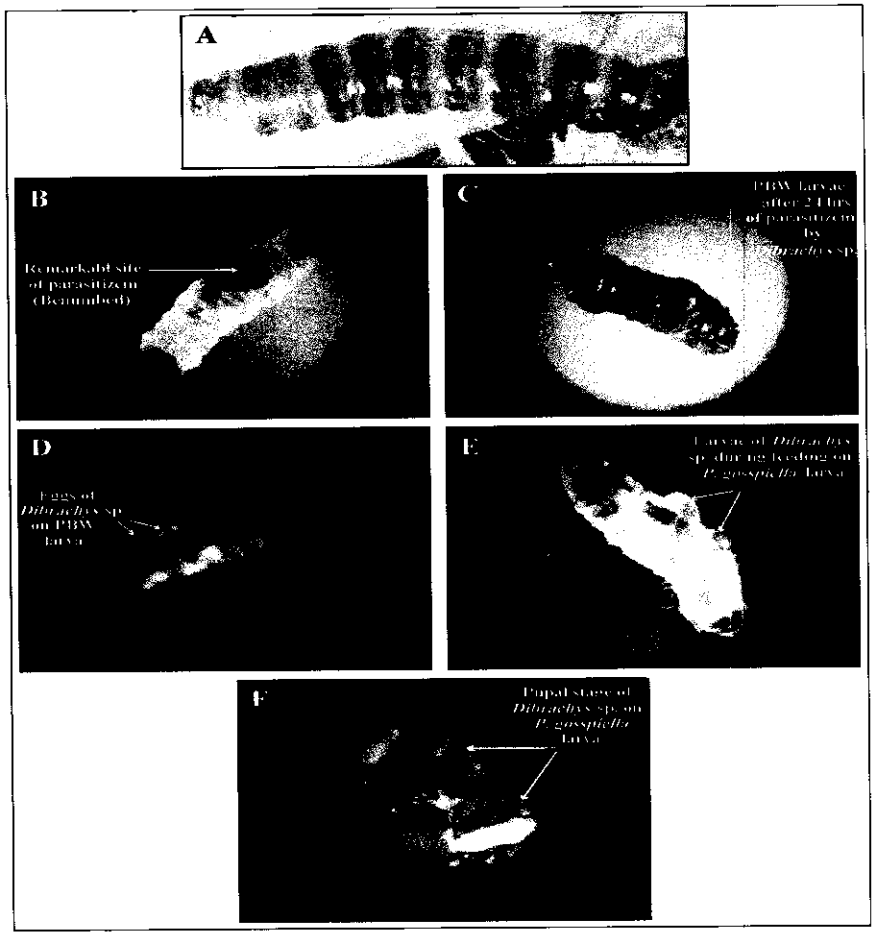


Fig. (6): Duration of immature stages *Dibrachys* sp on *P. gossypiella* larva.

A: Larva of *Pectinophora gossypiella* (Saund.) before Paralized by *Dibrachys*.

B: Larva of *P. gossypiella* after paralized by parasite.

C: Eggs of *Dibrachys* sp. on *P. gossypiella* larva.

D: Larvae of *Dibrachhys* sp. during feeding on *P. gossypiella* larva.

E: Pupal stage of *Dibrachys* sp. on *P. gossypiella* larva.

– 3) 1.44 ± 0.014 (1.3 – 1.5) and 0.73 ± 0.09 (0.7 – 0.75) days, respectively by rearing on ***P. gossypiella***. While, this duration was 1.44 ±0.001 (1.4 – 1.5), 1.23 ± 0.01 (1.2 – 1.3) and 0.74 ± 0.004 (0.71 – 0.75) days on full grown ***E. insulana*** larvae(Tables, 10 & 11). Fig (6 & 7)

Pupal period

Data in Tables, 10 & 11 show that the durations of ***Dibrachys* sp.**pupal stage . were 8.09 ± 0.06 (8 – 9) days, 6.2 ±0.05 (6 – 6.5) days and 3.4 ± 0.01 (3.4 - 3.6) days by reareing on ***P. gossypiella***, 7.3 ± 0.19 (5 – 8), 5.9 ± 0.15 (5 – 7) and 3.5 ± 0.01 (3.4 – 3.6) days, respectively, on ***E. insulana*** (Figs 6, 7).

Tótal develomental period :

At 22, 26 and 30°C and 65- 70 % R.H., the total developmental period of ***Dibrachys*** sp. (from egg deposition to adult emergence) lasts 22.07 ± 1.5 (20 – 22), 16.7 ± 0.77 (16.4 – 17) and 9.44 ± 0.316 (8.116 – 9.7) days on ***P. gossypiella***, while on ***E. insulana*** this period lasts 21.148 ± 1.487 (18 .73 – 21.79), 16.48 ± 0.707 (15.5 – 17.6) and 6.53 ± 0.66 (6.5 – 8.9) days, respectively.

These data indicate that the shortest total developmental period of the parasitoid ***Dibrachys* sp.** was recorded at 30°C and this duration prolonged by decreasing the temperature. Also, it could be, generally observed that this period was shorter by rearing on ***E. insulana*** than in cases of rearing on ***P. gossypiella***.

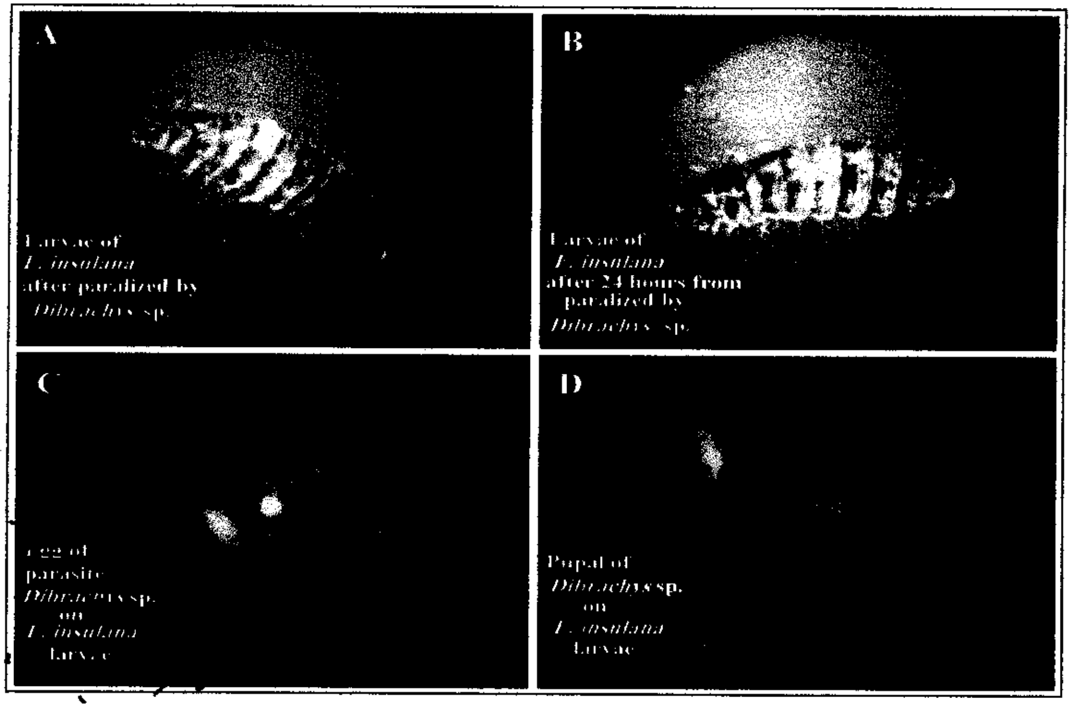


Fig. (7): Immature stages of *Dibrachys* sp., on *E. insulana* larvae.

Table (12): Duration of immature stages of ***Dibrachys* sp.** reared on pre-pupa & pupa of ***E. insulana*** at 26 °C & 65 – 70 % R. H.

Developmental Stage / Periods	Mean ± SE.	Range
Egg	2.6 ± 0.1	(2.5 – 2.9)
1st instar	1.83 ± 0.03	(1.79 – 1.87)
2nd instar	1.90 ± 0.02	(1.8 – 1.95)
3rd instar	1.78 ± 0.08	(1.6 – 1.8)
4th instar	2.70 ± 0.04	(2.6 – 5.8)
Total larval period	8.20 ± 0.02	(8.04 – 8.3)
Pre-pupa	1.50 ± 0.74	(1.4 – 1.58)
Pupa	7.976 ± 0.85	(7 – 8.9)
Total developmental period	20.34 ± 0.17	(18.83 – 21.48)

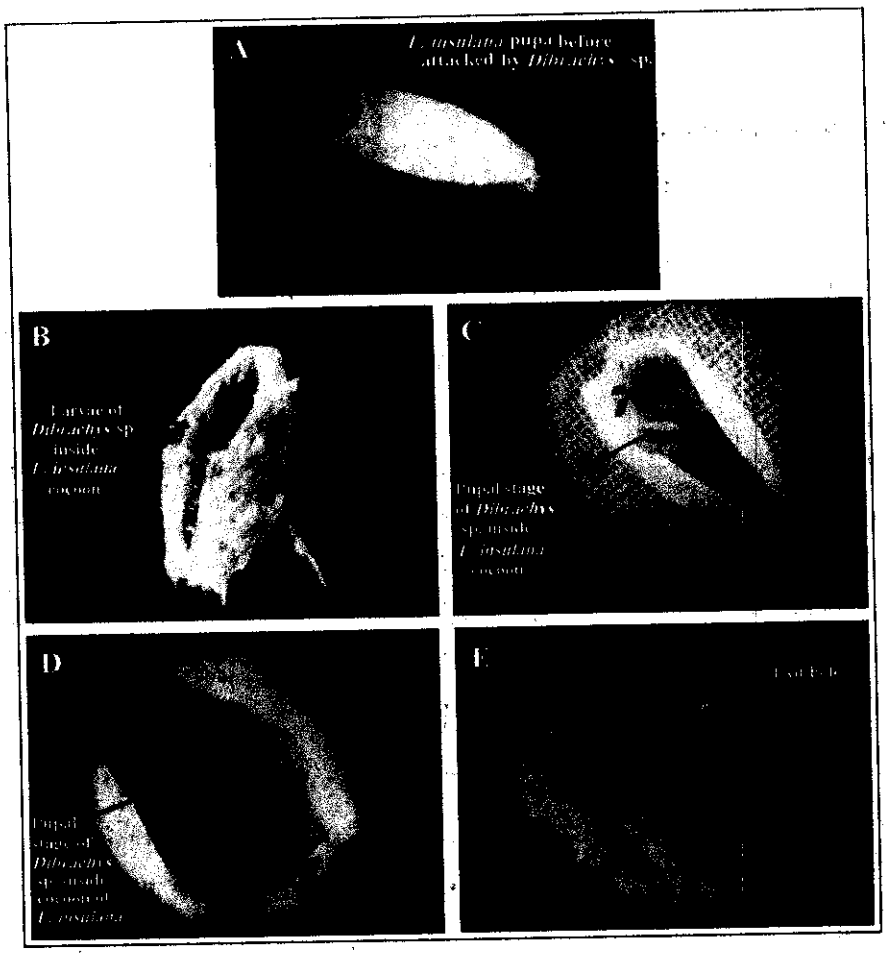


Fig. (9): *Dibrachys* sp. immature stages inside *E. insulana* cocoon.

The second instar larva

Data in (Table, 12) show that this instar occupies 1.9 ± 0.02 with a minimum 1.8 and a maximum 1.95 days.

The third instar larva:

This stadium elapses 1.78 ± 0.08 (1.6 – 1.8) days (Table 12).

The fourth instar larva:

The duration of the fourth instar larva at 26 ± 1°C and 65 - 75% R.H. last 2.7 ± 0.04 with a minimum of 2.6 and a maximum of 2.8 day.

The total larval period:

As shown in Table (12), the total larval period of ***Dibrachys* sp.** averages 8.2 ± 0.02 (8.04 – 8.3) day Fig (9).

Pre-pupal stage:

Data in Table (12) show that the duration of ***Dibrachys* sp.** prepupal stage inside spiny bollworm cocoon, lasts 1.5 ± 0.74 (1.45 – 1.58) day at the same laboratory conditions Fig (9).

Pupal stage

Data in Table (12) show that the duration of pupal stage of ***Dibrachys* sp.** lasted 7.976 ± 0.85 with a minimum of 7 and a maximum of 8.9 days under the laboratory conditions of 26°C and 65 - 70 % R .H., (Fig, 9).

Total developmental period:

The total developmental period of ***Dibrachys* sp.**, at 26°C and 65% R. H., when reared on ***E. insulana*** pupae, ranges between 18.83 and 21.48 days with an average of 20.34 ± 0.17 days (Table, 12).

IV-1-2-3-The relationship between kind of food offered to *Dibrachys* sp. adults, at different constant temperatures and their longevity and fecundity:

The longevity and fecundity of the parasitoid, ***Dibrachys* sp**. were investigated under laboratory conditions of 22, 26 and 30°C and 65 - 70% R .H. when adult were nourished by three different kinds of food; i .e., Protein + 10 % sucrose solution, 10% sucrose solution and water, to clarify the effects of adults' nutrition on egg reproductivity and adult longevity.

Ovipositional periods

Pre-oviposition period

Data in Table (13) show that the pre–oviposition period for mated female of ***Dibrachys* sp.** was prolonged by decreasing temperature. So, the longest pre–oviposition periods were 2.07 ± 0.06 (2 – 3), 2.13 ± 0.08 (2 – 3) and 2.0 ± 0.1 (0 – 3) days recorded at 22°C, when adults were fed on 10% sucrose + protin, 10% sucrose and water, respectively. While the shortest periods were recorded at 30°C, being 0.66 ± 0.12 (0 – 1), 0.8 ± 0.1 (0 - 1) and 0.26 ± 0.12 (0 – 1) days for females fed on the three artificial diets, respectively.

Table (13)): Ovipositional periods and number of eggs per mated female of *Dibrachys* sp. at different constant temperatures and different three types of food

Temperature	Different foods	Oviposition periods (days) Mean +S.E.			No. of eggs/female	
		Pre-ovipositon	Ovipositon	Post-ovipositon	Daily	Total
22°C	Type (1)	2.07 ± 0.1 a (2 - 3)	18.8 ± 0.38 a (17 - 21)	2.6 ± 0.13 (2 - 3)	10.244 ± 0.19 (6.76 - 11.64)	154.5 ± 3.6 a (128 - 173)
	Type (2)	2.13 ± 0.08 (2 - 3)	15.2 ± 0.27 a (13 - 17)	2.0 ± 0.0 (2 - 2)	8.15 ± 0.38 (6.33 - 11.56)	124.06 ± 6.4 (95 - 154)
	Type (3)	2.0 ± 0.13 (0 - 3)	3.06 ± 0.25 b (1 - 5)	1.66 ± 0.2 (1 - 3)	0.8 ± 0.5 (0.46 - 1)	6.212 ± 1.28 (1 - 12)
F. value		0.681	527.628 *			349.073 *
L. S. D. 5%		0.352	0.913			12.307
26°C	Type (1)	1.93 ± 0.06 (1 - 3)	14.46 ± 0.23 (11 - 14)	1.73 ± 0.1 (1 - 2)	13.25 ± 0.26 (11.14 - 14.66)	184.7 ± 3.07 (156 - 201)
	Type (2)	1.66 ± 0.12 (1 - 2)	12.2 ± 0.4 (10 - 17)	1.6 ± 0.13 (1 - 2)	10.95 ± 0.18 (8.69 - 11.14)	121.33 ± 17.3 (101 - 166)
	Type (3)	1.53 ± 0.3 (1 - 2)	2.26 ± 0.25 (1 - 4)	1.68 ± 0.15 (1 - 3)	0.95 ± 0.01 (0.9 - 1)	8.0 ± 1.3 (2 - 14)
F. value		4.015	238 *			706.32 *
L. S. D. 5%		0.342	1.279			954
30°C	Type (1)	0.66 ± 0.13 (0 - 1)	12.46 ± 0.4 (10 - 16)	0.8 ± 0.14 (0 - 1)	17.548 ± 0.47 (15 - 20.8)	216.6 ± 4.9 (188 - 265)
	Type (2)	0.8 ± 0.11 (0 - 1)	10.6 ± 0.37 (8 - 13)	0.66 ± 0.12 (- 1)	11.07 ± 2.15 (7.38 - 16.28)	154.6 ± 3.8 (96 - 158)
	Type (3)	0.26 ± 0.11 (0 - 1)	1.8 ± 0.19 (1 - 3)	1.2 ± 0.5 (0 - 2)	1.3 ± 0.076 (1 - 1.7	12.29 ± 2.79 (2 - 19)
F. value		0.323	227.15 *	0.69 *		486.6 *
L. S. D. 5%		0.335	1.021	0.349		14.137

type 1= protein + 10% sucros
type 2= 10% sucrose
type 3= water

Oviposition period

The oviposition period for mated female of ***Dibrachys* sp.** lasts 18.8 ± 0.38 (17 – 21) , 15.2 ± 0.27 (13 – 17) and 3.06 ± 0.25 (1 – 5) days when kept at 22 °C and fed on the three food types , respectively . While, when fed on protein + 10% sucrose solution, 10% sucrose solution and only water and kept at 26 °C, these periods lasted 14.46 ± 0.23 (11 – 14), 12.2 ± 0.4 (10 – 17) and 2.26 ± 0.25 (1 – 4) days, respectively. While at 30°C and by feeding on the same three diets, these periods were 12.46 ± 0.4 (10 – 16), 10.6 ± 0.37 (8 – 13) and 1.8 ± 0.19 (1 – 3) days, respectively (Table 13).

Post–oviposition

As shown in Table (13), the post–oviposition period of ***Dibrachys* sp.** females averaged 2.6 ± 0.13 (2 – 3), 2.0 ± 0.0 (2 – 2) and 1.66 ± 0.2 (1 – 3) days at 22°C. 26°C, this period was 1.73 ± 0.1 (1 – 2), 1.6 ± 0.13 (1 – 2) and 1.86 ± 0.15 (1 – 3) days. When adults were kept at a higher temperature of 30°C, the post–oviposition period lasted 0.8 ± 0.41(0 – 1), 0.66 ± 0.11 (0 – 2) and 1.2 ± 0.5 (0 – 2) days by feeding on protein + 10 % sucrose, 10 % sucrose and water, respectively.

Form the results in Table (13), It could be concluded that there was a negative relationship between the ovipositional periods of ***Dibrachys* sp.** females and temperature.

Number of doposited eggs / female:

Data in Table (13) reveal that the daily and total number of deposited eggs / female are affected by both the type of food offered to adult female and temperature. Concerning the

effect of food, it is clear that the highest daily mean number of eggs/female were recorded with females fed on protein + 10 % sucrose solution; being 17.548 ± 0.46 (15 – 20.8) 13.25 ± 0.25 (11.14 – 14.6) and 10.224 ± 0.19 (6.76 – 11.64) eggs at 30, 26 and 22°C, respectively .While, the lowest mean of daily number of eggs/female (1.3 ± 0.3, 0.95 ± 0.05 and 0.8 ± 0.21, respectively) was obtained when the ***Dibrachys* sp.** adults were fed on water only. The same trend could be observed for the total number of eggs deposited/females; i. e., the highest eggs' reproductivity (total of 216.6 ± 4.8, 184 ± 3.07 and 154.5 ± 3.7 eggs/female at 30, 26 and 22°C, respectively) was recorded from females fed on protein + 10% sucrose solution, and the lowest (12.29 ± 2.79, 8 ± 1.3 and 6.21 ± 1.28 eggs/female, respectively) was obtained when females were fed on water only. As shown in Table (13) feeding of adults on 10% sucrose solution without adding any protein led to satisfactory eggs' reproductivity, although the produced numbers of eggs/female were, significantly, less than those resulted in case of adding protein to the sucrose solution.

Adults' longevity.

Data in Table (14) reveal that the longest periods of ***Dibrachys* sp.**, females' longevity were 23.46 ± 0.36 (20 – 24), 16.2 ± 0.17 (15 – 17) and 13.93 ± 0.44 (12 – 18) days at 22, 26 and 30°C, respectively, when fed on protein + 10 % sucrose solution. While, the shortest periods were 8.3 ± 0.17 (7 – 10), 5.43 ± 0.23 (5 – 9) and 1.03 ± 0.23 (1 – 4) days at 22, 26 and 30°C, respectively, when females were supplied

Table (14): Longivity of adult mated male and female of *Dibrachys* sp. reared on different food types and at different constant temperatures.

temperature ℃	Different foods	Longevity(days) Mean ±S.E.	
		Male	Female
22	Type (1)	18.26 ± 0.31 a (15-19)	23.46± 0.36 a (20-24)
	Type (2)	14. 86 ± 0.31 b (13-17)	19.33 ± 0.25 b (17-21)
	Type (3)	6.45 ± 0.18c (6-9)	8.3± 0.17 c (7-10)
F. value		474.65	804.15
L. S. D. 5%		0.912	0.866
26	Type (1)	14.0+0.19 a(13-15)	16.2 ± 0.23a (15-17)
	Type (2)	12.8 +0.29b (11-14)	17.46 ± 1.39 b (14-20)
	Type (3)	4.31+0.74c (4-6)	5.43 ± 0.23 c (5-8)
F. value		5.34	325.04
L. S. D. 5%		0.68	1.114
30	Type (1)	10.66+0.22 a (9-123)	13.93 ± 0.44 a (12-18)
	Type (2)	9.066+0.23 b (8-10)	12.0 ± 0.35 b (10-14)
	Type (3)	0.51 ± 0.07 c (0-3)	1.03 ± 0.23 c (1-4)
F. value		254.17	444.283
L. S. D. 5%		0.956	0.578

Type (1): protein + sugar
Type (2): sugar solution
Type (3): water

with water (Table, 14). Longevity of males taken the same trend.

Data in Table (14) indicate also that the female live, generally for longer period than the male under both three types of diets and different temperatures. From these data, it is clear that the protein nutrition of adult females play an important role for increasing their egg production and consequently increases the rate of parasitism. From the same data, it could be concluded also that adults of the parasitoid ***Dibrachy* sp.** is better to be supplied with the artificial diet (protein + 10 % sucrose solution) at 30°C for assuring higher reproductivity of eggs by the parasitoid females and consequently production of higher numbers of the parasitoid.

IV-1-2-4-Reproduction potential and life table parameters:

Data in Table (15) and (Figs. 10 - 12) represents the effect of different food on life table parameters of ***Dibrachys* sp.** at 22, 26 and 30°C and 75 – 80 % R.H., respectively.

Data show that the multiplication per generation (Ro) increased as temperature increased from 22°C to 30°C when ***Dibrachys*** adults fed on water, sugar and protein. At 22°C (Ro) values were 0.285, 49.364 and 71.46 when ***Dibrachys*** adults fed on the three mentioned food types, respectively. At 26°C the same values were 1.307, 58.884 and 85.83 while at 30°C the values were 0.806, 45.74 and 95.24. In contrary, the mean generation time (T) decreased when temperature was

Table (15): Effect of different food source on life table Parameters of *Dibrachys* sp. at 22, 26 and 30°C and 65 - 70 % R.H.

Temperature / Parameters	22°C			26°C			30°C		
	Water	Sugar	Protein	Water	Sugar	Protein	Water	Sugar	Protein
Netre production rate (Ro)	0.285	49.364	71.46	1.307	58.884	85.83	0.806	45.74	95.24
Mean Generation Cine (T)	24.45	30.808	31.087	22.54	24.482	25.22	10.97	13.937	14.25
Intrinsic rate of increase (rm)	-5.125	0.126	0.137	1.867	0.166	0.176	1.96	0.274	0.319
Finite rate of increase (exprm)	0.95	1.135	1.147	1.012	1.18	1.193	0.981	1.316	1.377
Sex. ratio	0.6	0.6	0.6	0.56	0.56	0.56	0.48	0.48	0.48
Time to 50% mortality days	_	41.00	41.00	_	32.00	30.00	_	18.00	21.00

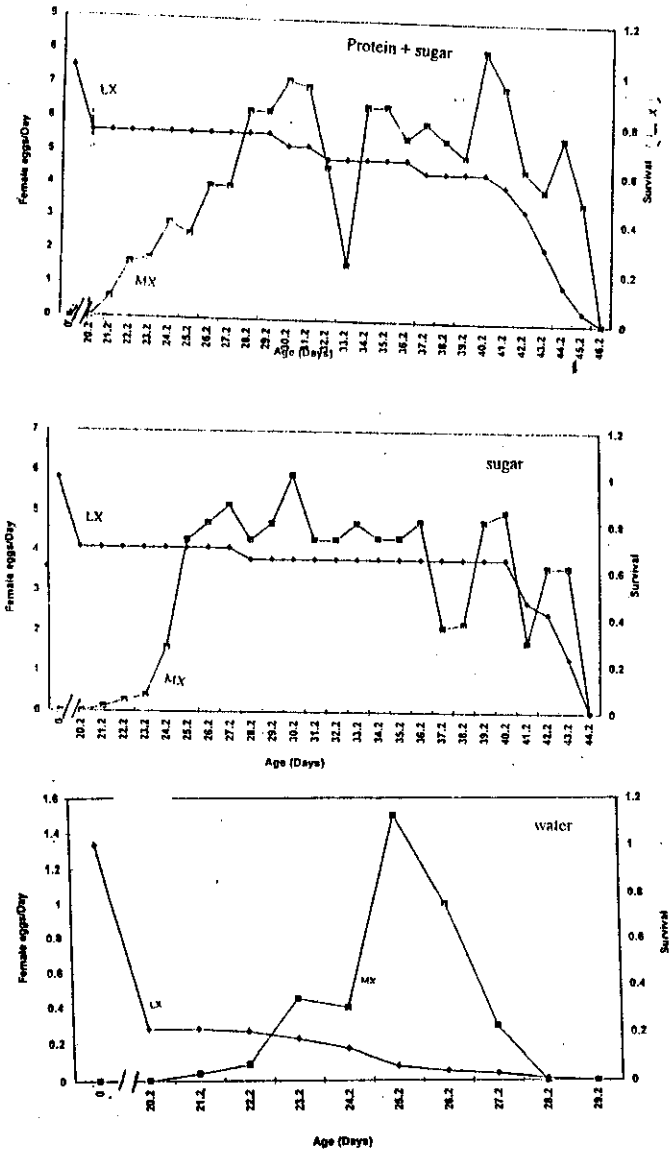


Fig. (10): Age specific fecundity and survivals of *Dibrachys* sp. feeding on different foods at 22 °C

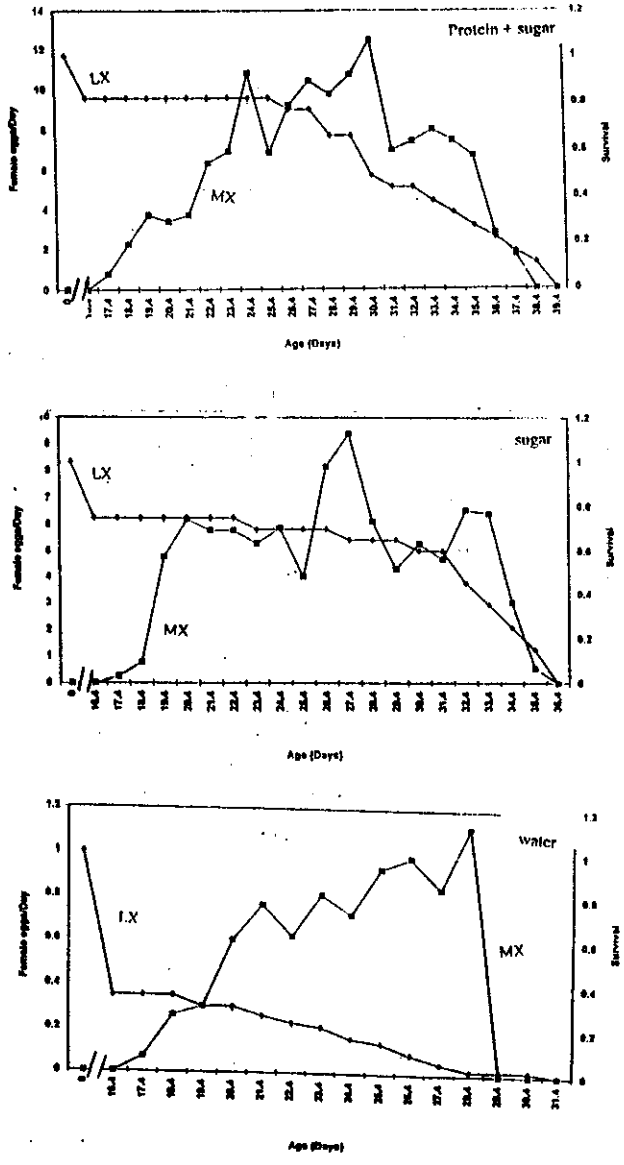


Fig. (11): Age specific fecundity and survivals of *Dibrachys* sp. feeding on different foods at 26 °C

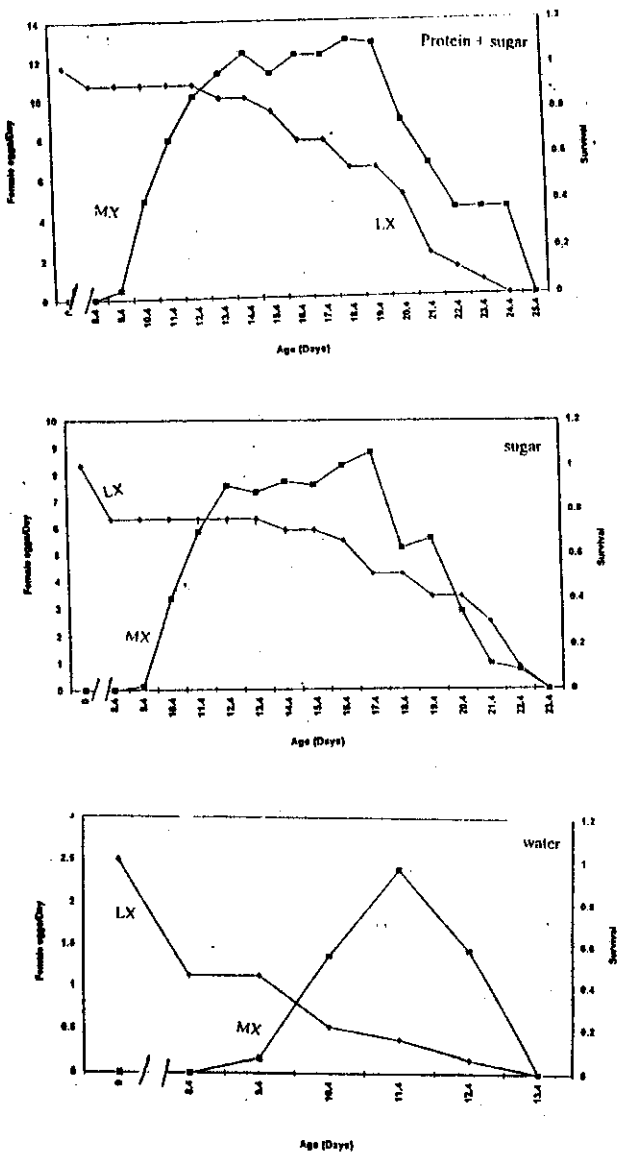


Fig. (12): Age specific fecundity and survivals of *Dibrachys* sp. feeding on different foods at 30 °C

increased, these values were 10.97, 13.937 and 14.25 at 30°C and 22.54, 24.482 and 25.22 at 26°C, while, at 22°C they were 15.45, 30.808 and 31.087, when ***Dibrachys*** adults were fed on water, sugar and protein, respectively.

The (rm) values were -5.125, 0.126 and 0.137 at 22°C and were -1.867, 0.166 and 0.176 at 26°C, while they were -1.96, 0.274 and 0.319 at 30°C when ***Dibrachys*** **sp.** fed on water, sugar and protein, respectively. The finite rate of increase (exp rml values) were approximately similar at 22, 26 and 30°C (Table 15). These values were 0.923, 1.135 and 1.147 at 22°C and 1.011, 1.181 and 1.193 at 26°C while they were 0.981, 1.315 and 1.376 at 30°C when ***Dibrachys*** adults fed on water, sugar and protein, respectively.

The sex ratio (♀: ♂) did not differ when the parasitoid fed on water, sugar and protein. Ratios were 0.6, 0.56 and 0.48 at 22, 26 and 30°C, respectively.

Time to 50% mortality (days) decreased when temperatures were increased from 22°C to 30°C. These values were 42, 30.4 and 30 days when ***Dibrachys*** adults were fed on protein at 22, 26 and 30°C, respectively (Table 15). These values were 40, 32 and 18.4 days when the parasitoid adults fed on sugar solution at 22, 26 and 30°C, respectively.

It is clearly obvious that feeding ***Dibrachys*** adults on protein gave a remarkable reprodution potential at 30°C followed by 26 and 22°C. Sugar solution is considered moderate source of food affecting on reproduction while water probably considered as low source of food to reared parasitoid under the three experimental constant temperature.

IV-2-Bionomics and feeding capacity of some predaceous insect species:

IV-2-1-*Hippodamia tredecimpunctata:*

IV-2-1-1-Durations of immature stages:

The durations of immature stages were studied under laboratory conditions of 26 ± 1°C and 65 - 70% RH.

Egg stage:

As shown in Table (16), the incubation period of ***H. tredecimpunctata*** eggs averaged 2.8 ± 0.55 (2 - 3) days when reared on ***P. gossypiella*** eggs and 3.86 ± 0.1 days with a minimum of 3 days and a maximum of 4 days when fed on ***E. insulana*** eggs.

Larval stage:

By feeding the larvae of ***H. tredecimpunctata*** on ***P. gossypiella*** eggs the durations of its four larval instars were 2.9 ± 0.06 (2 - 3), 2.6 ± 0.13 (2 - 3), 2.2 ± 0.15 (2 - 3) and 3.6 ± 0.12 (3 - 4) days for the 1st, 2nd, 3rd, and 4th instars, respectively. While, when ***H. tredecimpunctata*** fed on ***E. insulana*** eggs, these periods were 2.95 ± 0.11 (3 - 4), 3.38 ± 0.11 (3 - 4), 2.05 ± 0.5 (2 - 3) and 3.57 ± 0.05 (2 - 3) days, respectively (Table, 16).

From these data it is clear that the fourth instar larva of ***H. 13-punctata*** has the longest durationperiod than the remaining three instars.

Concerning, the total larval period, Table (16) shows that this period was 11.4 ± 0.24 (9 - 13) and 11.92 ± 0.08

Table (16): Length, in days, of immature stages of *H. tredecimpunctata* when fed on *P. gossypiella* and *E. insulana* eggs in laboratory at 26+ 2°C and 65-70%R.H.

Stage		Durations in days (Average±S. E.)	
		On *P. gossypiella* eggs	On *E. insulana* eggs
Eggs (incubation period)		2.8 ± 0.55 (2 - 3)*	3.86±0.1 (3 - 4)
Larvae	1st instar	2.9±0.06 (2 - 3)	2.95±0.11(3 - 4)
	2nd instar	2.6±0.13 (2 - 3)	3.38±0.11(3 - 4)
	3rd instar	2.2±0.15 (2 - 3)	2.05±0.05 (2 - 3)
	4th instar	3.6±0.12 (3 - 4)	3.57±0.05 (2 - 3)
Total larval period		11.4±0.24 (9 - 13)	11.92±0.1(11 - 13)
Pre pupa period		1.25±0.13 (1 - 2)	1.89±0.08 (1 - 2)
Pupal period		4.44±0.12 (4 - 5)	7.21±0.09 (7 - 8)
Total period of immature stage		17.15 ± 0.18 (16 - 19)	22.3 ± 0.8 (19 - 23)

* Duration range (days).

(11 – 13) days when larvae were reared on ***P. gossypiella*** and ***E. insulana*** eggs, respectively.

Butler and Dickerson (1972) found that the duration of larval stage of ***H. convergens*** lasted 17.2, 15.1, 15.2, 11.2, 8.9, 8.7 and 7.4 at 15.20, 22, 25, 28, 30, 33, and 37°C, respectively.

In this respect, **Henneberry and Clayton (1985)** found that the larval duration of ***Hippodamia convergens*** from first-instar to pupae was 9.8 days when fed on ***P. gossypiella*** eggs, while **Mousa (1998)** indicated that the larval stage of ***Hippodamia tredecimpunctata*** lasted 22.06 ± 3.42; 16.38 ± 1.56; 19.68 ± 2.64; 18.20 ± 1.94 and 17.23 ± 1.49 days when offered five artificial diet.

Pre-pupal period:

The effect of the kind of prey offered to ***Hippodamia tredecimpunctata*** larvae on duration of pre-pupa is presented in (Table, 16). These data revealed that the pre-pupal period last 1.25 ± 0.13 (1 - 2) and 1.89 ± 0.08 (1 - 2) days when the larvae were fed on the eggs of ***P. gossypiella*** and ***E. insulana***, respectively.

Pupal period:

By feeding the predator larvae on ***P. gossypiella*** and ***E. insulana*** eggs, the pupal period of ***H. tredecimpunctata*** last 4.44 ± 0.506 (4 - 5) days and 7.21 ± 0.09 (7 - 8) days with an average of 7.21 ± 0.418, respectively.

Mousa (1998) indicated that the pupal stage of ***H. tredecimpunctata*** has an average duration of 4.87 ± 0.80;

3.96 ± 0.5; 4.80 ± 7.40; 4.50 ± 0.62 and 41.12 ± 1.20 days when fed on five-artifiical diets.

Also, **Butler and Dickerson (1972)** studied the duration of pre-pupal and pupal stage of ***H. convergens*** at several constant temperatures (15, 20, 22.8, 25.0, 28.9, 30.0, 33.9 and 37.2°C) and they found that the durations of the pre-pupa lasted 1.7 ± 0.7, 1.4 ± 0.5, 1.3 ± 0.8, 1.0 ± 0.0, 1.0 ± 0.0 and 1.0 ± 0.0 days. While, the pupal stage lasted 11.9 ± 1.1, 6.6 ± 0.5, 6.3 ± 0.4, 5.4 ± 0.5, 5.6 ± 0.7, 3.4 ± 0.7, 3.0 ± 0.2 and 2.7 ± 0.4 days, respecively.

Total developmental period of immature stages:

As shown in Table (16), the total immature period of ***H. tredecimpunctata*** last 17.15 ± 0.18 (16 - 19) days when fed on ***P. gossypiella*** eggs and 22.3 ± 0.32 (19 - 23) days when fed on ***Earias insulana*** eggs.

From the above mentioned results, it could be concluded that the egg and larval periods of ***H. tredecimpunctata*** were nearly, equal when feeding on eggs of ***P. gossypiella*** or ***E. insulana***. While, the pupal duration was clearly longer on ***E. insulana*** eggs than on ***P. gossypiella*** eggs and consequently the total developmental period of immature stages lasted longer period by rearing on ***E. insulana*** than on ***P. gossypiella*** eggs.

IV-2-1-2-Feeding capacity of *H. tredecimpunctata* larvae on *P. gossypiella* and *E. insulana* eggs:

The consumption rates of ***H. tredecimpunctata*** larvae on ***P. gossypiella*** and ***E. insulana*** eggs under the same

previously mentioned conditions are presented in Tables (17 & 18).

First instar larva:

When feeding on ***P. gossypiella*** eggs, the larva of ***H. tredecimpunctata*** consumed 14.5 ± 0.36 (11 - 16), 27.7 ± 0.3 (24 - 29), 19.84 ± 0.7 (17 - 23) eggs/day throughout the three days of this stadium, respectively.

While, in case of larval feeding on ***E. insulana*** eggs, the 1st instar larva consumed 6.71 ± 0.47 (3 - 9), 14.09 ± 0.39 (12 - 17) and 2.95 ± 0.35 (1 - 7) eggs/day throughout its developmental days, respectively. The total consumption of eggs throughout this larval instar was 59.98 ± 1.39 (44 - 67) and 23.62 ± 0.5 (20 - 28) eggs when fed on ***P. gossypiella*** and ***E. insulana*** eggs, respectively. From the above-mentioned data it could be concluded that ***H. tredcimpunctata*** 1st instar larvae feeds on higher numbers of ***P. gossypiella*** than ***E. insulana*** eggs. This may be due to the larger size of ***E. insulana*** eggs than that of ***P. gossypiella***.

The second instar:

Daily consumption of the second larval instar of ***H. tredecimpunctata*** on eggs of ***P. gossypiella*** averaged 57.74 ± 0.74 (29 - 65), 71.55 ± 2.6 (28 - 89) and 27.7 ± 0.48 (25 - 30) eggs/larva, respectively with a total of 144.7 ± 2.7 (112 - 154) eggs, (Table, 17).

While, in case of feeding on ***E. insulana*** eggs, the daily egg consumption was 18.28 ± 0.53 (16 - 21), 24.76 ± 0.92 (23 - 30), 11.47 ± 0.38 (9 - 15) and 4.12 ± 0.43 (2 - 7) eggs/larva

Table (17): Consumption of *P. gossypiella* eggs by larvae of *H. trdecimpunctata* at 26 ± 1°C and 65 – 70% R. H.

Larval stage	Consumed *P. gossypiella* aggs				
	1st day	2nd day	3rd day	4th day	Total consumption
1st instar	14.5 ± 0.36 (11 – 16)*	27.7 ± 0.3 (24 – 29)	19.84 ± 0.7 (17 – 23)	-	59.98 ± 1.3 (44 – 67)
2nd instar	57.7 ± 0.74 (29 – 65)	71.55 ± 2.6 (28 – 83)	27.7 ± 0.48 (25 – 30)	-	144.7 ± 2.7 (112 – 154)
3rd instar	113.22 ± 3.16 (106 – 130)	135.5 ± 0.95 (128 – 141)	36.11 ± 1.25 (54 – 68)	-	254.66 ± 12.12 (128 – 318)
4th instar	159.37 ± 1.05 (157 – 180)	188.96 ± 1.28 (186 – 210)	203.31 ± 3.25 (148 – 211)	87.22 ± 1.36 (70 – 95)	206.26 ± 16.78 (343 – 645)

Total consumption during the total larval period = 1061.2 ± 26.69 (663 – 1167) eggs.

***Range of consumed *P. gossypiella* eggs**

Table (18): Consumption of *E. insulana* eggs by larvae of *H. trdecimpunctata* at 26 ± 1°C and 65 – 70% R. H.

Larval stage	Consumed *E. insulana* aggs				
	1st day	2nd day	3rd day	4th day	Total consumption
1st instar	6.71 ± 0.47 (3 – 9)*	14.04 ± 0.39 (12 – 17)	2.95 ± 1.43 (1 – 7)	-	23.62 ± 0.5 (20 – 28)
2nd instar	18.78 ± 0.33 (16 – 21)	24.76 ± 0.94 (23 – 30)	11.47 ± 0.38 (9 – 15)	4.12 ± 0.43 (2 – 7)	55.9 ± 0.94 (49 – 63)
3rd instar	40 ± 0.53 (37 – 43)	51.33 ± 0.92 (47 – 57)	3.5 ± 1.14 (0 – 7)	-	91.4 ± 1.08 (78 – 100)
4th instar	65.52 ± 1.63 (51 – 80)	78.47 ± 0.23 (69 – 97)	86.76 ± 1.6 (71 – 88)	10.45 ± 0.56 (7 – 13)	134.8 ± 3.2 (210 – 265)

Total consumption during the total larval period = 406 ± 3.96 (377 – 439) eggs.

*Range of consumed *E. insulana* eggs

throughout the successive days of this instar, respectively. The total number of eggs consumed by a larva throughout this instar was 55.9 ± 0.94 (49 - 63) eggs Table (18).

The third instar:

The third instar larva of ***H. tredecimpunctata*** consumes 113.22 ± 3.16 (106 -130), 135.5 ± 0.95 (128 - 141) and 63.11 ± 1.25 (54 - 68) eggs of ***P. gossypiella***/day during the three days of this instar, respectively, compared to 40 ± 0.53 (37 - 43), 51.33± 0.92 (39 - 57) and 3.5 ± 1.1 (0 - 7) eggs/larva/day, respectively. In case of feding on ***E. insulana*** eggs. The total consumption of eggs throughout this instar was 254.66 ± 12.12 (128 - 318) and 91.4 ± 1.08 (78 -100) eggs for ***P. gossypiella*** and ***E. insulana***, respectively (Tables 17 &18).

Fourth instar:

Daily consumption of ***P. gossypiella*** eggs by the 4th instar larva of ***H. tredecimpunctata*** averaged 159.37 ± 1.05 (157 - 180), 188.96 ± 1.28 (186 - 210), 203.31 ± 3.25 (148 - 211) and 87.22 ± 1.36 (70 - 95) eggs/larva/day. While, in case of feeding on ***E. insulana*** eggs these values were 65.5±1.63 (51-80), 78.47 ± 0.23 (69 - 97), 86.76 ± 1.6 (71 - 88) and 10.45 ± 0.56 (7 - 13) eggs/larva/day, respectively. The total number of consumed eggs throughout the whole period of 4th instar larva averaged 602.26 ± 16.78 (343 - 645) and 234.8 ± 3.2 (210 - 265) eggs of ***P. gossypiella*** and ***E. insulana***, respectively (Tables, 17 & 18).

Total consumption throughout the larval stage:

Throughout the whole period of the larval stage the larva of ***H. tredecimpunctata*** consume an average of 1061.2 ± 26.69 (663 - 1167) eggs of ***P. gossypiella*** and 406 ± 3.96 eggs of ***E. insulana*** with a minimum of 377 and a maximumof 439 eggs (Tables, 17&18).

The presented data indicate that the larvae of this predator consume much more eggs of ***P. gossypiella*** (more than two times) than ***E. insulana*** eggs. This higher number of eggs consumed may attributed to the smaller size of ***P. gossypiella*** eggs than those of ***E. insulana***.

In a similar study, **Henneberry and Clayton (1985)** found that during the whole larval period of ***Hippodamia convergens***, the larva consumed from 633 to 777 eggs of ***P. gossypiella***.

Adult stage:

Under laboratory conditions of 26 ± 1°C and 65 - 70% R. H. and by feeding ***H. tredecimpunctata*** adults on eggs of pink bollworm, the adult male lived for 48.94 ± 1.4 (38 - 63) days, while the female life-span lasted 62.11 ± 0.87 days with a minimum of 55 and maximum of 67 days (Table, 19).

Also, as shown in the same table and throughout adult life-span, the adult male of ***H. tredecimpunctata*** consumed a total number of 3171.9 ± 139.9 ***P. gossypiella*** eggs with a minimum of 2386 and a maximum of 4083eggs, while the adult female fed more amounts of ***P. gossypiella*** eggs (4480.89 ± 76.34) with a range (3655 - 5102). The daily mean number of consumed eggs was estimated as 65.4 ± 0.76

Table (19): Feeding capacity of *H. 13-punctata* adults on *P. gossypiella* eggs in laboratory at 26 ± 1 °C and 65 -70 % R. H.

Adult No.	males			Adult No.	females		
	Life-span (days)	Total No. of consumed eggs	Mean consumed eggs/day		Lifespan (in days)	Total No. of consumed eggs	Mean consumed eggs/day
1	39	2454	62.92	1	55	3655	66.45
2	44	2560	58.2	2	56	4369	78
3	38	2386	62.78	3	56	4363	77.9
4	43	2759	64.16	4	63	4733	75.13
5	42	2692	68.34	5	63	4690	74.44
6	42	2544	64.97	6	64	4227	66.04
7	50	3185	63.7	7	60	4206	70.1
8	56	3603	64.34	8	63	4383	69.57
9	50	3323	66.47	9	67	4270	70
10	59	3846	68.2	10	67	4911	73.3
11	50	3264	65.29	11	64	4502	70.3
12	57	3840	67.37	12	62	4383	70.7
13	40	2806	70.14	13	60	4620	77
14	42	2969	70.7	14	60	4242	70.7
15	57	3590	62.6	15	66	5102	77.3
16	60	4019	66.99	16	66	4653	70.5
17	63	4083	64.85	17	63	4744	75.3
				18	63	4603	73.06
Mean ± S.E.	48.94 ± 1.4	3171.9 ± 139.9	65.4 ± 0.76	Mean ± S.E.	62.11 ± 0.87	4480.89 ± 76.34	72.54 ± 0.88

(62.058.2 – 70.7) eggs/male/day and 72.54 ± 0.88 (66.04 – 75.44) eggs/female/day Table (19).

On the other hand, when adults were reared on ***E. insulana*** eggs, the male lived for 41.16 ± 0.34 days with a minimum of 37 and a maximum of 44 days, while the female life-span lasted 51.16 ± 1.09 days (38 - 58) days/femal Table (20). Throughout its life span, the adult male of ***H. tredecimpunctata*** consumed a total number of 1919.9 ± 32.4 ***E. insulana*** eggs with a minimum of 1702 and a maximum of 2199 eggs. But female consumed more amounts of eggs (2834.6 ± 92.36; 2152 – 3973 eggs) (Table, 20).

The daily overall mean number of consumed eggs was estimated as 46.65 ± 0.79 (40.52 - 50.97) eggs/ male/ day and 54.05 ± 0.44 (51.33 - 54.17) eggs/ female/ day, Table (20).

In general, These results indicated that the females of ***H. tredecimpunctata*** lived for a longer period than males on either of the two preys . Also, the female adults' longevity of ***H. tredecimpunctata*** was longer on ***P. gossypiella*** than on ***E. insulana*** eggs and this was opposite to results obtained in case of larvae .

Concerning the feeding capacity of adults, it is clear that the female adults ***H. tredecimpunctata*** consumed higher number of eggs than male . Also, both male and female consumed higher amounts of ***P. gossypiella*** eggs than ***E. insulana*** eggs. The consumption of higher amounts of ***P. gossypiella*** eggs than ***E. insulana*** may be due to the difference in the size of egg which is larger in case of the latter prey than the farmer one.

Table (20): Feeding capasity of *H. 13-punctata* adults on *E. insulana* eggs in the laboratory at 26±1°C and 65 - 70% RH.

Adult no.	Male			Adult no.	Female		
	Life span (days)	Total no of consumed eggs	Mean consumed eggs/day		Life span (days)	Total no of consumed eggs	Mean consumed eggs/day
1	42	2142	50.97	1	58	3374	53.17
2	42	1870	44.52	2	51	2787	54.65
3	41	2050	50.00	3	51	2738	53.68
4	42	1702	40.52	4	55	2906	52.83
5	42	1839	43.78	5	46	2649	57.58
6	42	1821	43.36	6	49	2678	54.65
7	42	1891	45.02	7	56	3134	55.96
8	41	1885	45.98	8	50	27 86	55.72
9	42	1831	43.59	9	49	2600	53.06
10	41	1899	46.32	10	47	2364	50.29
11	41	1884	45.95	11	55	2881	52.38
12	42	1900	45.24	12	51	2744	53.80
13	44	2199	49.97	13	53	2866	54.07
14	41	1905	46.46	14	56	3973	53.09
15	39	2189	56.13	15	49	2735	55.82
16	39	1807	46.33	16	56	3038	54.25
17	41	1910	46.58	17	51	2618	51.33
18	41	2018	49.22	18	38	2152	56.63
19	37	1719	46.46	-	-	-	
Total	782	36461	886.4	Total	921	51023	972.96
Mean ± S. E.	41.16 ±0.34	1919.0 ± 32.4	46.65 ± 0.79	Mean ± S. E.	51.16 ± 1.09	2834.6 ± 92.35	54.05 ± 0.44

Eggs – laying activity.

Data in Table (21) show that when ***H. tredecimpunctata*** was reared on ***P. gosspiella*** eggs, the adult female of ***H. tredecimpunctata*** started egg–laying after a pre–oviposition period of 4.94 ± 0.15 (4 – 6) days at 26 ± 1°C and (65 – 70) % R. H. Under the same conditions, the oviposition period lasted 51.16 ± 0.7 days with a minimum of 43 and a maximum of 54 days . Throghout this period, a single mated female deposited an average of 836.6 ± 18.1 eggs (716 – 1021). The mean number of eggs deposited /day / female ranged from 13.26 to 22.196 eggs with an average of 16.46 ± 0.51 eggs / female / day. (Table, 21) . The post – oviposition period lasted 4.66 ± 0.6 with a minimum 4 and a maximum 6 days.

While, by feeding of ***H. tredecimpunctata*** adults on ***E. insulana*** eggs, the pre–oviposition, oviposition and post–oviposition periods were 5.25 ± 0.21 (4 – 7), 44.15 ± 0.48 (26 – 48) and 4.9 ± 0.42 (2 – 7) days, respectively. Throughout the oviposition period a single mated female deposites an average total of 377.85 ± 10.0 (219 – 460) eggs. While, the mean daily number of deposited eggs was 15.75 ± 0.21 eggs/female with a minumum of 14.58 and a maximum of 17.04 eggs.

Mousa (1998) reported that the averages of female longevity and mean number of deposited eggs/female of ***H. tredecimpunctata*** were (63.67 ± 5.89 days ; 125.86 ± 2.48 eggs) ; (75.74 ± 6.23 days ; 285.30 ± 7.42 eggs) ; (70.61 ± 6.45 days ; 195.36 ± 6.14 eggs) when feeding on five artifiticial diets, respectively. While, the averages of male

Table (21): Preoviposition, oviposition , post-oviposition periods , longevity (day) and total number of eggs produced/female of *H. 13-punctata.*

Period	On *P. gossypiella* (average ± S. E.)	On *E. insulana* (average ± S. E.)
Pre-oviposition	4.94 ± 0.15 (4 - 6)	5.25 ± 0.21 (4 - 7)
Oviposition	51.16 ± 0.7 (43 - 54)	44.15 ± 0.48 (26 - 48)
Post-oviposition	4.66 ± 0.6 (4 - 6)	4.9 ± 0.42 (2-7)
Total eggs/female	836.6 ± 18.1 (716 - 1021)	377.85 ± 10.0 (219 - 460)
Mean no. of egg daily	16.46 ± 0.51 (13.26 - 22.169)	15.75 ± 0.21 (14.58 - 17.04)

longevity were 52.38 ± 4.60; 63.74 ± 5.36; 65.84 ± 3.99; 51.32 ± 4.5 and 58.37 ± 5.26 days on the previously mentioned five artificial diets. **Clausen (1915)** found that the greatest number of eggs being secured from a single ***H. convergens*** was 409 eggs, and the maximum number of eggs deposited by a single female in one day was 43 eggs.

IV-2-2-*Coccinella undecimpunctata L.*

Another experiment was carried out to estimate the developmental periods and feeding capacity of ***C. undecimpunctata*** when fed on ***P. gossypiella*** and ***Earias insulana*** eggs .

IV-2-2-1-Duration of immature stages:

Egg stage

At the same a forementioned conditions of 26 ± 1°C and 65 - 70% R.H., the eggs incubation period of ***C. undecimpunctata*** lasted 2.77 ± 0.3 (2 – 4) days when fed on ***P. gossypiella*** eggs and 3.63 ± 0.12 (3 – 4) days when fed on ***E. insulana*** eggs (Table 22).

These data indicate that this period was longer on ***E. insulana*** than on ***P. gossypiella*** eggs.

Larval stage:

By feeding larvae on ***P. gossypiella*** eggs , the durations of first , second , third and fourth instars lasted 2.59 ± 0.1 (2 – 3) , 2.68 ± 0.14 (3 – 4) , 3.86 ± 0.08 (2 – 3) and 2.73 ± 0.1 (2 – 4) days, respectively (Table 22) . These results, indicate that the third larval instar occupied the longest period

Table (22): Duration (in days) of immature stages of *C. undecimpunctata* when fed on *P. gossypiella* and *E. insulana* eggs in laboratory at 26+1°C and 65 - 70%R.H.

Stage		Durations in days (Average±S. E.)	
		On *P. gossypiella* eggs	On *E. insulana* eggs
Egg (incubation period)		2.77± 0.3 (2 - 4)*	3.63 ± 0.12 (3 - 4)
Larva	1st instar	2.59±0.1(2 - 3)	2.84±0.11(2 - 3)
	2nd instar	2.68±0.14 (3 - 4)	3.78±0.1(3 - 4)
	3rd instar	3.86±0.08 (2 - 3)	2.89±0.07 (2 - 3)
	4th instar	2.73±0.1(2 - 4)	3.3±0.11(3 - 7)
Total larval period		11.9±0.19 (10 - 13)	12.84±0.14 (12 - 14)
Pre pupal period		1.04±0.12 (1 - 2)	1.68±0.12 (1 - 2)
Pupal period		4.95±0.19 (4 - 6)	5.63±0.12 (5 - 7)
Total developmental period		18.14±0.15 (17 - 19)	20.62±0.5 (19 - 23)

*Duration range (days)

followed by the fourth and the second instars, while the first instar occupied the shortest duration.

On the other hand, when *C. undecimpunctata* was fed on *E. insulana* eggs, the durations of the 1 *st*, second , third and fourth instars lasted 2.84 ± 0.11 (2 – 3), 3.78 ± 0.1 (4 - 3), 2.89 ± 0.07 (2 - 3) and 3.3 ± 0.11 (3 – 7) days. From these results, it is clear that the second and fourth instar larvae occupied the longest period .

Total larval period

The total larval period occupied 11.9 ± 0.19 days with a minimum of 10 days and a maximum of 13 days by feeding on *P. gossypiella* eggs, opposed to 12.84 ± 0.14 (12 – 14) days in case of rearing on *E. insulana* eggs. These data indicate that the total larval period of *C. undecimpunctata* was longer by rearing on *E. insulana* than on *P. gossypiella* eggs(Table 22).

Pre–pupa

This stage has a duration of 1.04 ± 0.12 (1 – 2) and 1.68 ± 0.12 with a minimum of 1 and a maximum of 2 days when larvae were reared on *P. gossypiella* and *E. insulana* eggs, respectively (Table,22).

Pupal period

The pupal period of *C. undecimpunctata* lasted 4.95 ± 0.19 (4 – 6) days and 5.63 ± 0.12 (5 – 7) days when fed on *P. gossypiella* and *E. insulana*, respectively (Table, 22).

From these data, it could be concluded that the larvae of *C. undecimpunctata* consumed more amounts of *P. gossypiella* eggs than those recorded on *E. insulana* eggs, and that the pre-pupal and pupal periods of *C. undecimpunctata* lasted longer time when their larvae fed on *E. insulana* than on *P. gossypiella*.

Total developmental period of immature stages:

As shown in Table (22), the total immature stages of *C. undecimpunctata* lasted 18.14 ± 0.15 (17 – 19) days when fed on *P. gossypiella* eggs and 20.62 ± 0.5 (19 – 23) days when fed on *E. insulana* eggs.

From the above mentioned results, it could be concluded that the total developmental period of immature stages lasted longer period by rearing on *E. insulana* than on *P. gossypiella*.

IV-2-2-2-Consumption of pink bollworm and spiny bollworm eggs by C. *undecimpunctata* larvae .

Consumption of *P. gossypiella* or *E. insulana* eggs by C. *undecimpunctata* larvae varied from one day to another and also between the different larval instars.

The first instar

The first instar larva of *C. undecimpunctata* consumed 12.36 ± 0.48 (10–15), 27.32 ± 0.57 (20 – 30) and 5.88 ± 0.21 (5 – 7) eggs of *P. gossypiella* throughout the three days of this stadium (Table 23). While, the successive daily means of feeding capacity on *E. insulana* eggs were 7.26 ± 0.34

Table (23): Consumption of *P. gossypiella* eggs by larvae of *C. undecimpunctata* at 26 ± 1°C and 65 – 70% R. H.

Larval stage	Consumed *P. gossypiella* aggs				
	1st day	2nd day	3rd day	4th day	Total consumption
1st instar	12.36 ± 0.48 (10 – 15)	27.32 ± 0.57 (20 – 30)	5.88 ± 0.21 (5 – 7)	-	41.86 ± 0.9 (36 – 49)
2nd instar	39 ± 0.5 (33 – 43)	60.9 ± 1.2 (40 – 67)	25.9 ± 0.5 (22 – 30)	-	117 ± 3.8 (96 – 133)
3rd instar	76.14 ± 0.9 (69 – 89)	100.32 ± 0.99 (93 – 117)	116.63 ± 1.4 (110 – 137)	59.78 ± 0.83 (49 – 66)	344.73 ± 3.9 (296 – 356)
4th instar	168.5 ± 0.83 (160 – 179)	201.54 ± 0.57 (198 – 207)	57.19 ± 2.8 (41 – 98)	-	411.64 ± 5.8 (369 – 462)

Total consumption during the total larval period = 969.136 ± 7.5 (856 – 1009) eggs.

*Range of consumed *P. gossypiella* eggs

(3 – 9), 14.05 ± 0.45 (9 –18) and 5.53 ± 0.31 (2 – 7) eggs/larval, respectively. From these results, it is clear that the highest daily consumption of ***P. gossypiella*** and ***E. insulana*** eggs occurred during the second larval instar (Table 24).

The total consumption of eggs throughout the whole period of this instar ranged between (36 – 49)eggs with an average of 41.86 ± 0.9 when fed on ***P. gossypiella*** eggs . While, the mean of total consumption of ***E. insulana*** eggs was 25.10 ± 1.13 with a minimum of 19 and a maximum of 32 eggs/larva (Tables, 23 & 24).

The second instar

In this instar, the averages in number of consumed eggs were 39.0 ± 0.5 (33 – 43), 60.9 ± 1.2 (40 – 67) and 25.9 ± 0.5 (22 – 30) eggs/larva/day in the first, second and third day, respectively, when fed on ***P. gossypiella*** eggs (Table, 23). Thus indicating highest egg consumption, during this instar, in the second day of its duration and least consumption in the third day before moulting to the subsequent instar.

In case of feeding on ***E. insulana*** eggs, the averages of consumed eggs were 27.34 ± 0.34 (25 – 30), 38.57 ± 0.31 (37 – 40), 48.8 ± 0.73 (40 – 53) and 7.66 ± 0.39 (5 – 12) eggs/day/larva in the 1st, 2 nd, 3 rd and 4th day, respectively (Table, 24). The highest egg consumption, during this instar, occurred in the third day of its duration and the lowest in the fourth day. The total consumption of ***P. gosspiella*** eggs during the second instar was counted as 96 – 133 eggs with an average of 117.6 ±3.8 eggs/larvae, being lower than that consumed when the 2nd instar larvae of ***C. undecimpunctata***

Table (24): Consumption of *E. insulana* eggs by larvae of *C. undecimpunctata* at 26 ± 1°C and 65 – 70% R. H.

Larval stage	Consumed *E. insulana* eggs				
	1st day	2nd day	3rd day	4th day	Total consumption
1st instar	7.26 ± 0.34 (3 – 9)	14.05 ± 0.45 (9 – 18)	5.53 ± 0.31 (2 – 7)	-	25.10 ± 1.13 (19 – 32)
2nd instar	27.34 ± 0.34 (25 – 30)	38.57 ± 0.31 (37 – 40)	48.8 ± 0.73 (40 – 53)	7.66 ± 0.39 (5 – 12)	120.79 ± 0.73 (112 – 127)
3rd instar	54.10 ± 0.96 (50 – 63)	68.44 ± 0.6 (62 – 73)	64.92 ± 4.1 (27 – 80)	-	166.94 ± 7.28 (124 – 202)
4th instar	84.63 ± 0.73 (84 – 89)	100.73 ± 1.47 (90 – 108)	53.87 ± 4.8 (44 – 57)	17.66 ± 0.83 (13 – 23)	239.05 ± 6.22 (181 – 273)

Total consumption during the total larval period = 562.68 ± 6.5 (525 – 626) eggs.
*Range of consumed *E. insulana* eggs

was fed on ***E. insulana*** eggs (112 – 127 eggs with an average of 120.79 ± 0.73 egg/larva/day).

The third instar

The third instar larva of *C.* ***undecimpunctata*** fed on 76.14 ± 0.9 (69 – 89) , 100.32 ± 0.99 (93 – 117) ,116.63 ± 1.4 (110 – 137) and 59.78 ± 0.83 (49 – 66) eggs of ***P. gossypiella*** throughout the four days duration of this instar, respectively, against 54.10 ± 0.96 (50 – 63), 68.44 ± 0.6 (62 - 73), 64.92 ± 4.1 (27 – 80) eggs of ***E. insulana*** throughout the three days duration of this instar.The total consumption of eggs by a larva throughout this instar was estimated by 344.73 ± 3.9 (296 – 356) and 166.94 ± 7.28 (124 – 202) eggs/larva when fed on ***Pectinophora gossypiella*** and ***E. insulana*** eggs, respectively (Tables,23&24).

Fourth instar :

The fourth instar larva of *C.* ***undecimpunctata*** consumed more amounts of ***P. gossypiella*** and ***E. insulana*** eggs than those recorded for the third , second, or first instar. During the successive days of fourth instar, the larva of *C.* ***undecimpunctata*** consumed 168.5 ± 0.83 (160 – 179), 201.54 ± 0.57 (198 – 207) and 57.19 ± 2.8 (41 – 98) eggs of ***P. gossypiella*** throughout the 1st, 2nd and 3rd day, respectively. In case of feeding on ***E. insulana*** eggs, the larval duration was 4 days, and a larva consumed 84.63 ± 0.73 (84 – 89), 100.73 ± 1.47 (90 – 108), 53.87 ± 4.8 (44 – 57) and 17.66 ± 0.83 (13 – 23) eggs during the 1st, 2nd, 3rd and 4th day, respectively. The total amount of consumed eggs were 411.64

± 5.8 (369 – 462) and 239.05 ± 6.22 (181 – 273) eggs/larva when fed on ***P. gossypiella*** and ***E. insulana*** eggs, respectively.

From these results, it is clear that the highest number of consumed eggs of both ***P. gosspiella*** and ***E. insulana*** was recorded by the fourth larval instar,(Tables, 23 & 24).

Total consumption during the larval stage .

Throughout the whole period of larval stage of *C.* ***undecimpunctata*** the larvae consumed 969.136 ± 7.5 (856 – 1009) eggs, when fed on ***P. gossypiella***, (Table,23).while, it consumed 562.68 ± 6.5 with a minimum 525 and a maximum 626 eggs/larva when fed on ***E. insulana*** (Table,24).

In general, it is clear that, inspite of the larval stage of *C.* ***undecimpunctata*** consumed higher amounts of ***P. gossypiella*** eggs than ***E. insulana*** eggs, but the total larval period was longer on spiny bollworm eggs than pink bollworm. The larger amount of consumed ***P. gossypiella*** eggs appears normal, because of the smalle size of its eggs than that in case of ***E. insulana***.

Brazzel and Martin (1957), Henneberry and Clayton (1985), and **Orphanides *et al.* (1971)** reported that the pink bollworm eggs were the most vulnerable stage to predation in the life-cycle of the insect, since larvae are protected in bolls. They recorded also that ***Cllops marinellus*** (Or: Coleoptera) and ***Geocoris puctipus*** (say), ***Notoxus calcaratus***, Horn; ***Nabis americoferus*** (Or: Hemiptera) destroyed 8 to 50 pink bollworm eggs per 48 h. exposuure period under laboratory

conditions. Also, **Henneberry and Clayton (1985)** found that a single ***Hippodamia convergens*** larva consumed during development to pupa 633 to 777 pink bollworm eggs.

Adult stage

Under laboratory conditions of 26 ± 1°C and 65 - 70% R. H. and when adults of *C.* ***undecimpunctata*** were fed on pink bollworm eggs, the male lived for 44.60 ± 0.24 (35 – 50)days , while the female life–span lasted 52.1 ± 0.78 days with a minimum of 45 and a maximum of 57days (Table 25) .

Also, As shown in the same table and throughout the adult life–span, the adult male of *C.* ***undecimpunctata*** consumed a total mean number of 2548.8 ± 89.7 (1721 – 3218) ***P. gosspiella*** eggs. While, female fed on more amounts of ***P. gossypiella*** eggs (3134.2 ± 71.2) with a minimum of 2529 and a maximum of 3670 eggs.

The overall daily mean number of consumed eggs was estimated as 57.4 ± 0.91 (49.17 – 65.18) eggs/male and 60.2 ± 1.05 (49.59 – 67.47) eggs/female.

On the other hand, when adults of the predator fed on ***E. insulana*** eggs, the male lived for 46.588 ± 1.32 days with a minimum of 30 and a maximum of 52 days, while the female life –span lasted 50.77 ± 0.63 (45 – 53) days.

Concerning the feeding capacity of *C.* ***undecimpunctata*** adults on spiny bollworm eggs, data in (Table 26) show that the male consumed a total mean number of 1979.7 ± 48.98 with a minimum of 1515 and a maximum of 2291 eggs. While the female fed on more amounts of ***E. insulana*** eggs

Table (25): Feeding capacity of *C. undecimpunctata* adults on *P. gossypiella* eggs in the laboratory at 26±1°C and 65 - 70 %R. H.

Adult No.	males			Adult No.	females		
	Life-span (days)	Totals No. of consumed eggs	Mean consumed eggs/day		Lifespan (day)	Totals No. of consumed eggs	Mean consumed eggs/day
1	47	2409	51.63	1	57	3601	63.18
2	47	2475	52.68	2	51	3261	63.94
3	35	1721	49.17	3	52	3069	59.02
4	47	2570	54.68	4	49	2670	54.49
5	46	2477	53.84	5	55	3351	60.93
6	44	2451	55.7	6	49	2825	57.65
7	47	2620	55.74	7	55	3175	57.73
8	50	2940	58.8	8	55	3195	58.09
9	41	2336	56.97	9	51	2529	49.59
10	49	2894	59.06	10	45	2551	56.68
11	41	2492	60.78	11	52	3246	62.42
12	44	2561	58.2	12	52	3365	64.71
13	37	2097	56.67	13	50	3128	62.56
14	37	2081	56.24	14	53	3226	60.86
15	44	2457	55.84	15	49	3259	66.41
16	50	3218	64.36	16	49	3306	67.47
17	49	3194	65.18	17	57	3484	61.12
18	48	2884	60.08	18	56	3175	56.69
Average±S.E.	44.6 ± 0.24	2548.8 ± 89.7	57.4 ± 0.91	Average±S.E.	52.1 ± 0.78	3134.2 ± 71.2	60.2 ± 1.05

Table (26): Feeding capacity of *C. undecimpunctata* adults on *E. insulana* eggs in the laboratory at 26±1°C and 65 - 70%R. H.

Adult No.	Males			Adult No.	females		
	Life-span (days)	Totals No. of consumed eggs	Mean consumed eggs/day		Lifespan (day)	Totals No. of consumed eggs	Mean consumed eggs/day
1	43	2057	47.84	1	46	2341	50.89
2	43	2079	48.34	2	49	2520	51.43
3	52	2131	40.98	3	48	2645	55.1
4	52	2164	41.6	4	51	2638	51.17
5	51	2109	41.35	5	45	2414	53.64
6	47	2003	42.62	6	54	3313	61.35
7	48	1778	57	7	54	2891	53.54
8	42	1708	40.59	8	53	2511	47.37
9	50	2203	44.06	9	51	3044	59.68
10	45	2066	45.9	10	51	2456	48.16
11	47	1763	37.51	11	52	2528	54.38
12	48	1801	37.52	12	53	2964	55.92
13	52	2291	44.06	13	53	2870	54.15
14	44	1937	44.02	14	52	2898	55.73
15	51	2149	42.14	15	52	2983	57.36
16	47	1901	40.44	16	51	2804	54.98
17	30	1515	50.5	17	48	2797	58.27
Average+S.E.	46.588 + 1.32	1979.706+48.98	43.910 + 1.16	Average+S.E.	50.77 + 0.63	2742.176 + 62.8	54.301 + 0.89

(2742.176 ± 62.8 eggs). The daily mean number of consumed eggs was estimated as 43.91 ± 1.16 eggs / male / day and 54.30 ± 0.89 eggs/female/day (Table 26).

Kamal (1951) stated that ***Coccinella undecimpunctata*** destorys large colonies of aphids, mealy bugs and ***Prodenia litura*** eggs and larvae. He claimed that beetles fed on ***Prodenia*** eggs are able to lay as many as 130 eggs and that the beetles prefers aphids to ***Prodenia*** larvae and eggs, and prefers ***Prodenia*** eggs and young ***Prodenia*** larvae to more developed larvae of this species. In this respect, **Hamed and Hassanein (1984)** found that the average total number of ***S. litloralis*** eggs consumed throughout the life–span of the adult beetle of ***C. undecimpunctata*** was 309.8 and the average number consumed per day was 55.3 ± 3.2 eggs.

Egg–laying activity.

To study, the egg–laying activity of ***C. undecimpunctata***, after emergence of female, adults, those were paired and confined in ½ kg glass jars.

Eggs of ***P. gossypiella*** or ***E. insulana*** were offered to adults. Under the same previously mentioned conditions, the pre–oviposition, oviposition and post–oviposition periods elapsed 4.1 ± 0.2 (3 – 5), 50.16 ± 0.48 (47 – 52) and 4.88 ± 0.19 (4 - 6) days, respectively (Table 27), when fed on ***P. gossypiella*** eggs.

While the females which were fed on ***E. insulana*** eggs showed pre-oviposition, oviposition and post–oviposition periods that lasted 5.33 ± 0.15 (4 – 6), 41.31 ± 0.68 (41 – 50) and 4.7 ± 0.17 (3 – 7) days. Throughout this period, a single

Table (27): Preoviposition, oviposition , post-oviposition periods longevity (in day) and eggs production/female of *C. undecimpunctata*.

Period	On *P. gossypiella* (average ± S. E.)	On *E. insulana* (average ± S. E.)
Pre- oviposition	4.1 ± 0.2 (3 - 5)	5.33 ± 0.15 (4 - 6)
Oviposition	50.16 ± 0.48 (47 - 52)	41.31 ± 0.68 (41 - 50)
Post- oviposition	4.88 ± 0.19 (4 - 6)	4.7 ± 0.17 (3 - 6)
Longevity	59.3 ± 0.39 (51 - 61)	50.3 ± 0.6 (49 - 51)
Total eggs/female	797.05 ± 18.99 (673 – 819)	519.16 ± 31.25 (340 – 560)
Mean daily deposited eggs	15.88 ± 1.41 (14.25 - 18.4)	12.33 ± 1.50 (7.7 - 17.5)

mated female deposited an average of 797.05 ± 18.99 eggs (673 – 819) throughout an oviposition period of 50.16 ± 0.48. The mean number of eggs deposited/day/female ranged from (14.25 – 18.4) eggs with an average of 15.88 ± 1.41 eggs/female/day when reared on ***P. gossypiella*** eggs. (Table 27) on the other hand when the female were reared on ***E. insulana*** eggs, a single mated female deposited an average total 519.16 ± 31.25 (340 – 560) with a mean daily number of deposited eggs 12.33 ± 1.50 (7.7 – 17.5).

IV-3-Storage of *H. tredecimpunetata* adults at two low temperatures, under different regimes of nutrition.

Adults of ***H. tredecimpunetata*** (24 hour old) were kept in the refrigerator at 8 – 10°C or 12 – 14°C until death. The effect of storage and the type of artificial diet were studied on these adults. During the storage period, adults were supplied with five types of artificial diets i. e., protein, milk, yeast, ascorbic acid, sugar and water (type 1); milk, yeast, ascorbic acid, sugar and water (type 2); yeast, ascorbic acid, sugar and water (type 3); yeast, sugar and water (type 4); and sugar & water (type 5). Data indicated that storage of adults at the two low temperatures prolonged, in all treatments, their life span. The adults' longevity was also the longest when supplied, in the refrigerator with type (1) diet the adults lived for 156.05 ± 4.8 & 145.9 ± 4.3 at 12 – 14°C and 142.7 ± 7.3 & 135.0 ± 5.8 days at 8 – 10°C for females and males, respectively (Table 28). That was followed by adults nourish mat on type (2) 111.65 ± 4.2 (69 – 140) &106.2 ± 4.7 (76 – 140) and 120.12 ± 5.05 & 123.08 ± 4.39 and type (3) 104.1 ± 4.5 (66 – 137) and

Table (28) longevity of *H . tredecimpunetata* adults kept at low temperatures under different regimes of nutrition.

Regimes of nutrition	Longevity (in days)					
	At (12 – 14) °C			At (8 – 10) °C		
	Females	Males	Avg. both sexes	Females	Males	Avg.both sexes
Type (1)	156.05 ± 4.8 (85 – 183)	145.9 ± 4.3 (113 – 170)	151.65 ± 3.1 (97.5 – 167.5)	142.7 ±7.3 (60 –175)	135.0 ± 5.8 (90 – 175)	139.97 ± 5.73 (70 – 175)
Type (2)	111.65 ± 4.2 (69 – 140)	106.2 ± 4.7 (76 – 140)	110.45 ± 4.7 (65 – 114)	120.12 ±5.05 (70 – 140)	123.08 ± 4.39 (87– 150)	118.3 ± 455 (68 – 143)
Type (3)	104.1 ± 4.5 (66 – 137)	91.9 ±5.08 (37 – 130)	97.5 ±3.7 (45 –114)	96.55 ± 4.3 (50 – 133)	105.25 ±5.6 (55 – 147)	101.05 ± 3.4 (53 – 119.5)
Type (4)	73.0 ±2.8 (56– 100)	85.5 ± 5.5 (38 – 120)	79.25 ±2.9 (43.5 – 98.5)	94.85 ± 2.9 (60 – 107)	93.65 ± 6.48 (40 – 149)	94.25 ± 3.48 (49 – 110)
Type (5)	48.9 ± 4.09 (18 –71)	45.0 ± 4.8 (10 – 70)	47.25 ± 2.8 (15 – 70)	59.25 ± 5.8 (11 – 90)	75.05 ± 6.36 (10 – 120)	66.77 ± 4.6 (10 – 105)

Type (1): protein, milk, ascorbic acid, yeast, sugar and water

Type (2): milk, ascorbic acid, yeast, sugar and water

Type (3): yeast, ascorbic acid, sugar and water

Type (4): yeast, sugar and water

Type (5): sugar and water

91.9 ± 5.08 (37 – 130) and 96.55 ± 4.3 (50 – 133) and 105.25 ± 5.6 (55 – 147) days.

In contrary, adults kept, in refrigerator, and fed on type (5) had the shortest life–span, being 48.9 ± 4.9 and 45.0 ± 4.8 days at 12 - 14°C and 59.25 ± 5.8 and 75.05 ± 6.36 days at 8 - 10°C for females and males, respectively.

Calculation of average longevity for both sexes at (12-14°C) were 151.65 ± 3.1 (97-167.5), 110.2 ± (56-114), 97.9 ± 5.08 (37- 130), 79.25 ± 2.9 (43.5-98.5) and 47.25 ± 2.8 915-70) days when ***H. tredecimpunctata*** fed on Type (1), Type (2), Type (3), Type (4) and Type (5), respectively. On the other hand the respective values were 139.97 ± 5.73 (70 – 175), 118.3 ± 4.55 (68 – 143), 101.05 ± 3.4 (53 – 119.5), 94.25 ± 3.48 (49 – 110) and 66.77 ± 4.6 (10 – 105), (8 – 10 °C).

IV-3-1-Effect of storage for 3 and 5 months at 12 – 14°C on the fecundity and longevity of *H. tredecimpunctata* adults:

Adults of ***H. tredecimpunctata*** (24 h. old) were stored at 12 – 14°C for different periods. After the storage period had finished, the fecundity and longevity of the predator adults were estimated.

Effect on fecundity of the resultant adults.

After a storing period of 3 months, the pre-oviposition period of mated ***H. tredecimpunetata*** females was 5.78 ± 0.34 (4 – 7) days and after that it produced an average total number of 358.43 ± 8.38 (322 – 395) eggs throughout an oviposition

period of 36.07 ± 1.4 (29 – 41) days (Table 29). A sharp decrease occurred in the total number of eggs when the mated female adults were stored for 5 months at 12 – 14°C. In this case, an average total number of 167.6 ± 10.09 eggs were obtained with a minimum of 123 and a maximum of 212 eggs, throughout an oviposition period of 25.17 ± 0.35 (22 – 27) days (Table 29). In both storing periods, the averages of total obtained eggs/female were less than that produced by normally reared adults (836.6 ± 18.1) eggs throughout an oviposition period of 51.11 ± 0.7 (43 – 59) days (Table 21).

The post-oviposition period of ***H. tredecimpunetata*** females was also found to be affected by adults' storage, where this period lasted 6.64 ± 0.43 (5 – 8) and 3.83 ± 0.3 (2 – 5) days in both the two storing periods respectively, compared to 4.94 ± 0.64 (4 – 6) days estimated for the normally reared adults (Table 29).

Effect on longevity of the obtained adults.

Negative relationship was detected between life-span of ***H. tredecimpunctata*** adults and the storing period. The averages of females and males longevity were 48.5 ± 1.07 (44 – 52) and 34.125 ± 1.48 with a minimum of 25 and a maximum of 41 days, respectively, for adults stored for 3 months at 12 - 14°C (Table, 29). The longevities were shorter, being 33.0 ± 0.3 (31 – 34) and 25.125 ± 2.13 (17 - 33) days for female and male respectively, when the storing period was elongated to five months.

Storing of ***H. tredecimpunetata*** adults at a low temperature appeared to reduce, sharply, the longevity of

Table (29)Fecundity and longevity of *H. tredecimpunctata* adults, after storage of adults for 3 and 5 months at (12 – 14)°C and fed on type (1) artificial diet.

Storage period	Period (in days)			Fecundity (No.of eggs/female)		Longevity (in days)	
	Pre-oviposition	Oviposition	Post-oviposition	Total eggs no.	% hatching	Female	Male
Three months	5.78 ± 0.34 (4– 7)	36.07 ±1.4 (29 – 41)	6.64 ±0.43 (5 – 8)	358.42 ± 8.4 (322 – 393)	78.2	48.5 ± 1.07 (44 – 52)	34.125 ± 1.48 (25 – 41)
Five months	3.72 ± 0.24 (3 – 5)	25.17 ± 0.35 (22 – 27)	3.83 ±0.3 (2 – 5)	167.6 ± 10.09 (123 – 212)	55.7	33.0 ± 0.3 (31 – 34)	25.125 ± 2.13 (17 – 31)

Type (1) diet: protein + milk + yeast powder + sugar + water.

female and male compared to that of normal adults which lived for 62.1 ± 0.87 (55 – 67) and 48.94 ± 1.4 (38 – 63) days, respectively (Table 21).

As previously mentioned, storing of predators is necessary in case of storage shipment or absence of prey although, in the present study caused reduction in female's longevity and fecundity. Generally, it could be concluded the storing of ***H. tredecimpunctata*** for 3 months was more safe than that for 5 months which caused more detrimental effect on the female's longevity to and fecundity compared data from control.

The effects of prey species and constant temperature regimes on the development of ***Hippodamia sinuata*** were studied by **Michel *et al.* (1991)** who reported that ***Hippodamia sinuata*** completed its larval development faster on ***Rhopalosiphum maidis*** than on ***Schizaphis graminum*** at two temperatures, but no significant difference was evident at lower threshold temperatures > 20°C. ***H. sinuata*** began development at lower threshold temperature (7.05°C), and required more day-degrees (338.63) for development where ***R. maidis*** was the prey rather than ***S. graminum*** (12.90°C , 259.54 day-degrees). At 25 and 30°C, larvae of ***H. sinuata*** consumed significantly more individuals of ***S. graminum*** than those consumed at 20 and 35°C.

IV-3-2-Storage of *C. undecimpunctata* adults, at two low temperatures under different regimes of nutrition.

This experiment was carried out to study the effect of storage at 8 – 10 and 12 – 14°C and the type of artifical diet on the longevity and fecundity of *C. undecimpuntata* adults .

Adults of *C. undecimpuntata* were kept in the refrigerator and were supplied with five regimes of nutrition; type, 1 (protien, milk, yeast, ascorbic acid, sugar and water); type, 2 (milk, yeast, ascorbic acid, sugar and water); type, 3 (yeast, ascobic acid, sugar and water); type, 4 (yeast, sugar and water) and type, 5 (water and scrous). Storage of adults at the two low temperatures prolonged, in all treatments, their life–span. The adults longevity was also the longest when offered, in the refrigerator, type (1), where the females lived for 150.96 ± 6.41 (69 – 180) days and males lived for 140.12 ± 5.4 (59 – 177) days at 12 – 14°C and 124.0 ± 7.97 (60 – 185) and 102.4 ± 6.6 (60 – 151) days for females and males, respectively at 8 – 10°C (Table 30). That was followed by adults nourished on type (2); 127.1 ± 6.14 (90–159) and 100.8 ± 4.1 (68–140) days at 12 – 14°C and 101.12 ± 4.68 (60 – 133) and 90.08 ± 5.75 (50 – 135) days at 8 – 10°C and type (3); 93.4 ± 6.12 (50 – 131) and 83.4 ± 5.8 (51 – 123) at 12 – 14°C and 82.1 ± 6.3 (33 – 131) and 80.9 ± 5.4 (30 –111) at 8 – 10°C for females and males, respectively (Table 30).

In contrary, adults lived the shortest life – span when kept in refrigerator and fed on type (5) being 47.3 ± 5.6 (15 – 97) & 43.8 ± 6.6 (10 – 99) at 12 - 14°C and 48.0 ± 5.3 (21 – 79) & 44.15 ± 3.95 (12 – 66) days at (8 – 10)°C for females and males, respectively.

Table (30):Longevities of *C. undecimpuntata* adults kept at two low temperatures under different regimes of nutrition.

Regime of nutrition	Longevity (days)					
	(12 – 14) °C			(8 – 10) °C		
	Females	Males	Avg. both sexes	Females	Males	Avg. both sexes
Type (1)	150.96 ± 6.41 (69 – 180)	140.12 ± 5.4 (59 – 177)	146.5 ± 3.9 (64 – 179)	124.0 ± 7.97 (60 –185)	102.4 ± 6.6 (60 – 151)	113.46 ± 4.84 (55 – 170)
Type (2)	127.1 ± 6.14 (90 – 159)	100.8 ± 4.1 (68 – 140)	115.3 ±4.9 (64 –154)	101.12 ± 4.68 (60 – 133)	90.08 ± 5.75 (50– 135)	95.84 ±3.25 (58 – 136)
Type (3)	93.4 ± 6.12 (50 – 131)	83.4 ± 5.8 (51 – 123)	88.7 ± 4.3 (50 – 115.5)	82.1 ± 6.3 (33 – 131)	80.9 ± 4.5 (30 – 111)	80.83 ±5.17 (31.5 – 109)
Type (4)	82.95 ± 6.3 (33 – 130)	61.15 ± 7.1 (20 – 113)	67.7 ± 5.4 (26 – 101.5)	71.1 ± 5.5 (23 – 101)	72.9 ± 6.13 (23 – 120)	71.97 ± 4.38 (21.5 – 104.5)
Type (5)	47.3 ±5.6 (15 – 97)	43.8 ± 6.6 (99 - 10)	48.9 ± 4.4 (15 – 89)	48.0 ± 5.3 (21 – 79)	44.15 ± 3.94 (12 – 66)	46.08 ±4.05 (10.5 – 71.5)

Type (1): protein, milk, ascorbic acid, yeast, sugar and water

Type (2): milk, ascorbic acid, yeast, sugar and water

Type (3): yeast, ascorbic acid, sugar and water

Type (4): yeast, sugar and water

Type (5): sugar and water

Calculation of average longevity for both sexes at (12 - 14°C)were 146.5 ± 3.9 (64 - 179), 115.35 ± 4.9 (64 - 154), 88.7 ± 4.3 (50 - 115.5), 67.7 ± 5.4 (26 - 101.5) and 48.9 ± 4.4 (15 - 89) day when *C. undecimpunctata* adults were fed on Type (1), Type (2), Type (3), Type (4) and Type (5), respectivily. On the other hand the respective values were 113.46± 4.84 (57-170), 95.84 ± 3.25 (75-136),80.83± 5.17 (3.15 –109),71.97 ± 4.38 (44.5 –104.5) and 46.08 ± 4.05 (10.5 – 71.5) days when *C. undecimpunctata* adults were fed on five Types, 1, 2, 3, 4 & 5, respectively.

IV-3-3-Effect of storage for 3 and 5 months at 12 – 14 °C on the fecundity and longevity of *C. undecimpuntata* adults .

In this experiment, adults of *C. undecimpuntata* (24 h.old) at 12 – 14°C for different periods and after the storing period had completed, the fecundity and longevity of the predator adults were recorded.

Fecundity of adults after storage.

After a storage period of 3 months, and supplying the adults with type (1) food, the pre–oviposition period of mated females was 4.73 ± 0.59 (4 – 6) days and after that a single female deposited an average total number of 211.2 ± 7.5 (185 – 246) eggs throughout an oviposition period of 25.46 ± 0.4 (23 – 27) days and the percentage of hatching was 63.1% (Table, 31). The average total number of eggs and % hatching obtained from a single mated female resulted from adults stored for 5 months at 12 – 14°C was 174.8 ± 7.07 (138 – 220)

Table (31): Fecundity and longevity of *C. undecimpunctata* adults resulted after storage for 3 and 5 months at (12 – 14)°C and fed on type (1) artificial diet.

Storage period	Period (in days)			Fecundity (No.of eggs/female)		Longevity (in days)	
	Pre-oviposition	Oviposition	Post-oviposition	Total eggs no.	% hatching	Female	Male
Three months	4.73 ± 0.21 (4 – 6)	25.46 ± 0.4 (23 – 27)	5.0 ± 0.33 (3 – 6)	211.2 ± 7.5 (85 – 246)	63.1	35.26 ± 0.34 (33 – 36)	31.5 ± 0.42 (29 – 33)
Five months	6.07 ± 0.2 (5 – 7)	22.28 ± 0.26 (21 – 23)	7.30 ± 0.49 (5 – 9)	174.8 ±7.7 (38 – 220)	45.97	33.4 ± 0.89 (28 – 39)	26.33 ± 0.36 (25 – 28)

Type (1)diet: protein + milk + yeast powder + sugar + water.

eggs with a minimum of 138 and a maximum of 220 eggs throughout an oviposition period of 22.28 ± 0.26 (21 – 23) days and percentage of hatching of 45.97% (Table 31). These numbers of eggs, which are less than of those produced by normally, reared adults (797.05 ± 79.77 eggs) throughout an oviposition period of 50.16 ± 2.06 days (Table 27).

These results indicated that storing of *C. undecimpunctata* adults for 3 or 5 months caused sharp decrease in number of deposited eggs than fresh adults. This effect increased by prolongation of the storage period from 3 to 5 months.

Effect on longevity of the obtained adults.

Data obtained after storage on the longevity *C. undecimpuntata* adults go in line with these obtained for *H. tredecimpunetata* predator; where, negative relationship was also recorded between life–span of *C. undecimpuntata* adults and the storing period. The average female and male longevity was 35.26 ± 0.34 (33 – 36) and male 31.5 ± 0.42 with a minimum of 29 and 33 days, respectively for adults stored for 3 months at 12 – 14°C (Table, 31) . While, the longevity was shorter, being 33.4 ± 0.89 (28 – 39) and 26.33 ± 0.36 (25 – 28) days for female and male respectively, when the storing period was prolonged to five months.

Storage of *C. undecimpuntata* adults at low temperatures appeared to reduce, sharply, the longevity of females and males, than of normal adults which lived for 59.3 ± 1.64 (51 – 61) for females and 44.6 ± 4.65 (35 – 50) days for males.

Jalali and Singh (1990) studied the effect of storage at different temperatures on fecundity and longevity of

Sticholotis madagassa (Coleptera: Coccinellidae). They found that storage at 5, 10, 15 and 26°C caused 81.2, 53.1, 0.29 and 0.29% mortality, respectively, after 7 days; 90.0, 84.2, 0.29 and 26.18 mortality after 15 days; 90.0, 90.0, 12.8 and 90.8 mortality after 60 days and 90.0, 90.0, 81.2 and 90.08 %mortality after 90 day. Storage at 15°C had relatively little effect on fecundity and was recommended. **Yigit *et al.* (1994)** studied the effect of adult storage of ***Cryptolaemus montrouzieri***, ***Nephus indens***, ***Leptomastix dactylopii*** and ***Leptomastidea abnormis*** at 7, 15 and 25°C and 70 % R. H. They found that adults of *C.* ***montrouzieri*** and *N.* ***includens*** could be stored for longer period at 15 than at 7°C. While, adults of ***Leptomastix dactylopii*** and ***Leptomastidea abnormis*** could also be stored for longer time at 15 than at 7 or 25°C.

IV-3-4-Feeding capacity of *H. 13-punctata* and *C. undicimpunctata* after storage:

Data presented in Table (32) demonstrate the consumption rate by ***H. tredecimpunctata*** and ***C. undicimpunctata*** adult after a storing period of 3 months and supplying the adults with type (1) food.

Feeding ***H. tredecimpunctata*** adults on the eggs of pink bollworm, the adult male consumed a mean number of 479.46 ± 34.76 of ***P. gossypiella*** eggs/male (424 – 573), while the female fed more amounts of ***P. gossypiella*** eggs 569.3 ± 31.04 (162 – 611). ***C. undecimpunctata*** adult consumed 328.07 ± 33.89 (101 – 5) egg/male while female consumed 393.2 ± 34.4 (141 – 521) eggs/female.

Table (32): Feeding capacity of *H. 13punctata* and *C. undecimpunctata* adults on *P. gossypiella* eggs or (eggs of PBW with aphid nymphs) in the laboratory at 26 ± 1°C & 65 – 70% R. H.

Conservation period	Number of *P. gossypiella* eggs and aphid consumed by adults periods					
	Eggs of *P. gossypiella*		Eggs + aphids at ration 1:1			
	♀	♂	♀ Eggs	♀ Aphid	♂ Eggs	♂ Aphid
H. 13-punctata	569.3 ± 31.04 (162 – 611)	479.46 ± 34.76 (424 – 573)	175.86 ± 23.7 (100 – 400)	238.06 ± 23.8 (117 – 516)	166.6 ± 16.5 (95 – 311)	227.1 ± 18.29 (125 – 412)
C. undecimpunctata	393.2 ± 34.4 (141 – 521)	328.07 ± 33.89 (101 – 533)	166.6 ± 16.5 (95 – 311)	233.86 ± 21.4 (120 – 421)	152.4 ± 17.1 (100 – 279)	193.2 ± 12.7 (112 – 267)

Sticholotis madagassa (Coleptera: Coccinellidae). They found that storage at 5, 10, 15 and 26°C caused 81.2, 53.1, 0.29 and 0.29% mortality, respectively, after 7 days; 90.0, 84.2, 0.29 and 26.18 mortality after 15 days; 90.0, 90.0, 12.8 and 90.8 mortality after 60 days and 90.0, 90.0, 81.2 and 90.08 %mortality after 90 day. Storage at 15°C had relatively little effect on fecundity and was recommended. **Yigit *et al.* (1994)** studied the effect of adult storage of ***Cryptolaemus montrouzieri***, ***Nephus indens***, ***Leptomastix dactylopii*** and ***Leptomastidea abnormis*** at 7, 15 and 25°C and 70 % R. H. They found that adults of *C.* ***montrouzieri*** and *N.* ***includens*** could be stored for longer period at 15 than at 7°C. While, adults of ***Leptomastix dactylopii*** and ***Leptomastidea abnormis*** could also be stored for longer time at 15 than at 7 or 25°C.

IV-3-4-Feeding capacity of *H. 13-punctata* and *C. undicimpunctata* after storage:

Data presented in Table (32) demonstrate the consumption rate by ***H. tredecimpunctata*** and ***C. undicimpunctata*** adult after a storing period of 3 months and supplying the adults with type (1) food.

Feeding ***H. tredecimpunctata*** adults on the eggs of pink bollworm, the adult male consumed a mean number of 479.46 ± 34.76 of ***P. gossypiella*** eggs/male (424 – 573), while the female fed more amounts of ***P. gossypiella*** eggs 569.3 ± 31.04 (162 – 611). ***C. undecimpunctata*** adult consumed 328.07 ± 33.89 (101 – 5) egg/male while female consumed 393.2 ± 34.4 (141 – 521) eggs/female.

Table (32): Feeding capacity of *H. 13punctata* and *C. undecimpunctata* adults on *P. gossypiella* eggs or (eggs of PBW with aphid nymphs) in the laboratory at 26 ± 1°C & 65 – 70% R. H.

Conservation period	Number of *P. gossypiella* eggs and aphid consumed by adults periods					
	Eggs of *P. gossypiella*		Eggs : aphids at ration 1:1			
	♀	♂	♀	♀	♂	♂
			Eggs	Aphid	Eggs	Aphid
H. 13-punctata	569.3 ± 31.04 (162 – 611)	479.46 ± 34.76 (424 – 573)	175.86 ± 23.7 (100 – 400)	238.06 ± 23.8 (117 – 516)	166.6 ± 16.5 (95 – 311)	227.1 ± 18.29 (125 – 412)
C. undecimpunctata	393.2 ± 34.4 (141 – 521)	328.07 ± 33.89 (101 – 533)	166.6 ± 16.5 (95 – 311)	233.86 ± 21.4 (120 – 421)	152.4 ± 17.1 (100 – 279)	193.2 ± 12.7 (112 – 267)

As the offered food was a mixture of ***P. gossypiella*** eggs and duranta aphid, the adult consumed 175.86 ± 23.7 (100 – 400 eggs + 238.06 ± 23.8 aphids)/female and 166.6 ± 16.5 eggs + 233.86 ± 21.4 aphids/male of ***H. 13punctata***. On the other hand, the adult female and male of ***C. undecimpunctata*** consumed 166.6 ± 16.5 eggs + 233.86 ± 21.4 aphid and 152.4 ± 17.1 eggs + 193.2 ± 12.7 aphids, respectively (Table 32).

This data indicate that the predaceous adult of ***H. 13punctata*** consumed 42.4% eggs of the (total number of mixture), while the female and male of ***C. undecimpunctata*** consumed 41.6% eggs/female and 44% eggs/male. Data indicate that storage for long-term had a positive effect on longevity and fecundity.

IV-4-Survey of some host plants infested with *Pectinophora gossypielly* (PBW) and *Earias insulana* (SBW):

Eight plant species could be recorded throughout the three years of investigation as hosts infested with ***Pectinophora gossypiella*** and ***Earias insulana*** in the two locations of study, (Moshtohor and Sids). (Table 33).

Six of these plant species ‹***Gossypium barbadence, Hibiscus carnabinus, H. esculentus, H. sabdariffa,*** (Fig 13), ***H. trionum*** (Venice mallow), (Fig 14) and ***Xanthimum straumarium*** belong to Fam. Malvaceae.

The remaining two species are, ***Zea maize*** (Fam.: Gramminae) which is attaked by ***E. insulana*** and ***Sesamum indicum*** (Fam.: Pedaliaceae) is attaked by ***P. gossypiella*** (Fig, 15), only.

From this study, ***Sesamum indicum*** was found infested by PBW in Beni-Suef Governorate and only 6 infested pods were detected throughout 1999 season. This record is the first in Egypt and in the world.

El-Zoheiri and El-Mistikawi (1951) recorded rosal as a host plant of ***E. insulana*** in Abul-Reish (Aswan Governorate). They also estimated the rate of infestation on ratooned rosal plants reached 9% during February and May.

Also ‹**Abu El-Nasr *et al.* (1972)** reported that Deccan hemp (Tile; ***Hibiscus canabinus***), Rosal (karkadeih; ***Hibiscus sabdariffa***), Okra (Bamia; ***Hibiscus esculentus***), Egyptian

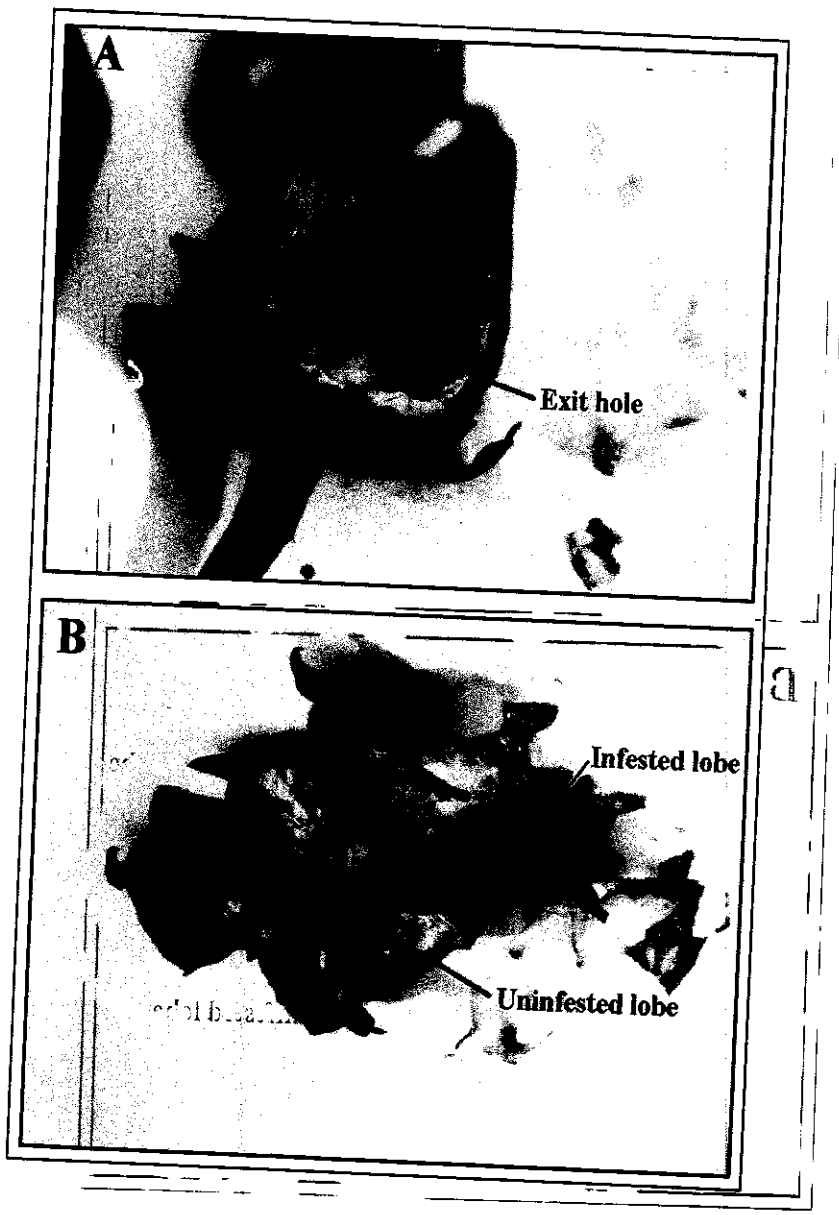


Fig. (13): Symptoms of infested Karkadieh fruits by *Earias insulana*.
A: External view of infested Karkadieh fruit.
B: Longitudinal section of infested Karkadieh fruit.

mallow (Khobbeizah; ***Malva parviflora***); Hollyhock (Khatmaiha; ***Althaea rosea***) were attacked by the spiny bollworm ***Earias insulana***.

IV-5-Survey of parasitoids and predators on pink and spiny bollworms:

Survey of some bollworm parasitoids and predators was conducted throughout the three years of investigation in different locations representing different Egyptian Governorates; A) Lower Egypt: Qalubia, Menoufia, Gharbia, Sharkia, Dakahlia, Kafr- El Sheikh, Damietta, Beheira and B) Upper Egypt: Fayoum, Beni-Suef, El-Minia, Asiut and Sohag.

The work was carried out by random collection of samples (blooms, bolls, pods and fruits) infested by ***Pectinophora gossypiella*** and/or ***Earias insulana*** from different host plants (cotton, okra, karkadeih and Tile) that were brought to the laboratory for examination. The (eggs, larvae and pupae) were isolated and placed separatly in glass vials. Samples of primary parasitoid species and hyperparasitoids that emerged from the isolated eggs or larvae and pupae, were identified.

Predaceous species were collected from different locations of cultivated cotton, either by using the insect sweeping net or by hand picking, then brought to the laboratory for identification.

Survey of parasitoids :

At least 10 parasitic insect species have been found to attack the pink and spiny bollworms in different locations in Egypt.

All the parasitoids belonged to Hymenoptera, seven of them are larval parasitoids, one true eggs parasitoids (***Trichogramma evanescens***) one egg- larval parasitoid (***Chelonus blackburni***) which is the first record in Egypt, emerged from the fullgrown larvae of ***Pectinophora gossypiella*** and another one ***Brachymeria*** **sp.**, a pupal parasitoid on ***Earias insulana.*** The species that showed highest parasitization were ***Bracon hebetor, Bracon brevicornis*** and ***Dibrachys*** **sp.** the following is a list of the species found to parasitize the pink and spiny bollworm.

Surveyed parasitoids:

The collected parasitic species were identified as follows:

1- Fam: Bethylidae

Parasierola **sp.**

2-Fam: Braconidae

1-***Apanteles*** **sp.**

2-***Bracon brevicornis*** Wesm.

3-***Bracon hebetor***

4-***Chelonus blackburni*** Cameron.

3- Fam: Chalcididae

Brachymeria sp.

4-Fam: Ichneumonidae

Exeristes* (*Pimpla*) *roborator (Fabr.)

5-Fam: Pteromalidae

1-***Dibrachys* sp.**

2-***Sphegigaster* sp.**

6-Fam: Trichogrammatidae

Trichogramma evanescens

Willcocks (1916) recorded the parasite ***Chelonus sulcatus*** Nees on ***P. gossypiella*** in Egypt, **Willard (1927)** in India recorded the parasite ***Chelonus blackburni*** Cam. on ***P. gossypiella***. In Arizona, **Brayon *et al.* (1973 and 1976)** and in California, **Legner (1979)** and **legner and Medved (1979)**; released ***Bracon kirkpatricki*** showed lobe promising for control of the spring generation of pink bollworm. **Hekal (1974)**, in Egypt, reported ***Parasierola* sp.** as a parasitoid attacking ***P. gossypiella*** also, **Hekal (1986)** observed the parasite, ***Bracon brevicornis*** emerging from cotton bolls in Egypt.

Hutchison *et al.* (1990) and Hentz *et al.* (1998) found several parasitoids such as ***Apanteles oeone*** Nixon and ***Chelonus nr curvimaculatus*** Cameron and ***Trichogramma bactrae*** Nagaraja, in cotton field.

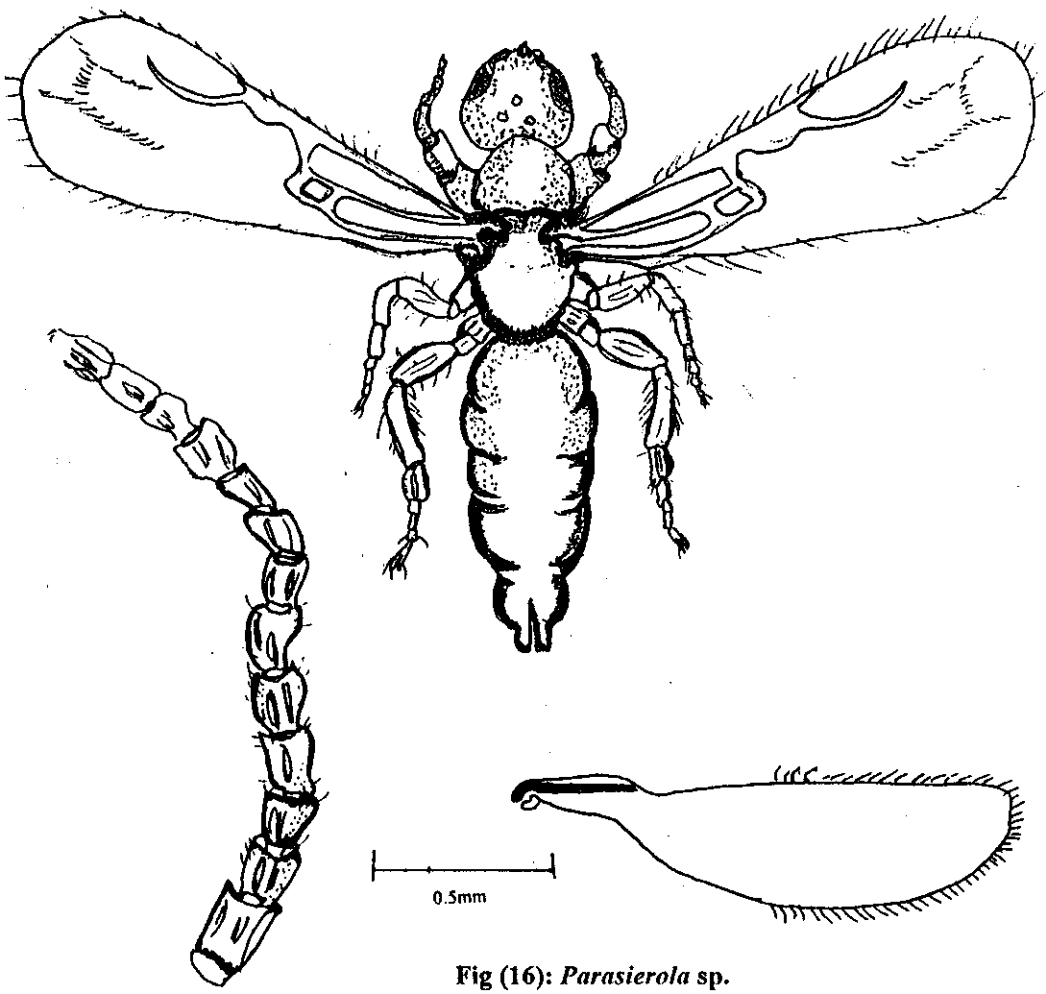


Fig (16): *Parasierola* sp.

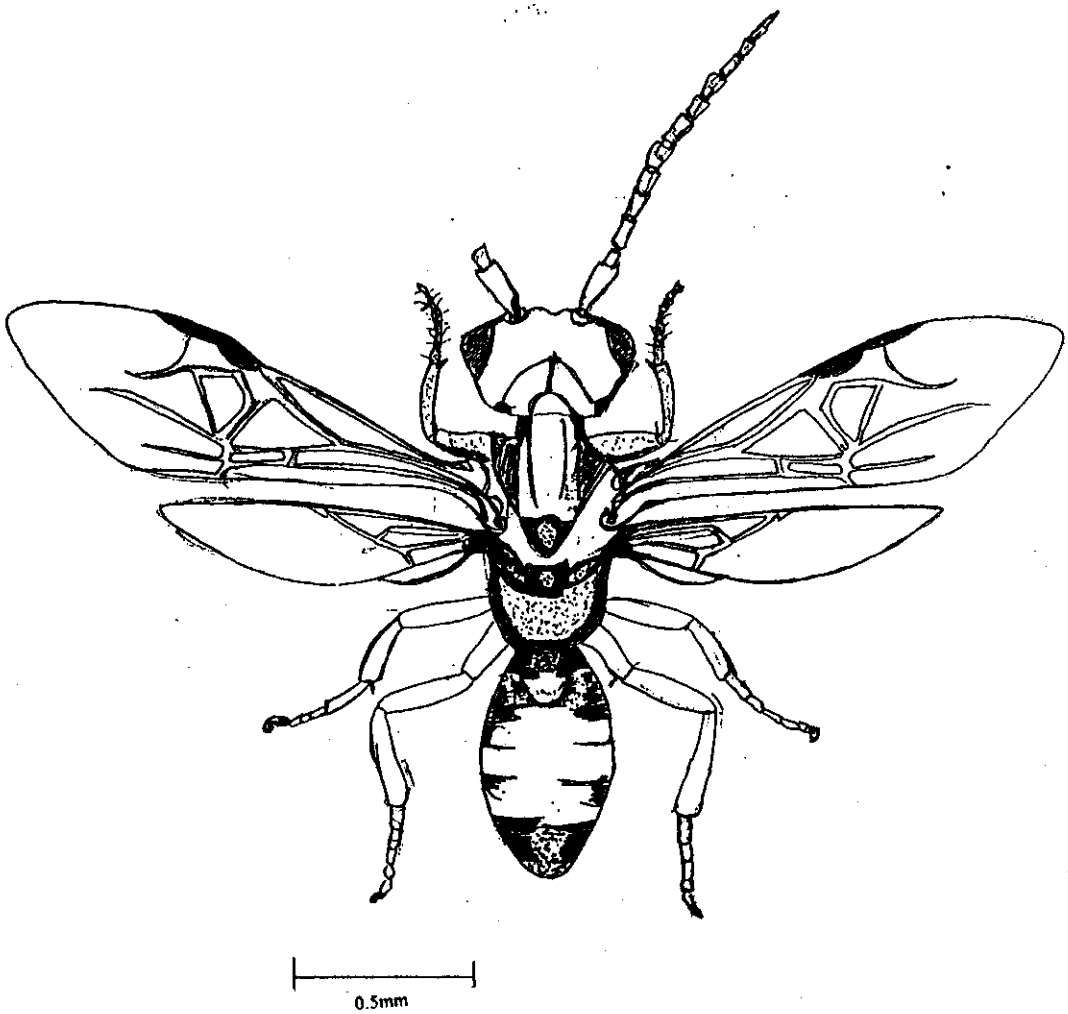


Fig (17): *Chelonus blackburni.*

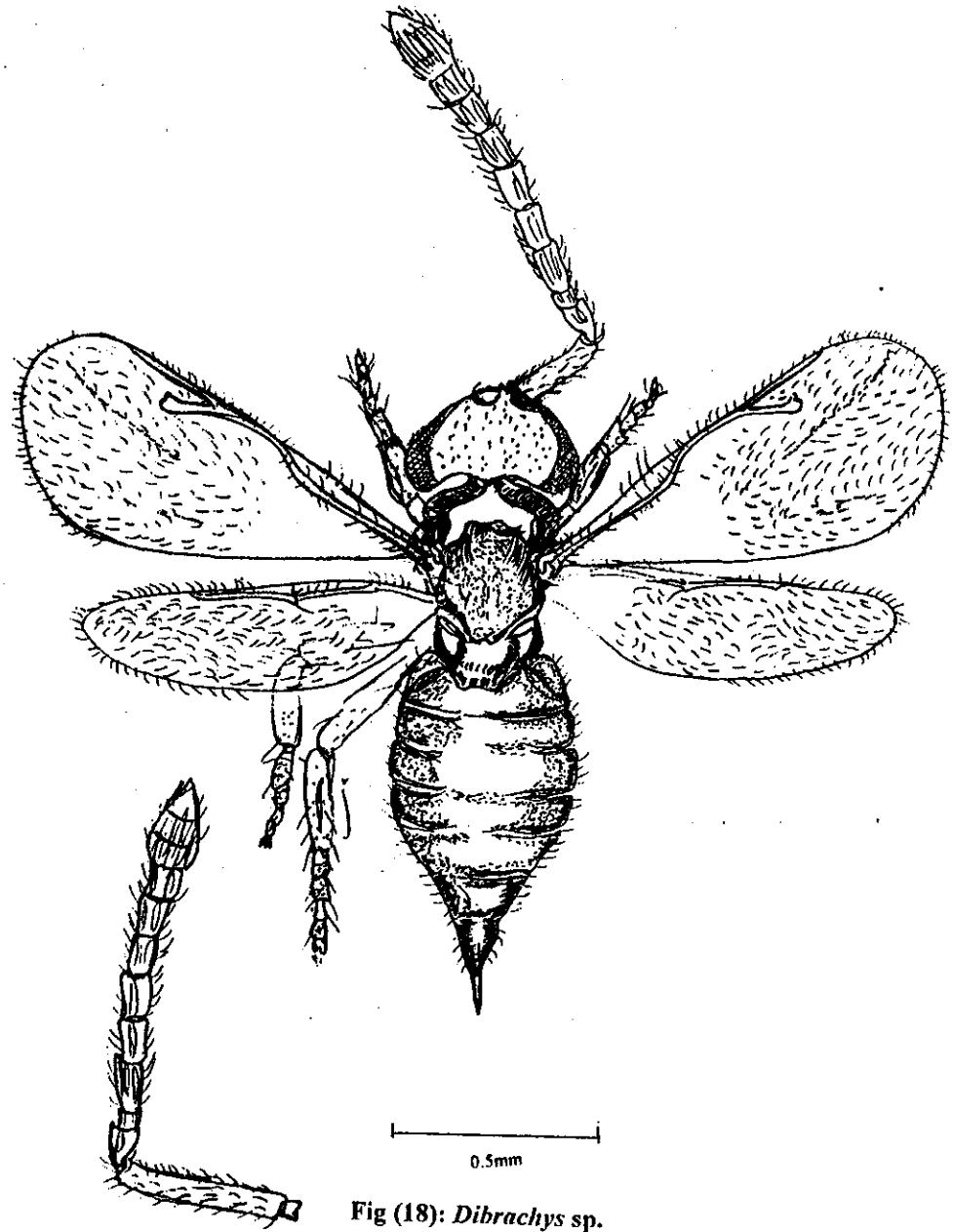


Fig (18): *Dibrachys* sp.

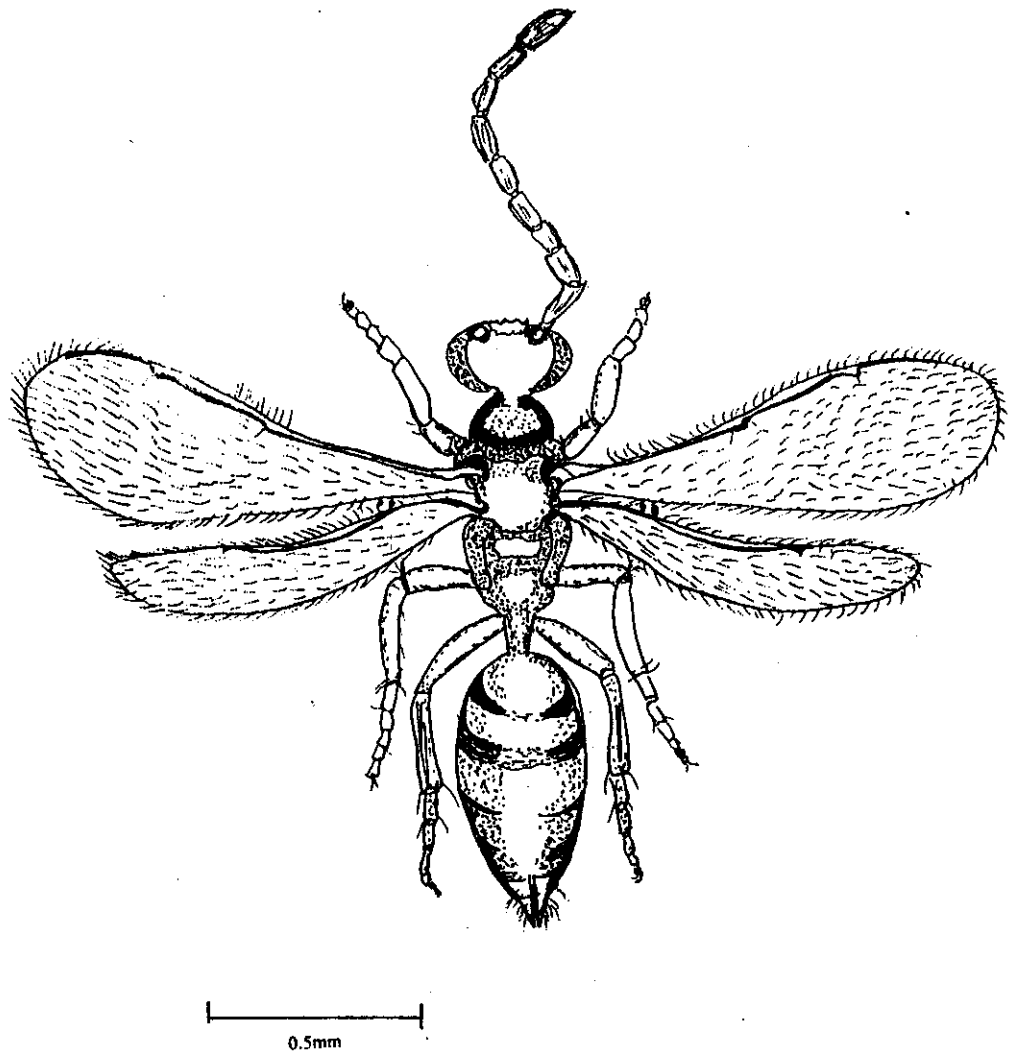


Fig (19): *Sphegigaster* sp.

IV-6-Survey and numbers of *Pectinophora gossypiella* parasitoids during diapause of its larvae:

Survey of parasitoids attacking ***P. gossypiella*** larvae during diapause was carried out during 1998/1999 and 1999/2000 at Moshtohor and Beni–Suef regions.

At harvesting time, 1000 infested cotton bolls were collected from each region to estimate the emerged parasitoid species, number of each species and percentage of parasitism.

Data in Table (34) show the surveyed parasitoid species which attack ***P. gossypiella*** larvae during the diapausing stage collected throughout the two seasons (199 – 1999; 1999 – 2000).

Bracon hebetor.

During the period of investigation, the number of ***Bracon hebetor*** larvae and cocoon ranged from 1 in January to 37 in November (Table 34) in 1998/1999 season, while in 1999/2000, this parasitoid reached 57 in November, but the lowest number (5 adults) was recorded in January in Qalubia. In Beni-Suef the highest numbers counted during November in both seasons were 44 and 30 (larva and cocoon), respectively (Fig 16a).

Bracon brevicornis.

In both regions, this gregarious parasitoid emerged from bolls collected during November and December (20 and 22

Table (34): Number of *P. gossypiella* parasitoid species emerged from its diapausing larvae collected from two regions throughout 1998/1999, 2000

Parasitoid	Year		No. of emerged adults	
			Moshtohor	Beni-Suef
Bracon hebetor (Gregarious)	Nov.	1998	37	44
	Dec.	1998	33	29
	Jan.	1999	1	0
	Nov.	1999	57	30
	Dec.	1999	32	10
	Jan.	2000	5	0
Bracon brevicornis (Gregarious)	Nov.	1998	20	41
	Dec.	1998	26	8
	Jan.	1999	0	0
	Nov.	1999	22	15
	Dec.	1999	23	7
	Jan.	2000	0	0
Dibrachys sp. (Gregarious)	Nov.	1998	23	36
	Dec.	1998	39	15
	Jan.	1999	3	0
	Nov.	1999	34	29
	Dec.	1999	10	11
	Jan.	2000	0	0
Exerista roborator (solitary)	Nov.	1998	6	8
	Dec.	1998	2	3
	Jan.	1999	0	1
	Nov.	1999	2	3
	Dec.	1999	0	4
	Jan.	2000	0	2
Parasierola sp. (Gregarious parasite)	Nov.	1998	8	2
	Dec.	1998	7	1
	Jan.	1999	0	0
	Nov.	1999	2	6
	Dec.	1999	3	3
	Jan.	2000	0	3
Sphagigaster sp. (solitary)	Nov.	1998	0	0
	Dec.	1998	0	0
	Jan.	1999	0	0
	Nov.	1999	0	0
	Dec.	1999	0	1
	Jan.	2000	0	0

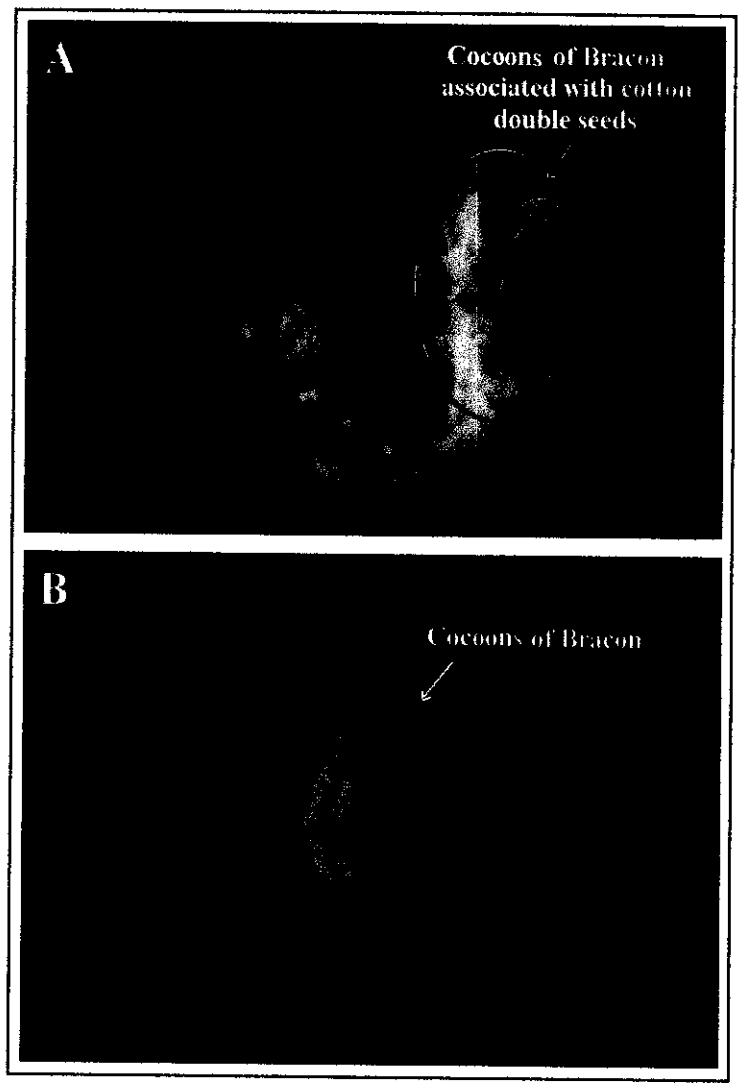


Fig. (16a): Double seeds collected from dried cotton bolls at the end of 1998 season.
A: Number of *Bracon* sp cocoons on cotton double seeds.
B: Cocoons of *Bracon* sp.

and 26 and 23, cocoons) in Moshtohor and (41 and 8 and 15 and 7, larvae and cocoons) in Sids during 1998 and 1999, respectively. No parasitized larvae were detected in infested bolls during January in both seasons (Table 34).

Dibrachys sp.

The highest numbers of this gregarious parasitoid collected from infested bolls, in Moshtohor, were recorded in December, 1998 and November, 1999 (39 and 34, respectively). In Beni-Suef, the highest numbers were recorded during December and November. The numbers of parasitoid emerged were 36 and 29 in boths season (1998 and 1999) (Table 34).

***Exeristes roborator* and *Parasierola* sp.**

During the period of investigation the two parasitiod were detected in few numbers as compared to the aformentioned parasitoids (Table 34).

In Egypt, the following parasitic species, ***Pimpla raborator*, *Pteromalids*, *Eulophids*, *Microbracon brevicornis*, *Apanteles* sp., *Elasmes platyedrae*, *Dibrachys* sp., *Microbracon kirkpatricki*, *Limnarium* sp. and *Chalcis* sp.** were recorded by, **Kamal (1936), Daoud (1968)** and **Hekal (1974 and 1986)**, associated with the diapausing larvae of ***P. gossypiella***.

Percentages of parasitism.

Data concerning the percentages of parasitism for ***Pectinophora gossypiella*** full-grown larvae during their diapausing period and throughout 1998 /1999 and 1999/ 2000 in two regions of study (Moshtohor and Sids) are presented in Tables (35 - 36). These data indicate the following: -

During the diapausing period of larvae of ***P. gossypiella***, the percentages of parasitized larvae in Moshtohor were estimated as 8.6 (0 – 17.97) and 8.3 (0 - 15.19) % in 1998/1999 and 1999/2000 seasons, respectively (Table, 35), being higher than those recorded in infested bolls collected from Beni-Suef (6.9; 0 - 15.4 and 7.3; 0 – 12.3%, respectively; Table 36).

During the period of investigation, the minimum rate of parasitism reported was 2.9 % and 1.66 % from bolls inspected in January during 1998 / 1999 and 1999 / 2000 respectively, in Moshtohor. While, the maximum rate of parasitism was 12.6% in December during 1998/1999, the total percentage increased in 1999 / 2000 to reach a maximum 8.2 % in November in Moshtohor, Table (35).

In Beni–Suef, the total rates of parasitism were 7.2, 8.5 and 2.3 during the respective months November, December and January, 1998 / 1999, while in 1999/2000 the rates of 10.4, 3.7 and 3.3 were recorded during the respective, months of November, December and January, Table (36).

The percentages of parasitism on ***P. gossypiella*** diapausing larvae are shown in Tables (35 and 36) were

Table (35): Number of parasitized larvae and percentage of parasitism on diapausing *P. gossypiella* larvae/100 infested cotton bolls during the diapausing period and throughout 1998-2000 at Moshtohor.

1998/1999					1999/2000				
Date		No. of Diapausing larvae/100 bolls	No. of Parasitized larvae	% of parasitism	Date		Diapausing larvae/100 bolls	No. of Parasitized larvae	% of parasitism
Nov.	1st	123	7	5.69	Nov.	1st	80	0	0
	2nd	110	5	4.54		2nd	104	11	10.6
	3rd	91	6	6.59		3rd	67	12	17.9
	4th	92	9	9.78		4th	92	5	5.4
Overall		416	27	6.5	Overall		343	28	8.2
Dec.	1st	108	8	7.4	Dec.	1st	85	6	7.1
	2nd	89	16	17.97		2nd	95	5	5.26
	3rd	80	9	11.3		3rd	97	8	8.25
	4th	41	7	17.07		4th	70	6	8.57
Overall		318	40	12.6	Overall		347	25	7.2
Jan.	1st	31	2	6.45	Jan.	1st	59	1	1.7
	2nd	37	0	0		2nd	21	0	0
Overall		68	2	2.9	Overall		60	1	1.66
Grand Total		802	69	8.6	Grand Total		650	54	8.3

Table (36): Number of parasitized larvae and percentage of parasitism on diapausing *P. gossypiella* larvae/100 infested cotton bolls during the diapausing period and throughout 1998-2000 at Beni-Suef.

1998/1999					1999/2000				
Date		No. of Diapausing larvae/100 bolls	No. of Parasitized larvae	% of parasitism	Date		Diapausing larvae/100 bolls	No. of Parasitized larvae	% of parasitism
Nov.	1st	118	9	7.63	Nov.	1st	142	16	11.7
	2nd	128	7	5.5		2nd	138	17	12.3
	3rd	105	8	7.6		3rd	90	9	10
	4th	91	8	8.8		4th	147	10	6.8
Overall		442	32	7.2	Overall		517	54	10.4
Dec.	1st	91	14	15.4	Dec.	1st	98	9	9.18
	2nd	133	7	5.26		2nd	89	0	0
	3rd	97	9	9.3		3rd	77	2	2.59
	4th	105	6	5.7		4th	88	2	2.27
Overall		426	36	8.5	Overall		352	13	3.7
Jan.	1st	21	0	0	Jan.	1st	63	2	3.17
	2nd	22	1	4.54		2nd	29	1	3.26
Total		44	1	2.3	Overall		92	3	3.3
Grand Total		912	63	6.9	Grand Total		961	70	7.3

generally indicating that the hymenopterous parasitoids which attack the diapausing larval stage of ***P. gossypiella*** play a partial role in supressing the numbers of ***P. gossypiella***, which will attack the cotton bolls during the subsequent season.

Previous works showed that rate of parasitism on same host by ***B. kirkpatricki*** reached 76% in open cotton bolls in Kenya **(Kirkpatrickr, 1927),** and 10.0, 3.5 and 10.8% during the respective months, November, December and January in Sudan **(Bedford, 1938)**.

In this respect, **Daoud (1968)**, reported that the rates of parasitism by ***Exeristes roborator*** were 2.6, 0.0, 5.0, 8.3, 4.5 and 0.0% during the respective months December, January, February, March, April and May in Egypt. Also, **Savvidis (1965)** reported a range of 4.6-22.5% parasitism by the same parasitoid on ***P. gossypiella*** larvae.

In Hawaii, it was found that ***Perisierola emigrata*** Rohw. destroyed a small percentage of diapausing larvae of the same hosts (***P. gossypiella***), although it was active indoors among the cotton-seeds **(Busck, 1917)** and parasitized 0.17% of them **(Willard, 1927)**. In Egypt, **Hekal (1974)** reported that ***parasierola* sp.** was restricted to attack the diapausing larvae of ***Pectinophora gossypiella*** in dry cotton bolls during October-May.

IV-7-Survey of Predators

The collected predaceous species and true spiders were identified as follows:

a- Predaceous insect species:

Order: Coleoptera

a – Fam : Coccinellidae .

1- ***Adonia variegata*** Goet.

2–***Coccinella undecimpunctata*** Linnaeus.

3- ***Coccinella cydonia septempunctata*** Linnaeus

4-***Cydonia vicina isis*** Muls.

5- ***Cydonia vicina nilotica*** Muls.

6- ***Hipodamia tredecimpunctata*** L.

7- ***Scymnus interruptus*** Marseul.

8- ***Scymnus syriacus*** Goeze.

9- ***Oxynychus*** **sp.** Fig. (20).

b-Fam: Staphylinidae:

Paederus alfierii Koch.

Order: Dermaptera

Fam: Labiduridae:

Labidura riparia (Pallas.)

Fig. (20): Adult of *Oxynychus* sp.

Order: Diptera

a- Fam: Cecidomyiidae:

Phaenobramia aphidivora Reut

b- Fam : Syrphidae:

1-***Sphaerophoria flavicauda*** Z.

2-***Syrphus corollae***

Order: Hemiptera.

Fam: Anthocoridae:

1-***Orius albidipennis*** Reut.

2-***Orius laevigatus*** F.

3- ***Geocoris punctipes*** (Say.) Fig. (21).

4-***Geocoris* sp.** Fig. (21).

Order: Neuroptera

Fam: Chrysopidae:

Chrysoperla carnea (Steph.)

B-True spiders (Class: Arachnida)

1-Fam: Thomisidae:

Thomisus spinifer

2-Fam: Araneidae:

Argiope trifasciata. Fig. (22)

3- Fam: Lycosidae:

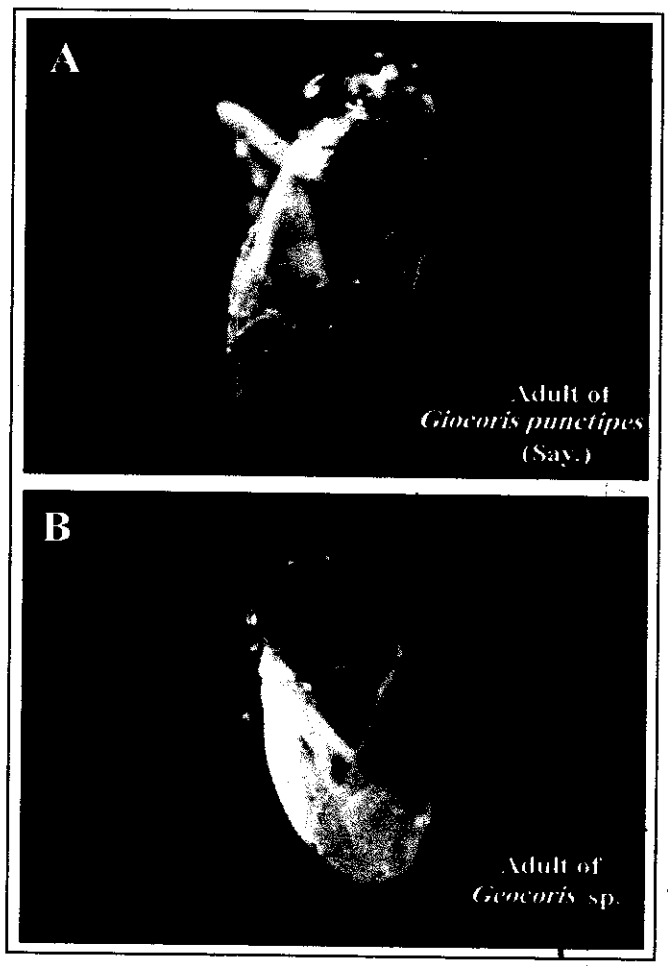


Fig. (21): Adult of Predaceous lygaeid collected from Sohag and Beni-Suef during 1998.

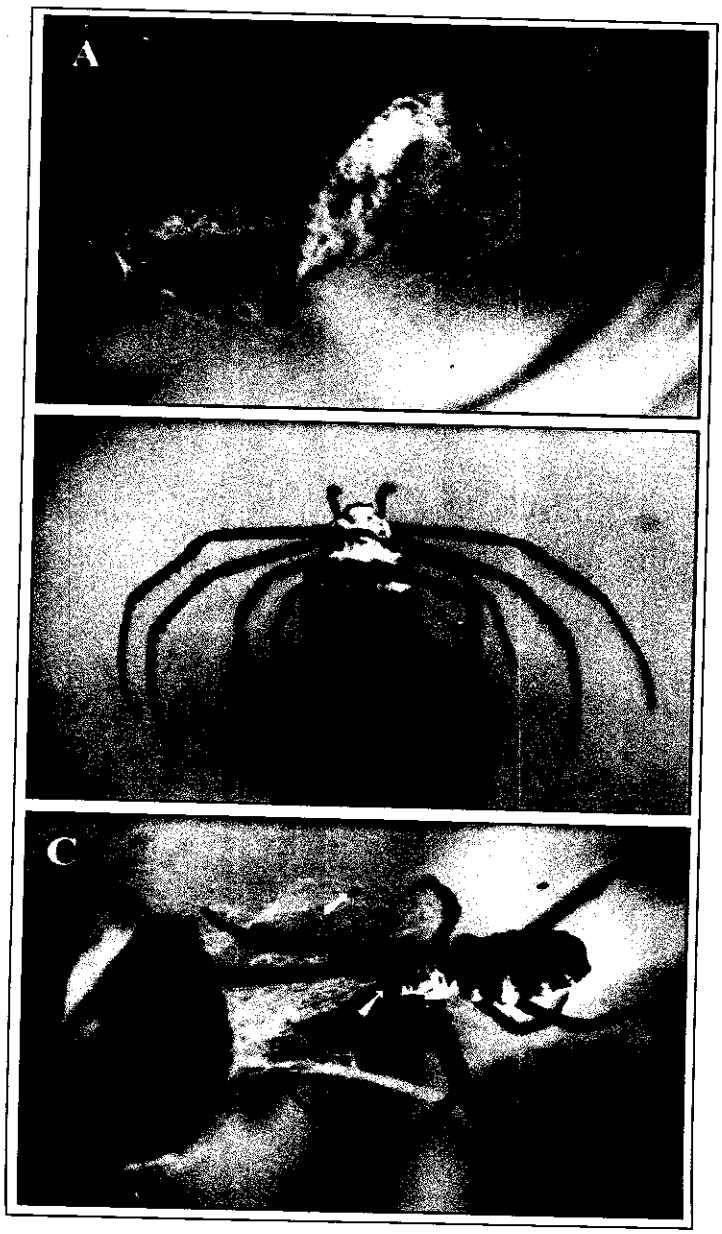


Fig. (22): *Argiope trifasciata.*

A: Eggs of *Argiope trifasciata.*

B: Adult of *Argiope trifasciata.*

C: Adult of *Argiope trifasciata* when fed on *E. insulana* larva.

Some bollworm predators were previously surveyed and / or studied in Egypt by **Hassan *et al.* (1960)** and **Habib *et al.* (1976)** who reported that ***Coccinella undecimpunctata*** and ***Paederus alfierii*, *Scymnus*** beetles (both ***syriacus*** Goeze. and ***interruptus*** Mars.) and ***Chrysopa carnea*** were common in cotton fields between April and September.

Abu El-Nasr (1967) found ***Orius* spp.** in cotton fields, also, **El-Heneidy *et al.* (1978), Naguib (1980)** and **Aly (1998)** recorded the same predators in cotton fields. **Tawfik *et al.* (1974)** recorded five species of syrphids in Egypt.

In the present investigation, only (2 adults of ***Oxynychus* sp.** were found in Moshtohor cotton fields throughout 1999 season) of study. This new species may be considered as a first record in Egypt, Fig (16).

IV-8-Percentage of infestation by pink bollworm and spiny bollworm to fruiting structures of cotton plants

Pink and spiny bollworms are serious pests which attack the cotton plants and cause great losses of fruiting structures and subsequently cotton yield. So, these experiments aimed to estimate the percentage of infestation by PBW, ***Pectinophora gossypiella*** and SBW, ***Earias insulana*** on pin–squares, blooms and green bolls and their population during the three successive seasons 1997, 1998 and 1999.

Also, these experiments were carried out on two cotton fields, one of them didn't receive any pesticides, while the other one was treated by conventional programme of

insecticides, in two locations Moshtohor, (Qalubia Governorate) and Sids, (Beni-Suef Governorate).

In Moshtohor region:

In Pin-squares:

Data in Table (37) indicate that, in Moshtohor region the overall mean percentages of infested pin squares by both pink and spiny bollworms during the whole season at the two cotton fields (untreated and treated) during the three seasons 1997,1998 and 1999, were (5.2, 4.27 and 5.4%) and (3.1, 3 and 3.4%), respectively.

It is clear that the rate of infestation in untreated field was higher than in treated cotton areas throughout the three successive seasons.

Two peaks of infestation on pin-squares were recorded, the first peak was during the last week of June, showing (8 and 6%) during 1997 and 1998 seasons and 9% on 1st week of July, 1999 in untreated erea, while in treated fields during 1997, 1998 and 1999 seasons, the first peak was during the last, 3rd and last week of June (5, 4 and 4%, respectively.

The second and highest peak of infestation was recorded in 2nd week of July during 1997 and 1998 seasons an on 1st week of August during 1999 season in untreated fields (9, 7 and 8%, respectively). While, in treated fields, those occurred in the 2nd week of July, 1997 and 3rd week of July, 1998

Table (37): Percentages of infestation by *P. gossypiella* and *E. insulana* in untreated and treated cotton areas throughout 1997, 1998 and 1999 seasons in Moshtohor region (results from 100 pin squares ,blooms and bolls).

Sampling date	1997						1998						1999					
	untreated			treated			untreated			treated			untreated			treated		
	Squares	Blooms	Bolls	Squares	Blooms	Bolls	Squares	Blooms	Bolls	Squares	Blooms	Bolls	Squares	Blooms	Bolls	Squares	Blooms	Bolls
Jun., 10	4	_	_	4	_	_	1	_	_	2	_	_	1	_	_	3	_	_
17	3	_	_	3	_	_	3	_	_	2	_	_	5	_	_	3	_	_
24	6	1	_	3	1	_	4	_	_	4	_	_	8	_	_	4	_	_
31	8	10	_	5	5	_	6	5	_	2	1	_	8	_	_	4	_	_
8/7	7	5	1	2	4	_	5	6	_	3	2	1	9	2	_	4	1	_
15	9	9	4	3	3	2	7	14	5	4	5	3	8	3	3	6	3	1
23	4	5	4	5	4	3	5	10	8	5	6	9	5	5	5	3	6	3
30	3	12	9	1	6	7	6	5	11	3	4	11	2	11	12	1	4	7
Aug., 6	5	9	11	4	5	8	5	4	22	4	3	13	5	6	11	4	3	12
13	3	4	18	1	2	7	3	3	24	3	1	21	2	4	18	2	1	16
20	_	2	25	_	3	20	2	4	34	1	5	32	_	4	19	_	1	14
27	_	1	31	_	_	14	_	4	41	2	1	26	_	3	23	_	4	14
Sept. 4	_	_	37	_	_	14	_	2	39	_	_	31	_	3	28	_	1	21
11	_	_	40	_	_	16	_	_	43	_	_	30	_	_	40	_	_	20
18	_	_	40	_	_	20	_	_	45	_	_	28	_	_	58	_	_	20
25	_	_	43	_	_	21	_	_	41	_	_	39	_	_	44	_	_	16
31	_	_	40	_	_	28	_	_	45	_	_	42	_	_	48	_	_	29
Oct., 8	_	_	48	_	_	28	_	_	50	_	_	40	_	_	49	_	_	36
15	_	_	52	_	_	34	_	_	53	_	_	46	_	_	58	_	_	40
%	5.2	5.8	28.86	3.1	3.6	16.14	4.27	5.7	33.14	2.9	3.1	24.8	5.4	4.5	27.9	3.4	2.66	20

(5 and 5%), it was 4% in the 1st week of August in 1999 season Fig (19).

Blooms:

Results on the incidence of pink and spiny bollworm larvae in blooms of cotton plants planted at Moshtohor throughout the three successive seasons 1997, 1998 and 1999 indicated that percentages of infestation varied between untreated and treated fields.

The overall mean of infestation percentage during the three seasons were (5.8%, 5.7% and 4.5%) and (3.6%, 3.1% and 2.66%) in untreated and treated cotton fields, respectively (Table 36).

In the same table data indicate that, in untreated fields, there were three peaks of infestation in 1997, (10, 9 and 12%) in June, 31st, July 15th and July 30th, respectively. In 1998 season, the highest percentage of infestation was 14% during July 15th. In 1999 season, the percentage of infestation increased gradually from 1st week of July (2%) till last week of July (11%) and decreased until 1st week of September to reach 3% in untreated fields.

In treated fields, two peaks of infestation could be detected in each

of the three seasons. The peaks were 5 and 6% during June 31st, and the last week of July in 1997. During 1998 and 1999 seasons the two peaks were 6 and 6% in the 3rd week of July

and the 2nd peak was 5 and 4% in the 3rd and 4th week of August.

Bolls:

During 1997, 1998 and 1999 cotton seasons, the infestation of bolls by PBw and SBw started in July, 1st when bolls were 2 to 3 weeks old.

Data in Table (37) indicate that infestation of green cotton bolls by pink and spiny bollworms began to appear on 1st and 2nd week of July (1, 5 and 3% in untreated cotton fields, and 2, 3 and 2% in treated fields during 1997, 1998 and 1999 seasons, respectively).

The % infestation increased gradually till the end of season, recording 43 and 52% on September 25th and October 15th 1997; 45 and 53% on September 18th and October 15th 1998; 53 and 58%, September 18th and October 15th, 1999 in untreated fields. While, in treated fields, the highest percentage recorded was on August 20th, and October 15th (20 and 34%), during 1997 season, on August 20th, September 31st and October 15th (32, 42 and 46%) during 1998 season, on August, 13th, September, 4th and October 15th (16, 21 and 40 %) during 1999, respectively.

The overall mean of percentages during the three seasons were (26.86, 33.14 and 27.9%) and (16.14, 24.8 and 20%) in untreated and treated cotton fields, respectively, Table (37).

In Beni-Suef region:

Results shown in Table (38) reveal a clear difference between percentages of infestation by pink and spiny bollworms in untreated and treated fields in Sids (Beni-Suef Governorate) thrououtght the three successive years of study.

Pin-Squares

The overall mean percentages of infested pin squares by both pest species on cotton plants, during the three seasons 1997, 1998 and 1999, were 4.54, 6.0 and 5.5% in untreated fields and 2.58, 2.9 and 2.9 % in treated fields, respectively (Table 38).

In untreated fields, the high percentages of infestation to pin-squares were 8 and 9% recorded at the end June, 1997 and 4th week of July, 1999. While, in 1998 the percentage of infestation increased gradually from 1 % in the 2nd week of June till 11% in 1st week of July.

In treated fields, data indicated that there were two peaks of infestation. The first peak occurred in 2nd week of June during 1997 season, and in 3rd week of June during 1998 and 1999 seasons, being 4, 6 and 6%, respectively. While, the 2nd peak was represented by 5, 6 and 4 % recorded in 2nd week of July during 1997, 1998 and 1999 season, respectively.

Table (38): Percentages of infestation by *P. gossypiella* and *E. insulana* in untreated and treated cotton fields throughout 1997, 1998 and 1999 seasons in Beni-Suef region. (results from 100 pin squear ,blooms and bolls).

Sampling date		1997						1998						1999					
		untreated			treated			untreated			treated			untreated			treated		
		Squares	Blooms	Bolls	Squares	Blooms	Bolls	Squares	Blooms	Bolls	Squares	Blooms	Bolls	Squares	Blooms	Bolls	Squares	Blooms	Bolls
Jun.	1	_	_	_	_	_	_	3	_	_	1	_	_	_	_	_	_	_	_
	8	2	_	_	1	_	_	3	_	_	1	_	_	4	_	_	1	_	_
	15	1	_	_	_	_	_	4	_	_	4	_	_	5	_	_	3	_	_
	22	4	_	_	2	_	_	6	_	_	6	_	_	9	_	_	6	_	_
	30	8	7	_	4	3	2	7	5	_	4	3	_	4	10	_	4	4	_
Jul.	6	5	8	4	3	3	2	11	3	3	4	4	4	6	12	2	2	6	_
	13	5	11	10	5	4	1	8	5	9	6	6	4	8	13	7	4	4	3
	20	7	6	20	3	5	7	6	8	13	3	4	4	5	11	17	3	5	10
	27	5	3	26	3	7	13	4	9	20	1	3	5	4	4	23	2	2	9
Aug.	2	5	9	31	4	4	15	7	3	25	2	3	9	3	6	36	1	6	17
	10	6	7	35	2	5	11	5	8	30	2	6	11	3	6	39	3	4	11
	17	2	6	39	2	2	13	5	5	39	2	4	13	_	4	43	_	5	9
	24	_	5	30	2	2	15	4	6	38	2	2	17	_	5	48	_	3	13
Sep.	3	_	4	57	_	2	18	_	4	51	_	1	16	_	8	49	_	_	11
	10	_	2	61	_	1	21	_	_	43	_	_	17	_	3	53	_	_	13
	17	_	_	40	_	_	31	_	_	49	_	_	18	_	_	49	_	_	10
	23	_	_	60	_	_	28	_	_	50	_	_	20	_	_	51	_	_	17
	30	_	_	50	_	_	30	_	_	53	_	_	28	_	_	49	_	_	21
Oct.	6	_	_	62	_	_	30	_	_	61	_	_	31	_	_	53	_	_	_
%		4.5	6.18	36.92	2.58	3.5	15.7	6.0	5.6	34.1	2.9	3.8	16	5.5	7.5	37.07	2.9	4.3	12.07

Blooms:

Results of the experiments conducted during the three successive cotton growing seasons (1997, 1998 and 1999) in Sids region indicated that the highest infestation percentages were recorded in 2nd week of July during 1997 and 1999 seasons, being 11 and 13%, respectively, while it was 9% in 4th week of July in 1998 season in untreated fields. On the other hand, in treated fields, the highest percentages of infestation were 7% on July 27th 1997, 6 % on July, 13th and August, 10th 1998, and 6% on July, 6th and August, 2nd 1999 (Table 38). The overall mean percentages of infested blooms by both pest species on cotton plants during the three seasons 1997, 1998 and 1999, were (6.18, 5.6 and 7.5 %) and (3.5, 3.6 and 4.3 %) in untreated and treated fields, respectively.

Bolls:

During the three seasons of investigation 1997, 1998 and 1999, data concerning the green bolls infestation by PBW and SBW indicated that infestation began to appear on July 6th by 4, 3 and 2 % in the three seasons, respectively in untreated fields and on June, 30th 1997 (2 %), July, 6th 1998 (4 %) and July, 13th 1999 (3 %) in treated fields. Then, the percentages of infestation increased gradually. Highest percentages of infestation occurred in untreated cotton fields on October, 6th in 1997 and 1998 (68 and 69 %, respectively), and on September, 10th and October, 6th 1999 (53 %), while in untreated plots, those occurred on September, 30th and

October, 6th 1997 (30 %), October, 6th 1998 (31 %) and on September, 10th 1999 (21%) (Table 39 & Fig. 20).

Joginder *et al.* (1983) in Punjab, India recorded that the incidence of ***P. gossypiella*** in buds, flowers and bolls of ***G. hirsutum*** cv. F414 was 45.11, 37.54 and 15.72%, respectively.

Shu and Cao (1987) found that cotton bolls formed from flowers infested by the 1st generation of the pest in mid-late July, developed normally. The number of infested flowers (3-16%) was insignificant compared with bolls shed (55-60%). Control of the 1st generation of ***P. gossypiella*** didn't give economic returns but it reduced the population of the 2nd generation. **Dhwan *et al.* (1990)** in Punjab recorded that ***P. gossypiella*** was the cause of 3.3 - 7.7% loss of the shed buds, 0.6% of the shed flowers, and 0.2-1.7% of the shed bolls. Also **Abdalla (1991)** in Egypt, indicated that, sowing date of cotton affected the number of infested bolls. The latter author reported that the seasonal means of infested bolls for the 4 cotton dates (6 March, 21 March, 10 April and 21 April) were (18.7, 19.6, 29.5 and 34.2%, respectively).

IV-9-Populatin dynamics of *Pectinophora gossypiella* and *Earias insulana* in cotton fields.

Pin-Squares

In Moshtohor region

Data in Table 39, indicate that the overall total number of pink and spiny bollworm larvae collected from infested pen squares were 32, 29 and 32 PBW and 20, 18 and 22 SBW larvae in untreated fields during 1997,1998 and 1999 seasons, respectively. While, in treated cotton fields, the overall total numbers of larvae were 18, 20 and 19 larvae of PBW and 13, 15 & 18 larvae of SBW during 1997, 1998 and 1999, respectively.

Highest monthly counts of PBW and SBW larvae in pen squares collected from untreated cotton fields occurred in June in case of the former pest (16, 12 and 15 larvae/100 pen squares in June of 1997, 1998 and 1999, respectively. while, that occurred in July in case of ***E. insulana*** (11, 11 and 14 individuals, respectively). In treated cotton fields, lower numbers were generally counted being 10 and 8 PBW larvae in June, 1997 and 1999, and 8 in July, 1998, against 6 SBW larvae in June, 1997 and 7 and 9 larvae in July 1998 and 1999, respectively.

In Beni-Suef region:

Data in Table (40) show that the total number of PBW larvae collected from infested cotton pen- squares were 32, 43

Table (39): Total numbers of PBW and SBW larvae counted/ 100 cotton pin squares /sample in untreated and treated cotton plants at Moshtohor (Qalubia Governorate) throughout 1997, 1998 and 1999 seasons.

Sampling date		1997				1998				1999			
		Untreated		Treated		Untreated		Treated		Untreated		Treated	
		P.	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*
Jun.	3	0	0	0	0	0	0	0	0	0	0	0	0
	10	3	1	3	1	1	0	2	0	1	0	3	0
	17	2	1	1	2	3	0	0	2	3	2	1	2
	24	5	1	2	2	3	1	2	2	6	2	2	2
	31	6	2	4	1	5	1	1	1	5	3	2	2
Total		16	5	10	6	12	2	5	5	15	7	8	6
Jul.	8	4	3	1	1	3	2	1	2	5	4	2	2
	15	4	5	2	1	4	3	2	2	4	4	3	3
	23	2	2	3	2	2	3	3	2	3	2	1	2
	30	2	1	0	1	3	3	2	1	0	2	1	0
Total		12	11	6	5	12	11	8	7	13	14	7	9
Aug.	6	2	3	2	2	2	3	3	1	3	2	3	1
	13	2	1	0	0	2	1	1	2	1	1	1	1
	20	0	0	0	0	1	1	1	0	0	0	0	0
	27	0	0	0	0	0	0	2	0	0	0	0	0
Total		4	3	2	2	5	5	7	3	4	3	4	2
Overall total		32	20	18	13	29	18	20	15	32	22	19	18

P= Pectinophora gossypiella

E= Earias insulana

Table (40): **Total numbers of PBW and SBW larvae collected from 100 pen squares sample in untreated and sprayed cotton plants at Sids (Beni-Suef Governorate) throughout 1997, 1998 and 1999 seasons.**

Sampling date		1997				1998				1999			
		Untreated		Treated		Untreated		Treated		Untreated		Treated	
		P.	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*
Jun.	1	0	0	0	0	2	3	0	1	0	0	0	0
	8	2	0	0	1	3	0	1	0	3	1	1	0
	15	1	0	0	0	2	2	2	2	4	1	3	2
	22	4	0	1	1	4	2	3	3	6	3	4	2
	29	6	2	1	2	4	3	3	1	3	1	2	2
Total		13	2	3	4	15	10	9	7	16	6	10	6
Jul.	6	4	1	1	2	8	3	2	2	4	2	1	1
	13	3	2	3	2	6	2	3	3	3	5	2	2
	20	4	3	2	1	5	1	2	1	3	2	2	1
	27	1	4	4	0	2	2	1	0	2	2	2	0
Total		12	10	10	5	16	8	8	6	12	12	7	4
Aug.	2	3	2	2	2	3	4	1	1	2	1	1	0
	10	3	3	1	1	3	2	2	0	2	1	2	1
	17	1	1	2	0	3	2	1	1	0	0	0	0
	24	0	0	1	1	3	1	1	1	0	0	0	0
	30	-	-	-	-	-	-	-	-	-	-	-	-
Total		7	6	6	4	12	9	5	3	4	2	3	9
Overall total		32	18	19	13	48	27	22	16	32	20	20	11

P= Pectinophora gossypiella

E= Earias insulana

and 32 in untreated cotton fields and 19, 22 and 20 larvae in sprayed fields during 1997, 1998 and 1999 seasons, respectively. While, the total numbers of SBW larvae were 18, 24 and 20 in untreated fields and 13, 16 and 11 larvae in treated fields during the three seasons, respectively.

Concerning, the monthly numbers of PBW larvae collected from infested pin-squares in Beni-Suef region, these numbers were, generally, higher than those of SBW larvae. These monthly numbers of PBW larvae had took the same trend as in Moshtohor region.

The three seasons data showed that the numbers of PBW and SBW larvae collected from infested pin-squares were lower in sprayed cotton fields, than those recorded from untreated cotton fields.

Sukhija and Reddy (1983) in Punjab reported that the lowest larval population was in the squares. **Aly (1998)** recorded the total numbers of infested pen-squares on cotton plants in Egypt during the whole season at the three planting dates (March 15th, March 30th and March 20th /1996 and March 20th, April 5th and March 25th in 1997) were 25, 31 and 21 and 30, 20 and 19 infested pen- squares in 1996 and 1997 seasons, respectively. Data also, showed that the lowest total number of infested pen-squares was recorded from treated cotton plants, which was represented by 21 and 19 infested pen squares during 1996 and 1997 seasons, respectively.

In cotton blooms.

Infestation by pink and spiny bollworms larvae in the flowering stage resulted normally from eggs laid by females on cotton pen squares. This study was also carried out in Moshtohor and Sids on untreated and treated cotton plantations throughout 1997, 1998 and 1999 cotton seasons to estimate the population of PBW and SBW larvae in rosetted blooms in each locatity.

In Moshtohor region:

Data summarized in Table (41) show the total numbers of pink bollworm and spiny bollworm larvae inside 100 infested cotton blooms collected from untreated and treated cotton fields during the three seasons.

These data indicate that the overall total numbers of pink and spiny bollworm larvae collected from infested blooms were (43, 44 and 26) and (15, 13 and 14) larvae in untreated fields during 1997, 1998 and 1999 seasons, respectively. While in treated cotton fields these numbers of larvae were (27, 19 and 16) of PBW and (6, 9 and 8) individuals of SBW during the three seasons, respectively.

Data, also, show that the highest population densities of larvae collected from infested blooms in untreated and treated fields occurred during July in the three years. Those were 20, 29 and 15 PBW and 14, 12 and 9 SBW larvae in untreated fields, and 11, 6 and 6 larvae of PBW and 3, 5 and 5 larvae of

Table (41): Total numbers of PBW and SBW larvae collected from100 bloom , sample in untreated and spryed cotton plants at Moshtohor (Qalubia Governorate) throughout 1997, 1998 and 1999 seasons.

Sampling date		1997				1998				1999			
		Untreated		Treated		Untreated		Treated		Untreated		Treated	
		P.	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*
Jun.	24	1	0	1	0	0	0	0	0	0	0	0	0
	31	10	0	5	0	5	0	1	0	0	0	0	0
Total		11	0	6	0	5	0	1	0	0	0	0	0
Jul.	8	4	1	3	1	6	0	1	1	2	0	1	0
	15	6	3	2	1	12	2	2	3	1	2	3	0
	23	3	2	4	0	7	3	5	1	3	2	3	3
	30	7	5	5	1	4	1	4	0	9	2	2	2
Total		20	11	14	3	29	6	12	5	15	6	9	5
Aug.	6	6	3	3	2	3	1	2	1	5	3	2	1
	13	3	1	1	1	1	2	1	0	2	2	1	0
	20	2	1	3	0	4	0	3	2	1	1	0	1
	27	1	0	0	0	1	3	0	1	2	1	3	1
Total		12	5	7	3	9	6	6	4	10	7	6	3
Sep.	4	0	0	0	0	1	1	0	0	1	1	1	0
	11	0	0	0	0	0	0	0	0	0	0	0	0
Total		0	0	0	0	1	1	0	0	1	1	1	0
Overall		43	16	27	6	44	13	19	9	26	14	16	8

P= Pectinophora gossypiella

E= Earias insulana

SBW from sprayed fields throughout 1997, 1998 and 1999 seasons, respectively.

In Beni-Suef region:

The seasonal total counts of pink and spiny bollworms larvae, recorded in Table (42), were 48, 39 and 68 PBW larvae from untreated fields and 27, 24 and 30 ***P. gossypiella*** larvae from treated fields during 1997, 1998 and 1999 seasons, respectively.

While the correspondent numbers of SBW larvae were 23, 17 and 15 larvae in untreated fields and 11, 13 and 9 larvae in treated fields during 1997, 1998 and 1999 season, respectively.

Sukhija and Reddy (1983) In Punjab reported that when seed material was one- third of untreated plots and more than half that in plots where spraying was initiated 2 weeks after flowering. The highest larval population in the shed material was in flowers, closely followed by the bolls, and the lowest was in the squares

On cotton green bolls:

In Moshtohor region:

Results in Table (43) indicate that the infestation of green cotton bolls by PBW began to appear on 1st week of July, in 1997 season and the second week of this month in

Table (42): Total numbers of PBW and SBW larvae collected from 100 blooms/sample in untreated and spryed cotton plants at Sids (Beni-Suef Governorate) throughout 1997, 1998 and 1999 seasons.

Sampling date		1997				1998				1999			
		Untreated		Treated		Untreated		Treated		Untreated		Treated	
		P.	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*
Jun.	22	0	0	0	0	0	0	0	0	0	0	0	0
	30	6	1	2	1	5	0	2	1	10	0	4	0
Total		6	1	2	1	5	0	2	1	10	0	4	0
Jul.	6	6	2	2	1	2	1	2	2	12	1	4	2
	13	8	3	4	0	2	3	5	1	10	3	4	0
	20	3	3	3	2	6	2	3	1	11	0	4	1
	27	2	1	4	3	8	1	3	0	2	2	2	0
Total		19	9	13	6	18	7	13	4	35	6	14	3
Aug.	2	7	2	3	1	2	1	2	1	4	2	3	3
	10	5	2	4	1	4	4	3	3	3	3	3	1
	17	4	2	2	0	4	1	2	2	3	1	5	0
	24	3	2	1	1	4	2	1	1	4	1	1	2
Total		19	8	10	3	14	8	8	7	14	7	12	6
Sep.	2	4	0	1	1	2	2	1	0	6	2	0	0
	10	0	2	1	0	0	0	0	0	3	0	0	0
Total		4	3	2	1	2	2	1	0	9	2	0	0
Overall total		48	23	27	11	39	17	24	13	68	15	30	9

P= Pectinophora gossypiella

E= Earias insulana

Table (43): Total numbers of PBW and SBW larvae collected from 100 green cotton bolls/sample in untreated and treated cotton plants at Moshtohor (Qalubia Governorate) throughout 1997, 1998 and 1999 seasons.

Sampling date		1997				1998				1999			
		Untreated		Treated		Untreated		Treated		Untreated		Treated	
		P.	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*
July	8	1	0	0	0	0	0	0	0	0	0	0	0
	15	3	1	2	0	4	1	1	0	5	0	1	0
	23	2	2	3	0	7	1	3	0	13	0	5	0
	30	15	3	5	2	9	2	3	3	18	5	8	3
Total		21	6	10	2	20	4	7	3	36	5	14	3
Aug.	6	17	1	7	4	20	2	7	3	28	1	7	3
	13	21	3	5	2	23	5	13	3	33	5	16	4
	20	25	5	15	5	30	7	17	2	27	4	13	5
	27	37	5	19	1	48	11	18	4	41	7	11	10
Total		100	14	46	12	121	25	55	12	129	17	47	22
Sept.	3	35	11	12	5	53	11	10	8	39	8	15	3
	10	51	10	32	3	67	13	17	7	55	13	19	7
	17	49	15	23	7	65	18	29	13	41	17	13	7
	23	85	20	15	6	46	13	15	9	60	14	0	6
	30	55	19	11	5	57	17	31	11	53	18	25	10
Total		275	75	93	26	288	72	102	48	248	70	72	33
Oct.	7	61	15	25	17	69	20	31	15	75	23	31	18
	14	39	28	37	12	77	26	37	13	101	25	38	13
Total		100	43	62	29	146	46	68	28	176	48	69	31
Overall total		496	138	211	69	575	147	232	91	589	140	202	89
Average		35.4	9.9	15.1	4.9	41.1	10.5	16.6	6.5	42.1	10.0	14.4	6.4

P= *Pectinophora gossypiella*
E= *Earias insulana*

1998 and 1999. While, in case of SBW, that began to appear on 2nd week of July, in the three seasons.

Data in Table (43) show that the overall total numbers of pink and spiny bollworm larvae collected from infested cotton bolls were 496, 575 and 589 larvae, while those were 138, 147 and 140 larvae of SBW larvae in untreated fields during 1997, 1998 and 1999 season, respectively. In treated fields the populations of larvae were 211, 232 and 202 individuals of PBW and 69, 91 and 89 individuals of SBW during 1997, 1998 and 1999 season, respectively.

In 1997, the population density of ***P. gossypiella*** and ***E. insulana*** larvae was very low during 1st week of July and gradually increased till end of the season. In untreated fields, results revealed that the first highest larval population density of PBW occurred during September, (1.97 larvae/boll) and the 2nd highest larval population was 89 individual per 52 infested bolls (1.7 larvae/boll).

In case of ***E. insulana*** there were two peaks of population, the first occurred during the 4th week of September, and the 2nd was during the 2nd week of October, showing 20 and 38 larvae of SBW, respectively.

In treated fields, data in the same table indicate that there were 3 peaks of PBW larval population, the first peak occurred during 4th week of August (19 larvae inside 14 infested bolls from 100 collected bolls, represented by 1.4 larvae/boll), the 2nd peak was during the 2nd week of September, 32 larvae/18 infested bolls i.e. 1.8 larvae/boll and

the third peak appeared in the 2nd week of October (37 larvae/34 infested bolls i. e. one larva/boll). In case of ***E. insulana*** only two peaks were estimated, the first one appeared in the 3rd week of September, and the 2nd peak was in the 1st week of October, showing 7 and 17 larvae, respectively.

In 1998, data in Table (43) show that the population of PBW and SBW larvae, in untreated fields occupied two peaks, the first was in the 2nd week of September, and the 2nd in the 2nd week of October, and these peaks were represented by 67 and 77 PBW larvae, respectively. In case of ***E. insulana***, the 1st peak appeared during 3rd week of September, and the 2nd peak occurred during 2nd week October; being 18 and 26 larvae, respectively.

In treated fields, three peaks of larval population abundance could be detected, those were represented by 18, 29 and 37 larvae of PBW during 4th week of August, 3rd week of September, and 2nd week of October, respectively, while, the larval population of ***E. insulana*** increased gradually from 3 larvae on July, 30th to 15 larvae in the 1st week of October.

In 1999 season, data in Table (43) showed that the population of PBW larvae in the untreated and treated cotton fields occupied five and four peaks, respectively, in the untreated field the first peak appeared during 2nd week of August, the 2nd in 4th week of August, the 3rd in 2nd week of September, the 4th in 3rd week of September and the 5th peak appeared in 2nd week of October, the numbers of larvae were 33, 41, 55, 60 and 101 individuals of PBW, while, in treated

four peaks estimated by 16, 19, 25 and 38 larvae of PBW during 2nd week of August, 2nd week of September, end of September and 2nd week of October, respectively.

In case of ***E. insulana***, there were three peaks of population, in untreated and treated fields estimated by 5, 17 and 25 larvae during 2nd week of August, 3rd week of September and 2nd week of October. While in the treated field the 1st peak occurred in 4th week of August the 2nd in 4th week of September and the 3rd in 1st week of October, the numbersof larvae were 10, 10 and 18 larvae, respectively.

In Beni-Suef location:

The total numbers of PBW and SBW larvae inside cotton bolls are shown in Table (44), these records indicated that the infestation of green bolls by PBW began to appear on June 30th showing (1, 3 and 3 larvae of PBW during 1997, 1998 and 1999 seasons, respectively), while infestation by ***E. insulana*** larvae began to appear on June 7th (2larvae / 100 bolls) during 1997,but during 1998 and 1999 seasons, infestation began to appear in the 2nd week of July (4 and 1 larva / 100 bolls, respectively).

After that, the larval population inside infested bolls gradually increased till the end of the season. The highest number of PBW larval population was recorded in September, showing 297, 267 and 386 larval/100 inspected bolls during 1997, 1998and 1999 seasons, respectively. In the same table, it could be also observed that the population density of SBW

Table (44): Total numbers of pink and spiny bollworm larvae collected 100 infested green cotton bolls/sample in untreated and sprayed cotton plants at Sids (Beni-Suef Governorate) throughout 1997, 1998 and 1999 seasons.

Sampling date		1997				1998				1999			
		Untreated		Treated		Untreated		Treated		Untreated		Treated	
		P.	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*	*P.*	*E.*
June	22	0	0	0	0	0	0	0	0	0		0	0
	29	1	0	0	0	3	0	0	0	3		0	0
		1	0	0	0	3	0	0	0	3	0	0	0
July	6	2	2	1	1	10	0	2	1	2	0	0	0
	13	16	4	1	0	19	4	6	1	4	1	5	1
	20	19	10	7	2	29	1	2	1	7	3	8	4
	27	24	9	9	4	30	6	8	3	10	2	9	4
Total		61	25	18	7	88	11	18	6	23	3	22	9
Aug.	2	29	12	19	8	27	5	10	13	49	9	15	3
	10	27	13	7	6	27	7	6	16	42	17	14	3
	17	52	10	10	14	29	11	19	9	50	11	9	3
	24	50	16	8	7	30	7	20	12	60	9	21	4
	30	0	0	0	0	37	5	19	13	201	7	25	4
Total		158	51	44	35	150	25	74	14	64	43	84	17
Sept.	4	37	20	30	10	21	10	21	10	69	11	31	6
	11	54	20	30	11	30	14	27	16	70	13	20	8
	18	60	30	34	17	39	9	16	15	104	10	24	11
	25	51	25	33	20	91	20	28	16	143	14	29	9
	31	95	31	34	15	86	27	47	71	0	27	0	10
Total		297	136	161	73	267	80	139	14	386	45	141	24
Oct.	6	91	24	25	17	61	40	32	14	107	23	34	15
Overall		607	226	248	132	466	166	243	10.26	755	141	217	98
Mean		42.9	16.14	17.7	9.43	31.06	11.06	16.21	10.26	50.3	9.4	18.76	6.53

P= Pectinophora gossypiella

E= Earias insulana

larvae inside the infested bolls took the same trend in the untreated fields during the three seasons, where the larval population infested cotton bolls started very low and increased successively in the subsequent samples throughout the three seasons until reaching the highest number in September (136, 80 and 45 larvae in 1997, 1998 and 1999 seasons, respectively).

From the previously mentioned data it could be concluded that the lowest number of infested cotton pen squares, blooms and green bolls was recorded in cotton fields from plants treated with the conventional-program of insecticidal application as recommended by the Egyptian Ministry of Agriculture. It could be also observed that the highest larval population in the shed material was in green bolls, closely followed by blooms, and the lowest was in the pen squares. As a matter of fact the highest infestation rates by the pink and spiny bollworm larvae to cotton occurred during September in both unsprayed and sprayed fields.

IV-10-Percentage of infested okra pods and karkadeih capsules by *Pectienophora gossypiella* and *Earias insulana* in both locations.

In the pesent work, the incidence of attack of okra pods or capsules of karkadieh were estimated in Sids and Moshtohor during the three seasons (1997, 1998 and 1999).

In case of okra (Bamia, *Hibiscus esculentus*):

The data given in Table (46 & 47) reveal that the percentage of infested fruits was low in comparison with those obtained in case of cotton bolls.

In each year, and in each location, squares and flowers began to appear by late July and those infested by pink bollworm or spiny bollworm were very few in the two locations during the three seasons.

In Moshtohor region:

The data given in Table (46) indicate that the percentages of infested fruits by ***P gossypiella*** were very low, being 1, 0 and 0% PBW on 2nd week of August in the three seasons, but increased rapidly to reach 7 and 8% during 2nd week of September in 1997 and 1999 and 6% in the 1st week of October, 1998.

On the other hand, the seasonal mean percentage of infested okra fruits decreased from 3.16% during 1997 to 2.6% during 1998 and 2.8% during 1999 season.

In case of ***E. insulana***, the percentage of infested okra fruits increased gradually from 0, 4 and 1% in 2nd week of

Table (46): Percentage of infested okra pods and karkadeih capsules (100 inspected fruits/sample), caused by ***Pectinophora gossypiella*** and ***Earias insulana*** during 1997, 1998 and 1999 seasons in Moshtohor (Kalubia Governorate).

Sampling date	Okra (*Hibiscus esculentus*)						Karkadieh (*Hibiscus sabdariffa*)					
	1997		1998		1999		1997		1998		1999	
	P. %	*E.* %	*P.* %	*E.* %	*P.* %	*E.* %	*P.* %	*E.* %	*P.* %	*E.* %	*P.* %	*E.* %
August 2nd week	1	0	0	4	0	1	0	0	0	0	0	0
August 4th week	3	7	1	10	3	6	0	0	0	0	0	0
September 2nd week	7	13	3	20	8	17	1	3	0	7	2	9
September 4th week	6	20	3	29	3	21	0	5	2	7	3	13
October 1st week	1	23	6	41	0	23	1	17	3	13	4	17
October 3rd week	1	43	0	47	-	39	3	41	2	17	6	17
November 1st week	-	-	-	-	-	-	1	36	5	20	3	30
Mean %	3.16	17.66	2.6	25.166	2.8	17.83	1.2	20.4	2.6	12.8	3.6	17.2

P. = *Pectinophora gossypiella.*

E. = *Earias insulana.*

Table (47): Percentage of infested okra pods and karkadeih capsuales (100, inspected fruits/sample), caused by ***Pectinophora gossypiella*** and ***Earias insulana*** during 1997, 1998 and 1999 seasons in Sids (Bine-suef Governorate).

Sampling date	Okra (*Hibiscus esculentus*)						Karkadieh (*Hibiscus sabdariffa*)					
	1997		1998		1999		1997		1998		1999	
	P. %	*E.* %	*P.* %	*E.* %	*P.* %	*E.* %	*P.* %	*E.* %	*P.* %	*E.* %	*P.* %	*E.* %
August 2nd week	0	5	3	6	4	9	0	0	0	0	0	0
August 4th week	4	13	7	9	6	17	0	1	0	1	0	2
September 2nd week	6	15	10	10	13	18	2	7	3	11	0	8
September 4th week	7	17	3	26	3	30	3	9	4	17	3	13
October 1st week	3	30	6	47	10	38	8	21	2	19	5	27
October 3rd week	-	-	-	-	-	-	6	30	5	25	5	30
November 1st week	-	-	-	-	-	-	3	31	3	27	7	39
Mean %	4.0	16	5.8	19	7.2	22.4	3.86	19.14	2.43	23.14	4.0	19.83

P. = *Pectinophora gossypiella.*

E. = *Earias insulana.*

August to 43, 47 and 39 % in the 3rd week of October during 1997, 1998 and 1999 seasons, respectively.

In Sids region:

The % of infestation started at low rate of 0, 3 and 4% PBW in 2nd week of August during 1997, 1998 and 1999 seasons, but increased to 7% in 4th week of September 1997 and to 10 and 13% in 2nd week of September during 1998 and 1999 seasons, respectively. these percentages reached 3, 6 and 10% in the 1st week of October of the three seasons, respectively. On the other hand, the percentage of infestation in fruits of okra by ***E. insulana*** increased gradually from 5, 6 and 9% in 2nd week of August to 30, 47 and 38% in the first week of October during 1997, 1998 and 1999 seasons, respectively.

It could be also observed from Table (47) that the seasonal mean percentage of infestation to okra pods by ***P. gossypiella*** increased from 4% in 1997 to 5.8 and 7.2% in 1998 and 1999, and by ***E. insulana*** from 16% in 1997 to 19% in 1998 and to 22.4% in 1999.

Pink bollworm and spiny bollworm infestation to Karkadieh (*Hibiscus sabderffa*):

In Moshtohor region:

Data presented in Table (46) show that the percentages of infested fruits by ***P. gossypiella*** were very low in 2nd week of September, being 1, 0 and 2% during 1997, 1998 and 1999 seasons, respectively, but increased to reach 3 and 6% in the

3rd week of October 1997 and 1999, and 5% in 1st week of November 1998.

On the other hand, the seasonal mean percentage of infested karkadeih fruits increased from 1.2% during 1997 to 2.6% during 1998 and to 3.6% during 1999 season. In case of ***E. insulana***, the percentage of infested fruits of karkadieh increased from 3, 7 and 9% in 2nd week of September during the three seasons, to a maximum of 41% in the 3rd week of October and to 20% and 30% in 1st week of November.

On the other hand, the seasonal percentage of infested karkadieh by ***E. insulana*** fruits was decreased from 20.4% during 1997 to 12.8% during 1998 and 17.2% during 1999 season.

In Sids region:

The data in Table (47) show that the rate of attack to karkadieh fruits by ***P. gossypiella*** started low from 2, 3 and 0.0% in the 2nd week of September, and increased to reach 8% in 1st week of October during 1997, 5% in 3rd week of October during 1998 and 7% in 1st week of November, 1999 season. The seasonal mean percentages of infestation were 3.8, 2.43 and 4% in 1997, 1998 and 1999, respectively.

In case of ***Earias insulana***, the percentage of infestation in fruits of karkadieh increased from 1, 1 and 2% in 4th week of August to 31, 27 and 39% in first week of November during 1997, 1998 and 1999 season, respectively.

IV-11-Comparison between percentage of infestation in (cotton, okra and karkadieh) in two locations:

In Moshtohor:

Figures (23b) show the comparison between percentages of infestaton by ***P. gossypiella*** and ***E. insulana*** to cotton okra and karkadeih in three successive yeares, 1997, 1998 and 1999. Data show that in 1997, the highest infestation occurred to cotton fields (36.3 %), follwed by karkadaih (21.6 %; 1.2 % ***P. gossypiella*** and 20.4 % % ***E. insulana***) and okra (20.82 %; 3.16 % PBW and 17.66 % SBW) in 1997 season.

In 1998, cotton fields harboured the highest percentages of infestation by PBW and SBW (43.11 %), followed by okra (27.76 %; 2.6 % PBW and 25.166 % SBW) and karkadieh (15.4 %; 2.6 % PBW and 12.8 % SBW).

In 1999, infestation of different crops took the same trend as the highest infestation occurred in cotton fields, and the percentages differed between okra and karkadieh. It could be also obseved that infestations of okra by ***E. insulana*** and karkadieh were higher than those of ***P. gossypiella*** in the two locations during 1997, 1998 and 1999 seasons. While, in cotton fields, the highest percentage of infestation caused by ***P. gossypiella*** than ***E. insulana***.

In Sids region:

Figures (23a) cleared that in 1997, the highest percentage of infestation (47.62 %) occurred in cotton fields, followed by karkadieh (23.0 %; 3.86 % PBW and 19.14 % SBW) and okra (20 %; 4 % PBW and 16 % SBW). While, in 1998 the highest percentage occurred in cotton fields

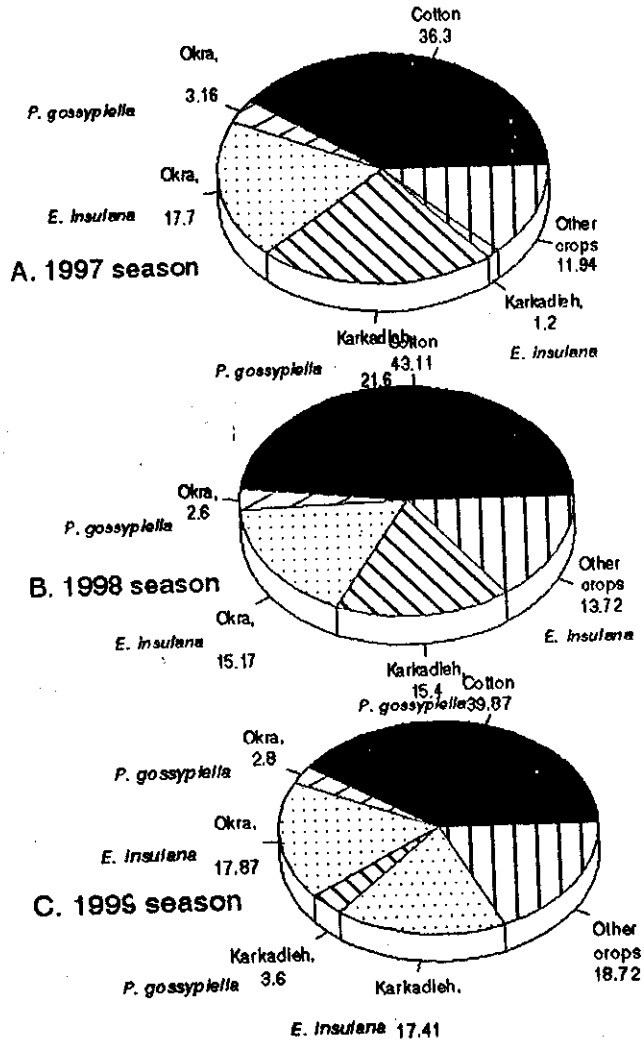


Fig.(23b): % Infestation by *P. gossypiella* and *E.insulana* on cotton, okra and karkadieh, in Moshtohor region.

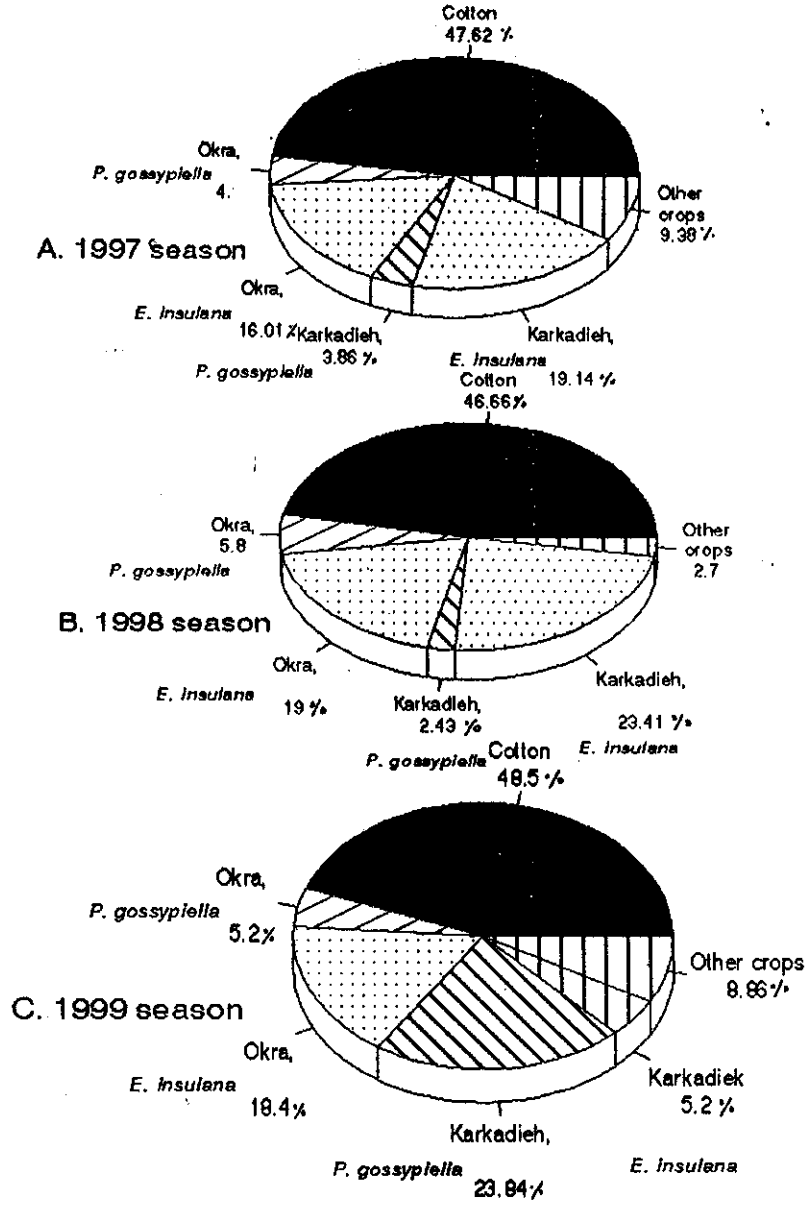


Fig. (23): % Infestation by *P. gossypiella* and *E.insulana* on cotton, okra and karkadieh, in Beni-Suef region.

(46.66%) followed by karkadieh (25.57 %; 2.43 % PBW and 23.14 % SBW) and okra (24.8 %; 5.8 % PBW and 19 % SBW). In 1999, the percentages of infestation were 48.15 % in cotton fields, 29.6 % (7.2 % PBW and 22.4 % SBW) in okra and 23.83 % (4.0 % PBW and 19.83 % SBW) in karkadieh.

IV-12-Population dynamics of bollworms PBW *Pectinophora gossypiella* and SBW *Earias insulana* and their predators:

IV-12-1-The seasonal fluctuations of the two bollworms:

Two locations were chosen for this study; Moshtohor (Qalubia Governorate) and Sids (Beni–Suef Governorate). A number of 100 cotton plants occuping 50 hills were randomly chosen for inspection and the parts of plant inserted by egg of PBW or SBW were collected and brought to the laboratory for estimating the number of eggs.

Data in Tables (48, 49, 50, 51, 52 & 53) show that the infestation of the cotton bolls by PBW during 1997, 1998 and 1999 cotton seasons started on 21/7, 23/7 & 20/8, at Moshtohor. The peak of infestation, 13.03, 28.90 &19.15% was observed on 25/8, 25/9 & 17/9 in the three seasons, respectively. The obtained data indicate that in 1998 the rate of infestation of bolls was extremely higher than the two other seasons.

IV-12-2-Degree of cotton infestation by bollworms:

The results obtained are illustrated in Tables 48, 49, 50, 51, 52 & 53. As has been mentioned before, infestation with the pink bollworm began at Moshtohor on 21/7 23/7 & 20/8 and persisted till the cotton picking, whereas infestation with the spiny bollworm began later in the three cotton seasons on 7/8, 6/8 & 20/8. During 1997, 1998 &1999, respectively. It is also shown that the maximum number of pink bollworm eggs/100 plants units abut 40, 100 &63 at 1997,1998 & 1999

Table (48) : Numbers of *P. gossypiella* and *E. insulana* eggs and their predators after direct counts from 50 hills (100 plants) in untreated cotton fields at Moshtohor (Kalubia Governorate) 1997 season.

Order	Lepidoptera		Coleoptera										Diptera			Hemi-ptera	Neuro-ptera		
Family	Gelech-iidae	Noctu-idae	Coccinellidae								Staphy-linidae	Total	Cecido-myiidae	Syrphi-idae	Total	Antho-coridae	Chry-sopidae	True spider	Overall mean
Date	*P. gossy-piella*	*E. insulana*	*C. undecim-punctata*	*C. septem-punctata*	*H. oxycion-punctatus*	*Adonia variegata*	*Cydonia vilanova*	*C. nigrolu-teis*	*Scymnus spp.*	Total	*P. alfierii*		*Ph. aphidi-phora*	*Syrphus sp.*		*Orius spp.*	*Ch. carnea*		
11/5	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1
18/5	0	0	0	0	0	0	1	3	0	4	0	4	0	0	0	0	12	0	16
25/5	0	0	2	3	0	1	7	6	0	19	4	23	0	1	1	1	20	3	48
7/6	0	0	11	2	0	3	3	4	10	33	12	45	0	0	0	4	25	6	80
15/6	0	0	30	2	2	7	4	3	17	65	13	78	0	0	0	8	16	8	110
22/6	0	0	25	3	2	0	3	10	10	53	11	64	8	2	10	19	16	7	116
29/6	0	0	14	1	1	0	1	3	21	41	1	42	5	3	8	18	13	7	88
7/7	0	0	18	0	8	0	1	0	20	47	4	51	0	0	0	34	19	15	119
14/7	0	0	12	0	1	7	0	0	15	35	16	51	0	0	0	25	24	19	119
21/7	20	0	18	6	3	0	0	2	17	46	17	63	0	1	1	24	34	16	138
29/7	25	0	0	9	3	0	1	1	23	37	13	50	0	1	1	30	36	21	138
7/8	16	8	5	7	3	6	3	0	12	36	7	43	0	2	2	30	35	5	115
12/8	17	8	7	5	4	7	11	1	17	52	8	60	0	3	3	28	16	1	108
18/8	36	10	15	3	13	7	1	1	11	51	11	62	0	7	7	27	11	1	108
25/8	40	10	23	1	6	0	0	2	9	41	12	53	28	11	39	18	28	13	151
7/9	30	11	18	1	3	3	1	1	21	48	9	57	11	13	24	12	36	16	145
12/9	17	23	12	0	3	1	5	0	23	44	3	47	37	23	60	16	38	16	177
19/9	13	27	36	3	9	0	9	0	20	77	0	77	4	21	25	58	33	18	211
26/9	30	16	13	9	0	0	6	0	15	43	10	53	10	24	34	43	48	19	197
7/10	33	20	2	7	1	0	3	0	19	32	13	45	10	10	20	64	38	3	170
14/10	30	10	0	1	3	0	3	0	3	10	8	18	0	0	0	11	24	21	74
Total	307	143	261	63	65	42	63	37	283	814	173	987	113	122	235	470	522	215	2429
%	-	-	10.75	2.59	2.68	1.73	2.59	1.52	11.65	33.51	7.12	40.63	4.65	5.02	9.67	19.35	21.49	8.85	100.0

Table (49) : Numbers of *P. gossypiella* and *E. insulana* eggs and their predators after direct counts from 50 hills (100 plants) in untreated cotton fields at Moshtohor (Kalubia Governorate) 1998 season.

Order	Lepidoptera		Coleoptera											Diptera			Hemi-ptera	Neuro-ptera		
Family	Gelec hildae	Noctu -idae	Coccinellidae									Staphy-linidae	Total	Cecido-myiidae	Syrph-idae	Tota l	Anthe-coridae	Chry-opidae	True spider	Overal l mean
Date	*P. gossy-piella*	*E. insulana*	*C. undecim-punctata*	*C. septem-punctata*	*H. variegata*	*Adonia variegata*	*Cydonia vicinia*	*C. viden-nata*	*S. interr-uptus*	*S. syriacus*	Total	*P. alfierii*		*Ph. aphidi-phora*	*Syrphus* sp.		*Orius* spp.	Ch. carnea		
16/5	0	0	6	0	0	3	0	0	0	0	9	0	9	0	0	0	0	0	0	9
23/5	0	0	0	3	0	3	0	0	0	0	6	2	8	0	0	0	0	0	0	8
30/5	0	0	2	5	10	1	0	0	10	6	34	1	35	0	0	0	5	6	0	46
10/6	0	0	11	9	13	2	0	1	10	7	53	3	56	0	0	0	3	5	1	65
17/6	0	0	40	3	17	3	0	3	8	3	77	7	84	0	3	3	18	3	4	112
24/6	0	0	36	1	5	3	0	4	1	0	60	9	69	0	9	9	21	6	5	110
1/7	0	0	11	1	2	5	0	8	13	1	41	11	52	0	1	1	38	0	6	97
8/7	0	4	8	0	1	0	1	2	4	5	21	5	26	0	0	0	50	7	3	86
15/7	0	1	6	0	2	0	3	1	7	7	26	2	28	0	0	0	30	8	8	74
23/7	7	0	6	0	2	0	1	0	19	8	36	2	38	0	0	0	20	8	8	74
30/7	4	0	0	0	3	1	1	0	13	2	20	3	23	0	0	0	20	16	11	70
6/8	3	5	16	0	8	1	1	0	0	0	26	3	29	0	1	1	39	5	13	87
13/8	11	7	10	0	15	2	0	0	0	0	27	4	31	0	3	3	57	9	11	111
20/8	15	3	17	3	5	2	0	0	0	0	27	4	31	0	2	2	90	13	10	146
27/8	11	10	42	5	3	0	0	0	1	6	57	5	62	0	2	2	63	21	7	155
4/9	21	13	43	7	3	0	0	5	17	2	77	7	84	5	9	14	51	34	16	199
11/9	0	11	32	5	6	7	10	7	20	3	90	9	99	11	13	24	30	41	21	215
18/9	33	10	11	2	7	23	16	18	20	3	100	11	111	31	21	52	27	45	23	258
25/9	100	29	0	1	17	11	11	9	23	5	77	5	82	49	30	79	20	37	30	248
2/10	80	21	0	0	5	7	5	3	37	7	64	2	66	15	11	26	13	15	35	155
15/10	61	21	1	0	0	1	2	1	5	1	11	1	12	0	0	0	5	9	4	30
Total	346	135	298	45	124	75	51	62	218	66	939	96	1035	111	105	216	600	288	216	2355
%			12.65	1.9	5.26	3.18	2.16	2.63	9.25	2.8	39.87	4.07	43.9	4.7	4.46	9.2	25.47	12.2	9.17	179.94

Table (5o) : Numbers of *P. gossypiella* and *E. insulana* eggs and their predators after direct counts from 50 hills (100 plants) in untreated cotton fields at Moshtohor (Kalubia Governorate) 1999 season.

Order	Lepidoptera		Coleoptera										Diptera			Hemiptera		Neuroptera	True spider	Overall mean
Family	Gelechiidae	Noctuidae	Coccinellidae								Staphylinidae	Total	Ochthiphilidae	Syrphidae	Total	Anthocoridae		Chrysopidae		
Date	*P. gossypiella*	*E. insulana*	*C. undecimpunctata*	*C. septempunctata*	*H. tredecimpunctata*	*Adonia variegata*	*Cydonia nilotica*	*C. vicina isis*	*Scymnus spp.*	Total	*P. alfierii*		*Leucopis sp.*	*Syrphus sp.*		*Orius laevigata*	*Orius albidipennis*	*Ch. carnea*		
12/5	0	0	120	0	0	0	0	0	0	120	0	120	0	0	0	0	0	0	0	120
19/5	0	0	197	0	0	0	0	0	0	197	0	197	0	0	0	0	0	0	0	197
26/5	0	0	255	0	0	2	0	0	0	257	0	257	0	0	0	8	6	0	0	271
6/6	0	0	130	0	0	6	0	0	8	144	6	150	0	0	0	3	7	0	1	161
14/6	0	0	60	0	3	1	1	0	1	66	0	66	0	0	0	13	15	3	1	98
21/6	0	0	15	0	2	1	1	0	0	19	3	22	0	0	0	2	7	4	0	35
28/6	0	0	10	0	1	0	0	0	3	14	6	20	0	0	0	1	9	7	3	40
6/7	0	0	5	1	1	0	0	0	3	10	5	15	0	1	1	8	13	5	3	45
13/7	0	0	3	1	3	1	0	0	2	10	3	13	0	2	2	3	31	7	2	58
20/7	0	0	9	0	3	0	0	0	2	14	2	16	0	0	0	3	15	7	5	46
27/7	0	0	11	0	5	0	0	0	5	21	1	22	0	0	0	7	17	13	2	61
5/8	0	0	21	0	1	2	1	1	5	31	13	44	0	1	1	2	21	17	9	94
12/8	0	0	30	1	1	3	1	0	2	38	5	43	1	1	2	17	43	31	1	137
20/8	10	3	5	1	0	1	2	0	1	10	7	17	1	3	4	13	60	40	2	136
27/8	21	13	7	1	0	0	1	0	1	10	7	17	0	5	5	11	51	43	1	128
3/9	45	20	25	1	3	0	0	1	3	33	3	36	10	6	16	27	33	61	7	180
10/9	50	27	51	0	2	3	2	1	13	72	1	73	15	9	24	30	57	70	11	265
17/9	63	15	8	1	1	3	3	0	7	23	1	24	17	13	30	25	50	75	17	221
24/9	40	17	3	1	0	1	1	0	18	24	0	24	21	13	34	20	21	30	20	149
31/9	50	31	2	0	0	1	0	0	8	11	5	16	11	27	38	15	13	40	21	143
7/10	50	30	3	1	2	1	1	0	10	18	0	18	8	11	19	7	10	21	30	105
Total	329	156	970	9	28	26	14	3	92	1142	68	1210	84	92	176	215	479	474	136	2690
%			36.1	0.33	1.04	0.96	0.52	0.11	3.4	42.45	2.53	44.98	3.12	3.42	6.65	7.99	17.8	17.6	5.0	100.0

Table (51) : Numbers of *P. gossypiella* and *E. insulana* eggs and their predators after direct counts from 50 hills (100 plants) in untreated cotton fields at Sids (Beni-Suef Governorate) 1997 season.

Order	Lepidoptera		Coleoptera										Diptera			Hemi-ptera	Neuro-ptera	True spider	Overall mean
Family	Gelechiidae	Noctuidae	Coccinellidae								Staphylinidae	Total	Ochiphilidae	Syrphidae	Total	Anthocoridae	Chrysopidae		
Date	*P. gossypiella*	*E. insulana*	*C. undecimpunctata*	*C. septempunctata*	*H. tredecimpunctata*	*Adonis variegata*	*Cydonia nilotica*	*C. vising intr.*	*Scymnus* spp.	Total	*P. alfierii*		*Leucopis* sp.	*Syrphus* sp.		*Orius* spp.	*Ch. carnea*		
15/5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26/5	0	0	0	4	6	6	0	0	0	16	8	24	0	0	0	0	0	0	24
2/6	0	0	11	8	15	11	0	0	1	46	13	59	9	0	9	0	10	0	78
9/6	0	0	34	10	17	8	3	1	5	78	17	95	8	10	18	15	20	0	148
16/6	0	0	16	3	14	6	14	3	9	65	23	88	8	11	19	27	40	0	174
23/6	0	0	7	4	11	0	2	0	37	62	15	77	6	14	20	46	25	3	171
30/6	0	0	12	1	1	0	2	0	21	37	11	49	0	6	6	48	23	7	133
6/7	0	0	30	6	8	8	2	2	17	73	10	83	3	3	6	50	35	0	174
13/7	0	2	16	8	9	10	12	1	16	72	16	88	0	1	1	108	42	2	241
20/	0	1	14	0	11	7	1	1	13	47	17	64	0	0	0	113	27	13	217
28/7	1	0	24	0	2	0	1	0	13	40	13	53	1	0	1	95	26	3	178
6/8	8	13	27	1	1	1	6	0	6	42	11	53	0	0	0	71	27	7	158
13/8	11	6	22	1	3	0	6	2	9	43	3	46	0	0	0	46	31	11	134
20/8	17	9	9	1	5	0	0	2	41	58	2	60	8	1	9	71	42	18	200
27/8	23	10	7	2	1	0	1	1	3	15	7	22	7	3	10	63	51	19	165
4/9	42	28	10	3	1	0	0	0	5	19	9	28	5	7	12	58	30	50	178
11/9	83	32	30	10	2	0	0	0	70	112	11	123	0	10	10	64	34	13	244
18/9	11	41	36	4	6	0	1	1	10	58	21	79	3	6	9	44	38	29	199
27/9	31	46	62	6	0	0	0	0	9	77	10	87	1	6	7	51	58	9	212
6/10	38	58	5	0	0	1	0	0	2	8	1	9	0	1	1	13	24	10	57
Total	265	246	372	72	113	58	51	14	287	969	218	1187	59	79	138	983	583	194	3085
%	8.59	7.97	12.06	2.33	3.66	1.94	1.65	0.45	9.30	31.41	7.07	38.48	1.91	2.56	4.47	31.86	18.90	6.29	100.0

Table (52) : Numbers of *P. gossypiella* and *E. insulana* eggs and their predators after direct counts from 50 hills (100 plants) in untreated cotton fields at Sids (Beni-Suef Governorate) 1998 season.

Order	Lepidoptera		Coleoptera										Diptera			Hemi-ptera	Neuro-ptera	True spider	Overall mean
Family	Gelechiidae	Noctuidae	Coccinellidae							Staphylinidae	Total		Cecidomyiidae	Syrphidae	Total	Anthocoridae	Chrysopidae		
Date	*P. gossypiella*	*E. insulana*	*C. undecim-punctata*	*C. septum-punctata*	*H. tredicim-punctata*	*Adonis variegata*	*Cydonia vilelica*	*C. visina lex*	*Scymnus* spp.	Total	*P. alfierii*		*Lecopus* sp.	*Syrphus* sp.		*Orius* spp.	*Ch. carnea*		
10/5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17/5	0	0	13	0	3	0	3	0	0	19	0	19	0	0	0	0	0	0	19
24/5	0	0	11	7	15	7	1	0	21	62	10	72	0	0	0	3	7	1	83
1/6	0	0	5	11	37	12	1	5	20	91	13	104	11	0	11	3	8	0	126
8/6	0	0	7	13	16	9	0	4	45	94	15	109	10	0	10	6	8	0	133
15/6	0	0	16	9	13	2	0	3	11	54	17	71	6	0	6	15	3	0	95
23/6	0	0	7	5	1	3	1	0	13	30	11	41	0	0	0	27	3	0	71
4/7	0	0	3	5	0	1	15	0	15	39	0	39	0	0	0	33	5	0	77
13/7	0	0	0	2	0	6	5	0	16	29	3	32	0	0	0	21	2	1	56
20/7	0	10	0	1	0	9	0	0	6	16	3	19	0	0	0	19	3	1	42
27/7	0	0	3	0	5	3	0	0	9	20	2	22	0	2	2	15	19	0	58
2/8	8	0	5	9	7	3	0	3	7	34	1	35	0	3	3	35	36	2	111
10/8	17	1	17	11	9	1	0	2	3	43	1	44	0	8	8	13	17	2	84
17/8	33	3	18	2	3	1	1	1	2	28	3	31	0	5	5	10	15	4	65
24/8	20	9	20	1	3	1	1	1	1	28	5	33	3	6	9	10	10	13	75
2/9	40	0	11	1	44	0	3	0	10	69	7	76	4	6	10	9	9	22	126
10/9	30	24	49	5	6	0	17	0	25	102	11	113	9	15	24	13	3	27	180
17/9	30	38	17	8	6	7	11	0	27	76	2	78	11	13	24	25	5	36	168
23/9	41	50	15	3	11	12	8	15	11	75	1	76	25	11	36	23	11	75	221
30/9	67	41	27	1	41	21	3	34	10	137	2	139	15	10	25	19	13	39	235
6/10	97	30	7	0	15	10	7	0	2	41	3	44	44	7	51	8	3	18	124
Total	383	196	251	94	235	108	77	68	254	1087	110	1197	138	86	224	307	180	241	2149
%	66.1	33.85	11.76	4.37	10.94	5.02	3.58	3.16	11.82	50.58	5.12	55.73	6.42	4.0	10.42	14.28	8.37	11.2	

Table (53) : Numbers of *P. gossypiella* and *E. insulana* eggs and their predators after direct counts from 50 hills (100 plants) in untreated cotton fields at Sids (Beni-Suef Governorate) 1999 season.

Order	Lepidoptera		Coleoptera										Diptera			Hemi-ptera	Neuro-ptera	True spider	Overall mean
Family	Gelechiidae	Noctuidae	Coccinellidae								Staphylinidae	Total	Cocidomyiidae	Syrphidae	Total	Anthocoridae	Chrysopidae		
Date	*P. gossypiella*	*E. insulana*	*C. undecimpunctata*	*C. septempunctata*	*H. tredecimpunctata*	*Adonis variegata*	*Cydonia nilotica*	*C. vinae lis*	*Scymnus* spp.	Total	*P. alfierii*		*Ph. aphidophora*	*Syrphus* sp.		*Orius* spp.	*Ch. carnea*		
23/5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30/5	0	0	2	5	0	0	0	0	0	7	2	9	0	0	0	0	0	0	9
6/6	0	0	5	13	1	10	1	1	13	44	12	56	5	4	9	0	10	0	75
13/6	0	0	5	7	4	18	6	1	18	59	37	96	10	3	13	33	5	0	147
20/6	0	0	7	3	6	16	8	3	40	83	25	108	0	0	0	27	47	0	182
27/6	0	0	5	5	2	1	0	0	3	16	14	30	0	0	0	36	13	1	80
5/7	0	0	5	2	3	1	0	0	11	22	10	32	3	2	5	31	11	5	84
12/7	0	0	3	1	5	1	0	3	10	23	12	35	5	1	6	15	4	9	69
19/7	0	0	0	1	11	0	1	3	2	18	1	19	4	2	6	0	7	8	40
26/7	0	0	0	1	3	0	2	0	1	7	1	8	0	3	3	4	5	13	33
4/8	0	0	31	2	1	0	3	0	3	40	8	48	1	1	2	1	9	15	75
12/8	9	3	25	5	0	1	1	10	5	47	3	50	5	3	8	15	11	26	110
20/8	15	11	21	7	25	3	4	13	7	80	3	83	3	3	6	17	18	31	155
5/9	40	24	33	1	5	7	5	9	17	77	8	85	7	9	16	80	71	47	299
12/9	53	31	56	0	1	7	11	3	51	129	8	137	8	8	16	29	43	46	271
19/9	70	15	11	2	1	13	17	3	23	70	6	76	3	15	18	20	41	27	182
26/9	90	30	1	3	1	1	16	3	21	46	3	49	3	1	4	15	33	6	107
Total	277	114	210	58	68	79	75	52	225	768	153	921	57	55	112	323	328	234	1918
%	19.24	4.48	8.26	2.28	1.34	3.11	2.95	2.05	8.85	28.84	6.02	34.85	2.24	2.86	4.41	12.71	12.90	9.21	0.74076

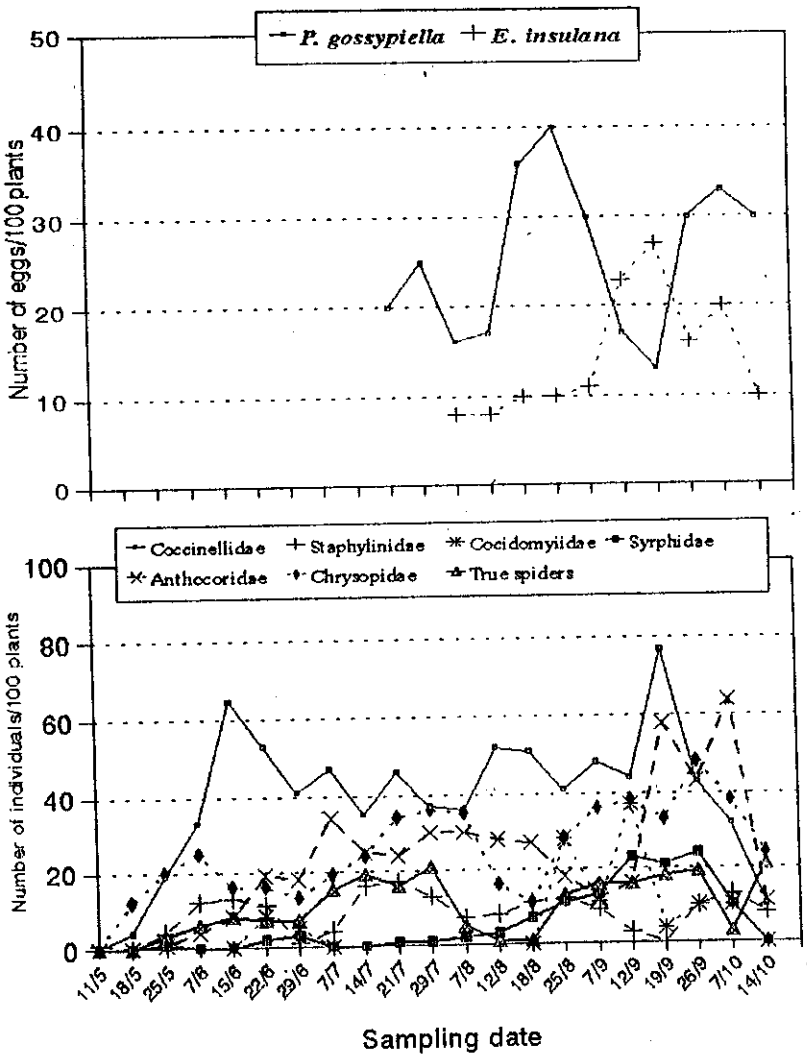


Fig. (24) : Number of *P. gossypiella* and *E. insulana* eggs/100 plants and their predators counted in Moshtohor cotton fields throughout 1997 cotton season.

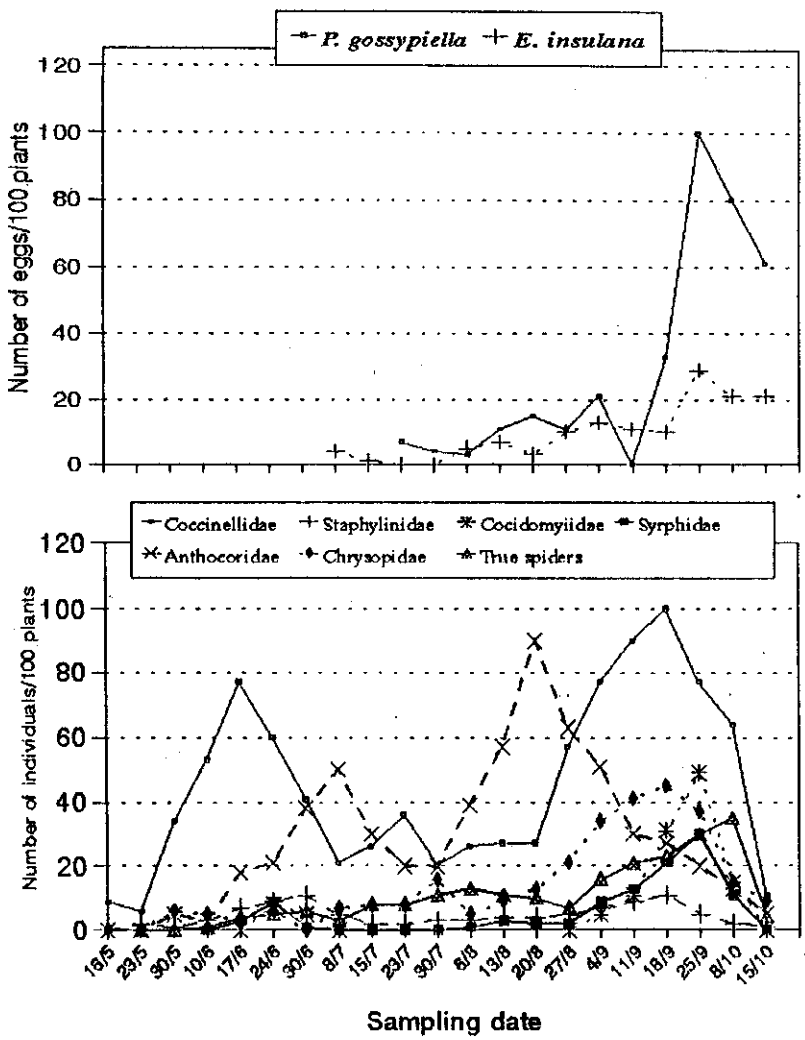


Fig. (25) : Number of *P. gossypiella* and *E. insulana* eggs/100 plants and their predators counted in Moshtohor cotton fields throughout 1998 cotton season.

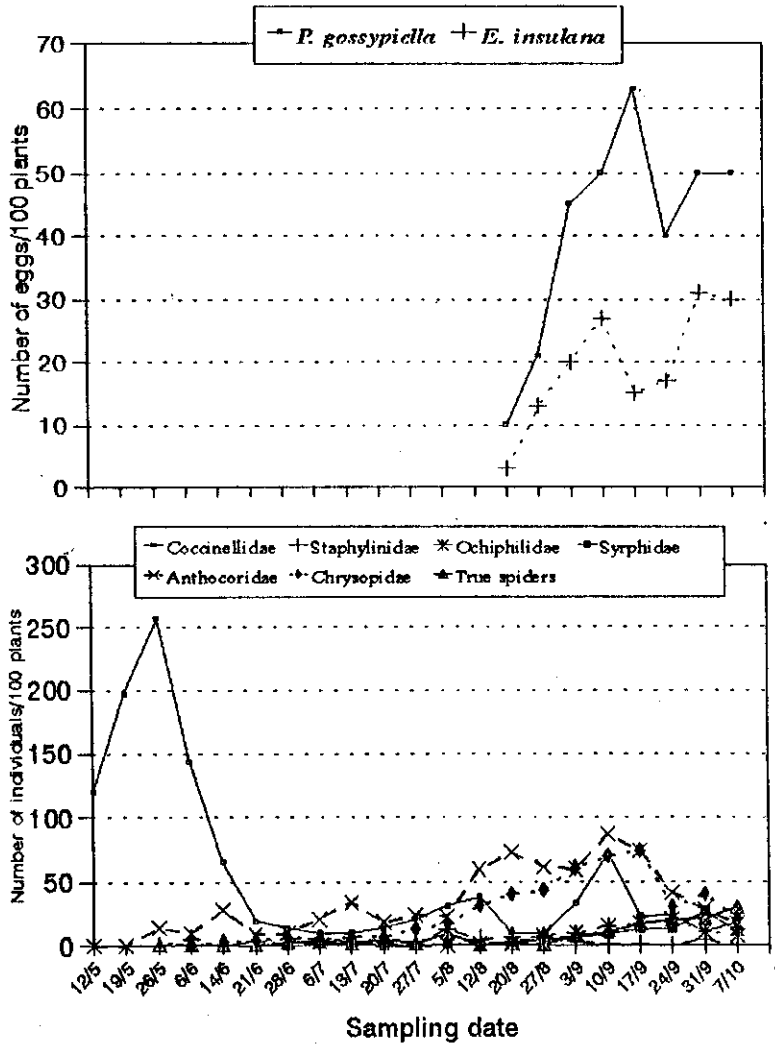


Fig. (26) : Number of *P. gossypiella* and *E. insulana* eggs/100 plants and their predators counted in Moshtohor cotton fields throughout 1999 cotton season.

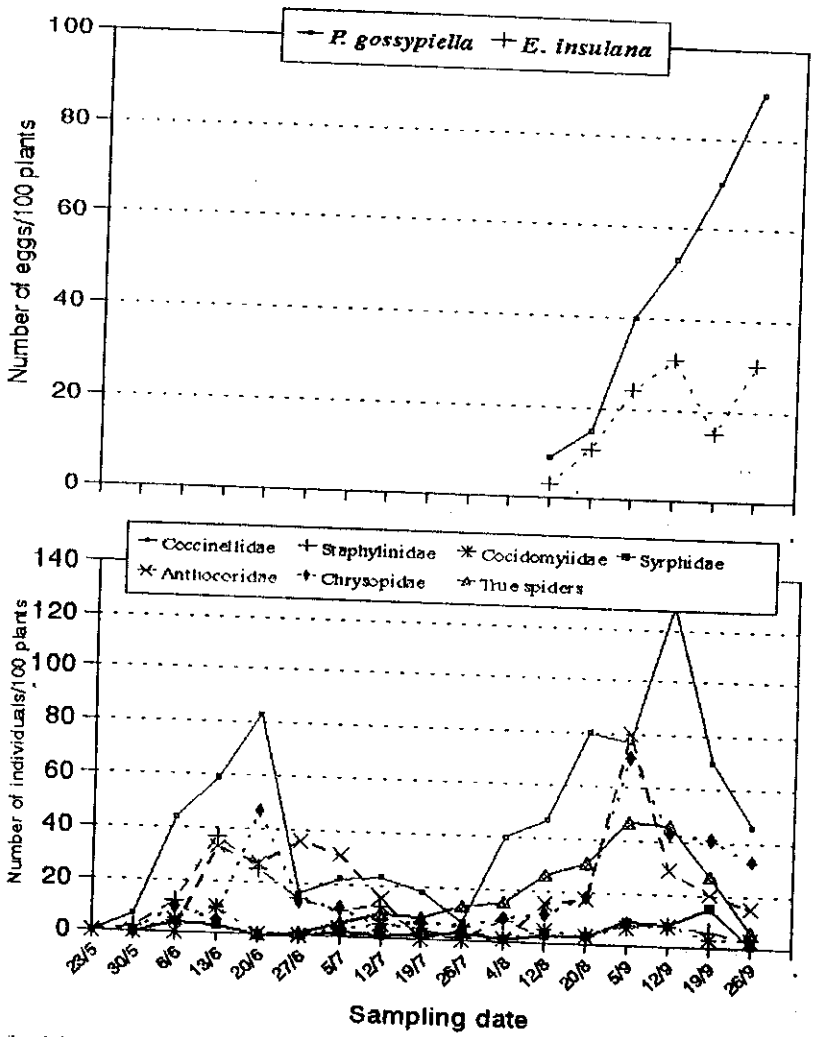


Fig. (21) : Number of *P. gossypiella* and *E. insulana* eggs/100 plants and their predators counted in Beni-Suef cotton fields throughout 1997 cotton season.

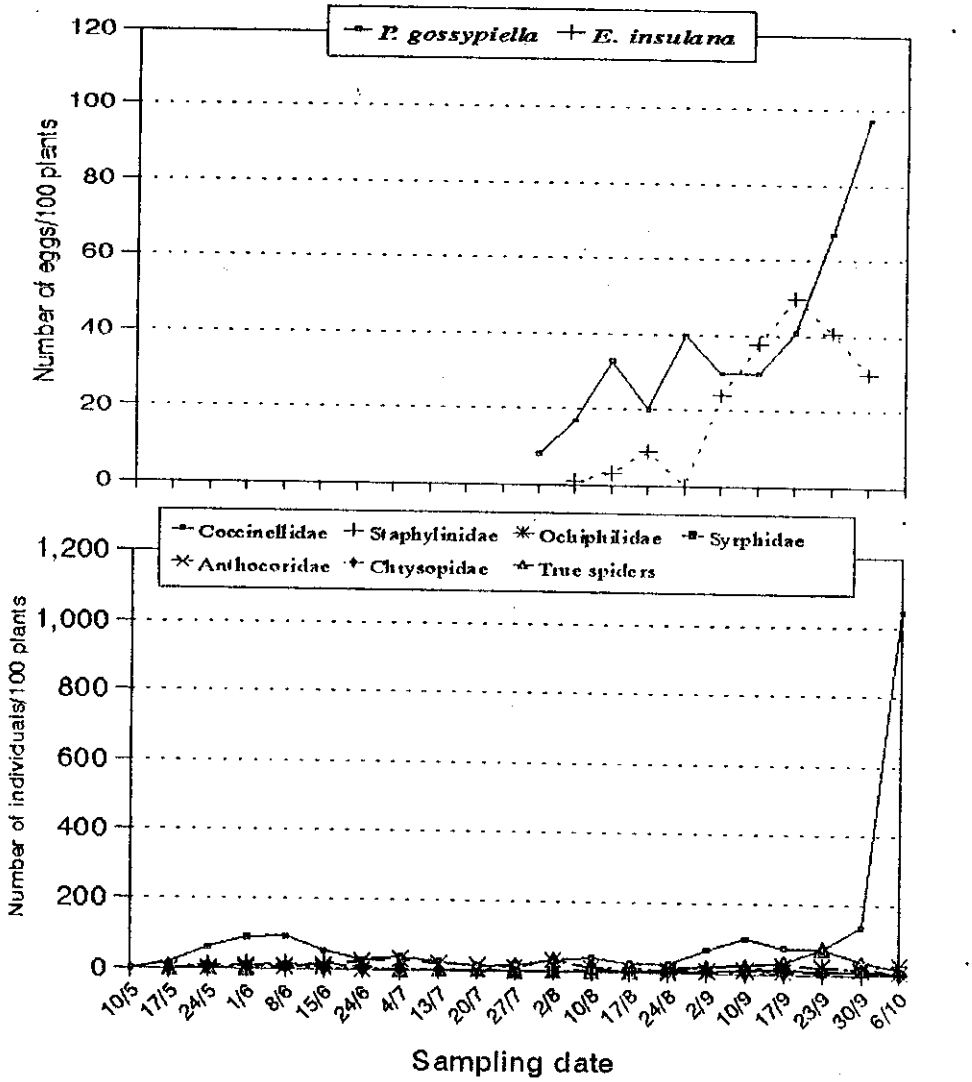


Fig. (28) : Number of *P. gossypiella* and *E. insulana* eggs/100 plants and their predators counted in Beni-Suef cotton fields throughout 1998 cotton season.

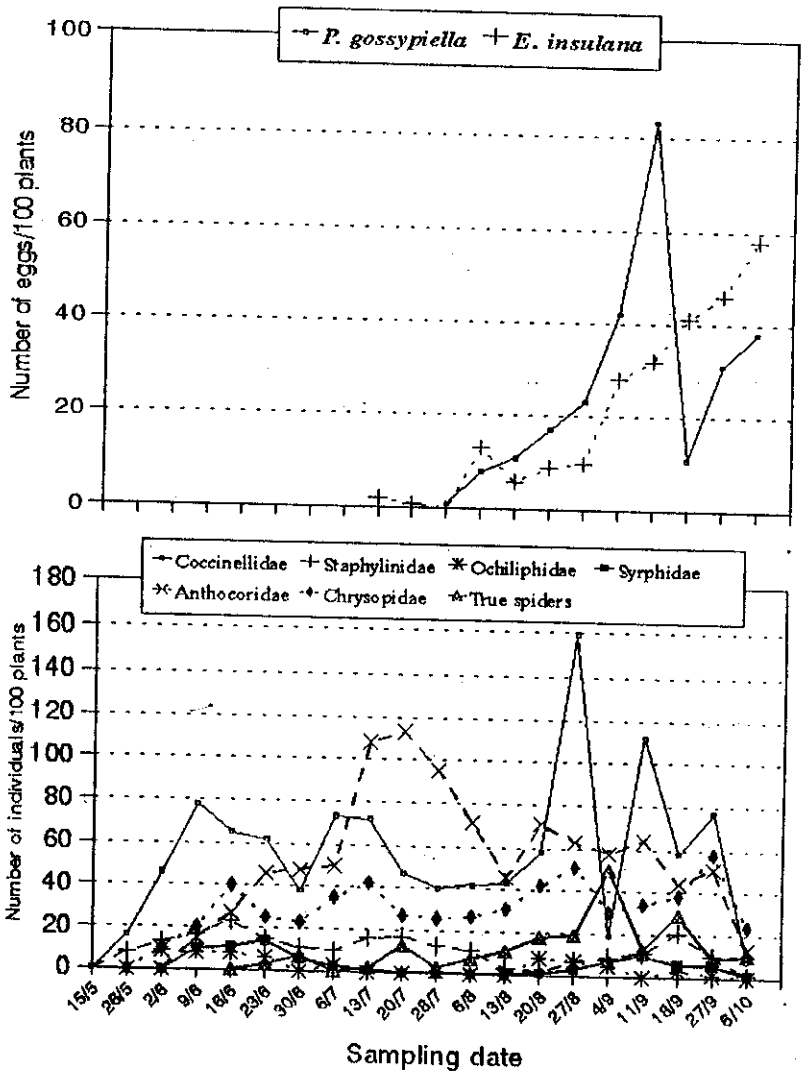


Fig. (29) : Number of *P. gossypiella* and *E. insulana* eggs/100 plants and their predators counted in Beni-Suef cotton fields throughout 1999 cotton season.

seasons, respectively Whereas the numbers of SBW in the respective seasons were 27, 29 & 31/ 100 plants, was observed on 19/9, 25/9 & 31/9, respectively. In the three seasons the pink bollworm infestation occurred earlier than that of the SBW, the former started on 21/7, 23/7 & 20/8 whereas the latter started on 7/8, 6/8 &during the three successive seasons. The number of PBW eggs increased gradually until the end of the 3 seasons. The maximum number was about 40, 100 & 63 eggs / 100 plant on, & during the 3 seasons. SBW infestation began late and the maximum average number of eggs / 100 plant was 27, 29 & 31 during the 3 seasons.

In Beni–Suef the obtained data are summarized in Tables 48, 49, 50, 51, 52 & 53 and Figs, 24-29. As in Moshtohor infestation with PBW began on 28/7, 2/8 & 12/8 and persisted until the end of 1997, 1998 & 1999 seasons; while the SBW infestation began in 13/7, 10/8 & 12/8 in the respective seasons. Data show that the number PBW eggs increased gradually until the end of the 3 seasons. The maximum number was about 83, 97 & 90 eggs / 100 plant on 11/9, 6/10 & 26/9; whereas the total number of collected eggs were 265, 383 & 277 during the 3 successive seasons, respectively. On the other hand, SBW eggs/100 plants always were less than PBW during the respective seasons. The maximum numbers occurred on 6/10, 23/9 & 12/9 were 58, 50 & 31, respectively, while the total collected eggs of SBW allover the 3 seasons were 246, 196 & 114, respectively.

IV-12-3-Seasonal abundance of total population of predators:

During the course of the present study seasonal abundance of predators was conducted for 3 successive cotton seasons, 1997, 98 & 99 in Moshtohor & Sids fields. For this purpose, direct count of the predators were made weekly on 100 cotton plants from 50 randomly choson hills in Moshtohor & Sids. At the same intervals counts of predators were also made by using an insect sweeping net throughout the three mentioned seasons in the two localities and in untreated and treated cotton fields. Results of the count in the three seasons are shown in Tables 48 , 49, 50, 51, 52, & 53. The total numbers of each species throughout the whole season, the percentage of each one relased to the general total of all the species are shown in these Tables. It appears, from these results, that the general trend of changes in population are follow the same letters in the three seasons of study, but in varying levels. Most of the insects collected belonged to order Coleoptera (Fam.: Coccinellidae) followed by Order Neuroptera, Hemiptera, Diptera. The true spiders were the least collected numbers. The number of insects for each family and their percentages to the total during the three seasons are shown in Tables (48 – 63).

IV-12-4-Abundance of total predators:

Direct counting data are presented in (Tables 48-50) clearly show that the populations of insect predators were,

generally, higher in Moshtohor than in Sids throughout 1998 and 1999 seasons. During the 3 seasons in Moshtohor, the respective number of predator individuals was 2429, 2355 and 2690, in direct count, while in sweeping net the overall total predators was 3003, 746 and 2699 individuals respectively (Tables 54-56). In treated fields the total predators in sweeping net was 509, 789 and 1022 respectively (Tables 55-57).

In Beni-Suef, the total numbers of insect predators in cotton fields by direct count in cotton fields was 3085, 2135 and 1918 individuals, respectively (Table 51-53). The overall total number of predators by sweeping net was 1824, 1005 and 1358 individuals (Table 57-59). In case of treated fields, the total number of individuals was 844, 701 and 859, respectively (Table 63-65).

As shown in Table (48) & Fig (24) the total number of predators in Moshtohor throughout 1997 season showed four peaks of population abundance, the 1st peak was in the 3rd week of June (116 individuals), the 2nd peak was in 3rd week of July (138 individuals) while the 3rd and 4th peak occurred in the 4th week of August and 3rd week of September, respectively (151, 211individuals).

The lowest abundance, however, was attained in the counting period during May (65) and in 1st week of June (80 individuals).

In 1998 season, two peaks of total number of predators were found in Moshtohor, the 1st peak was in 2nd week of July

(112 individuals) and the 2nd at 3rd week of Sept. (258 individuals). Data in the Table (49) & Fig (25) clearly showed that the populations of insect predators generally began latter than the previous season by one week.

1999 season, two peaks of abundance were obtained; they occurred in the 4th week of May and 2nd week of September (271 and 265 individuals). The lowest abundance of predators occurred in 3rd week of June and continues until 3rd week of July (35-59 individuals) (Table 50).

In Beni-Suef region, the total number of predators showed four peaks of abundance in 1997 season. They occurred in 3rd week of June (174 individuals), 2nd peak occurred in the 2nd week of July (241 individuals), 3rd peak occurred in 3rd week of August (200 individuals) and 4th peak occurred in 2nd week of September (244 individuals) (Table 51).

1998 season, the total number population predator of showed four peaks of abundance. They occurred in 2nd week of June (132 individuals), 2nd peak in 1st week of August (111 individuals), 3rd peak in 2nd week of September (180 individuals) and 4th peak appeared in 4th week of September (235 individuals) (Table 52), In the subsequent season 1999, two peaks of predators' abundance could be detected in the 3rd week of June (182 individuals) and 2nd peak on the 1st week of September (299 individuals) (Table 53).

Kamal (1951) found that predators started to appear in low numbers in the 1st week of May and their numbers

increased to reach a peak in 3rd week of June. Predators began gradually to decrease in numbers in July, become in significantly fewer in September and disappeared from cotton fields in October. **Nassef (1995)** indicated that the population of total predators fluctuated and recorded three peaks of abundance during mid-June, half of July and 2nd half of August. The decrease in predators abundance occurred during September.

IV-12-5-Abundance of different predators:

14 predaceous insect species were surveyed in this investigation belong to 7 insect families, i. e. Coccinellidae, Staphylinidae, Cecidomiidae, Octhphilidae, Syrphidae, Anthocoridae and Chrysopidae. True spiders were also taken into consideration, as these arachnids are known as insectivorous. The relative population abundance of each of surveyed predators in the two regions of investigation (Moshtohor and Sids) are represented in (Tables 43-48), Direct count of the predators' numbers was estimated weekly. Data may be explain as follows:

1- Coleopterous predators

1-1-Family Coccinellidae:

Eightlady beetle spesies were abundant on cotton plants found, during the three years of study (1997, 1998 and 1999) in two locations (Moshtohor and Sids). All stages of the

predator (egg, larva, pupa and adult) were directly counted/100 plants of cotton (50 hills).

In Moshtohor region, highest relative population abundance of ladybirds occurred on 2nd week of June (65 individuals), 1st week of July (47 individuals)/100 plants, 2nd week of August (52 individuals)/100 plants and 3rd week of September (77 individuals) / 100 plants, during 1997 season (Table 48 & Fig 24). In 1998, three peaks occurred during 2nd week of June 3rd week of July and 3rd week of September (77, 36 and 100 individuals / 100 plants, respectively) (Table 49 and Fig. 25).

In 1999 season, highest relative population abundance of lady birds occurred on 4th week of May (257 individuals/100 plants), 2nd week of August (38 individuals / 100 plants) and 3rd peak appeared in 2nd week of September (72 individuals / 100 plants) (Table 50 and Fig. 26).

In Beni-Suef region, four peaks appeared during three seasons investigation, the highest counts were 78, 73, 112 and 77 individuals/100 plant occurred on 2nd week of June, 1st week of July, 2nd and 4th week of September in 1997 season (Table 51 & Fig. 27). While in 1998 season the highest counts were 94 individuals on June 8th, 39 individuals on 1st week of July (102 and 137 individuals) on September 10th and 30th, respectively (Table 52 & Fig. 28). In 1999 season, four peaks occurred in 3rd week of June 2nd week of July 3rd week of August and 2nd week of September with 83, 23, 80 and 129 individuals/100 plants, respectively (Tables 53 & Fig. 29).

From the above mentioned results, the following conclusion could be made the population abundance of lady beetles fluctuated by increasing and decreasing throughout the cotton season in nearly complete coincidence with that of PBW and SBW eggs infesting cotton plants.

The stages of coccinellid beetles for counted to determine the relative population density throughout the season were eggs, larvae, pupae and adults in case of ***Coccinella undecimpunctata***, ***Hippodamia 13-punctata***, ***Adonia***, ***Cydonia vicina isis***, ***C. vicina nilotica*** and larvae and adults in case of ***Scymnus*** **spp**. The final total counts of lady bird beetles allover the cotton season were estimated as (814, 939 and 1210 individuals, in Moshtohor and 969, 1087 and 768 individuals in Beni-Suef during 1997, 1998 and 1999 seasons, respectively, (Tables 48-53).

These counts represented 33.51, 39.87 and 42.54 % of the total population counts of predators throughout 1997, 1998 and 1999 seasons, respectively, in Moshtohor, while in Beni-Suef region this counts represented 31.41 %, 50.9 and 28.84 % of total population counts of predators (Tables 48-53).

***Coccinella undecimpuctata* L.**

The total counts of ladybird beetle, ***C. undecimpunctata*** allover the cotton season was estimated as 261, 298 and 970 and 372, 251 and 210 individuals in Moshtohor and Beni-Suef regions in 1997, 1998 and 1999 seasons, respectively. This

total counts represented 10.75, 12.65 and 36.1 % and 12.06, 15.7 and 8.26 % of the overall total counts of all predators.

Weekly counts of *C. undecimpunctata* individuals in cotton plantations at Moshtohor indicated four peaks of population abundance in 1997. Those were estimated by 30 individuals/100 plants on 2nd week of June, 18 individuals on 3rd week of July, 23 individuals/100 plants on 4th week of August and 36 individuals/100 plants on 4th week of September, Table (43).

In 1998 season, two peaks of population abundance were estimated by 40 and 43 individuals/100 plants on June 17th and September 4th Table (44), while in 1999 season, these peaks occurred on May 26th, August 12th and September 10th (255, 30 and 51 individuals/100 plants, respectively; (Table 49). In Beni-Suef region, four peaks of population abundance, were estimated as 34, 30, 27 and 62 individuals / 100 plants on 2nd week of June, end week of June, 1st August and 4th week of September, respectively during 1997 season (Table 46), while in 1998 and 1999 seasons, three peaks estimated by 16, 49 and 27 individuals / 100 plants and 7, 31 and 56 individuals/100 plants on 2nd week of June, 2nd and 4th week of September during 1998 and 3rd, 1st and 2nd week of June, August and September, respectively (Tables 47-48) It appears from the present results (Tables 43, 44 & 45), that the general trend of changes in population more or less follows the same pattern in the 3 seasons of study, but in varying levels. During 1997, results indicated that an obvious increase in the

population of occurred during May, they decreased sharply in July (Table 48).

In contrast, **Nassef (1995)** indicated that the population of this predator increased during July.

C. septempunctata:

Relative total population densities of predators in Moshtohor and Beni-Suef field were estimated throughout 1997, 1998 and 1999 seasons (63, 45 and 95) and (72, 94 and 58) individuals throughout the three seasons, Moshtohor and Beni-Suef, respectively (Tables 48-53). These counts represented (2.59, 1.9 and 0.33) and 2.33,4.37and 2.28 % of the total population counts of predator, in the respective locations during the 3 seasons of study.

In Moshtohor region, the highest number occurred on 4th week of July and 4th week of September (9 and 9 individuals / 100 plants) in both 1997 and 1998 seasons. In 1999 season 1, 29, 8, 3, 3 and 14 individuals were the only counted on cotton plant during May, June, July, August, September and October, the first highest numbers appeared on 2nd week of June and 1st week of October were (14 and 14) individuals / 100 plants, respectively (Table 50).

In Beni-Suef region, the highest population abundance of *C. septempunctata*, could be detected (10 individuals / 100 plants) on 2nd week of June and 2nd week of September during 1997 season, while in 1998 season, two peaks occurred during 2nd week of June and 2nd week of August (13 and

11individuals / 100 plants, respectively). But, during 1999 season, the first and highest peak estimated as 13 individuals / 100 plants on 1st week of June.

The able mentioned data indicate that this predator was generally, of lower abundance, in Moshtohor than Beni-Suef.

Hippodamia tredecimpunctata:

The average total number of ***H. 13-punctata*** counted on cotton plants in Moshtohor and Beni-Suef throughout 1997, season was 65 and 113 individuals (Tables 48 and 51), those counted allover 1998 season were 124 and 217 individuals (Tables 49 and 52) and in 1999 season were 28 and 68 individuals (Tables 50 and 53) in Moshtohor and Beni–Suef, respectively. These counts represented (2.68 and 3.66 %), (5.26 and 10.94 %) and (1.04 and 1.34 %) of the total population counts of predator, in Moshtohor and Beni-Suef), respectively.

In Moshtohor region, these predaceous insect disappeared completely during May of 1997 season, its appearance in cotton fields mostly started with few numbers in the following months, the highest number occurred on 3rd week of August, 13 individuals / 100 plants (Table 48). In 1998 season, three peaks occurred, the first peak of population abundance was detected in cotton plantations, with only 17 individuals / 100 plants on June 17th, the 2nd peak with 15 individuals / 100 plants was detected on August 13th and the third peak of 17 individuals / 100 plants was detected on

September 25th. In 1999 season, the highest number estimated as 5 individual / 100 plants on July 27th (Table 50)

During the three seasons this predator showed lower abundance throughout the different months.

In Beni-Suef region; ***H. tredcimpunctata*** had very low abundance on cotton plants, in the first season 6 individuals only recorded in May, while the high peak were 17 individuals/100 plant on 2nd week of June and 11 individuals on 3rd week of July, Table (51).

In 1998 season, the population abundance of the predators show the highest number of 37 individuals / 100 plants on 1st week of June, the predator showed lower abundance from 4th week of June until 1st & 4th week of September, the number of predator was 44 & 41 individuals / 100 plants (mostly eggs) (Table 52).In 1999 season, two peaks appeared on July 19th and on August 20th (11 and 25 individuals / 100 plants), no predators appeared on May (Table 53).

****Adonia varegatus:***

This predaceous insect was, relatively, low abundant in Moshtohor (Total counts of 42, 75 and 26) than Beni-Suef (total counts of 58, 108 and 79 individuals) (Table 48-50). These counts represented 1.73, 3.18 and 0.96 % and 1.94, 5.06 and 3.11% of the total population count of predator.

In Moshtohor region, during 1997 season; 1, 10, 7, 20 and 4 individuals were the only counted on cotton plants during May, June, July, August and September, while no predator find was detected during October (Table 48).

In 1998 season, one peak on the 3rd week of September (23 individuals / 100 plants) was detected (Table 49). The numbers of predator adults during the whole season were 75 individuals, which are controlled very low.

In 1999 season; the total number of ***Adonia*** in cotton fields showed also one peak. This peak was represented by 16 individuals / 100 plants on 1st week of June. The population decreased in other months in this season (Table 50).

In Beni-Suef region, during 1997 season, the total number of predators in cotton fields showed also two peaks of total predator's abundance throughout the cotton season. These peaks were (11 and 10 individuals / 100 plants) on 1st week of Jun and 2nd week of July, respectively, this predator disappeared from mid of August until the end of the season (Table 51). In 1998 and 1999 seasons, in Beni-Suef region, the population abundance differed from one month to the other, two peaks of predator abundance could be detected in each season. Those were estimated by 12 and 21 individuals in 1st week of June, and 2nd peak on 4th week of September, in 1998 season and (18 and 13) individuals / 100 plants, on 2nd week of June and 3rd week of September during 1999 season, respectively (Table 52 & 53).

Cydonia vicina nilotica:

Total counts of *C. visina nilotica* throughout 1997, 1998 and 1999 cotton seasons in Moshtohor and Beni-Suef regions were 63, 51 and 14 individuals / 10 plants, 51, 77 and 75 individuals / 100 plants, respectively (Tables 48-53). These counts represented 2.59, 2.16 and 0.52 and 1.65, 3.58 and 2.95% of total predators in Moshtohor and Beni-Suef throughout 1997, 1998 and 1999 seasons, respectively.

Thus indicating that the predator was, generally of lower abundance, in both regions of study, than *C. undecimpunctata*, on one hand, and that this predator was more abundant on cotton plants at Beni-Suef than Moshtohor (Table 48-53).

C. vicina nilotica had 3 peaks of population abundance in Moshtohor 1997 cotton season (7, 11 and 9 individual / 100 plants) on 4th week of May, 2nd week of August and 3rd week of September, respectively (Table 48).

Two peaks occurred in 1998 cotton season, 2nd week of July and 3rd week of September (3, 16 individuals/100 plant) respectively (Table 49). While the highest appearance of this predaceous insect occurred in the 3rd week of September, 1999 (Table 50).

On cotton plants in Beni-Suef, the peaks of abundance were estimated on June 16th and July 13th (14 and 12 individuals / 100 plants) during 1997 season, also, two peaks on July 4th and September 10th were found (15 and 17 individulas / 100 plants) during 1998 season. While in 1999

season, the 1st peak occurred on 3rd week of June and the 2nd peak during 3rd week of September giving 8 and 17 individuals / 100 plants.

Cydonia vicina isis:

The total counts of ***C. vicina isis*** in cotton plantations throughout three seasons in both regions of study was 37, 62 and 3 individuals / 100 plants in Moshtohor region, while in Bein-Suef region it was 14, 68 and 52 individuals, respectively, (Table 48-53). The percentage of 1.52, 2.63 and 0.11 % and 0.45 %, 3.16 and 2.05 % of total predator count, in Moshtohor and Beni-Suef region throughout 1997, 1998 and 1999 season, respectively. Weekly counts of ***C. vicina isis*** gave two peaks of abundance in 1997, on May 25th and June 22nd (6 and 10 individuals / 100 plants), also, 1998 season had two peaks occurred on June 30th and September 18th estimated as 8 and 18 individuals / 100 plants. But in 1999 season, the predator appeared with very low counts; only 3 individuals were obtained all in the season Table (48-50).

In Beni-Suef, 1997, the predator was either absent or had very low abundance on cotton plants, while in 1998 and 1999 seasons, the predator had very low abundance on cotton plants in May, July & August and high peak occurred 4th week of September (34 individuals recorded during 1998 season), (Table 52). In 1999 season, ***C. v. isis*** appeared with high numbers on 3rd week of August (13 individuals / 100 plants) (Table 53).

***Scymnus* spp.:**

In Moshtohor, the total counts of ***Scymnus interraptus*** in cotton plantations throughout 1997 season was 283, while in 1998 season the 2 species of ***Scymnus*** (***S. interruptus***) and (***S. syriacus***) were found. The total number estimated as 218 individuals / 100 plants, but ***S. syriacus*** estimated as 66 individuals / 100 plants. In 1999 one species of ***Scymnus*** was found, the total counts of ***Scymnus interraptus*** was 92 individuals / 100 plants (Tables 48-50).

By counting total ***Scymnus*** collected in successive samples, Table (48) clearly show that the four peaks of population abundance occurred on June 15th, 29th (17, 21 individual / 100 plants), on July 29th (23 individuals / 100 plants) and (23 individuals / 100 plants) in 7th week of September. In 1998 season, three peaks occurred on June 30th, July 23rd and October 8th with 13, 19 and 37 individuals / 100 plants of ***S. interraptus***, while, in case of ***S. syriacus***, the population counts of predator individuals were fluctuated from one week to the other. This predator disappeared during the whole month of August. The population counted from this predator ranged between (0-7) individuals during all the season. The highest number collected was in the 3rd weekly July.

In 1999 season, the population of ***S. interraptus*** was very low, two peaks appeared during 2nd and 3rd week of September, the counts were 13 and 18 individuals/100 plants, respectively (Table 50).

In Beni-Suef region the overall total number was 287, 254 and 225 individuals, this count represented 9.3, 11.8 and 8.85% of total predators counted, throughout 1997, 1998 and 1999 seasons, respectively (Tables 51-53). ***Scymnus* spp** appeared and their number increased successively until reaching the first peak in population abundance on 3rd week of June, the 2nd peak occurred on the 3rd week of August and 3rd peak on the 2nd week of September (37, 41 and 70 individuals / 100 plants) during 1997 season (Table 51)

In 1998 season, the first peak occurred in June 8th and the second peak of the population on the 3rd week of September (45 and 27 individuals / 100 plants), no count of predator was made on May and the low in numbers population occurred 3rd week of July until 4th week of August (Table 52). Also, in 1999 season two peaks occurred, the first peak appeared in 3rd week of June, (40 individuals / 100 plants) and the 2nd peak appeared during 2nd week of September (51 individuals / 100 plants) and this predator took the same trend as in 1998.

Nassef (1995) stated that ***Scymnus* spp.** had 3 peaks of abundance during a period extended from mid-June to mid-September. The same author reported highest means of the predator on cotton sown early, but no significant difference has been observed between tested planting dates. The main climatic factors that affected population changes were the wind speed and temperature.

1-2-Fam. Staphylinidae:

Adults of ***Paederus alfierii*** were the only Staphylinid found on cotton plants in Moshtohor and Beni-Suef throughout the 3 seasons of study. This predaceous insect was very few on cotton plants in the two locations at the three seasons 1997, 1998 and 1999, the overall total number was 173, 96 and 68 individuals in Moshtohor during the three seasons, respectively (Tables 48-50). In Beni-Suef region the overall total number was 218, 110 and 153 individuals, respectively (Table 51-53). This count represented 7.12, 4.07 and 2.53% in Moshtohor and 7.07, 5.12 and 6.02% of total counted predators, respectively.

Present results indicate that the population of this predator was of low abundance in Moshtohor than in Beni-Suef.

In Moshtohor region, during the three seasons of investigation, Tables (48, 49 and 50) and Fig (24, 25 & 26) showed that the highest peak of abundance could be detected during 2nd week of June (13 individuals / 100 plants) and 3rd week of July (17 individuals / 100 plants), 4th week of August (12 individuals / 100 plants) and (13 individuals / 100 plants) during October 7th, respectively, in 1997 season, while, in 1998 season, two peaks of predator population estimated (11 individuals / 100 plants) during 4th week of June and 3rd week of September . But, in 1999 season, the first and highest peak of abundance could be detected during 1st week of August, (13 individuals / 100 plants).

In Beni-Suef region during 1997, three peaks occurred in 3rd week of June, 2nd week of July and 3rd week of September (23, 17 and 21 individuals / 100 plants) respectively, while in 1998 season, the population abundance of this predator estimated as (17 and 11 individuals / 100 plants) on 3rd week of June and 2nd week of September. In 1999 season, the first and highest peak of abundance could be detected on 2nd week of June, (37 individuals / 100 plants) (Tables 51-53).

Abbas and El-Deeb (1993) found that the population density of ***P. alfierii*** was high in July then decreased gradually until end of the season.

Nassef (1995) found that the rove beetles were the dominant predators and the population occurred throughout the whole period of cotton season recording two peaks of abundance during July and August. The highest means were recorded in early planting dates of cotton. **Ali (1998)** recorded the total counts of adults throughout the whole cotton season to be 146 and 189 adult for 1996 first and second planting dates, and 219 and 179 in 1997 two planting dates, respectively.

2-Himepterous predators:

2-1-Fam. Anthocoridae:

The average total number of ***Orius*** **sp.** nymphs and adults counted on cotton plants throughout 1997, 1998 and 1999 seasons in both locations Moshtohor and Beni-Suef were 470, 600, 694 and 983, 307 and 323 individuals / 100 plants,

respectively. This counts represented 19.35, 25.47 and 25.79% and 31.86, 14.28 and 12.71% of total predators counts (Tables 48-53) & (Figs. 24-26).

In Moshtohor region, the highest population abundance was estimated 34, 58 and 64 individuals / 100 plants 1st week of July, 2nd week of September, and 1st week of October, respectively during 1997 season, while, in 1998 season, two peaks occurred in 1st week of July, 3rd week of August (50 and 90 individuals / 100 plants), respectively, also, in 1999 season the highest population of this predator estimated by 73 and 87 individuals / 100 plants on the 3rd week of August and 2nd week of September.

In Beni-Suef region, ***Orius* spp.**, appeared in cotton fields mostly, no counts were made during May and a few individuals were abundant until mid of June, then the population of this predator increased gradually. The highest population occurred 2nd week of July (113 individuals / 100 plants) and (71 individuals / 100 plants) in 3rd week of August during 1997 season (Table 51 & Fig 27) In 1998 season, the population was very low during all the season. The highest population was 33, 35 and 25 individuals / 100 plants on 1st week of July and 1st week of August and 3rd week of September, respectively (Table 52 & Fig 28). In 1999 season, the first peak occurred in 4th week of June (36 individuals / 100 plants) and the 2nd peak occurred on 1st week of September (80 individuals / 100 plants) (Table 53 & Fig 29)

Hafez (1960) stated that the high population of ***Orius* sp.** begins early in June and their number was sharply increased

to reach a peak of about 2000 bugs per kirat during third week of that month. The population then started to decline, at first sharply, until early in July and then gradually until late in July. **Habib *et al.* (1976)** reported that the main occurrence of ***Orius*** adults at Qalubia Governorate was during June to August in the two seasons of study. **Ali (1998)** recorded total counts of ***Orius* spp.** on the untreated plot, it was higher in the early sowing date than in the late sowing date.

3-Neouropterous predators:

3-1-Chrysopidae :

Chrysoperla carnea Steph. was the only Chrysopid species that could be detected on cotton plants in both regions (Moshtohor and Beni-Suef) throughout the three seasons of study (1997, 1998 and 1999). All stages of the predator (eggs, larvae, pupae and adults) were directly counted / 100 plants. This predator manifested the highest total population (522, 288 and 474 individuals / 100 plants) at Moshtohor and (583, 180 and 328 individuals / 100 plants) at Beni-Suef region during 1997, 1998 and 1999 seasons, respectively. These counts represented by 21.49, 12.2 and 17.6 %; 18.9, 8.37 and 12.9 % of total predators counts at Moshtohor the three seasons, respectively (Tables 48-53).

Regarding the weekly counts of relative populations of ***C. carnea*** in cotton fields, data in Tables (48-50) and Figs. (24-26) indicated three high peaks of the different stage population abundance that was estimated as 25, 36 and 48

individuals / 100 plants on 1st week of June, 4th week of July and 4th week of September, respectively during 1997 season (Table 48). In 1998 season, two peaks occurred in 4th week of July and 3rd week of September (16 and 45 individuals / 100 plants) (Table 49). In 1999 season, one high peak of *C. carnea* population was abundant and was estimated as 75 individuals / 100 plants on 2nd week of September (Table 50).

In Beni-Suef region, four peaks occurred in 2nd week of June, 1st week of July, 4th week of August and 4th week of September (40, 42, 51 and 58 individuals / 100 plants, respectively, while, in 1998 season, the population of *C. carnea* started in the season with very few number from 4th week of May; then these numbers increased to their highest level on the 1st week of August (36 individuals / 100 plants). The population abundance of this predator in 1999 season estimated as 47 and 71 individuals / 100 plants, on 4th week of June and 2nd week of September, respectively. Several authors studied the fluctuations in *C. carnea* population throughout the cotton season. **Habib *et al.* (1976)** discussed the relatively considerable increase in *C. carnea* larvae numbers during June, July and August.

Naguib (1980) showed that *C. carnea* was detected at two peaks during June and July. **Abbas and El-Deeb (1993)** found that the population density of *C. carnea* was high in July then decreased gradually until the end of season; **Nassef *et al.* (1996)** reported three peaks of abundance for *C. carnea* during the period from May to October.

Dipterous predators:

Fam. Cocidomyiidae, (***Phaenoperemia aphidivora***), Fam. Octhiphilidae (***Phaenobremia aphidivora***) and Syrphidae (***Syrphids***) were the dipterous predators that were detected on cotton plants cultivated in both regions of study (Moshtohor and Beni-Suef). Larvae of these predators are beneficial, as these larvae are known to feed, on eggs of ***Pectinophora gossypiella***. Throughout the three seasons of study (1997, 1998 and 1999 cotton seasons) counts in Tables (43-48) indicate that these predators are absent at the beginning of the three seasons at two locations from 4th week of June throughout the three seasons in the Moshtohor Qalubia. But, these dipterous predators were found generally less abundant in Beni-Suef, while the population began to appear on the 1st week of June.

The dipterous predator relative population abundance may be explained as follows:

Fam: Cocidomyiidae: *Phaenopremia aphidivora*):

This predaceous insect was relatively much more abundant during 1997, 1998 seasons. But ***Ph. aphidivora*** completely disappeared on cotton plants during 1999 cotton season in Moshtohor. (Total counts was 113 and 111 individuals / 100 plants) in 1997 and 1998 seasons, respectively (Tables 48 and 49). In Beni-Suef region, these predaceous insects appeared throughout the three successive seasons, (overall total counts were 59, 124 and 57 individuals

/ 100 plants), during 1997, 1998 and 1999 seasons (Tables 51-53). These count represent 4.65 and 14.88 % of total predators counted in Moshtohor during 1997 & 1998 seasons, respectively, while in Beni-Suef the percentage were 1.91, 5.7 and 2.24 % of total predator count.

In Moshtohor region two peaks in of ***Ph. aphidivora*** larvae population abundance of estimated in 1997 28 and 37 individuals / 100 plants on the 4th week of August and 2nd week of September, while 1998 season, the first and highest peak estimated as 49 individuals / 100 plants on 4th week of September.

Duging 1997 in Beni-Suef region, the predaceous count was very low during all season, while in 1998 two peaks were estimated as 25 and 30 individuals on 3rd and 1st week of September and October, respectively. In 1999 season, two peaks appeared on the 2nd week of June and 2nd week of September (10 and 8 individuals / 100 plants), respectively (Table 51-53).

*** *Leucopis* sp.:**

This predaceous insects, was absent during 1997 and 1998 seasons in Moshtohor and appeared in 1999 season. But completely absent throughout the three seasons in Beni-Suef. During 1999 cotton season the overall total numbers of ***Leucopis*** **sp.** larvae counted in Moshtohor were (84 individuals / 100 plants). These individuals were counted from the 2nd week of August to the 1st week of October. The

percentages of this predaceous species was 2.95 % of total predators, while the predator was completely absent on cotton plants throughout May to July (Table 45).

Previous studies on the population abundance of ***Leucopis* sp.** were carried out by **Azab *et al.* (1965)**. The authors found that optimum seasonal abundance of ***Leucopis* sp.** occurred in mid summer and the highest peak of abundance was attained during August.

4-2. Syrphids:

Fewer numbers of total Syrphid larvae and pupae were counted on cotton plants in Beni-Suef location than Moshtohor location throughout the three seasons of study.

The total numbers of Syrphids found throughout the three years of study were 122, 105 and 92 larvae and pupae during 1997, 1998 and 1999 seasons, respectively, at Moshtohor, while in Beni-Suef, the total population of this predator were (79, 86 and 55 larvae and pupae / 100 plants), throughout 1997, 1998 and 1999 season, respectively. In Moshtohor region, 1, 5, 2, 23, 81 and 10 larvae and pupae were counted on 100 cotton plants during May, June, July, August, September and October, respectively, during 1997 season. (Table 48). In 1998 season, no larvae and pupae were detected during May and July, while 13 and 8 individuals only in June and August, respectively. The first and highest peak of Syrphids counted throughout September 25th, 930 individuals (Table 49). In 1999 season, 1, 3 and 10 larvae were counted

on cotton plants during June, July and August months, respectively, while no larvae detected during May (Table 50). In the same season the predator larvae were, relatively, more common during September and October. The total count was of (68 and 11) larvae, respectively.

In Beni-Suef region; 0, 4, 9 and 0 larvae and pupae were counted in July, September and October. 1997 season (Table 51). In the subsequent two seasons, the predator larvae were relatively, more common during June and August (41 and 15 larvae), respectively, and the highest count (14 individuals / 100 plants) was detected on June 23rd.

In 1998 season, only 2 syrphid larvae were recorded from May 10th to 4th week of July and this predator increased gradually and started the first peak on September 10th. In 1999 season 7, 8, 7 and 33 larvae and pupae were the only counted on cotton plants during May, June, August and September (Table 53).

True spiders:

True spiders were found in cotton fields in the two locations of study and throughout 1997, 1998 and 1999 seasons. Inspections of plants indicated that these arachnids were, almost absent from cotton fields during 1st, 2nd week of May and started to appear in low population late May, the increase in their population occurred throughout the season until reaching 21 individuals / 100 plants in July 29th, 19 individuals / 100 plants on 4th week of September and 31

individuals on 2nd week of October, during 1997 season. In 1st week of August and 1st week of October (13 and 35) individuals were recorded at 1998 season. Also, in 1999 season 2 peaks occurred on 4th week of September and 1st week of October (20 and 30 individuals), respectively at Moshtohor region (Tables 48-50 & Fig. 26).

While in Beni-Suef region, the overall total numbers of true spiders were estimated as 194, 241 and 240 individuals throughout 1997, 1998 and 1999 seasons, respectively. Two peaks in population of true spiders could be detected during 3rd week of July and 1st week of September 1997 season, those were counted by 13 and 50 individuals / 100 plants, respectively, while the highest population abundance of this predator estimated as 75 individuals / 100 plants on the 3rd week of September during 1998 and 47 individuals / 100 plants in 2nd week of September throughout 1999 season (Tables 51-53 & Fig. 29)

Kamal (1951), Hafez (1960) and **Nassef (1995)** found that spiders started in cotton fields in few numbers in early June, the number of spiders increased gradually till it reached a maximum in July. They found that the number of true spiders decreased to reach a minimum during the 3rd week of September.

IV-12-6-Counts of predators in cotton fields by using net sweeping technique, throughout 1997, 1998 and 1999 season, in untreated and treated fields:

As previously mentioned, cotton seeds of Giza-85 variety were shown at the Experimental Farms of two locations, one at the Farm of the Faculty of Agriculture at Moshtohor, Kalubia Governorate and the other at Sids Experiment Research station, Beni-Suef Governorate in the three seasons 1997, 1998 and 1999. Half of Rach farm received application of Hostathion 40% EC (the recommended insecticide for controlling bollworms) the other plantation in the two locations were kept free from any insecticidal treatment. Survey and counts of the predators found in cotton fields were made weekly throughout 3 seasons at Moshtohor and Beni-Suef by making 100 double strokes on cotton plants. Recorded counts are presented in Tables (54-63).

Abundance of total predators

Data in the above mentioned Tables, clearly, show that the population of insect predators was generally higher In Moshtohor during the three different seasons (Total count were 2264, 746 and 2699 individuals, throughout the whole three seasons in untreated fields) than those counted in Beni-Suef (1824, 1005 and 1358 individuals during 1997, 1998 and 1999 seasons respectively). This may be due to the

Table (54) : Number of predators collected by 100 double strokes (sweeping net) at Moshtohor (Kalubia Governorate), (field free from any insecticidal treatments), throughout 1997 season.

Order	Coleoptera										Diptera				Hemiptera			Neuro-ptera	True spider	Overall mean
Family	Coccinellidae								Staphy-linidae	Total	Ochtphil-idae	Syrphidae		Total	Anthocoridae		Total	Chry-sopidae		
Date	C. undecim-punctata	C. septem-punctata	H. variolosa	Adonia variegata	Cydonia vittata	C. transversalis	Scymnus spp.	Total	P. alfierii		Laemophloeus sp.	Syrphus sp.1	Syrphus sp.2		Orius albifi-peranis	Orius leavi-gatus		Ch. carnea		
11/5	3	0	0	2	0	2	0	7	10	17	0	0	0	0	10	16	26	5	0	48
18/5	4	6	13	2	1	0	0	26	13	39	0	11	10	21	15	13	28	11	0	99
25/5	17	13	13	10	0	0	7	60	11	71	0	12	9	21	49	30	79	10	0	181
7/6	19	13	11	20	0	0	40	103	13	116	0	13	11	24	42	3	45	10	3	198
15/6	21	2	9	10	0	0	18	60	14	74	8	1	13	22	45	10	55	11	1	163
22/6	11	11	6	10	0	1	15	54	11	65	0	0	0	0	49	51	100	13	1	179
29/6	11	6	3	0	0	1	10	31	10	41	0	0	1	1	48	10	58	17	3	122
7/7	8	6	6	6	0	3	20	49	10	59	0	0	0	0	21	10	31	17	3	110
14/7	0	0	2	8	0	0	15	25	17	42	0	1	0	1	23	3	26	19	3	91
21/7	10	1	3	0	0	0	11	25	11	36	0	0	0	0	38	7	45	18	1	100
29/7	6	1	3	0	1	0	10	21	15	36	3	1	0	4	12	9	21	13	17	91
7/8	6	3	7	6	7	0	9	38	13	51	7	0	3	10	10	19	29	18	5	113
12/8	13	5	3	0	3	1	9	34	17	51	9	0	1	10	10	18	28	15	1	105
18/8	11	9	7	1	23	0	17	68	14	82	0	0	2	2	14	8	22	31	3	140
25/8	11	1	3	1	5	0	15	36	7	43	0	2	15	17	15	18	33	19	16	28
7/9	5	1	0	0	3	0	20	29	3	32	12	3	13	28	17	18	35	13	13	121
12/9	7	6	0	0	1	3	19	36	7	43	0	7	17	24	21	16	37	7	9	190
19/9	1	0	3	0	1	2	13	20	1	21	0	0	0	0	31	19	50	2	4	77
26/9	7	0	1	0	1	0	9	18	5	23	5	5	0	10	3	3	6	10	5	54
7/10	0	1	0	0	3	2	0	6	0	6	1	1	2	4	1	5	6	3	5	24
Total	171	85	93	76	49	15	257	746	202	948	45	57	97	199	474	286	760	262	95	2264
%	7.55	3.75	4.1	3.36	2.16	0.66	11.35	32.9	8.92	41.9	1.99	2.5	2.28	8.79	20.9	12.6	33.6	9.8	4.19	100.0

Table (55) : Number of predators collected by 100 double strokes (sweeping net) at Moshtohor (Kalubia Governorate), (field free from any insecticidal treatments), throughout 1998 season.

Order	Coleoptera										Diptera			Hemiptera			Neuro-ptera	True spider	Overall mean
Family	Coccinellidae								Staphy-linidae	Total	Ochiph-iidae	Syrph-idae	Total	Anthocoridae		Total	Chry-sopidae		
Date	*C. undecim-punctata*	*C. septem-punctata*	*H. variolosa-punctata*	*Adonia variegata*	*Cydonia vidatica*	*C. vicina isis*	*Scymnus* spp.	Total	*P. alfierii*		*Leucopis* sp.	*Syrphus* sp.		*Orius albifi-pennis*	*Orius laevi-gatus*		*Ch. carnea*		
16/5	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	1
23/5	0	1	0	0	0	0	0	1	1	2	0	0	0	0	0	0	0	0	2
30/5	0	2	5	0	0	0	1	8	2	10	0	0	0	0	0	0	0	0	10
10/6	1	2	11	3	0	0	3	20	2	22	0	0	0	5	3	8	0	0	30
17/6	2	3	4	0	0	0	1	10	1	11	0	0	0	7	12	19	7	0	37
24/6	2	4	3	0	0	0	1	10	0	10	0	0	0	0	12	12	9	0	31
30/6	3	1	1	0	0	0	2	7	0	7	0	0	0	9	13	22	18	0	47
8/7	0	6	18	1	1	0	1	27	5	32	0	0	0	1	2	3	12	1	48
15/7	3	8	9	2	2	0	2	26	7	33	0	0	0	3	2	5	5	1	44
23/7	1	0	7	1	1	0	0	10	8	18	3	1	4	3	1	4	3	2	31
30/7	1	0	2	0	0	0	0	3	6	9	1	1	2	2	5	7	2	3	23
6/8	0	1	1	1	0	2	0	5	3	8	2	0	2	8	6	14	1	4	29
13/8	2	7	3	1	0	1	0	14	1	15	3	0	3	5	9	14	3	6	41
20/8	1	0	6	1	0	2	0	10	6	16	10	0	10	3	2	5	7	3	41
27/8	0	1	1	0	0	2	1	5	2	7	10	2	12	2	2	4	12	3	38
4/9	0	4	1	3	1	3	3	15	0	15	2	8	10	11	5	16	11	9	61
11/9	1	4	2	2	0	2	7	18	0	18	12	8	20	11	3	14	9	3	64
18/9	4	0	6	0	0	0	13	23	1	24	17	6	23	0	1	1	10	2	60
25/9	4	0	0	0	1	0	16	21	0	21	13	5	18	2	1	3	5	8	55
8/10	2	0	0	1	0	0	5	8	3	11	0	3	3	0	1	1	10	5	30
15/10	0	0	1	0	0	0	17	18	0	18	0	0	0	1	1	2	2	1	23
Total	27	44	81	16	6	12	74	260	48	308	73	34	107	73	81	154	126	51	746
%	3.62	5.90	10.86	2.14	0.80	1.61	9.92	34.85	6.43	41.29	9.79	4.56	14.37	9.79	10.86	20.64	16.89	6.84	100.0

Table (56) : Number of predators collected by 100 double strokes (sweeping net) at Moshtohor (Kalubia Governorate), (field free from any insecticidal treatments), throughout 1999 season.

Order	Coleoptera										Diptera			Hemiptera			Neuro-ptera		
Family	Coccinellidae								Staphy-linidae	Total	Ochiph-ilidae	Syrph-idae	Tptal	Anthocoridae		Tptal	Chry-sopidae	True spider	Overall mean
Date	*C. undecim-punctata*	*C. septem-punctata*	*H. tredecim-punctata*	*Adonis variegata*	*Cydonia vidanica*	*C. nine nis*	*Scymnus spp.*	Total	*P. alfierii*		*Lacepus sp.*	*Syrphus sp.*		*Orius albifi-pennis*	*Orius laevi-gatus*		*Ch. carnea*		
19/5	467	3	0	3	0	0	0	473	0	473	0	0	0	0	0	0	0	0	473
26/5	355	15	2	7	0	0	0	379	0	379	0	0	0	0	0	0	1	0	380
6/6	247	19	4	2	0	0	0	272	2	274	0	0	0	13	15	28	3	2	307
1/6	330	11	8	1	0	0	0	350	1	351	0	0	0	20	17	37	11	3	402
21/6	110	3	0	0	0	0	0	113	1	114	0	0	0	13	11	24	2	5	145
28/6	20	0	0	0	0	1	0	21	3	24	0	0	0	21	5	26	1	1	52
6/7	5	0	7	0	0	0	6	18	4	22	0	0	0	27	3	30	3	3	58
13/7	3	0	3	1	0	0	10	17	2	19	0	1	1	10	0	10	2	3	35
20/7	1	1	1	1	0	0	5	9	1	10	0	2	2	11	0	11	2	2	27
27/7	0	2	1	0	0	0	4	7	1	8	0	0	0	15	0	15	1	1	25
5/8	2	3	0	3	0	0	13	21	9	30	0	0	0	18	2	20	2	7	59
12/8	3	5	3	4	0	0	17	32	8	40	0	0	0	11	3	14	4	7	65
20/8	3	1	3	4	0	1	4	16	2	18	0	0	0	15	5	20	5	9	52
27/8	3	1	4	1	0	1	4	14	2	16	2	1	3	28	11	39	5	10	73
3/9	0	1	4	0	3	6	5	19	2	21	4	3	7	29	11	40	17	13	98
10/9	10	0	7	0	6	1	2	26	7	33	3	5	8	23	14	37	15	15	108
17/9	11	0	3	0	9	1	1	25	6	31	2	9	11	21	15	36	11	12	101
24/9	13	0	2	0	9	3	1	28	3	31	1	3	4	20	11	31	9	37	112
30/9	9	0	0	0	2	1	10	22	3	25	0	6	6	12	7	19	8	17	75
7/10	1	2	0	0	1	1	5	10	1	11	3	7	10	13	0	13	2	16	52
Total	1593	67	52	27	30	16	87	1872	58	1930	15	37	52	320	130	450	104	163	2699
%	59.02	2.48	1.93	1.00	1.11	0.59	3.22	69.36	2.15	71.51	0.56	1.37	1.93	11.86	4.82	16.67	3.85	6.04	100.0

Table (57) : Number of predators collected by 100 double strokes (sweeping net) at Sids (Beni-Suef Governorate), (field free from any insecticidal treatments), throughout 1997 season.

Order	Coleoptera										Diptera			Hemiptera			Neuroptera	True spider	Overall mean
Family	Coccinellidae								Staphylinidae	Total	Ochiphilidae	Syrphidae	Tptal	Anthocoridae			Chrysopidae		
Date	*C. undecimpunctata*	*C. septempunctata*	*H. tredecimpunctata*	*Adonis variegata*	*Cydonia vilanica*	*C. mixtus*	*Scymnus* spp.	Total	*P. alfierii*		*Lucopus* sp.	*Syrphus* sp.		*Orius albifipennis*	*Orius laevigatus*	Total	*Ch. carnea*		
8/5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14/5	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1
24/5	1	1	5	8	0	0	6	21	3	24	0	2	2	3	5	8	6	0	40
2/6	5	3	3	10	0	0	12	33	12	45	0	0	0	7	3	10	9	1	65
9/6	3	2	8	13	9	0	15	50	5	55	0	0	0	29	5	34	11	3	103
16/6	2	3	2	8	6	0	11	32	7	39	0	0	0	13	5	18	25	3	85
25/6	1	3	1	6	2	2	9	24	3	27	0	0	0	17	6	23	8	7	65
7/7	3	0	0	2	1	1	5	12	2	14	0	5	5	20	6	26	15	25	85
14/7	5	0	0	0	3	0	7	15	9	24	0	2	2	33	3	36	4	8	74
21/7	2	0	3	0	3	0	5	13	5	18	0	0	0	15	3	18	5	7	48
28/7	1	0	4	0	0	0	8	13	7	20	0	0	0	11	7	18	5	3	46
2/8	2	2	5	1	1	3	16	30	9	39	5	5	10	31	15	46	6	9	110
11/8	2	2	3	2	2	3	12	26	3	29	9	0	9	40	27	67	8	7	120
18/8	4	1	3	3	0	1	4	16	3	19	11	0	11	65	20	85	10	7	132
25/8	6	1	1	9	0	0	6	23	2	25	0	8	8	69	31	100	13	5	151
1/9	8	1	7	9	0	0	11	35	5	41	3	5	8	101	35	136	17	13	215
8/9	6	3	6	11	3	3	20	52	1	53	3	5	8	95	17	112	21	5	199
15/9	3	1	3	2	1	2	14	26	1	27	1	4	5	99	16	115	15	7	169
28/9	1	1	1	1	1	1	20	26	0	26	1	9	10	21	5	26	7	3	72
6/10	1	1	2	3	0	1	18	26	1	27	3	3	6	8	0	8	3	0	44
Total	56	25	58	88	32	17	199	475	78	553	36	48	84	677	209	886	188	113	1824
%	3.07	1.37	3.18	4.82	1.75	0.93	10.91	26.04	4.28	30.32	1.97	2.63	4.61	37.12	11.46	48.57	1031	6.20	100.0

Table (58): Number of predators collected by 100 double strokes (sweeping net) at Sids (Beni-Suef Governorate), (field free from any insecticidal treatments), throughout 1998 season.

Order	Coleoptera											Diptera			Hemiptera			Neuro-ptera		
Family	Coccinellidae									Staphy-linidae		Clauda-mytidae	Syrphi-dae	Total	Anthocoridae		Total	Chry-sopidae	True spider	Overall means
Date	C. undecim-punctata	C. septem-punctata	H. tredecim-punctata	Adonia variegata	Cydonia vittata	C. vitti-ata	Scymnus interrup-tus	Scymnus syriacus	Total	P. alfierii	Total	Syrphus sp.1	Syrphus sp.2		Orius albifi-pennis	Orius laevi-gatus		Ch. carnea		
10/5	0	0	0	2	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	2
17/5	0	1	1	1	0	0	0	0	3	3	6	0	0	0	0	0	0	1	0	7
24/5	2	3	1	0	0	3	2	1	12	4	16	3	5	8	13	2	15	3	0	42
1/6	1	3	2	2	1	1	7	0	17	7	24	5	7	12	17	7	24	5	1	66
8/6	0	5	9	2	3	1	13	0	33	5	38	2	3	5	25	18	43	9	1	96
15/6	1	1	3	1	4	0	1	0	11	3	14	0	3	3	16	3	19	2	1	39
25/6	3	1	3	1	5	0	3	2	18	1	19	0	0	0	11	1	12	1	1	33
4/7	5	1	7	0	1	0	4	3	21	1	22	0	0	0	9	1	10	1	0	33
13/7	8	0	15	0	3	0	7	1	34	5	39	0	0	0	13	5	18	10	1	68
20/7	4	0	4	3	3	0	9	2	25	11	36	0	0	0	21	3	24	9	2	71
27/7	1	2	2	5	2	0	11	2	25	13	38	0	0	0	13	1	14	5	3	60
2/8	2	3	0	6	0	0	5	0	16	5	21	0	0	0	7	0	7	3	0	31
10/8	3	5	1	2	0	0	3	0	14	0	14	2	4	6	1	0	1	11	1	33
17/8	5	4	1	1	0	0	4	3	18	0	18	3	2	5	3	0	3	8	3	37
24/8	2	1	1	2	2	0	1	4	13	1	14	1	1	2	1	0	1	6	8	31
2/9	3	1	0	0	2	5	1	4	16	3	19	0	0	0	1	0	1	2	5	27
10/9	7	1	0	3	1	6	2	7	27	3	30	6	7	13	19	3	22	5	13	83
17/9	9	0	3	3	0	3	1	9	28	3	31	0	3	3	21	17	38	9	7	88
23/9	2	0	9	5	0	1	1	1	19	2	21	0	6	6	20	13	33	6	9	75
23/9	3	0	11	5	0	0	0	3	22	1	23	4	6	10	15	3	18	2	1	54
6/10	1	0	3	9	3	1	0	1	18	1	19	1	0	1	1	1	2	0	7	29
Total	62	32	76	53	30	21	75	43	392	72	464	27	47	74	227	78	305	98	64	1005
%	6.17	3.18	7.56	5.27	2.99	2.09	7.46	4.28	39.00	7.16	46.17	2.69	4.68	7.36	22.59	7.76	30.35	9.75	6.37	100.0

Table (59) : Numbers of *P. gossypiella* and *E. insulana* eggs and their predators after direct counts from 50 hills (100 plants) in untreated cotton fields at Moshtohor (Kalubia Governorate) 1999 season.

Order	Coleoptera										Diptera				Hemiptera			Neuroptera	True spider	Overall mean
Family	Coccinellidae								Staphylinidae	Total	Ochthiphilidae	Syrphidae		Total	Anthocoridae		Total	Chrysopidae		
Date	*C. undecimpunctata*	*C. septempunctata*	*H. tredecimpunctata*	*Adonia variegata*	*Cydonia nilotica*	*C. vicina isis*	*Scymnus* spp.	Total	*P. alfierii*		*Leucopis* sp.	*Syrphus* sp.1	*Syrphus* sp.2		*Orius albidipennis*	*Orius laevigatus*		*Ch. carnea*		
6/6	3	0	9	0	0	0	30	42	0	42	0	3	0	3	15	3	18	0	0	63
13/6	5	0	11	0	0	0	40	56	0	56	0	5	0	5	21	9	30	3	1	95
20/6	14	8	13	0	0	1	20	56	3	59	0	1	2	3	12	5	17	3	3	85
27/6	14	7	18	3	0	1	17	60	1	61	0	0	3	3	9	7	16	3	3	86
5/7	6	3	12	1	0	1	13	36	5	41	0	0	0	0	13	10	23	1	5	70
12/7	10	2	19	10	12	0	9	62	9	71	0	0	1	1	13	15	28	5	7	112
19/7	1	1	19	6	2	0	7	36	3	39	8	0	0	8	9	11	20	2	9	78
26/7	17	1	11	3	3	0	2	37	8	45	9	2	0	11	7	2	9	12	11	88
4/8	10	5	10	3	1	0	21	50	4	54	11	1	0	12	31	19	50	13	13	142
12/8	13	1	3	1	1	0	18	37	7	44	10	1	1	12	30	20	50	11	20	137
20/8	12	9	2	1	2	0	11	37	9	46	9	1	1	11	21	8	29	10	31	127
5/9	5	8	5	2	3	1	11	35	10	45	3	0	0	3	21	1	22	7	40	117
12/9	1	3	2	1	0	0	7	14	3	17	3	1	0	4	26	3	29	7	11	68
19/9	1	3	3	1	2	3	2	15	0	15	7	3	1	11	5	2	7	4	10	47
26/9	1	2	1	1	1	5	1	12	0	12	3	1	2	6	3	1	4	3	8	33
6/10	0	0	1	0	0	1	1	3	0	3	0	0	1	1	3	1	4	1	1	10
Total	113	53	139	33	27	13	210	588	62	650	63	19	12	94	239	117	356	85	173	1358
%	13.14	6.16	16.16	3.84	3.17	2.56	24.42	69.42	7.21	76.63	7.33	2.21	1.40	10.93	27.79	13.60	41.40	9.88	20.12	158.95

Table (56) : Numbers of predators collected by sweeping net (100 double strokes) on cotton plants received conventional insecticidal spraying, at Moshtohor (Kalubia Governorate) 1997 season.

Order	Coleoptera							Diptera	Hemiptera			Neuroptera	True spider	Overall mean
Family	Coccinellidae					Staphylinidae	Total	Syrphidae	Anthocoridae		Total	Chrysopidae		
Date	*C. undecimpunctata*	*C. septempunctata*	*H. tredecimpunctata*	*Scymnus* spp.	Total	*P. alfierii*		*Syrphus corollae*	*Orius laevigatus*	*Orius albidipennis*		*Ch. carnea*		
18/5	0	3	0	3	6	0	6	0	2	0	2	0	0	8
25/5	0	1	0	7	8	1	9	3	6	1	7	0	0	19
7/6	0	2	7	9	18	0	18	2	6	3	9	3	0	32
15/6	4	3	8	11	26	2	28	5	7	5	12	4	2	51
22/6	8	5	11	5	29	2	31	1	15	10	25	2	1	60
29/6	11	1	5	2	19	5	24	0	9	13	22	1	3	50
7/7	3	1	3	3	10	3	13	1	7	5	12	1	3	30
15/7	0	0	1	1	2	4	6	1	6	4	10	2	5	24
22/7	2	1	0	1	4	4	8	1	3	1	4	5	2	20
28/7	1	1	0	2	4	1	5	0	6	5	11	1	1	18
7/8	1	3	0	1	5	3	8	0	9	7	16	4	1	29
12/8	2	2	0	5	9	2	11	0	11	7	18	2	3	34
18/8	1	1	0	2	4	1	5	0	3	6	9	3	3	20
25/8	1	0	0	0	1	2	3	0	2	3	5	1	2	11
7/9	3	0	1	0	4	0	4	1	7	8	15	2	2	24
12/9	1	2	2	0	5	3	8	2	7	1	8	4	4	26
19/9	0	1	4	0	5	1	6	1	6	1	7	3	6	23
26/9	0	1	1	2	4	1	5	1	3	3	6	2	3	17
7/10	0	1	1	4	6	0	6	3	1	0	1	1	2	13
Total	38	29	44	58	169	35	204	22	116	83	199	41	43	509
%	7.47	5.7	8.64	11.4	33.2	6.9	40.08	4.22	22.8	16.3	39.1	8.1	8.48	100

Table (61) : Numbers of predators collected by sweeping net (100 double strokes) on cotton plants received conventional insecticidal spraying, at Moshtohor (Kalubia Governorate) 1998 season.

order	Coleoptera							Diptera			Hemiptera			Neuroptera	True spider	Overall mean
Family	Coccinellidae					Staphylinidae	Total	Coccidulidae	Syrphidae	Total	Anthocoridae		Total	Chrysopidae		
Date	C. undecimpunctata	C. septempunctata	H. tredecimpunctata	Scymnus spp.	Total	P. alfierii		Lecopus sp.	Syrphus sp.		Orius albidipennis	Orius laevigatus		Ch. carnea		
16/5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23/5	0	0	0	0	0	0	0	0	0	0	4	0	4	3	0	7
30/5	1	0	0	0	1	6	7	6	0	6	6	0	6	1	0	20
10/6	2	0	0	0	2	5	7	8	0	8	8	7	15	0	0	30
17/6	0	3	0	1	4	10	14	13	0	13	9	2	11	7	1	46
24/6	0	3	0	3	6	15	21	16	0	16	7	4	11	7	3	58
30/6	1	4	0	1	6	9	15	14	0	14	11	0	11	0	5	44
8/7	1	0	0	5	6	8	14	9	0	9	8	3	11	10	3	47
15/7	0	0	0	0	0	1	1	1	0	1	7	5	12	11	1	26
23/7	0	1	6	6	13	17	30	18	0	18	11	3	14	13	4	79
30/7	3	1	0	3	7	12	19	15	0	15	23	7	30	11	4	79
6/8	4	2	4	0	10	10	20	12	0	12	22	1	23	8	0	63
13/8	6	0	3	1	10	10	20	17	0	17	22	11	33	21	1	92
20/8	0	5	1	1	7	7	14	10	0	10	13	5	18	23	4	69
27/8	1	1	1	0	3	7	10	14	0	14	17	7	24	11	8	67
4/9	0	1	1	0	2	7	9	12	0	12	16	3	19	9	7	56
11/9	5	0	1	0	6	15	21	16	0	16	7	11	18	7	1	63
18/9	0	1	3	4	8	11	19	12	0	12	5	5	10	13	3	57
25/9	0	1	2	1	4	5	9	6	0	6	9	10	19	11	11	56
8/10	1	1	0	0	2	3	5	3	0	3	11	11	22	0	5	35
15/10	0	1	0	2	3	3	6	4	1	5	7	3	10	1	6	28
Total	25	25	22	28	100	161	264	206	1	207	223	98	321	167	67	1022
%	3.17	2.44	2.79	3.55	7.6	20.41	25.7	20.08	0.97	20.18	28.26	12.42	40.68	21.17	8.49	100

Table (62) : Numbers of predators collected by sweeping net (100 double strokes) on cotton plants received conventional insecticidal spraying, at Moshtohor (Kalubia Governorate) 1999 season.

Order	Coleoptera								Diptera	Hemiptera			Neuro-ptera	True spider	Overall mean
Family	Coccinellidae						Staphy-linidae	Total	Syrphidae	Anthocoridae		Total	Chry-sopidae		
Date	*C. undecim-punctata*	*C. septem-punctata*	*Adonea variegata*	*H. 13 punc-tata*	*Scymnu syriacus*	Total	*P. alfierii*		*Syrphus corollae*	*Orius laevi-gatus*	*Orius albidi-pennis*		*Ch. carnea*		
19/5	213	2	1	0	0	216	0	216	0	0	0	0	0	0	216
26/5	129	9	3	0	0	141	0	141	0	0	0	0	0	0	141
6/6	205	12	1	0	0	218	1	219	5	13	10	23	2	0	249
14/6	217	7	1	3	0	228	1	229	7	15	13	28	5	2	271
21/6	83	3	0	1	0	87	1	88	3	6	9	15	3	5	114
28/6	70	2	0	1	2	75	2	77	0	0	0	0	1	3	81
6/7	9	1	0	2	3	15	3	18	0	18	17	35	2	1	56
13/7	3	1	0	1	8	13	1	14	0	5	12	17	3	1	35
20/7	3	0	1	1	2	7	1	8	0	3	9	12	3	2	25
27/7	1	0	1	1	3	6	1	7	0	2	7	9	3	3	22
5/8	1	0	2	0	9	12	5	17	0	10	19	29	5	3	54
13/8	2	1	3	2	11	19	3	22	0	11	20	31	0	5	58
20/8	2	1	3	2	6	14	0	14	0	15	21	36	0	4	54
27/8	3	1	1	3	3	11	1	12	0	11	20	31	0	6	49
3/9	7	1	2	1	2	13	1	14	0	20	23	43	9	6	72
10/9	9	1	1	8	2	21	3	24	2	22	30	52	13	7	98
17/9	11	1	0	3	4	19	3	22	5	11	25	36	9	9	81
21/9	7	0	0	4	9	20	4	24	8	8	20	28	7	11	78
24/9	1	0	0	3	3	7	5	12	0	7	15	22	7	10	51
7/10	3	0	0	3	3	9	2	11	9	3	7	10	1	9	40
Total	979	43	20	39	70	1151	38	1189	39	180	277	457	73	87	1841
%	53.2	2.3	1.1	2.12	3.81	62.5	2.1	66.6	2.12	9.77	15.05	24.8	3.96	4.7	100

Table (63) : Numbers of predators collected by sweeping net (100 double strokes) on cotton plants received conventional insecticidal spraying, at Sids (Beni-Suef Governorate) 1997 season.

Order	Coleoptera									Diptera			Hemiptera			Neuro-ptera		
Family	Coccinellidae							Staphy-linidae	Total	Ochiph-ilidae	Syrph-idae	Total	Anthocoridae			Chry-sopidae	True spider	Overall catch
Date	*C. undecim-punctata*	*C. septem-punctata*	*Adonia variegata*	*H.13 punc-tata*	*C. nilotica*	*S. interna*	Total	*P. alfierii*		*Lacopus sp.*	*Syrphus sp.*		*Orius albidi-pennis*	*Orius laevi-gatus*	Total	*Ch. carnea*		
15/5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24/5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2/6	2	1	4	3	0	3	13	1	14	0	0	0	2	3	5	3	0	22
9/6	5	4	6	5	0	7	27	5	32	0	0	0	2	5	7	8	2	49
16/6	2	3	5	1	0	9	20	3	23	0	0	0	7	10	17	7	3	50
25/6	2	1	5	1	0	7	16	3	19	0	1	1	21	13	34	5	3	62
7/7	1	0	3	1	0	3	8	2	10	0	2	2	3	19	22	9	11	54
14/7	3	0	2	1	0	2	8	4	12	0	2	2	3	16	19	3	8	44
21/7	4	0	1	1	0	2	8	4	12	3	0	3	5	15	20	2	6	43
28/7	3	0	1	0	0	1	5	4	9	1	0	1	7	11	18	2	4	34
2/8	5	0	1	3	0	10	19	6	25	2	0	2	9	13	22	1	4	54
11/8	3	0	1	4	0	6	14	4	18	0	0	0	0	6	6	1	13	38
18/8	1	0	1	0	0	0	2	1	3	0	0	0	0	0	0	0	9	12
25/8	1	0	6	0	0	0	7	1	8	0	0	0	0	0	0	0	7	15
1/9	3	5	9	2	3	4	26	1	27	2	3	5	11	7	18	5	6	61
8/9	6	3	8	4	4	9	34	1	35	5	7	12	27	11	38	17	3	105
15/9	7	1	8	5	7	5	33	0	33	3	4	7	20	13	33	13	9	95
28/9	2	1	1	1	2	4	11	0	11	3	3	6	15	5	20	9	9	55
6/10	1	1	0	1	2	4	9	1	10	3	3	6	10	9	19	6	10	51
Total	51	20	62	33	18	76	260	41	301	22	25	47	142	156	298	91	107	844
%	6.04	2.4	7.3	3.9	2.1	9	30.8	4.9	35.7	2.6	2.9	5.6	16.8	18.5	35.3	10.78	12.7	100

Table (64) : Numbers of predators collected by sweeping net (100 double strokes) on cotton plants received conventional insecticidal spraying, at Sids (Beni-Suef Governorate) 1998 season.

Order	Coleoptera										Diptera	Hemiptera			Neuro-ptera	True spider	Overall mean
Family	Coccinellidae								Staphy-linidae	Total	Syrph-idae	Anthocoridae		Total	Chry-sopidae		
Date	*C. undecim-punctata*	*C. septem-punctata*	*Adalia variegata*	*H.13 punc-tata*	*C. nilotica*	*S. interae*	*S. syriacus*	Total	*P. alfierii*	Total	*Syrphus sp.*	*Orius albidi-pennis*	*Orius laevi-gatus*	Total	*Ch. carnea*		
10/5	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	1
17/5	0	0	1	0	0	0	0	1	1	2	0	0	0	0	5	0	7
24/5	1	1	0	1	0	0	0	3	4	7	6	0	0	0	7	0	20
1/6	1	2	1	5	2	0	0	11	5	16	5	4	0	4	3	0	28
8/6	4	2	1	3	3	5	0	18	3	21	2	13	5	18	4	0	45
15/6	1	6	2	2	0	9	0	20	3	23	3	19	11	30	6	1	63
25/6	0	1	1	1	0	1	0	4	0	4	1	10	9	19	5	1	30
4/7	3	0	3	6	0	7	0	19	0	19	5	8	4	12	2	3	41
13/7	6	0	5	2	0	3	0	16	0	16	3	7	4	11	1	1	32
20/7	3	1	2	2	0	3	0	11	6	17	0	7	5	12	1	0	30
27/7	3	1	3	1	0	9	1	18	7	25	0	3	2	5	0	0	30
2/8	5	1	1	4	0	8	0	19	3	22	0	6	2	8	0	4	34
10/8	2	0	0	0	0	6	0	8	1	9	0	3	0	3	2	0	14
17/8	0	0	0	0	0	3	0	3	0	3	0	0	0	0	1	0	4
24/8	0	0	0	0	0	3	0	3	0	3	0	0	0	0	1	5	9
2/9	5	0	0	0	2	0	1	8	0	8	2	7	3	10	2	3	25
10/9	9	5	2	3	4	1	3	27	0	27	3	9	7	16	3	5	54
17/9	13	3	6	7	5	1	5	40	2	42	9	15	8	23	5	8	87
23/9	7	3	1	6	7	3	4	31	1	32	6	20	11	31	4	8	81
30/9	1	1	1	4	1	0	3	11	1	12	2	10	13	23	4	1	42
6/10	1	1	0	3	1	0	2	8	1	9	2	6	3	9	3	1	24
Total	65	28	30	51	25	62	19	280	38	318	49	147	87	234	59	41	701
%	9.27	4.0	4.3	7.3	3.6	8.8	2.7	39.9	5.4	45.4	6.99	20.9	12.4	33.9	8.4	5.8	100

Table (65) : Numbers of predators collected by sweeping net (100 double strokes) on cotton plants received conventional insecticidal spraying, at Sids (Beni-Suef Governorate) 1999 season.

Order	Coleoptera									Diptera	Hemiptera			Neuro-ptera	True spider	Overall mean
Family	Coccinellidae							Staphy-linidae	Total	Syrphi-dae	Anthocoridae		Total	Chry-sopidae		
Date	*C. undecim-punctata*	*C. septem-punctata*	*Adlalia variegata*	*H.15 puncto-tata*	*C. vicina isis*	*S. interna*	Total	*P. alfierii*		*Syrphus* sp.	*Orius albidi-pennis*	*Orius laevi-gatus*		*Ch. carnea*		
23/5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30/5	6	1	0	4	0	20	31	0	31	0	20	7	27	0	0	58
6/6	11	1	0	9	0	33	54	0	54	0	13	17	30	0	0	84
13/6	10	2	2	7	2	11	34	1	35	5	9	3	12	1	2	55
20/6	9	4	1	7	0	9	30	1	31	3	7	2	9	1	3	47
27/6	7	5	3	6	3	5	29	1	30	1	5	3	8	1	3	43
5/7	9	4	7	3	4	0	27	7	34	0	13	3	16	2	4	56
12/7	3	3	6	2	5	3	22	3	25	1	11	6	17	3	6	52
19/7	1	1	3	2	2	9	18	3	21	1	10	5	15	6	4	47
26/7	1	1	3	1	1	9	16	2	18	1	8	4	12	3	4	38
4/8	8	6	1	4	0	13	32	6	38	0	6	4	10	7	3	58
12/8	5	3	1	3	0	0	12	1	13	0	6	0	6	4	0	23
20/8	4	0	2	2	0	0	8	1	9	0	4	0	4	4	2	19
5/9	11	0	3	1	3	0	18	5	23	2	10	3	13	11	9	58
12/9	3	7	3	0	2	9	24	1	25	1	15	7	22	17	11	76
19/9	2	3	1	5	2	7	20	1	21	1	10	17	27	20	15	84
26/9	0	2	1	6	4	3	16	0	16	1	9	11	20	13	11	61
Total	90	43	37	62	28	131	391	33	424	17	156	92	248	93	77	859
%	10.5	5	4.3	7.2	3.3	15.3	45.5	3.84	49.36	1.98	18.2	10.7	28.9	10.8	8.98	100

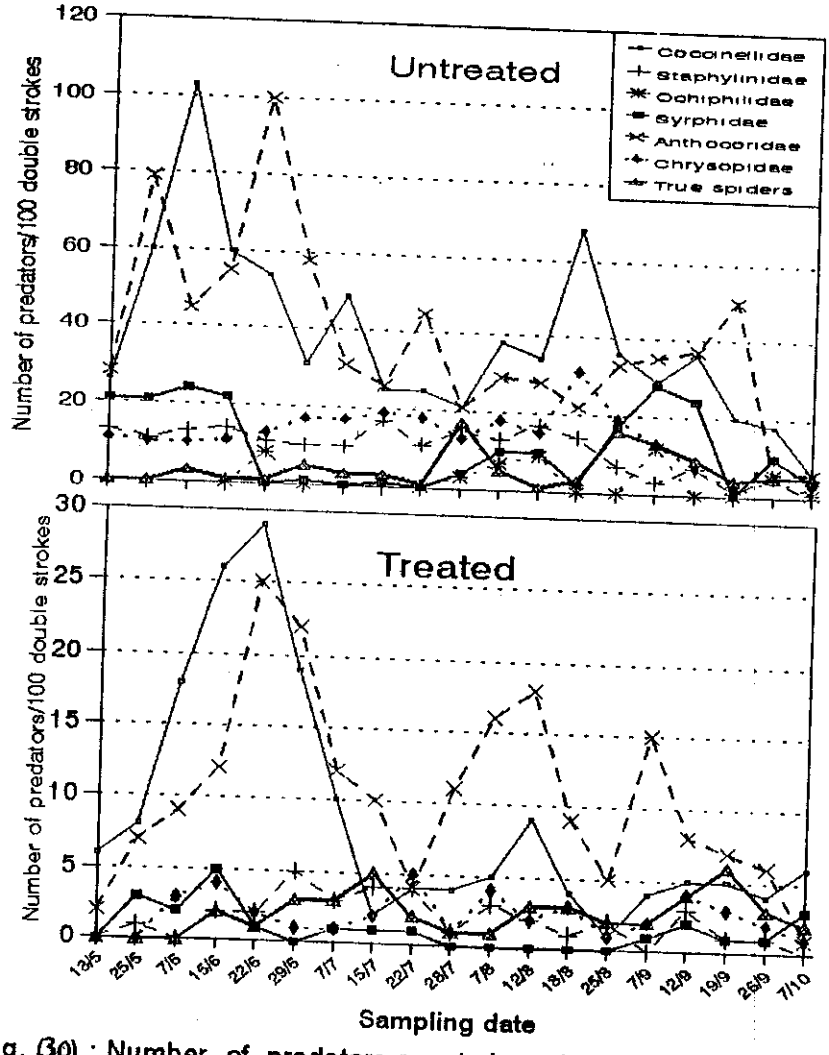


Fig. (30) : Number of predators counted per 100 plants from free and treated cotton fields in Moshtohor throughout 1997 season.

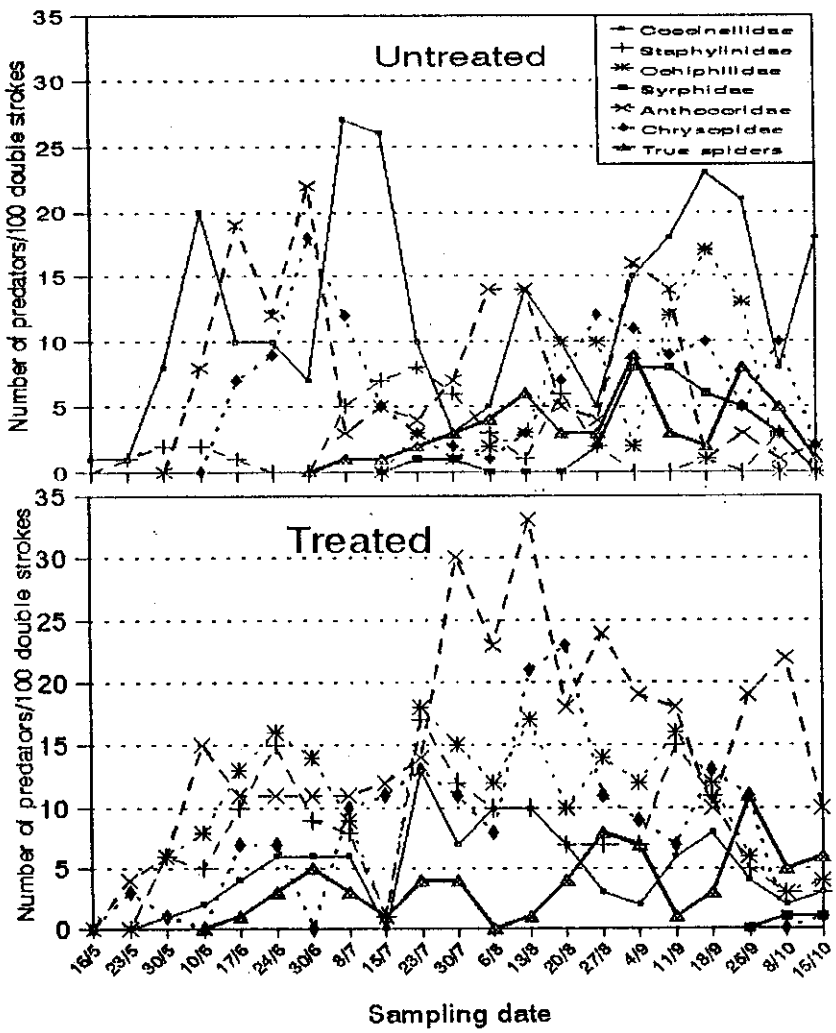


Fig. (31) : Number of predators counted per 100 plants from free and treated cotton fields in Moshtohor throughout 1998 season.

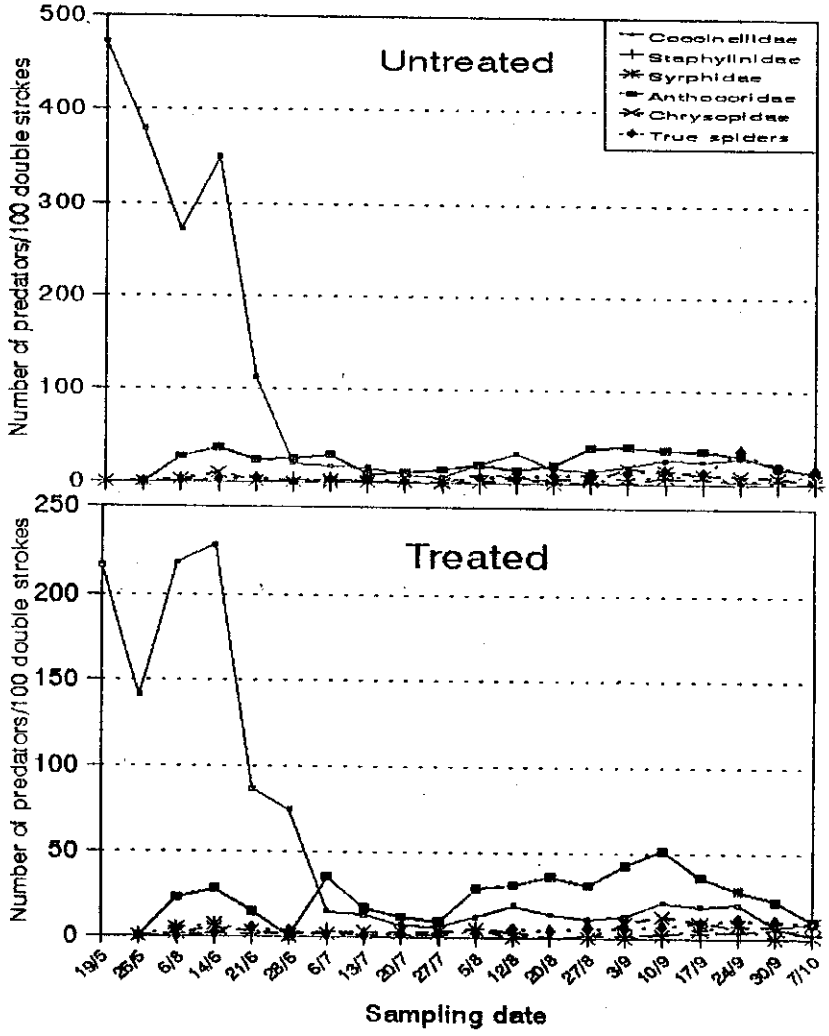


Fig. (32) : Number of predators counted per 100 plants from free and treated cotton fields in Moshtohor throughout 1999 season.

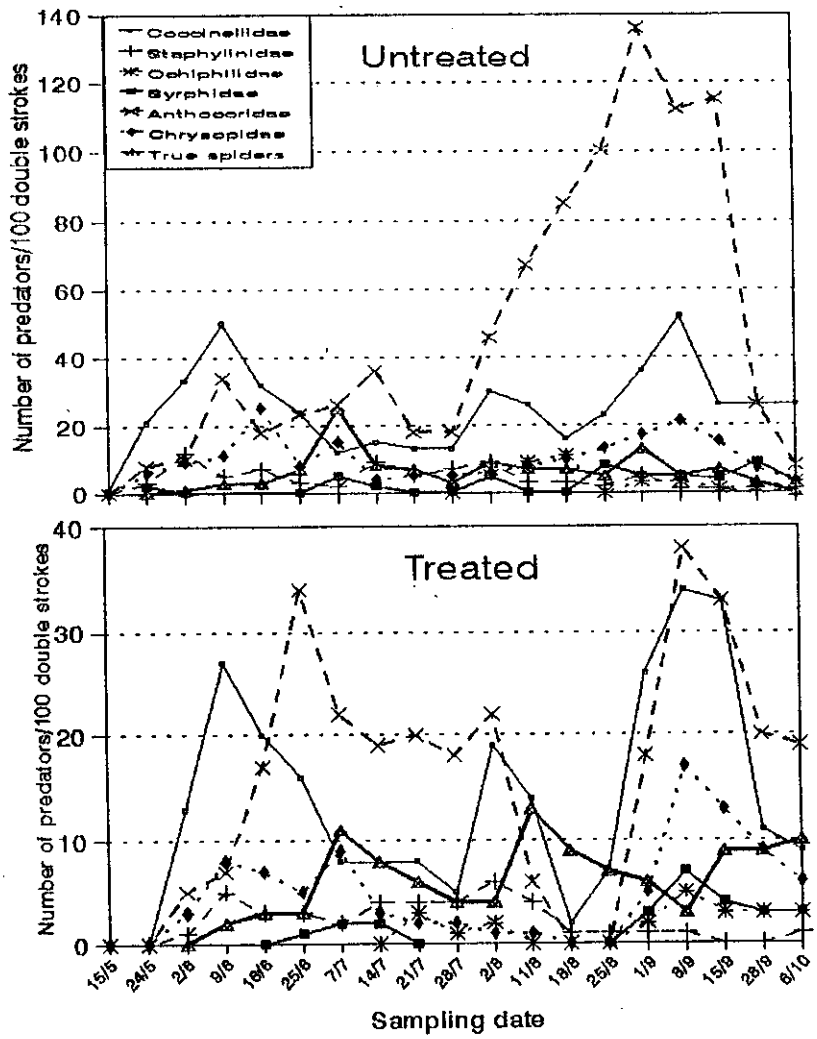


Fig. (33) : Number of predators counted per 100 plants from free and treated cotton fields in Beni-Suef throughout 1997 season.

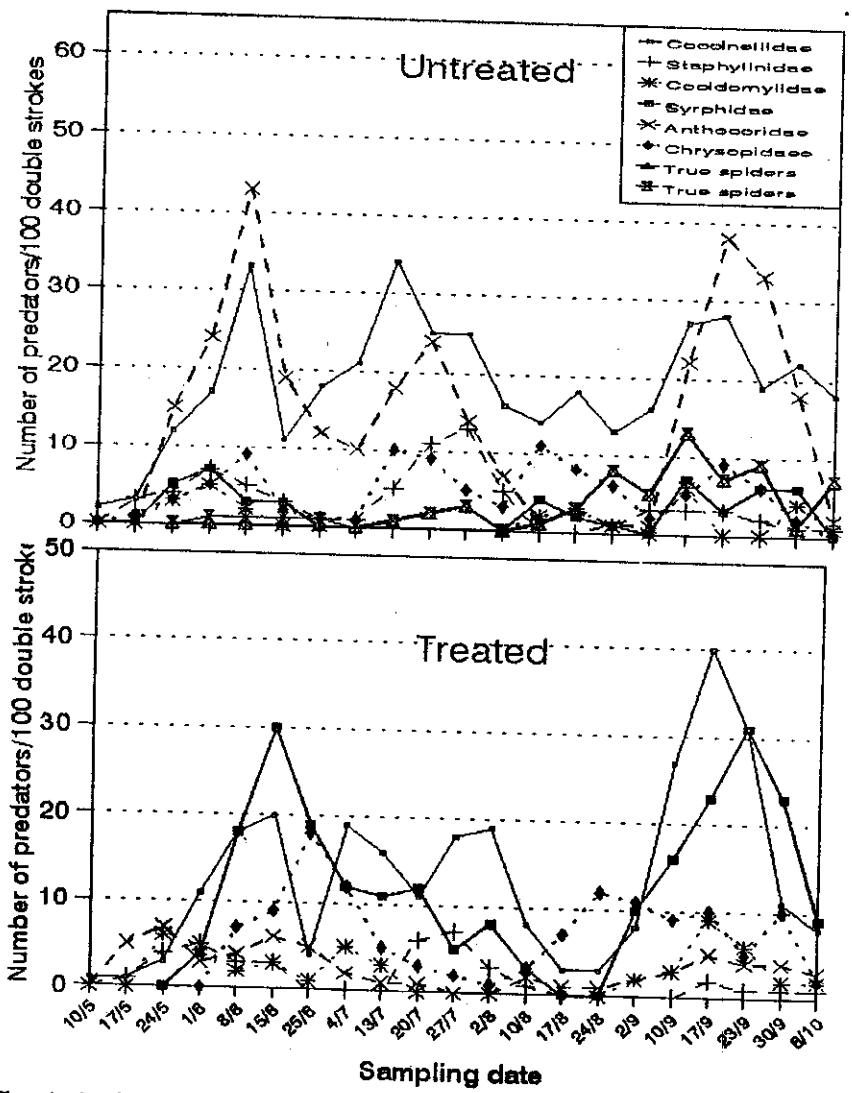


Fig. (34) : Number of predators counted per 100 plants from free and treated cotton fields in Beni-Suef throughout 1998 season.

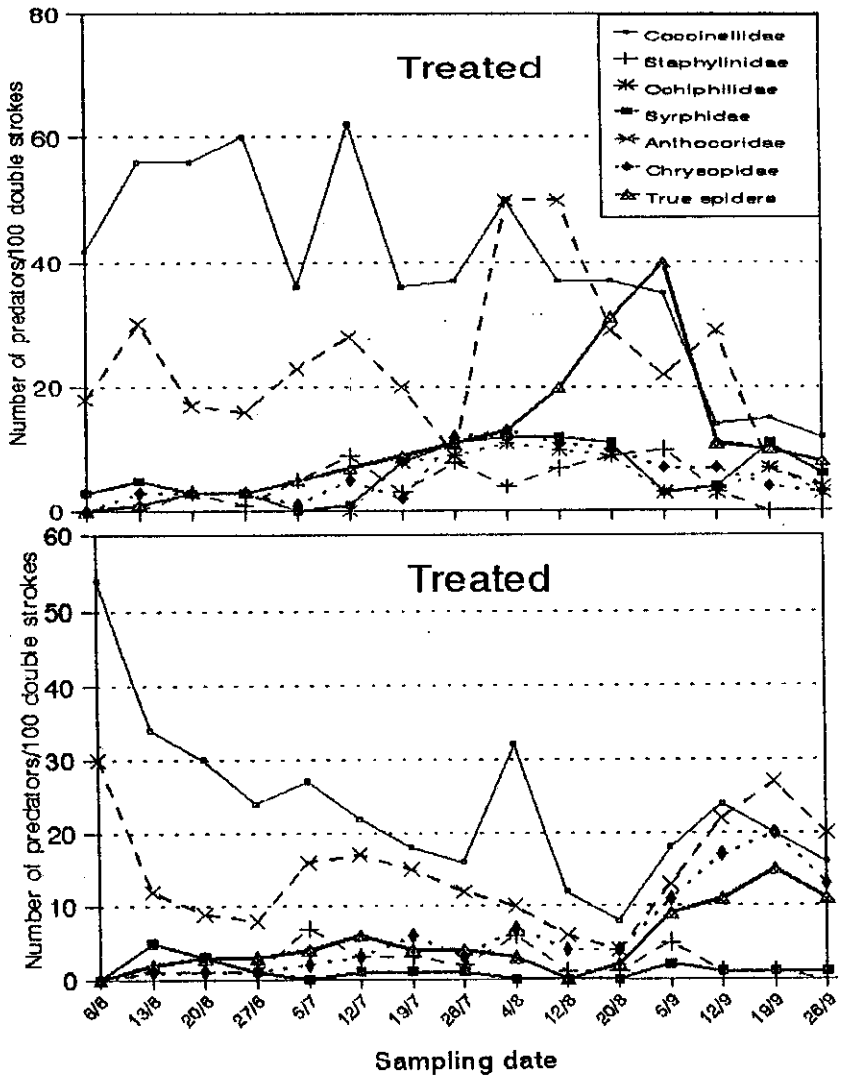


Fig. (35) : Number of predators counted per 100 plants from free and treated cotton fields in Beni-Suef throughout 1999 season.

environmental conditions, which vary from one year to the other or from Governorate to another, or to any other factors.

Regarding the counts of the total numbers of insect predators on cotton plants. At Moshtohor that were kept free from any insecticidal treatment throughout the whole period of plant growth, data in Tables (54-56) clearly, show that the population of predators started with few individuals (48) on 2nd week of May and increased gradually until reaches a peak which occurred in the 1st and 3rd week of June (198 & 179 individuals / 100 double net strokes, 140 individuals / 100 double net strokes on 3rd week of August in 1997 season in Moshtohor. In 1998 season the numbers of predators were very low during all the seasons, the highest total population were 37 individuals, 48 and 64 individuals on 2nd week of June, 1st week of July and 2nd week of September, respectively, while in 1999 season, the total population abundance started very high on May, 19th with 473 individuals, then high peaks were estimated as 380, 402, 108 and 112 individuals on May, 26th, June, 14th and September, 10th and 24th, respectively.

At Beni-Suef untreated fields, the overall total of predators occurred in two peaks during 1997 and 1998 seasons. These peaks estimated as 103 and 215 individuals on the 2nd week of June and 1st week of September in 1997 season; 96 and 88 individuals on the 2nd week of June and 3rd week of September in 1998 season. Also, in 1999 season two peaks were estimated as 112 and 142 individuals on the 1st week of July and 4th week of July, respectively.

The predators in treated cotton fields in the two locations during the 3 successive seasons were surveyed. About 9 species of predators, most of them belong to order Coleoptera, and true spiders recorded in low numbers throughout the 3 seasons.

Tables (60-65) summarize the obtained data of predators in treated cotton fields at the two locations of study throughout the 3 seasons. Data clearly show that the population of insect predators, were, generally, lower in the treated fields in the two locations Moshtohor and Beni-Suef in 1997, 1998 and 1999 seasons than the untreated fields (Tables 54-59). Total counts of 509, 102 and 1841in Moshtohor and 844, 701 and 859 individuals in Beni-Suef were obtained throughout the three seasons, respectively.

From these data, it was concluded that apparently insecticide treatments play a major role in reducing predator numbers.

The present results indicated high abundance of total predators in June, August and September are in complete accordance with those previously reported by **kamal (1951)** and **Hafez (1960)** as they recorded highest abundance of total predators during the mentioned months and also a decrease in number of these predators during July. This increase in June and September and decrease in July seems to be due to the increase in temperature during July

Azab *et al.* (1965) found that all the predators were active during July and August **Habib *et al.* (1976)** also found that most predators in untreated cotton fields reached their

maximum abundance during July and August. **El-Heneidy *et al.* (1978 –1979)** found the total predator decline observed during July and increase during August.

The surveyed predators were as follows:

I-Order: Coleoptera:

Fam : Coccinellidae

Eight predaceous species of coccinellidae were discerned by using the sweeping net strokes on cotton plants throughout three seasons in Moshtohor and Beni-Suef namely ***C. undecimpuncteta*, *C. septimpunctaca*, *H. 13-punctata*, *Adonia variegata*, *C. vicina isis*, *C. vicina nilotica*, *Scymmus interruptus*** and ***S. syriacus***.

The coccinellids comprise a very important group as predators of different pests during both larval and adult stages. The total number of coccinellid adults captured throughout the whole season was 746, 260 and 1872 adults in Moshtohor during the three seasons, respectively, while in Beni-Suef region, the total number of coccinellid adults captured throughout 1997, 1998 and 1999 seasons was counted as 475, 392 and 527 adult, respectively. Comprising high percentages of 24.84 %, 34.85 % and 69.36 % of total predators at Moshtohor, and high percentages of 26.04 % 39.06 % and 48.3 % of total predators in Beni- suef, in the untreated fields during the three seasons, respectively (Tables 54-59).In treated cotton fields, at the two locations data in Tables (60-65) indicate that fewer population of total predators'

number collected (169, 100 and 1151 individuals in Moshtohor region and 260, 280 and 391 individuals in Beni-Suef throughout 1997, 1998 and 1999 seasons, respectively). These numbers represented 3302, 9.7 and 62.5% of the total number of collected predators in Moshtohor region while, 30.8, 39.9 and 45.5% of the total number of collected predators in Beni-Suef region, these numbers are less than thos counted on the untreated fields.

By counting the total coccinellid adults captured in successive samples in untreated fields, it is clear from Tables (54, 55, 65 and Fig 30) that three peaks in the adults population abundance could be detected in two season 1997 and 1998 in untreated cotton fields in Moshtoher. In 1997 the peaks were (103, 68 and 36 adult/ 100 double strokes on 1st week of June, 3rd week of August and 2nd week of September, respectively), while in 1998 they were 20,27 and 23 individuals / 100 double strokes, on 2nd week of June, 2nd week of July and 3rd week of September, respectively. But, in 1999 season two peaks occurring on 2nd week of June, and 4th week of September, 350 and 28 adults / 100 double strokes . While, in Beni-Suef region, two peaks appeared during 1997 and 1999, but in 1998 had 3 peaks appeared. In 1997 season the two peaks estimated as 50 and 52 adults / 100 double stokes on 2nd week of both June and September. In 1998 season, 3 peaks estimated as 33, 34 and 28 on the 2nd week of both June, July and 3rd week of September respectively, the lowest number occurred on May and October at the two

seasons, 1997 & 1998 in Moshtohor and during three seasons in Beni-Suef.

In treated field at Moshtohor region, three peaks of predator abundance occurred during 3rd week of June 2nd week of August and September during 1997, 3rd week of July 1st week of both August, and 3rd week of September during 1998 season. But in 1999 season, the highest and first peaks occurred in 1st week June and 2nd, 3rd peaks occurred in 2nd and 4th week of September. These peaks estimated as 29, 9 and 6 individuals, 13, 10 and 8 individuals and 218, 21 and 20 individuals, during 1997, 1998 and 1999 seasons, respectively, (Tables 60-62).

In the treated fields at Beni-Suef region, three peaks appeared during the two seasons 1997 and 1998. These peaks estimated as 9, 10 and 9 in 3rd week of June, 1st week of August and 2nd week of September in 1997 season. In 1998 season, these peaks estimated as 20, 19and 40 individuals in 3rd week of June, 1st week of August and 3rd week of September, while, in 1999 season three peaks estimated as 54, 32 and 24 individuals in 1st week of June, 1st week of August and 2nd week of September, respectively.

Coccinella undcimpunctata:

Throughout 1997 season, total number of 171 and 56 *C. undecimpunctata* were captured by using the sweeping net in untreated fields in Moshtohor and Beni-Suef, respectively, (Tables, 54 and 57). Those counts represented 7.55 and 3.07% of total counted predators throughout the season in Moshtohor

and Beni-Suef, respectively. Weekly counts of *C. undecimpunctata* adults by using the net-sweeping method on untreated cotton plants cultivated in Moshtohor region, two peak estimated as 21 and 13 adults/100 double strokes on 2nd week of June and 2nd week of August, the lowest abundance occurred in May and October, estimated as 24 / adult / 3 weeks and 0 adult/week, respectively (Table 54).

In Beni-Suef, counts showed 1, 11, 11, 14, 18 and 1 adult / months of May, June, July, August, September and October, the first and highest peak estimated as 8 adult / 100 double strokes, on the 1st week of September.

Regarding the aforementioned results of estimation of the population abundance of this lady bird species in 1997 cotton season by using the direct counting method, four peaks of abundance at Moshtohor and Beni-Suef occurred in 2nd week of June, 3rd week of both July, August and September and 2nd week of June, 1st and 4th week of July and 4th week of September, respectively. These results indicate that survey of these predators by direct counts gave high population number than sweeping net method.

While in 1998 and 1999 cotton seasons, total numbers counted in untreated fields (27 and 1593 adults) and (62 and 115) adults of *C. undecimpunctata* were captured by using the sweeping net in Moshtohor and Beni-Suef regions, respectively (Tables 55 & 56 and 58 & 59). Those counts represented (3.62% and 59.02%) and 6.17% and 8.39% of the total predator counted throughout the two seasons in Moshtohor and Beni-Suef, respectively. Weekly counts of

C. undecimpunctata adults by using the sweeping net method on cotton plants cultivated in Moshtohor showed, the population of this predator to be very low during 1998 season, (8, 5, 3, 9 and 2 individuals) in June, July, August, September and October, while no predators counted on May, but in 1999 season, the number of this predator started with very high number on May and June, the highest peak estimated as 330 adults/100 double strokes on the 2nd week of June then the number decreased gradually until disappearing on the 4th week of July and increased to 13 adults on the 4th week of September. In Beni-Suef region; this predator appeared very low allover 1998 season 2, 5, 18, 12, 24 and 1 adults captured on May, June, July, August, September and October, respectively, (Table 58). While in 1999-season two peaks occurred on the 3rd and 4th week of June (14 adult / 100 double strokes and 17 adults / 100 double strokes on 3rd week of July) (Table 59).

In Moshtohor and Sids fields received conventional insecticidal treatments, Tables (60-65) clearly show that the total counts of *C. undecimpunctata* adults were 38, 25 and 979 individuals and 51, 65 and 90 individuals during the whole seasons of 1997, 1998 and 1999, respectively. The percentage of totally collected adults occupied 7.47, 3.17 and 53.2 % of the total numbers of collected predators in the three seasons in Moshtohor (Tables 60-62). These percentages were 6.04, 9.27 and 10.5% of total collected adult predators in the three seasons in Beni-Suef region (Table 63-65). In Moshtohor region, the first and highest peak occurred in 4th week of June (11 individuals / 100 double strokes) (Table 60).

While, in 1998 season 2 peaks appeared (6 and 5 adult / 100 double strokes) in 2nd week of both August and September, respectively. In 1999 season, it could be fairly said that ***C. undecimpunctata*** is the most abundant predator on cotton throughout this year of study. It began high in population and then decreased gradualy and the very low numbers achieved in June, August and October. The first and highest peak was 217 adults/100 double strokes in June 14th and second peak estimated as 11 adults / 100 double strokes on 3rd week of September (Table 62).

In Beni-Suef region, in 1997 season, two peaks appeared on 2nd week of June and 3rd week of September was (5 and 7 adult / 100 double strokes) respectively (Table 63).

In 1998 season, fewer number of total ***C. undecimpunctata*** adults were counted on cotton plants that were sprayed throughout the conventional program, two peaks occurred on the 2nd week of July and 3rd week of September (6 and 13 individuals/100 double strokes), and the lowest number counted in May, June, August and October, respectively (Table 64).

In 1999 season, three peaks appeared estimated as 11, 8 and 11 adults/100 double strokes, on 1st week of June, 1st week of August and 1st week of September (Table 65).

C. septempunctata:

In untreated cotton fields, total number of 85, 44 and 67 adult were recorded at Moshtohor during 1997, 1998 and 1999 seasons, respectively and 25, 32 and 53 adult at Beni-

Suef region during the respective seasons. These counts represented 2.83, 5.9 and 2.48% and 1.37, 3.18 and 3.86% of totally collected adults predators, respectively, during the three seasons at Moshtohor and Beni-Suef (Tables 54-59).

But, in treated fields, the ladybird beetle ***C. septimpunctata*** was found in few numbers during the three seasons of study (1997, 1998 and 1999) and in the two locations.

These total numbers were 29, 25 and 43 individuals at Moshtohor region and 20, 28, 43 adults on cotton during the three seasons, respectively, in Beni-Suef. These total counts of ***C. septempunctata*** adult represented 5.7, 2.44 and 2.3% and 2.4, 4.0 and 5.0% of the total counts of predators collected in treated cotton fields of the three seasons 1997, 1998 and 1999 at Moshtohor and Beni-Suef, respectively (Tables 55-60).

These results showed much lower abundance of ***C. septempunctata*** than using direct count at Moshtohor and Beni-Suef during the three successive seasons in both treated and untreated fields.

H. tredecimpunctata:

Throughout the cotton season the total number of ***H. tredecimpunctata*** adults counted on untreated cotton plants using sweeping net were (93, 81 and 52 and 58, 76 and 139) adults at Moshtohor and Beni-Suef in 1997, 1998 and 1999 season, respectively. These total counts represented 3.1,

10.86 and 1.93% and 3.18, 7.56 and 10.15% of total surveyed predators, respectively.

These ladybird beetle, ***H. 13-punctata*** was found during all seasons of study in the two treated locations. Regarding the total number of this predator 44, 22 and 39 individuals were recorded at Moshtohor in 1997, 1998 and 1999 seasons, respectively, while, in Beni-Suef, these total were 33, 51 and 62 individuals, in the three seasons. These total counts of ***H. 13-punctata*** adults represented 2.79, 2.12 and 3.9% (Tables, 60-62) of all the total counts of all predators collected in Moshtohor, on the other hand the percentage of predator throughout 1997, 1998 and 1999 seasons, were 3.9, 7.3 and 7.2% of the total counts of all predators in Beni-Suef (Tables 63-65).

Adonia variegata:

Throughout the three cotton seasons, the total number of ***Adonia*** adult counted on untreated cotton plants using sweeping net were 76, 16, 27 individuals at Moshtohor and 88, 53 and 33 at Beni-Suef (Table 54- 59) in 1997, 1998 and 1999 seasons, respectively. Those total counts represented 2.53, 2.14 and 1.0% and 4.82, 5.27 and 2.41% of the total counts of predators in the two locations, respectively. .

Data in Tables (60-65) show the total number of ***Adonia varigata*** collected from treated fields at Moshtohor and Beni-Suef during the three seasons of study. Data indicated that no counts of ladybird beetle, ***Adonia*** was recorded during 1997 season in Moshtohor, but it appeared during 1998 and 1999

seasons in the same location. While, this predator counted throughout the three seasons in Beni-Suef region. In addition the predator was generally found in low numbers during 1998 and 1999 seasons at Moshtohor than at Beni-Suef region in the three seasons of study.

In the treated fields at Moshtohor region, the total numbers of the predators were 56 and 20 individual, represented by 3.55% and 1.1% (Tables 61& 70) of the total counts of all predators collected allover the two seasons, respectively, while in Beni-Suef region, the total number of predators were 62, 30 and 37 individuals on cotton plants of the three seasons 1997, 1998 and 1999 seasons, respectively, these total counts of ***Adonia*** adults represented 7.3, 4.3 and 4.3% Tables(63-65) of the total counts of all predators collected during the three seasons, respectively.

It is concluded that the predator was generally less abundant in Moshtohor than Beni-Suef and in treated field than in untreated fields and the decreased in number of the predator appeared in July and August months.

Cydonia visina nillotica:

The total counts of 49,6 and 30 adults were obtained at Moshtohor and 32, 30 and 27 adults at Beni-Suef, respectively 1.63, 0.80 and 1.11% and 1.75, 2.99 and 1.97% of all predators counted in 1997, 1998 and 1999 seasons were calculated at the two locations, respectively (Tables 54 - 59).

In Moshtohor region, one peak appeared on the 3rd week of August 23 adults / 100 double strokes were obtained, while the predator disappeared from 2nd week of June to 3rd week of July (Table 54). During 1998 only 6 adults were surveyed allover the season (Table 55). While, in 1999 season this predator disappeared from 3rd week of May to 4th week of August (Table 56).

In Beni-Suef region; data in Table (57) indicate that the collected ***Cydonia*** in sweeping net ranged between (0 – 3 adults / 100 double strokes) while 1998; the predator completely disappeared during May, and the 1st 3 weeks of August. The weekly count ranged between 1 & 5 adults / 100 double strokes. In 1999 season, the highest count was 12 adults / 100 double strokes in 2nd week of July and no ***Cydonia*** were collected by sweeping net from May to end of June. Moreover, this species disappeared from cotton fields treated with conventional insecticides in the two locations during the course of study.

C. visina isis

The total counts of this predator was 15, 12 and 16 at Moshtohor and 17, 21 and 33 adults at Beni-Suef, representing 0.66, 1.61 and 0.59 % and 93, 2.09 and 2.4% of all predator in 1997, 1998 and 1999, respectively.

***Scymnus* spp.**

Scymnus interaptus:

Scymnus* spp.** were the other coccinellids concerned in this study. Two species of ***Scymnus are well known to be present in cotton fields in Moshtohor and Beni-Suef, and well observed in direct count and by using sweeping net in untreated fields. But in treated fields, no ***Scymnus syriacus*** appeared in Moshtohor fields during the 3 successive seasons.

Scymnus interaputs appeared in the two locations Moshtohor and Beni-Suef on untreated cotton plants throughout the three seasons 1997, 1998 and 1999 (total of 306, 74 and 87 adult/100 double strokes and 199, 75 and 201 adult/100 double strokes, representing 13.6, 9.92 and 3.22% of the total collected adults predators at Moshtohor during the 3 season and representing 10.91, 7.46 and 14.7% of the total collected adult predators at Beni-Suef (Table 54-59).

While in treated fields the total counts of ***Scymnus interruptus*** adults throughout the whole seasons in untreated cotton fields was higher than in treated fields. Data in Tables 60-65 indicate that the total number of predators throughout the seasons 1997, 1998 and 1999 were 58, 28 and 70 individuals and represented 11.4, 3.55 and 3.8% of the total counts of all predators, respectively, in Moshtohor.

While in Beni-Suef region, the total counts of the same predator adults were 76, 72 and 131 individuals (Tables 63-65). These data indicated that ***S. interraptus*** occupied 9.0, 8.8 and 15.3% of the total collected predators during the three seasons, respectively.

While, ***Scymnus syiacas*** were detected in Beni-Suef at untreated cotton plantations, the overall total of this predator was 43 adult collected by double strokes, representing 4.28% of the total collected adults (Table 58). In Moshtohor region, ***S. interaptus*** was the only species collected from cotton plants using sweeping net method. In direct count the two species of ***Scymnus*** (***interruptus*** and ***syriacus***) were collected, the second species was collected as (larvae and pupae on cotton plants).

S. syriacus, appeared in the treated cotton fields of Beni-Suef the total during 1998 season was very low. The total estimated number was 19 individuals (Table 64). This data indicate that this predator occupied 2.7 % of the total counts of all predators.

Results on the abundance of ***Scymnus*** **spp.** in cotton fields by using the sweeping net technique show low abundance compared to those previously recorded in case of using the direct counting technique (Table 65).

Hafez (1960) and **Azab *et al.* (1965)** reported that the ***Scymnus*** **spp**. stayed moderately during the 2nd week of June. The results of **Habib *et al.* (1976)** confirmed the results in the present investigation as they found that ***Scumnus*** **spp**. were very active on cotton in June and August; **Nassef (1995)** stated that ***Scymnus*** **spp**. had 3 peaks of abundance during a period extended from mid-June to mid-September. The main climatic factors that affected population changes were the wind speed and temperature.

Fam. Staphylinedae:

Total number of 202, 48 and 58 adults and 78, 72 and 62 adults, throughout 1997, 1998 and 1999 season at the two locations, Moshtohor and Beni-Suef, were calculated, respectively. Those represented 6.73, 6.43 and 2.15 % and 4.28, 7.16 and 4.5% of the total number of predators collected (Tables 54-59). These results indicate that the percentage of adults of ***P. alfferii*** in Moshtohor was higher than in Beni-Suef during 1997, 1998 but in 1999 season, the percentage in Beni-Suef was higher than in Moshtohor.

In Moshtohor; two peaks appeared on the 2nd week July and 2nd week of August in 1997, while 1998 and 1999 the highest number was collected (8 adults / 100 double strokes) in 3rd week of July and 9 adults / 100 double strokes on 1st week of August, respectively (Tables 49-51).

In Beni-Suef region, the number of collected adults by sweeping net was very low, the highest number collected (12 adults and 9 adults) on the 1st week of June and 2nd week of July during 1997. While 13 adults / 100 double strokes on the 4th week of July, 1998 and (9 and 8 adults / 100 double strokes) on 1st week of July and 4th week of July, 1999. The results in Tables (52-54) showed that weekly counts of ***P. alfierii*** adults indicated very low abundance on cotton plants during the three seasons.

Also, in Beni-Suef the percentage of counted ***P. alfierii*** by direct counted in 1997 season was higher than that collected by sweeping net, while in the two seasons 1998 and 1999 percentage of predators by sweeping net was higher than

that of direct count. Spraying of cotton plants by the conventionally recommended insecticides caused reductions in ***P. alfierii*** populations. The total counts of adults throughout the whole cotton season was 35, 161 and 38 for 1997, 1998 and 1999 seasons, respectively, in Moshtohor, while in Beni-Suef region the total counts was 41, 38 and 33 individuals during the three seasons, respectively (Tables 60-65). Thus indicating that the predator was little abundant on treated cotton fields than untreated fields. The mentioned total counts represented 6.9, 20.41 and 2.1 % of the total counts of all predators, respectively, in Moshtohor and 4.9, 5.4 and 3.84 % of the total counts of all predators.

Regarding the weekly counts of ***P. alfierii*** adult on the treated cotton fields, data in Tables (60-65) indicate that the number of predator differed from 1 to 7 adult/100 double net strokes at the three seasons in the two locations.

Naguib (1980) found that the population of ***P. alfierii*** in cotton fields fluctuated sharply and showed several peaks during June. In contrast to the present results, **Habib *et al.* (1976)** indicated that the population density of ***P. alfierii*** was highest during July and August. **Abass and El-Deeb (1993)** found that the population density of ***P. alfierii*** was high in July then decreased gradually until end of the season.

Diptera:

***Leucopes* sp.**

Spraying of cotton plants by the conventionally recommended insecticides caused disappearance and decrease

in some predators such as reductions in ***Leucopes* sp.** populations. That could be easily detected from data in Tables (60–65). Data indicate no counts of ***Leucopes* sp.** during 1997 and 1999 in Moshtohor and 1998 and 1999 at Beni-Suef. But the predators appeared during 1998 and 1997 in Moshtohor and Beni-Suef, respectively, as the total counts of the predator adults was 206 and 22 individuals, respectively.

The mentioned total counts represented 20.08 and 2.6% of total predators counted. Data in Tables (61 & 63) show that this predator appeared from 30th May to 15th October in Moshtohor region, while in Beni-Suef region predator began to appear in 3rd week of July until 1st week of August and disappeared until end of August and then appeared with low number until end of season. The highest number occurred in August and September months (53 & 13 adults) in the two regions, respectively.

Syrphids:

Data in Tables 60-65 indicate that the number of ***Syrphids*** during the seasons 1997, 1998 and 1999 at Moshtohor and Beni-Suef was 22, 1 and 39 and 25, 49 and 17 individuals, respectively. These total counts of syrphid adults represented 4.3, 0.97 and 2.12% and 2.9, 6.99 and 1.98% of the total counts of all predators collected on treated cotton fields (Table 55-60). These data indicate that using conventional insecticides against cotton pests resulted in fewer numbers of syrphid predator adults.

II- Order: Hemiptera:

***Orius* spp.:**

Two species belonging to genus the ***Orius***, namely ***albidipennis*** and ***laevigatus*** are known as the most common predators belonging to this genus in cotton and corn plantations in Egypt.

As shown in Tables 49-54, individuals of ***Orius* spp.** were detected amongst most other collected samples of predator insects in untreated fields. The total counts of ***Orius*** (***albidipennis*** and ***laevigatus***) in Moshtohor and Beni-Suef region throughout the seasons 1997, 1998 and 1999 seasons, was (474, 73 and 320 of ***O. albidipennis*** and 286, 81 and 130 of ***O. lavigatus*** in Moshtohor while in Beni-Suef ***O. albidipennis*** counts were 677, 227 and 239 during 1997, 1998 and 1999, respectively ***O. laevigatus*** counts were 209, 78 and 117 in the respective seasons. These data indicate that ***Orius*** (***albidipennis*** and ***laevigatus***) occupied (25.31, 20.64 and 16.6% and 48.57, 30.35 and 17.4% of total counts of all predators, respectively. Data indicate also that ***Orius*** (***albidipennis*** and ***laevigatus***) were the second abundant predaceous species after family Coccinellidae.

On the other hand, the total counts of ***Orius*** (***albidipennis*** and ***laevigatus***) on cotton plants that recived the conventional sprays were 116, 223 and 277 ***O. albidipennis*** and 83, 98 and 277 adult ***O. laevigatus*** in Moshtohor region, while in Beni-Suef region, 142, 147 and 156 ***O. albidipennis*** and 156, 87 and 92 ***O. laevigatus*** (Tables 55-60), which reprecented 22.8, 28.26 and 9.77 % ***O. albidipennis*** and 16.3, 12.42 and 15.05% ***O. laevigatus***, of the total counts of all

predators, at the three seasons in Moshtohor, while in Beni-Suef this predator represent 16.8, 20.9 and 18.2 ***O. albidipennis*** and 18.5, 12.4 and 10.7 of ***O. laevigatus*** of the total counted predators throughout the respective seasons.

The present result to agree with those of **Habib *et al.* (1976)** who concluded that the predaceous insect, ***Orius* spp.** were susceptible to treatment of cotton pests by conventional insecticidal programs.

Concerning the weekly counts of ***Orius albidipennis*** and ***laevigatus*** individuals in Moshtohor region, throughout the cotton season 1997, it is clear from (Tables 54), that on the untreated cotton plants, the first peak for both species estimated by (49 and 30 adults / 100 double strokes) on May 25th, the seconed peak estimated by (49 for ***O. albidipennis***) on June 22nd, also, 3rd and 4th peaks appeared during the same season estimated by (38, 31 adult / 100 double strokes) on July 21st and September 19th. The lowest number counted during August and October in both predators and very low adults were counted in July in case of ***O. albidipennis*** (Table 54).

During 1998 season in Moshtohor, no ***Oruis*** were counted during May. The highest number counted of ***O. albidipennis*** were 13 adults/100 double strokes on June 30th, while in case of ***O. laevigatus*** three peaks estimated by (9, 8 and 11) adults / 100 double strokes) on June 30th, August 6th and September 4th and 11th, respectively (Table 55).

1999 season, three peaks estimated by (20, 27 and 29) adult ***O. albidipennis*** / 100 double strokes on June 14th, July 6th and September 3rd, respectively, while, in case of

O. laevigatus, two peaks appeared on 2nd week of June and 3rd week of September (17 and 15 adults / 100 double strokes) (Table 56).

In Beni-Suef region, the weekly counts of ***Orius albidipennis*** and ***laevigatus*** individuals throughout the cotton season, indicate that in the untreated cotton plants, this predator began to appear from May 24th during 1997 and 1998 seasons, but in 1999, began to appear from May 30th (Table 52). During 1997 season, the two predators ***Orius albidipennis*** and ***O. laevigatus*** had two and three peaks on June 9th, July 14th and September 1st and August 11th and September 1st (29, 33 and 101 adults ***albidipennis***/100 double strokes and 27 and 35 adult ***O. lavigatus***/100 double strokes (Table 56).

In 1998 season, also three peaks and two peaks recorded in ***Orius albidipennis*** and ***O. laevigatus*** the peaks of abundance which were counted as 25, 21 and 21 adult and 18 and 17 adults / 100 double strokes on the June 8th, July 20th and September 17th and June 8th and September 17th, respectively, (Table 58).

In 1999, three peaks (21, 13 and 31 adults ***O. albidipennis***) and (9, 15 and 20 adults ***O. laevigatus*** / 100 double strokes) occurred on the June 6th, July 5th and July 26th and June 6th, July 5th and August 4th, respectively (Table 59). The remaining weeks of the season showed variations in the counted numbers of ***Orius*** **spp.** on untreated cotton plants. Compared with the previous predaceous insect species, the highest abundance of both ***Orius*** species were counted during June and July.

In Moshtohor, as for the weekly counts of ***Orius*** on cotton plants that received the conventional insecticidal spraying, data in Table (60) indicated that of counts these predators of 15 and 11 adults of ***O. albidipennis*** and 13 and 8 adults ***O. laevigatus*** on the 3rd and 2nd week of both June and August and 4th and 1st week of June and September, respectively. On the other hand, the numbers of the two predators were very low throughout the whole season.

While, in 1998 season, four peaks of 11, 23, 17 and 11 adults of ***O. albidipennis*** and 7, 11, 11 and 11 adult of ***O. laevigatus*** on the 4th week of June, July and August and 1st week of October and 2nd week of June, August, September and October, respectively (Table 61). Also, 4 peaks appeared during 1999 season in Moshtohor region of both (***Orius albidipennis*** and ***laevigatus***) estimated as 15, 13; 18, 17; 15, 21 and 22, 30 adults / 100 double strokes on the 2nd week of June, 1st week of July, 3rd week of August and 2nd week of September, respectively (Table 62).

In Beni-Suif region, three peakes appeard during 1997 estimated as 21, 9 and 27 adult / 100 double strokes of ***O. albidipennis*** on 4th, 1st and 2nd week of June, August and September, respectively, no ***Orius*** individuals were counted in May while it disappeared from 2nd until 4th week of August. While in ***Orius laevigatus,*** three peaks appeared during 1st week of July and August and 3rd week of September were 19,13 and 13 adult/100 double strokes (Table 63).

During 1998 season, two peaks appeared on the 3rd week of June 19 and 11 adult/100 double strokes ***Orius*** (***albidipennis*** and ***laevigatus***) were counted respectively, and

the 2nd peak appeared on the 3rd and 4th week of September (20 and 13 ***Orius*** (***albidipennis*** and ***laevigatus***), respectively (Table 64).

While, in 1999 season, Table (65), three peaks of ***Orius*** (***albidipennis*** and ***laevigatus***), occurred 20, 13 and 15 and 17, 6 and 17 adults/100 double strokes on the 1st week of June, July and 2nd week of September and 1st, 2nd and 3rd week of June, July and September were counted, respectively. On the other hand, the predator appeared in very low numbers during August month.

III- Order: Neuroptera:

***Chrysoperla carnea* (Steph.):**

Total numbers of *C. carnia* adults counted throughout the whole three cotton seasons 1997, 1998 and 1999 in untreated fields in Moshtohor and Beni-Suef regions, were 262, 126 and 104 and 188, 98 and 85 adults on cotton plant, respectively (Tables 54-59).

On cotton plants that received conventional insecticidal treatments, the total counts of *C. carnea* adults were 41, 167 and 73 and 91, 59 and 93 individuals throughout the whole seasons 1997, 1998 and 1999 in Moshtohor and Beni-Suef, respectively.

Percentages of totally collected *C. carnea* adults occupied 9.8, 16.89 and 3.85 % and 10.31, 9.75 and 9.88 % of total numbers of collected predators in the two locations Moshtohor and Beni-Suef and throughout the three seasons 1997, 1998 and 1999 in untreated fields, respectively (Tables 54-59).

On the sprayed areas in 1997, 1998 and 1999 the percentages of totally collected *C. carnea* adult occupied 8.1, 21.17 and 3.96 % and 10.78, 8.4 and 10.8 % of total numbers of collected predators in Moshtohor and Beni-Suef regions, respectively (Tables 60-65) and Fig. (30-35). These results clearly showed that *C. carnea* had the low population density than any of the remaining predators.

Regarding the weekly counts of relative populations of *C. carnea* in cotton field, data in Table (60) and Fig (30) indicated three peaks of the adults population abundance that was estimated by 11, 17 and 31 adults/100 double strokes on 3rd week of May, 2nd week of July 3rd week of August, the few number counted by 1 adult/100 double strokes on 1st week of October of the 1997 season in Moshtohor region.

1988 season, Table (61) and Fig (32) show that four peaks estimated by 18, 12, 10 and 10 adult / 100 double strokes on June 30th, August 27th, September 18th and October 8th. No counted *C. carnea* from 15th May to 10th June and the lowest number were counted from mid-July to mid-August. In 1999 season, two peaks counted by 11 and 17 adults/100 double strokes on mid-June and 1st week of September, then the captured *C. carnea* adults showed a remarkable decrease in population abundance during May (1 adult / month) and from 3rd week of June until 4th week of August.

While in Beni-Suef region, three peaks occurred in two seasons 1997 and 1998 seasons estimated by 25, 15 and 21 and 9, 10 and 11 adults/100 double strokes on 3rd week of June, 1st week of July and 1st week of September and 2nd week

of June, 2nd week of July and September, respectively, Tables (52-53) Fig (33-34).

While in 1999 season, two peaks appeared on 1st and 4th week of July estimated by 5 and 13 adults/100 double strokes (Table 54 & Fig. 35).

In treated fields at Moshtohor Table (55) show low population abundance during all months June, July, August, September and October the predator count by 10, 9, 10, 11 and 1 adults/month and no counted *C. carnea* on May. But, in 1998 season three peaks estimated by 13, 23 and 13 adult/100double strokes on 3rd week of July, August and September, respectively and the lowest number counted occurred during May only 4adult/month (Table 56).

In 1999 season, Table (56) shows no *Chrysopa* adults were counted on May and September, only 11, 11 and 5 adults/month of June, July and August.

As for the population abundance of *C. carnea* on cotton plants in Beni-Suef received the conventional insecticidal spraying, weekly count indicated the same trend of fluctuations in population throughout the period of cotton seasons of 1997 and 1999 in Moshtohor.

In 1997, Beni-Suef region no Chrysopa counts in May but in June, July and August 23, 16 and 2 adults/month but the highest population occurred on September 44 individuals/month (Table 57 & Fig 33). In 1998 season, during May, June, July and August, the number of *C. carnea* estimated by 12, 18, 4 and 4 individuals, respectively Table (58) and Fig (34). Also during 1999, no *C. carnea* on May,

while in June, July, August the number counted by 5, 12 and 26 adults, respectively. In September an increase in the population abundance of this predator occurred on cotton (61 adults were recorded).

Several authors studied the fluctuation in *C. carnea* population throughout the cotton season, their results agree with those found during the present study. **Azab *et al.* (1965)** found that the predator was active in August of which it had two peaks of abundance. **Naguib (198)** showed that *C. carnea* was detected at two peaks during June and July. **Abbas and El-Deeb (1993)** found that the population density of *C. carnea* was high in July then decreased gradually until the end of the season. **Nassef (1995)** reported three peaks of abundance for *C. carnea* during the period from May to October. Also, the same authors indicated that insecticidal application decreased the number of predators in cotton fields.

V- True spider:

Data in the mentioned Tables, clearly, show that the population of true spider was generally higher in direct count than using sweeping net, while in untreated fields numbers was higher than in treated fields, in both location throughout 1997, 1998 and 1999 season.

Tables (54-59) and Figs (30-35) clear that the overall total of true spider in two location Moshtohor and Beni-Suef throughout 1997, 1998 and 1999 seasons were 95, 51 and 163 and 113, 64 and 173 individual on cotton plant, respectively, percentage of totally collected true spider individuals adults

occupied 4.19, 6.84 and 6.04% and 6.2, 6.37 and 12.6 % of total numbers of collected predators in two regions and throughout three seasons, respectively.

On cotton plants that received the conventional insecticidal treatments, the total counts of true spider, represented 8.48, 8.49 and 3.96% and 12.7, 5.8 and 8.96 % of the total number of collected predators in the two regions and throughout 1997, 1998 and 1999 seasons, respectively.

Regarding the weekly counts of relative populations of true spider in untreated cotton fields in Moshtohor region throughout 1997, 1998 and 1999 season, data in Tables (54-56) and Fig (30-32) indicated two peaks of nymphs population abundance that was estimated by 17, 16; 9, 8 and 15, 37 on 4th week of July and August, 1st and 4th week of September and 2nd and 4th week of September, respectively.

Also, two peaks appear in Beni-Suef during the 1997 and 1998 seasons, were 25, 13; 13, 9 on 1st week of July and September and 2nd and 4th week of September and one peak in 1999 season 40 individuals were counted on 3rd week of August (Tables 57-59 & Fig 33-35).

The previously explained results show, clearly, that the population abundance of true spider on cotton plants took nearly the same trend as that explained for the whole predators as true spider number started by nil or very few number in early season while the highest peaks abundance occurred during July, August and September.

Weekly counts of true spider on cotton plants that were sprayed through the conventional program recommended by the Egyptian Ministry of Agriculture throughout 1997, 1998

and 1999 seasons, in Moshtohor region Table (60-62) and Fig (30-32) show that the counted number were generally few ranging from 0.6, 0.11 and 0.13 individuals/100 double strokes, the highest counts that were estimated by 11 & 11 individuals/100 double strokes in 1998 & 1999 seasons on 2nd week of September.

Also, in Beni-Suef region, Table (63-65) and Fig (33-35) clear that the counted number were generally few ranging from 0-13, 0-8 and 0-15 individuals/100 double strokes throughout the three seasons 1997, 1998 and 1999, respectively.

The highest counts that were estimated by 11 and 13 individuals/100 double strokes on 1st and 2nd week of July and August. Eight individuals were on 3rd week of September 1998 and 15 individuals/100 double strokes on 3rd week of September 1999.