Summary

V-SUMMARY

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.. Other experimental studies were bionomics and feeding capacity of some predaceous insect species and storage of some predator adults, at two low temperatures, under different regimes of nutrition were carried out. In addition, field studies were carried out throughout three years (1997, 1998 & 1999) in different Egyptian Governorates to survey host plants, on the cotton bollworms, ***Pectinophora gossypiella*** (Saund.) and ***Earias insulana*** (Boisd.) and also the associated parasitoids and predators. Also, weekly counts of the two bollworms larvae and its predators were taken by direct counting to study the fluctuations in population of different species on cotton throughout three seasons in Moshtohor (Qalubia Governorate) and Sids (Beni-Suef Governorate). The changes in relative population density of predators were also studied throughout 1997, 1998 & 1999 seasons in the two locations (untreated and treated by the conventional insecticides) fields by using the sweeping net strokes on cotton plants.

I- Biological aspects of *Bracon hebetor* and *Dibrachys* sp.:

I.1- *Bracon hebetor*:

In laboratory, at 22, 26 & 30 °C the durations of the egg stage, different larval instars and pupal stage in addition to male and female's longevity were estimated.

The egg stage hatched after 2.5±0.03, 1.17±0.17 & 0.78±0.08 days at 22, 26 & 30°C when reared on ***P. gossypiella*** full-grown larvae. While, by rearing on ***E. insulana*** larvae, the incubation periods were 2.86±0.01, 1.28±0.03 & 0.97±0.1 days, respectively, at the same temperatures.

I.1.1- Duration of larval stage:

The duration of each instar was estimated under the same mentioned conditions (22, 26 & 30°C). The duration in days of the first instar larva, when reared on larvae of ***P. gossypiella*** & ***E. insulana*** was 1.8 ± 0.007, 0.87 ± 0.02 & 0.79±0.008 days and 1.86 ± 0.01, 0.94 ± 0.001 and 0.8±0.006 days, respectively. The second instar larva occupied 1.52 ± 0.004, 0.79 ± 0.001 & 0.065 ± 0.003 days and 1.92 ± 0.07, 0.73 ± 0.005 & 0.63±0.005 days at 22, 26 & 30°C, respectively.

At the same conditions, the third instar larva occupied 1.69 ± 0.001, 0.84 ± 0.006 & 0.49 ± 0.001 days on ***P. gossypiella,*** while on full-grown larvae of ***E. insulana***, this period lasted 1.8 ± 0.007, 0.76 ± 0.003 and 0.53 ± 0.004 days at 22, 26 & 30°C, respectively. The fourth instar larval period elapsed 1.95 ± 0.01, 1.82 ± 0.003 and 1.57 ± 0.006 days at the three temperatures, respectively, by rearing on ***P. gossypiella***.

While, on *E. insulana* this period lasted 2.17±0.09, 1.92±0.006 & 1.67±0.003 days, respectively.

Prepupal stage of ***B. hebetor*** lasted 1.54±0.016, 0.77±0.004 &0.77±0.004 days on ***P. gossypiella*** and 1.5±0.02, 0.95±0.01& 0.78±0.005 days on ***E. insulana*** at 22, 26 & 30°C, respectively.

Durations of pupal stage at 22, 26 & 30°C and ***P. gossypiella*** and *E.* ***insulana*** were 5.9±0.03, 4.87±0.003 & 3.5±0.01 and 7.67±0.1, 4.84±0.16 & 3.58±0.08 days, respectively.

The total developmental period lasted 16.75, 10.79 &8.72 on ***P. gossypiella*** and 19.78, 10.78 and 8.07 days on ***E. insulana*** larvae, respectively.

I-1-2-The relationship between the kinds of food offered to *Bracon hebetor* adults, and different constant temperatures on longevity and fecundity:

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

The preoviposition period was shortened, as the temperature became higher, 1.00, 0.86 & 0.30 days at 30°C when fed on protein + 10 % sucrose, 10 % sucrose and only water, respectively. It was prolonged to reach 0.57±0.11, 2.00±0.13 & 1.44 days at 26°C and to 2.35±0.3, 2.3±0.12 and 2.14±0.3 days at 22°C, respectively.

The oviposition period averaged 10.46±0.44, 8.33±0.22 & 1.00±0.12 days at 30°C; but at 26°C this period became 12.5±0.45, 12.38±0.4 and 1.78±0.17 days, respectively. While at 22°C, this period lasted 17.15±0.7, 12.13±0.93 & 2.93±0.3 days when fed on 10 % sucrose + protein, 10 % sucrose & water, respectively.

The post-oviposition periods elapsed 0.86±0.08, 0.80±0.14 and 0.20±0.02 at 30°C when fed on protein + 10 % sucrose, 10 % sucrose and water, respectively against 1.70±0.13, 2.26±0.12 and 1.57±0.14 days/female at 22°C.

Number of deposited eggs/female:

The mean daily and total number of eggs laid / female were affected by the type of food offered to adult females. The highest daily means in number of eggs / female were recorded with females fed on protein + 10 % sucrose solution, being 18.73 ± 0.64, 15.73 ± 0.85 and 11.46 ± 0.05 eggs / female at 30, 26 and 22°C, respectively. While, the lowest daily mean numbers of eggs / female were 5.30 ± 0.13, 3.68±0.7 & 1.40±0.23 at 22, 26 & 30°C, respectively, when fed on water. The total number of eggs/female has taken the same trend, i.e. the highest total number of eggs was associated with females fed on protein + 10 % sucrose solution (199.9±4.07, 197.13±14.38 & 197.40±12.4, respectively) at 30, 26 & 22°C.

Adult longevity: The longevity of ***B. hebetor*** females averaged 21.0±0.4, 16.75±4.8 & 12.46±0.4 days at 22, 26 & 30C, respectively, when fed on protein + 10 % sucrose solution. But, when females were supplied with water only

this period lasted 5.78±0.23, 4.57±0.13 and 1.30±0.12 days, respectively.

Reproduction potential and life table parameters:

The multiplication per generation (Ro) increased by the increase in temperature from 22, 26 & 30°C. (Ro) values were 0.57, 28.408 & 108.0 at 22°C, while at 26°C, (Ro) values were 0.817, 50.32 & 65.393; and at 30 °C, (Ro) values were .92, 29.79 & 62.36. The mean generation time (T) decreased when temperature was increased, these values were 10.84, 13.84 and 13.61 at 30°C, against 18.46, 21.08 and 21.74 at 22°C when ***Bracon*** adults were fed on water, sugar & protein. The (rm) values were -3.02, 0.158 & 0.215 at 22°C; -1.4, 0.212 & 0.231 at 26°C; while those were –7.29, 0.252 & 0.304 at 30°C when ***Bracon*** adults were fed on water, sugar and protein, respectively.

I.2- *Dibrachys* sp.:

Incubation period of eggs were 3.14 ± 0.03, 1.54 ± 0.001 and 0.71 ± 0.001 days and 3.01 ± 0.001, 1.98 ± 0.01 & 0.73 ± 0.001 at 22, 26 & 30 °C when reared on ***P. gossypiella*** and ***E. insulana***, respectively.

At 22, 26 and 30°C, four larval instars were recorded for the parasitoid ***Dibrachys*** **sp.** on ***P. gossypiella*** and ***E. insulana*** larvae. The first instar larval duration was 2.14 ± 0.01, 1.70 ± 0.01 & 0.67 ± 0.01 and 2.46 ± 0.01, 1.70 ± 0.01 & 0.81 ± 0.002 days. For 2nd instar were 1.95 ± 0.01, 1.64 ± 0.08 & 0.62±0.2 days and 1.87 ± 0.01, 1.57 ± 0.009 & 0.87 ± 0.005 days; while for the 3rd instar was 2.47 ± 0.02, 1.70 ±

0.01 & 0.85 ± 0.004 days and 1.77 ± 0.01, 1.85 ± 0.01 & 0.86 ± 0.02 days and the 4th instar lasted 2.60 ± 0.01, 2.38 ± 0.01 & 1.54 ± 0.01 days and 2.72 ± 0.02, 2.43 ± 0.02 & 1.50 ± 0.008 days, respectively, when all stages were reared on 22, 26 & 30°C and on ***P. gossypiella*** and ***E. insulana*** full-grown larvae, respectively.

Pre-pupal and pupal stages, at 22, 26 & 30 °C and on ***P. gossypiella*** and ***E. insulana*** lasted 2.14 ± 0.07, 1.44 ± 0.014 & 0.73 ± 0.09 days and 1.44 ± 0.001, 1.23 ± 0.01 & 0.74 ± 0.004 days, respectively. While pupal stage taken 80.9 ± 0.06, 6.2 ± 0.05 & 3.40 ± 0.01 days on ***P. gossypiella*** and 7.30 ± 0.19, 5.90 ± 0.15 & 3.50 ± 0.01 days on ***E. insulana***, respectively.

I.2.1-Duration of *Dibrachys* sp. on pupal stage of *E. insulana* and *P. gossypiella*:

No parasitism occurred on ***P. gossypiella*** pupae, while the parasitoid succeeded to deposit on 56 % of the exposed ***E. insulana*** pupae.

In the laboratory, at 26 ± 1°C and 65-70 % R.H., the durations of the egg stage, the four larval instars, pre-pupal and pupal stages were 2.60 ± 0.1, (1.83 ± 0.03, 1.90 ± 0.02, 1.78±0.08 & 2.70 ± 0.04), 1.50 ± 0.74 and 7.976 ± 0.85 days, respectively.

I.2.2- The relationship between the kind of food offered to *Dibrachys* sp. adults, at different constant temperatures and their longevity and fecundity:

The longevity and fecundity of parasitoid, ***Dibrachys*** sp. were estimated under laboratory conditions of 22, 26 & 30°C when adults were nourished by three different kinds of food.

Pre-ovipositional periods of female was prolonged be decreasing temperature, being 2.07 ± 0.06, 2.13 ± 0.08 & 2.00 ± 0.1 days at 22 °C and shortest periods were recorded at 30 °C (0.6 ± 0.12, 0.80 ± 0.1 & 0.26 ± 0.12 days)by feeding on protein + 10 % sucrose, 10 % sucrose and water.

The oviposition period lasted 18.80 ± 0.38, 15.20 ± 0.27 & 3.06 ± 0.25 days at 22°C on three food types, but this period was shortest at 30°C, i.e. 12.46±0.4, 10.60±0.37 & 1.80±0.19 days, on the same previous diets, respectively.

Post-oviposition period followed the same trend, as it was prolonged by decreasing temperature and shortened with increase of temperature.

A mated female deposited the highest total number of eggs (216.6 ± 4.8, 184.0 ± 3.07 and 157 ± 3.7) at 30, 26 and 22°C when females were fed on protein + 10 % sucrose, with a mean daily deposition of 17.548±0.46, 13.25 ± 0.25 & 10.224 ± 0.19 eggs and the lowest number of eggs obtained when adults were fed on water only where it deposited 12.29 ± 2.79; 8.0 ± 1.3 & 6.21 ± 1.28 eggs with a mean daily number of 1.30 ± 0.3, 0.95 ± 0.05 and 0.80 ± 0.21 eggs at 30, 26 and 22 °C, respectively.

The longest periods of ***Dibrachys***, females' longevity were 23.46 ± 0.36, 16.20 ± 0.17 & 13.93 ± 0.44 days at 22, 26 and 30 °C, respectively, when fed on protein + 10 % sucrose, while the shortest periods were 8.30 ± 0.17, 5.43 ± 0.23 & 1.03 ± 0.23 days at 22, 26 & 30 °C, respectively, when fed on water only.

I.2.3- Reproduction potential and life table parameters:

Studies were carried out on the effect of different food types on life table parameters of ***Dibrachys*** sp. at 22, 26 & 30 °C.(Ro) increased by the increased temperature from 22, 26 &30°C. (Ro) values were 0.285 ,49.364 & 71.46 at 22°C, while 0.806 ,45.74 and 95.24 at 30°C when fed on water, sugar and protein + sugar. The mean generation time (T) decreased when temperature was increased, these values were obtained 10.97, 13.937 & 14.25 at 30 while at22°C 24.45, 30.80 and 31.087.

II-Bionomics and feeding capacity of some predaceous insect species:

II.1- *Hippodamia tredecimpunctata* :

In the laboratory, at 26 ± 1°C and 65-70 % R.H., the durations of the egg stage, different larval instars and pupal stage in addition to male and female's longevity were estimated. The 1st, 2nd, 3rd and 4th instar larvae consumed 59.98 ± 1.39, 144.70 ± 2.7, 254.66 ± 12.12 and 602.26 ± 16.78 eggs of ***P. gossypiella*** and 23.62 ± 0.5, 55.90 ± 0.94, 91.40 ± 1.08 & 234.80 ± 3.2 eggs of

E. insulana, respectively, with a total consumption of 1061.20 ± 26.69 (663-1167 eggs) of *P. gossypiella* and 406.0 ± 3.96 eggs of *E. insulana*. An adult male consumed 3171.9 ± 139.91 eggs with a daily mean of 65.4 ± 0.74 eggs of *P. gossypiella* and 1919.9 ± 32.4 *E. insulana* eggs; while the total consumption of *P. gossypiella* & *E. insulana* eggs were 4480.89 ± 76.34 & 2834.6 ± 92.36 eggs, respectively.

A mated female deposited 836.6 ± 18.1 eggs throughout an oviposition period of 15.16 ± 0.07 days when fed on *P. gossypiella*, and 377.85 ± 10.0 eggs when fed on *E. insulana* eggs throughout an oviposition period of 44.15 ± 0.48 days.

II.2- *Coccinella undecimpunctata*:

Durations of the 4 larval instars averaged 2.59, 2.68, 3.86 and 2.73, respectively when reared on *P. gossypiella*, while when reared on *E. insulana* eggs, the durations were 2.84, 3.79, 2.89 & 3.30 at 26°C. During these instars, larvae consumed 41.86 ± 0.9, 117.6 ± 3.3, 344.73 ± 3.9 and 411.64 ± 5.8 eggs of *P. gossypiella*, against 25.10 ± 1.13, 120.79 ± 0.73, 166.94 ± 7.28 and 239.05 ± 6.22 eggs of *E.insulana*. The total consumption during the larval stage was 969.136 ± 7.5 eggs of *P. gossypiella* and 542.68 ± 6.5 eggs of *E. insulana*. An adult male consumed 2548.8 ± 89.7 eggs of PBW, while it consumed with an 1979.7 ± 48.98 eggs of *E. insulana*. The overall daily mean number of consumed eggs of PBW and SBW were 57.4 ± 0.91 and 43.91 ± 1.16 eggs, respectively; while female fed on more amounts of *P. gossypiella* eggs 3134.2 ± 71.2 eggs and 2742.17 ± 155.7

eggs of ***E. insulana***. . The overall daily mean number of consumed eggs of PBW and SBW were 60.20 ± 1.05 & 54.30 ± 0.89 eggs, respectively. Thus indicating higher feeding capacity of females. A mated female deposited 797.05 ± 18.99 eggs throughout an oviposition period 50.16 ± 0.48 days when reared on ***P. gossypiella*** eggs and 519.16 ± 31.25 eggs throughout an oviposition period 41.31 ± 0.68 days when reared on ***E. insulana***.

II.3-Storage of *H. 13-punctata* at two low temperatures under different regimes of nutrition:

The results indicated that:

1- Adults lived longest then fed on type (1) dite; i..e., protein, milk yeast, ascorbic acid, sucrose and water. Female and male lived for 156.05 ± 4.80& 145.90 ± 4.30 days, respectively at 12-14°C and 142.70 ± 7.30& 135 ± 5.80 days, respectively at 8-10°C. on contrary, adults kept, in refrigerator, and fed on type (5) diet (sucrose and water) lived the shortest life-span, being 48.9 ± 4.9 and 45.0 ± 4.8 days at (12-19°C) and 59.25 ± 5.8 and 75.05 ± 6.36 days at (8-10°C) for females and males, respectively.

2- Effect on fecundity of the resultant adults: After a storing period of 3 months, the pre-oviposition period of mated ***H. 13-punctata*** female was 5.78 ± 0.34 days and produced an average total number of 358.43 ± 8.38 eggs throughout an oviposition period 36.07 ± 1.4 days. While, after 5 months, the produced average total number decreased to 167.6 ± 10.09 eggs throughout an oviposition period of 25.17 ± 0.35 days.

3- Also, adults of *C. undecimpunctata*, at type (1), the females lived 150.96±6.41 days and males 140.12±5.4 days at 12-14°C and 124.0±7.97 and 102.4±6.6 days for females and males, respectively, at (8-10°C).

4- Effect of storing for 3 months at 12-14°C on the fecundity and longevity of *C. undecimpunctata*, a single female deposited an average total number of 211.2 ± 7.5 eggs throughout an oviposition period of 25.46 ± 0.4 days with 63.1 % hatching, while the average total number of eggs and % hatching obtained from a single mated female resulted from adults storing for 5 months at 12-14°C was 174.8 ± 7.07 eggs with 45.97 % hatching.

Field studies:

Survey of some host plants, which are attacked by PBW & SBW:

Eight plant species belong to 3 families were surveyed at Moshtohor and Beni-Suef, namely; ***Gossypium barbadense***, ***Hibiscus canabinus***, ***H. sabdariffa***, ***H. trionum***, ***Zanthimum stanmarium***, ***Zea maize*** attaked by ***E. insulana*** and ***Sesamum indicum***, which attached by ***P. gossypiella.*** this plant new first time in the world.

Survey of some bollworm parasitoids :

Ten hymenopterous parasitoids were surveyed on ***Pectinophora gossypiella*** and ***Earias insulana*** namely; ***Parasierola*** sp.on ***P. gossypiella*** (Bethylidae), ***Apanteles*** **sp.** on ***P. gossypiella***, ***Bracon brevicornis***, ***Bracon hebetor*** and ***Chelonus blackburni*** (Braconidae)on ***P. gossypiella*** and

E. insulana pupa, *Brachymeria* sp. (Chalcididae), *Exeristes roborator* (Ichneumonidae), *Dibrachys* sp. *P. gossypiella* and *E. insulana*, *Sphegigaster* sp. *P. gossypiella* for these first time of PBW (Pteromalidae), *Trichogramma evanescens* (Trichogrammatidae) on eggs of *P. gossypiella* and *E. insulana*.

Percentages of parasitism were generally low (maximum percentages 8.6 & 8.3 at Moshtohor and 6.9 & 7.3 at Beni-Suef) on cotton plants in 1998/1999 & 1999/2000, respectively. Among the recorded parasitoids, *B. hebetor* was the most abundant, followed by *B. brevicornis*, then *Dibrachys* sp., while *Sphagigaster* sp. was the least common.

C-Survey of pink and spiny bollworm predators:

Thirty-two predaceous insect species were surveyed throughout the three seasons of study, being 9 coccinellids, one staphylinid, one cecidomyiid, one octhiphilid, two syrphids, four anthocorids, one chrysopid and one dermapteran. Three true spider species were also found and recorded as predators on pink and spiny bollworm.

Percentage of infestation by pink and spiny bollworms to fruiting structures of cotton plants:

These experiments aimed to estimate the effect of PBW and SBW on pin squares, blooms and green bolls during the three successive seasons 1997, 1998 & 1999.

A- In Moshtohor region:

1- Effect on pin squares:

In Moshtohor region, the overall seasonal mean percentages of infested pin squares by both pink bollworm and spiny bollworms at the two fields (untreated and treated by conventional insecticides) were (5.2, 4.27 & 5.4 %) and (3.1, 3.0 & 3.4 %) during 1997, 1998 & 1999 seasons, respectively.

2- Effect on blooms:

The overall seasonal mean of percentages of infestation blooms during three seasons were (5.8, 5.7 & 4.5 %) and (3.6, 3.1 & 2.66 %) in untreated and treated cotton fields, respectively. The highest peak of infestation reached 12 % in June 31st during 1997, 14 % during July 15th during 1998, while in 1999 season this percentage was 11 % in July.

3- Effect on bolls:

The overall mean of percentages during three seasons were (26.86, 33.14 & 27.9 %) in untreated fields and (16.14, 24.8 & 20.0 %) in treated cotton fields.

B- In Beni-Suef region:

1- Effect on pin squares:

The overall seasonal mean percentages of infested pin squares by both species on cotton plants, during the three seasons, 1997, 1998 & 1999 were (4.54, 6.00 & 5.50 %) in untreated fields and (2.58, 2.90 & 2.90 %) in treated fields.

2- Effect on blooms:

The overall percentages of infested blooms by both pest species on cotton plants during the three seasons 1997, 1998 and 1999, were 6.18, 5.6 & 7.5 % and 3.5, 3.6 & 4.3 % in untreated and treated cotton fields, respectively.

3- Effect on bolls:

The overall mean percentages of infestation by both pink and spiny bollworm during the whole season at the two fields (untreated and treated) were 39.14, 34.1 & 37.07 and 15.7, 15.0 & 12.07 %, respectively.

Seasonal abundance and total population of predators:

a- By using direct counting method :

The populations of insect predators were, generally, higher in Moshtohor than Sids throughout 1998 and 1999 cotton seasons. During the 3 seasons, in Moshtohor, the respective total numbers of predators were 2429, 2355 & 2970, while in Beni-Suef, the total numbers of insect predators in cotton were 2085, 3276 & 1883 individuals.

Family Coccinellidae

Eight lady beetle species abundant on cotton plants were found during the three seasons, 1997, 1998& 1999. The final total counts of ladybird betles allover the cotton season were estimated by 814, 939 &1142 individual, in Moshtohor and 969, 933 and 733 individual in Bein-Suef throughout 1997,1998&1999 seasons, respectively.

These counts represented 33.51, 71.19 &40.17% of the total population counts of predators throughout the three seasons, respectively. While in Beni-Suef region thee counts represented 31.41, 65.33 and 28.84% of total population counts of predators.

- Family Staphylinidae :

Adults of ***Paederus alfierii*** were the only staphylinid found on cotton plant in Moshtohor and Beni-Suef regions throughout the 3 successive seasons. The overall total numbers were 173, 96 & 68 individuals in Moshtohor during the 3 seasons, respectively. While in Beni-Suef region, the overall total numbers were 218, 100 & 153 individuals throughout 1997, 1998 & 1999 seasons. These count represented 7.12, 7.27 & 2.39 % in Moshtohor and 7.07, 3.5 & 6.02 % of total predators, respectively.

- Family Anthocoridae :

The average total number of *Orius* spp. 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 & 323 individuals, respectively. This counts represented 19.35, 80.43 & 24.3 % and 31.86, 17.98 & 12.7 % of total predators count, respectively.

- Family Chrysopidae :

Chrysoperla carnea Steph. stages of the predator (eggs, larvae, pupae and adults) were directly counted / 100

plants. The highest total population (522, 288 & 474) individuals at Moshtohor and 583, 180 and 328, these count at Beni-Suef represented by 21.49, 12.23 & 16.67 at Moshtohor and 18.9, 11.28 & 12.9 % of total predators counts at 1997, 1998 & 1999 seasons, respectively.

- Family: Cecidomyiidae:

Phenobremia aphidivora: This predaceous insect was relatively much more abundant during 1997, 1998 seasons (counts 113 & 111 individuals, respectively). But, ***Ph. avidivora*** completely disappeared on cotton plants during 1999 season. While in Beni-Suef, the predator has very low population during 1999 season, the total count during all season was 57 individuals with 2.24 %.

- *Leucopis* sp.:

This predator was absent during 1997, 1998 season in Moshtohor and 1999 in Beni-Suef. The overall total number of ***Leucopis*** sp. Counted larvae larva were 84 individuals represented 2.95 and in Moshtohor and 59, 124 individuals, represented 1.91 and 8.5 % in Beni- Suef during 1997 and 1998 seasons.

- Syrphids:

Fewer numbers of total syrphids (larvae and pupae) were counted on cotton plants in Beni-Suef region than Moshtohor location throughout the three seasons of study. The total numbers of syrphids counted, throughout the three years of study, were 122, 105 & 93, represented 5.02, 4.46 %

of total predators at Moshtohor, while in Beni-Suef, the total numbers of syrphid larvae and pupae of this predator were 79, 86 & 48, respectively) throughout the 1997, 1998 & 1999 seasons, respectively.

- True spiders:

The totalcounts of true spider species on cotton plants at Moshtohor and Beni-Suef during 1997, 1998 & 1999 seasons were 215, 216 & 136 individuals represented 8.85, 9.17 & 4.78% of total predators, in Moshtohor, respectively. In Beni-Suef the total count of true spider 194, 241 & 234 individuals, represented 9.21, 11.28 and 6.29 % of the total predator, respectively.