SUMMARY

The present study was carried out in two plantations of maize (Summer and Nili) cultivated in Moshtohor Fac. of Agric.Res. farm during the two successive years 1995 and 1996. Summer and Nili plantations of 1995 season were sown on June, 3rd and July, 7th and those of 1996 season were sown on June 15 th and July 12 th . The study was aimed to the following aspects:

1- Estimation the rates of damage for the major insect pests attacking maize plants.

2- Estimation of seasonal fluctuations of predaceous insects in maize field in different plantations.

3- Surveying and estimating the rate of parasitism by parasitoids attacking the insect pests under study.

4- Studies on parasitoids on hibernating corn borer larvae infesting corn stalks.

5- Physiological studies on the haemolymph of both active and hibernating healthy of ***S. cretica and O. nubilalis*** and those parasitized by ***Bracon brevicornis.***

The obtained results can be summarized as follows:

I. Rate of damage for some major insect pests attacking maize.

I.1.Rate of infestation caused by *Sesamia cretica* .

Two peaks of damaged plants could be detected in both, 1995 & 1996 Summer and Nili plantations. As for , in the % of infestation for the first and second peaks of damaged plants it were 3.2 & 3.8 % and 7.77 & 4.5 % for Summer plantations of the two years . As for the first Nili plantation it was 4.1 & 1.8 % , while in the subsequent Nili plantation it was 9.6 & 2.4 %. The infestation to maize plants by ***S.cretica*** was generally higher in 1996 than 1995 throughout both Summer and Nili plantations . Maize plants of the Nili maize plantation harboured, generally , higher infestation rate by ***S.cretica*** than the Summer plantation of maize was more infested than the Nili plantation.

I.2. Rate of infestation caused by ***Ostrinia nubilalis***

It could be deduced that in Summer plantation, infestation to maize plants by ***O.nubilalis*** started in August on few numbers of plants. Throughout the subsequent weeks, the rate of infestation increased successively until reached the highest accumulative percentage of infestation at the end of the season (69.54 % on September, 16 th 1995 and 96.5 % on September, 28 th 1996 .

I.3. Rate of damage caused by *Spodoptera littoralis* and *Spodoptera exigua*

In the first Summer plantation , the highest increase in the rate of damage (3.8) occurred in two periods , the first on July, 22 nd while the second was detected on August, 12 th . In 1996 , Summer plantation the highest increase in the rate of damage (1.6) occurred on August, 31 st .

In Nili plantations of both years the highest rates of damage were 5.4 on Sept., 23 th ; and 0.8 % on Sept., 15 th .

I.4. Rate of infestation by aphids :

In Summer plantation 1995, aphids activity started from July, 29 th with rate of infestation 0.9 % to August, 26 th with rate of infestation 10 %. During this period the highest rate of infestation 100 % and the abundance (1883 aphids / plant) occurred on August, 19 th . In Summer plantation 1996, aphid activity started on July, 27 th with 5 % rate of infestation and ended on August, 31 th with 3.18 rate of infestation . The highest rate 100 % occurred on August, 17 th while the highest abundance 1195 aphids / plant was on August, 10 th .

In Nili plantation 1995, aphids activity elapsed the period between August, 26 th to Sep., 16 th. with range rate of infestation 1.36 to 40.91 % with highest abundance 882 aphids / plant occurred on Sept., 2 nd. . While in Nili plantation 1996, there were three slight separated periods of activity , the first elapsed two weeks from August, 11 th to 18 th with 35 & 21 individual aphid / plant . The second were 95.9 to 100 % infestation with 12 & 15 individual aphid / plant on Sept. 1 st to 8 th . The third was on Oct., 13 th to 20 th with 6 to 8 individuals aphid / plant and % infestation 1.4 to 2.4 , respectively.

II. Entomophagous insects :

II.1. Predators :

Eight predaceous species were concerned in this study .

1.1. ***Orius spp.***

The two Summer seasons study indicated that ***Orius. spp*** were nearly of the same trend of occurrence in the two seasons.
Two peaks of the predator abundance of 118 & 98 adults / 50 plants occurred on July, 29 th and August 19 th Summer plantation 1995. and 175 & 115 adults / 50 plants on August, 10 th , 31 st in Summer plantation1996. The total number of counted adults was higher in the latter year (646 adults) than in the former one (585 adults) .

As for the two Nili plantations, the predator was detected throughout a longer period in 1996 than in 1995. Also higher total number of ***Orius spp.*** adults were counted in 1996 (726 adults) than throughout 1995 (636 adults) . Two peaks of the predator abundance each of 100 adults / 50 plants were detected on Sept., 9 th and Oct., 7 th . While 1996 in Nili season, only one high peak of 17 adults / 50 plants were counted on August, 25 th . In the two seasons the existance of ***Orius*** coincidence with egg-masses and young larvae of ***S.cretica & O.nubilalis*** and with ***S.littoralis*** and ***S.exigua.*** and covered all the activity period of ***R.maidis***

1.2. ***Scymnus spp.*** (mainly ***interruptus*** Goeze and ***syriacus*** Mars.)
In Summer plantation 1995, this groups of predators was found highly abundent from July, 22 nd to August, 19 th and 28 adults were counted in the last inspection, seemed to cover the activity period of the aphid ***R.maidis.*** In 1996 Summer plantation, two peaks of abundance were observed. The first was on August, 17 th with 70 adults in coincidence with peak of ***R.maidis*** while the second on Sept., 7 th with 23 adults in absence of ***R.maidis*** .

In Nili plantation 1995, there was one peak of 34 adults on Sept., 23 th . While in 1996 Nili plantation there were three peaks on August, 25 th , Sept., 22 th and Oct., 20 th with 24 , 18 and 24 adults, respectively . In the three peaks of activity ***Scymnus*** were in association with ***R.maidis*** .

1.3. Ladybird beetles.

1.3.a. ***Coccinella undecimpunctata*** L.

In 1995 Summer plantation the predator appeared in high abundance from August, 12 th to September, 2 nd where one peak of 170 individuals was detected on August 19 th. The same trend of the predator activity was observeds in 1996 Summer plantation where the predator showed one peak of 320 individual on August, 17 th .

In 1995 Nili plantation, the predator started to appear from August, 5 th up to October 14 th . Highest abundance of the predator 90 individuals occurred on August, 26 th . In the subsequent Nili season, the peak of predator abundance (274 individuals) was detected on August, 25 th 1996. In the two seasons the predator seemed to be active against egg-masses and young larvae of corn-borers, ***S.littoralis***, ***S.exigua*** and ***R.maidis***.

1.3.b. ***Cydonia vicina*** var. ***nilotica*** Muls .

One peak of the predator abundance of 38 adults / 50 plants was the only detected in the Summer (on August, 19 th) and the Nili (on September, 30 th) season of the first year of study. While, in 1996, the weekly counts throughout the period of both the Summer and Nili plantations were very weak. During the 2 seasons of study the predator seemed to be active against ***R.maidis*** .

1.3.c. ***Cydonia vicina*** var. ***isis*** Muls .

During the first Summer plantation, one peak of abundance (36 individuals) was detected on August, 19 th . While in 1996 Summer plantation the predator showed its highest number (16 individuals) on August, 17 th

In the first Nili maize plantation, the predator showed its peak of abundance (36 individuals) on Sept., 30 th . While in 1996 Nili plantation, the predator showed one peak of 28 individuals on August, 25 th . On all plantations aphids seemed to be the main prey of the predator.

1.3.d. ***Adonia variegata*** Goez.

This predators was only observed in late summer and Nili plantations season 1996. Very few numbers could be detected feeding on corn aphids

1.4. Aphid lions ***Chrysoperla carnea*** (Steph.)

On maize plants of 1995 Summer season highest counts of larvae were detected on August, 2 nd (36 larvae). While in the subsequent Summer season one peak of 33 larvae was detected on August, 17 th . On Nili plantation, one peakof 16 larvae was detected on Sept., 30 th 1995. While in 1996 Nili season, the predator larvae were detected throughout a longer period but in few numbers.

1.5. ***Paederas alffierii*** . Koch

In Summer plantation 1995, adults were detected active during the whole season representing a peak of 52 adults on mid July. In summer plantation 1996, peak of 57 adults appeared on Sept., 7 th. .

In Nili plantation 1995, the predator was observed active from August, 5 th. to the end of the season and reached its highest number 90 adults on Sept., 30 th. . The peak of 46 adults on Sept., 1st Nili plantation 1996 was noticed.

II.2. Parasitoids

II.2.1. Egg parasitoid.

2.1.a. ***Platytelenomus hylas*** Nixon

It is an egg parasitoid on ***S.cretica*** . In both Summer seasons ,throughout the period that extended from August, 19 th up to the end of 1995 season the percentages ofparasitism ranged from 96.1-100 % and throughout the period from August, 24 th to the end of 1996 season, parasitism occurred in 90-100 % of the host eggs. While in the Nili season throughout the periods from August, 11 th to October 6 th 1996 the percentages of parasitism ranged between 21.2 - 100 and 28.6 - 100 % respectively.

2.1.b. ***Trichogramma evanscens*** Westwood

The percentages of parasitism by***T.evanscens*** were estimated in ***O.nubilalis*** eggs infesting maize plants throughout 4 seasons of study. The highest percentages of parasitism reached 55.85 % on Sept., 16 th and 52.94 % on sept., 21 st 1996 . On the Nili seasons, the highest percentages of parasitism were recorded during the first week October 55.94 % 1995 and the end of August (56.8 %) 1996 .

II.2.2. Larval and pupal parasitoids :

2.2.a. Larval and pupal parasitoids of ***S.cretica*** weekly numbers ***S.cretica*** larvae and pupae were collected from host plants during the two successive years 1995 and 1996 . Six parasitoids species are recorded.

1. ***Meteorus rubens*** Nees (Hymenoptera : Braconidae).

It is a gregarious parasite secured from the larvae of ***S.cretica*** and recorded during July in Summer plantation 1995 and 1996 . The rate of parasitism ranged from 1.79 to 3.33 % .

2. ***Meteorus gyrator*** Thunberg (Hymenoptera : Braconidae)

It is a larval solitary endoparasitoid, ***M.gyrator*** was recorded during summer plantation 1995 with rate of parasitism ranged from 2.1 to 3.7 %

3. ***Bracon brevicornis*** Wesm. (Hymenoptera : Braconidae).

B.brevicornis is a gregarious ectoparasitoid recorded in the late of season during Summer plantation 1996, with rate of parasitism ranged from 2.04 to 4 % . While in the two Nili plantations of 1995 and 1996 , the rates of parasitism ranged from 2.86 to 3.33 % and 1.69 to 4.54 % , respectively .

4. ***Apanteles sp***

Apanteles sp is a gregarious endoparasitoid. It was recorded only during Summer plantation 1996 in July with a rate of parasitism ranged from 1.79 to 3.92 % .

5. ***Tachina larvarum*** (L.) (Diptera : Tachinidae)

In Summer plantations 1995 and 1996, the rate of parasitism ranged from 1.49 to 2.7 % and from 1.88 to 2.5 % , respectively . While those of the two Nili plantations it ranged from 2 to 2.5 % and 1.88 to 2.7 %, respectively .

6. ***Conomarium eremita*** Forst (Hymenoptera : Pteromalidae)

C.eremita is a parasitic wasp recorded attacking the pupae of ***S.cretica*** in the early season during Summer plantation of the two years . Overall averages of parasitism were 1.21 % and 2.41 % during 1995 and 1996 respectively .

2.2.b. Larval parasitoid of ***O.nubilalis***

Bracon brevicornis

B.brevicornis was recorded parasitizeing larvae of ***O.nubilalis*** late in the season . In Summer plantation 1995 , the overall percentages of parasitism were 1.2 % and 1.03 % in the Summer plantation, and 1.05 % and 0.88 % in Nili seasons 1995 and 1996 respectively

2.2.c. Egg larval and larval parasitoids of ***S.littoralis*** and ***S.exigua*** :

1- ***Chelonus inanitus*** (L.) (Hymenoptera : Braconidae)

Chelonus inanitus is an egg larval parasite . It was recorded during July , August , September and early October in Summer and Nili plantation Season 1995. The rate of parasitism ranged from 1.32 % on July, 29 th to 8.6 % on Sept., 9 th in Summer plantation 1995 . While in Nili plantation it ranged from 0.61 % on Oct., 14 th to 5.88 % on Sept., 9 th.

2. ***Microplitis rufiventris*** Kok. (Hymenoptera : Braconidae)

M.rufiventris is an internal larval parasite was found attacking both of ***S.litoralis*** and ***S.exigua larvae*** . In Summer plantation 1995 , the percentages parasitism on ***S.litoralis*** larvae ranged from 4.65 % on July 8 th to 17.73 % on August 19 th ,while these percentages on ***S.exigua*** larvae ranged from 4.76 % on July, 15 th to 10.41 % on July 1 st . In Summer plantation 1996, the highest percentages of parasitism on ***S.littoralis*** larvae was 13.33 % on July, 13 th while it was 4 % on ***S.exigua*** on July, 20 th .

In Nili plantation 1995, on ***S.littoralis*** larvae the rate of parasitism ranged from 3.25 % on Oct., 28 th to 11.58 % on July 29 th . In Nili plantation 1996, on ***S.littoralis*** rate of parasitism ranged from 8.33 % on Sept., 22 th to 17.85 % on Sept., 8 th . On the larvae of ***S.exigua*** it was 4.76 % on July, 28 th

Zele nigricornis Walk. (Hymenoptera : Braconidae)

Z.nigricornis is an internal larval parasite . It was found to be attacking both ***S.litoralis*** and ***S.exigua*** larvae . In Summer plantation 1995 , the percentages of ***Z.nigricornis*** parasitism on ***S.litoralis*** larvae ranged from 0.9 % on July 22 th to 2.95 % on August 19 th,while these percentages ranged from 2.94 % on July, 22 th to 4.76 % on July 8 th on ***S.exigua*** larvae. In Summer plantation 1996, rate of parasitism on ***S.littoralis*** larvae ranged from 2.17 % on July, 27 th to 3.03 % on July, 20 th .and from 3.13 % to 4.35 on July 20 & 13 th on ***S.exigua*** larvae.

In Nili plantation 1995, highest percentage of parasitism on ***S.littoralis*** larvae was 1.41 % on August, 19 th . In Nili plantation 1996, highest percentage of parasitism by ***Z.nigricornis*** on ***S.littoralis*** larvae was 4.34 % on Sept., 1 st and 4.76 % on ***S.exigua*** larvae on July, 28 th .

4. ***Apanteles.sp***

Apanteles.sp is a parasitoid recorded also on larvae of ***S.exigua*** in Summer plantation 1996 with a rate of parasitism ranged from 6.25 % on July, 20 th to 0.09 % on July 6 th .

5. ***Meteorus gyrator***

M.gyrator parasitized ***S.exigua*** larvae with a rate of parasitism ranged from 10 % on June, 24 th to 14.71 % on July, 22 th Summer plantation 1995. While in Summer plantation 1996 the rate of parasitism ranged from 5.25 % on July , 27 th to 8.69 % on July , 13 th . In Nili plantations 1995 & 1996 highest rates of parasitism were 11.11 % on August , 5 th and 4.76 % on July 28 th respectively .

6. ***Periboea orbata*** Wied (Diptera : Tachinidae)

P.orbata is an internal larval parasite. It was found to be active during July, August and September . In both of the two Summer plantations 1995 and 1996 the percentages of parasitism were ranged from 0.9 % on July, 22 th to 3.94 % on August 19 th and from 1.88 % on August 3 rd to

3.23 % on August 24 th, respectively . In Nili plantations 1995 and 1996 percentages of parasitism ranged from 0.56 % on Oct., 7 th to 4.39 % on Sept., 2 nd and from 4.16 % on August, 25 th to 5.26 on Sept., 15 th, respectively .

III. Percentages of parasitism by *B.brevicornis* on larvae of *S.cretica* and *O.nubilalis* infesting corn stalks.

The rate of parasitism by ***B.brevicornis*** gradually increased as the date of inspection advanced. On ***S.cretica***,rates of parasitism ranged from 7.41 to 41.66 % and from 4.76 to 40 % during 1995 and 1996 seasons , respectively .

On***O.nubilalis*** rate of parasitism ranged from 1.96 to 30 % and from 2.5 to 37.04 % during 1995 and 1996 season , respectively .

Sex-ratio of ***B.brevicornis*** :

Sex-ratio of ***B.brevicornis*** could be detected by collected parasitized larvae of ***O.nubilalis*** and ***S.cretica*** during the two successive years 1995 & 1996. The emerged parasite adults were obtained and differentiated into females and males . indicating a sex ratio of 1 female : 1.05 male and 1 : 1.09 in case of ***O.nubilalis*** during 1995 and 1996 respectively . While in case of ***S.cretica*** a sex-ratio of 1 : 0.95 and 1 : 0.96 were obtained during the two years respectively.

IV. Physiological studies on the haemolymph of both active and hibernating heathy 6 th instar *S.cretica* and *O.nubilalis* larvae and those parasitized by *B.brevicornis* :

IV.1. Determination of total haemocyte counts (THC_s).

After parasitization by the 2 nd instar of the braconid ectoparasitoid ***Bracon brevicornis*** for both ***S.cretica*** and ***O.nubilalis*** larvae, a decrease in the total haemocyte counts appeared as compared to those of unparasitized ones during the active and diapausing period. Also a reduction in the total haemocyte counts was observed during the diapausing period probably reflected the very low metabolic activity in their physiological state.

IV.2. Types of haemocytes

On basis of light microscopy inspections, eight types of haemocytes could be morphologically differentiated in the haemolymph of both ***S.cretica*** and ***O.nubilalis***. The identified haemocyte types were prohaemocytes, phagocytic cells (plasmatocytes, granular and spindle cells) adipohaemocytes, oenocytoids cells, spherule cells and cystocyte cells. Drawing and descriptions of the haemocytes are given.

IV.3. Differential haemocyte counts (DHCs) :

IV.3.a. Qualitative analysis :

The sixth instar larvae of ***S.cretica*** and ***O.nubilalis*** just after moulting were exposed to the females of the ectoparasite ***B.brevicornis***. Inspection of each of eight haemocyte types took place from host larvae, at the third day of parasitism, where the parasitoid become in their 2 nd instar. The haemolymph inspections included the dimensions of cells and nuclei from each type (length and width) in unparasitized larvae as well as parasitized ones of the same age during the active and diapausing period. The nucleus cell ratio was also estimated in each case. Drawings of each

The nucleus cell ratio was also estimated in each case. Drawings of each haemocyte type are given for the unparasitized and parasitized larvae during the two periods.

Parasitism resulted in the appearance of abnormalities in all types of haemocytes, as irregularity and elongation of cell wall with twisting it ends of spindle cells. The cytoplasm of cells was badly and faintly stained. During the hibernating period, the spherule cells of parasitized ***S.cretica*** larvae disappeared from the haemolymph. Also, the cystocyte cells of unparasitized ***O.nubilalis*** larvae were disapeared.

IV.3.b. Quantitative analysis of haemocytes :

The phagocytic cell (plasmacytes, granular and spindle cells) in parasitized larvae increased as compared to those of unparasitized ones of the same ages while the prohaemocytes of parasitized larvae become reduced in numbers as compared to those of unparasitized larvae during the active and diapausing period. The reduction in prohaemocytes is supposed to be due to prohaemocytes transformation into phagocytic cells, which are responsible for defence against invading organisms emphasizes their function against the parasitoid. The spherulocytes and oenocytoids decreased in parasitized larvae than in the unparasitized ones.

More, a decrease in numbers of all cell types was detected except the adipohaemocytes which increased during the period of hibernation. This probably correlated with the various physiological states of hibernation development.