J. Plant Prot. and Path., Mansoura Univ., Vol. 2 (2): 153 - 167, 2011

EFFECT OF SOME INTERCROPPING SYSTEMS AND POTASSIUM FERTILIZATION RATE FOR MAIZE WITH COWPEA CROPS ON THE POPULATION DENSITY OF CERTAIN PESTS AND THEIR NATURAL ENEMIES IN SHRAKIA GOVERNORATE, EGYPT.

Abd-Elsamed, A.A.; M.S. Hashem and A.A.A. Salah
Plant Protection Res. Institute, Agric. Res. Center, Dokki , Giza , Egypt.

ABSTRACT

This study was conducted to evaluate the effect of intercropping and potassium fertilization for maize with cowpea plants on the population density levels of some piercing –sucking insects at Diarb Negm distract in Sharkia Governorate during 2009 and 2010 seasons. The obtained results showed that intercropping system (3:3) maize with cowpea decreased *Rhopalosiphum maidis* (Fitch)*, Rhopalosiphum padi*(L .) *, Aphis gossypii* (Glover)*, Empoasca decedens* (Paoli), *Empoasca decipiens*(Paoli) , *Cicadulina chinai* (Ghauri) and whitefly *Bemisia tabaci* **(**Genn**.)**. Whereas, increased average numbers of planthopper *Sogatella vibix* (Haupt) and *Sogatella furcifera* (Horv.) in both seasons . The results indicate that increased of yield in the solid system but insignificantly with intercropping system (3:3). Data presented clearly that rate of 100 kg of potassium fertilization / fed. gave increased of yield maize with cowpea plants and decreased infestation of sap-sucking insects in both seasons. *Lysiphlebus fabarum* (Marshall) was the singe primary parasitoid species emerged from *Aphis craccivora* (Koch.) mummies Also, *Diaeretiella rapae* (M' Intosh) was the primary parasitoid emerged from *R. maidis* mummies and *Praon* sp. was the primary parasitoid emerged from *R. padi* mummies. The mean percentage of parasitoid were 5.52 ± 2.02 and 4.33 ± 1.58 in (*L. fabarum*), 1.21 ± 0.43 and 1.71 ± 0.46 (*D. rapae*) and it were 1.38 ± 0.53 and 1.11 ± 0.35 (*Praon* sp.) in both seasons respectively. Five predators were associated with these insects on cowpea crop. These predators were *Coccinella undecimpunctata* (L.), *Cydonia vicina isis, Cy. vicina nilotica, Metasyrphus corolla* (F.) and *Chrysoperla carnae* (Steph). Meanwhile three predators were associated with these insects on maize crop. These predators were *C. undecimpunctata, M. corolla* (F.) and *C. carnae*.
Keywords: Aphid, leafhoppers, Aphid parasitoids, Predators.

INTRODUCTION

Intercropping is considered one of the safe and effective control agents which is successfully used in IPM program of cotton pests (Rao and Reedy, 1999). Companion cropping, which increases crop diversity, modifies the insects habitat interferes with the insects identification of, and responses to, its host plant (Tahvanainen and Root, 1972). Modifications that lead to the reduction of population of a pest have been referred to as cultural control (Root, 1973). Many farmers in the tropics practice companion cropping involving a few to several crops (Okigbo and Greenland, 1976). Cowpea is mostly intercropping with maize, soybean, millet and cassava. Studies on the effect of companion cropping on insect pests have been conducted in systems involving cowpea – maize, cowpea – sorghum and cowpea Cassava, association (Singh and Rachie, 1985). The population of *Empoasca*

dolichi, Sericothrips occipitalis and *callosobruchus maculates* as well as flower thrips were reduced in cowpea – maize intercropping (Perfect *et al.*, 1978; Matteson, 1982; Ezuech and Taylor, 1984. Rosseto *et al.,* 1997) found that the fertilization (NPK) increased the numbers of aphid on cotton while aphid numbers decreased in absence of fertilizers and phosphorus. Application of potassium increased of population of *T. urticae,* which was reduced in the presence of hen manure. Watson *et al.,* (1994) studied the effect of three nitrogen fertilizer levels on the development of sweet potato whitefly (*Bemisia tabaci*) population infesting cotton plants and found that the nitrogen level had no effect on its development. This study was conducted to evaluate the effect of different intercropping cowpea with maize on the infestation of pests and investigate the effect of potassium fertilization on the infestation levels of some pests.

MATERIALS AND METHODS

Field experiment was carried out at Dierb- Nigm distract in Sharkia Governorate, Egypt during the two successive growing seasons 2009 and 2010.

1- Intercropping systems.

To investigate the effect of certain agricultural practices on some insect pests and their natural enemies associated with maize and cowpea plants under solid and intercropping system, the experimental design was split plot in all growing season, of maize and cowpea plants. An area of about half fed, was divided into three replicates were used for each treatment. Each subplot consisted of 12 ridges (6 meters length and 60 cm width), in case of solid cultivation, one side of the ridges was planted with maize at 35 cm spaces, while one side of ridges were planted with cowpea at 15 cm spaces, in case of first intercropping system (1:1), the second (3:3) included three ridges of maize: three ridges of cowpea plants respectively. In intercropping maize of 2031 variety (High Tic Company) and cowpea, cream 7 variety were cultivated on the 2nd week of May in both 2009 and 2010 season.

I-Sampling technique

a) Maize plants (*Zea mays* L.)

Aphid (Aphididae: Homopetra)

Weekly, samples consisting of ten leaves and five tissues from different intercropping and solid were taken at randomly from different levels of plants when the aphid found on the plants until harvest. These samples were kept in tightly closed paper bags and then transferred to laboratory for examination on the same day with the aid of a stereomicroscope.

Leafhopper and planthopper (Cicadellidae: Auchenorrhynca, Homoptera).-

Each sample consisted of 100 double strokes by sweep net was taken randomly from both diagonals of the field. The samples were taken weekly to surveyed, counted leafhopper and planthopper insects.

B): Cowpea plants (*Vigna unquiculata* L.)

Aphid and whitefly (Aphididae Aleyrodidae :Homoptera)

Weekly, samples consisting of 25 leaves from different intercropping and solid were taken randomly from plants after four weeks from sowing date until harvest. These samples were kept in tightly closed paper bags and then transferred to laboratory from examination of the same day with the aid of a stereomicroscope. The number of aphids as well whitefly and their predators and parasitoids were counted on two surfaces.

2-Leafhopper (Cicadellidae : Homoptera):-

Each sample consisted of 100 double strokes by sweeping net was taken random from both diagonals.

II) Effect of fertilization

The experimental was divided four treatments, 25, 50,100 kg of potassium sulphate (48% k_2o) fertilization / fed. and control (without potassium fertilization). Normal agricultural practices were applied without pesticides treatments. Samples of leaves were taken weekly as previously mentioned in intercropping. **Costat software program (1990)** was used for data analysis of insect species.

III) Natural enemies:

Survey and estimate of parasitism in the field:

Field studies were carried out during 2009 and 2010 seasons on cowpea and maize. Weekly randomly samples of aphids infested twenty five leave from cowpea crop and ten leaves and five tissues from maize plants. Samples were transported to the laboratory in tight closed plastic bags. All aphid individuals found on leaves/ sample were counted. Aphid were supplied by fresh host leaves and supplied by fresh host leaves and kept in Petri dishes (50 aphids/Petri dish) until formation of mummies. The emerged parasitoids were mounted and identified. Rates of parasitism were estimated according to Farrell and Stufkens (1990).

$$\text{Percentage of parasitism} = \frac{A+B}{A+B+C} \times 100$$

A = Number of mummified aphids counted at the date of inspection

B = number of mummified host appeared during the laboratory rearing.

C= No. of unparasitized aphids.

Samples were taken weekly from solid plot and calculated monthly. Also associated predators with insects were surveyed and counted on cowpea (25 leaves) and maize (ten leaves and five tissues)

RESULTS AND DISCUSSION

1-Effect of intercropping

a) Maize plants:-

1- Aphid species:-

Data in Table (1) showed that the maize plants intercropped with cowpea were infested by three aphid species *R. maidis , R. padi,* and *A. gossypii* the obtained results revealed that solid increased the population

density of *R. maidis* , *R. padi* and *A. gossypii* compared with intercropping. The solid was influenced, the occurrence of aphid species highly significantly in compared with intercropping maize. These results agree with those of Hegab *et al* (1987) and Abd- Elsamed (2006) who found that aphid species *R. maidis , R. padi* and *A. gossypii* in maize field

2-Leafhopper and planthoppers insects:-

The presented data in Table (1) showed that three leafhopper species *E. decedens, E. decipiens* and *C. chinae* were recorded. The solid was influenced, the occurrence of leafhoppers highly significantly in compared with intercropping maize plants. The population density of *E. decedens* was 63.71, 43.82, 37.57and 46.15, 38.08 and 38.61 individuals / sample in both seasons respectively. On the other hand, the population density of *E. decipiens* were 50.79, 40.87 and 38.46 individuals per sample in the first season and 53.14, 48.46 and 45.68 individuals / sample in the second season, mean while population density of *C. chinae* were 43.27, 35.58, 33.66and 36.35, 25.21, 23.79 individuals / sample in both seasons respectively. The average number of *S. vibix* were 36.11, 37.55 and 43.82 individuals / sample in 2009 season and 30.32, 34.96 and 40.74 individuals / sample in 2010 season, while mean numbers of *S. furcifera* were28.52, 30.0, 36.57 and 31.45, 32.22 and 39.66 individuals / sample in both seasons at different intercropping system solid, 1:1 and 3:3 (maize: cowpea), respectively . These findings agree with Hegab (1993) and Hegab – Ola (1997 & 2001)

B) Cowpea plants:-

Aphid:-

Data in Table (2) showed that the cowpea plants intercropping with maize were infested by two aphid species *A. craccivora* and *A. gossypii.* The average numbers of *A craccivora* were 370.14, 361.86, 236.68 individuals / sample in the first season and 214.63, 198.44, 185.81 individuals /sample in the second season respectively. On the other hand the population density of *A. gossypii* were 46.48, 37.03, 27.83 and 31.51, 29.76, 22.20 /sample in both seasons at different intercropping system solid, 1:1 and 3:3 (cowpea : maize) respectively. Similar results were obtained by El – Gindy (2002) and Abd-Elsamed (2006) who found that aphid species *A. craccivora* and *A. gossypii* in leguminous plant species, cowpea, bean, broad bean and pea.

Leafhopper:

Data in Table (2) cleared that three leafhopper species *E. decedens, E. decipiens* and *C. chinae* were found. The intercropping was influenced, the occurrence of leafhoppers, *E. decedens* and *E. decipiens* highly significantly and insignificantly with *C. chinae* compared with solid cowpea plants. In both seasons respectively (Table 2).

The present results agree with those obtained by Ammar and Farrag (1976), Mowafy (1988), El- Sayed (1993) and El- Gindy (2002) who surveyed the aforementioned homopterous insects on leguminous plants.

Whitefly:-

Data in Table (2) cleared that the cowpea intercropping system with maize decreased the population density of whitefly compared with solid the means population density of adult *B. tabaci* were 72.36, 50.60, 34.17 and 35.34, 31.8, 28.72/ sample. while immature stage were 110.85, 99.0, 80.0 and 90.87, 81.17, 73.43/ sample in both seasons at different intercropping system solid, 1:1 and 3:3 (cowpea: maize) respectively. The present result agrees with those obtained by Hammad (1978), El- Gindy (2002) and Hashem (2005).

Mean yield (Kg/plot).

Table (1 and 2) showed that yield maize plants were affected significant by intercropping. Solid system yielded the highest mean of (39.45) and (49.22) Kg/plot in two seasons, respectively. While intercropping (3:3) system (34.21) and (42.79) Kg/plot insignificant with solid system in 2009 and 2010 seasons respectively . The same phenomenon took place with cowpea plant, yield solid system (9.08) and (10.20) Kg /plot insignificant with (3:3) system (8.05) and (9.78) in the first and second season, respectively.

As previously mention intercropping system did play an important role in mean yield of maize and cowpea plants.

2) Effect of fertilization:-

Three level 25, 50, 100 kg / fed. of potassium were applied as soil fertilization and control (without potassium fertilization) to study their effects on the population density of some injurious pests attacking maize and cowpea plants during two successive growing seasons of 2009 and 2010. The obtained results could be discussed as follows:

a) Pests attacking maize intercropping with cowpea plants:

Aphid: Data in Table (3) showed that the effect of potassium fertilizer on the infestation degree of maize plants with maize aphids *R. maidis, R. padi and A. gossypii*) were statistically highly significant in both seasons. The highest averages numbers of 1272.28, 1169.13 and 782.76, 708.25 insects (*R. maidis*) leaf occurred on leaves of maize plants fertilized by F4 (without potassium fertilization) and F3 (25kg of potassium fertilization / fed.) during 2009 and 2010 seasons, respectively. Whereas, the lowest population density of this pest (*R. maidis)* was recorded in F1 (100kg potassium fertilization / fed.) in both seasons (955.99 and 596.26 insects) respectively. While the highest averages numbers of *R*. *padi* were 597.87, 543.29 and 494.97, 456.90 insects/sample occurred on leaves of maize plants fertilized by F4(without potassium fertilization) and F3 (25 kg of potassium fertilization / fed.) during 2009 and 2010 seasons respectively. On the other hand the highest averages numbers of *A. gossypii* were 83.57, 74.4 and 74.93, 68.10 insect/sample occurred on leaves of maize plants fertilized by F4 and F3 during two seasons, respectively.

Leafhopper and Planthopper:-

Data in Table (3) cleared the effect of potassium fertilizer on the infestation degree of maize plants with three leafhopper and two planthopper were statistically highly significant in both seasons. The highest average numbers of leafhopper, *E. decedens, E. decipiens* and *C. chinae* were 45.14, 41.71& 48.75, 44.27 and 42.79, 39.98 insects/sample occurred on leaves

fertilized by F4 and F3 in the first season respectively. But in the second seasons its were 49.12, 44.35& 54.32, 51.51 and 34.26, 31.46 insects/sample occurred on leaves fertilized by F4 and F3 respectively. On the other hand the highest average numbers of Planthopper, *S. vibix* and *S. furcifera* were 43.81, 40.96 & 40.89, 37.24 and 36.96, 33.52 &41.46, 35.54 insect/ sample occurred on leaves fertilized by F4 (without potassium fertilization) and F3 (25kg of potassium fertilization / fed.) during 2009 and 2010 seasons , respectively . On the other hand, intercropping cowpea after 12 weeks from maize planting, significantly reduced insect damage thus determining the best system for intercropping cowpea with maize (Ezuech and Taylor, 1984)

B) Pests attacking cowpea intercropping on maize plants

Aphid insects:

Data Table (4) revealed that effect of potassium fertilizer on infestation degree of cowpea plant with two cowpea aphid *A. craccivora* and *A. gossypii* were statistically highly significant in both seasons. The highest averages numbers of *A. craccivora* and *A. gossypii* 363.50, 346.39& 226.15, 204.96 and 46.52, 39.66 & 34.89, 29.76 insects /sample occurred on leaves of cowpea plants fertilized by F4 (without potassium fertilization) and F3 (25kg potassium fertilization /fed.) during two season 2009 and 2010, respectively.

Leafhopper:

Data Table (4) indicated that the effect of potassium fertilizer on the infestation degree of cowpea plants with three leafhopper *E. decedens, E. decipiens* and *C. chinae* were statistically highly significant in both seasons. The highest averages number of three leafhopper were 14.71, 12.97& 25.92, 19.92 and 6.62, 5.94 insects/sample occurred on fertilized by F4 and F3 in the first season. Meanwhile in the second season it were 12.79, 11.32& 18.46, 15.64 and 7.21, 6.53 insects/sample occurred on fertilized by F4 and F3 respectively.

3) Whitefly:

Data in Table (4) cleared the effect of potassium fertilization on the infestation degree of cowpea was statistically highly significantly in both seasons. The highest averages numbers were 66.20, 57.68 and 36.93, 34.14 insects /sample occurred on fertilized by F4 (without potassium fertilization) and F3 (25kg potassium fertilization / fed.) during the two seasons of study respectively.

The present results revealed that cowpea plants were infested with *A. gossypii and A. craccivora* these pests were recorded on cowpea plants by Mali and Kulthe (1980) and Hassan (2009). However, intercropping of cotton with cowpea significantly influenced the spread of *A. gossypii*, *E. dicipiens* and *B. tabaci.* Suggesting that the presence of cowpea plant with cotton could result in a reduced population build up of these insect (Omar *et al.*(1991) and Omar *et al.*(1994)) However, the high rates of potassium reduced the population density of these pests on cereal, legumes and maize plants. These results are in same line of Hegab (2001), El- Gindy (2006) and El – Gindy *et al*.(2009).

3-4

They mentioned that as the increase of potassium fertilization the population density of many homopterous pests decreased. Similar conclusion was obtain by the same authors, they found that potassium fertilization increased the thickness of epidermal leaves and suppressed the infestation of several piercing and piercing sucking insect pests on cereal, legumes and maize plants

Mean yield (Kg/plot).

As clearly shown from the results in Table (3 and 4), the yield of maize plants treated with the different tested treatments was highly significant as flounced by fertilization treatments. The highest yield of (46.36 and 58.03) Kg/plot was recorded with F1 (100 kg potassium fertilization /fed.) whereas, the lowest yield of (16.56 and 20.49) Kg/plot was recorded with F4 (control) in the first and second seasons, respectively.

The same phenomenon took place with cowpea plants Table (4) data show that mean yield in both seasons increased with increasing the rat of the used fertilization the highest yield of (10.70 and 13.02) Kg/plot was recorded with F1 whereas, the lowest yield of (5.96 and 6.67) Kg/plot was recorded with F4 (control).

III) Natural enemies:

III.1- Cowpea:

III.1.A. Aphid parasitoids

Weekly counts of aphid (*A. craccivora*) on cowpea leaves during 2009 and 2010 seasons are given in (Table 5).

Table (5): Monthly mean percentage of parasitism *A. craccivora* by *Lysiphlebus fabarum* on cowpea plants during the two successive seasons 2009 – 2010.

seasons	Sampling dates	No. of examined aphid	No. of parasitized			C.	Parasitism%
			A	B	total		
2009	July	850	3	7	10	840	1.18
	August	626	16	12	28	598	4.47
	Sep.	660	28	44	72	588	10.91
Mean		712±49.27	15.66	21	36.66	675.34	5.52±2.02
2010	June	993	0	0	0	993	0
	July	602	5	8	13	589	2.16
	August	450	10	15	25	425	5.56
	Sep.	593	24	33	57	536	9.61
Mean		659.5±87.92	9.75	14	23.75	635.75	4.33±1.58

During the first season (2009), the infestation started during the 4th of July with (1038 individuals / sample) mean while, the infestation started to appear during the 1st week of July with (993 individuals/ 25 leaves) in 2010 season. *Lysiphlebus fabarum* was the single primary parasitoid species emerged from *A. craccivora* mummies. Percentage of parasitism ranged between 2.35 – 12.08 and 2.27 – 10.14 % in 2009 and 2010 seasons respectively. The highest percentage of parasitism was 12.08 and 10.14% in the both seasons respectively. Also the mean percentage of parasitism were

5.52 ± 2.02and 4.33 ±1.58 in the two seasons respectively. Selim *et al.* (1987) and Abdel- Samad (1996) recorded *L. fabarum* as a parasitoid on *A. craccivora* in Egypt. Ragab(1996) and Abdel- Samad (1996) recorded *T. angelicae* (Hal.) as parasitoid of *A. craccivora.* This latter parasitoid *T. angelicae* was not recorded on the same aphid species during the present study. The present results agree with those of Abdel – Samad (1996) and Ragab *et al.* (2002) who mentioned that *D. rapae, L. fabarum* and *Ephedrus sp.* as a parasitoids of *A. craccivora*. However Abdel- Samad (1996) in Egypt reported that the rate of parasitism varied between 15.4 and 22.0 in March on the some aphid species. Also Ragab *et al.* (2002) in Egypt showed that the highest total percentage of parasitism was 15.14% in February in the first season (1998), meanwhile, it was 17.40% in January in the second season (1999).

III.1.B. Predators

Results in Table (8) showed that the predator species found on cowpea plants 2009 and 2010 seasons, respectively. Six beneficial insects, these species are belonging to orders: Coleopteran, Diptera , Neuroptera and Hymenoptera. The total numbers and ratio of these species were *C. undecimpunctata* (78 individual = 16.88% and 92 individuals= 23.96), *Cy. vicinia isis* (33 individuals = 7.14% and 22 individuals = 5.73%), *Cy. vicinia nilotica* (19 individuals = 4.11% and 14 individuals = 3.65%), *M. corollae* (15 individuals = 3.25% and 11 individuals = 2.86%), *C. carnea* (17 individuals = 3.68% and 12 individuals = 3.13%) and (300 individuals = 64.94% and 233 individuals = 60.68%) in both seasons respectively .However, Mohamed (1996) mentioned that beneficial insects in sweet pea, the dominant beneficial species were, *C. undecimpuntata, Cy. Vicina isis, S. syriacus, Cy. Vicinia nilotica* and *M. corollae.*

III.2. Maize:-

III.2.A. Aphid parasitoids:

Two aphid species, *R. maidis* and *R. padi* were surveyed on maize plants during 2009 and 2010 seasons. The weekly counts of the two aphid species were given in (Table 6&7). During the first season(2009), the infestation started to appear from the beginning of the 1st week of July with (601 individuals/sample) *R. maidis* and (280 individauls /sample)*R. padi,* while it appeared during the 4th of June with (592 individual/ sample) *R. maidis* and 256 individual/ sample) *R. padi,* in 2010 season. *D. rapae* was the primary parasitoid emerged from *R. maidis* mummies and *Praon* sp. was the primary parasitoid emerged from *R. padi* mummies. Percentage of parasitism ranged between 0.75 to 3.00% and 0.84 to 3.49% for *D. rapae* on *R. midis* in both seasons 2009 and 2010. Mean while the percentage parasitism of *Praon sp.* on *R. padi* ranged between 0.80 to 3.45% and 0.79 to 2.44% in both seasons respectively. The mean percentage of parasitism were 1.21 ± 0.47 and 1.71 ± 0.46 (*D. rapae*) and it were 1.38 ± 0.53 and 1.11 ± 0.35 (*Praon sp.*) in both seasons, respectively. However, AL Hag *et al,* (1996) recorded that *D. rapae* as an important parasitoid of *R. maidis* on wheat and barley fields in Saudi Arabia. Meanwhile, Giustina *et al.,*(1982) concluded that the main parasitoids of *R. padi* on maize plant were *Aphidius sp. Praon sp.,* and *Aphelius sp.* On the other hand, *D. rapae* is an important

primary parasitoid of a wide range of aphid species in the world and Egypt, *Brevicoryne brassicae, Myzus persicae, Diuraphis noxia, A. gossypii, A. craccivora, R. padi, R. maidis* and *A. nerii* (Saleh 2004 and Vazet *et al.,*2004).

Table (6): Monthly mean percentage of parasitism *R. maidis* by *D. rapae* on maize plants during the two successive seasons 2009 – 2010.

seasons	Sampling dates	No. of examined aphid	No. of parasitized			C.	Parasitism%
			A	B	total		
2009	July	558	0	0	0	558	0
	August	375	2	3	5	370	1.33
	Sep.	391	3	6	9	382	2.30
Mean		441.33±41.37	1.66	3	4.66	436.67	1.21±0.47
2010	June	521	0	0	0	521	0
	July	482	3	5	8	474	1.66
	August	498	5	8	13	485	2.61
	Sep.	429	4	7	11	418	2.56
Mean		482.5±14.75	3	5	8	474.5	1.71±0.46

Table (7): Monthly mean percentage of parasitism *R. padi* by *Praon sp.* on maize plants during the two successive seasons 2009 – 2010.

seasons	Sampling dates	No. of examined aphid	No. of parasitized			C.	Parasitism%
			A	B	total		
2009	July	274	0	0	0	274	0
	August	257	1	3	4	253	1.56
	Sep.	231	2	4	6	225	2.59
Mean		254±9.67	1	2.33	3.33	250.66	1.38±0.53
2010	June	252	0	0	0	252	0
	July	263	0	2	2	261	0.76
	August	283	2	4	6	277	2.12
	Sep.	255	2	2	4	251	1.57
Mean		263.25±5.27	1	2.0	3	260.25	1.11±0.35

III.2.B. Predators:

Date in Table (9) illustrated the predator species on maize plants 2009 and 2010 seasons, these species were belonging orders Coleoptera, Diptera, Neuroptera and Hymenoptera. The total numbers and ratio of these species were *C. undecimpunctata* (15 individuals = 12.82% and 18 individuals = 12.08%), *M. corollae* (13 individuals = 11.11% and 17 individuals = 11.41%), *C. carnea* (15 individuals = 12.82% and 19 individuals = 12.75%), True spiders (19 individuals = 16.24% and 24 individuals = 16.11%), *D. rapae* (35 individuals = 29.92% and 55 individuals = 36.91%) and *Praon sp.* (20 individuals = 17.09% and 16 individuals = 10.74%) in two season respectively .However, Darwish and ali (1991) reported that predators comprised about 88% of the total natural enemies recorded in maize fields in

upper Egypt. On the other hand Shoeb *et al.,*(2008) mentioned that predators migrated from Egyptian clover field into adjacent maize field; particularly *C. undecimpunctata* and *S. interruptus* followed by *C. carnea, Orius spp., P. alferii* and true spiders.

Table (8): Number of beneficial insect species and their percentages to the total catch on cowpea crop during the two seasons of study.

Years Species	2009		2010	
	Total number of insect species	% to the total numbers	Total number of insect species	% to the total numbers
A: Coleoptera				
C. undecimpunctata	78	16.88	92	23.96
Cy. vicina isis	33	7.14	22	5.73
Cy. vicina nilotica	19	4.11	14	3.65
B: Diptera				
M. corollae (F.)	15	3.25	11	2.86
C: Hymenoptera				
L. fabrum	300	64.94	233	60.68
D: Neuroptera				
C. carnea	17	3.68	12	3.13
Total	462	100	384	100

Table (9): Number of beneficial insect species and their percentages to the total catch on maize plants during the two seasons of study.

Years Species	2009		2010	
	Total number of insect species	% to the total numbers	Total number of insect species	% to the total numbers
A: Coleoptera				
C. undecimpunctata	15	12.82	18	12.08
B: Diptera				
M. corollae (F.)	13	11.11	17	11.41
D: Neuroptera				
C. carnea	15	12.82	19	12.75
D:				
E; True spiders	19	16.24	24	16.11
C: Hymenoptera				
D. rapae	35	29.92	55	36.91
Praon sp.	20	17.09	16	10.74
Total	117	100	149	100

REFERENCES

Abdel- Samad, S. S. M. (1996) Studies on natural enemies of certain insects attacking leguminous crops. M.S.C. Thesis, Faculty of Agriculture, Ain Shams Univ., 94pp.

Abd - Elsamed, A.A. (2006) Studies on some homopterous insect vectors of plant diseases .Ph.D. Thesis, Fac. Agric. Zagazig Univ. Egypt. 387 pp

AL-Hag, E.; A.A. AL- Rokaibah and A.A. Zaitoon (1996): Natural enemies of cereal aphids in sprinkler – irrigated wheat in central Saudi Arabia Bulletin of the Fac. of Agric., Cairo university 47:649 – 633.

Ammar, E.D. and S.M. Farrag (1976) Preliminary survey and relative abundance of leafhoppers and planthoppers at Giza using modified light trap. Bull. Soc. Ent. Egypt 60 : 297 - 303.

Costat, S. (1990) Microcomputer program analysis, version 4-20 Cohort Software,Berkly CA,USA.

Darwish, Y.A. and A.M. Ali (1991) Field population trends of cereal aphids and their natural enemies on corn plants in Upper Egypt. Assiut J. Agric. Sci., 22(2): 33 – 42.

El- Gindy, M.A. (2002) Studies on certain homopterous insect vectors of plant pathogenic diseases Ph. D. Thesis, Fac. Of Agric., Zagazig Univ. 274pp.

El- Gindy, M.A. (2006) susceptibility of three maize cultivars to leafhopper infestation and effect of potassium fertilization on leafhoppers. Egypt. J. of Appl. Sci., 21(10a): 302 – 314.

El- Gindy, M. A.; R.M. El- Refaey and E.E. Hatab (2009) Abundance of some potato homopterous pests as affects by potassium fertilization level. Egypt. Acad. J. Biology Sc., 2(2): 179 – 185.

El-Sayed, A. M. (1993) Insect pests and their associated natural enemies on cowpea *(Vigna unguiculata* L.) plants. Zagazig J. Agric. Res. 20 : (3) 1175-1183.

Ezuech, M.F. and A. T. Taylor (1984) Effect of time of intercropping with maize on cowpea susceptibility to three major pests. Trop. Agric. (Trinidad) Vol. 61: 47 – 57.

Farrell, J.A. and M.W. Stufkens (1990) The impact of *Aphidius rhopalosiphi* (*Metopolophium dirhodum*) (Homoptera: Aphididae) on cereals in Cankrbury, Newzeland Bull. Ent. Res., 80 : 377 – 383.

Giustina, W.; P. Deriu and P. Foessel (1982) Role of specific natural enemies in the control of maize aphid populations in the Paris area Preliminary results. Bulletin Srop., 10(1): 12 – 22.

Hammad, S.M. (1978) Pests of grain legumes and their control in Egypt. Pests of grain legumes Ecological and control. P. 453

Hashem, M.S. (2005) Studies on certain piercing – sucking insects infesting some vegetable crops. Ph.D.Thesis, Fac. Agric. Moshtohr, Zagazige Univ.

Hassan, S. (2009): Effect of variety and intercropping on two major cowpea (*Vigna unguiculata*(L.) Walip) field pests in Mubi, Adamawa State, Nigeria. J. of Horticulture and Forestry Vol.1(2): 14 – 16.

Hegab , A.M.; I. M. kelany and M. M.,El - Maghraby (1987) Survey of leafhoppers and planthoppers infesting maize plants by using three techniques in newly reclaimed sandy areas at Salhia distric , Egypt. Minia, J. Agric. Rec. & Dev. 9(2):945- 953.

Hegab-Ola, I.M.S. (1997) Studies on certain homopterous insects vector of plant pathogenic diseases. M. Sc. Thesis, Fac. Agric. Zagazig Univ.

Hegab-Ola, I.M.S.(2001) Studies on certain insect vectors of plant pathogenic agents. Ph.D. of Science. Fac. Agric. Zagazig Univ.

Hegab, S.A.S. (1993): Studies on certain pest infesting some cruciferous plant. M. Sc. Thesis, Fac. Agric. Zagazig Univ.

Mali, V.R. and K.S. Kulthe (1980) A seed borne potyvirus causing mosaic of cowpea in India. Plant Disease 64: 925 – 928.

Matteson, P.C. (1982) The effects of intercropping with cereal and minimal Permethrin application on insect pests of cowpea and their natural enemies in Nigeria. Tropical Pest Management 28:373-380.

Mohammed, N.E. (1996) Studies on using certain native predators in the control of certain insect pests. M. Sci. Thesis, Fac. of Agric. Mansoura Univ. pp.153.

Mowafy, K.H.A. (1988) Studies on insect pests attacking leguminous field crops in Egypt. Ph. D. Thesis, Fac. of Agric. Moshtohor, Zagazig Univ.

Okigbo, B.N. and D. J. Greenland (1976) Intercropping systems in Tropical Africa American Society of Agronomy. Madison, WI.

Omar, H.I.H.; M.F. Hagdar and A.E.M. El- Sorady (1994): Effect of sowing date of intercropping cowpea with cotton on infestation with some major pests. J. Agric. Rec., 72(3): 691 – 697.

Omar, H. I. H.; A. Hegab; H. A. Awad and A. E. M. El- Sorady (1991) Effect of intercropping of cowpea with cotton plants on infestation with some important insect pests. Alex. Sci. Exch. Vol. 12(4): 701 – 711.

Perfect, T.J.; A.G. Cook and B.R. Critchley (1978) Effects of intercropping on pest incidence in Ibadan, Nigeria IITA. Memo.

Ragab, M.E.; A.M. Abou El- Naga; A.A. Ghanim and A.A. Saleh (2002) Ecological and biological study on certain aphid parasitoids especially those of *Aphis craccivora* Koch. J. Agric, Sci. Mansoura Univ., 27(4): 2611-2620.

Ragab, M.E. (1996) Biology and efficiency of *Trioxys angelicae* Hal. (Hymenoptera: Aphidiidae) anewly recorded parasitoid of *Aphis craccivora* Koch. (Homoptera : Aphidiidae). Egyptian J. of Biol. Control, 6(1): 7- 11.

Rao, M.S. and K.D. Reedy (1999) Non pesticidal approaches in cotton IPM. a review. Agricultural review (Krnal), 20 (3/4):203-219. (c.f. R.A.E., 88 (11):1399).

Root, R.B. (1973) Organization of a plant arthropod association in simple and diverse habitats, the fauna of collards (*Brassica clearces*). Ecological Monographs 43:95-124.

Rosseto, D.; J.L. Florcovski and M.H. Calaflori (1997) Influence of fertilizer on *Tetranychus urticae* and *Aphis gossypii* infestation on cotton plants. Ecossistema, 22:52-58(c.f. R.A.E., 87(5):639).

Saleh, A. A. (2004): Mass production field application of some aphid natural enemies. Ph. D. Thesis, Fac., of Agric., Mansoura Unvi., 161 PP.

Selim, A.A.; S.A. El-Refai and A., El. Gantiry (1987) Saesonal fluctuations in the population of *Aphis craccivora* Koch , *Myzus persicae* (Sulz.) *Aphis gossypii* (Golv.) and their parasites. Ann. Agric. Sci, Ain Shams Univ., 32(3):1837 – 1848.

Shoeb, M.A.; A.A. Attalla and A.H. EL- Heneidy (2008) On the migration of common predatory species from Egyptian clover to adjacent maize field in Egypt. Egyptian J. of Biol. Pest Control, 18(2): 385-389.

Singh S.R. and K.O. Rachie (1985) Cowpea research, Production and Utlilization. Wiley, London, 448 pp.

Tahvanainen, J.O. and R.B. Root (1972) The influence of vegetation diversity on the population ecology of a specialized herbivore, *Phyllotreta crucfera* (Coleoptera: Chrysomelidae). Oecologia (Berlin) 50: 621 – 346.

Vaz, L. A. L.; M. T. Travares and C. Lomonaco (2004) Diversity and size of parasitic Hymenoptera of *Brevicorne brassicae* L. and *Aphis nerii* Boyer de Fonscolombe (Hemiptera : Aphididae) Neotropical Entomol. Voll. 33(2): 225 – 230.

Watson, T.F.; J.C. Silvertooth and A. Tellez (1994) Varietal and nitrogen levels effects on sweet potato whitefly population in cotton. Proceeding of Beltwide Conferences, San Diego, January 5-8, CA, U.S.A.: 868-869.

تأثير بعض نظم التحميل و معدل التسميد البوتاسى لمحصولى الذرة و اللوبيا على الكثافة العددية لبعض الافات و الاعداء الحيوية فى محافظة الشرقية، مصر

عبد الله على عبدالصمد ، مصطفى سعيد هاشم و احمد امين احمد صالح

معهد بحوث وقاية النباتات – مركز البحوث الزراعية – الدقى – الجيزة – مصر

أجريت الدراسة فى منطقة ديرب نجم محافظة الشرقية موسمى ٢٠٠٩- ٢٠١٠ لتقييم تأثير التحميل و معدل التسميد البوتاسى على الكثافة العددية لبعض الافات الثاقبة الماصة للعصارة و اظهرت النتائج ان نظام التحميل الذرة مع اللوبيا ٣:٣ يقلل تعداد انواع المن *Rhopalosiphum maidis* و *Rhopalosiphum padi* و *Aphis gossypii* و *Aphis craccivora* و كذلك الذبابة البيضاء *Bemisia tabaci* و نطاطات الاوراق *Empoasca decedens* , *Empoasca decipiens* بينما تزداد تعداد نطاطات النباتات *Cicadulina chinae* , *Sogatella furcifera* . و اظهرت النتائج زيادة المحصول فى نظام المفرد و لكن غير معنوية مع نظام التحميل ٣:٣ فى كلا الموسمين . و اوضحت النتائج ان معدل التسميد ١٠٠ كجم للفدان اعطى زيادة فى محصولى الذرة و اللوبيا و اقل تعداد للحشرات الثاقبة الماصة للعصارة فى موسمى الدراسة . و اظهرت النتائج وجود طفيل اولى و احد (*Lysiphlebus fabaum*) يتطفل على من لبقوليات *Aphis craccivora* و كذلك الطفيل *Diaeretiella rapae* يتطفل على من الذرة *R. maidis* و الطفيل (*Praon* sp.) يتطفل على من الشوفان *R. padi* و متوسط نسبة التطفل ٥.٥٢ ± ٢.٠٢ & ٤.٣٣ ± ١.٥٨ للطفيل *Lysiphlebus fabaum* و ١.٢١ ± ٠.٤٧ & ١.٧١ ± ٠.٤٦ للطفيل *Diaeretiella rapae* و ١.٣٨ ± ٠.٥٣ & ١.١١ ± ٠.٣٥ للطفيل *Praon* sp. فى الموسمين على التوالى. و خمسة مفترسات حشرية تم حصرها على محصول اللوبيا و هى *Coccinella undecimpunctata* و *Cydonia isis* و *Cydonia vicina nilotica* و *Chrysoperla carnea* وكذلك *Metasyrphus corollae* بينما تم حصر ثلاث مفترسات حشرية على محصول الذرة و هى *Coccinella undecimpunctata* و *Metasyrphus corollae* بالاضافة الى *Chrysoperla carnea*.

قام بتحكيم البحث

أ.د / عبد البديع عبد الحميد غانم — كلية الزراعة – جامعة المنصورة

أ.د / محمود السيد النجار — مركز البحوث الزراعية

Table (1): Effect of different intercropping on the infestation of maize plants by certain leaf insects along with yield during 2009 and 2010 seasons.

Inter-cropping	Aphid / sample						Leafhopper /sample						Planthopper / sample				Mean yield kg/plot	
	R. maidis		*R. padi*		*A. gossypii*		*E. decedens*		*E. decipens*		*C. chinae*		*S. vibix*		*S. furcifera*			
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
solid	1583.50^{a}	999.01^{a}	694.97^{a}	608.27^{a}	88.23^{a}	73.53^{a}	63.71^{a}	46.15^{a}	50.79^{a}	53.14^{a}	43.27^{a}	36.35^{a}	36.11^{b}	30.32^{a}	28.52^{a}	31.45^{a}	39.45^{a}	49.22^{a}
1:1	928.76^{b}	550.14^{b}	443.68^{b}	331.81^{b}	64.05^{b}	61.56^{b}	43.82^{b}	38.61^{b}	40.87^{b}	48.46^{b}	35.58^{b}	25.21^{b}	37.55^{b}	34.96^{a}	30.0^{a}	32.22^{b}	24.62^{b}	30.64^{b}
3:3	840.89^{c}	503.67^{c}	391.93^{c}	302.51^{b}	62.82^{b}	61.95^{b}	37.57^{c}	38.08^{b}	38.46^{b}	45.68^{b}	33.66^{c}	23.79^{b}	43.82^{a}	40.74^{a}	36.57^{a}	39.66^{b}	34.21^{a}	42.79^{a}
LSD	**	**	**	**	**	**	**	**	**	*	**	**	**	n.s	n.s	**	**	**
0.05%	17.828	9.863	15.82	34.54	3.902	5.586	1.415	1.424	3.414	4.173	1.516	2.869	3.495			1.114	5.651	7.276

Table (2): Effect of different intercropping on the infestation of cowpea plants by certain leaf insects along with yield during 2009 and 2010 seasons.

Interc-ropping	Aphid / sample				Leafhopper/ sample						Whitefly *B. tabaci*/ sample				Mean yield kg/plot	
	Aphis craccivora		*Aphis gossypii*		*E. decedens*		*E. decipiens*		*C. chinae*		Adult stage		Immature stage			
	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
solid	370.14^{a}	214.63^{a}	46.48^{a}	31.51^{a}	13.35^{a}	11.33^{a}	20.12^{a}	16.37^{a}	5.81^{a}	6.34^{a}	72.36^{a}	35.34^{a}	110.85^{a}	90.87^{a}	9.08a	10.20^{a}
1:1	361.86^{b}	198.44^{b}	37.03^{b}	29.76^{a}	11.42^{b}	10.43^{b}	17.65^{b}	13.28^{b}	5.57^{a}	6.18^{a}	50.60^{b}	31.80^{b}	99.00^{a}	81.17^{a}	6.76b	7.60^{b}
3:3	263.68^{c}	185.81^{c}	27.83^{c}	22.20^{b}	11.17^{b}	9.88^{b}	16.13^{c}	13.08^{b}	5.53^{a}	5.90^{a}	34.17^{c}	28.72^{c}	80.00	73.43^{a}	8.05a	9.78^{a}
LSD	**	**	**	**	**	**	**	**	n.s	n.s	**	**	n.s.	n.s.	**	**
0.05%	3.661	2.198	1.463	2.329	0.263	0.630	0.682	0.872			2.262	0.730			1.061	1.154

Means followed by the same letter in a column between the three intercropping systems are not significantly different at the (L.S.D.5%) level of probability

Table (3): Effect of different levels potassium fertilization on the infestation of maize plants intercropping with cowpea plants by certain leaf insects along with yield during 2009 and 2010 seasons.

Fertil-ization	Aphid insects						Leafhopper insects						Planthopper insects				Mean yield kg/plot	
	R. maidis		*R. padi*		*A. gossypii*		*E. decedens*		*E. decipens*		*C. chinae*		*S. vibix*		*S. furcifera*			
	2009	20010	2009	20010	2009	20010	2009	20010	2009	20010	2009	20010	2009	20010	2009	20010	2009	20010
F1	955.99^{a}	596.26^{a}	418.27^{a}	324.96^{a}	59.41^{a}	55.57^{a}	33.06^{a}	33.31^{a}	38.16^{a}	43.84^{a}	32.03^{a}	22.11^{a}	35.48^{a}	29.20^{a}	26.74^{a}	28.71^{a}	46.36^{a}	58.03^{a}
F2	1073.4^{6b}	649.83^{b}	481.34^{b}	379.96^{b}	69.25^{b}	64.12^{b}	37.55^{b}	37.01^{b}	42.31^{b}	46.70^{a}	35.20^{b}	25.98^{b}	36.39^{a}	34.02^{a}	29.56^{ab}	32.06^{b}	37.96^{b}	47.43^{b}
F3	1169.13^{c}	708.25^{c}	543.29^{c}	456.90^{c}	74.60^{c}	68.10^{b}	41.71^{c}	44.35^{c}	44.27^{b}	51.51^{b}	39.98^{c}	31.46^{c}	40.96^{b}	37.24^{ab}	33.52^{bc}	35.54^{c}	30.18^{c}	37.59^{c}
F4	1272.28^{d}	782.76^{d}	597.87^{d}	494.97^{d}	83.54^{d}	74.93^{c}	45.14^{d}	49.12^{d}	48.75^{c}	54.32^{b}	42.79^{d}	34.26^{c}	43.81^{b}	40.89^{b}	36.96^{c}	41.46^{d}	16.56^{d}	20.49^{d}
LSD	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
0.05%	9.560	10.921	17.59	15.51	2.861	4.317	1.167	2.606	3.008	2.886	2.288	2.848	3.04	4.967	4.174	1.968	4.126	5.097

Table (4): Effect of different levels potassium fertilization on the infestation of cowpea plants by certain leaf insects along with yield during 2009 and 2010 seasons.

Fertil-ization	Aphid				Leafhopper						whitefly				Mean yield kg/plot	
	Aphis craccivora		*Aphis gossypii*		*E. decedens*		*E. decipiens*		*C. chinae*		Adult stage		Immature stage			
	2009	20010	2009	20010	2009	20010	2009	20010	2009	20010	2009	20010	2009	20010	2009	20010
F1	295.36^{a}	174.58^{a}	27.33^{a}	21.33^{a}	8.87^{a}	8.26^{a}	11.79^{a}	10.30^{a}	4.70^{a}	4.91^{a}	38.04^{a}	26.14^{a}	72.24^{a}	74.65^{a}	10.70^{a}	13.02^{a}
F2	322.32^{b}	192.81^{b}	34.94^{b}	25.31^{b}	11.37^{b}	9.82^{b}	15.23^{b}	12.82^{b}	5.28^{b}	5.91^{b}	47.58^{b}	30.60^{b}	90.403^{b}	86.73^{b}	8.14^{b}	9.14^{b}
F3	346.39^{c}	204.96^{c}	39.66^{c}	29.76^{c}	12.97^{c}	11.32^{c}	19.92^{c}	15.64^{c}	5.94^{c}	6.53^{c}	57.68^{c}	34.14^{c}	94.736^{c}	89.81^{c}	7.06^{bc}	7.93^{bc}
F4	363.50^{d}	226.15d	46.52^{d}	34.89^{d}	14.71^{d}	12.79^{d}	25.92^{d}	18.46^{d}	6.62^{d}	7.21^{d}	66.20^{d}	36.93^{d}	105.22^{d}	118.6^{d}	5.96^{c}	6.67^{c}
LSD	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**	**
0.05%	3.077	10.69	1.588	1.149	0.760	0.463	0.474	0.891	0.239	0.236	1.283	1.382	174.75	416.14	1.315	1.708

F_1= 100kg of potassium fertilization/fed. F_2 = 50kg of potassium fertilization / fed. F_3= 25kg of potassium fertilization/fed.
F_4 = Control (without potassium fertilization)
Means followed by the same letter in a column between the four levels potassium fertilization are not significantly different at the (L.S.D.5%) level of probability.