

SURVEY AND POPULATION DENSITY OF SOME DOMINANT HOMOPTEROUS INSECTS ATTACKING SOYBEAN PLANTS

Abd-Elsamed, A. A.; Aml Z. N. Al-Habshy and M.A. Ahmed
Plant Protection Research Institute, Agric. Res. Center.

ABSTRACT

The present work was conducted during two successive seasons 2009 and 2010. Survey some piercing sucking insects infesting soybean at Diarb – Nigm district, Sharkia Governorate Egypt. The aforementioned insect pests were collected by the two methods from soybean plants. The plant samples and sweep net were used. The obtained results showed that the visual examination proved to be the best method to collect all the aphid species, thrips and whitefly insects. The date showed that the sweep net proved to be the best method to collect all the leafhopper species. The seasonal population abundance of *Aphis gossypii* (Glover) on soybean plants showed one peak was recorded at the 3rd week of August for the two seasons. The leafhopper species *Empoasca decipiens* (Paoli) and *Empoasca decedens* (Paoli) were the most abundant species on soybean plants. Two peaks were recorded for *E. decipiens* and *E. decedens*. The first peak occurred at 2nd week of July for *E. decipiens*, while the first peak of *E. decedens* was noticed at 4th week of July for the two seasons, respectively. The second peak was recorded in 2nd week of August for *E. decipiens*, while *E. decedens* attained its second peak in 3rd week of August for the two seasons of study respectively. One peak was found for *Thrips tabaci* (Lind.) during the 4th week of June for the first season. While occurred in the first week of July during the second season. The whitefly species *Bemisia tabaci* (Genn.) was the most abundant species on soybean plants, two peaks density were recorded for this insect. The first one occurred in the first of July for the adult stage. The second peak was recorded in 2nd week of August for the same stage. While the first one occurred at 4th week of June for immature stage, and the second peak was recorded in the first week of August during the two seasons, respectively

Keywords: Soybean plants, seasonal abundance, leafhopper, aphid, thrips and whitefly.

INTRODUCTION

The homopterous insects (aphids, leafhoppers, thrips and whitefly) are economic pests of many agricultural crops in Egypt. Soybean plants are infested by these insect pests which affect the quantity of yield as results of their direct feeding on plant, in addition, these insects are responsible for natural spread of several virus diseases to soybean plants (Nielson, 1968 and Hegab, Ola 2001). The fauna of these insects on most maize fields has been studied in Egypt (Herakly, 1970; El Nahal *et al.*, 1977 and Hegab *et al* 1987). Further studies are needed to assess the relation between plant varieties, potassium fertilization rates and chemical constituent of plant and the level of population density of aphids and leafhoppers. Therefore, the aim of the current investigation to survey and study the population density of some dominant homopterous insect pests attacking soybean crop.

MATERIALS AND METHODS

An area about 1100 m² was chosen to carry out this investigation at Diarb-Nigm district, Sharkia Governorate. Treatments were distributed as three, replication consisted (10 meters long and 35 meters wide). The space between holes was 25-30 cm. The sowing date of soybean plants was during the middle of May, in 2009 and 2010 seasons. The normal agricultural practices were followed in due time and all plots were kept free of any insecticide treatments.

Sampling started when the age of soybean plants reached about 21-28 days after sowing and continued at weekly intervals throughout the growing seasons in 2009 and 2010 seasons. The following procedures of sampling were adopted:

- 1) Visual examination, 25 leaves representing different strata, viz. terminal, middle and bottom parts were taken from randomly. These leaves and tassels were examined in the laboratory using a binocular microscope and the total number of existing of aphids, thrips and whitefly insects on both surfaces of the leaves and tassels were recorded.
- 2) Sweep net, 30 cm diameter and 60 cm deep. Each sample consisted of 100 double strokes were taken from both diagonal directions of the experimental area. Each sample was kept in a tight closed paper bag and transferred to the laboratory for inspection by binocular microscope and the collected leafhoppers and whitefly were killed by cyanide, sorted into species and identified according to the work of Ribaut (1952), Nielson (1968) and Hegab *et al.* (1989). Counts of captured leafhoppers were recorded for each sample.

RESULTS AND DISCUSSIONS

Survey of homopterous insects on soybean plants

Aphids insects:

Survey was conducted during two successive seasons on soybean plants in Diarb-Nigm, district, Sharkia Governorate. The obtained results revealed that presence of the following aphid species *Aphis gossypii* (Glover) recorded mean number of 473 and 364 insects / plant sample for the two seasons, respectively (Table 1).

Leafhopper insects:

The data presented showed that two leafhopper species belonging to family Cicadellidae on soybean plants. The collected leafhopper species were arranged descending according to their abundance as follows: *Empoasca decipiens* (Paoli) recorded mean number of 269 and 210 insects / sweep net sample and *Empoasca decedens* (Paoli) recorded mean number of 288 and 242 insects / sweep net sample for the two seasons, respectively and the results were shown in Table (1).

Thrips insects

The following thrips species namely *T. tabaci* was collected on soybean plants recorded mean number of 132 and 144 insects / plant sample during 2009 and 2010 seasons, respectively and the results are shown in Table (1).

Whitefly insects:

The following whitefly species namely *Bemisia tabaci* immature stage was collected mean number of 1556 and 1377 insects / plant sample while adult stage was collected mean number of 995 and 898 insects / plant sample during 2009 and 2010 seasons, respectively Table (1). These results agree with the findings of Hegab et al. (1987)& (1989), who showed that sticky board and yellow pan trap have a remarkable selectivity for attracting certain leafhoppers species from different field crops, vegetable crops and fruit orchards. Results obtained by Hemeida (1981), who mentioned that, only *E. decipiens* were found infesting solanaceous vegetable plants at Giza region.

Table (1): Total number of some homopterous insects collected from soybean plants by using visual examination and sweep net at Diarb-Nigm district, Sharkia Governorate during 2009 and 2010 seasons.

Insect species	Visual examination		Sweeping net		
	2009	2010	2009	2010	
<i>E. decipiens</i>	15	18	269	210	
<i>E. decedens</i>	13	7	288	242	
<i>A.gossypii</i>	473	364	22	13	
<i>T. tabaci</i>	132	144	5	7	
Whitefly	Adult stage.	995	898	10	25
	Immature stages.	1556	1377	-	-

Seasonal abundance of the dominant homopterous insects on soybean plants.

Aphid insects:

The data illustrated in fig. (1) showed the seasonal population abundance of *A. gossypii* on soybean plants .One peak was recorded at the 3rd week of August with a mean number of 85 and 78 insects/sample at a mean of 26.86C°, 30.14C° with 68.0% and 63.15% RH. during the two seasons, respectively.

Regarding the weekly counts of *A. gossypii* it is clear that this species was slightly a abundant in 2009 and 2010. Results in general concerning the population density of *A. gossypii* on the soybean plants show clearly that these species have one peak on soybean plants. This result agree with the findings of Cornack *et al.* (2004), Myers *et al.*(2005), Nicolas *et al.*, (2006) and Rutledge and Neil (2006). who showed that the fieght activity of *R. maidis* , *R. padi* and *A. gossyppii* have one peak maize plants during summer plantation .

Leafhopper insects:

The leafhopper species *Empoasca decipiens* and *E. decedens* were the most abundant species on soybean plants during 2009 and 2010 seasons. The weekly numbers of leafhopper insects collected from soybean plants in 2009 and 2010 seasons were shown in Fig. (2). Two peaks of were recorded for *E. decipiens* and *E. decedens* during 2009 and 2010 seasons on

soybean plants. The first one occurred at 2nd week of July with a total number of 47 and 33 insects/sample for *E. decipiens* at a mean of 27.29C^o, 28 C^o with 66.58% and 61.71% RH. for the two seasons, respectively, while the first peak of *E. decedens* was found at 4th week of July with a total number of 42 and 37 insects/sample at a mean of 29.40 C^o, 29.15C^o with 64.14 % and 63.29% RH for the two seasons, respectively. The second peak was recorded in 2nd week of August and with a total number of 51 and 43 insect/sample for *E. decipiens* at a mean of 27.72C^o, 22.71C^o with 67.71 % and 63.14 % RH for the two seasons, respectively, while *E. decedens* attained its second peak in 3rd week of August and with a total number of 38 and 44 insects/sample at a mean of 26.86C^o, 30.14C^o with 68.0% and 63.15% RH for the two seasons, respectively Fig. (3).

Results in general concerning the population density of leafhopper species on soybean plants show clearly that both of *Empoasca decipiens* and *E. decedens* had two peaks (2nd week of July and 3rd week of August) during the period of study. Calderon *et al.* (1992); Rassoulia *et al.*(2005). Demichelis *et al.*(2010); and Galetto *et al.* (2011) who mentioned that *E. decipiens* and *E. decedens* had one peak on soybean plants. Similar trends were also recorded by Rassoulia *et al.*(2005).

Thrips insects

The population density of *T. tabaci* on soybean plants illustrated in Fig. (3) the obtained results showed that one peak was found for *T. tabaci* at the 4th week of June with a mean number of 35 insects/sample at a mean of 28C^o with 60.43% RH. for the first season. While occurred at 1st week of July with a total number of 41 insects/sample for *T.tabaci* at a mean of 27.43C^owith 62% RH. for the second season of study.

These results are in agreement with the findings of Isenhour *et al.* (1981) and Demirel and and and Yildirim (2008). Who mentioned that *T. tabaci* adult stage had one peaks on soybean plants in summer plantation.

Whitefly insects:

The whitefly species *B. tabaci* was the most abundant species on soybean plants during 2009 and 2010 seasons Fig. (5 and 6). Two peaks of population density were recorded for *Bemisia tabaci* the aforementioned species during 2009 and 2010 seasons on soybean plants. The first one occurred at 1st week of July with a total number of 78 and 67 insects/sample for adult stage at a mean of 25.82C^o,27.43 C^o with 66.86% and 62% RH. for the two seasons, respectively. The second peak was recorded in 2nd week of August and with a total number of 210 and 153 insect/sample for adult stage at a mean of 27.72C^o, 22.71C^o with 67.71 % and 63.14 % RH for the two seasons, respectively. While the first one occurred at 4th week of June with a total number of 160 and 142 insects/sample for immature stage at a mean of 25.97C^o,28 with 61.14% and 60.43% RH. for the two seasons, respectively. The second peak was recorded in 1st week of August and with a total number of 330 and 297 insect/sample for immature stage at a mean of 28.65C^o, 29.22C^o with 66.43 % and 62.57 % RH for the two seasons, respectively

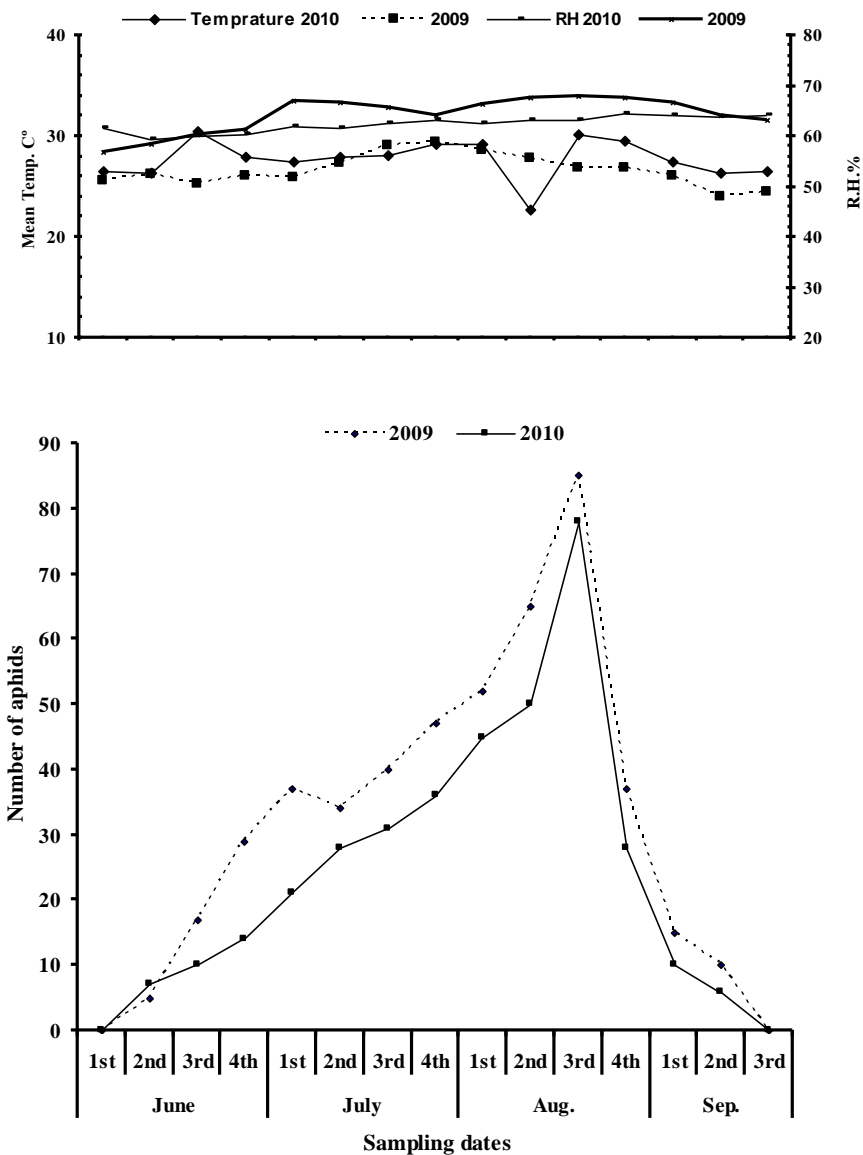


Fig. (1) :Population density of aphid *A. gossypii* (Glover) infesting soybean plants collected by visual examination at Dirab-Nigm district ,Sharkia Governorate during 2009 and 2010 seasons.

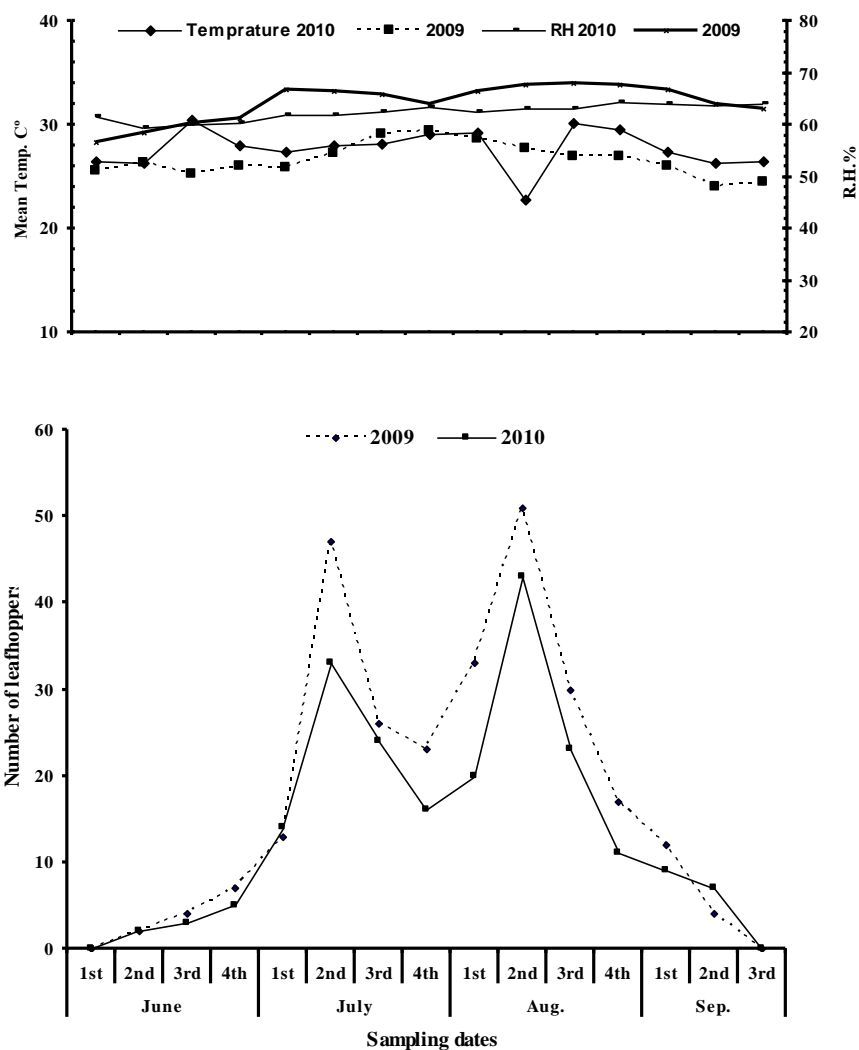


Fig. (2): Population density of leafhopper *Empoasca decipiens* infesting soybean plants collected by sweep net at Dirab-Nigm district, Sharkia Governorate during 2009 and 2010 seasons.

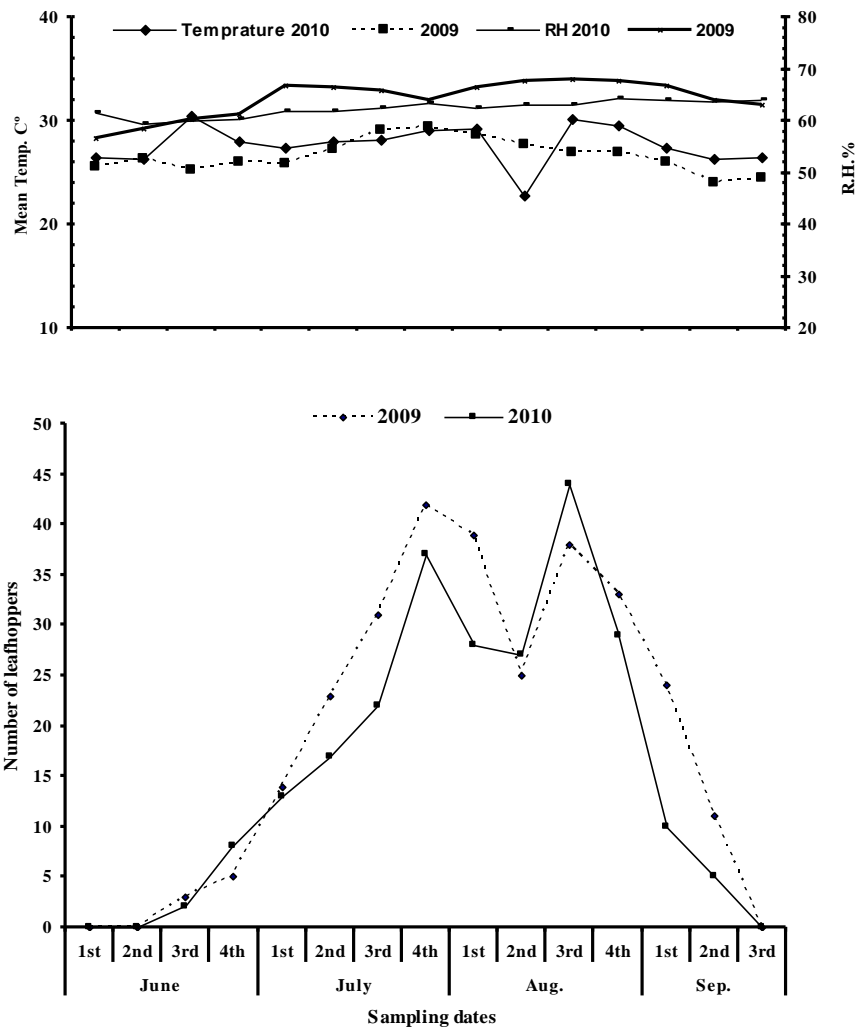


Fig. (3): Population density of leafhopper *Empoasca decedens* infesting soybean plants collected by sweep net at Dirab-Nigm district ,Sharkia Governorate during 2009 and 2010 seasons.

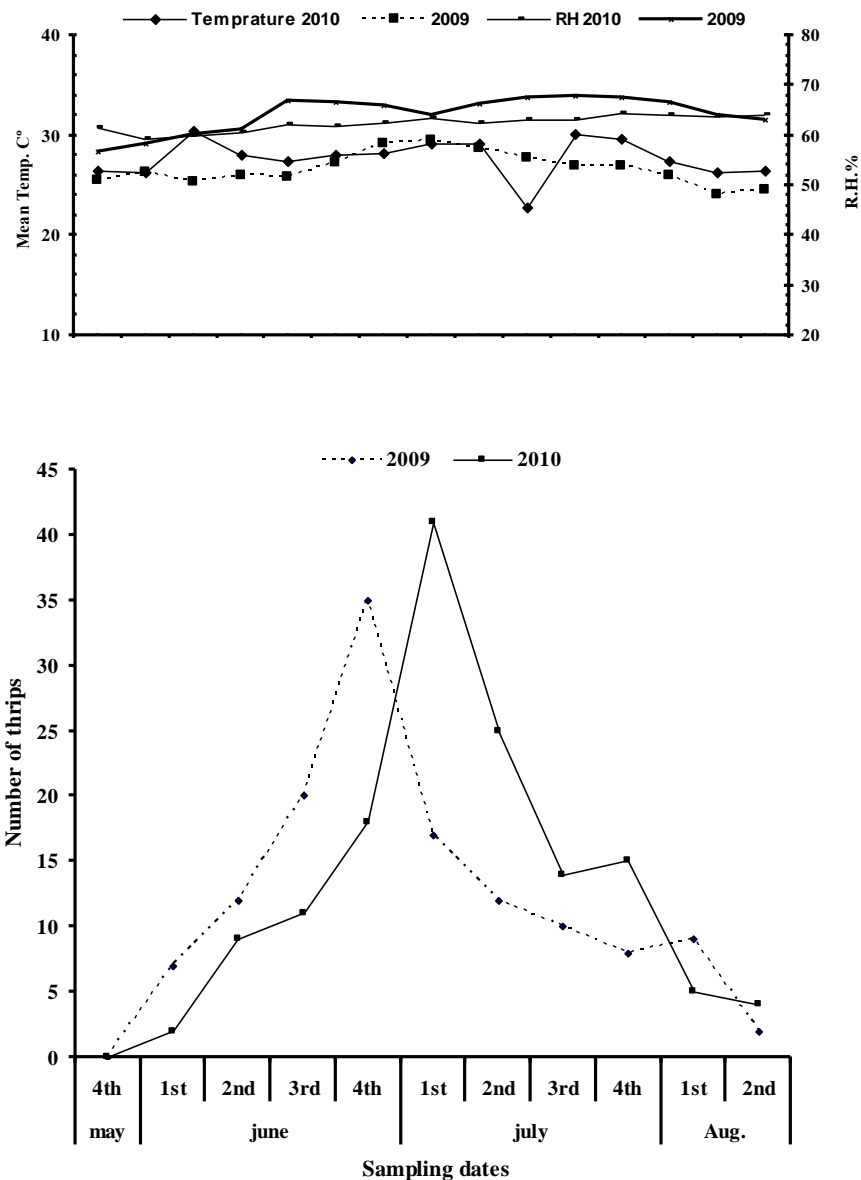


Fig. (4): Population density of *Thrips tabaci* infesting soybean plants collected by visual examination at Dirab-Nigm district ,Sharkia Governorate during 2009 and 2010 seasons.

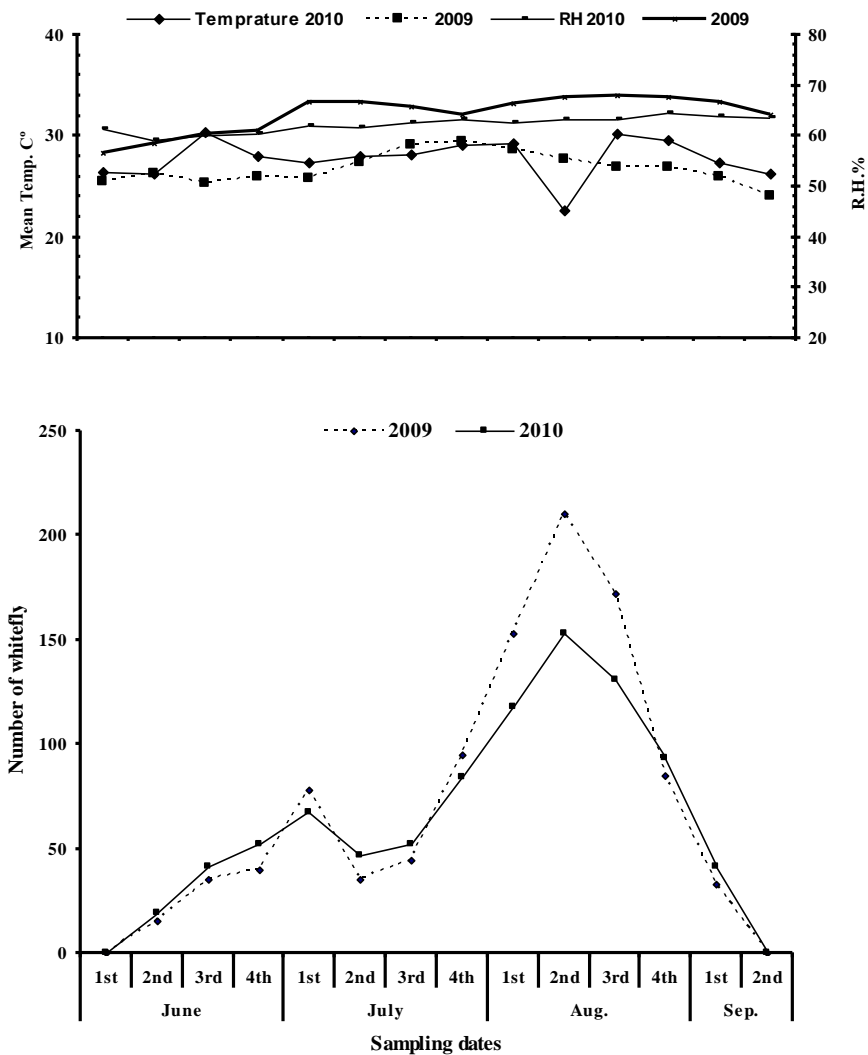


Fig. (5): Population density of whitefly adult stage *Bemisia tabaci* infesting soybean plants collected by visual examination at Dirab-Nigm district , Sharkia Governorate during 2009 and 2010 seasons.

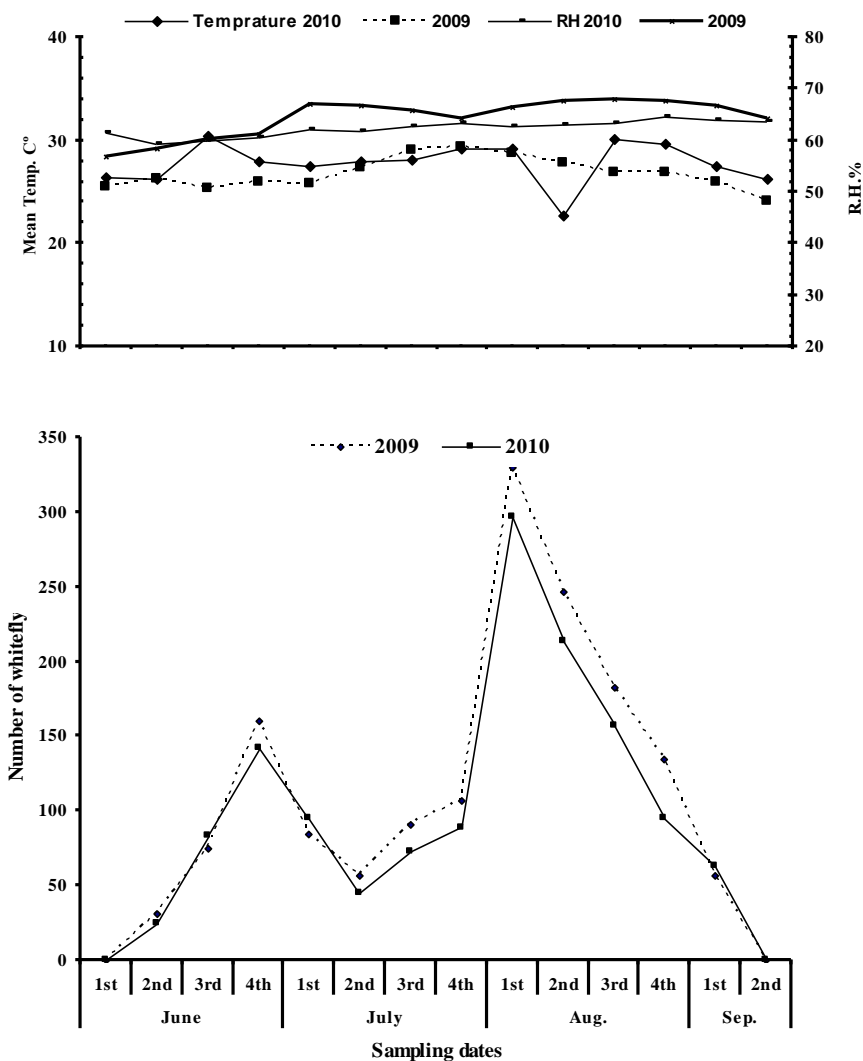


Fig. (6) : Population density of whitefly immature stage *Bemisia tabaci* infesting soybean plants collected by visual examination at Dirab-Nigm district ,Sharkia Governorate during 2009 and 2010 seasons.

These results are in agreement with the findings of Akbar *et al.* (2000); Gulluoglu *et al.* (2010) and Pherson *et al.* (2010). Who mentioned that *B. tabaci* adult stage had two peaks on soybean plants in summer plantation.

Effect of maximum temperature, Minimum temperature and relative humidity on the population density of some dominant homopterous insects (aphids, leafhoppers, thrips and whitefly) infesting soybean plants

Generally the results in Table (2) indicated that the correlation coefficients between the insects population and maximum temperature, minimum temperature and relative humidity was positively insignificant and in other cases negatively insignificant according to different records of temperature and relative humidity during the two seasons of 2009 and 2010.

These results ensure that the tested meteorological factors play a great role in regulating the population density and seasonal abundance of such insect pest. Similar findings were reported by Parh (1986), and Raupach *et al.* (2002) which greatly correspond with the present results.

Table (2): Simple correlation coefficients and partial regression between the means of maximum temperature , minimum temperature and mean relative humidity and total numbers of certain insects infesting soybean plants during 2009 and 2010 seasons.

Insect species	Simple correlation coefficients						Partial regression				
	2009			2010			Explained variance % R ²		Unexplained variance %		
	r1	r2	r3	r1	r2	r3	2009	2010	2009	2010	
<i>A. gossypii</i>	0.4644	0.6157*	0.6520*	0.4994	0.659*	0.3663	0.575	0.444	0.426	0.556	
<i>E. decipiens</i>	0.5203	0.732**	0.6667*	0.189	0.4142	0.3426	0.575	0.372	0.359	0.628	
<i>E. decedens</i>	0.6742*	0.7857**	0.7425**	0.441	0.757**	0.5902*	0.874	0.639	0.126	0.361	
<i>T. tabaci</i>	-0.0993	0.1939	-0.1865	-0.3063	0.3065	-0.2944	0.777	0.449	0.223	0.551	
whitefly	Immatures	0.471	0.516	0.3902	0.5133	0.4185	0.1437	0.323	0.372	0.677	0.628
	Adults.	0.4331	0.5206	0.5815*	0.534	0.6838**	0.3946	0.476	0.495	0.524	0.505

r1=correlation coefficient between max. temp. and number of insects

r2=correlation coefficient between min. temp. and number of insects

r3=correlation coefficient between R.H. and number of insects

REFERENCES

- Akbar, W.; K. Abdul and M. Amjad (2000): Rating of same early maturing soybean varieties for whitefly responses and its population trends in autumn and spring seasons. *International Journal of Agric.*, 1(2):99-103 .
- Calderon, J. D. and E. A. Backus (1992): Comparison of the probing behaviors of *Empoasca fabae* and *E. kraemeri* (Homoptera: Cicadellidae) on resistant and susceptible cultivars of common beans. *J. Econ. Entomol.* 85: 89–99.
- Cornack, B. P.; D. W. Ragsdale and R. C. Venette (2004): Demography of soybean aphid (Homoptera: Aphididae) at summer temperatures. *J. Econ. Entomol.*, 97: 854–861.
- Demichelis, S.; A. Manino; C. Sartor; D. Cifuentes, and A. Patetta. (2010): Specific identification of some female *Empoasc* spp (Hemiptera: Cicadellidae), using morphological characters of the ovipositor and isozyme and mtcoi sequence analyses. *Can. Entomol.* 142: 513–531.
- Demirel, N. and A. E. Yildirim. (2008): Attraction of various sticky color traps to *Thrips tabaci* Lindeman (Thysanoptera: Thripidae) and *Empoasca decipiens* Paoli (Homoptera: Cicadellidae) in cotton. *J. Entomol.* 5: 389–394.

- El-Nahal, A. K. M; E. D. Ammar and M.M.EL-Bolok (1977): Survey and population density of leafhoppers, planthoppers and froghoppers (Homoptera: Auchenorrhyncha) on field and vegetable crops at Giza. Bull. Soc. Ent. Egypt 61: 99-108.
- Galetto, L.; C. Marzachi; S. Demichelis; and D. Bosco(2001): Host Plant Determines the Phytoplasma Transmission Competence of *Empoasca decipiens* (Homoptera: Cicadellidae). Journal of Economic Entomology 104(2):360-366.
- Gulluoglu, L.; A. Hals and k. Cemal (2010): Field evaluation of soybean cultivars for resistance to whitefly *Bemisia tabaci* Genn) infestations. African Journal Agric. Res. 5(7): 555 – 560.
- Hegab, A. M. ; I. M. Kelany and M. M. El-Maghraby(1987) : Survey of leafhoppers and planthoppers infesting maize plants by using three sampling techniques in newly reclaimed sandy areas at Salhia district, Egypt. Mina J. Agric. Res. 9 (2): 945-953.
- Hegab, A. M.; M. M. El Zohairy and M. M. Helaly (1989):Survey and seasonal abundance of leafhoppers infesting certain solanaceous vegetable plants in newly reclaimed sandy areas at salhia district ,Egypt, Zagazig J.Agric.Res.Vol16(2): 175-187.
- Hegab,Ola I. M. (2001): Studies on certain insect vectors of plant pathogenic agents.Ph. D Thesis, Fac Agric. Zagazig Univ.
- Hemeida, E.A. (1981): Studies on some insects attacking certain solanaceous plants (Ph.D. Thesis Cairo Univ., Egypt).
- Herakly, F.A.(1970): Studies on certain jassids infesting vegetables in Egypt. M. Sc. Thesis, Fac.of Agric.Ain Shams Univ.Egypt.
- Isenhour, D. J. and K. V. Yeargan (1981): Predation by *Orius insidiosus* on the soybean thrips, *Sericothrips variabilis*: effect of prey stage and density. Environ. Entomol, 10: 496–500.
- Myers, S. W.; C. Gratton; R. P. Wolkowski; D. B. Hogg and J. L. Wedberg (2005): Effect of soil potassium availability on soybean aphid (Homoptera: Aphididae) population dynamics and soybean yield. J. Econ. Entomol., 98: 113–120.
- Neilson, M. W. (1968): The leafhopper vectors of phytopathogenic viruses(Homoptera:Cicadellidae) taxonomy , biology and virus transmission. Agric .Ser .M.S.Dept.Agr.89.386.
- Nicolas D.; J. O. Robert and S. Y. H. Jung (2006): Suppression of Population Growth of the Soybean Aphid, *Aphis glycines* Matsumura, by Predators: The Identification of a Key Predator and the Effects of Prey Dispersion, Predator Abundance, and Temperature. Environmental Entomology 35(5):1342-1349.
- Parh, I.A. (1986): The reaction of the cowpea leafhopper *E. dolichi* (Paoli), to temperature and humidity, Indian J. of Entomology,48 (3) : 346-353.
- Pherson, R.M.; W.C. Johnson; B.G. Mulinix; W. A. Milis and F.S. Peebles (2010): Influence of herbicide tolerant soybean production systems on insect pest populations and pest induced crop damage. Environmental Entomology, 38(5):1485-1495.
- Rassouliau, G.R.; H. Sardarbandeh and A. K. Pakdel (2005):Study of soybean leafhoppers fauna and an investigation on biology of dominant species *Empoasca decipiens* (Paoli) in Karaj area. Commun Agric Appl Biol Sci. 2005 ;70 (4):671- 675.

- Raupach, K.; C. Borgemeister; M. Hommes; H. M. Poehling and M. Sétamou (2002): Effect of temperature and host plants on the bionomics of *Empoasca decipiens* (Homoptera: Cicadellidae). Crop Prot. 21: 113–119
- Ribaut, H. (1952): Homoptera Auchenorhynques II Jassidae faune France, 57 : 1- 474
- Rutledge, C. E. and R. J.O. Neil (2006): Soybean plant stage and population growth of soybean aphid. J. Econ. Entomol., 99: 60–66.

حصرو دراسة الكثافة العددية لبعض الحشرات متشابهة الاجنحة التي تهاجم نباتات الفول الصويا

عبدالله على عبد الصمد و امل زكريا نورالدين الحبشى و مجدى عبدالعظيم احمد
معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - جيزة

أجريت الدراسة فى خلال موسمين متتاليين 2009 و 2010 بهدف حصر أنواع المن و نشاطات الأوراق والتربس والذبابة البيضاء وكذلك دراسة الوفرة الموسمية للأنواع السائدة التي تصيب نباتات فول الصويا المنزرعة فى منطقة ديرب نجم محافظة الشرقية وذلك باستخدام طريقتين لاختبار العينات وهى العينات النباتية والمصيدة الشبكية. وقد أوضحت النتائج أن المن الذي يصيب نباتات فول الصويا هو *Aphis gossypii* (Glover).

بينما أنواع نشاطات الأوراق التي تصيب نباتات الفول الصويا هي *Empoasca decedens* (Paoli) و *Empoasca decipiens* (Paoli) والحصر للتربس و الذبابة البيضاء *Bemisia tabaci* و *Thirps tabaci* وتم دراسة الوفرة الموسمية للأنواع السائدة على النباتات موضع الدراسة وجد ان النوع *Empoasca decipiens* (Paoli) له قمتين نشاط على نباتات فول الصويا خلال موسمي الدراسة فى الأسبوع الثانى من شهر يوليو وأغسطس بينما نشاط الأوراق *Empoasca decedens* (Paoli) له قمتين نشاط على نباتات الفول الصويا خلال موسم الدراسة فى الأسبوع الرابع من شهر يوليو و الأسبوع الثالث من شهر وأغسطس. التربس له قمة نشاط واحدة فى الأسبوع الرابع من شهر يونية للموسم الاول وفى الأسبوع الاول من شهر يوليو للموسم الثانى. الذبابة البيضاء لها قمتين نشاط على نباتات فول الصويا خلال موسمي الدراسة فى الأسبوع الاول من شهر يوليو و الأسبوع الثانى من شهر اغسطس للحشرات الكاملة اما الاطوار الغير كاملة لها قمتين نشاط على نباتات الفول الصويا خلال موسمي الدراسة فى الأسبوع الرابع من شهر يونية و الأسبوع الاول من شهر وأغسطس.

ومن دراسة تأثير كل من درجة الحرارة العظمى والصغرى وكذلك الرطوبة النسبية على تعداد الحشرات أوضحت النتائج أن التأثير كان أكبر بالنسبة لدرجات الحرارة يتبعها الرطوبة النسبية.

يهدف هذا البحث الى استخدام نتائج المتحصل عليها و الاستفادة منها عند وضع برامج مكافحة متكاملة لهذه الافات على محصول فول الصويا.

قام بتحكيم البحث

كلية الزراعة - جامعة المنصورة
مركز البحوث الزراعية

أ.د / عبد البديع عبد الحميد غانم
أ.د / السيد علي حسن شريف

