SEASONAL ABUNDANCE AND POPULATION DYNAMICS OF CERTAIN SUCKING INSECTS ON SOYBEAN IN KAFR EL-SHEIKH GOVERNORATE, EGYPT

EL-KHOULY A.S.[1], E.M.E. KHALAFALLA[2], M.M. METWALLY[1], H.A. HELAL[1] AND A.B. EL-MEZAIEN[2]

1 Faculty of Agriculture, Al Azhar University, Cairo, Egypt.

2 Plant Protection Research Institute, Agricultural Research Centre, Dokki, Egypt.

(Manuscript received 31 March, 1997)

Abstract

Soybean plants are subjected to attack by piercing-sucking insect pests causing severe damage. The interactions between insects and their natural enemies are essential ecological processes that contribute to the regulation of insect populations. So, the present investigation was conducted to study the population density of aphids, *Aphis spp.*, whitefly, *Bemisia tabaci* (Genn.), thrips, *Thrips tabaci* (L.) and jassids, *Empoasca spp.* on soybean in relation to common associated predators (*Paederus alferii* Koch., *Chrysoperla carnea* Steph, *Coccinella undecimpunctata* L. and *Scyminus spp.*) and some prevailing climatic factors (temperature, relative humidity and wind speed) during two seasons (1992 and 1993).

Obtained data indicated the following:

1. The populations of the considered insect pests and associated predators were higher in the second season than in the first one.
2. Every insect pest had one abundance peak which incoincided with the others.
3. It was appeared that the whitefly, thrips and jassids had one generation a season. While, two generations of aphids were detected.
4. Concerning the associated predators, their total population peaked twice annually. The first peak appeared in the second half of July for the two tested seasons while, the second peak appeared on Sept. 27 for 1992 season and on Sept. 6 for 1993 season.
5. The combined effect of the weekly mean of predators population, daily mean temperature, relative humidity and wind speed was responsible for 84.76, 73.9, 68.70 and 58% of changes in the populations of jassids, thrips, whitefly and aphids, respectively in the first season, while it recorded 79.40, 54.80, 66.30 and 45.8%, respectively in the second one.

Such results are important in enlightening integrated control of these sucking insects.

INTRODUCTION

Soybean, *Glycine max* (L.) is one of the important leguminous crops. Seeds of soybean have high nutritional value and their proteins contain many essential amino acids (Badenhop and Hackler, 1971). Piercing-sucking insects are of the major insect pests which attack this crop in the fields causing severe damage (El-Kifl *et al.*, 1974; Hamed, 1977; Shaheen, 1977; Metwally, 1989; Awadalla *et al.*, 1991) .

The role of the predacious insects in suppressing the population of the main insect pests of soybean has been reported by several investigators (El-Kifl *et al.*, 1974; Bechinski and Bedigo, 1982; El-Adl *et al.*, 1988; Awadalla *et al.*, 1992). The interactions between insects and their natural enemies are essential ecological processes that contribute to the regulation of insect populations (Dent, 1991).

However, environmental conditions at any location influence the seasonal phenology of insect numbers, the number of generations and the level of insect abundance (Dent, 1991) in addition to the geographic range and abundance of various groups of predators (Kogan and Herzeg, 1980).

Therefore, the present work was conducted to study the population density of certain sucking insects, mainly aphids *aphis spp.* whitefly, *Bemisia tabaci* (Genn.) thrips, *Thrips tabaci* (L.) and Jassids, *Empoasca* spp. on soybean in relation to common associated predators and some prevailing climatic factors during two successive growing seasons.

MATERIALS AND METHODS

The experiment was conducted on the farm of Sakha Res. Station, Kafr El-Sheikh during 1992 and 1993 seasons to study the population density of certain sucking insects; aphids *aphis spp.* Whitefly, *Bemisia tabaci* (Genn.), thrips, *Thrips tabaci* (L.) and Jassids, *Empoasca spp.* as well as common associated predators on soybean plants in relation to some climatic factors. The experimental area of two feddans was divided into four plots of 1/2 feddan each. Clark variety of soybean was cultivated approximately in mid-May of 1992 and 1993 seasons. The regular agricultural practices were followed without any chemical control throughout the growing seasons. To determine the numbers of aphids species and common associated predators, weekly samples of 10 plants from each plot taken at random were examined. For counting whitefly, thrips and jassids, ten *leaves* of soybean from each plot were picked up randomly from three levels of the plant in early morning and in-

dividuals of each insect species were counted. The annual generations of every insect pest was calculated according to Audemard and Milaire (1975) and Iacob (1977).

Records of temperature, relative humidity and wind speed during the seasons of 1992 and 1993 were obtained from Meteorological Station at Sakha Res. Station. Daily mean of these climatic factors during the week preceding the sampling date and weekly mean number of predators were used for calculating the simple correlation and partial regression values according to Fisher (1950).

RESULTS AND DISCUSSION

Population density of certain sucking insects and common associated predators on soybean

Data presented in Table 1 clear the population fluctuations of certain sucking insects and common associated predators on soybean plants during the 1992 growing season. Jassids population started to appear in low numbers on July 19, then, increased gradually forming the only peak of 89 insects by August 23. Thereafter, the numbers of jassids decreased gradually until the end of season. These results were confirmed by those of Metwally, 1989 and Ali, 1993 who found that the population of *Empoasca discipiens* had only one peak on soybean plants.

As for thrips, the infestation began to appear early in the season; this may be due to some plant chemical components and/or certain environmental conditions that affect the population. The population reached its peak by July 5 witha a mean of 75 insects per 10 leaves, then, it decreased gradually to disappear completely on August 2.

These results were in agreement with those of Metwally 1989 and Awadalla *et al.*, 1991 who found only one peak for thrips on soybean plants during the growing season.

Whitefly appeared in relatively high numbers of 78.5 larvae/10 leaves and peaked on 2nd August with a mean of 191.2 larvae/10 leaves while aphid population appeared firstly in nearly mid-season with a mean number of 100 insects/10 plants, then increased rapidly till it peaked on September 13 recording 2761 insects/10 plants. Following these peaks the populations of the two insects declined until the end of season. From the previous results it is obvious that every insect had

one peak throughout the season. On the other hand, Ali, 1993 mentioned that *B.tabaci* reached its only peak throughout late August to early September during 1990, while in 1991 the insect peaked twice, the first occurred on mid August and the second during the first week of September.

However, there was incoincidence of the considered insects peaks, this represents a difficulty in chemical control programmes on soybean fields.

Data recorded in Table 1 clear the common predators in soybean fields, i.e. *Paederus alferii* (Koch.), *Coccinella undecimpunctata* (L.), *Chrysoperla carnea* (Steph.) and *Scyminus* spp. during 1992 season. Their populations began to appear earlyin the season except, *C.carnea* that started to exist two weeks later.

Table 1. Weekly mean number of certain sucking insects and associated predators on soybean plants during 1992 season at Sakha region, Kafr El-Sheikh.

Sampling date	No. of insects/10 leaves				Mean numer of predators/10 plants				Total of predators
	Jassids	thrips	whiteflies	aphids	*Paederous alferii*	*Chrysoperla carnea*	*C.undcim-punctata*	*Scyminus spp.*	
June 7	0	0	0	0	2.0	0	3.3	6.3	11.6
14	0	0	0	0	5.7	0	7.5	7.5	20.7
21	0	50.0	0	0	10.0	0.5	9.5	7.5	27.0
28	0	64.0	0	0	11.0	1.0	10.0	11.0	33.0
Jul. 5	0	75.0	0	0	11.3	2.0	9.0	10.5	32.8
12	0	50.0	78.5	0	12.3	4.0	10.3	7.3	33.9
19	14.5	25.0	94.0	0	16.0	5.0	8.5	16.0	45.5
26	19.5	18.0	120.2	0	14.0	7.0	9.3	14.0	44.3
Aug. 2	32.7	0	191.2	0	5.0	10.0	5.0	6.5	26.5
9	61.2	0	180.0	100	2.3	13.0	4.5	3.0	22.8
16	74.7	0	170.0	120	3.0	14.0	5.0	6.8	28.8
23	89.0	0	150.5	182	5.0	16.0	7.0	4.0	32.2
30	75.2	0	140.0	234	7.0	17.7	9.0	5.5	39.2
Sept. 6	65.5	0	60.0	2088	9.5	9.5	14.0	9.8	42.2
13	40.0	0	20.0	2761	9.0	13.2	12.0	10.0	44.2
20	30.0	0	10.0	1734	8.5	16.5	10.3	9.0	44.3
27	16.2	0	5.0	502	9.5	10.0	12.0	15.3	46.8
Total	518.0	282.0	1218.5	7721	141.1	139.6	145.7	150.0	576.4
Mean	30.4	16.6	71.6	454.2	8.3	8.2	8.6	8.8	33.9

Considering the total count of predators, the population started to appear with low numbers then increased gradually to reach its maximum (45.5 predators) on 19th July. After that, the population decreased to reach 22.8 predators on 9th August. The population, then began to increase again to record the highest number with a mean of 46.8 predators in late season and this was associated with low numbers of whitefly, jassids and aphids. These results indicate that the predators may play a role in decreasing the insect pests populations.

In the second season 1993, data presented in Table 2 indicate that the numbers of sucking insects and associated predators were higher than in the first season. This phenomenon may be due to the differences in climatic conditions or other

Table 2. Weekly mean number of certain sucking insects and associated predators on soybean plants during 1993 season at Sakha region, Kafr El-Sheikh.

Sampling date	No. of insects/10 leaves				Mean numer of predators/10 plants				Total of predators
	Jassids	thrips	whiteflies	aphids	*Paederous alferii*	*Chrysoperla carnea*	*C.undcim-punctata*	*Scyminus spp.*	
June 7	0.0	0.0	0.0	0.0	3.0	1.0	4.0	7.0	15.0
14	0.0	45.0	0.0	0.0	4.0	2.0	6.6	7.3	19.9
21	0.0	73.5	0.0	0.0	5.0	2.4	8.7	8.0	24.1
28	0.0	106.0	0.0	0.0	10.0	3.6	11.0	10.0	34.6
Jul. 5	0.0	134.0	0.0	0.0	14.0	4.4	12.5	13.0	43.9
12	0.0	85.0	102.0	0.0	16.0	5.3	13.6	14.0	48.9
19	0.0	42.7	136.7	0.0	18.0	6.3	13.7	17.0	55.0
26	58.0	0.0	170.0	0.0	24.0	9.4	15.6	20.0	69.0
Aug. 2	61.0	0.0	234.0	120.0	14.0	11.4	16.1	14.5	56.0
9	89.2	0.0	210.7	151.0	10.0	14.0	15.0	16.5	55.5
16	93.0	0.0	200.0	205.0	9.0	15.0	18.0	11.0	53.0
23	130.0	0.0	180.0	326.7	9.0	18.5	14.5	12.0	54.0
30	135.0	0.0	160.7	1746.7	10.0	23.5	18.5	13.0	65.0
Sept. 6	120.0	0.0	140.7	3222.0	13.0	22.6	12.4	11.0	59.0
13	113.0	0.0	129.0	2999.0	11.0	15.3	17.7	9.0	53.0
20	80.0	0.0	90.0	2170.0	8.0	15.2	23.8	10.0	57.0
27	20.0	0.0	60.0	612.0	8.0	13.1	19.9	11.0	52.0
Total	899.2	486.2	1814.1	11552.4	186.0	183.0	241.6	204.3	814.9
Mean	52.8	28.6	106.7	679.6	10.9	10.8	14.2	12.0	47.9

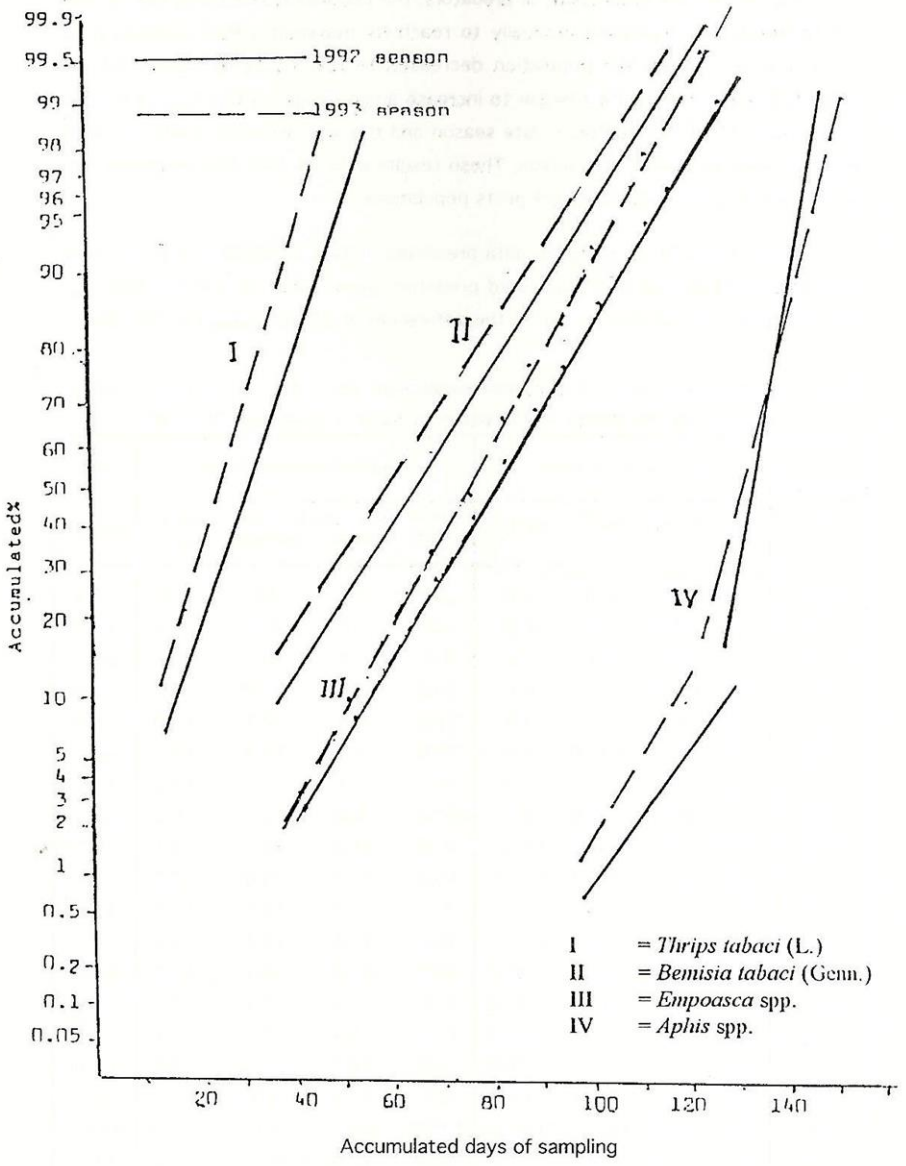

Fig.1. The duration and number of certain sucking insects field generations on soybean plants according to Audemard and Milaire (1975) and Iacob (1977) during season 1992 and 1993 at Sakha region, Kafr El-Sheikh Governorate.

factors. In general, similar trend was observed for the fluctuation of both considered sucking insects and associated predators, since every insect species had one peak of abundance and these peaks were not coincided. With regard to the predators, the same predators were observed but in higher numbers than in the first season. Concerning the total count of predators, the population peaked twice, the first peak of 69 predators was in late July and the second peak occurred in late August with a mean of 65 predators. The latter peak was coincided with jassid peak.

The estimated numbers of the considered insects generations were illustrated in Fig. 1. One generation was detected for whitefly, thrips and jassids for every season, but aphids recorded two generations.

Effect of related climatic factors and common associated predators on the population of certain sucking insects in soybean fields.

Statistical analysis in Table 3 reveal that relative humidity and wind speed had positively high significant effect on Jassids population in the two season. This means that the two climatic factors were below the optimal range of population activity, whereas the temperature was within the optimal range as it exhibited insignificant effect.

Table 3. Statistical parameters for certain sucking insects under the predators and some climatic factors on soybean during 1992/1993 season.

Season	Insect	Weekly mean predators		Daily mean temperature		Daily mean relative humidity		Daily mean wind speed		% Explained variance
		Simple correlation	Partial regression	Simple correlation	Partial regression	Simple correlation	Partial regression	Simple correlation	Partial regression	
1992	Jassids	0.162	-1.032	-0.053	1.896	0.786**	3.581**	-0.609**	-5.629*	84.76
	Thrips	-0.002	1.730**	0.530*	6.942*	-0.454	-2.558**	0.651**	1.457	73.90
	Whitefly	-0.046	-3.442	0.355	9.378	0.605*	9.067**	-0.149	-0.566	68.70
	Aphids	0.504*	27.374	-0.596*	-91.169	0.441	7.200	-0.607**	-127.422	58.80
1993	Jassids	0.656**	-0.831	0.479	9.080	0.685**	2.023	-0.849**	-21.237*	79..40
	Thrips	-0.415	1.343	-0.021	16.887	-0.529*	-1.638	0.623**	20.897	54.80
	Whitefly	0.789**	2.945	0.317	0.741	0.502*	2.169	-0.771**	-7.606	66.30
	Aphids	0.390	-44.386	0.320	149.261	0.280	-52.407	-0.592*	-627.821*	45.80

* = Significant, ** = high significant

As for the effects on thrips population, the temperature gave positively insignificant effect in 1992 season and negatively insignificant one in 1993 season, while wind speed exhibited positively high significance in the two seasons. Alos, the population was affected with relative humidity insignificantly in the first season and significantly in the second one.

Regarding whitefly, the temperature induced positive but insignificant effect on the population in the two seasons, whereas relative humidity exhibited positively significant effect. On the other hand, the effect of wind speed was negatively insignificant in the first season and highly significant in the second one.

Concerning aphids, the effect of relative humidity on the population was insignificantly positive in the two seasons while wind speed induced significantly negative effet. On the other hand, the temperature affected the population negatively significant in the first season and positively insignificant in the second one.

The results obtained clear that the effect of predators on the population of the tested insects was insignificant except for the effect on aphids which was significant in first season, whereas it was highly significant on jassid and whitefly in the second one.

The combined effect of the four considered factors on the population of the tested insects, Table 3 as percentage of explained variance clears that in the first season the four considered factors were responsible for 84.76, 73.9, 68.70 and 58% of changes in the population of jassids, thrips, whitefly and aphids, respectively, and for 79.40, 54.80, 66.30 and 45.8%, respectively in the second season. This means that there are remained factors affecting the populations of the tested insects.

Finally, the gained results lead to the conclusion that populations of the four sucking insects were higher in the second season than in the first one. Aphids was the most dominant insect species during both seasons. Also, the combined effect of the common predators and the three climatic factors was more pronounced on jassids than on the other tested insects while aphids was the least affected.

REFERENCES

1 . Ali, F.I. 1993. Ecological studies on certain insect pests of maize and soybean/ maize intercropping systems. Ph.D. Thesis, Fac. of Agric. Al-Azhar Univ.

2 . Audemard, H. and H.G. Milaire. 1975. Le pegeage carpocapse (*Laspeyresia pomonella* L.) avec une phermone sexuelle de synthese: premiers results utilisables pour l, estimation des populations et la conduite de la lulte. Ann. Ecol. Anim. 7: 61.

3 . Awadalla, S.S., A.A.S. El-Zanan and R.M. Salem. 1991. Studies on injurious insects infesting soybean plants and the efficiency of certain chemicals against these pests at Kafr El-Sheikh, Egypt. J. Agric. Sci. Mansoura Univ. 16 (2) : 420-429.

4 . Awadalla, S.S., A.A.S. El-Zanan and R.M. Salem. 1992. Abundance of predaceous insects in soybean fields as influenced by the application of some insecticides and their binary mixtures with two synthesis inhibitors. Egypt. J. Appl. Sci., 7 (15) : 716-726.

5 . Badenhop, A.F. and L.R. Hackler.1971. Protein quality of dry roasted soybean: amino acid composition and protein efficiency ratio. J. of Food Science 36:1-4.

6 . Bechinaki, E.J. and H.P. Bedigo. 1982. Evaluation of method for sampling predatory arthropods in soybeans. Environ. Ent., 11 (3) : 756-761.

7. Dent, D. 1991. Insect pest management. C.A.B. International.

8. El-Adl, M.A., A.A. Ghanim and A.A.A. Said. 1988. Field trials on predator insects inhabiting soybean and their susceptibility to some insecticides and their combinations with two IGR'S at Mansoura, Egypt. J. Agric. Sci. Mansoura Univ., 13 (3) : 1427-1434.

9. El-Kifl, A.H., A.E.A. Wanab, M.A. Assem and A.A. Metwally. 1974. List of insects, mites and pests associated with leguminous crops in Egypt. Bull. Soc. ent. Egypte, 58: 297-302.

10. Fisher, R.A. 1950. Statistical methods for research workers. Il. Rev. Ed. Oliver and Boyd. London.

11. Hamed, M.A.A. 1977. Survey of insects on soybean. M.Sc. Thesis, Fac. of Agric. Al-Azhar Univ., Cairo.

12. Iacob, N.O. 1977. Un model matimatic pentra stabitirea limiterloor economic de to lerenta a atacalui molilor tructilor in lupta integrate. Ana Lele I.C.P.P. 15-179 Romania.

13. Kogan, K. and D.C. Herzog. 1980. Sampling methods in soybean Entomology. Springer-Verlag New York PP. 507.

14. Metwally, S.A.G. 1989. Ecological studies on some insect pests infesting certain legume crops in Qualyobia Governorate. Ph.D. Thesis, Fac. of Agric., Cairo Univ.

15. Shaheen, A.H. 1977. Survery of pests attacking soybean plants in Egypt with some ecological notes. Agric. Res. Rev. 55 (1) : 59-65.

ديناميكية تعداد بعض الحشرات الثاقبة الماصة ووفرتها الموسمية على فول الصويا بمحافظة كفر الشيخ

عبد المنعم سليمان الخولى ١، السيد محمد السيد خلف الله٢ ، منير محمد متولى١ ،
هلال أحمد هلال١ ، الأنصارى بلتاجى المزين٢

١ كلية الزراعة - جامعة الازهر - القاهرة .
٢ معهد بحوث وقاية النباتات - مركز البحوث الزراعية الدقى .

تهاجم الحشرات الثاقبة الماصة فول الصويا فى الحقل مسببة له اضرار خطيرة - وحيث أن العلاقات بين الحشرات واعدائها الحيوية من العمليات الايكولوجية الضرورية التى تشارك فى تنظيم تعداد تلك الحشرات، لذا أجرى هذا البحث لدراسة الكثافة العددية للمن والذبابة البيضاء والتربس والجاسيد على فول الصويا وعلاقتها بالمفترسات المصاحبة (حشرة الرواغة - اسد المن - وابو العيد ذو الاحدى عشر نقطة - حشرة الإسكمنس) والعوامل الجوية السائدة (الحرارة - الرطوبة النسبية - سرعة الرياح) خلال موسمى ١٩٩٢ ، ١٩٩٣ م.

واوضحت النتائج المتحصل عليها ما يلى :-

١ . كان تعداد الحشرات الثاقبة الماصة والمفترسات المصاحبة موضع الدراسة أعلى فى الموسم الثانى عنة فى الموسم الأول.

٢ . حدث الاعداد كل حشرة ذروة واحدة لا تتفق مع ذروات الحشرات الأخرى.

٣ . لوحظ لكل من الذبابة البيضاء والتربس والجاسيد جيل واحد خلال كل موسم بينما كان للمن جيلين فى الموسم الواحد.

٤ . بأخذ المجموع الكلى للمفترسات فى الإعتبار حدثت ذروتان لأعدادها فى كل موسم - حيث ظهرت الذروة الأولى فى النصف الثانى من يولية لكلا الموسمين بينما ظهرت الذروة الثانية فى ٢٧ سبتمبر للموسم الأول ١٩٩٢ ، ٦ سبتمبر للموسم الثانى ١٩٩٣ م.

٥ . كان التأثير المشترك للمتوسط الإسبوعى لتعداد المفترسات ودرجة الحرارة والرطوبة النسبية وسرعة الرياح مسئولا عن ٧٦ ، ٨٤٪، ٧٣,٩٪، ٦٨,٧٠٪، ٥٨,٠٠٪ من المتغيرات فى تعداد كل من الجاسيد والتربس والذبابة البيضاء والمن على الترتيب فى الموسم الاول بينما كان التأثير المشترك مسئولا عن ٧٩,٤٠٪ ، ٥٤,٨٠٪ ، ٦٦,٣٠٪ ، ٤٥,٨٠٪ من المتغيرات فى تعداد الجاسيد والتربس والذبابة البيضاء والمن على الترتيب فى الموسم الثانى. وعموما هذة النتائج هامة جدا فى عمليات المكافحة المتكاملة لهذة الحشرات.