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SURVEY OF ARTHROPODOUS AND EFFECT OF COTTON BOLLWORMS INSECTICIDES ON PIERCING-SUCKING PESTS AND THEIR ASSOCIATED PREDATORS IN COTTON FIELD AT ASSIUT DISTRICT

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ABSTRACT

Survey of arthropodous fauna on cotton was carried out at Assiut district from the first week of July till the end of ٢٠٠٨ cotton growing season. The experiment was carried out weekly on four plots treated with different insecticides, leaving untreated plot as control. Results indicated the occurrence of ٣٦ insect and mite species, pertaining to ٢٤ families of ١١ orders, in addition to some unidentified species of true spiders. The most dominant and abundant of piercing-sucking pests were: *Empoasca* spp., *Aphis gossypii* and *Campylomma impecta*. Meanwhile, true spiders, *Scymnus* spp. and *Orius* spp. were the common predators. The results also showed that, population density of the piercing-sucking pests increased gradually and reached the maximum during the fourth week of July then decreased gradually till the end of the season. Concerning the insecticide treatments, Cloroban pesticide was less effective on the piercing-sucking pests, followed by Curacron. Agristar and Bestox were the most destructive insecticides on the piercing-sucking pests. On the other hand, all tested insecticides were unsafe on the predators, and can be

arranged descendingly according to their toxicity to predators as follows: Bestox, Curacron, Cloroban and Agristar. Finally, all tested insecticides were harmful to pests and predators occurred in cotton fields.

Piercing-sucking pests in cotton field at Assiut district

INTRODUCTION

Cotton crop, *Gossypium barbadense* Linn. is subjected to attack by several pests in Egypt causing severe damage in quantity and quality of the crop. Recently, the piercing-sucking pests are considered the most important pests, causing major economic damage to the cotton plants from seedling stage until crop maturation (El-Sayed *et al*., ١٩٧٦; Mohamed, ١٩٨٦; Helaly *et al*., ١٩٩٤; Hassanein *et al*., ١٩٩٥; Abdel-Galil *et al*., ٢٠٠٢ and Nassef & Nassef, ٢٠٠٣). Many authors discussed the population densities of predators in cotton fields and studied their role in regulating cotton pests in Egypt (Hafez, ١٩٧٢; Ali *et al*., ١٩٧٥; El-Heneidy *et al*., ١٩٧٩; Hamed *et al*., ١٩٨٣; Abdel-Fattah *et al*., ١٩٨٧; Gharib, ١٩٩٢; Abbas & El-Deeb, ١٩٩٣ and Abo-Shaeshae, ٢٠٠١).

The use of pesticides was the basis of most efforts to control cotton pests. Recently, Ministry of Agriculture and Land Reclamation started to implement new strategies for the use of pesticides in pest control management. Among these strategies; biological control agents (Predators and Parasitoids) of certain serious pests attacking cotton plants.

The present work was conduced to survey the arthropodous fauna inhabiting cotton fields in order to determine the dominance and abundance of the major piercing-sucking pests and their associated predators. The relative abundance of the piercing-sucking pests and their predators in untreated and treated cotton plants was also studied.

MATERIALS AND METHODS

Experimental outline:

Survey and population densities of the piercing-sucking pests and their associated predators prevailing in cotton fields were studied at Mousha Province, Assiut Governorate during ٢٠٠٨ season from the first week of July till the end of the season. An area of ٥ feddans cultivated with cotton, variety Giza ٩٣ was divided into ٥ plots

(١ feddan / each). Four plots were treated with different chemical insecticides in order to control the cotton bollworms and the remaining one did not receive any insecticides and served as a control. The control treatment was used to study the fauna composition of the athropodous exhibiting cotton fields. The insecticides used and the time of spraying were as tabulated.

Pesticide group	Commercial name	Dose/ feddan	Time of spraying*		
			First	Second	Third
Pyrethroids	Bestox	١٦٥ cm	٥/٧	٢٦/٧	١٨/٨
	Agristar	٥٠٠ cm	٥/٧	٢٦/٧	١٨/٨
Organophosphorus	Curacron	٧٥٠ cm	٨/٧	٢٣/٧	٩/٨
	Cloroban	١ L.	٨/٧	٢٣/٧	٩/٨

* Pesticide applications were practiced on July ٥th at ٣ week intervals in case of pyrethroids and ٢ week interval in case of the organophosphorus.

Sampling technique:

To study the fauna composition of arthropodous and their associated predators exhibiting untreated cotton plantation, the sweep-net (١٥ inches in diameters) was used. Also, the same technique was used to determine the population densities of the piercing-sucking pests and their predators in the untreated and treated cotton plantation. Weekly samples were randomly taken (١٠٠ net strokes) from untreated and treated growing cotton (Samhan, ٢٠٠٣). Each collected sample was placed in a labeled collecting muslin bag and transferred to the laboratory. Collected arthropods were killed by chloroform and

examined for counting and identification by means of stereoscopic microscope. Numbers of species of each sample were recorded. Identification of collected arthropods was made by specialists of insect classification Department, Plant Protection Research Institute, Agricultural Research Center.

From the forementioned counts, the dominance, abundance degrees and the relative abundance of the piercing-sucking pests and their predators were determined.

Dominance degrees (D) for the identified species were calculated according to the formula of Facylate (١٩٧١):

$$D = t/T \times ١٠٠$$ where,

t= Total number of each species during the collecting periods.
T= Total number of all species collected during the same collecting periods.

Abundance degrees (A) of the pests and their associated predators during the collecting periods were calculated according to the formula of Facylate (١٩٧١):

$$A = n/N \times ١٠٠$$ where,

n= Number of samples in which each species appeared.
N= Number of samples taken allover the season

To calculate the Reduction (R%) in number of the predators Abbott's formula (Abbott, ١٩٢٥) was used

RESULTS AND DISCUSSION

Fauna composition of arthropodous species in the untreated cotton fields:

The surveyed of arthropoda recovered from the untreated cotton plants are listed in Table ١. Arthropod (٣٦) species pertaining to ٢٤ families under ١١ orders were identified. Certain unidentified species of the true spiders (order: Araneae) were also collected. The list indicated that, order Hemiptea recorded the highest number of species

(٩), followed by Coleoptera (٦), Homoptera (٥), both Hymenoptera and Lepidoptera (٤), Diptera and Orthoptera (٢), then Dictyoptera, Neuroptera and Thysanoptera (١). The two-spotted spider mite, *Tetranychus arabicus* was also recoded.

Regarding to families, the coccinellidae and Noctuidae have the highest number of species (٤) followed by Lygaeidae (٣), while Aphididae, Anthocoridae, Miridae, Jassidae and Acrididae (٢). Rest of families have recorded ١ species. Abdel-Galil *et al*. (١٩٨٢) recorded eighteen species of insects and one species of Araneae in cotton fields, in Upper Egypt.

Piercing-sucking pests in cotton field at Assiut district

Table ١: Partial list of arthropodous fauna recovered from untreated cotton fields, Assiut, ٢٠٠٨.

Order	Family	Common name	Scientific name	Remarks
Araneae	Various families	True spiders	Unidentified species	B
Acari	Tetranychidae	Two spotted spider mite	*Tetranychus arabicus*	A
Dictyoptera	Mantidae	Praying mantids	*Sphodromantis bioculata* Burm	B
Orthoptera	Acrididae	Clover grasshoppers	*Eypreponemis aloans* (Charp.)	A
		Egyptian locust	*Anacridium aegyptium* L.	A
Thysanoptera	Thripidae	Cotton thrips	*Thrips tabaci* Lind.	A
Hemiptera	Anthocoridae	Flower bug	*Orius albidipennis* (Rossi)	B
		Flower bug	*Orius laevigatus* (F.)	B
	Lygaeidae	Cotton seed bug	*Oxycarenus hyalinipennis* Costa	A
		Large bigeyed bug	*Geocoris pallidipennis* (Rossi)	B
		Seed bug	*Nysius gramincohus* Kolenut	A
	Miridae	Bad-shedder bugs	*Creontides pallidus* Rambur	B
		Campylomma bugs	*Campylomma impicta* (Wan.)	A
	Nabidae	Damsel bugs	*Nabis viridis* Koch	B
	Pentotomidae	Green stink bugs	*Nezara viridula* L.	A
Homoptera	Aphididae	Cotton aphid	*Aphis gossypii* Glover	A
			Aphidius sp.	C
	Aleyrodidae	Cotton whitefly	*Bemisia tabaci* (Genn.)	A
	Jassidae	Leaf hoppers	*Emposasca descipiens* Padi	A
		Leaf hoppers	*Empoasca lybica* (Ninfa)	A
Neuroptera	Chrysopidae	Green lacewing	*Chrysopa carnea* Steph.	B
Lepidoptera	Noctuidae	Cotton cut worm	*Spodoptera exigua* (Hubner)	A
		Cotton leaf worm	*Spodoptera littoralis* (Boisd.)	A
		Spiny boll worm	*Earias insulana* (Boisd.)	A
		Pink boll worm	*Pectinophora gossypiella*	A

			(Saund.)	

Table ١: Cont.

Order	Family	Common name	Scientific name	Remarks
Coleoptera	**Coccinellidae**	**Ladybird beetles**	***Coccinella undecimpunctata* L.**	**B**
			***Scymnus interruptus* Goeze**	**B**
			***Scymnus syracus* Mars.**	**B**
			***Scymnus pallipediformis* Gun.**	**B**
	Cuculionidae	**Clover leaf weevil**	***Phytonomus variabilis* Herbst**	**A**
	Staphylinidae	**Rove beetles**	***Paederus alfierii* Koch**	**B**
Hymenoptera	**Apidae**	**Honey bee**	***Aphis mellifera***	**D**
	Braconidae	**braconids**	***Bracon* sp.**	**C**
	Trichogrammatidae	**Minute egg parasite**	***Trichogramma* sp.**	**C**
	Vespidae	**Yellow wasps**	***Polistes gallica* L.**	**B**
Diptera	**Muscidae**	**House fliy**	***Musca domestica* L.**	**D**
	Syrphidae	**Hover fliy**	***Syrphus corollae* F.**	**B**

A = Pest B = Predator
C = Parasitoid D = Visitor

Dominance and abundance degrees of sucking pests and associated predators:

Data in Table ٢ show the dominance and abundance degrees of the piercing-sucking pests and the associated predators in cotton field at Assiut Governorate during ٢٠٠٨ season. It is clear that the pests

dominated over the predators. The total numbers of the pest species comprised ٦٤.٧٧٪ of the total number of pests and predator species collected during the period which extended from the first week of July to the end of the cotton growing season, ٢٠٠٨. The corresponding percentage of predator species was ٣٥.٢٣٪. On the other hand, most serious pests on late cotton season in the studied area were; *Empoasca* spp., *Aphis gossypii* and *Campylomma impicta*, which had high values ٤٣.٠٨٪ & ٩٦.٨٨٪; ٣١.٧٥٪ & ٦٨.٧٥٪; and ١٢.٢٤٪ & ٦١.٥٤٪ for both dominance and abundance degrees, respectively. The low dominance and abundance degrees of *Bemisia tabaci*, *Thrips tabaci* and *Nezara viridula* were ٤.٩٠٪ & ٣٧.٥٠٪; ٥.٩٧٪ & ٥٣.١٣٪ and ٢.٠٧٪ & ٢٥.٠٠٪, respectively. This may be indicated that, these pests could not be considered as economic pests during the late cotton season.

The highest degrees of the dominance and abundance of certain predators such as: true spiders, *Scymnus* spp. and *Orius* spp. with occurrence percentages of ٣٦.٥٦٪ & ١٠٠.٠٠٪; ٢٤.٦١٪ & ١٠٠.٠٠٪ and ٢٠.٢٤٪ & ١٠٠.٠٠٪, respectively, indicated that these species are well established themselves in the studied area.

In general, true spiders seemed to be the dominant predator in the experimental cotton field of Assiut, followed by *Scymnus* spp., then *Orius* spp. The dominance degrees of the examined pests were in general greater than those of the recovered predators. The lower density of the predators in the late cotton season may be due mainly to the decreasing of the pests and/or the migration of these predators to the adjacent plants.

These results for certain extent are agreed with those recorded by Abdel-Galil (١٩٧١) was found that true spiders were considered one of the most dominant predaceous arthropods in cotton fields, it's appeared during April and reach it's peak throughout June, July and August. On the other hand, El-Heneidy *et al*. (١٩٧٩) reported that, *Orius* spp. seemed to be the dominant predator followed by the spiders

in cotton field at El-Fayoum Governorate. Nassef *et al*. (١٩٩٦) stated that, the common dominant predators recorded on cotton plants were *P. alfierii* followed by *C.undecimpunctata* , *Scymnus* spp., true spiders, *Orius* spp. and *Ch.carnea*

Table ٢: Dominance and abundance degrees (D & A) of the piercing-sucking pests and their predators recovered from untreated cotton fields, Assiut, ٢٠٠٨.

No. of individuals/١٠٠ net strokes							
Piercing sucking pests				**Predators**			
Species	**No.**	**D%**	**A%**	**Species**	**No.**	**D%**	**A%**
A. gossypii	٨٣٠	٣١.٧٥	٦٨.٧٥	***C. undecimpunctata***	٤٣	٣.٠٢	٣١.٢٥
B. tabaci	١٢٨	٤.٩٠	٣٧.٥٠	***Scymnus* spp.**	٣٥٠	٢٤.٦١	١٠٠.٠٠
***Empoasca* spp.**	١١٢٦	٤٣.٠٨	٩٦.٨٨	***P. alfierii***	٥٨	٤.٠٨	٣٧.٥٠
N. viridula	٥٤	٢.٠٧	٢٥.٠٠	***G. pallidipennis***	١٠	٠.٧٠	٢٥.٠٠
C. impecta	٣٢٠	١٢.٢٤	٦١.٥٤	***N. viridis***	١٥	١.٠٥	١٨.٧٥
T. tabaci	١٥٦	٥.٩٧	٥٣.١٣	***Orius* spp.**	٢٩٠	٢٠.٤٠	١٠٠.٠٠
				C. pallidus	٦٧	٤.٧١	٦٢.٥٠
				C. carnea	٥٧	٤.٠١	٥٠.٠٠
				S. biculata	١٢	٠.٨٤	٤٣.٧٥
				True spiders	٥٢٠	٣٦.٥٦	١٠٠.٠٠
Total	٢٦١٤			**Total**	١٤٢٢		
G. Total	٤٠٣٦						
Dominance %	٦٤.٧٧			٣٥.٢٣			

Population densities of the piercing-sucking pests and their predators in untreated and treated cotton fields:

Data in Table ٣ show the total numbers of the piercing-sucking pests recovered from the untreated and treated cotton fields during ٢٠٠٨ season. The number of the piercing-sucking pests/١٠٠ net strokes in the control plot was ٨٥ individuals on ١٠th July. The number increased gradually to reach the peak (٢٦٨ individuals/١٠٠ net strokes) in the fourth week of July then decreased gradually till the

end of the season, ranging between ٢٨ to ١٨٨ individuals/١٠٠ net strokes. Abdel-Galil *et al*. (٢٠٠٢) reported that leafhoppers, whiteflies, cotton aphid and spider mites were the most encounted pests inhabiting cotton fields at seedling and foliage stages.

Concerning the treated plots, the total numbers of the piercing-sucking pests were in the of range ٢٢ to ٤٨ individuals/١٠٠ net strokes on ١٠th July after the application of insecticides. A decrease in number was always noticed in the treated plots compared with the control till the end of the season. The data of Table ٣ also show that, cloroban pesticide was less effective on the pests (٥٦٧ individuals), followed by Curacron (٥٥٢ individuals). Meanwhile, Agristar and Bestox recorded (٣١٤ and ٤٠٦ individuals), respectively were the most destructive insecticides on piercing-sucking pests. Collman and All (١٩٨٢) mentioned that the pyrethroids insecticides were the most effective toxicant against all the life stage on the greenhouse whitefly. The increase in the late season population of the pests may be due to the decrease in the early season populations of the predators in the treated fields (Nassef and Nassef, ٢٠٠٣).

Table ٣: Numbers of piercing-sucking pests recovered from treated and untreated cotton fields, Assiut, ٢٠٠٨.

Sampling date	Number of pests/١٠٠ net strokes				
	Control	Treated plots			
		Organophosphorus		pyrethroids	
		Curacron	Cloroban	Bestox	Agristar
١٠/٧/٢٠٠٨	٨٥	٣٦	٤٨	٢٦	٢٢
١٧	١٧٠	١١٠	٨٦	٣٢	١٧
٢٤	١٩٨	٤٤	٥٢	٥٦	٤٥
٣١	٢٦٨	٩٠	٤٨	٢٤	٣٢

Piercing-sucking pests in cotton field at Assiut district

٧/٨	١٨٨	٦٤	٤٤	٣٢	٢٦
١٤	١١٦	٣٨	١٠٠	٣٠	٣٨
٢١	١٢٢	٥٠	٦٨	٧٨	٦٦
٢٨	٩٦	٧٠	٥٧	٦٠	٢٨
٤/٩	٦٣	٣٣	٤٢	٥٤	٢٦
١١	٢٨	١٨	٢٢	١٣	١٤
Total	١٣٣٤	٥٥٢	٥٦٧	٤٠٥	٣١٤

The relative abundance of predator species associated with piercing-sucking pests are summarized in Table ٤. In the control plot it could be arranged in the descending orders according to their densities as follows: true spiders, *Scymnus* spp., *Orius* spp., *C.pallidus, P.alfierii, Ch.carnea, C.undicimpunctata, N.viridis* and *G. pallidipennis*. The total number of these predators in the late season were, ٥٢٠, ٣٥٠, ٢٩٠, ٦٧, ٥٨, ٥٧, ٤٣, ١٥ and ١٠, respectively.

Table ٤: Relative abundance of predators recovered from untreated and treated cotton fields, Assiut, ٢٠٠٨.

Predators	Number of individuals/١٠٠ net strokes								
	Control	Treated plots							
		Organophosphorus				Pyrethroids			
		Curacron	R%	Cloroban	R%	Bestox	R%	Agristar	R%
C. carnea	٥٧	١٠	٨٢.٤٦	٢٨	٥٠.٨٨	١٧	٧٠.١٨	٢٥	٥٦.١٤
C. pallidus	٦٧	١٤	٧٩.١٠	٢٢	٦٧.١٦	١١	٨٣.٥٨	١٨	٧٣.١٣
Coccinella spp.	٤٣	١٥	٦٥.١٢	١٣	٦٩.٧٦	١٣	٦٩.٧٦	٣٨	١١.٦٣
G. pallidipennis	١٠	٨	٢٠.٠٠	٦	٤٠.٠٠	٥	٥٠.٠٠	٧	٣٠.٠٠
Orius spp.	٢٩٠	٢٢	٩٢.٤١	٧٧	٧٣.٤٥	١٦	٩٤.٤٨	١٢	٩٥.٨٦
P. alfierii	٥٨	٣	٩٤.٨٣	١٨	٦٨.٩٧	٧	٨٧.٩٣	٢٠	٦٥.٥٢
N. viridis	١٥	١٣	١٣.٣٣	١١	٢٦.٦٧	٤	٧٣.٣٣	٨	٤٦.٦٧
Scymnus spp.	٣٥٠	٣٥	٩٠.٠٠	٦٣	٨٢.٢٠	٣٠	٩١.٤٣	٥٥	٨٤.٢٩
True spiders	٥٢٠	٤٦٠	١١.٥٤	٣٩٠	٢٥.٠٠	٤٢٠	١٩.٢٣	٤٨٠	٧.٦٩
Total	١٤١٠	٥٨٠		٦٢٧		٥٢٣		٦٦٣	
Mean	١٥٦.٦٧	٦٤.٤٤		٦٩.٦٧		٥٨.١١		٧٣.٦٧	

In the treated plots, the number of predators decreased dramatically after insecticides application. All tested pesticides were found to be unsafety on predators. It could be arranged in the descending orders according to their effectiveness as follows: Bestox, Curacon, Cloroban and Agristar. The total numbers of predators in untreated after application with these forementioned insecticides were: ٥٢٣, ٥٨٠, ٦٢٧ and ٦٦٣ respectively. Many authors studies the population abundance of major predators occurring in cotton fields (Ibrahim, ١٩٦٢; Habib *et al.*, ١٩٧٦; El-Heneidy *et al.*, ١٩٧٩ and

Hamed *et al*., ١٩٨٣), they indicated that the successive application of pesticides to control pests badly affected the natural enemies, for this reason the population of the piercing-sucking pests increased to considerable levels, causing injury in cotton yield.

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حصر مفصليات الارجل وتأثير مبيدات ديدان اللوز على الحشرات الثاقبة الماصة ومفترساتها فى حقول القطن فى منطقة اسيوط.

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أجريت هذه الدراسة بهدف دراسة التركيب النوعي لمفصليات الأرجل التي تتواجد علي نباتات القطن غير المعاملة وكذلك دراسة التأثير المباشر لاستخدام مبيدات ديدان اللوز علي تعداد الحشرات الثاقبة الماصة والمفترسات المصاحبة لها خلال موسم ٢٠٠٨ . وفيما يلي أهم النتائج:

سجلت النتائج ٣٦ نوعاً من مفصليات الأرجل تنتمي إلي ٢٤ فصيلة و ١١ رتبة حشرية بالإضافة إلي بعض الأنواع غير المعرفة من العناكب الحقيقية التابعة لرتبة Araneida . ووجد أن حشرات نطاطات الأوراق ، منّ القطن ، بق النبات هي أهم الحشرات الثاقبة الماصة تواجداً علي نباتات القطن من حيث درجة السيادة والوفرة العددية، في حين كانت العناكب الحقيقية، حشرة أبي العيد، إسكمنس ، حشرة بق الأوريس هي أهم المفترسات سيادة ووفرة عددية بالنسبة لباقي الأنواع الأخري من المفترسات . وقد وجد أن درجة السيادة للآفات كانت عالية مقارنة بسيادة المفترسات المصاحبة لها وأن الحشرات الثاقبة الماصة سجلت أعلي تعداد لها في نهاية شهر يوليو ثم أخذت في التناقص تدريجياً حتي نهاية الموسم.

كما أوضحت الدراسة أن جميع المبيدات المستخدمة كان لها تأثير فعال علي كلاً من الحشرات الثاقبة الماصة والمفترسات. سجل مبيد كلوروبان أقل تأثير علي الحشرات الثاقبة الماصة يليه مبيد كوراكرون بينما كانت المبيدات أجريستار وبستوكس ذو تأثير عالي في خفض تعداد الحشرات الثاقبة الماصة كما أمكن ترتيب المبيدات المستخدمة تنازلياً علي حسب شدة سميتها علي المفترسات كما يلي: بستوكس ، كوراكرون ، كلوروبان وأجريستار.

Piercing-sucking pests in cotton field at Assiut district