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INCIDENCE OF CERTAIN ARTHROPOD PESTS AND PREDATORS INHABITING COWPEA, WITH SPECIAL REFERENCE TO THE VARIETAL RESISTANCE OF SELECTED CULTIVARS TO *BEMISIA TABACI* (GEN.) AND *TETRANYCHUS URTICAE* KOCH.

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ABSTRACT :

Incidence and faunistic composition of arthropod pests and their associated predators in cowpea plantations have been determined during 2000 and 2001 growing seasons in Assiut Governorate. Fifteen phytophagous species and five arthropod predators in addition to unidentified true spiders were recorded by using sweep net method. Results indicated that the dominance percentages of arthropod pests was higher than those of predators. The most dominant pest species were the piercing sucking pests *Empoasca* spp.; *Nezara viridula*, *Creontiades pallidus* and the lycaenid *Lambides boeticus*. However, the most dominant predators were *Coccinella undecimpunctata; Orius* spp. and *Scymnus interruptus*. Also results, exhibited distinct compatability between the abundance of the above mentioned pests and their associated predators. These results must be use to enable these biological control agents in suppressing cowpea pests and regulate their numbers. Regarding to the relative susceptibility of the tested cowpea cultivars to the whitefly *Bemisia tabaci* and the two spotted spider mite *Tetranychus urticae* the cowpea cultivar Kaha 1 only showed some sort of resistance against the two pests. It appeared as low resistant (LR) and moderately resistant (MR) cultivar against these two pests, respectively. Leaf morphological characters and/or sap nutrients of this cultivar may be the main factors responsible for the existence of these resistance degrees. Therefore, plant breeders must be study characters of this cultivar in more details and transfere the desirable one's into the other new produced cowpea cultivars.

INTRODUCTION:

Cowpeas (blackeye peas, or simply beans in many parts of Africa), *Vigna unguiculata*, L (Walp) are widely grown in the tropics and subtropics for human as well as for animal food. They are eaten as green seeds, green pods and dry grains. Tender leaves are used as a vegetable (Kayumbo, 1978). In Egypt, cowpeas has been subjected to attack by several pests (Harakly, 1972 and El-Kifl *et al.*, 1974). The whitefly (WF) *Bemisia tabaci* and the two spotted spider mite (TSSM) *Tetranychus urticae* have been reported as severe cowpea pests in Southern Upper Egypt (Abdel-Alim, 1994 and Abou El-Saad, 1998). Nowdays, control strategies must be developed to control cowpea

pests without using insecticides. Resistant plants appears to be one of the most promising alternatives to the use of chemicals for cowpea pests control as reported by Nosser, (1996); Amro, (1999); Mohamed *et al.*, (2000) and Abdel-Galil *et al.*, (2001). Therefore, the present study was initiated to recover the incidence of the cowpea pests and their associated predators and determine their faunistic composition. Also, to determine the relative susceptibility of certain cowpea cultivars to *B. tabaci* and *T. urticae* under Southern Egypt circumstances.

MATERIALS AND METHODS:

The present study was carried out in the Experimental Farm of the Faculty of Agriculture, Assiut University, during the two successive cowpea growing seasons 2000 and 2001. An area of about 1/8 feddan was cultivated with 5 cowpea cultivars which obtained from Faculty of Agriculture, Assiut University and Horticulture Institute, Agricultural Research Center. The experiment was carried out in completely randomized block design, with three replicates (1/400 fed.) per each cultivar. Regular conventional practices were normally performed and insecticides were prevented.

1-Faunistic composition of arthropod pests and predators inhabiting cowpea plantations:

Sweep net method have been used to study the faunistic composition of arthropod pests and their associated predators inhabiting cowpea plantations. Four samples of 50 double sweeps/100 m^2 were randomly taken weekly 60 days after plantations till harvesting. Each collected sample was emptied into a labelled collecting muslin bag and transferred into the laboratory. Specimens were killed by chloroform and examined under steriomicroscope. Number of individual and species of each sample was recorded. Identification of collected arthropods was made by the specialists of Insect Classification Department, Plant Protection Research Institute, Agricultural Research Center.

2-Dominance and abundance percentages of the recovered species:

By using the same above mentioned samples, dominance and abundance percentages of arthropod pests and predators inhabiting cowpea plantations were determined by the formula(s) of Facylate (1971) as follows:

$$1\text{- } D = (t/T) \times 100$$

where:
D= Dominance percentage.
t= Total number of each species during collecting period.
T=Total number of all species collected during the collecting period.

$$2\text{-}A = (n/N) \times 100$$

where,
A= Abundance percentage
n= Total number of samples in which each species appeared.
N= Total number of samples taken all over the season.

3-Susceptibility of cowpea cultivars to the whitefly *Bemisia tabaci* and the two spotted spider mite *Tetranychus urticae*:

The whitefly and the spider mite populations were monitored weekly during July, August and September in the two cowpea successive growing seasons. Samples of 5 trifoliate leaves were picked up at random from each abovementioned experimental unit. Numbers of the whitefly (nymphs) and the spider mite (mobile stages) which refere to the seasonal fluctuations of these pests were calculated. The classification of the susceptibility degree of each cowpea cultivar

were dependent on the general mean number ($\overline{X}$) of the (WF) and/or the (TSSM) and the standard deviation (SD) as reported by Chiang and Talekar (1980). The cultivars that had mean numbers more than $\overline{X}$+2SD, considered highly susceptible (HS); between $\overline{X}$ and $\overline{X}$+2SD, susceptible (S); between $\overline{X}$ and $\overline{X}$-1SD, low resistant (LR); between $\overline{X}$-1SD and $\overline{X}$-2SD, moderately resistant (MR) and less than $\overline{X}$-2SD, were considered highly resistant (HR).

Data obtained were statistically analyzed by using F-test. The means were compared according to Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION:

1-Faunistic composition of arthropod pests and predators inhabiting cowpea plantations:

A partial taxonomic list of arthropod pests and predators recovered from cowpea plantations is reported in Table (1). Arthropod pests were represented by 15 species belonging to 9 families and 4 orders. However, arthropod predators were represented by 5 species belonging to 4 families and 4 orders. Unidentified true spiders were also countered. In a similar study, El-Sayed (1993) recorded 16 insect pest species and 8 arthropod predators in addition to 8 parasitoid species in association with cowpea plantations in Minufiya Governorate.

2-Dominance and abundance percentages of the recovered species:

Data presented in Table (2) indicate the dominance and abundance percentages of arthropod pests and predators inhabiting cowpea plantations. The dominance percentages of arthropod pests were so high and represented by 90.53 and 96.86% during 2000 and 2001 growing seasons, respectively. However, the dominance percentages of the associated predators were low and represented by 9.47 and 3.14% during the same period. The leafhopper *Empoasca* spp., revealed the highest dominance percentage during the period of study. It followed by the Heteropteran sucking pests *Nezara viridula* and *Creontiades pallidus* and then by the Lycaenid *Lambides boeticus*. The rest of the herbivorous species were represented in low dominance percentages. In order to the predaceous species the lady bird beetle *Coccinella undecimpunctata* revealed the highest dominance percentage. It followed by the Heteropteran predator *Orius* spp. and the Coccinellid *Scymnus interruptus*. The true spiders also, were represented in high dominance percentages. Concerning the abundance percentages, the above mentioned phytophagous and predaceous species were exhibited the highest abundance percentages. This synchronyzation and/or agreement between the incidence of the main cowpea serious pests and their associated predators may be increase the ability of these biological control agents in suppressing the populations of insect pests and regulate their numbers. In this respect, very few numbers of biological control agents that have potential importance in cowpea pests suppression have been reported by few workers such as Hammad, (1978); Saharia, (1980) and Daoust *et al*., (1985). Though, the current investigation may be consider as a view on the relationship between the herbivorous cowpea insects and their associated predators which may be maintain their population densities so low that their effect on plant dynamics would be small.

Table (1) : A taxonomic list of collected arthropod pests and predators recovered by sweep net from cowpea plantations, Assiut 2000 and 2001.

Order	Family	Scientific name
Pests		
Hemiptera-Heteroptera	**Pentatomidae (stink bugs)**	***Carpocoris purureipennis* (De Geer)**
		***Eysarcoris inconspicuus* (H. & S.)**
		***Nezara viridula* (Linnaeus)**
	Lygaeidae (seed bugs)	***Graptostethus servus* (Fabricius)**
		***Nysius graminikola* (Kolenati)**
		***Oxycarenus hyalinipennis* (Costa)**
		***Spilostethus longulus* (Dallas)**
	Miridae (Plant or leaf bugs)	***Campylomma impicta* (Wagner)**
		***Creontiades pallidus* Ramb**
	Rhopalidae (Scentless plant bugs)	***Liorhyssus hyalinus* (Fabricius)**
Homoptera	**Cicadellidae (leaf hopper)**	***Empoasca* spp.**
	Aleyrodidae (Whiteflies)	***Bemisia tabaci* (Gennadius)**
	Aphididae (Aphids or plant lice)	***Aphis* spp.**
Coleoptera	**Bruchidae (seed beetles)**	***Callosobruchus maculatus* Fabricius**
Lepidoptera	**Lycaenidae (Blues)**	***Lampides boeticus* L.**
Predators		
Hemiptera-Heteroptera	**Anthocoridae (Minute pirate bugs)**	***Orius* spp.**
Neuroptera	**Chrysopidae (Green lacewings)**	***Chrysoperla carnea* Stephens**
Coleoptera	**Coccinellidae (Ladybird beetles)**	***Coccinella undecimpunctata* L.**
		***Scymnus interruptus* Mars**
	Staphylinidae (Rove beetles)	***Paederus alfierii* Koch.**
Araneida	**True spiders**	**Unidentified species**

Table (2):Dominance and abundance percentages of the recovered arthropod species from cowpea plantations, Assiut 2000 and 2001.

Recovered species	Dominance %		Abundance %	
	2000	2001	2000	2001
Pests	90.53	96.86		
Carpocoris purureipennis (De Feer)	0.44	0.42	42.85	42.85
Eysarcoris incospicuus (H. & S.)	0.12	0.00	21.42	0.00
Nezara viridula (Linnaeus)	2.45	4.20	78.57	100.00
Nysius graminikola (Kolenati)	0.04	0.08	7.14	14.28
Oxycarenus hyalinipennis (Costa)	0.08	0.08	14.28	14.28
Spilostethus longulus (Dallas)	0.04	0.00	7.14	0.00
Campylomma impicta (Wagner)	0.48	0.00	7.14	0.00
Creontiades pallidus Ramb	2.66	1.33	85.71	71.42
Liorhyssus hyalinus (Fabricius)	0.00	0.08	0.00	14.28
Empoasca spp.	89.58	92.81	100.00	100.00
Aphis spp.	1.45	0.08	35.71	14.28
Callosobruchus maculatus Fabricius	0.08	0.00	7.14	0.00
Lampides boeticus L.	2.58	0.92	64.28	64.28
Predators	9.47	3.14		
Orius spp.	27.31	20.51	78.57	42.85
Chrysoperla carnea Stephens	4.62	2.56	50.00	14.28
Coccinella undecimpunctata L.	43.08	14.10	100.00	55.55
Scymnus interruptus Mars	15.38	21.80	64.28	85.71
Paederus alfierii Koch.	1.15	2.57	14.28	14.28
True spiders	8.46	38.46	85.71	100.00

3-Susceptibility of cowpea cultivars to the whitefly *Bemisia tabaci* and the two spotted spider mite *Tetranychus urticae*:

Data presented in Table (3) exhibit the average numbers and the susceptibility degrees of cowpea cultivars to the (WF) and the (TSSM) collected during 2000 and 2001 growing seasons.

a-The whitefly *B. tabaci*:

Statistical analysis of the data revealed highly significant differences between the mean numbers of this pest on the tested cultivars (F= 39.95>0.01). The cowpea cultivars, Monarch blackeye; Dokki 331 and TVu21 improved were suffer from highly infestations with an average of 23.50, 21.17 and 20.17 nymphs/15 trifoliate cowpea leaves, respectively. However, Kaha 1 and Kafr El-Seikh 1 were infested by quitely low numbers with an average of 14 and 12.17 nymphs/15 leaves, respectively. In respect to the susceptibility degrees, the first three cultivars appeared as susceptible (S) cultivars, whereas they harboured high numbers of this pest. The other two cultivars which harboured quitely low numbers showed some sort of resistance and appeared as low resistant (LR) and moderately resistant (MR) cultivars, respectively. Therefore it is important to point out herein that the insect mean numbers must be refere to and/or agree with the resistant degree of each cultivar. These differences in infestation may be due to leaf characters of each cowpea cultivar. Although the resistance mechanism in the tested cowpea cultivars is not clear, antixenosis "nonpreference" phenomenon probably responsible. This phenomenon may be dependent on the hooked trichomes density which can deter the adult ovipositer from reaching to the leaf surface. About this phenomenon, Pillemer and Tingey (1976) reported that hooked trichomes can capture the leafhopper nymphs and may be consider as a resistant mechanism.

b-The two spotted spider mite *Tetranychus urticae:*

In respect to the mean numbers and the degree of infestation of the (TSSM), results showed the existence of highly significant differences between the tested cultivars (F= 75.59>0.01). In this respect, the lowest value was recorded on the cowpea cultivar Kaha 1 with an average of 3.17 individuals/15 trifoliate cowpea leaves. The rest cultivars recorded high infestation values. According to the measurements of the susceptibility degrees, the obtained results indicated that all of the tested cultivars appeared as susceptible (S) cultivars, except of Kaha 1 which appeared as moderately resistant (MR) cultivar. These variations in cultivar's resistance degrees may be due to the presence of antixenosis (nonpreference) and/or antibiosis characteristics distinguishable the last cultivar than the others. The obtained results can be documented by those reported by Metwally *et al*. (1991) who proved that, life cycle, generation and pre-oviposition period of *T. urticae* were prolonged when it reared on the cowpea tolerant cultivars, while its longevity and oviposition period were longer and its fecundity were higher when it reared on the susceptible cultivars.

Table (3): Average numbers[(a)] and susceptibility degrees of cowpea cultivars to *Bemisia tabaci* and *Tetranychus urticae*, Assiut 2000 and 2001.

Cowpea cultivar (s)	*B. tabaci*			Susceptibility degree	*T. urticae*			Susceptibility degree
	2000	2001	Mean ± SD		2000	2001	Mean ± SD	
TVu 21 improved	18.00^{a}	22.33^{a}	20.17±3.06^{b}	S	9.33^{b}	10.00^{b}	9.67±1.21^{b}	S
Monarch blackeye	20.33^{a}	26.67^{a}	23.50±4.23^{a}	S	9.67^{b}	9.33^{b}	9.50±1.05^{b}	S
Dokki 331	23.00^{a}	19.33^{b}	21.17±2.75^{b}	S	9.33^{b}	11.33ab	10.33±2.07^{b}	S
Kaha 1	9.67^{b}	18.33^{b}	14.00±4.89^{c}	LR	3.67^{c}	2.67^{c}	3.17±0.98^{c}	MR
Kafr El-Seikh 1	11.00^{b}	13.33^{c}	12.17±1.72^{c}	MR	15.67^{a}	12.67^{a}	14.17±1.83^{a}	S
Mean	16.40	19.99	18.20		9.53	9.20	9.37	
F-value	24.46**	37.75**	39.95**		49.18**	31.35**	75.59**	

(a) Based on 5 trifoliate cowpea leaves/plot.
F value: ** = Highly significant at 0.01 level of probability.
Means followed by the same letter in each column are not significantly different at 0.05 level of probability by Duncan's multiple range test.
S= Susceptible LR= Low Resistant MR= Moderately Resistant.

Generally, it can be concluded that morphological leaf characters such as hooked trichomes density and the sap nutrients may be responsible as resistant mechanisms against the (WF) *B. tabaci* and the (TSSM) *T. urticae*. These phenomena must be studied in more details and transfere with another desirable resistant phenomena by plant breeders into the locally new produced cowpea cultivars especially which exhibit some sort of resistance to these pests.

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تواجد بعض الآفات من مفصليات الأرجل والمفترسات المصاحبة لها على زراعات اللوبيا مع الإشارة لمقاومة بعض أصناف اللوبيا للذبابة البيضاء *BEMISIA TABACI* (GEN.) وأكاروس العنكبوت الأحمر *TETRANYCHUS URTICAE* KOCH.

محمد عبد الرحمن محمد عمرو

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

تم حصر الآفات الحشرية من مفصليات الأرجل والمفترسات المصاحبة لها على زراعات اللوبيا ودراسة تركيبها النوعى بمحافظة أسيوط خلال موسمى ٢٠٠٠، ٢٠٠١م .

أظهرت النتائج تواجد ١٥ نوعاً من الحشرات آكلة النباتات وصاحبها خمسة أنواع من المفترسات الحشرية بالإضافة لبعض العناكب. وقد وجد أن درجة السيادة للآفات كانت عالية جداً مقارنة بسيادة المفترسات المصاحبة لها. وقد كانت أكثر الآفات سيادة هى نطاطات الأوراق *Empoasca* spp. تلاها البقة الخضراء *Nezara viridula* ثم بق إسقاط البراعم الزهرية واللوز *Creontiades pallidus* ثم أبى دقيق البقوليات *Lambides boeticus* . بينما كانت أكثر المفترسات سيادة هو أبى العيد ذو الإحدى عشر نقطة *Cocinella undecimpunctata* ثم بق الأزهار *Orius* spp. ثم حشرة الأسكمنس *Scymnus interruptus* .

كما أظهرت النتائج أيضاً درجة واضحة من التوافق بين وفرة كل من الآفات الحشرية والمفترسات المصاحبة لها . ويجب أن تفيد النتائج المتحصل عليها فى تمكين عناصر المكافحة البيولوجية فى خفض اعداد آفات اللوبيا . أما بالنسبة لحساسية أصناف اللوبيا المختبرة لكل من الذبابة البيضاء *Bemisia tabaci* وأكاروس العنكبوت الأحمر *Tetranychus urticae* فقد أظهر صنف اللوبيا قها ١ بمفرده نوعاً من أنواع المقاومة لكلتا الآفتين. وقد تعود درجات المقاومة هذه للصفات المورفولوجية لأوراق هذا الصنف أو لنوعية المواد الغذائية فى عصارة أوراقه؛ لذا يجب على مربى النباتات دراسة صفات هذا الصنف من اللوبيا بالتفصيل ونقل المرغوب منها إلى أصناف اللوبيا التى يتم إنتاجها حديثاً .