QUALITATIVE ESTIMATION OF ARTHROPOD COMPOSITION OF EL-FARAFRA OASIS COTTON PLANTATIONS.
A- SURVEY OF COTTON ARTHROPODS

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ABSTRACT

The present study aimed to survey the faunastic composition of arthropods inhabiting cotton fields under El-Farafra Oasis environmental conditions. During 2003 and 2004 cotton growing seasons recovered arthropod pests were represented by 14 species belonging to 11 families drifted from 5 orders. On cotyledon stage *Frankliniella* sp., *Anacridium aegypticum* and *Schistocerca gregaria* were firstly monitored. Beside the previous pests, true cotton leaves were attacked by *Empoasca* sp., *Creontiades pallidus*, *Liorhyssus* sp. and *Bemisia tabaci*. Appearance of first square was coincided by the occurrence of *Nezara viridula*, *Eusarcoris ventralis*, *Graptostethus servus* and *Erias insulana*. Blossoms were attacked by *E. insulana* and *G. servus*. Each of *Aphis gossypii*, *Pectinophora gossypiella*, *E. insulana*, *N. viridula*, *E. ventralis* and *G. servus* were recorded attacking cotton bolls. Scouted beneficial arthropods were categorized into natural enemies (both predators and parasites) and pollinators. Monitored natural enemies represented by 22 species divided among 20 families and 7 orders. Predators were included within 18 families and 6 orders. Monitored parasites were harbored within 2 families and 2 orders. Among monitored orders, Aranidae was the most represented order followed by Coleoptera. Hymenoptera and Hemiptera orders were the 3rd represented orders and both Odonata and Neuroptera orders were the last represented ones. Detected parasites and pollinators came in the following rank.

INTRODUCTION

New Valley governorate, which locates in the southwestern portion of the Egyptian western desert, represents 43% of the total area of Egypt. It has three

administrative districts, based on three main depressions called El-Farafra, El-Dakhla and El-Kharga Oases. Such Oases extend in an un-straight line parallel to the Nile valley and far from the west direction by about 200 to 300 Km.

In Egypt, reclamation of desert areas represented a great challenge to face the huge increase in human population. Accordingly, in El-Farafra Oasis, from about 10.000 Km^2 which represents the total area of the Oasis, Egyptian Ministry of Agriculture reclaimed about 22.000 feddans. In El-Farafra Oasis, the agricultural production and system of irrigation are depending on fossil (limited-renewed) ground water. So, agricultural extensions of some crops (as rice) with high water supplements were more or less limited and replaced by other economic crops with moderate water supplement such as cotton, sunflower, maize, peanut...etc. As a result of agricultural extension of cotton crop into El-Farafra Oasis, the present study aimed to estimate the faunastic composition of arthropods inhabiting cotton fields (both pests and natural enemies) under El-Farafra Oasis environmental conditions.

MATERIAL AND METHODS

I- Study site

The present study was conducted in El-Amal village, El-Farafra Oasis, New valley governorate, during 2003 and 2004 cotton growing seasons. Three feddans. Cotton variety Giza 83 was sown on April 25th and April 20th at 2003 and 2004 cotton seasons, respectively. The surrounding adjacent habitats of this cotton plantation were represented mainly by cultivated summer crops (as corn, peanut, alfalfa...) a00.nd some wild shrubs such as giant reed; *Arundo donax* and salt-cedar; *Tamarix aphylla*. Regular conventional agricultural practices were normally performed.

II- Faunastic composition of cotton arthropods

At El-Amal village locality, once cotton emerged, random monitoring or scouting processes were performed at biweekly intervals throughout the entire season. During 2003 and 2004 cotton growing seasons plant inspection (direct count, square inch investigation and pheromone trap methods) and sweeping net sampling techniques were applied for surveying pest and beneficial arthropods.

Direct count sampling was timed to sunrise and started from May 16th – September 13th and from May 15th – September 2nd at 2003 and 2004 cotton seasons, respectively.

In square inch investigation, 150 cotton leaves(50plants, 3 leaves of each plant) were chosen randomly, cotton leaves were collected in paper bags for microscopical investigation.

For surveying cutworm, cotton field was checked as soon as cotton emerged (4 to 7 days after planting) for cutworm damage. Soil around the bases of damaged plants was checked to confirm the presence of cutworm larvae.

Sweeping net technique was applied, once cotton plant stalks became more rigid, from June 28th and June 25th, respectively till harvesting. Fifty double sweeps were randomly taken in an axial manner. Each collected sample was emptied in a labeled collecting glass jars after killing using cyanor jars and transferred to laboratory for investigation.

Pheromone traps for pink and spiny bollworms and armyworm were hanged in both 2003 and 2004 cotton season on June 5th and May 29th, respectively. Pheromone traps were placed vertically at or just above plant height. Two types of sex Pheromone traps were used, circular tray trap for both pink boll worm and armyworm and funnel trap for spiny boll worm (Sokar,1988). These synthetic sex Pheromone capsules were obtained form Plant Protection Research Institute, use in all cotton cultivated areas. Sex Pheromone vials were replaced and counted every two weeks.

Collected arthropods were identified and checked by the specialists of Insect Classification Department, Faculty of Science, Ain Shams University and Insect Classification Department, Plant Protection Research Institute, A. R. C.

RESULTS AND DISCUSSION

1- Herbivorous species

Recovered arthropod pests were informed in Table (1) and synchronized with the basic schedule of cotton developmental stages (cotyledons, leaves, squares, flowers and bolls). The recovered arthropod pests were represented by 14 species belonging to 11 families drifted from 5 orders.

Thrips (*Frankliniella* sp.), grasshoppers (*Anacridium aegypticum*) and desert locusts (*Schistocerca gregaria*) were first monitored on cotton plant at its cotyledon stage. Thrips ruptured plant cells and imbibed their released contents by its rasping mouthparts, while the later two species nibbled cotton leaves through their chewing mouthparts. These species were belonged to Thripidae and Acrididae families, respectively.

True cotton leaves established within about 9 to 11 days of emergence. In addition to the previous pests, leafhopper (*Empoasca* sp.), plant bugs (*Creontiades pallidus* and *Liorhyssus* sp.), whitefly (*Bemisia tabaci*) and beet armyworm (*Spodoptera exigua*) were found. The adult and nymphal stages of the first four species extracted cotton leaf juices through their piercing sucking mouthparts. The adult stage of *S. exigua* was monitored within pheromone traps, while neither its egg nor larval stages were detected on cotton plants along the whole study period

Appearance of first square was attained within 35 to 40 days of emergence, and was coincided by the occurrence of certain square attacking pests. Two species of pentatomid stink bugs (*Eusarcoris ventralis* and *Nezara viridula*) and *Graptostethus servus* from Lygaeidae family were monitored piercing cotton squares through their adult and nymphal stages. From Noctuidae family spiny bollworm moth (*Earias insulana*) was firstly noticed within its pheromone lure trap. Its larval damage was mainly evident as a hole chewed through squares.

In about 60 to 70 days of seedling emergence, first flower or blossom was recognized and damage performance of both *E. insulana* and *G. servus* was continued.

Cotton developmental schedule terminated within about 95 to 100 days of seedling emergence by the formation of mature cotton boll. Some pests attacked cotton bolls were previously recorded, while others were firstly. From Aphididae and Gelechiidae families both cotton aphid (*Aphis gossypii*) and pink bollworm (*Pectinophora gossypiella*), respectively were firstly monitored. *A. gossypii* defoliated cotton bolls by sucking their juice and accordingly it considered as late season pest. Pink bollworm (PBW) moth was captured through its pheromone trap while its larval stage was recorded chewing the internal boll contents. The previously recorded spiny bollworm, stink bug and plant bug continued their occurrence and roles in attacking cotton bolls till the end of the season.

It was important to note that certain cotton pest species which are endemic in the Nile valley plantations not found among El-Farafra cotton pest species. The previous results indicated that along the whole scouted period each of cutworm, spider mites and loppers were never monitored on El-Farafra cotton plantations. Unfavorable climatic conditions during summer months or naturally occurring beneficials characterized El-Farafra cotton plantation may be the cause of such scarcity. In Egypt, Zidan *et al.* (1998) mentioned that pest density of *A. ipsilon* recorded its peak during winter and was the lowest during summer. Such interpretation was in harmony with Maree *et al.* (1999) who recorded the peak of *A. ipsilon* on cabbage crop on 2nd February then it disappeared after March. Where, roles of naturally occurring beneficials as egg feeder ants, *Lasius neoniger*, (Lopez

and Potter, 2000), entomopathogenic nematodes, *Steinernema* spp. and *Heterorhabditis indica*, (Hussaini *et al.*, 2000) and entomopathogenic viruses (Fediere *et al.*, 2003) were the main factor for suppressing population built up of cutworm. Similar trend was stated by Ronald (1999) on both spider mites and loopers, where both of which were highly susceptible to the naturally existing predators and entomopathogens.

Catchments of beet armyworm (*S. exigua*) male moths within its pheromone trap without any representation of either its egg batches or larval stages on cotton plants meant that, *S. exigua* was found within the cotton circumstance area and that the extended range of its pheromone (1 pheromone trap/ 20 feddans) may responsible for such moth catchments. In El-Farafra Oasis, cotton cultivations are scattered and surrounded by other crops where female moths may prefer to lay their egg masses on such crops more than on cotton plants. On the same direction *S. exigua* moth is considered as a relatively mobile insect so; it was easy to conclude that there were no quantitative relationship between pheromone trap catch and subsequent field infestation. In accordance El-Zanan and El-Hawary (1999) in Egypt, stated that the weak correlation between egg masses counts and adult catch of *S. littoralis* may be attributed to the sudden influxes of mated females which might increase the egg mass numbers without a comparable increase in the male catches in the pheromone traps.

2- Beneficial species

Scouted beneficial arthropods inhabiting cotton plantation were categorized into 2 main groups: natural enemies (both predators and parasites) and pollinators Beneficial species were represented by 25 species belonging to 23 families from 7 orders. Most of these species were natural enemies (20 predators and 2 parasites) while only 3 species were pollinators. Table (2) summarized these results.

2.1- Natural enemies

Predators were belonged to 18 families from Araneidae, Coleoptera, Neuroptera, Hymenoptera, Hemiptera and Odonata orders. Depending on the number of order's dominant families, Aranidae was the most represented one. True predacious spiders were represented by five families in addition to the unidentified ones.

Order Coleoptera by its Coccinellidae, Staphylinidae and Anthicidae monitored families categorized as the 2nd represented order. Where, both *Coccinella septempunctata* and *Scymnus* sp. were belonged to the first family, *paederus alfierii* and *Oxytelus nitidulus* to the second family and *Anthicus* sp. to the last one.

The recorded families of both Hymenoptera and Hemiptera orders were

similar to that of order Coleoptera, but they had fewer species. Order Hymenoptera was represented by *Polistes gallica*, *Pompilus melas* and *Dielis collaris* which belong to Vespidae, Pomplidae and Scolidae families, respectively. While Lygaeidae, Reduviidae and Nabidae families from order Hemiptera were represented by *Geocoris* sp., assassian bug, *Coranus aegyptius* and *Nabid* sp., respectively.

Both Odonata and Neuroptera orders were the least represented ones. Within the scouted cotton plantation, dragonfly (*Hemianax ephippiger*) and damselfly (*Ischnura senegalensis*) were recorded from order Odonata, and *Chrysoperla carnea* was the only captured species from order Neuroptera.

Tachina sp. and *Aphelinus* sp. as monitored parasites were harbored within Tachinidae and Aphelinidae families which belong to Diptera and Hymenoptera orders, respectively.

2.2- Pollinators.

Three bee species (*Apis* sp., *Nomia* sp. and *Andrena* sp) were identified as pollinator bees. They were belonged to three families (Apidae, Halictidae and Andrenidae) which listed under Hymenoptera order.

From the pre-mentioned data it was noticed that lower number of herbivorous species (14 species) were monitored inhabiting El-Farafra cotton plantation as compared with higher representation of beneficial ones (25 species). Scarcity of chemical insecticide applications at El-Farafra plantations may be a reasonable explanation of such findings as it may conserve and enhance population built-up of naturally occurring beneficials. Such endemic beneficials may express their role in retarding cotton pests through their predation or parasitization behaviors. Schmutterer (1985) stated that, excessive and repeated chemical pesticide applications against cotton pests resulted not only to the occurrence of resistance and cross-resistance strains of such pests but also repressed the role of naturally occurring beneficials due to their high sensitivity to chemicals. In Oklahoma cotton plantations, built up of aphid, boll weevil and spider mite populations were noticed by Miles (1987) after certain insecticidal applications with reverse built up of bollworm predators and parasitoids. However, potential of natural enemies in cotton plantation according to Steven *et al.* (2003) was rarely realized due to the widespread use of insecticides with broad toxicity, which not only disrupted natural control of key pests but also caused outbreak of secondary pests.

Native beneficial arthropods play an important role in population regulation of insect pests. Certain predators such as *Oxytelus nitidulus*, *Anthicus* sp. and

predator wasps which were rarely or poorly represented within Nile valley cotton plantation were detected within El-Farafra cotton one. Such note may also confirm the high representation of beneficial species than herbivorous ones.

TABLE (I)

A taxonomic list of arthropod pests recovered from cotton fields, El-Amal village, El-Farafra Oasis (2003 and 2004).

Plant part	Insects		Family	Order
	Common name	Scientific name		
Cotyledons	Thrips	*Frankliniella* sp.	Thripidae	Thysanoptera
	Grasshopper	*Anacridium aegypticum*	Acrididae	Orthoptera
	Desert Locust	*Schistocerca gregaria*		
Leaves	Thrips	*Frankliniella* sp.	Thripidae	Thysanoptera
	Plant Bug	*Creontiades pallidus*	Miridae	Hemiptera
		Liorhyssus sp.	Rhopalidae	
	Whitefly	*Bemisia tabaci*	Aleyrodidae	Homoptera
	Leafhopper	*Empoasca decipiens*	Cicadellidae	
	Beet Armyworm	*Spodoptera exigua*	Noctuidae	Lepidoptera
	Grasshopper	*Anacridium aegypticum*	Acrididae	Orthoptera
	Locust	*Schistocerca gregaria*		
Squares	Stink bug	*Eusarcoris ventralis*	Pentatomidae	Hemiptera
		Nezara viridula		
	Plant bug	*Graptostethus servus*	Lygaeidae	
	Spiny Bollworm	*Earias insulana*	Noctuidae	Lepidoptera
Flowers	Spiny Bollworm	*Earias insulana*	Noctuidae	Lepidoptera
	Plant bug	*Graptostethus servus*	Lygaeidae	Hemiptera
Bolls	Cotton aphid	*Aphis gossypii*	Aphididae	Homoptera
	Spiny bollworm	*Earias insulana*	Noctuidae	Lepidoptera
	Pink bollworm	*Pectinophora gossypiella*	Gelechiidae	
	Stink bug	*Eusarcoris ventralis*	Pentatomidae	Hemiptera
		Nezara viridula		
	Plant bug	*Graptostethus servus*	Lygaeidae	

Some benificials are general feeders while others are specific one where it depends on a single phytophagous species for food. Most of the mentioned predators and Tachinid fly (their maggots shared parasitoid habit) were of general feeders. True predacious spiders which detected within cotton canopy shortly after emergence were the most represented species. In Egypt, El-Heneidy *et al.* (1996) surveyed about 17 genera of predacious spiders belonging to 10 families preyed on different stages of cotton pests. Comparably, Martin (1999) detected about 10 insect orders making up the bulk of Araneid spider preys. In accordance, Ronald (1999) found that all spiders were predacious and many species were common in cotton fields.

TABLE (II)

A taxonomic list of beneficial arthropods recovered from cotton fields, El-Amal village, El-Farafra Oasis (2003 and 2004).

Common name		Scientific name	Family	Order
Predators				
Jumping spider		True spiders	Salticidae	Araneidae
Sheet web spider			Linyphiidae	
Cobweb spider			Theridiidae	
Long-legged sac spider			Philodromidae	
Broken spiders			Miturgidae	
Lady beetle		*Coccinella septempunctata*	Coccinellidae	Coleoptera
		Scymnus sp.		
Rove beetle		*Paederus alfierii*	Staphylinidae	
		Oxytelus nitidulus		
Hooded flower beetle		*Anthicus* sp.	Anthicidae	
Predator wasp	Paper wasp	*Polistes gallica*	Vespidae	Hymenoptera
	Spider wasp	*Pompilus melas*	Pompildae	
	Flower wasp	*Dielis collaris*	Scolidae	
Big-eyed bug		*Geocoris* sp.	Lygaeidae	Hemiptera
Assassin bug		*Coranus aegyptius*	Reduviidae	
Damsel bug		*Nabid* sp.	Nabidae	
Dragon fly		*Hemianax ephippiger*	Aschnidae	Odonata
Damsel fly		Iscnura senegalensis	Agrionidae	
Green lacewing		*Chrysoperla carnea*	Chrysopidae	Neuroptera
Parasites				
Aphid parasitoid		*Aphelinus* sp.	Aphelinidae	Hymenoptera
Tachina fly		*Tachina* sp.	Tachinidae	Diptera
Pollinators				
Honey bee		*Apis mellifica*	Apidae	Hymenoptera
Alkali bee		*Nomia* sp.	Halictidae	
Digger bee		*Andrena* sp.	Andrenidae	

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