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FERTILIZATION AS A FACTOR AFFECTING THE POPULATION OF PHYTOPHAGOUS MITES AND TURE SPIDERS INHABITING SOYBEAN PLANTS

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ABSTRACT

The fertilization have an important role in the abundance of different mite species and spider species associated with different crops. The results revealed the presence of 28 different mite species belonging to 14 families related to four suborders, Astigmata, Prostigmata, Mesostigmata and Cryptostigmata, associated with soybean leaves. It was found that the abundant families were Tetranychidae, Phytoseiidae, Tydeidae and Tarsonemidae with great number on leaves of soybean treated with chemical fertilization than those treated with biofertilizer once allover the study periods. Also, the study proved that the total numbers of soil mites in chemical treated plots were more than of plots treated with biofertilizer once, with the exception of mesostigmatid mites were higher in biofertilizer soils. Also data shows that the presence of 16 spider species belonging to 12 families collected by both plant shaking and pit-fall traps methods. The dominant collected families on plants were Araneidae, Dictynidae, Linyphidae, Tetragnathidae and Therididae. The highest density of spiders were observed during September pre- harvest time of crop, and spiders density in chemical fertilization location were higher than those of biofertilization treatment in shaking plant, while the commonest spiders families in soil were Gnaphosidae, Lycoseidae and Oecobiidae, and the population on chemical fertilizer plots were higher than those of biofertilizer once in pit-fall traps. The highest population was noticed for Gnaphosidae.

INTRODUCTION

Soybean (*Glycin max* (L.) Merill) is one of the most important crops in Egypt and it is infested by many insects and mites.Soybean plants are a good shelter for many mite species during adverse environmental conditions, Saweries 1983 .

The phenomenal increase in soybean cultivation during the last decade in Egypt has drawn the attention to its pests and their associated predators . It is undoubtedly that plant nutrition has a direct effect on the host plant, but it indirectly affects its association pests. Spider mites (Family Tetranychidae) cause great damage to leaf surfaces, the stomata, and the palisade and spongy parenchyma, and they may inject toxic substances into the leaf and interferer with vital processes, Baker and Connel, 1963. Early in 1949, Garman and Kennedy reported positive correlation between high rates of mineral fertilizer and population increase of the spider mite *Tetranychus urticae* Koch on cucumber, tomato and beans. Also, Carlson, 1969 mentioned that complete defoliation due to mite feeding can reduce pod set and seed yield, the severity depending on timing, duration, and magnitude of the infestation. Although mite infestation can occur at any time in cropping season, mid-to late-season populations are more common. Cadapan, 1976 noted that soybean is apparently most susceptible to mite injury during the pod and seed development periods, attaining population levels of over 1000 individuals per leaf. Mite injury and outbreaks are associated with hot, dry weathers on numerous field crops, including soybean. Relative humidity, field moisture, and temperature may adversely affect spider mite populations, Boudreaux 1958, and Simpson and Connell 1973. Cadapan, 1976. The most important factor contributing to spider mite outbreaks is the availability of a physiologically suitable host plant. Fertilizers are very important components in farming systems and they enhance some of the spider prey like Collembola and other small insects.

The present study was therefore carried out to know more about the effect of different fertilizers (biofertilizer and chemical fertilizers) on different mite and spiders population. The spiders are the most abundant predators in agricultural systems. They are generalist predators that constitute one of the most numerous groups of the animal Kingdome; with more than 30.000 species, Nyffeler *et al*. 1992, Comstock 1995, Sunderland 1999. Workers interested in the ecology of soil fauna did not give enough attention to spiders, which are believed to be highly beneficial arthropods in biological control aspects, Tawfik, 1993. In Egypt, spiders a considerable ratio (36.34%) of the total soil fauna, collected by pitfall-traps, in different agroecosystems (old lands) in Fayoum, Middle Egypt, Ghabbour and Mikhail, 1993, but only 4.44 % in the newly reclaimed desert ecosystem west of the Nile Delta, Hussein, 1993. Survey of the spiders occur in the Egyptian soybean fields has not attracted the researchers, so this investigation was carried out for this reason.

MATERIALS AND METHODS

A field experiment was conducted at El-Menofia Governorate during 2006 growing season. Giza 111 cultivar of soybean was grown in 60 rows in three treatments (chemical fertilizer, biofertilizer and non-treated plots). Each treatment consists of 20 rows and 4 plots. Each row 60 cm wide and 10 m long. The plants were planted on April 20th. No pesticidal treatments were applied throughout the experiment. Concerning fertilization , the first plot was treated by biofertilizer (Phosphorien, phosphate soluble bacteria) in which the seeds were mixed with phosphorien, the second plot was treated by chemical fertilizer (N. P. K.) and the third plot was untreated as a control. The chemical fertilizers used were 50 Kg / feddan potassium sulphate, 150 Kg / feddan calcium nitrate and 150 kg / feddan super phosphate. The fertilizers were added as soon as the field prepared and before sowing date. Soybeans seeds were planted in hills with 3 cm depth and 25 cm distance between hills.

Samples of 10 leaflets per plot were randomly taken at 15 days intervals when the age of the plants was about 5 weeks. The mite populations were lower in samples of new leaves than those of old ones, Mohamed 1964. All active forms of mites and spiders were recorded. The number of active forms of mites per a random square inch per leaflets on both surfaces (upper and lower) were counted directly by aid a stereomicroscope which were taken with complete randomized method. Although the distribution on the plant might depend on species, but early infestations of spider mites are more frequently observed on older, more foliage than on younger which more tender foliage, the investigation occurred on the different foliage on all levels of the plant. Soil mites extraction was achieved by maintaining the samples in Tullgren funnels for a period of 24 hours. Mites were received in Petri dishes filled with some water. Living specimens were examined by using stereomicroscope and collected by camel hair brush and cleared in Nesbitt solution, then mounted in Hoyer's medium on glass slides and examined microscopically. Mites were identified according to Krantz, 1978 and Zaher, 1986. Survey and seasonal abundance of spiders were studied in the soybean field using sampling techniques : pit-fall traps and plant shaking .

1.Pit-fall traps method

Samples of the soil spiders fauna were collected from the study area by pit-fall trap method described by Slingsby and Cook 1986 and Southwood and Henderson 2000.In this study, the number of spiders trapped in primarily depend on their locomotion activity (Greenslade and Greenslade, 1983; Kromp, 1990 and Mikhail, 1993. The traps were used in each sampling date in different plots according to Rizk *et al.* 2005. The number of spiders collected is the total number of individuals / 10 traps to avoid decimal fraction.

Plastic containers (10 cm diameter) were filled with detergent and water (1 : 40). The traps were embedded in the soil at the soil surface. Ten traps were distributed at the experimental soybean area (½ Fadden). Trap catches were collected every two week and the old traps were replaced by new ones at the same place.

2. Plant-shaking method

The spiders live on foliage were collected by shaking the plants on a cloth or a shake sheet. This method is referred as the drop cloth method. Five soybean plants were shacked over the shaking white cloth (1m x 1m) twice monthly during the surveying period. The spiders were collected from each plots (chemical, biofertilized, and non-treated plots). The surveyed spiders were kept in glass vials containing 75 % ethyl alcohol and droplets of glycerin.

RESULTS AND DISCUSSION

The data tabulated in Table (1) showed that there was 28 different collected mites belonging to 14 families associated with soybean plants (treated with chemical and biofertilizers and non-treated once) belonging to three suborders namely, Astigmata, Prostigmata and Mesostigmata. The collected mites were classified according to their feeding habits and habitats The table also showed the different feeding and habitats for these mites. The mites surveyed in the soybean field in season 2006 were classified into four groups, fungivorous, predators, phytophagous and uncertain feeding mites on leaves. The mites belonging to suborder Astigmata were 3 species in two families Acaridae and Chortoglyphidae, while those belong to suborder Prostigmata were 13 different species in five families, Cunaxidae, Cheyletidae, Tarsonemidae, Tetranychidae and Tydeidae . On the other hand the mesostigmatid mites collected in this study were 11 different species belonging to six families, Ameroseiidae, Ascidae, Laelapidae, Parasitidae, Phytoseiidae and Uropodidae.

Table (1) : List of the collected mites associated with soybean plant at El-Menofia Governorate during 2006 season

Suborder	Family	Species	Behavior	Habitat
Astigmata	Acaridae Ewing and Nesbitt	*Rhizoglyphu robini* Claparede	Fungivorous	Foliage& soil
		Tyrophagus putrescentiae (Schrank)	,,	soil
	Chortoglyphidae Berlese	*Chortoglyphus* sp.	,,	soil
Prostigmata	Cunaxidae Thor	*Cunaxa capreolous* (Berlese)	Predator	Soil
		Neocunaxoides andrei (Baker and Hofmann)	Predator	Soil
	Cheyletidae (Leach)	*Acaropsellina docta* (Berlese)	Predator	Soil
		A. notchi Gomaa and Hassan	Predator	Soil
		Cheletomorpha lepidopterorum (Shaw)	Predator	Soil
		Cheyletus badryi Zaher and Hassan	Predator	Soil
	Tarsonemidae Kramer	*Tarsonemus granaries* (Lindquist)	Fungivorous	Soil
		Tarsonemus sp.	Fungivorous	Foliage
	Tetranychidae Donnadieu	*Tetranychus urticae* Koch	Phytophagous	Foliage
	Tydeidae (Kramer)	*Orthotydeus californicus* (Banks)	Uncertain	Soil
		O. kochi (Oudemans)	Uncertain	Soil
		Pronematus ubiquitus McGregor	Uncertain	Foliage
		Tydeus aegyptiaca (Rasmy and El-Bagoury)	Uncertain	Soil

Table (1) : Cont.

Suborder	Family	Species	Behavior	Habitat
Mesostigmata	Ameroseiidae	*Kleemenia plumosus* (Oudemans)	Fungivorous	Soil
		K. kosai El-Badry, Nasr and Hafez	Fungivorous	Soil
	Ascidae (Voigts & Oudemans)	*Blattisocius tarsalis* (Berlese)	Predator	Soil
		Proctolaelaps aegyptiaca Nasr	Predator	Soil
	Laelapidae (Berlese)	*Androlaelaps casalis* (Berlese)	Predator	Soil
		Hypoaspis freemani Hughes	Predator	Soil
	Parasitidae Oudemans	*Parasitis consanguineus* Oudemans and Voigts	Predator	Soil
	Phytoseiidae Berlese	*Amblyseius swiriskii* A-H.	Predator	Foliar
		Phytoseiulus peresimilis (A-H.)	Predator	Foliar
		Euseius scutalis (A.-H.)	Predator	Foliar
	Uropodidae Berlese	*Urobovella krantzi* Zaher and Afifi	Predator	Soil
Cryptostigmata	Oppiidae Grandjean	*Oppia sticta* Popp	Fungivorous	Soil

As shown in Table (2) data revealed that the population of tetranychid mites was higher in case of using chemical fertilization (1178 mites) during the all count dates compared with that of biofertilizer (949) mites and this mean that the fertilization by biofertilizer is more safe for soybean production.

The only tetranychid mites collected in this study was *Tetranychus urticae* Koch only. The peak of the abundance of this mite was observed during 10th July (240 individuals).

Table (2) :Population of the different mites on soybean leaves / 20 leaves during 2006 season.

Sampling dates	Chemical fertilizers				Biofertilizer				Control			
	Tetr.	Phyt.	Tyed.	Tarso.	Tetr.	Phyt.	Tyed	Tars.	Tetr	Phyt.	Tyed.	Tars.
25.5.2006	0	0	0	0	0	0	0	0	0	0	0	0
10.6.2006	80	0	0	0	60	0	0	0	86	2	1	0
25.6.2006	110	0	0	0	85	0	0	0	119	8	6	0
10.7.2006	420	31	0	0	307	21	0	0	492	40	7	0
25.7.2006	286	74	5	0	260	66	0	0	310	85	12	0
10.8.2006	120	130	19	20	100	87	11	16	145	139	25	0
25.8.2006	100	100	40	30	86	70	35	25	105	125	57	27
10.9.2006	62	95	35	35	51	64	30	29	70	100	42	33
Total	1178	430	99	85	949	308	76	70	1327	499	150	60
	1792				1403				2036			

Tetr. = Tetranychidae Phyt. = Phytoseiidae Tyd. = Tydeidae Tarso. = Tarsonemidae

Also the phytoseiid mites abundant were observed during 8th August (130 mites) in case of chemical fertilization while the abundant in the presence of biofertilizer recorded with 87 individuals during 10 th August.The phytosseiid mites were *Amblyseius siwiriskii* , *Phytoseiulus persimilis* and *Euseius scutalis*. Considering the mites belonging to families Tydeidae and Tarsonemidae (most of them are fungivorous), the total number of collected mites was 99 and 85 & 76 and 70 individuals from different mites species for tydeid and tarsonemid mites, in case of chemical and biofertilization treatment, respectively. Generally the collected mites for chemical fertilized plots were more (1792 individual mites) than biofertilized once (1403 individual mites). In this study, there were another factors affecting on the mite population such as environmental factors. The relationship between field moisture and temperature and occurrence and density of mite populations on soybean was demonstrated by Simpson and Connell 1973. Using data from eight fields over a seven year period, it showed that much of the variation in infestation level of *Tetranychus turkestani* Ugarov and Nikolski in soybean could be explained by weather conditions.The differences may be due to shade of plants and availability expressed as water requirements for crop in addition to density of plants. This directly affects abundance of spiders' prey and governs occurrence of birds and other spiders' natural enemies, Ghabbour *et al*. 1999.

The data tabulated in Table (3) showed that , in case of chemical fertilization the total number of mites belonging to Suborder Mesostigmata was lower (130 individual mites) than that in case of biofertiliaztion (163 individual mites) in soil. Also, the prostigmatid mites population was recorded with more (80 mites) than in case of biofertilizer (60 mites). On the other hand in case of astigmatid mites, their total number was more abundant in the presence of chemical fertilization (230 individual mites) which in case of biofertilizer it recorded with 145 individual mites. Generally, the number of mites was high in case of soil chemical fertilized followed by biofertilized one, and finally the non-fertilized area came in the least order. The present study is in harmony with those obtained by DunXiao *et al*. (1995) , where they studied the variation of community structures of soil Acari under different fertilizer conditions and noticed that the fluctuation of diversity, richness and evenness of mites was higher in chemical than in organical fertilized soil. Also, they found more predaceous and nematophagous mites in organical fertilized soil, and more fungivorous mites were in chemical fertilized soil .Revealed data in Table (4), clear that the collected spiders associated with soybean plants were 16 spider species belonging to 14 genera and 12 families. The identification of individuals to species level is difficult in some cases (6 species). The most abundant number of spider species were collected in the family Miturgidae (3 species) and Theridiidae (2 species). However, the foliar species collected by shaking method were 12 species and those of soil were 3 species , and one species collected from both soil and on leaves, *Erigone* sp..

Table (3): Seasonal abundance of the different soil mites associated with soybean plant at El-Menofia Governorate during 2006 season.

Month	Chemical fertilizers			Biofertilizer			Control		
	Ast.	Prost.	Mesost.	Ast.	Prost.	Mesost.	Ast.	Prost.	Mesost.
May	5	0	5	0	0	10	0	0	10
June	35	0	15	20	0	25	14	0	20
July	62	15	20	35	10	28	25	10	25
August	86	20	35	60	15	40	45	26	35
Sept	42	45	55	30	35	60	18	30	40
Total	230	80	130	145	60	163	102	66	130
	440			368			298		

Ast. = Astigmata Prost. = Prostigmata Mesost. = Mesostigmata

Table (4) : List of collected spider species associated with soybean plants at El-Menofia Governorate during 2006 season.

Family	Species	Fauna	Occurrence
Araneidae Simon	*Argiope* trifasciata Forskal	Foliage	May – Sept.
	Cyrtophora citricola (Forskal)	,,	
Gnaphosidae Pocock	*Zelotes* sp.	Soil	June.
Lycosidae Sunderval	*Hogna ferox* (Lucas)	Soil	June – Sept.
Miturgidae Simon	*Cheiracanthium* sp	Foliage	July - Sept.
	C. isiacum Cambridge	,,	
	C. pelasgicum (Koch)	,,	
Philodromidae Thorell	*Thanatus albini* (Audouin)	,,	July – Sept.
Theridiidae Sundeval	*Eurgopis* sp.	,,	May – Sept.
	Crustulina conspicus (Cambridge)	,,	May – Sept.
Thomisidae Sunderval	*Thomisus spinifer* Cambridge	,,	Aug. – Sept.
Salticidae Blackwall	*Plexippus paykulli* (Audouin)	,,	Aug. – Sept.
Tetragnathidae Menge	*Tetragnatha nitens* (Audouin)	,,	May – Sep.
Dictynidae Cambridge	*Dictyna* sp.	,,	May. – Sept.
Linyphiidae Blackwall	*Erigone* sp.	Foliage & soil	May – Sep.
Oecobiidae Blackwall	*Oecobius* sp.	soil	June

Ghabbour *et al*. (1999) collected the spiders, *Prinerigone vegans, Erigone dentipalpis* (Linyphidae), Phillodromidae and Salticidae families under potato and soybean plants by using pitfall-trap method. By studying the population of collected common spider families by using the plant shaking method, Table (5) clear that the commonest spiders were belonging to 5 families , Araneidae, Dictynidae, Linyphidae, Tetragnathidae and Theridiidae. The chemical treated plots were harbor more spiders number than those of biofertilized once. for all these families. The number were 24, 16, 49, 17 and 28, & 13, 11, 16, 5 and 17 for the aforementioned families, respectively. The highest total number of collected spiders on soybean plants was recorded during September 131 individuals followed by 101 spiders during August and July (70 individuals), June (38 individuals) and finally 9 individuals during May. Considering the abundance of spiders collected by pitfall-traps, the spiders belonging to family Gnaphosidae were 92 different species followed by those belonging to family Oecobiidae and Lycosidae 42 and 40 spiders, respectively, Table (6). Also, the obtained data denoted that the more collected spiders were observed for chemical fertilized plots, 40, 17 and 28 for Gnaphosidae, Lycosidae and Oecobidae, respectively, these numbers were 26, 11 and 6 for biofertilization, respectively. The obtained results suggest that the chemical soybean fields support a greater abundance and diversity of mites and spiders. In turn, the large and more complex community of mites and spiders could help in controlling crop pests in the chemical treated fields. The results suggest also that, chemical farming systems, as the extreme expression of low input agriculture in Egyptian field can potential sustain larger and more diverse mites and spider communities than intensive farming systems.

Table (5) : Seasonal abundance of the spider species / 5 plants by plant shaking method in the soybean field at El-Menofia governorate during season 2006.

Month	Araneidae			Dictynidae			Linyphidae			Tetragnathidae			Theridiidae			Total
	Co.	B.	C.	Co.	B.	C.	Co.	B.	C.	Co.	B.	C.	Co.	B.	C.	
May	1	0	1	1	0	0	1	0	0	1	0	2	1	0	1	9
June	1	0	1	1	0	1	8	5	7	4	0	2	3	2	3	38
July	7	4	6	1	0	1	9	1	14	4	2	3	7	5	6	70
August	9	3	7	7	5	6	17	1	15	7	1	5	7	4	7	101
Sept	11	6	9	8	6	8	17	9	13	7	2	5	13	6	11	131
Total	29	13	24	18	11	16	52	16	49	23	5	17	31	17	28	

Co. Control B. Biofertilizer C. Chemical fertilizers

Table (6) : Seasonal abundance of the spider species / 10 pit fall traps in soybean field at El-Menofia governorate during season 2006.

Month	Gnaphosidae			Lycosidae			Oecobiidae		
	Co.	**B.**	**C.**	**Co.**	**B.**	**C.**	**Co.**	**B.**	**C.**
May	0	0	0	0	0	0	0	0	0
June	2	0	5	0	1	0	0	0	4
July	5	7	9	5	4	4	2	0	6
August	11	10	12	4	3	6	2	3	8
Sept	8	9	14	3	3	7	4	3	10
Total	26	26	40	12	11	17	8	6	28
	92			40			42		

Co. Control B. Biofertilizer C. Chemical fertilizers

In conclusion, we believe that the spider and predaceous mite species may play as a buffer to regulate populations of many soybean mite and insect pests such as mite pests stem borer, maggots, and leaf and plant hoppers. The beneficial role of the spider and predaceous mite species might be interpreted by the low populations of the pests when they existed. Accordingly , conservation of these beneficial species are necessary to keep the natural balance in soybean as well in other ecosystem, Hendawy, and Abul-Fadl (2004). This could be mainly done by minimizing the application of any chemicals, Sallam 2002. Barrion and Litsinger, 1980 and Nentwig (1987) reported that small pests, such as thrips, midges and aphids, may die by being eaten or caught in the webs of large spiders.

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التسميد لعامل يؤثر على تعداد الأكاروسات والعناكب الحقيقية المتواجدة فى نباتات فول الصويا

عصام محمد عبد السلام ياسين - جيهان محمد السيد سلام
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يلعب نوع التسميد دورا هاما فى وجود الاكاروسات والعناكب المختلفة المرتبطة ببعض المحاصيل والهدف من الدراسة توضيح دور التسميد على تعداد الاكاروسات والعناكب المختلفة المرتبطة بمحصول فول الصويا. أوضحت الدراسة أن هناك ٢٨ نوع من الاكاروسات تنتمى الى ١٤ فصيلة تابعة لـ ٤ رتب وهى رتبة عديمة الثغر – ذات الثغر الامامى – ذات الثغر المتوسط – والحلم الخنفسى. وبدراسة التذبذب العددى للاكاروسات المتواجدة على اوراق فول الصويا سجلت أربعة عائلات وهى Tetranychidae و Phytoseiidae و Tydeidae و Tarsonemidae ووجد ان مجموع الاكاروسات المتحصل عليها على النباتات المعاملة بالتسميد الكيماوى على مدار الموسم اعلى من التى وجدت على النباتات المعاملة بالتسميد الحيوى. أيضا اثبتت الدراسة ان مجموع اكاروسات التربة المتواجدة فى المعاملات ذات التسميد الكيماوى اعلى من التى تم تسميدها بالسماد الحيوى بوجه عام ولكن وجد ان مجموع اكاروسات التربة المنتمية لتحت رتبة ذات الثغر المتوسط كان اعلى فى المعاملة بالتسميد الحيوى عن التسميد الكيماوى بعكس الاكاروسات المنتمية الى تحت رتبة ذات الثغر الامامى التى وجدت اعلى فى التسميد الكيماوى. وبدراسة عشائر العناكب الحقيقية المتواجدة على اوراق فول الصويا وجد ١٦ نوع من العناكب تابعة لـ١٢ فصيلة والتى جمعت بواسطة هز النباتات والمصائد الارضية وكانت العائلات السائدة على نباتات فول الصويا هى Araneidae و Dictynidae و Linyphidae و Tetragnathidae و Therididae حيث كان اعلى تعداد لها خلال شهر سبتمبر قبل الحصاد مباشرة وكان تعداد العناكب فى المعاملات ذات التسميد الكيماوى اعلى منه فى التسميد الحيوى على المجموع الخضرى لنباتات فول الصويا. اما العائلات السائدة فى التربة فكانت ثلاث وهى Gnaphosidae و Lycosidae و Oecobiidae وكان تعداد هذه العناكب فى التربة المعاملة بالتسميد الكيماوى اعلى من التسميد الحيوى و اعلى تعداد لهذه العناكب ممثلة فى عائلة Gnaphosidae.

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