SOIL INHABITING MITES AND COLLEMBOLA UNDER CUCUMBER AND TOMATO GROWN UNDER PLASTIC TUNNELS AT KAFR EL-SHEIKH.

BY

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ABSTRACT

An investigation that carried out at farm of the faculty of Agriculture, Kafr El-Sheikh, Tanta University. One plastic tunnel was under control and was of 270m^2 divied into two equal parts 135m^2 each, one was cultivated with Cucumber, *Cucumis sativus* L. var Delta star, while the other half was grown up with Tomato, *Lycopersicon esculentum* var. Strain B-VF 145B. Results revealed in recording 30 species of soil mites belonging to 17 families, they all were under 4 sub-order Oribatida, Gamasida, Actinedida and Acaridida. **Oribatida,** were represented by 48.42% and 59.81% in Cucumber and Tomato plants, respectively, **Gamasida,** that was represented by 22.15% and 28.04% in Cucumber and Tomato, respectively, **Actinedida,** occurring at 20.89% and 3.27% on Cucumber and Tomato, respectively and **Acaridida,** was represented by 8.54% and 8.88% for both Cucumber and Tomato, respectively. As for Collembola: The recorded collembolans were found to belong to 2 groups: **The spherical collembola** that were recorded by 2 suborders Arthropleona and Symphypleona and one family, **Prolonged collembola,** The sub-order Arthropleona was the only record for that group and included 3 families. In accordance with the first collembola group it was represented by 7.08% and 11.49% on Cucumber and Tomato, respectively, while the second group was represented by 20.78% and 28.57% for either Cucumber or Tomato plants.The population fluctuations of mites and Collembola studies from Cucumber plantation indicted that the highest record was (345.00 ind.) while that of Tomatoes (360.00 ind.). Arranging mites and Collembola populations from Cucumber plantations in a desending magnitude it could be stated that; Oribatida came first (34.93%), followed by Gamasida (15.98%) second, Actinedida (15.07%) third, while Acaridida fourth (6.16%) and the least in that category. However, from Tomato plantation results were different Oribatida came first (35.85%), Gamasida second (16.81%), Actinedida third (5.32%) and Acaridida fourth and least (1.96%). On the other hand, Collembola records were (27.86%) for Cucumber while it was (40.06%) for Tomato.

Key words: Soil fauna, Oribatida, Gamasida, Actinedida, Acaridida, mites, Collembola and plastic tunnels.

INTRODUCTION

The development in the use of plastics in greenhouses have recently taken place in Egypt, mainly over the past 25 years as research on protected cultivation started in 1968. The total covered area by walk-in tunnels ranged in-between 25704 feddan (1995) and raised up to 42840 feddan in 1996 **El-Aidy, (1996) and El-Aidy and Moustafa (1997)**. Among the three geographical zones of Egypt, i.e.: The Nile Valley, the Northern coastal zone and the Eastern coastal zone (Red Sea), more than (93%) of walk-in tunnels is situated in the Nile Valley, followed by Northern coastal zone (5.7%), while (0.6%) is only located in the Eastern coastal zone (Red Sea). The majority of the tunnels located in the Nile Valley (87.4%) were in Delta **El-Aidy (1996) and El-Aidy and S.A.Moustafa (1997)** The most important grown vegetable crops under walk-in tunnels is Cucumber, representing (63%-65%) of the total vegetable crops (Table 1) followed by sweet pepper (22-17%). On the other hand, the main crop under low tunnels (Table 1) is Tomato (66-71%), followed by Cucumber (18-36%). Some other vegetable crops were also grown under plastic tunnels, i.e. Strawberry, Okra, Eggplant, Squash and/or nursery stock **El-Aidy (1996)** The recent records indicated a reasonable increase in the cultivated vegetable crops under walk-in tunnels. It was found out that, Cucumber was cultivated in 11341 and 11238 feddans in 1999 and 2000 and it yielded 97232 and 76968 tons, respectively (according to statistical data of the Ministry of Agriculture, 1999 & 2000) **(Abd-Alla, 2002)**.

Table (1): Crop distribution of vegetables grown under plastic tunnels, in the Ismaillia Governorate (per cent).

	(% areas)	Cucumbers	Tomatoes	Sweet peppers	Green beans	Melon	Others(*)	Without crop
Tunnel-greenhouses	1992-1993	63	7	22	0.0	0.0	8.0	0.0
	1995-1996	65	3	17	2.9	2.4	4.9	5.3
Low tunnels	1992-1993	18	71	0.2	0.0	10.6	0.2	0.0
	1995-1996	36	66	0.2	0.3	1.5	0.4	0.0

(*) Strawberries. Okra. Eggplants. Squash and nursery stock
Source : El-Aidy, 1996.

The soil fauna under green-house and in the open field on both Cucumber and Tomato plants was studied by **Tadros and Saad (1980)**. They found that the mean of extracted fauna under Cucumber was higher 212.13 than that under Tomato 37.05. They also found that the closer the plants were planted 62.07% at 20 cm deep, the more the fauna flourished either under tunnels or in the outer atmosphere. **Zaher (1984)** found some mite species during a survey of soil mites in Sinai, *Rhizoglyphus robini* (Claparede), *Tyrophagous putrescentiae* (Schrank), *Heterodispus elongatus* (Tragardh) and *Cheyletus malaccensis* (Oudemans). **Hassan *et al.* (1986)** recorded six soil acarina species; *Spinibedlla bifurcata* (Atyeo), *Cheyletus malaccensis* (Oudemans), *Heterodispus elongatus* (Tragardh), *Tyrophagous putrescentiae* (Schrank),

Rhizoglyphus robini (Clebarede) and *Epilohmannia cylindrica* (Berlese). **Karg (1986)**, in G.DR stated that the abundance of the mite group Uropodina (turtle-mites) was greatest in soils under cultivation Cucumber plants in glass houses, in arable soils receiving organic manure and in the superficial strata of deciduous woodland. Most recorded species were from uropodina are carnivorous, it can also feed on decaying organic matter. However, the author indicated that some species can change to a phytophagous nutrition under the demands of the situation, e.g., *Uroobovella marginata* occasionally destroys parenchyma at the base of stalks of Cucumber plants in greenhouses. **Sharshir (1986)** surveyed acarina and collembola in soil. He found that it comprised (48.67% and 43.13% respectively) of the total extracted fauna and that were found to fall under four sub-orders of Acarina ; Mesostigmata, Prostigmata, Cryptostigmata and Astigmata. He also stated that the Cryptostigmatids and Astigmatids were the most dominant group (60.69%) followed by the Prostigmata (24.72%), while the Mesostigmata were the least (14.59%). The previous subclasses was represented by seven families in Mesostigmatids, and 15 in prostigmatids, wile Cryptostigmata was represented by 11 families (54.12%) and Astigmata by only one family (45.88%). On the other hand the order Collembola, He stated that the previous order was found to include five genera, they were, hypogastrura, Isotomurus, Proistoma, Sphaeridia and Tullbergia. The most prevalent extracted individuals were from the family Tullbergidae (69.74%) followed by the Isotomidae (16.72%) while Sphaeridae (0.05%) was the least category. A few scattered numbers were met with from the families Hypogastruridae (7.68%) and Poduridae (5.81%). **Sakchiev *et al.* (1987)** showed, during their investigations in southern Turkmenistan, recorded 58 mite texa were in soil under Cucumber and Tomato crops. They also recorded 19 gamasoid species and two of Oribatid mites for the first time from that region. *Rhizoglyphus echinopus* was the most abundant mite pest of the plant shoots in these houses and indicated that phenomenon may be due to its resistant hypopus stage. The same auther mentioned that the *Rhizoglyphus echinopus* was the most abundant pest of the plant shoot in soil under Cucumber and Tomato crops in hot houses. **Fata (1991) and El-Shafei(2003)** carried out a quantitative and qualitative survey for mites attacking vegetable plants such as Tomatoes, Cucumber and Pepper which were cultivated under greenhouse. Thirty four mite species belonging to 25 families were identified and found to be associated with the soil in the experimental samples. The Prostigamatid mites were found to form the highest species of mites being 15 species, followed by Mesostigmatid mites which constituted 11 species, Oribatid mites composed 5 species, while the Acarids represented the lowest group, only three species. **Ibrahim (1995)** recorded the mites associated with the plastic houses from soil samples in Alexandria

and El-Tahrir region. The recorded species were; *Aleuroglyphus ovatus, Rhizoglyphus robini, Tyrophagus putrescentiae, Scutacarus evansi, Pediculastes gallinae, Galumna* sp. and *Oribatula* sp. **Tadros *et al.* (1995)**, found that more than 150 species of ten fauna groups. The results showed that Colembola was one of the most prevalent groups in soil. The 0-30 cm strata was the much richer zone of the fauna. The present investigation is to find out the soil fauna. Survey, the diversity of soil mites and Colembola and Population flections of soil mites and Colembola associated with Cucumber and Tomato plantations under plastic tunnels.

MATERIALS AND METHODS

The present investigation was carried out in the Experimental Farm of the Faculty of Agriculture, Kafr El-Sheikh, Tanta University was chosen. One plastic tunnel was under control and was of 270 m^2 divided into two equal parts, (135 m^2) each, one was cultivated with Cucumber, *Cucumis sativus* L. var. Delta Star., while the other half was grown up with Tomato, *Lycopersicon esculentum* var. Strain B-VF 145B. That pervious plastic tunnel of (270 m^2) was never treated with any pesticides and was left under natural circumstances. That plastic tunnels was designed as a modified round arched tunnel as commonly found in Egypt. Ventilation was installed at the middle of the tunnel, and the ventilation opening dimensions are 3 x 12 meters (L x W), and was covered with an anti-insect nets. On the other hand, solid iron bars of (9 mm diam.) were used for the structure of every tunnel, and its dimensions were 6 x 45 x 2.5 meters (W x L x H). Soil structures in the tested areas were the same, silty clay. Mineral fertilization was added to the soil during the growth season of the plants. The applied compounds were added at the two chosen sites and were as follows: 300 kg of ammonium sulphate (20.5% N); 200 kg of calcium superphosphate (15.5% P_2O_5) and 100 kg of potassium sulphate (48% K_2O). Those mentioned amounts were divided into 3 equal parts and were applied at monthly intervals, starting one month after transplanting. Samples were taken monthly in the early morning (8.00 A.m.) at random in-between the growing plants near the root system, special care had to be done to avoid destroying either the plants nor the root system. Soil samples were taken by a steel cylinder of 4″ in its inner diameter at a depth of 20 cm. described by **wafa *et al.*, (1965)** The sampling procedure began from November 1999 till May 2000 from Cucumber area, and from November 1999 to April 2000 from Tomato area. The same procedure was deviced by **Tadros (1967)**. Soil samples were taken to represent the whole area of the chosen plastic tunnel. Extraction took place by using batteries of modified Tullegran funnels for (48) hrs. specimens were collected in petri-dishes containing water and were counted and identified by the aid of a binuclear microscope. For identification, purposes material was preserved in 70% ethyl alcohol, and/or were

mounted on slides using Hoyer's media. The obtained data were statistically analyzed according to **Duncan's (1955).**

RESULTS

1. Survey Studies:

The survey studies in the present investigation revealed in recording 30 soil mites species belonging to 17 Families; and all under four suborders, or rather, Oribatida, Gamasida, Actinedida and Acaridida (Table 2). The most prevalent soil springtails that were recorded were 8 species, belonging to 5 Families under the two grown vegetable crops was Cucumber and Tomato .In the same Table it was found out that soil mites was the most prevalent group in soil, since it represented (72.14%) of the whole encountered soil fauna, while the springtails represented (27.86%) only from Cucumber plantations. While it was (59.94%) and (40.06%) for soil mites and springtails respectively from Tomato plantation. On the other hand, there were some differences in-between the recorded acarina sub-order in the two grown vegetable crops. The dispersion of species was also clear.

2. The Diversity of Soil Mites species in two Vegetable Crops:

2.1. Cucumber Plantations:

The records in Table (2) indicated that individuals of the Family Oribatulidae (*Scheloribates laevigatus* (Koch.), *Siculobata sicula* (Berl.) and *Zygoribatula* spp). and the Family Oppiidae, *Oppia sitnikovae* (Sheref) were the most prevalent ones with the same percentage (12.34%), while the species *Rhodacarus* sp.; *Amblyseius* sp. and *Cheyletus malaccensis* (Oudemans) of the Families Rhodacaridae, Phytoseiidae and Cheyletidae were the same record and the least (2.53%). Epilohmanniidae [*Epilohmannia cylindrica cylindrica* (Berl.) and *E. pallida aegyptica* (Bayomi)] came second in rank (10.44%). Acaridae (*Tyrophagus putrescentiae* (Schrank) and *Tyrophagus* spp.) came third (8.54%), followed by Scutacaridae (*Scutacurus* sp.) (8.23%) the fourth. Preparing the other 7 unmentioned Families in a descending magnitude, the following picture clears up that Belbidae (*Belba* sp.) (7.91%); *Pachylaelapidae* (*Pachylaelps* sp.) (6.33%), Pygmephoridae (*Pygmephorus* sp., *Bakerdania* sp. and *Pediculaster* sp.) (5.38%), and Lohmaniidae (*Lohmania* sp. *and Papillacarus aciculatus* (Berl.) the same category (3.38%), Eupodidae (*Eupodes* sp.) (4.75%), Parasitidae (*Parasitus* sp.) (4.43%), Pachylaelapidae (*Laelapus* sp.) (3.48%), Ascidae (*Ololaelaps bregetova* (Shereef and Soliman), *Blattiosocius* sp., *Lasioscuis* sp. and *Prorogamasellus denticus* (Nasr) (2.85%).

Finding the occurrence of mites percentages to total fauna (Table 2), it was found out that those percentage ran in the same way as calculated with the mites Families and species with some differences in the percentages. Both Oribatulidae (*S. laevigatus, S.*

sicula and *Z.* spp.) and Oppiidae (*O. sitnikova*) came first on the top of the list (8.90%). followed by Epilohmanniidae (*E. pallidae* aegyptica and *E. cylindrica cylindrica*) that came second in that category (7.53%), and so on, however the Rhodacaridae, Phytoseiidae and Cheyletidae (1.83%) were the least.

2.2. Tomato Plantation:

Data shown in Table (2) indicated that the occurrence of the 20 recorded species of mites that were found to be belonged to 4 acari suborders were not the same. Accordingly, it was found that *Oribatula tadrosi* (Fam. Oribatulidae) was the most prevalent mite species (21.03%) in soil under Tomato plantations, while *Rhizoglyphus* sp. (Fam. Acaridae) was the least (2.80%). The other 18 speices came in-between those to items. *Bleba* sp. (Fam. Belbidae) (18.69%) came second in that category, *Scheloribates laevigatus* (Koch), *Siculobata sicula* and *Zygoribatula* spp.) (Fam. Oribatulidae) came third (8.88%), *Epilohmannia cylindrica cylindrica* and *E. pallidae aegypitca* (Fam. Epilohmanniidae) came fourth (7.48%) (*Ololaelaps bregetova, Blattiosocius* sp., *Lasioscuis* sp. and *Prorogamasellus denticus*) (Fam. Ascidae) (6.54%) and *Pachylaelaps* sp. (Fam. Pachylaelapidae) were the same percentage (6.54%) and were fifth in rank, followed by *Laelaps* sp. (Fam. Pachylaelapidae) (6.08%) sixth. Preparing the rest of the list descendingly it was found that *Amblyseius* sp. (Fam. Phytoseiidae) (5.61%) was seventh, *Ctenocarus* sp. (Fam. Ctenocaridae) (3.73%) eighth, *Parasitus* sp. (Fam. Parasitidae) and *Speleorchestes* sp. (Fam. Speleorchestidae) were the same percentage (3.27%) tenth in that list.

Finding the percentages of every recorded mites species to the total encountered soil fauna (mites + springtails). The results showed that, it was just the same recorded above with slight differences. *Oribatula tadrosi* (Fam. Oribatulidae) came on the top and was the most prevalent (12.61%), while *Rhizoglyphus* sp. (Fam. Acaridae) was the least (1.68%). The other 18 species came in-between, preparing them in a descending magnitude, it could be stated as follows: *Belba* sp. (Fam. Belbidae) (11.21%) followed by *Scheloribates laevigatus, Siculobata sicula* and *Zygoribatula* sp. (Fam. Oribatulidae) (5.32%), *Epilohmannia cylindrica cylindrica* and *Epilohmannia palida aegyptica* (Fam. Epilohmanniidae (4.84%) followed by *Ololaelaps bregetova, Blattiosocius* sp. *Lasioscuis* sp. and *Prorogam asellus denticus* (Fam. Ascidae) and *Pachylaelapus* sp. (Fam. Pachylaelapidae) (3.92%), *Laelapus* sp. (Fam. Pachylaelapidae) and *Tyrophagus putrescentiae* and *Tyrophugus* spp. (Fam. Acaridae) were the same percentage (3.64%). *Amblyseius* sp. (Fam. Phytoseiidae) (3.36%); *Ctenacurus* sp. (Fam. Ctenacaridae) (2.24%), *Speleorchestes* sp. (Fam. Nanorchestidae) and *Parasitus* sp. (Fam. Parasitidae) the same percentage (1.96%).

Table (2): Survey and diversity of soil mites and Collembola associated with Cucumber and Tomato plants under plastic tunnels during two seasons 1999-2000.

Sub-order	Family	Species	Cucumber				Tomato			
			mean	% of total mites	% of total group	% of total fauna	mean	% of total mites	% of total group	% of total fauna
A. Mites :										
Oribatida	Oppiidae	*Oppia sitnikovae* (Shereef) *	39.00	12.34	25.49	8.90	0.00	0.00	0.00	0.00
	Oribatulidae	*Scheloribates laaevigatus* (Koch)	39.00	12.34	25.49	8.90	19.00	8.88	14.84	5.32
		Siculobata sicula (Berl.)								
		Zygoribatula spp.								
		Oribatula tadrosi (Popp)**	0.00	0.00	0.00		45.00	21.03	35.16	12.61
	Epilohmanniidae	*Epilohmannia cylindrica cylindrica* (Berl.)								
		Epilohmannia pallida aegyptica (Bayomi)	33.00	10.44	21.57	7.53	16.00	7.48	12.50	11.21
	Belbidae	*Belba* sp.	25.00	7.91	16.34	5.71	40 00	18.69	31.25	4.84
	Lohmanniidae	*Lohmannia paradoxa* (Halle)*	17.00	3.38	11.11	3.88	0.00	0.00	0.00	0.00
		Papillacarus aciculatus (Berl.)								
	Ctenacaridae	*Ctenacarus* sp.**	0.00	0.00	0.00	0.00	8.00	3.73	6.25	2.24
Total Oribatida			153.00	48.42	-	34.93	128.00	59.81	-	35.85
Gamasida	Rhodacaridae	*Rhodacarus* sp.*	8.00	2.53	11.43	1.83	0.00	0.00	0.00	0.00
	Pachylaelapidae	*Pachylaelaps* sp.	20.00	6.33	28.57	4.57	14.00	6.54	23.33	3.92
	Laelapidae	*Laelapus* sp.	11.00	3.48	15.71	2.51	13.00	6.08	21.62	3.64
	Phytoseiidae	*Amblyseius* sp.	8.00	2.53	11.43	1.83	12.00	5.61	20.00	3.36
	Ascidae	*Ololaelaps bregetovae* (Saheeref & Soliman)	9.00	2.85	12.86	2.05	14.00	6.54	23.33	3.92
		Blattiosocius sp.								
		Lasioscuis sp.								
		Prorogamasellus denticus (Nasr)								
	Parasitidae	*Parasitus* sp.	14.00	4.43	20.00	3.20	7.00	3.27	11.67	1.96
Total Gamasida			70.00	22.15	-	15.98	60 00	28.04	-	16.81

Cont. Table (2) :

Sub-order	Family	Species	Cucumber				Tomato			
			mean	% of total mites	% of total group	% of total fauna	mean	% of total mites	% of total group	% of total fauna
Actinedida	Eupodidae	*Eupodes* sp.*	15.00	4.75	22.73	3.42	0.00	0.00	0.00	0.00
	Scutacaridae	*Scutacarus* sp*.	26.00	8.23	9.39	5.94	0.00	0.00	0.00	0.00
	Cheyletidae	*Cheyletus malaccensis* (Oudemans)	8.00	2.53	2.12	1.83	0.00	0.00	0.00	0.00
	Pygmephoridae	*Pygmephorus* sp.*	17.00	5.38	25.76	3.88	0.00	0.00	0.00	0.00
		Bakerdania sp.								
		Pediculaster sp.								
	Nonorchestidae	*Speleorchestes* sp.**	0.00	0.00	0.00	0.00	7.00	3.27	100.0	1.96
Total Actinedida			66.00	20.89	-	15.07	7.00	3.27	-	1.96
Acaridida	Acaridae	*Rhizoglyphus* sp. **	0.00	0.00	0.00	0.00	6.00	2.580	31.58	1.68
		Tyrophagus putrescentiae (Schrank)	27.00	8.54	100.00	6.16	13.00	6.08	68.42	3.64
		Tyrophagus sp.								
Total Acaridida			27.00	8.54	-	6.16	19.00	8.88	-	5.32
Total mites			316.00	-	-	-	-	214.00	-	
B. Collembola :										
i. *Spherical collembola*										
Arthropleona	Entomobryidae	*Seria squamboornata*	31.00		25.41	7.08	41.00		28.67	11.49
Symphypleona	Sminthuridae	*Sminthurinus* sp.								
ii. *Prolonged collembola*										
Arthropleona	Poduridae	*Lepidocertinus incertus* (Hand.)	91.00		74.59	20.78	102.00		71.33	28.57
		Hypogastrura manubrialis (Tulb.)								
		Hypogastrura armata (Nic)								
		Friesea claviseta (Axelson)								
	Onychiuridae	*Tullbergia* sp.								
	Isotomidae	*Folsomides parvulus*								
Total Collembola			122.00				143.00			
Total fauna			438.00			27.86	357 00			
% soil mites			72.14				59.94			
% soil Collembola			27.86				40.06			

* Represented only in Cucumber. ** Represented only in Tomato.

2.3 The Divetisty of Soil *Collembola* spp. Under Two Vegetable Crops:

The records in (Table 2) indicated that 8 Collembolan species were encountered as two groups, first the spherical Collembolan spp. and secondly the prolonged ones. In concern with the first group 2 collembolan species were recorded, and were found to belong to 2 Families, while the second recorded species were 6 and were found to be under 3 Families. The reason for that way of record was due to the fact that the identification of springtails was encountered in a later time after sampling took place for a long period, and also, that part of soil fauna was studied as a subsidiary part of the present study.

2.3.1 Cucumber Plantations:

In Cucumber as shown in Table (2), the spherical collembolans (*Seria squamoornata* and *Sminthurinus* sp.) were less in numbers (7.08%) than the prolonged ones [(*Lepidocertinus incertus* (Hand.); *hypogastrura manubrialis* (Tulb.); *H. armuta* (Nic.); *Friesea claviseta* (Axelson); *Tullbergia* sp. and *Folsomides parvulus* (Stach)] which considered as the prevalent ones and it constituted (20.78%).

2.3.2. Tomato Plantation:

As shown in Table (2) and as in Cucumber the same two collembolan categories were represented in Tomato at a different percentage since the prevalent species was the prolonged collembolans (28.57%) while the other one was the spherical ones and were (11.49%).

3- The Occurrence of Total Mean and Percentage of Mites sub-order and Collembola Under Two Vegetations Uunder Plastic Tunnel During 1999-2000.

The total mean fauna under the two grown vegetable crops was different in accordance with the four encountered mite groups (Table 3). It was found out that fauna under Cucumber plantations were higher (55.09%) than those under Tomatoes (44.91%). On the other hand, soil mites were the prevalent group under Cucumber plantations reaching (72.14%) while those under Tomatoes reached only (59.94%). In concern with Collembola, the picture reversed, i.e., springtails under the Tomato plantations were the prevalent (40.06%), while those under Cucumber the lower (27.86%).

In accordance with the recorded mite species under Cucumber and Tomato and the four mites sub-orders. It was found out that Oribatida was the most prevalent sub-order under the two vegetable crops, reaching a mean of 153.00 ind. (= 48.42%) and 128.0 ind. (= 59.81%) under Cucumber and Tomato respectively. The second encountered sub-order was Gamasida, since the record indicated

70.00 ind. (= 22.15%) and 60.00 ind. (= 28.04%) under Cucumber and Tomato plantations, respectively. Actinedida was third in rank with that category 66.00 ind. (= 20.89%) under Cucumber plantations, followed by Acaridida fourth 27.00 ind. (= 8.54%). On the other hand, the picture changed with mites under Tomato, since Acaridida 19.00 ind. (= 8.88%) came third and Actinedida 7.00 Ind.(= 3.27%) fourth.

Table (3): The occurrence of total mean of Mites sub-orders and Collembola under two vegetations, Tomato and Cucumber under plastic tunnels during 1999-2000.

Mites sub-order	Cucumber			Tomato		
	Mean	%		Mean	%	
		sub-or./ tot. mites	sub-or./ tot. Fauna		sub-or./ tot. mites	sub-or./ tot. Fauna
Oribatida	153.00 a	48.42	34.93	128.00 a	59.81	35.86
Gamasida	70.00 b	22.15	15.98	60.00 b	28.04	16.80
Actinedida	66.00 b	20.89	15.07	7.00 c	3.27	1.96
Acaridida	27.00 c	8.54	6.16	19.00 c	8.88	5.32
Tot. mites	316.00 a		72.14	214.00 b		59.94
Tot. Collembola	122.00 a	-	27.86	143.00 b	-	40.06
Tot. fauna	438.00 a			357.00 b		
%	55.09			44.91		

Mean number of mites-Order and Collembola with different latter are significant different (p = 0.05) **Duncan's (1955)** multiple range test.

Evaluating the percentage of every soil fauna group, or rather the Four acari groups and Collembola too (Table 3), it was found out that, under Cucumber plantations if preparing those percentages descendingly, it could be stated that Oribatida, came first (34.93%) followed by Collembolans (27.86%), Gamasida came third (15.89%), Actinedida fourth (15.07%), while Acaridida, the least (6.16%) and was fifth in that category. On the other hand, fauna under Tomato plantations, were not the same as recorded with Cucumber, Collembolans came in first rank (40.06%), followed by Oribatida (35.86%), Gamasida came third (16.80%), followed by Acaridida (5.32%) fourth, while Actinedida (1.96), the least and fifth in that category. We found significant between tot. of mites under Cucumber and total mites under Tomato. On the other hand. no significant between total Collmbola under Cucumber and Tomato. While found significant between total fauna of each Cucumber and Tomato.

4- Population Fluctuation of Six Families of Sub-Order Oribatida Associated With Cucumber Plantations Grown Under Plastic Tunnels During 1999-2000.

4.1. Cucumber Plantation:

As shown in Table (4) it was clear that total species of every Family group fluctuated during the 7 months of investigation in Cucumber plantations, however, that fluctuation was not the same in every family. The chosen Families that were more abundant

were; Oppiidae which represented by (25.49%), Oribatulidae was represented by the same percentage (25.49%), Epilohmanniidae, came second (21.57%), Belbidae third (16.34%), while Lohmanniidae (11.11%), the least and the fourth on that category.

Table (4): Population fluctuation Six Families of domenant sub-order Oribatida associated with soil grown up with Cucumber and Tomato under plastic during 1999-2000.

Months	Families Oribatida											
	Oppiidae		Oribatulidae		Epilohmannidae		Belbeidae		Lohmanniidae		Ctenacaridae	
	A	B	A	B	A	B	A	B	A	B	A	B
Nov.	3.00	-	4.00	10.00	5.00	4.00	4.00	21.00	2.00	-	-	5.00
Dec.	6.00	-	4.00	12.00	6.00	1.00	0.00	3.00	2.00	-	-	1.00
Jan.	4.00	-	3.00	12.00	1.00	3.00	3.00	4.00	0.00	-	-	2.00
Feb.	0.00	-	6.00	4.00	3.00	2.00	6.00	10.00	0.00	-	-	0.00
Mar.	4.00	-	5.00	11.00	2.00	2.00	5.00	0.00	1.00	-	-	0.00
Apr.	10.00	-	4.00	15.00	9.00	4.00	1.00	2.00	1.00	-	-	0.00
May	12.00	-	13.00	-	7.00	-	5.00	-	11.00	-	-	-
Total	39.00	-	39.00	64.00	33.00	16.00	25.00	40.00	17.00	-	-	8.00
Mean	5.57	-	5.57	10.67	4.71	2.67	3.57	6.67	2.43	-	-	1.33
%	25.49	-	25.49	50.00	21.57	12.50	16.34	31.25	11.11	-	-	6.25

A= Cucumber B = Tomato

May was the month of high populations with 3 Families ; Oppiidae (12.00 ind.), Oribatulidae (13.00 ind.) and Lohmanniidae (11.00 ind.), while it was April with Epilohmanniidae (9.00 ind.) and February with Belbidae (6.00 ind.). On the other hand, the minimum records in those 5 Families were; Oppiidae February (0.00 ind.), Oribatulidae January (3.00 ind.), the same month with the Epilohmanniidae (1.00 ind.), Belbidae Dec. (0.00 ind.) and finally Lohmanniidae January and February (0.00 ind.).

4.2. Tomato Plantations:

As shown in Table (4) it was clear that only 4 Families were encountered instead of the 5 ones with Cucumber. However, it was distinct also that two of the recorded Families in soil grown, up with Cucumber were totally absent in Tomato plantations, they were the Families Oppiidae and Lohmanniidae. Another fact was clear, that is, meeting will representatives from the Family Ctenacaridae that was absent in soils of Cucumber plantations, the Family Oribatulidae represented (50.00%) in Tomato plantations, representing the most prevalent Family with Cucumber too, giving an idea of its prevalence in the two chosen vegetable crops. Belbidae, came second in rank (31.25%), while Epilohmanniidae (12.50%) third in that category. The least occurring Family was Ctenacaridae, that was represented by (6.25%).

In concern with soil mite fluctuations and the six months period of investigation, it was clear from (Table 4) that mite species fluorished and its highest fluctuation was recorded in November 1999 with the Families Belbidae (21.00 ind.), Epilohmanniidae (4.00 ind.) and Ctenacaridae (5.00 ind.), however, it was April with

Family Oribatulidae (15.00 ind.) just around the timing with Cucumber plantations. Bearing in mind that the experiment terminated with Tomatoes in April, while it extended to May with Cucumber. The minimum recorded fluctuations were different within the four recorded soil mite Families. In concern with Oribatulidae, it was in February (4.00 ind.); while Belbidae in March (0.00 ind.); Epilohmanniidae in December (1.00 ind.), while with Ctenacaridae it was from February till the end of experiment in April (0.00 ind.). The total numbers of soil mites were found fluctuating in-between those two limits (maximum and minimum) mentioned. The diversity of species was clear in two sub-orders of the four encountered ones, or rather with Oribatida and Gamasida (Table 2).

5. Population Fluctuation of Four Mites Sub-Orders and Collembola Associated With Cucumber Plantations Under Plastic Tunnels During 1999/2000 Seasons:

5.1. Total Mites Fluctuations Associated With Cucumber:

As indicated in Table (5) it was clear that May 2000 held the majority of soil mites 68.00 ind.(= 21.51%) while January, 2000 held the minority 19.00 ind. (= 6.01%). The other five months came in-between those tow limits. It was found out that November 99 came second in rank, 61.00 ind. (= 19.37%). December the same year, 47.00 ind. (= 14.87%) came third; February came fourth 45.00 ind. (= 14.24%), April came fifth 41.00 ind. (= 12.97%); March 35.0 ind. (= 11.10%) came sixth in that category.

Table (5): Population fluctuation of four mites sub-orders and springtails during 7 months, from Cucumber plantations, during 99-2000.

Months	Oribatida	Gamasida	Actinedida	Acaridida	Collembola	Total		%	
						Mites	Fauna	Total mites	Total fauna
Nov.	18.00 c	12.00 b	18.00 a	13.00 a	16.00 b	61.00	77.00	19.30	17.66
Dec.	18.00 c	6.00 d	17.00 a	6.00 b	17.00 b	47.00	64.00	14.87	14.68
Jan.	11.00 d	6.00 d	2.00 d	0.001 e	10.00 d	19.00	29.00	6.01	6.65
Feb.	15.00 c	17.00 a	12.00 b	1.00 c	30.00a	45.00	75.00	14.24	17.20
Mar.	17.00 c	8.00 c	4.00 c	6.00 b	18.00 b	35.00	53.00	11.10	12.16
Apr.	26.00 b	12.00 b	2.00 d	1.00 c	16.00 c	41.00	57.00	12.97	13.07
May	48.00 a	9.00 c	11.00 b	0.001 e	13.00 c	68.00	81.00	21.59	18.58
Total	153.00 a	70.00 c	66.00 c	27.00 d	120.00 b	316.00	436.00	100.00	100.00
% Sub-orders/ total mites :									
	48 42	22.15	20.89	8.54					
% Sub-order/ total fauna :									
	35.09	16.06	15.14	6.19	27.52				

Mean numbers of mites sub-orders and Collembola with different (p=0.05) **Duncan's (1955)** multiple range test.

5.2. Total Fauna Fluctuations Associated With Cucumber:

As shown in Table (5), it was clear that total fauna (Mites + Collembola) flourished during May 2000 reaching a total mean of

81.00 ind. (= 18.58%), while January 2000, was the least, 29.00 ind. (= 6.65%). The other five months were found to fluctuate in-between; November 99 came second in rank, 77.00 ind.(= 17.66%), followed by February 75.00 ind. (= 17.20%) third, December 99 was the fourth in that category 64.00 ind.(= 14.68%) April came fifth 57.00 ind. (= 13.07%), while March 53.00 ind. (= 12.16%) was sixth in that category.

5.3. Four Sub-Orders of Mites Associated With Cucumber:

It was clear from Table (5) that mites belonging to the four encountered sub-orders during all time experiment were not the same: **Oribatida,** May was the month of highest fluctuations of the Oribatids reaching a total mean of (48.00 ind.) while January was the least (11.00 ind). The least of the studied months were found to be in-between those two limits, preparing the mean number of the other five months descendingly. It could be stated that: April (26.00 ind.) came second, followed by November and December 99, that were equal and gave the same record (18.00 ind.), March (17.00 ind.) came fifth, February (15.00 ind.), sixth in that category. **Gamasida:** The gamasids fluctuations (Table 5) were found to be less in its numbers than the Oribatids. However February means were the maximum record 17.0 ind. followed by November 99 and April 2000 second and the same record (12.00 ind.), May 2000 came third (9.00 ind.), March (9.00 ind.) fourth in that category, while December 99 and January 2000 the same record, (6.00 ind.) and fifth in that category. **Actinedida:** That sub-order was the third one studied in that category, and it was clear that its fluctuating numbers were less than the other sub-orders. Preparing the recorded numbers of Actinedids descendingly, it was clear that November came first (18.00 ind.), December (17.00 ind.) second, February (12.00 ind.) third; May (11.00 ind.) fourth, March (4.00 ind.), fifth both April and January 2000, were the least (2.00 ind.) and was encountered as the seventh. **Acaridida:** The acaridids were found to be the least soil mites in the present investigation. Its numbers were recorded within only five months of the seven month work. November 99 was the highest month (13.00 ind.), December 99 and March 2000, the same (6.00 ind.) came second, followed by February and April came third and were the same record (1.00 ind.), while both January and May were the same record also, and held nil (0.001 ind.), and were fourth in that category.

We found significant relation ship between total sub. Order Oribatida and other total suborders mites under Cucumber. On the other hand found significant relation ship between May (48.00ind.) and other months of Oribatida, Feb. (17.00 ind.) of Gamasida Nov. and Dec 18.00 & 17.00 ind. Of Actinedida and Nov. (13.00 ind.) of Acaridida and other months under Cucumber.

5.4. Springtails Associated With Cucumber:

The recorded means of Collembolans were found to be second in rank after the Oribatida, and, its numbers were found to fluctuation with in the 7 months of experiment. January 2000 was the least (10.00 ind.), while February 2000 gave the maximum record (30.00 ind.). Preparing the other five months, it could be stated as follows: March (18.00 ind.) came second, December 99 (17.00 ind.) third, November and April the same record (16.00) fourth, May (13.00 ind.) fifth in that rank.

6. Population Fluctuation of Four Mites Sub-Orders and Collembola Associated With Tomato Plantations Under Plastic Tunnels During 99/2000 Season:

6.1. Total Mites Fluctuations Associated With Tomato:

As seen in Table (6) the results indicated that November 99, had the maximum record of the soil mites as (60.00 ind.) comprising (28.04%) while Mar. 2000, held the minimum as (26.00 ind.) comprising (12.16%). The other four months came in-between those tow limits. It was found out that December 99 came second, 33.00 ind. (= 15.42%) while January, February and April 2000, came third and have the same records (32.00 ind.) comprising (14.48% and 14.95%) respectively.

6.2. Total Fauna Fluctuations Associated With Tomato:

Table (6) showed that total fauna (Mites + Collembolans) flourished during November 99 reaching a total mean of (74.00 ind.) comprising (20.73%), while April, 2000, was the least 51.00 ind. comprising (14.95%) the other four months were found to fluctuate in-between; December 99 came second 62.00 ind. (=17.37%), followed by March 2000, third 62.0 ind. (=17.37%), February 55.00 ind.(= 15.41%) fourth, while January 53.00 ind. (14.85%) came fifth in that category.

Table (6): Population fluctuation of four mites sub-orders and springtails during 6 months, from Tomato plantation, during 99-2000.

Months	Oribatida	Gamasida	Actinedida	Acaridida	Collembola	Total		%	
						Mites	Fauna	Total mites	Total fauna
Nov.	40.00 a	14.00 a	1.00 b	5.00 a	14.00 c	60.00	74.00	28.04	20.73
Dec.	17.00 c	12.00c	0.001 e	4.00 a	29.0 a	33.00	62.00	15.42	17.37
Jan.	21.00 b	5.00 d	2.00 a	3.00 c	22.00 b	31.00	53.00	14.48	14.85
Feb.	16.00 c	13.00 b	1.00 b	2.00 c	23.00 b	32.00	55.00	14.95	15.41
Mar.	13.00 d	8.00 d	1.00 b	4.00 a	36.00 a	26.00	62.00	12.16	17.37
Apr.	21.00 b	8.00 d	2.00 a	1.00 d	19.00 c	32.00	51.00	14.95	14.27
Total	128.00 a	60.00 b	7.00 d	19.00 c	143.00 a	214.00	357.00	100.00	100.00
% Sub-orders/ total mites :									
	59.81	28.04	3.27	8.88					
% Sub-order/ total fauna :									
	35.85	16.81	1.96	5.32	40.06				

Mean numbers of mites sub-orders and Collembola with different (p=0.05) **Duncan's (1955)** multiple range test

6.3. Four Sub-Orders of Acarina Associated With Tomato:

It was obvious from Table (6) that mites belonging to every one of the four encountered sub-orders during the whole time experiment were not the same as follows: **Oribatida,** November was the month of high numbers of Oribatids reaching a total mean of (40.00 ind.), while March 2000, was the least (13.00 ind.) in that rank. The rest of the studied months were found to fluctuate as follows: both January and April 2000 were the same record and were second in rank (21.00 ind.), followed by December 99 (17.00 ind.) third, February came fourth (16.00 ind.). **Gamasida,** November was the month of high record of the gamasids reaching (14.00 ind.) first in rank, followed by February second (13.00 ind.), December 99 third (12.00 ind.), both March and April 2000 came fourth (8.00 ind.), while January the fifth and least of that category (5.00 ind.). **Actinedida,** were found to be less in its numbers than the other 3 sub-orders. Both January and April 2000 were the highest record (2.00 ind.) first in rank, followed by November 99,. February and March 2000, second in rank and giving the same record (1.00 ind.) while December 99, was the least and held nil (0.001 ind.). **Acaridida,** The acaridids were found to be fluctuating as follows: November 99, held the majority of the soil mites (5.00 ind,), while April 2000, held the minority (1.00 ind,), the other 4 months fluctuated between the two limits both December 99 and March 2000, held the same record (4.00 ind.) and were second in rank, followed by January 2000, third (3.00 ind.), while February came fourth in that rank (2.00 ind.).

We found significant relation ship between total suborder Oribatida and other total suborders mites and as total Collombola in the same trend on the other hand no found significant relation ship between totals suborder Oribatida and total Collmbola under Tomato while, found significant relation ship between mean number suborder Oribatida, Gamasida and Acaridida in November and other months while, mean number suborder Actinedida found significant relation ship between April and other months under Tomato.

6.4. Springtails Associated With Tomato:

The data shown in Table (6) indicated that the mean of springtails were found to be the first, or rather the highest records from soil acari, as March 2000, was the highest month (36.00 ind) while November was the lowest (14.00 ind.) the other 4 months came in-between as December 99, was second (29.00 ind.), followed by February third (23.00 ind.), January came fourth (22.00 ind.) then came April the fifth (19.00 ind.) in that category.

DISCUSSION

The population fluctuation of soil mites under Cucumber were found to flourish on May 2000, the highest record, while January gave the lowest record. The other months fluctuated in between those two limits. the highest records varied from one sub-order to another. According to **Helmy *et al.*, (1994), Tadros *et al.*, (1995); *Sharshir* (1998) and prus *et al.*, (1999)** the decrease in doil acarina magnitude in winter was due to the change happening in soil structure, soil cold, aeration light and heat penetration of soil layer and in mean time evaporation of soil moisture which is considered on of the a main essential factors needed for the development and life cycle of most soil fauna. So, a lot of soil organisms may desiccate and die. The same outhers stated that the high numbers of soil mites in summer season may be due to the immigration of some soil living animals to the upper soil strata and may multiply if its offered good plant cover, convenient ecological factors and plant roots grows. However, as for Oribatida it was May, Gamasida it was February, but for both Actinedida and Acaridida, it was November that differences probably due to the mode of living of these organisms and to the soil substrate it lives and the its specific diet according to every group. On the other hand, that results was not the same under Tomatoes. As for springtails population fluctuation, it was found out that. February was the month of highest records, while January the least. However it was not the same with Tomatoes, and that results may be attributed to the nature of roots and the accompanying microflora. The diversity of species was watched more clear with the sub-order. Oribatida and specially the family Oribatulidae and also with the sub-order Gamasida, specially the family Ascidae. **Sharshir (1986, 1998), Tadros *et al.*, (1995), Abou Taysh (1997) and El-Shafei (2003)** Suggested that the dispersion of soil organisms may be correlated with the growth of plants, sufficient good grown roots, relative humidity, organic matter, aeration, fertilizers, water table and other indirect factors responsible for the convenient factors needed for the growth and reproduction of soil organisms. As for the Collembola that phenomenon was clear with the family poduridae. that mentioned diversity probably mite be referred to the mode of living, nourished diet, and adaptation of species to the available offered nutrition.

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الملخص العربى

الأكاروسات والقافزات التى تعيش فى تربة الخيار والطماطم النامية تحت الصوب البلاستيكية

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أخذ الاهتمام باستخدام الصوب البلاستيكية فى مصر فى الظهور منذ عام ١٩٦٨ فى الأغراض البحثية ثم زاد الاهتمام بها فى أغراض الانتاج ولم تعد الخضر هى المحاصيل الوحيدة التى تزرع تحت الصوب ولكن تعدت الى نباتات الزينة كالقطيفة والجربيرا والكرايزانثيمم وكذلك عيش الغراب وبعض انواع الفاكهة ولهذا زادت المساحة المنزرعة فى مصر بالصوب حتى وصلت ٤٢٨٤٠ فدان عام ١٩٩٦.

ويعتبر محصول الطماطم من المحاصيل الرئيسية التى تزرع تحت الصوب البلاستيكية حيث بلغت النسبة المنزرعة منها (٦٦,٠٠-٧١,٠٠%) يليها محصول الخيار (١٩,٠٠-٣١,٠٠%) ، إلا أن معظم المزارعين يفضلون زراعة محصول الخيار كمحصول رئيسى تحت الصوب وذلك من وجهة النظر الاقتصادية والربح السريع.

وقد كان الغرض من تناول الدراسة الحالية تسجيل **اكاروسات وحشرات التربه** تحت الغطاء النباتى للمحصولين الآتيين وهما :-

محصول الخيار *Cucumis sativus* Var Delta Star. ، صنف Delta Star ، وكذلك محصول الطماطم *Lycopersicon esculentum* Var. StrainvB- VF 145 B صنف سترين B تحت ظروف الصوب البلاستيكية ودراسة كثافتهم العددية وتذبذبهم العددى خلال مدة التجربة ، وقد تمت التجربة فى مزرعة كلية الزراعة بكفرالشيخ فى موسمين للخيار وموسم واحد طويل للطماطم ، ولفحص فونة التربة فقد أخذ العينات بنفس الطريقة المسجلة بواسطة (تادرس والقفل ، ١٩٦٣) والتى تم تعديلها بواسطة (تاردس ١٩٦٧) وكان يتم الفصل باستخدام طريقة أقماع تليجرن المحسنة لمدة ٤٨ ساعة.

وهنا تم تسجيل كل من اكاروسات وقافزات التربة على عمق ٢٠ سم قد تم تسجيل ٣٠ نوع من اكاروسات التربة وجد انها تتبع ١٧ عائلة وتقع تحت أربع رتبيات وهى: Acaridida, Actinedida, Gamasida, Oribatida. وقد وصلت النسبة المئوية لرتبية Oribatida ٤٨,٤٢% ، ٥٩,٨١% فى كلا الخيار والطماطم على التوالى.

أما **رتبية Gamasida** فتمثلت على كلا الزراعتين الخيار والطماطم بنسب مئوية قدرها ٢٢,١٥% ، ٢٨,٠٤% على التوالى. **رتبية Actinedida** وقد بلغت النسبة المئوية لها ٢٠,٨٩% ، ٣,٢٧% لكل من الخيار والطماطم على التوالى. **رتبية Acaridida** وبلغت النسبة المئوية لتواجدها على الخيار ٨,٥٤% ، وعلى الطماطم ٨,٨٨%.

أما قافزات الترتبة Collembola فقد تم تسجيل ٨ انواع تابعة الى خمس عائلات سواء من الأنواع المطاولة Prolonged او الكروية Spherical وقد بلغت النسبة المئوية لتواجد القافزات على الخيار ٢٧,٨٦% بينما على محصول الطماطم ٤٠,٠٦%.

تم دراسة التذبذبات العددية للفونة أى لكلا الأكاروسات وحشرات التربه على كلا محصولى الخيار والطماطم حيث سجل أعلى تعداد تحت نبات الخيار (٤٣٥ فرد) بينما تحت نبات الطماطم (٣٦٠ فرد) طيلة مدة التجربة وبترتيب نسبة تواجد الأكاروسات تنازليا على محصول الخيار كانت كالآتى: Oribatida ٣٤,٩٣% ، Gamasida ١٥,٩٩% ، Actinedida ١٥,٠٧% ، Acaridida ٦,١٦%. بينما أظهر محصول الطماطم الترتيب التالى: Oribatida ٣٥,٨٥% ، Gamasida ١٦,٨١% ، Acaridida ٥,٣٢% ، Actinedida ١,٩٦%. وعند حساب موضع الكولمبولا فى التربه فيكون وضعها كالتالى فى التعداد: بالنسبة للخيار (٢٧,٨٦%) بينما فى محصول الطماطم (٤٠,٠٦%).