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Effect of microbial inoculants and nitrogen fertilization on soil mites and collembola in cowpea crop, at Kafr el - Sheikh, Egypt.

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Abstract

Two field trials were conducted at Sakha Agric. Res. Station during the two successive summer growing seasons of 2010 and 2011. Cowpea plants (vigna unquiculata (L.) walp.) variety Dokki 331, were inoculated with micro symbiont . *Bradyrhizobium sp* along with urea fertilizer at 40 and 80 kg N/fed . applied in two equal doses : at 30and 45 days after sowing . The investigation lasted for three months in the two seasons of study aiming to survey the occurring soil predacious mites, miscellaneous mites and Collembola in four Nodulation and N – fertilization treatments : Nodulated + 50%N,Nodulated+100%N, Non – Nodulated+50%N, and Non - Nodulated +100%N under field conditions and the diversity between species under Nodulation and N- fertilization. Results revealed occurring of 8 species of predacious mite, belonging to 7 families in all Nodulators and N- fertilizers during the two seasons . while miscellaneous mite had 14 species belonging to 13 families in all Nodulators and N- fertilizers during the two seasons , except for Non - Nodulation +100%N during seasons 2010, which had 13species belonging to 12 families. Also, 5 species of Collembola belonging to 5 families in both two seasons. Results indicated that the population density of the soil mite and Collembola increased with application of both microbial inoculants and N-fertilization , recording the highest figure at 80kg N/fed . *Amblyseius sp* and *Cheyletus malaccensis* (Oudmans) were the most dominant species under different applications of microbial inoculants and N- fertilization .While , *Cheyletus eruditus* (Oudmans)was the least species to be recorded .*Pygmephorus sp*. was the dominant species under cowpea field in the two seasons under different types of Nodulators and N- fertilizers. While , *Galumna sp* was the least one *Proistoma* sp. was the dominant species in the two seasons under different types of Nodulators and N- fertilizers , while , *Onychiurus* sp. *Hypogastura* sp . *Tulbergi* sp. and *Entombyra* sp. were least recorded species .

Diversity index values of predacious *mite* species were (0.8456, 0.8638, 0.9330, 0.8525) and(0.8753, 0.8874,0.8659, 0.8866). While miscellaneous mite, were (2.1411, 1.0919, 2.7336, 1.0888) and (1.1047,1.1169, 1.1047 , 1.1096) on the other hand Collembola were(0.6974, 0.6966 , 0.6978, 0.6985) and (0.6977, 0.6976, 0.6981, 0.6984) for Nodulated + 50%N, Nodulated+100%N, Non – Nodulated+50%N, and Non - Nodulated +100%N during seasons (2010 and 2011) , respectively.

Keywords: microbial incoulants , nitrogen fertilization , mites , collembola , cowpea

Introduction

Cowpea is one of the most important leguminous vegetable crops in Egypt .Recently,its cultivated area was rapidly increased .However , the production of this crop has bean constrained by the limitation imposed by soil mites and Collembola. which cause serious damage . The total number of predacious mite , miscellaneous mite and Collembola species . differ among crops and proportion of species also varied (EL- Hawary *et al*.,1995) .The relationship between species diversity and ecological processes can change quantitatively and qualitatively with environmental context (Cardinale & Nelson,1999) .Survey of predacious mite and miscellaneous mite and Collembola associated with cowpea plants were reported by(Hassan *et al*.,1985 and Abdel – Alim 1994) .it was stated that it can derive nitrogen from soil ,fertilizer and through dinitrogen – fixation by symbiosis with the specific micro partner *Bradyrhizobium* sp ,Increase of plant nitrogen content to certain level was found to induce the severity of infestation with major cowpea pests such as soil mites and Collembola (El-Kifl, 1957 and Abo-korah *et al*.,1985) .

Investigation on soil mites is necessary according to their importance in improving soil fertility .Moreover, some soil mites act as predators and /or parasites for different stages of injurious species of mites (El-Kifl, 1957& 1968 , Tadros, 1975 and Boraei *et al*.,1994) . Soil fauna always flourish and increase under different crops receiving nitrogen fertilization , while higher nitrogen level more than the recommended doses reduce their population density (Abo Korah *et al*.,1984-1985 a & Tadros, 1975, Sharshir 1986 , Rosche 1992 and Gamieh & Saadon 1995).

The objective of the present work aimed to study the effect of application of microbical inoculants of cowpea seeds with the micro symbiont *Bradyrhizobium* sp . , two rates of nitrogen fertilizer on soil mites and Collembola on cowpea plants and to see the species diversity as related to cowpea variety Dokki 331 in Egypt.

Materials and methods

Two field trials were conducted at Sakha Agricultural Research Station , Kafr EL- Sheikh ,Egypt . in the two seasons of 2010 and 2011; Cowpea variety Dokki 331 was sown on June 1st 2010 and in May 28th,2011in clay –loamy alluvial soil in a Split – Split Plot design with four replications. Each sub sub –plot ($21m^2$) contained 10 rows .The main –plots were randomly assigned by microbial inoculants application for seeds (or not)with the micro symbiont *Bradyrhizobium* sp.using a peat –based inoculum (8.40×10^8cfu/g)at 200g inoculum/40 kg seeds. The plots were irrigated Just after sowing .The sub –plots were assigned to the urea fertilization (46%N)at 40 and 80kg N/fed applied in two equal doses 30 and 45 days after sowing.

The used cultural practices (treatments)were as follows:

Nodulated + 50% N- fertilization(40kg/feddan)
Nodulated + 100% N- fertilization(80kg/feddan)
Non- Nodulated + 50% N- fertilization (40kg/feddan)
Non- Nodulated + 100% N- fertilization(80kg/feddan)

Sampling started one week after sowing .An area of one Feddan was chosen for carrying out the present study.Samples were taken weekley by the use of a steel cylinder of 10cm diameter and 20cm depth as described by EL-kifl (1957) was used in the present investigation. They obtain about 1571.5cc of soil . Four samples were taken at random on every sampling date.

Every soil sample was put in a special plastic bag, tightly closed recording the needed data on each bag and carried directly to the laboratory for the extraction of organisms. Separation of organisms took place by the electric use of batteries of modified tullgren funnels adapted with 40 Watt bulbs for 48 hours. Organisms were collected in Petri - dishes containing water. Identification of organisms was done by help of a binocular microscope. At every sampling date, four replicates were taken and mixed together thoroughly . From those thoroughly mixed four samples, 0.75kg was taken to represent that date and location of soil sample.

Shannon-Weaner diversity index (S.W.I.) was used to measure diversity of arthropod pest species as it is one of the most commonly used (Price, 1984). The Shannon-Weaner index was calculated according to the following equation:

$$Hs = \sum_i^s Pi \, Log \, Pi$$

Hs = The symbol for the amount of diversity in a group of species in this case, the category of classification used in the species (hence the sub-scripts) but other categories could be used as well, it may be applicable to families, order, … etc.

S = Number of species with sample,

Pi = The proportion of the 1st species in the total sample, it measures the relative abundance and ranges between 0.00 to 1.00

Log_e = Natural logarithm. The negative sing is added to make the come out positive value = 2.718.

The function was derived independently by Shannon and Weaner and is sometimes mislabeled as the Shannon-Weaner function in the ecological literature (Kerbs, 1978).

Results and discussion

1. Survey studies:

As shown in Table (1), the first category was the total recorded predacious mite species were 8 species from Nodulated + 50% N- fertilization, Nodulated + 100% N- fertilization, Non- Nodulated + 50% N- fertilization and Non- Nodulated + 100% N- fertilization during seasons 2010& 2011 . While, were 14 species were recorded from miscellaneous mite belonging to 13 families in both Nodulated + 50% N- fertilization, Nodulated + 100% N- fertilization, and Non- Nodulated + 50% N- fertilization that 13 miscellaneous mite species belonging to 12 families during season 2010. On the other hand, during season 2011 ,it could be stated that 14 miscellaneous mite species belonging to 13 families were recorded from Nodulated and N- fertilization above mentioned. Finally the springtails (Collembola) were represented by 5 species in all Nodulation and N- fertilization during 2010&2011. Population of these fauna in cultivated soil with a crop is affected by many factors ;i.e, cultivated crop, water content ,soil porosity, Nodulation and N- fertilization, organic matter, content, total soluble salts and mechanical analysis (Abou -Tayesh, 2008,Abou-Tayesh et al.2013and Gamieh *et al* .1998).

2.Population density of *predacious& miscellaneous mite* and *collembolan* species in soil on four Nodulation and N- fertilization in cowpea field:

2.1. predacious mites:

A- Season 2010:

In Table (1), the dominant recorded species was *Amblyseius* sp. reaching (16.51%) of the total predacious mite in Nodulation + 50% N- fertilization while ,the least recorded one was *Cheyletus eruditus* (Schrank) reaching (0.54%), *Macracheles* sp . came in second rank , *Rhodacarus sp* (15.15%).was the third in rank .All other species came in –between prep (those records it in a descending magnitude , the following picture would indicate that , *Cheyletus malaccensis* (oudmans) (14.88%), *Bdella sp* . (14.47%), *Cunaxa capreolus* (Berlese) (14.21%) and *Blattioscius sp* (7.85%) . while , in Nodulation +

100% N- fertilization, the prevalent recorded species was *Amblyseius* sp. reaching (17.51%) of the total predocious mite , while ,the least one was *Cheyletus eruditus* (Oudmans)reaching (2.09%) .*Cunaxa caprealus* (Berlese) came the second in rank , *Bdella sp* (15.16%)the third in rank .All other species came in between preparing it in a descending magnitude .The following picture indicated that, *Cheyletus malaccensis* (oudmans) (13.41%), *Macrocheles sp*(12.72%), *Rhodacarus sp* .(12.36%) and *Blattisocius sp (*9.58%) . While , in Non-Nodulation+ 50% N- fertilization, as shown , dominant recorded species was *Amblyseius* sp. reaching (17.56%) of the total predocious mite , while ,the least one recorded was *Cheyletus eruditus* (Oudmans) reaching (0.75%) . *Bdella* sp. came second in rank(17.55%) and *Cheyletus malaccensis* (Oudmans) (16.04%), the third in rank .All other species came in-between preparing those records it in a descending magnitude,the following picture indicated that, *Rhodacarus sp* .(14.90%), *Macrocheles* sp. (14.72%) and *Blattisocius sp* (6.98%) . Finally , in Non- Nodulation+ 100% N-fertilization the dominant recorded species was *Amblyseius* sp. reaching (16.56%) of the total predacious mites , while ,the least one was *Cheyletus eruditus* (oudmans) reaching (0.91%) . *Bdella* sp.(16.11%) came second in rank and *Cheyletus malaccensis* (Oudmans) (14.89%), the third in rank .All other species came in-between , and may be arranged records it in a descending magnitude as follows, *Rhodacarus* sp .(14.58%),*Macrocheles* sp.(14.28%) and *Blattisocius* sp. (8.51%) .

B- Season2011:

Data in Table (1) show that in Nodulation + 50% **N**- fertilization , the dominant recorded species was *Amblyseius* sp. reaching (15.67%) of the total predacious mite ,while, the least one recorded was Cheyletus *eruditus* (Oudmans) reaching (3.49%). *Bdella* sp and *Macrocheles* sp . came second in rank . Cheyletus malaccensis (Oudmons) (14.43%) was the third in rank followed by *Cunaxa capreolus* (Berlese) and *Rhodacarus sp* (13.85%) the fourth in rank , then , *Blattiosocius* sp. (8.67%) . In Nodulation + 100% N- fertilization, the prevalent recorded species was *Amblyseius* sp reaching (16.03%) of the total predocious mite , while ,the least one *was Cheyletus eruditus* (Oudmans)reaching (5.80%) . *Bdella sp* came second in rank followed by , *Cunaxa caprealus* (Berlese) (14.72%).All other species came in –between preparing it in a descending magnitude as follows , *Cheyletus malaccensis* (Oudmans) (13.72%), *Mocrocheles sp*.(12.99%) , *Rhodacarus sp* .(11.84%) and *Blattisocius sp* (9. 72%) . While , in Non- Nodulation+ 50% N- fertilization, as shown , that dominant recorded species was *Amblyseius sp* reaching (16.12%) of the total predacious mite , while ,the least one recorded was *Cheyletus eruditus* (Oudmans)reaching (2.41%), *Bdella* sp. came second in rank, *Cheyletus malaccensis* (oudmans) (15.81%), the third in rank. All other species came in-between to be arrange in a descending magnitude, as; *Macrocheles* sp(15.18%) *Rhodacarus* sp .(13.93%), *Cunaxa caprealus* (Berlese) (11.83%) and *Blattisocius* sp (8.69%) . While in Non-Nodulation+ 100% N- fertilization, the dominant record species was *Cheyletus malaccensis* (Oudmans) reaching (15.21%) of the total predacious mite ,while, the least one was *Cheyletus eruditus* (Oudmans)(5.38%) .

2.2 Miscellaneous mites:

A.season 2010

Data presented in Table (1) revealed that the most dominant miscellaneous mite in Nodulation+ 50% N- fertilization, was *pygamephorus* sp. reaching (13.59%) of the total miscellaneous mites, While, the least recorded one was *Galumna* sp. reaching (0.03%), *Tydeus* sp. came second in rank (10.38%), *Tyrophagus putrescentiae* (Schrank) (9.27%) had the third rank . All other species came in-between. The obtained data indicated that *Tarsonemus* sp.(8.76%), *Kleemannia plumosus* (Oudmans)(8.27%), ,*lohmannia sp.*(8.17%), *Phthiracaeus* sp.(7.95%), *Scheloribates* sp.(7.92%), *Epilohmannia* sp.(7.66%), *Oribatula* sp. (6.85%), *Haplozetes* sp (4.70%), *Hypochthonus* sp. (3.24%) and *Belba* sp (3.17%), while in Nodulation+ 100% N- fertilization, the most prevalent recorded species was *Pygmephorus* sp.(12.43%), of the total miscellaneous mite, while, the least one was *Galumna* sp.(0.15%). While in Non- Nodulation+ 50% N- fertilization, the prevalent record species was *Pygmephorus* sp. reaching (11.89%), of the total miscellaneous mites, while, the least one was *Galumna* sp. with (0.05%). while in Non-Nodulation+ 100% N- fertilization, as indicated , the dominant recorded species was *Pygmephorus sp.* reaching (12.56%), of the total miscellaneous mites, while, the least one was *Belba* sp. with (2.85%).

B. season 2011

Data in Table (1) show that the most dominant species in Nodulation+ 50% N- fertilization, Nodulation+ 100% N- fertilization, Non-Nodulation+ 50% N- fertilization, and Non - Nodulation+ 100% N- fertilization was *pygmephorus* sp. with (11.30%,9.96% ,10.14% and 10.35%) respectively of the total miscellaneous mite, while, the least recorded was *Galumna* sp. reaching (0.29%, 0.93%, 0.28% and 0.35%) respectively.

3.2.Collembola:

A.season 2010

Results represented in table (1) show that, in Nodulation+ 50% N- fertilization, the dominant recorded species was *proistoma* sp. with(23.17%) of the total springtails, while the least one was

Onychurius sp. with(19.07%).In Nodulation+ 100% N- fertilization, the most prevalent recorded species was proistoma sp. with(23.76%) of the total springtails, while, the least one was *Entombyra* sp. reaching(18.12%).In Non- Nodulation+ 50% N- fertilization, the dominant recorded species was *proistoma* sp. with(21.83%) of the total spring tails, while the least one was *Hypogastrura* sp .reaching (17.41%).In Non-Nodulation+ 100% N- fertilization, the most prevalent recorded species was *proistoma* sp. with(21.12%) of the total springtails, while the least one was Entombyra sp. reaching(19.00%) .

B. season 2011:

Data in table (1) show that, the most dominant species in Nodulation+ 50% N- fertilization , was *proistoma sp* with(23.04%) of the total springtails, while the least one was *Tulbergi sp* with(19.12%).In Nodulation+ 100% N- fertilization, the most prevalent recorded species was *proistoma sp* with(22.83%) of the total spring tails, while the least one was *Entombyra sp* with (18.65%).In Non-Nodulated+ 50% N- fertilization, the most dominant species was *proistoma sp* reaching (21.65%) of the total spring tails, while the least one was *Hypogastrura sp* reaching (18.27%) .In Non-Nodulation+ 100% N- fertilization, the most dominant species was *proistoma sp* with(21.71%) of the total spring tails, while the least one was *Hypogastrura sp* reaching (19.12%) .

Table 1. Mean numbers and percentages of predacious mite, miscellaneous mite and collembolan species sampled from soil of cowpea variety Dokki 331 during 2010 and 2011 seasons at Kafr El-Sheikh as affected by nodulation and fertilization .

	Family	Species	Season 2010							
			*		**		***		****	
			Mean	%	Mean	%	Mean	%	Mean	%
Predacious mite	Cunaxidae	*Cunaxa capreolus(Berlese)*	10.50	14.21	19.70	17.16	6.10	11.51	9.30	14.13
	Bdellidae	*Bdella* sp.	10.70	14.47	17.40	15.16	9.30	17.55	10.60	16.11
	Cheyletidae	*Cheyletus malaccensis (Oudmans)*	11.00	14.88	15.40	13.41	8.50	16.04	9.80	14.89
		Cheyletus eruditus(Oudmans	0.40	0.54	2.40	2.09	0.40	0.75	0.60	0.91
	Phytoseiidae	*Amblyseius* sp.	12.20	16.51	20.10	17.51	9.30	17.56	10.90	16.56
	Macrochelidae	*Macrocheles* sp.	12.21	16.37	14.60	12.72	7.80	14.72	9.40	14.28
	Rhadacaridae	*Rhodacarus* sp.	11.20	15.15	14.20	12.36	7.90	14.90	9.60	14.58
	Ascidae	*Blattiosocius* sp.	5.80	7.85	11.00	9.58	3.70	6.98	5.60	8.51
Miscellaneous mite	Haplozetidae	*Haplozetes* sp.	14.50	4.70	28.70	6.13	10.30	5.08	15.80	5.62
	Hypochthoniidae	*Hypochthonus* sp.	10.00	3.24	16.20	3.46	7.20	3.55	10.30	3.66
	Domacidae	*Belba* sp.	9.80	3.17	13.50	2.88	3.90	1.92	8.00	2.85
	Galumnidae	*Galumna* sp.	0.10	0.03	0.70	0.15	0.10	0.05	0	0
	Lohmannidae	*Lohmannia* sp.	25.20	8.17	37.70	8.05	15.80	7.79	21.70	7.72
	Oribatulidae	*Oribatula* sp.	21.10	6.85	31.80	6.79	14.70	7.25	20.50	7.29
		Scheloribates sp.	24.40	7.92	41.00	8.75	16.30	8.04	22.20	7.90
	Phthircaridae	*Phthiracarus* sp.	24.50	7.95	43.70	9.33	15.90	7.85	21.90	7.79
	Epilohmanidae	*Epilohmania* sp.	23.60	7.66	37.50	8.01	17.70	8.74	21.30	7.58
	Tarsonemidae	*Tarsonemus* sp.	27.00	8.76	37.70	8.05	18.80	9.27	26.80	9.54
	Tydeidae	*Tydeus* sp.	32.00	10.38	46.70	9.97	19.30	9.53	25.90	9.22
	Pygmephoridae	*Pygmephorus* sp.	41.90	13.59	58.20	12.43	24.10	11.89	35.30	12.56
	Ameroseiidae	*Kleemannia plumosus*(Oud).	25.50	8.27	31.40	6.70	18.20	8.98	23.20	8.25
	Tyroglyphidae	*Tyrophagus putrescentiae (Sch).*	28.60	9.27	43.50	9.28	20.30	10.02	28.00	9.96
Collembola	Onychiuridae	*Onychiurus* sp.	54.50	19.07	62.80	18.29	32.10	20.25	52.00	20.45
	Sphaeridae	*Tulbergia* sp .	54.80	19.18	68.80	20.04	32.20	20.31	50.50	19.86
	Hypogastruridae	*Hypogastrura* sp.	55.10	19.28	67.90	19.77	27.60	17.41	49.70	19.55
	Poduridae	*Proistoma* sp.	66.20	23.17	81.60	23.76	34.60	21.83	53.70	21.12
	Entombyridae	*Entombyra* sp.	55.10	19.28	62.20	18.12	32.00	20.18	48.30	19.00

*= Nodulated +50%N- fertilization ***= Non- Nodulated +50%N- fertilization
= Nodulated +100%N- fertilization * *= Non- Nodulated +100%N- fertilization

Table 1. Continue

	Family	Species	Season 2011							
			*		**		***		****	
			Mean	%	Mean	%	Mean	%	Mean	%
Predacious mite	Cunaxidae	*Cunaxa caprelous*(Berlese)	19.00	13.85	38.30	14.72	11.30	11.83	21.50	13.62
	Bdellidae	*Bdella* sp .	20.60	15.01	39.50	15.18	15.30	16.02	22.80	14.45
	Cheyletidae	*Cheyletus malaccensis (Oudmans)*	19.80	14.43	35.70	13.72	15.10	15.81	24.00	15.21
		Cheyletus eruditus(Oudmans)	4.80	3.49	15.10	5.80	2.30	2.41	8.50	5.38
	Phytoseiidae	*Amblyseius* sp .	21.50	15.67	41.70	16.03	15.40	16.12	23.90	15.14
	Macrochelidae	*Macrocheles* sp.	20.60	15.01	33.80	12.99	14.50	15.18	21.10	13.37
	Rhadacaridae	*Rhodacarus* sp.	19.00	13.85	30.80	11.84	13.30	13.93	20.90	13.24
	Ascidae	*Blattiosocius* sp.	11.90	8.67	25.30	9.72	8.30	8.69	15.10	9.56
Miscellaneous mite	Haplozetidae	*Haplozetes* sp.	26.50	6.05	51.80	7.08	18.60	6.55	31.40	6.88
	Hypochthoniidae	*Hypochthnus* sp.	19.30	4.41	37.20	5.08	13.60	4.79	22.60	4.95
	Domacidae	*Belba* sp.	18.90	4.32	32.00	4.37	9.40	3.31	20.10	4.41
	Galumnidae	*Galumna* sp.	1.30	0.29	6.80	0.93	0.80	0.28	1.60	0.35
	Lohmannidae	*Lohmannia* sp.	35.20	8.04	55.10	7.53	22.40	7.89	34.10	7.47
	Oribatulidae	*Oribatula* sp.	30.60	6.98	51.20	6.99	20.70	7.29	33.80	7.41
		Scheloribates sp.	33.90	7.74	60.60	8.28	22.80	8.03	36.70	8.05
	Phthircaridae	*Phthiracarus* sp.	34.10	7.78	64.00	8.75	22.20	7.82	35.60	7.80
	Epilohmanidae	*Epilohmania* sp.	33.30	7.60	56.80	7.76	23.40	8.24	34.40	7.54
	Tarsonemidae	*Tarsonemus* sp.	38.70	8.84	60.80	8.31	26.00	9.16	41.00	8.98
	Tydeidae	*Tydeus* sp.	45.40	10.36	69.30	9.47	28.40	10.00	45.70	10.02
	Pygmephoridae	*Pygmephorus* sp.	49.50	11.30	72.90	9.96	28.80	10.14	47.20	10.35
	Ameroseiidae	*Kleemannia plumosus*(Oud.)	35.10	8.01	55.20	7.55	22.10	7.78	36.30	7.96
	Tyroglyphidae	*Tyrophagus putrescentiae (Sch.)*	36.10	8.24	57.80	7.90	24.70	8.70	35.60	7.80
Collembola	Onychiuridae	*Onychurius* sp.	65.10	19.15	85.70	18.70	39.10	20.01	67.70	20.45
	Sphaeridae	*Tulbergia* sp .	65.00	19.12	91.00	19.86	39.20	20.06	64.80	19.57
	Hypogastruridae	*Hypogastrura* sp.	66.20	19.49	91.40	19.95	35.70	18.27	63.30	19.12
	Poduridae	*Proistoma* sp.	78.30	23.04	104.60	22.83	42.30	21.65	71.90	21.71
	Entombyridae	*Entombyra* sp.	65.30	19.21	85.50	18.65	39.10	20.01	63.40	19.15

*= Nodulated +50%N- fertilization ***= Non- Nodulated +50%N- fertilization
= Nodulated +100%N- fertilization * *= Non- Nodulated +100%N- fertilization

3. Population density of mites and Collembola on four ratios of Nodulation and N-fertilization, on cowpea field in soil:

Data in Table (2), showed that the population of predacious mite , miscellaneous mites and Collembola started to appear with high numbers in Nodulation+ 100% N- fertilization, as follow ; 37.33%,37.16% and 32.95% during season 2010.While ,during season 2011 those were 39.98%,38.31% and 34.59% respectively .On the other hand , in Non- Nodulation+ 50% N-fertilization appeared with lowest number as follow; 17.23%,16.07%and 15.21% during season 2010.While , during season 2011 were 14.67%,14.86% and 14.75 respectively . It was observed that the miscellaneous mites were higher than Collembola and predacious mite in all nodulation and n- fertilization, during seasons 2010&2011. Generally ,it is worth to mention that the highest number of soil mites was recorded in case of nodulation plants , and in addition to the highest rate of nitrogen, similar results were recorded by Abo-Korah *et al*., (1984-1985a,b and 1985). .Saleh and Tadros (1985). Sharshir (1986), Rosche (1992) and Gamieh and Saadon (1995 a and b) in different crops. They recorded a positive relationship between count of soil mites and gradual increase of nitrogenous fertilization.

4. Population density of soil mites and Collembola under cowpea plants as affected by Nodulation and N- fertilization during (June - July – August) months (2010&2011).

As shown in Table (3), it was found that the population of predacious mite, miscellaneous mites and Collembola started to appear with high number in Nodulation+ 100% N- fertilization during June , July and August(2010) as follow ; (45.51% , 38.01% and 41.15%), (35.56%, 33.71% and 30.36%) ; (38.95% ,46.39% and 36.19%), respectively . While, during season 2011, those were (43.98%, 41.34% and 43.43%); (38.31%, 35.17% and 31.82%) ; (41.54% ,43.73%and 33.68%) respectively . On the other hand , in Non- Nodulation+ 50% N-fertilization appeared with lowest number as follow; (9.63%, 17.03% and 12.34%) ; (18.00%, 18.37% and 16.13%) ;(18.23%, 9.38% and 14.07) during season 2010.While , during season 2011 those were

(11.62%,14.21% and 11.02 %);(15.45% ,16.91% and 15.83%); (14.71%, 10.56% and 14.02%). It was obvious that the miscellaneous mite were high than Collembola and predacious mite in all Nodulation and N- fertilization, during both season 2010 & 2011.

Table 2. Population density of soil mites and collmebola under Cowpea plants as affected by Nodulation and N-fertilization.

Treatment		Season2010			Season 2011		
		predacious mite	Miscellaneous mites	Collembola	predacious mite	miscellaneous mites	Collembola
Nodulated+ 50%N-fertilization (40kg/feddan)	Mean	73.90	308.20	285.70	137.20	437.90	339.90
	%	11.06	46.15	42.78	14.99	47.86	37.15
	%	24.03	24.46	27.43	21.08	22.93	25.66
Nodulated+ 100%N-fertilization (80kg/feddan)	Mean	114.80	468.30	343.30	260.20	731.50	458.20
	%	12.39	50.55	37.06	17.95	50.45	31.60
	%	37.33	37.16	32.95	39.98	38.31	34.59
Non-Nodulated+ 50%N-fertilization (40kg/feddan)	Mean	53.00	202.60	158.50	95.50	283..90	195.40
	%	12.79	48.92	38.27	16.61	49.39	33.99
	%	17.23	16.07	15.21	14.67	14.86	14.75
Non-Nodulated+ 100%N-fertilization (80kg/feddan)	Mean	65.80	280.90	254.20	157.80	456.10	331.10
	%	10.95	46.75	42.30	16.69	48.26	35.04
	%	21.39	22.29	24.40	24.25	23.88	24.99

a

Table 3. Population density of soil mites and collmebola under Cowpea plants during June, July and August as affected by Nodulation and N- fertilization.

	Treatment		Season2010			Season 2011		
			predacious mite	Miscellaneous mites	Collembola	predacious mite	miscellaneous mites	Collmebola
June	Nodulated+ 50%N-fertilization (40kg/feddan)	Mean	16.00	59.25	32.75	41.25	129.75	66.25
		%	14.81	54.86	30.32	17.38	54.68	27.92
		%	21.26	20.81	26.95	16.53	17.89	21.47
	Nodulated+ 100%N-fertilization (80kg/feddan)	Mean	34.25	108.25	50.00	109.75	299.75	134.00
		%	17.79	56.23	25.97	20.19	55.15	24.65
		%	45.51	38.01	41.15	43.98	41.34	43.43
	NonNodulated+50% N- fertilization (40kg/feddan)	Mean	7.25	48.50	15.00	29.00	103.00	34.00
		%	10.25	68.55	21.20	17.46	62.05	20.48
		%	9.63	17.03	12.34	11.62	14.21	11.02
	NonNodulated+100 %N- fertilization (80kg/feddan)	Mean	17.75	68.75	23.75	69.50	192.50	74.25
		%	16.09	62.36	21.54	20.66	57.25	22.08
		%	23.58	24.14	19.55	27.85	26.55	24.06
July	Nodulated+ 50%N-fertilization (40kg/feddan)	Mean	127.75	524.00	428.50	219.50	669.25	486.50
		%	11.82	48.51	39.66	15.96	48.66	35.37
		%	24.93	24.91	27.64	22.60	23.71	26.26
	Nodulated+ 100%N-fertilization (80kg/feddan)	Mean	182.25	709.00	470.75	372.00	992.50	589.50
		%	13.38	52.05	34.56	19.04	50.79	30.16
		%	35.56	33.71	30.36	38.31	35.17	31.82
	NonNodulated+ 50%N- fertilization (40kg/feddan)	Mean	92.25	386.50	250.00	150.00	477.25	293.25
		%	12.66	53.04	34.30	16.29	51.85	31.86
		%	18.00	18.37	16.13	15.54	16.91	15.83
	NonNodulated+ 100%N-fertilization (80kg/feddan)	Mean	110.25	483.75	401.00	229.50	682.75	483.50
		%	11.08	48.62	40.30	16.44	48.92	34.64
		%	21.51	23.00	25.86	23.63	24.19	26.09

Table 3. Continue

	Treatment		Season2010			Season 2011		
			Predacious mite	Miscellaneous mites	collembola	predacious mite	miscellaneous mites	Collembola
August	Nodulated + 50%N-fertilization (40 kg/feddan)	Mean	41.00	187.25	253.00	52.25	295.75	297.00
		%	8.52	38.91	52.57	12.18	43.81	44.00
		%	22.65	24.57	27.13	20.25	24.11	25.82
	Nodulated+100%N-fertilization (80kg/feddan)	Mean	70.50	353.50	337.50	168.75	536.50	422.00
		%	9.26	46.42	44.32	14.97	47.59	37.44
		%	38.95	46.39	36.19	41.54	43.73	33.68
	NonNodulated+50%N-fertilization (40kg/feddan)	Mean	33.00	71.50	131.25	59.75	129.50	161.25
		%	13.99	30.33	55.67	17.05	36.94	46.00
		%	18.23	9.38	14.07	14.71	10.56	14.02
	NonNodulated+100%Nfertilization (80kg/feddan)	Mean	36.50	149.75	210.75	95.50	265.00	270.00
		%	9.19	37.72	53.08	15.15	42.03	42.83
		%	20.16	19.65	22.60	23.51	21.60	23.47

5. Shannon-Weaner diversity index (S.W.I) of predacious mite, miscellaneous mite and Collembola:

a. In the first season 2010:

Data in Table (4) presented the computed values of the Shannon-weaner diversity index in relation to cowpea in which samples were taken. The S.W.I for predatory mite in the sampled cowpea was highest in Non- Nodulated+ 50% N- fertilization, Nodulated+ 50% N- fertilization and Non-Nodulated+ 100% N- fertilization being 0.9330, 0.8638 and 0.8525. respectively. while in Nodulated+ 50% N- fertilization the lowest value was 0.8456.The number of species were 8 species for the Nodulation & Non – Nodulation+ N-fertilization. the S.W diversity index for miscellaneous mites in the sampled cowpea was highest in Non- Nodulated+ 50% N- fertilization, Nodulated+ 50% N- fertilization and Nodulated+ 50% N- fertilization being 2.7336 , 2.1411 and 1.0919 respectively , while , in Non -Nodulated+ 100% N- fertilization , it was the lowest , being 1.0888 , The number of species were 14 and 13 species for the Nodulation & Non – Nodulation+ N-fertilization .Also the S.W. diversity index for springtails in the sampled cowpea was highest in Non- Nodulation+ 100% N- fertilization, Non-Nodulation+ 50% N- fertilization and Nodulated+ 50% N- fertilization , being 0.6985, 0.6978 and 0.6974 respectively ; While ,in Nodulated+ 100% N-fertilization it was the lowest , being 0.6966 . The number of species were 5 species for the former Nodulation+ N- fertilization . It could be concluded that cowpea has dominant and subdominant predacious mite , miscellaneous mite and springtails species which can affect the diversity index values .The relationship between species and ecological process can change quantitatively and quantitatively with environment context (Cardinale & Nelson ,1999).

B. in the second season 2011:

Data in Table (4) revealed That S.W. diversity index for predatory mite species was the highest in Nodulated+ 100% N- fertilization, Non-Nodulated+ 100% N- fertilization and Nodulated+ 50% N-fertilization being 0.8874, 0.8866 and 0.8753 respectively . While, in Non- Nodulated+ 50% N-fertilization, it was the lowest, being 0.8659.The number of species were 8 species for the former Nodulation and N- fertilization. Also, the S.W. diversity index for miscellaneous mite species was the highest in Nodulated+ 100% N- fertilization, Non- Nodulated+ 100% N- fertilization and Non-Nodulated+ 50% N- fertilization being 1.1169 , 1.1096 and 1.1048 respectively , while ,in Nodulated+ 50% N- fertilization ,it was the lowest , being 1.1047. The number of species was 14 species for the former Nodulation and N- fertilization .On the other hand , the S.W. diversity index for springtails in the sampled cowpea was highest in Non- Nodulation+ 100% N- fertilization, Non-Nodulated+ 50% N- fertilization and Nodulated+ 50% N- fertilization being 0.6984, 0.6981 and 0.6977 respectively , while ,in Nodulated+ 100% N-fertilization it was the lowest 0.6976 . The number of species were 5 species for the former Nodulation and N- fertilization . Similar results were obtained by El – Dakhakhni *et al.*(1995)who reported that clover had the highest number of beneficial insect species ,was 22 while , cotton and soybean had the lowest number ,12 for each one .The S.W. for natural enemy species in the sampled crops was the highest in clover being 2.52 while in maize it was the lowest being 1.81.As for cotton and soybean , it was 2.08 and 2.41 respectively .Also , El-Mezayyen (2001) indicated that S.W. diversity index for pests , beneficial and visitors species in the sampled crops was the highest in alfalfa at sebha being 1.664, 0.6129 and 0.8222 while in the Egyptian clover at Kafr El- sheikh , it was the lowest , being 0.6154, 0.5152 and 1.1480 .The number of species were 14,11 and 5 for alfalfa . While , they were 13,8 and 6

for the Egyptian clover respectively , in the current study , it was anticipated that the relative predacious mite , miscellaneous mite and springtails abundance of species on cowpea crop may have an effect on diversity index values of S.W. support such suggestion.

Table 4. Shannon-weaner index as computed from related species of predacious mite , miscellaneous mite and Collembola from Cowpea field as affected by Nodulation and N- fertilization during seasons 2010&2011.

Treatment	Predacious mite			Miscellaneous mite			Collembola		
(2010)									
	Mean no	No. of species	SW	Mean no	No. of species	SW	Mean no	No. of species	SW
Nodulated+ 50%N-fertilization (40kg/feddan)	73.90	8	0.8456	308.20	14	2.1411	285.70	5	0.6974
Nodulated+100%N-fertilization (80kg/feddan)	114.80	8	0.8638	468.30	14	1.0919	343.30	5	0.6966
NonNodulated+50%N-fertilization (40kg/feddan)	53.00	8	0.9330	202.60	14	2.7336	158.50	5	69780.
NonNodulated+100%N-fertilization (80kg/feddan)	65.80	8	0.8525	280.90	14	1.0888	254.20	5	0.6985
2011									
Nodulated+ 50%N-fertilization (40kg/feddan)	137.20	8	0.8753	437.90	14	1.1047	339.90	5	0.6977
Nodulated+100%N-fertilization (80kg/feddan)	260.20	8	0.8874	731.50	14	1.1169	458.20	5	0.6976
NonNodulated+50%N-fertilization (40kg/feddan)	95.50	8	0.8659	283.90	14	1.1048	195.40	5	0.6981
NonNodulated+100%N-fertilization (80kg/feddan)	157.80	8	0.8866	456.10	14	1.1096	331.10	5	0.6984

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تأثير التلقيح البكتيري والتسميد الأزوتى على كل من الأكاروسات و الكولمبولا في التربة في حقول اللوبيا فى محافظة كفر الشيخ

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أجريت هذه التجربة بمحطة البحوث الزراعية بسخا– كفر الشيخ وذلك في حقول منزرعة بمحصول اللوبيا Vigna unguiculata(L)walp. صنف دقي 331 وذلك في موسم زراعة هذا المحصول على موسمين 2010 , 2011م. تم تلقيح بذور اللوبيا بمثبت الأزوت التكافلي *Bradyrhizobium* sp. وسمدت النباتات بمعدلات 40 , 80 كيلو جرام أزوت للفدان على دفعتين عند 30 ,45 يوما من الزراعة . جرى اختبار تأثير التلقيحات والتسميد الازوتى (ملقح +50% أزوت , ملقح+ 100%أزوت , وغير ملقح + 50%أزوت ، وغير ملقح +100%أزوت) على تعداد الاكاروسات المفترسة و الاكاروسات متعددة الغذاء والكولمبولا كذلك عمل حصر كامل لهم في التربة كذلك شملت الدراسة ايضا التنوع في الأنواع Diversity in species بالنسبة للمجاميع المختبرة . سجلت أعداد الاكاروسات المفترسة ، الاكاروسات متعددة الغذاء و الكولمبولا أعلى تعداد لها في الملقح +100%أزوت يليها في الملقح +50%أزوت بينما سجلت أقل إعداد الاكاروسات في التربة في القطع المعاملة بالغير الملقح +100% و50%أزوت كما أمكن تسجيل 8أنواع من الاكاروسات المفترسة تتبع 7 عائلات ، كذلك أمكن تسجيل 14 نوعا من الأكاروسات متعددة الغذاء تتبع 13 عائلة ،وأيضا تم تسجيل 5 أنواع من الكولمبولا تتبع 5 عائلات وذلك خلال موسم 2010 م .بينما خلال موسم 2011 سجلت أعداد الأكاروسات المفترسة و الاكاروسات متعددة الغذاء أعلى تعداد لها في الملقح +100%أزوت يليها في الغير ملقح +100%أزوت بينما سجلت أقل أعداد الأكاروسات في التربة في القطع المعاملة بالملقح +50%أزوت والغيرملقح +50% أزوت. كذلك أمكن تسجيل 8أنواع من الاكاروسات المفترسة تتبع 7 عائلات ، كما أمكن تسجيل 14 نوعا من الاكاروسات متعددة الغذاء تتبع 13 عائلة ،وأيضا تم تسجيل 5 أنواع من الكولمبولا تتبع 5 عائلات.أوضحت النتائج تسجيل أعلى تعداد لكل من الاكاروسات المفترسة ومتعددة الغذاء والكولمبولا خلال شهور يونيو ويوليو وأغسطس على محصول اللوبيا خلال موسم الدراسة فى الملقح +100% أزوت بينما سجلت أقل الأعداد في الغير ملقح +50%أزوت .كانت قيم دلائل التنوع 0.8456، 0.8638، 0.9330، 0.8525 بالنسبة للملقح +50%أزوت ,والملقح +100%أزوت ،والغير ملقح +50%أزوت ،والغير ملقح +100%أزوت على الترتيب للأكاروسات المفترسة بينما في الاكاروسات متعددة الغذاء كانت فيم دلائل التنوع 2.1411، 1.0919 ، 2.7336 ، 1.0888 . فى حين كانت قيم دلائل التنوع للكولمبولا 0.6974 ،0.6966، 0.6978، 0.6985 ,على التوالى وذلك خلال موسم 2010م. بينما في خلال موسم 2011م كانت قيم دلائل التنوع للاكاروسات المفترسة هي 0.8753، 0.8874 ، 0.8659 ، 0.8866 . بينما كانت قيم دلائل التنوع للاكاروسات متعددة الغذاء هي 1.1047 ، 1.1169 1.1048 ، 1.1096 وأخيرا كانت قيم دلائل التنوع الكولمبولا هي 0.6977 ، 0.6976 ، 0.6981 ، 0.6984 على التوالي في محصول اللوبيا. وجد أيضا أن التواجد النسبي لأنواع الاكاروسات المفترسة و الاكاروسات متعددة الغذاء والكولمبولا في أرض اللوبيا لها تأثير على قيم دليل التنوع .