RESULTS AND DISCUSSION

RESULTS AND DISCUSSION

Ecological field studies: -

I- Incidence of spider mites associated with cotton plants during two successive seasons 2002 and 2003 at El-Fayoum and El - Menofia Governorates: -

Cotton crop (*Gossypium* sp.) has been more than a commodity over the years, it has been a culture and tradition, it has threaded throughout the entire history of the world. In Egypt, cotton is the most important to producers and to the Egyptian national income. The production and processing of this natural fiber play a key role in the national income.

In Egypt, the future of cotton industry depends on the competitiveness in the world market and its profitability to the producer. These demands emphasize the need for more effecting integrated cotton management system. **Taha *et al.* (2001)** cotton crop suffer from infesting with different mite pests all over the growth stages of cotton plants. Therefore incidence of different mite pests associated with cotton crop during the two seasons 2002&2003 at El-Fayoum and El-Menofia Governorates were recorded as the following:

The tetranychid mites which belong to Sub–order Actinedida (Prostigmata) considered to be the most injurious mite species which causing a great damage to cotton and different crops. The sub-order Actinedida was represented by 5 mite species belonging to three families Table (1) the wise species was arranged as the text below: -

Family :Tetranychidae: -

Spider mites are the main pest which threatens the crop yield. However, characteristic signs are tiny yellow spots, or stipples on leaves. As the injury becomes more sever, leaves turn yellow, then brown or bronze and finally die and drop.

This family was represented by two species, which consider to be the most important pests on cotton plants, where they cause a great damge and loss of yielding. These species are:

1- *Tetranychus urticae* Koch

This species was represent with high populations infesting cotton plants at El-Fayoum and El- Monofia Governorates, (Table 1)

2- *T. cucurbitacearum* (Sayed),

This mite species was represented with low population in El- Menofia.

Family: Tarsonemidae: -

This family was represented by one species mite *Tarsonemus* sp. which considered to be most one of the injurious mites, were it was presented with moderate numbers at the aforementioned Governorates .

Family :Tydeidae: -

This family was represented by two mite species, *Orthotydeus californicus* and *O. kochi* the former species was recorded with high numbers, while the latter was recorded with lower numbers on cotton plants at the two investigated Governorates.

Table (1):- Incidence of non-predacious prostigmatid mites associated with cotton plants at El- Fayoum and El-Menofia Governorate during two seasons 2002 and 2003.

Family	Species	Locality	Remarks
Tetranychidae	*Tetranychus urticae* Koch	El-Menofia and El-Fayoum	+++
	T. cucurbitacearum Sayed	El-Menofia	+
Tarsonemidae	*Tarsonemus* sp.	El-Menofia and El-Fayoum	++
Tydeidae	*Orthotydeus californicus* (Banks)	El-Menofia and El-Fayoum	+++
	O. kochi (Oudemans)	El-Menofia and El-Fayoum	+

+ = Rare (1 – 3)

++ = Moderate (3 -9)

+++ = High, more than 9

RESULTS AND DISCUSSION----------

II- Incidence of predacious mites, insects and spiders associated with cotton plants during the two seasons 2002 and 2003 at El-Fayoum and El-Menofia governorates:-

Relative abundance of predators in El-Menofia and El-Fayoum Governorates was estimated throughout two growing successive years 2002-2003. Direct counting was made on 100 leaves from 100 randomly plants for all mite and insect predators.

The predaceous mites that were surveyed in this investigation belonging to families: Phytoseiidae, Stigmaeidae, Cheyletidae and Tydeidae, while the predaceous insect species were found in this study belonging to families Coccinellidae, Chrysopidae and Anthocoridae. The true spider was also taken into consideration as these arachnids are known insectivorous.

Collected mites, insects and spiders as natural enemies in El-Menofia and El-Fayoum Governorates are presented in Tables (2, 3 and 4). Obtained results indicated the presence of these predators associated with pests in cotton field experimental they were recorded as 9 predacious mites, 5 predaceous insects and 16 spiders.

II .A- Predacious mites: -

Predacious mites play an important role in biological control, they minimizing the populations of different pests especially sucking pests on cotton.

A large number of mites are known inhabiting soil grasses and plants, the distribution and pattern is however not constant every where which varies according the climatic factors **Taha *et al.* (2001).**

The predatory mites could be arranged as the following in Table (2):-

Table (2): Incidence of predacious mites associated with pests infesting cotton crop during two season 2002 and 2003 at El-Fayoum and El- Menofia Governorates.

	Species	Family	Suborder	Remarks
1-	*Amblyseius swiriskii* Athias-Henriot	Phytoseiidae	Gamasida	+++
2-	*A. gossipi* ELBadry	,,	,,	+++
3-	*A .cydnodaclylon* Shehata& Zaher	,,	,,	+
4-	*Neoseiulus barkeri* (Hughes)	,,	,,	+
5-	*Cheletogenis ornatus* Can. & Fanz.	Cheyletidae	Actinedida	+
6-	*Agistemus exertus* (Gonzales)	Stigmaeidae	,,	++
7-	*Stigmaeius africanus* Soliman & Gomaa	Stigmaeidae	,,	+
8-	*Pronematus ubiquitus* (McGregor)	Tydeidae	,,	+++

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II .A. 1- Sub-order: Gamasida (Mesostigmata)

Mesostigmatid mites are represented by five predator species belonging to **family Phytoseiidae.**

***Amblyseius swirskii* Athias-Henriot.**

This mite species was collected from El-Fayoum and El-Menofia.Mite individuals were found during the two season on cotton plants allover the season in high numbers especially in late of seasons .

***A. gossipi* (=*Euseius scutalis*) El -Badry**

The predator mite *A. gossipi* was found in low numbers on cotton plant during the two seasons 2002 &2003 at El-Fayoum and El-Menofia Governorates.

***A. cydnodaclylon* Shahata &Zaher.**

This mite species was found in high numbers during the two seasons 2002&2003 associated with pests on cotton in El-Fayoum and El-Menofia Governorates with lower numbers.

***Neoseiulus barkeri* Hughes**

This mite was recorded in rare numbers on grasses in cotton fields in El-Fayoum and El-Menofia during the second season 2003 only.

II .A . 2. Suborder: Actinedida

This suborder recorded with 3 families as follows

Family: Cheyletidae.

Family Cheyletidae was represented by one species *Cheletogenes ornatus* Can. & Fanz. which was recorded in rare numbers in both Governorates during the two seasons

Family: Stigmaidae.

This family was represented by two species *Agistemus exirtus* (Gon.) and *S. africanus* Soliman & Gomaa these species were recorded in low numbers in association with cotton plants during the two seasons 2002 & 2003 at El-Fayoum and El-Menofia Governorates.

Family: Tydeidae

Feeding habits of this family differ according to mite species some are predaceous and have gained their importance from controlling small plant species, (**Hessein** and **Perring 1986**), other authors are considered the tydeid mites plant feeders, or fungivorous, (**Yassin 2004**), while some species is still debatable. **Gerson (1968)** considered most of the tydeid mites to be scavengers. In this study, only one predacious mite species of this family was collected, *Pronematus ubiquitus*, which was recorded with low populations in both Governorates on cotton plant.

Similar results were obtained by **Yassin, 1997**.collected the phytoseiid mite, *Amblyseius swirskii* ,stigmaeid mite *Agistemus exertus* and Tydeid mite *Pronematus ubiquitus* on cotton plants at El- Menofia Governorate.

II- B - Predacious Insects: -

Obtained data in Table (3) showed that the predatory insects associated with pests infesting cotton plants during the tow seasons 2002 and 2003 at the two localities; these predators were classified into their categories whereas they belonging to three families under three orders as the following: -

1-Order: Coleoptera.

Family: Coccinellidae, was represented by two species

***Coccinella undecimpunctata* L.** and ***C. septempunctata* Dinheyer.**

Field observations revealed that Ladybird beetles were abundant on cotton plants cultivated in El- Fayoum and El-Menofia Governorates throughout the whole cotton seasons 2002&2003 except during the seedling stage where, these predators were absent. Also, it is noticed that the population abundance of ladybird beetles fluctuated by increasing and decreasing throughout the cotton season in nearly complete coincided with that of aphid insects infesting cotton plants. These predators were recorded with high number at two localities during the two seasons 2002-2003 (Table 3)

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2-Orderd: Neuroptera

Family: Chrysopidae.

Chrysopella vulgaris Schm was the chrysopid species recorded on cotton plants during the two seasons 2002&2003 of this course study. Eggs, larvae and adults were found during growing season.

3- Orderd: Hemiptera

Family: Anthocoridae.

This family was represented by two species, *Orius lavigtus* (Fieb) and *Orius tristicolor* (White)

These insect predators were appeared during the vegetation periods at cotton plants at late May of the two seasons 2002& 2003 at the two Governorates, with few numbers.

RESULTS AND DISCUSSION----------

Table (3): Incidence of predacious insects associated with pests infesting cotton crop during two seasons 2002 and 2003 at El- Fayoum and El- Menofia Governorates.

Order	Family	Species	Locality	Remarks
Coleoptera	Coccinellidae	*Coccinella undecimpunctata* L.	**El- Fayoum and El-Menofia**	+++
		C. septempunctata Dinheyer	**El- Fayoum and El- Menofia**	+++
Neuroptera	Chrysopidae	*Chrysopella vulgaris* Schm	**El- Fayoum and El- Menofia**	++
Hemiptera	Anthocoridae	*Orius lavigtus* (Fieb)	**El- Fayoum and El- Menofia**	+
		Orius tristicolor (White)	**El- Fayoum and El- Menofia**	+

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II . C. Spiders

True spider constitutes a major component as predators in the ecosystem and considered very important natural control agent for a wide range of economically injurious pests. Cotton plant, which was examined from April to September over two-season 2002 and 2003, indicated that presence more than twelve spider families were found.

Samples were collected from cotton crop fields in El-Fayoum and El-Menofeia Governorates and processed for recording and identification.

Sixteen spider species belonging to twelve families were found and shown in Table (4). These families were Agelenidae, Araneidae, Dictynidae, Lycosidae, Gnaphosidae, Linyphiidae, Miturgidae, Philodromidae, Salticidae, Theridiidae and Thomisidae.

Gnaphosidae and Lycosidae were collected by hand sorting but the other families were collected from cotton plants themselves.

Family :Agelenidae: -

Agelenidae family was represented by one spider species, *Lycosoides coarctata* (Dufour) which was recorded on plants cotton at El-Fayoum Governorate, with high numbers during the two seasons. but it represented in low number at El-Monofia Governorate. during the two seasons.

Family: Araneidae: -

Only one species of this family, *Cyrtophora citricola* (Forskal) was collected from cotton fields at El-Fayoum and El-Monofia Governorate in low number.

Table (4): Incidence of True spiders on cotton Plant at El-Fayoum and El- Menofia Governorates during two seasons 2002 and 2003.

Spider species	El-Fayoum Gov.	El- Menofia Gov.
	Remarks	Remarks
Family:Agelenidae Koch *Lycosoides coarctata* (Dufour)	+++	+
Family: Araneidae Simon *Cyrtophora citricola* (Forskal)	+	+
Family: Dictynidae Cambie *Dictyna* sp C.L.Sundevall	++	++
Family: Lycosidae Sundevall *Hogna ferox* (Lucas)	+++	+++
Family: Gnaphosidae Prosock *Setaphis subtilis* (Simon)	+	+
Family: Linyphiidae Black wall *Erigone dentipalpis* (Wider) *Prinerigone vegans* (Savigny)	+++ +++	- +++
Family: Miturgidae Simon *Cheracanthum isiacum* (Cambridge) *Cheiracanthium* sp	+++ +	- +
Family: Philodromidae Thorell *Thanatus albini* (Audouin) *Philodromus* sp.	+++ ++	+++ ++
Family: Salticidae Blackwall *Synageles* sp. E. Simon *Thyene imperialis*(Rossi)	+++ +++	+++ +++
Family: Titanoecidae *Nurscia albomaculata* (Lucas,1946)	+++	-
Family: Theridiidae Sundevall *Theridion* sp.	+	++
Family: Thomisidae Sundevall *Thomisus spinifer* Cambridge	+++	++

+ = Rare **++ = Moderate** **+++ = High, more**

Family: Dictynidae: -

This family was represented by one species, *Dictyna* sp. C. L. Sundevall, which was found on cotton crop at El-Fayoum and El-Monofia Governorates, with moderate number.

Family: Lycosidae: -

This family was presented with one species, *Hogna ferox* (Lucas), which collected from cotton field at El-Fayoum and El-Monofia Governorate with high number.

Family :Gnaphosidae: -

This family was presented by one species, *Setaphis subtilis* (Simon) which was collected from cotton fields at El-Fayoum and El-Monofia Governorate with low umber.

Family: Linyphiidae: -

Linyphiidae family was represented by two species, *Erigone dentipalpis* (Wider) and *Prinerigone vegans* (Savigny).

The former species *Erione dentipalpis* (Wider) was found on cotton at El-Fayoum, while the latter *P. vegans* (Savigny) was occurred in both localities El-Fayoum and El-Menofia Governorates with high number.

Family :Miturgidae: -

Family Miturgidae was represented by two spider species, *Cheiracanthium isiacum* (Cambridge) and *Cheiracanthium* sp. at El-Fayoum.

The first species *Cheiracathium isiacum* (Cambridge) was found in high number on cotton plants at El- Fayoum only, while the second species was recorded in both localities with low number. .

Family: Philodromidae: -

This family recorded with two species *Thanatus albini* (Audouin) and *Philodromus* sp. which were found on cotton at El-Fayoum and El-Menofia.

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The dominant species was *Thanatus albini* (Audouin) collected with high number in both localities, while *Philodromus* sp. was recorded in moderate numbers is association with cotton plants.

Family:Salticidae: -

This family included two species *Synageles* sp. and *Thyene imperialis* (Rossi). *Synageles* sp. these species were found in high number in both Governorate, El-Menofia and El- Fayoum.

Family: Titanoecidae: -

This family was represented by one species *Nurscia lbomaculata* (Lucas, 1946) which was collected in high number on cotton plants at El- Fayoum Governorate.

Family:Theridiidae: -

This family was represented by one species *Theridion* sp. which was recorded on cotton plants at El- Fayoum Governorate, in low number, but it was represented in moderate number at El-Monofia Governorate.

Family: Thomisidae: -

The spider *Thomisus spinifer* Cambridge was collected from cotton plants at El-Fayoum and El- Menofia Governorates. It was recorded with high numbers at El-Fayoum and represented in moderate numbers at El-Menofia Governorate. In conclusion, the above mentioned results clearly demonstrated that the population density of the true spiders occurred from mid summer till mid autumn especially in August at El- Fayoum governorate and from August to September at El- Menofia governorate in two successive years. In this respect, **Rahil (1988)** collected the clubionid species ***Cheiracanthium jorium*** Denis from cotton fields at El-Fayoum Governorate. Also, **El-Erksousy (2000)** collected the Theridiidae spider species, *Crustulina conspicua* (Camb.) from cotton fields by holding an inverted open white umbrella. Data showed that the spider numbers increase during cotton season.

RESULTS AND DISCUSSION----------

1-2 Population dynamics

Population dynamics of spider mite species and predators inhabiting cotton plants at El-Menofia and El-Fayoum Governorates

The population dynamics based on studying the natural balance between phytophagous mites and predaceous mites, insects and spiders under environmental conditions on cotton plant at El-Menofia and El- Fayoum governorates during seasons 2002 and 2003.

A-) El-Menofia Governorate. .

Data shown in Tables (5 & 6) and illustrated in Fig. (1, 2, 3 & 4) classify the natural infestation of different spider mite species and predators during 2002 and 2003 seasons on cotton plants. The appearance of the two-spotted spider mites, *T. urticae* and *T. cucurbitacearum* occurred during all count dates. Generally, the low level of *T. urticae* and *T. cucurbitacearum* population observed in this locality during the first of May during 2002 and 2003 was cultivated seasons, respectively.

Recorded one peak for the spider mite species during mid June and first July in both season 2002 and 2003 with 105, 70 individual at 2002 and 112, 77 individual at 2003 season.

The data also showed that, predacious mites which represented by Phytoseiidae, Stigmaeidae, Cheyletidae, Tydeidae and spiders were recorded on cotton during the investigation in the two seasons under study with one peak at first August and mid July during season of 2002 and 2003, respectively, Table (5 & 6).

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Statistical analysis using F- test showed that there is no significant deference between the two seasons, L.S.D at 0.05 = 36.71 for *T. urticae* (Table 7). Data in tables 8 and 9 cleared the changes in the population of *T. urticae* in relation to the change of other biotic and a biotic factor. The analysis shows a positive correlation between each of maximum temperature, minimum temperature and *T. urticae* population. However, the all tested factors affected negatively on *T. urticae* population.

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Table (5): Population fluctuations of spider mites and other predators associated cotton plants during 2002 at El-Menofia Governorate

Sampling dates		A	B	C	D	E	Temperature		R. H. %
							Max.	Min.	
May	1	25	20	0	0	0	28.3	13.2	54
	15	70	35	15	6	10	29	18	58
June	1	80	40	25	10	25	31.6	17.7	55
	15	105	50	100	13	55	35	20.2	54.5
July	1	100	70	105	25	23	36	20	50
	15	15	67	130	35	0	36.2	22	65
August	1	20	45	140	30	0	37	25	65
	15	55	42	85	15	34	37.4	25.5	64.5
September	1	90	16	72	15	42	41	25	49.5

A= *T. urticae*
B = *T.cucurbitacearum*
C = Predacious mites
D = Predacious insects
E = True Spiders

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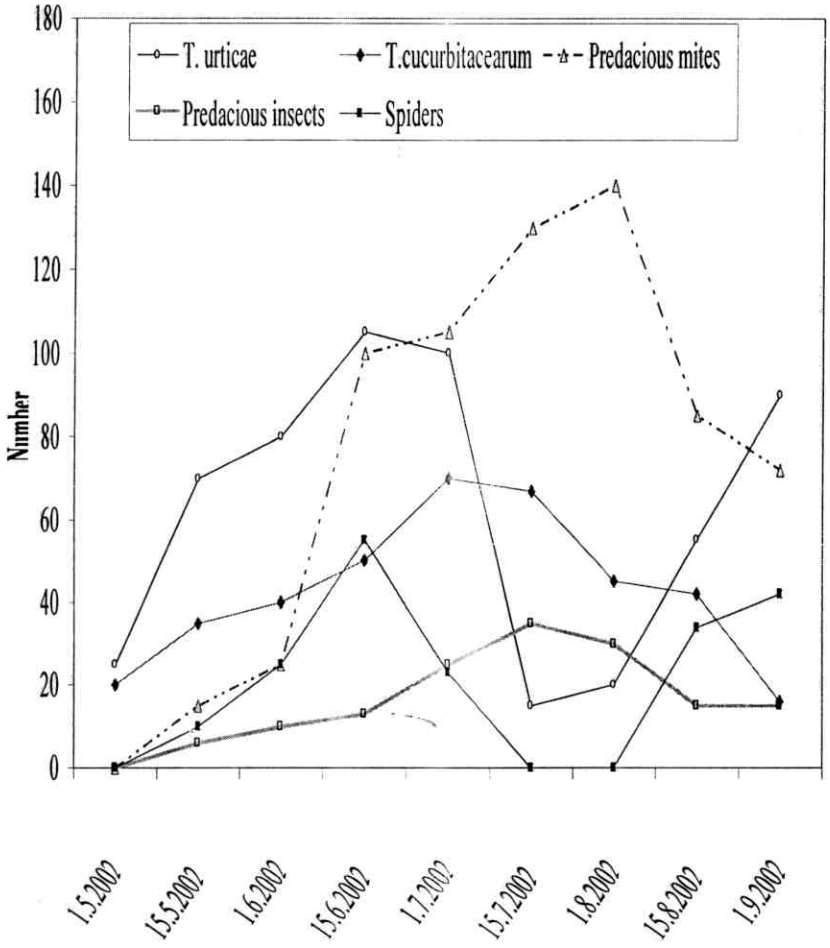

Fig. (1) : Population fluctuation of spider mites and other predators inhabiting cotton plants during season 2002 at El-Menofia Governorate

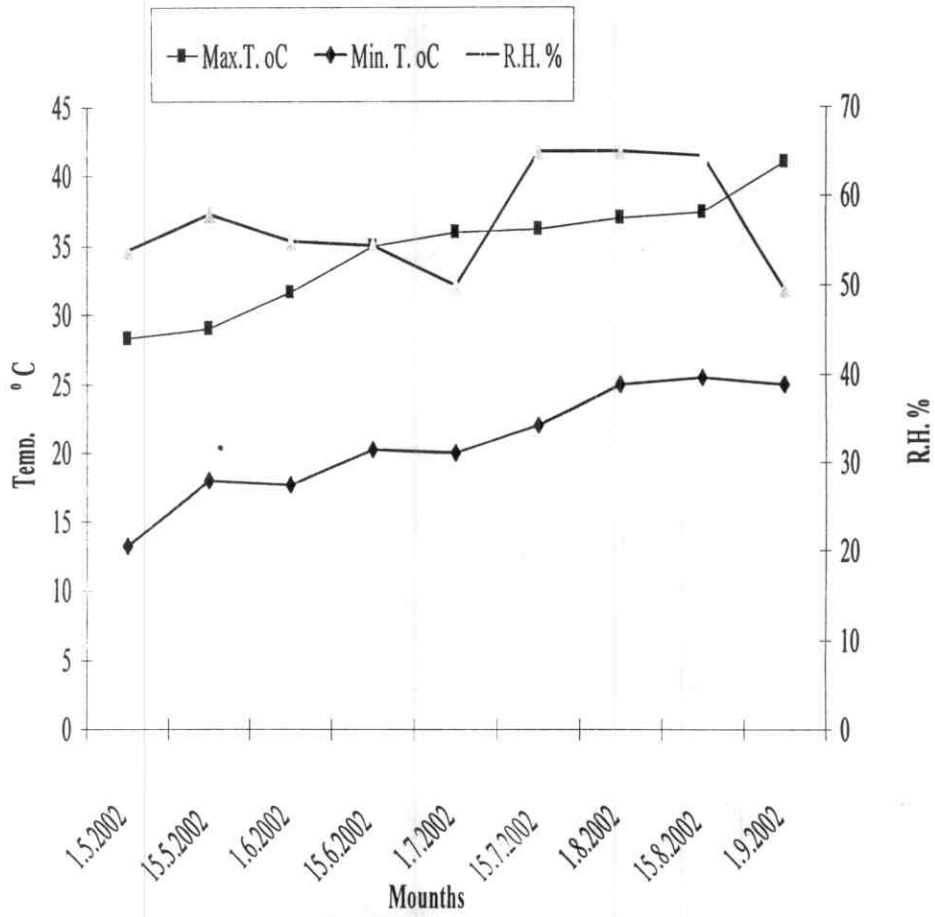

Fig. (2): Maximun, minum temperature and relative humidity of the sampling dates at El-Menofia Governorate during season 2002

Table (6): Population fluctuations of spider mites and other Predators Associated with cotton plant during 2003 at El- Menofia Governorate.

Sampling dates		A	B	C	D	E	Temperature		R. H. %
							Max.	Min.	
May	1	15	26	0	8	0	28.9	14.1	55
	15	72	39	0	12	8	301	17.6	58
June	1	92	46	15	20	15	32.2	17.1	57
	15	112	55	105	30	55	36.1	22.1	56
July	1	105	77	115	26	27	36.2	19.3	53
	15	16	71	160	12	9	37.2	21.7	68
August	1	32	49	145	13	4	36.9	24.2	67
	15	70	52	92	10	33	37.9	27.4	63.2
September	1	100	19	84	15	44	40.5	24	51.2

A= *T. urticae*
B = *T.cucurbitacearum*
C = Predacious mites
D = Predacious insects
E =True Spiders

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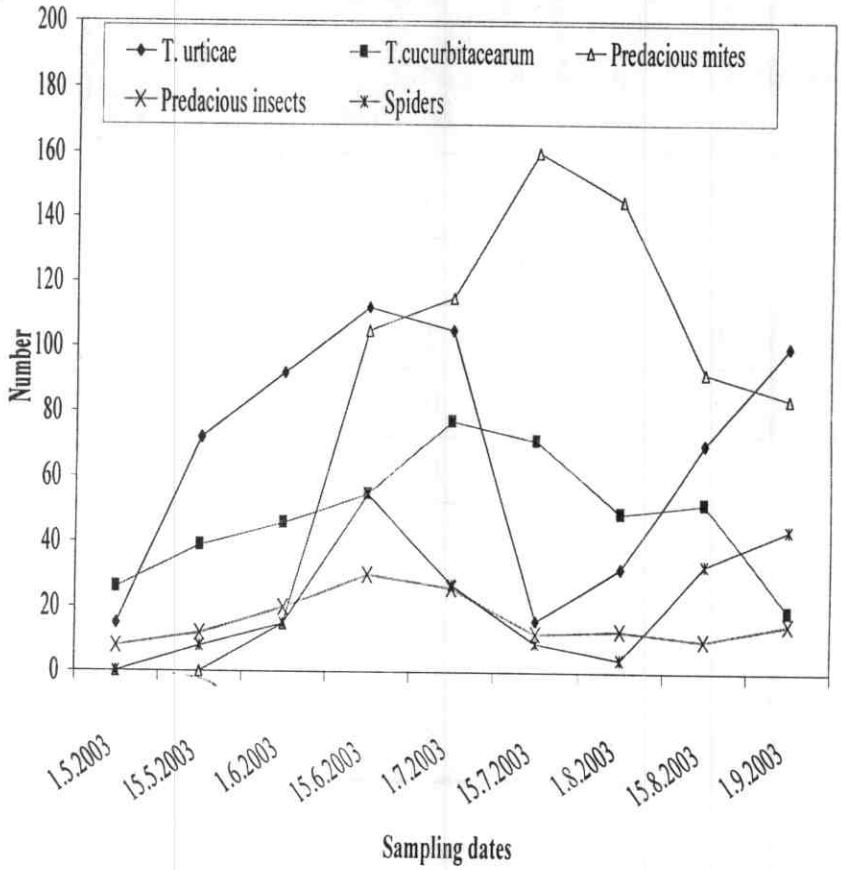

Fig. (3) : Population fluctuations of spider mites and other predators inhabiting cotton plants during season 2003 at El-Menofia Governorate

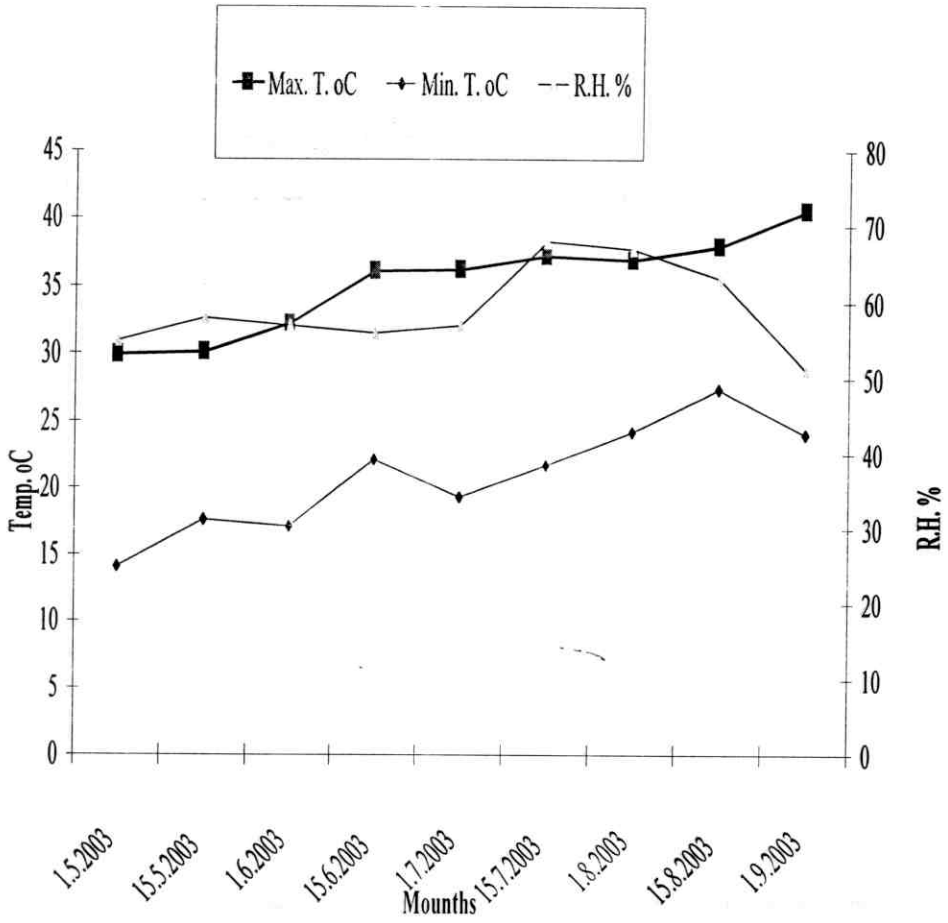

Fig. (4): Maximun, minum temperature and relative humidity of the sampling dates at El- Menofia Governorate during season 2003

Table (7): Population fluctuations of spider mites and other predators inhabiting cotton plants during 2002 and 2003 at El-Menofia Governorate.

Sampling dates		A	B	C	D	E	Temperature		R. H. %
							Max.	Min.	
May	1	20	23	0	0.5	0	28.6	13.65	54.5
	15	71	37	7.5	5.5	9	29.55	17.8	58
June	1	86	43	20	9	20	31.9	17.4	56
	15	108.5	52.5	102.5	12.5	55	35.55	21.15	55.25
July	1	102.5	73.5	110	22.5	25	36.1	19.65	51.50
	15	15.5	69	145	32.5	4.5	36.7	21.85	66.50
August	1	26	47	142.5	28	2	36.95	24.6	66.00
	15	62.5	47	88.5	13.5	33.5	37.65	26.45	63.85
September	1	95	17.5	78	14	43	40.75	24.5	50.35
L.S.D. at 0.05 level		36.71							

A= *T. urticae*
B = *T.cucurbitacearum*
C = Predacious mites
D = Predacious insects
E =True Spiders

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Table (8): The correlation effect on the population of *T. urticae* associated with cotton plants at El-Menofia Governorate during 2002 and 2003.

Variable	Factor	Corr (r)	Slop (b)	Y Int (a)
T.urticae	Predacious insects	-0.0415	-0.0612	84.4970
	Predacious mites	-0.1002	-0.1525	87.0616
	Spiders	-0.2574	-0.0739	20.01590
	Maximum Temperature	0.2231	0.0243	33.2723
	Minimum Temperature	0.0831	0.0093	20.1747
	R.H. %	-0.6652	-0.1111	65.2434
T.cucurbitacearum	Predacious insects	-0.1655	-0.0012	82.5749
	Predacious mites	-0.3000	-0.1118	84.0017
	Spiders	-0.1631	-0.0406	19.0058
	Maximum Temperature	0.1431	0.0007	19.0734
	Minimum Temperature	0.0094	-0.2141	61.4404

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Table (9): The correlation effect on the population of predacious mites and spiders associated with cotton plants at El-Menofia Governorate during seasons 2002 and 2003.

Variable	Factor	Corr (r)	Slop (b)	Y Int (a)
Predacious mites	Predacious insects	0.2978	0.2889	85.2210
	Spiders	0.8971	0.1694	2.2706
	Maximum Temperature	0.7646	0.0548	30.6322
	Minimum Temperature	0.7071	0.0521	16.7619
	R.H. %	0.4675	0.0513	54.0367
Spiders	*T.urticae*	-0.2574	-0.8960	78.9618
	Predacious insects	-0.2753	-1.4151	87.9772
	Predacious mites	0.8971	4.7512	4.2578
	Maximum Temperature	0.6262	0.2378	31.2136
	Minimum Temperature	0.5702	0.2227	17.3683
	R.H. %	0.5018	0.2917	53.5205

B-) El-Fayoum Governorate

The half monthly count data, Tables (10&11) and Figs. (5,6,7 &8) for different arthropods in El-Fayoum governorate revealed that the infestation was observed for mostly sampling dates except for predacious insects and true spiders which were absent during May 2002 and observed as 6 spiders only during the middle of May 2003 for spiders.

In the beginning of July recorded the highest level of *T. urticae* 90 and 95 individuals during 2002 and 2003 seasons, respectively, where the peak was observed for predacious mites during mid and first of July with 60 and 64 individuals of mites, respectively

The spider mite, *T.cucurbitacearum* was absent from cotton fields at El- Fayoum governorate.

Also, the predacious insects which belonging to the same families mentioned before in El-Menofia governorate reached to the highest abundance during the beginning of August, 136 and141 individuals, during 2002 and 2003, respectively, and for the spiders during the mid of July of the two tested seasons with 36 and 44 individuals, respectively.

The commonest collected true spider species were belonging to families Lycoseidae, Linyphiidae and Salticidae .The spiders were found on cotton plants during most dates of the studying seasons. Inspections of plants indicated that the arachnids were almost absent from cotton fields during the first count of the study (first of May) in the two seasons 2002 and 2003, but it absent in mid May in 2002 and appeared with rare numbers in mid May in 2003 season with 6 individuals.

The observed peak of spiders' population at El-Fayoum Governorate was noticed in mid July, where it recorded. 36 and 44 individuals during 2002 and 2003, respectively. Statistical analysis of given data using F-test showed that there is no significant differences between the two seasons at the same region , L.S.D. at 0.05 level = 31.75for *T. urticae* (Table 12).

The obtained results showed that the predacious mites, insects and spiders were recorded on cotton plants during the investigation in the study periods were similar to that obtained at El-Menofia Governorate but in smaller number and appearance of mites, *A. gossypi*, *T. swiriskii*, *N. barkeri*, *C. ornatus* and *Stigmaeus africanus* at El- Menofia Governorate, with exception of *T. cucurbitacearum*.

In conclusion, the above mentioned results clearly demonstrated that true spiders increased in summer and autumn and these results agreed with those obtained by **Mohafez (2002)**.

According to the results shown in Table (13), it could be concluded the accurate influence on different factors on population of *T. urticae* on cotton plants at El-Fayoum Governorate yielded positively correlation in case of spiders and maximum temperature on *T. urticae* population.

Results of analysis of given data in Table (14) showed that the effect of different factors on population density of predacious mites and spiders. This effect was observed as positive correlation in case of all factors except on predacious mites and these results are agree with that obtained by **Yassin (1997)** where he noticed that there are different correlation affects of the biotic and the a biotic factors on the population dynamics of *T. urticae*, *T .cucurbitacearm* and other associated mites. He added that, there is another biotic and abiotic factor not taken in consideration affected on these populations.

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Table (10): Population fluctuations of spider mites and other predators inhabiting cotton plants during season 2002 at El-Fayoum Governorate

Sampling dates		A	B	C	D	Temperature		R. H. %
						Max.	Min.	
May	1	5	18	0	0	32.4	15.4	55.0
	15	35	26	0	0	31.2	17.2	55.5
Jun.	1	45	31	7	5	33.8	19.6	57.0
	15	75	39	62	11	37.0	21.2	55.0
Jul.	1	90	55	87	28	39.0	20.4	53.0
	15	7	60	109	36	37.8	23.0	60.5
Aug.	1	10	41	136	19	41.2	27.2	62.5
	15	22	33	52	15	39.0	24.0	56.0
Sept.	1	47	15	66	11	43.0	22.6	53.0

A = *T. urticae*
B =Predacious mites
C = Predacious insects
D =True Spiders

RESULTS AND DISCUSSION----------

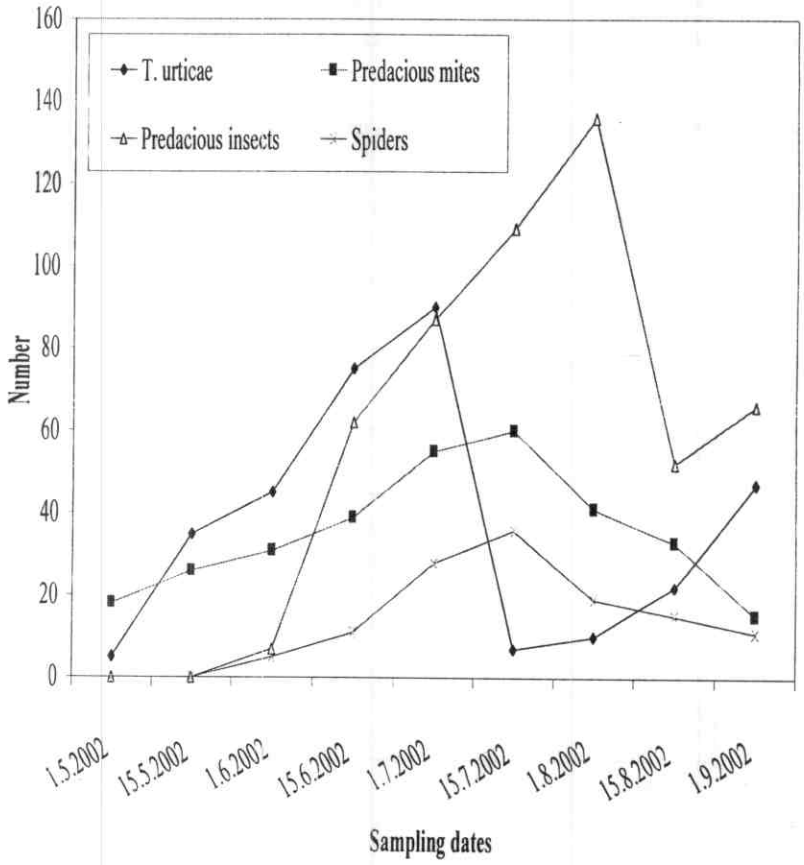

Fig. (5) : Population fluctuations of the spider mites and other predators inhabiting cotton plants during season 2002 at El-Fayoum Governorate

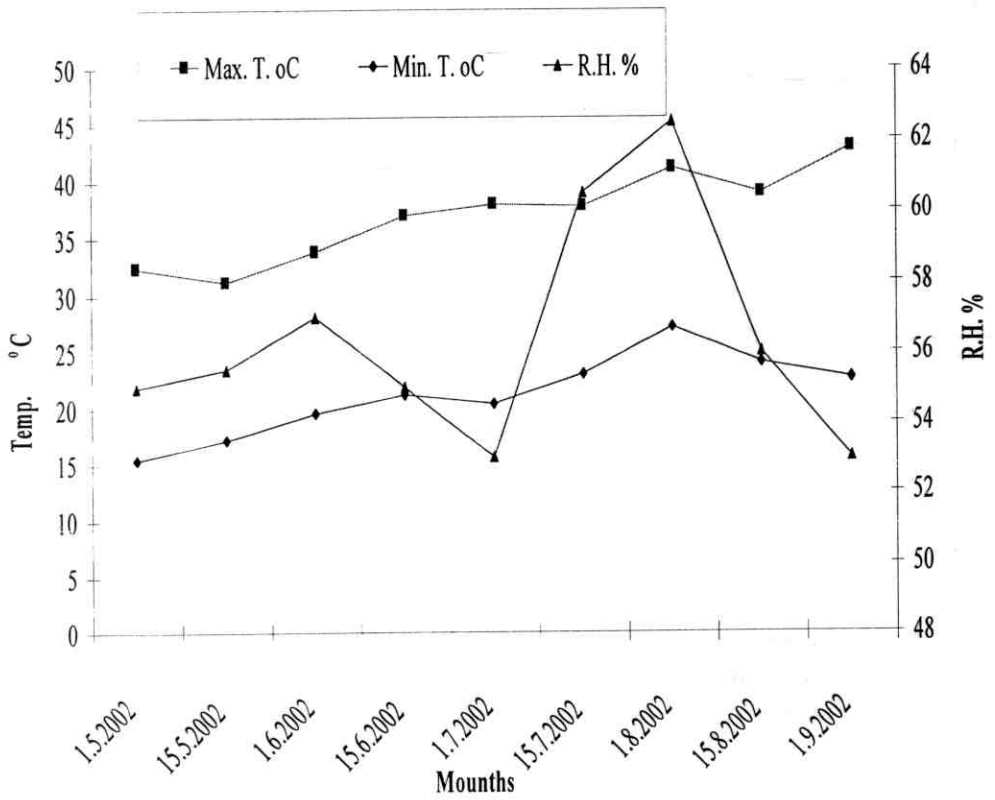

Fig. (6): Maximun, minum temperature and relative humidity of the sampling dates at El- Fayoum Governorate during season 2002

Table (11): Population fluctuations of spider mites and other predators inhabiting cotton plants during season 2003 at El-Fayoum Governorate

Sampling dates		A	B	C	D	Temperature		R. H. %
						Max.	Min.	
May	1	9	22	0	0	31.7	16.1	55.2
	15	42	33	0	6	32.9	16.8	56.2
June	1	48	38	9	8	34.2	20.2	58.0
	15	89	53	60	17	38.1	23.1	56.2
July	1	95	64	75	29	39.4	22.4	56.0
	15	6	60	95	44	39.2	24.2	62.0
August	1	13	40	141	22	42.9	29.2	63.0
	15	32	45	57	17	37.9	26.2	50.0
September	1	65	12	70	15	42.4	24.2	54.2

A = *T. urticae*
B = Predacious mites
C = Predacious insects
D = True Spiders

RESULTS AND DISCUSSION----------

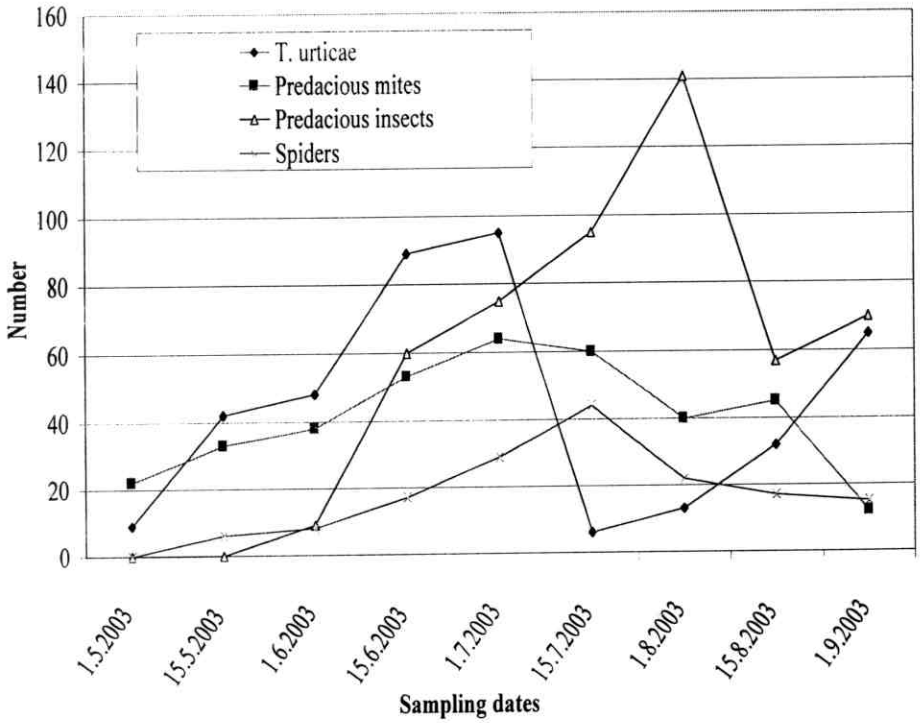

Fig. (7) : Population fluctuations of spider mites and other predators inhabiting cotton plants during season 2003 at El-Fayoum Governorate

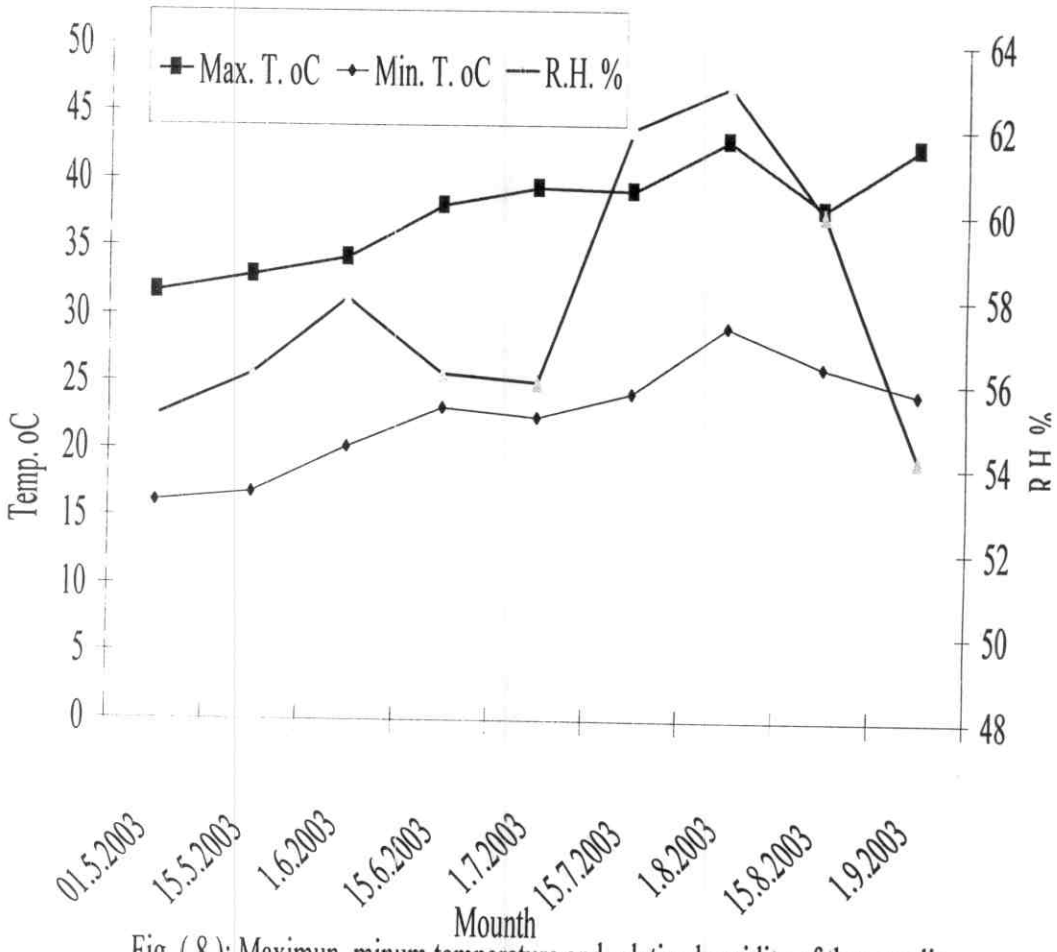

Fig. (8): Maximun, minum temperature and relative humidity of the sampling dates at El- Fayoum Governorate during season 2003

Table (12): The population fluctuations of spider mites and other predators inhabiting cotton plants during 2002 and 2003 seasons at El- Fayoum Governorate

Sampling dates		A	B	C	D	Temperature		R. H. %
						Max.	Min.	
May	1	7.0	20.0	0.0	0.0	32.05	15.75	55.10
	15	38.5	29.5	0.0	3.0	32.05	17.00	55.85
June	1	46.5	34.5	8.0	6.5	34.00	19.90	57.50
	15	82.o	46.0	61.0	14.0	37.55	22.15	55.60
July	1	92.0	59.5	81.0	28.5	38.70	21.40	54.50
	15	6.5	60.0	102.0	40.0	38.50	23.60	61.25
August	1	11.5	40.5	138.0	20.5	42.05	28.80	62.75
	15	27.0	39.0	54.5	16.0	38.45	25.10	58.00
September	1	56.0	13.5	68.0	13.0	42.70	23.40	53.60
L.S.D. at 0.05 level		31.75						

A= *T. urticae*
B = Predacious insects
C = Predacious mites
D = True Spiders

RESULTS AND DISCUSSION----------

Table (13): The correlation effect on the population of *T. urticae* associated with cotton plants at El-Fayoum Governorate during season 2002 and 2003.

Variable	Factor	Corr (r)	Slop (b)	Y Int (a)
T.urticae	Predacious insects	0.6540	0.8348	15.9669
	Predacious mites	-0.0430	-0.0645	59.6352
	Spiders	0.0419	0.0168	15.0337
	Maximum Temperature	0.1408	0.0174	36.6263
	Minimum Temperature	-0.0476	-0.0059	22.0754
	R.H. %	-0.5653	-0.0575	59.4785

Table (14): The correlation effect on the population of Predacious mites and spiders associated with cotton plants at El- Fayoum Governorate during season 2002 and 2003.

Variable	Factor	Corr (r)	Slop (b)	Y Int (a)
Predacious mites	*T. urticae*	-0.0430	-0.0287	42.4715
	Predacious insects	-0.0192	-0.0163	50.9885
	Spiders	0.7705	0.2067	3.9372
	Maximum Temperature	0.8436	0.0697	33.3615
	Minimum Temperature	0.8596	0.0713	17.7687
	R.H. %	0.5571	0.0378	54.9697
Spiders	*T. urticae*	0.0419	0.1043	39.1933
	Predacious insects	0.0045	0.0144	49.8282
	Predacious mites	0.7705	2.8720	11.8454
	Maximum Temperature	0.5941	0.1831	34.4594
	Minimum Temperature	0.6074	0.1878	18.8804
	R.H. %	0.4816	0.1219	55.02100

2-1-Laboratory Experiments

Effectiveness of some entomopathogenic fungi on *Tetranychus urticae* Koch under laboratory conditions

This experiment was carried out to determine the efficacy of entomopathogenic fungi against immature and adult stages of *Tetranychus urticae* under laboratory condition.

Five concentrations of *Beauveria bassiana* were tested as follow 5.2×10^3, 2.6×10^3, 1.3×10^3, 0.65×10^3 and 0.325×10^3 spores/ml. while *Metarhizium anisoplae* was tested at concentrations of 64×10^3, 32×10^3, 16×10^3, 8×10^3 and 4×10^3 spores/ml. and *M. flavovridae*, was tested at concentrations of 3.4×10^3, 1.7×10^3, 0.85×10^3, 0.425×10^3 and 0.213×10^3 spores/ml.

Five replicates were made for each concentration for immature and adult stages. In each replicate 10 individuals immature and 10 adults were tested. Mortality percentage of immature and adults stages were determined (1, 3, 7) days after the exposure time of treatment.

RESULTS AND DISCUSSION----------

1) Efficacy of *Metarhizium flavovridae* on immature and adult stages of *T. urticae*.

1-1 Efficacy of *M. flavovridae* on immature stages of *T. utricae*.

Data in Table (15) considering, effect of *M. flavovrida* on immature stage of *T. urticae* indicate that mortality percentage were 4.40, 0.13, 7.10, 0.15 and 1.72% the first day after treatment at concentrations, 3.4, 1.7, 0.85, 0.425 and 0.213×10^3, respectively.

While after three days 27.57, 9.47, 29.21, 6.67 and 12.83%, at the same concentrations, respectively. After seven days, there was pronounced increase in mortality percentage, whereas mortality percentage averaged 35.23 and 60.28% with individual untreated.

In Table (16) and Fig. (9) LT_{50} values increased from 5.41 – 10.71 days while the LT_{90} values increased from 15.95- 45.10 days for immature stages. Also the lower increased from 4.17-7.57 days and the upper increased from 6.79-36.10 days respectively for the different concentrations.

There were slight differences in slope values (b) between the five concentrations. The (b) values were 2.33±0.36, 3.57±0.68, 1.93±0.43, 3.08±0.58 and 2.05±0.57 for 3.4×10^3, 1.7×10^3, 0.85×10^3, 0.425×10^3 and 0.213×10^3 spore/ml, respectively but the intercept (a) between the different concentrations were 3.29±0.27, 1.98±0.55, 3.53±0.32, 2.03±0.47 and 2.88±0.45, respectively.

Table (15): Mortality percentage of *Tetranychus urticae* immature stages after treatment with different concentrations of *M. flavovridae*.

Concentration ($\times 10^3$)spore/ml	Mortality % at indicated after treatment		
	1	3	7
3.4	4.40	27.57	60.28
1.7	0.13	9.47	50.12
0.85	7.10	29.21	56.47
0.425	0.15	6.67	35.78
0.213	1.72	12.83	35.23
Control	0.13	4.21	14.79

Table (16): Effect of different concentrations of *Metrhizium flavovridae* on immature stages of *T. urticae.*

Concentration ($\times 10^3$)spore/ml	LT_{50}	Fucidal limit		LT_{90}	Intercept (a)	Slope (b)
		Lower	Upper			
3.4	5.41	4.36	6.79	19.22	3.29±o.27	2.33±0.36
1.7	6.98	5.81	8.96	15.95	1.98±0.55	3.57±0.68
0.85	5.76	4.17	8.72	26.58	3.53±0.32	1.93±0.43
0.425	9.18	7.57	13.17	23.88	2.03±0.47	3.08±0.58
0.213	10.71	7.42	36.10	45.10	2.88±0.45	2.05±0.57

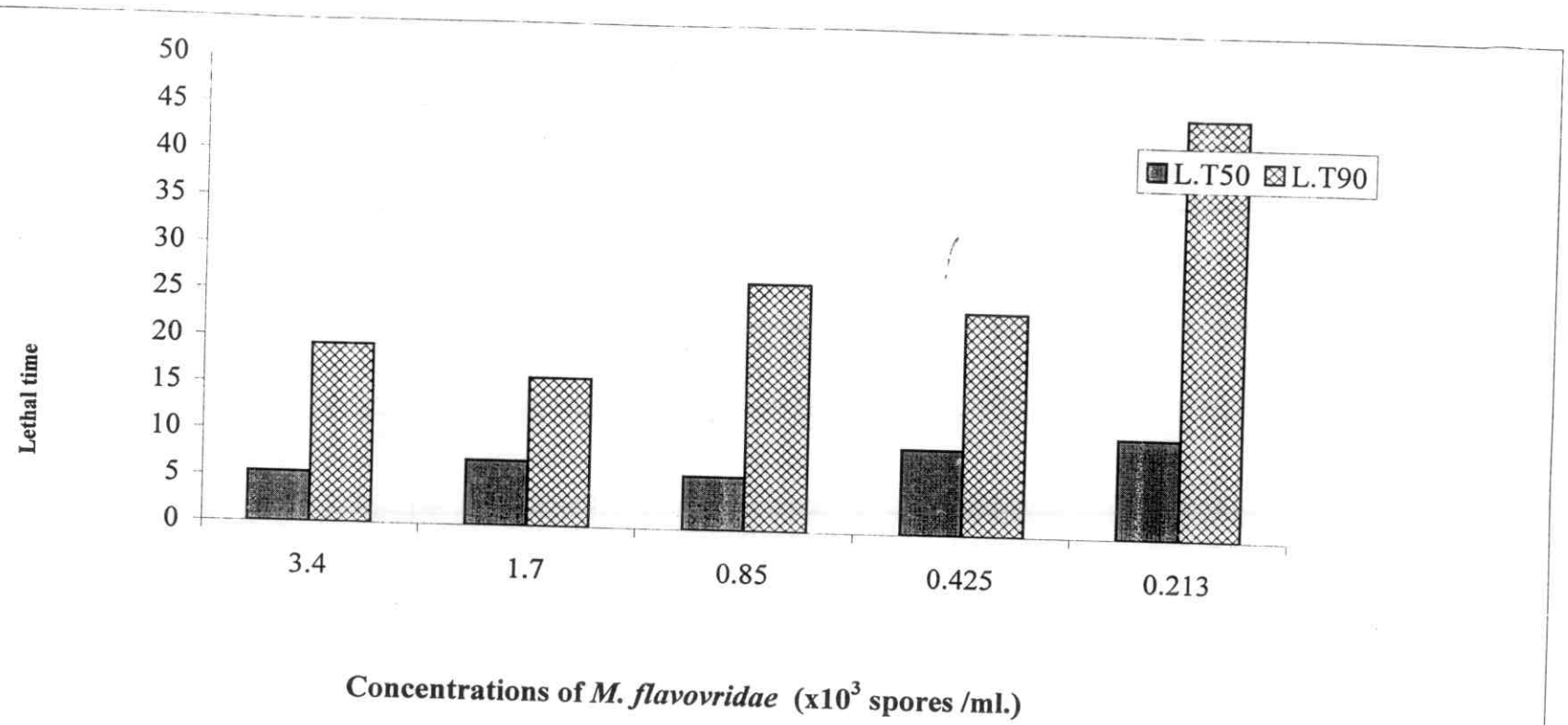

Fig. (9):Relationship between concentration of *Metarhizium flavovridae* and Lethal time (LT_{50} & LT_{90}) of *T. urticae* immature stages treated with fungs - under laboratory conditions.

As for immature stages, data in Table (17) LC_{50} values were 21.69×10^3, 23.36×10^3 and 1.39×10^3 spores/ml after three, five and seven days, respectively.

Taking into accomplish, the LC_{90} values were 176.82×10^3, 32.96×10^3 and 71.56×10^3. There were slight differences in slope values (b) between the three, five and seven days. The (b) values were 0.27±0.55, 0.41±0.22 and 0.74±0.19 .Also the intercept (a) between the same days were 3.60±0.23, 4.01±0.09 and 4.89±0.08.

Table (17): Toxicity line parameters of *T. urticae* after treatment of immature stages with different concentrations of (*Metarhizium flavovridae*).

Days after treatment	LC_{50} $x10^3$ spore/ml	Fucidal limit		LC_{90} $x10^3$ spore/ml	Intercept (a)	Slope (b)
		Lower	Upper			
3rd day	21.69	6.29	32.43	176.82	3.60±0.23	0.27±0.55
5th day	23.36	ND	ND	32.96	4.01±0.09	0.41±0.22
7th day	1.39	0.85	3.10	71.56	4.89±0.08	0.74±0.19

ND: not detected

1-2) Efficacy of *M. flavovridae* on adult stages of *T. urtcae.*

Data in Table (18) show that adult mortality percentage increased with increasing the time after treatment of different concentrations of *M. flavovridae*, it was ranged between 0.01- 4.47% after the 1st day post application.

After three days, mortality percentage ranged between 8.73and 20.12%, while it was ranged between 38.58 and 71.19% after seven days of treatment with individual untreated.

Taking into account, the LT_{50} values, data in Table (19) and Fig. (10) show the adult LT_{50}, the LT_{50} values decreased with increasing the fungal concentration. The LT_{50} ranged between 5.61-10.46 days. The same observation was found in LT_{90} values whereas, the LT_{90} almost increased with increasing the tested concentration. The LT_{90} was 14.65, 9.63, 30.25, 29.86 and 61.47days when concentrations were 3.4, 1.7, 0.85, 0.425, 0.213 $\times 10^6$. The LT_{90} values at the three lower concentrations depending on the calculation program are not logic because of the life cycle of *T. urticae* is two weeks.

Also the lower of Fucidal limit increased from 4.7-8.45days and the upper increased 6.17-14.63days.

There were slight differences in slope values (b) between the five concentrations. The (b) values were 3.07±0.21, 5.21±0.76, 2.23±0.27, 2.33±0.52 and 1.67±0.25 for 3.4×10^3, 1.7×10^3, 0.85×10^3, 0.425×10^3 and 0.213×10^3 spores/ml, respectively, while the intercept (a) between the different concentrations were 2.69±0.17, 1.15±0.59, 2.97±0.22, 2.84± 0.41and 3.31±0.19 for the same concentrations, respectively .

Table (18): Mortality percentage of *T. urticae* adult stages after application with different concentrations of *Metarhizuim flavovridae.*

Concentrations ($\times 10^3$)spore/ml	Mortality % at indicated after treatment		
	1	3	7
3.4	1.06	20.12	61.58
1.7	0.01	8.73	71.19
0.85	2.11	16.76	44.42
0.425	1.53	14.73	42.50
0.213	4.47	18.31	38.58
Control	0.13	4.21	14.79

Table (19): Effect of different concentrations of (*Metarhizium flavovridae*) on adult stages of *T. urticae*.

Concentrations ($\times 10^3$)spore/ml	LT_{50}	Fucidal limit		LT_{90}	Intercept (a)	Slope (b)
		Lower	Upper			
3.4	5.61	5.11	6.17	14.65	2.69±0.17	3.07±0.21
1.7	5.47	4.70	6.22	9.63	1.15±0.59	5.21±0.76
0.85	8.08	7.05	9.69	30.25	2.97±0.22	2.23±0.27
0.425	8.43	6.46	14.50	29.86	2.84±0.41	2.33±0.52
0.213	10.46	8.45	14.63	61.47	3.31±0.19	1.67±0.25

Regarding toxicity line parameters, data in Table (20) show that the LC_{50} values after three, five and seven days were 356.8×10^3, $94.78\times10^3$and 0.69×10^3spors/ml for the adult stages .

On the other hand , the LC_{90} values were 442.26×10^3, 265.4×10^3 and 38.85×10^3 after three, five and seven days, respectively. There were slight differences in slope values (b) between the three, five and seven days. The (b) values were 0.45±0.32, 0.53±0.23 and 0.73±0.33. Also the intercept (a) between the same days were 3.37±0.13, 3.94 ±0.09 and 5.11±0.14, respectively.

RESULTS AND DISCUSSION----------

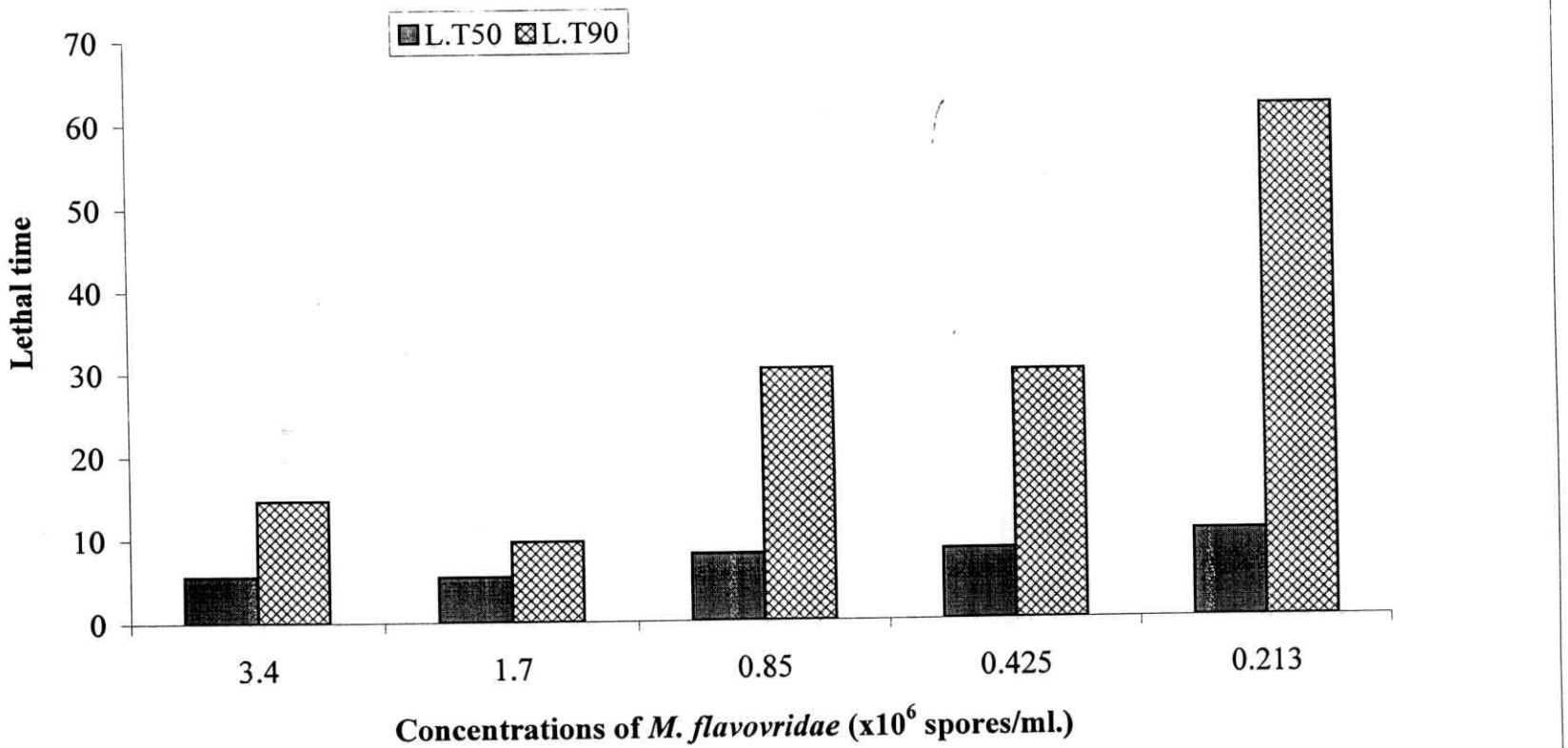

Fig. (10):Relationship between *Metarhizium. flavovridae* concentratuion and Lethal time (LT_{50} &LT_{90}) of *T. urticae* adult stage treated with fungs under laboratory condition

Table (20): Toxicity line parameters of *T. urtica* after treatment of adult stage with different concentrations of (*Metarhizium flavovridae*).

Days after treatment	LC_{50} $x10^3$ spore/ml	Fucidal limit		LC_{90} $x10^3$ spore/ml	Intercept (a)	Slope (b)
		Lower	Upper			
3rd day	356.8	ND	ND	442.26	3.37±0.13	0.45±0.32
5th day	94.78	10.46	5.66	265.40	3.94±0.09	0.53±0.23
7th day	0.69	ND	ND	38.85	5.11±0.14	0.73±0.33

ND: not detected

These results reveal that the *M. flavovrdiae* was highly effective with different concentrations on different stages of *T. urticae* .

The concentrations 3.4×10^3, 1.7×10^3 spores/ml were high mortality percentage on the immature and adult stages. Also, after 7days it was more effective (71.19% and 61.58% mortality percentage) than 1 and 3 days mortality of *T. urticae* different stages.

RESULTS AND DISCUSSION----------

2) Effect of different concentrations of *Metarhizium anisopliae* on adult and immature stages of *T. urticae* under laboratory conditions

2-1) Efficacy of *M. anisopliae* on the immature stages of *T. urticae*

Data in Table (21) revealed that, the mortality percentage after the first day increased from 0.01-3.97% but after three and seven day, the mortality percentage ranged from 2.18-26.28%, and 27.44-70.94% respectively.

Data in Table (22) and Fig (11) Effect of different concentrations of *M. anisopliae* on immature stage of *T. urticae* under laboratory conditions showed that increasing to the LT_{50} values, it were 4.78, 5.18, 7.77, 10.01 and 8.66 days with concentration for 64×10^3, 32×10^3, 16×10^3, 8×10^3 and 4×10^3 spores/ml, respectively.

While the LT_{90} represented the 11.80, 15.63, 34.83, 21.55 and 33.54 days for the same concentrations, respectively.

Also, there were slight differences in slope values (b) between the different concentrations. The (b) values were 3.26 ±0.29, 2.67±0.26, 1.96±0.24, 3.85±0.50 and 2.18±0.27, respectively. While the intercept (a) for the five concentration gives 2.77±0.21, 3.09±0.19, 3.24±0.19, 1.14±0.43 and 2.95±0.21 respectively.

Also in the same Table for immature stages showed that the mortality percentage ranged from (4.35 to 7.47), (5.22 to 10.61) for the fucidal limit lower and upper percentage, respectively.

Table (21): Mortality percent of *T. urticae* immature stages after treatment with different concentrations of *M. anisopliae.*

Treatments ($\times 10^3$) spore/ml.	Mortality % indicated after treatments		
	1	3	7
64	1.32	25.39	70.94
32	2.81	26.28	63.74
16	3.97	20.77	46.41
8	0.01	2.18	27.44
4	2.05	15.77	42.00
Control	0.06	1.90	11.95

Table (22) Effect of different concentrations of (*M. anisopliae*) on immature stages of *T. urticae*.

Concentrations ($\times 10^3$)spore/ml.	LT_{50}	Fucidal limit		LT_{90}	Intercept (a)	Slope (b)
		Lower	Upper			
64	4.78	4.35	5.22	11.80	2.77±0.21	3.26±0.29
32	5.18	4.65	5.76	15.63	3.09±0.19	2.67±0.26
16	7.77	6.69	9.48	34.83	3.24±0.19	1.96±0.24
8	10.01	8.98	11.76	21.55	1.14±0.43	3.85±0.50
4	8.66	7.47	10.61	33.54	2.95±0.21	2.18±0.27

Data in Table (23) showed that the LC_{50} values were 4.25 $\times 10^3$,13.14$\times 10^3$ and 18.45$\times 10^3$ after the first, three and seven days respectively .Also LC_{90} 8.98 $\times 10^3$, 31.66 $\times 10^3$ and 89.9$\times 10^3$, respectively. In the same table data showed that the slope values (b) were 0.24±0.53, 0.58±0.23 and 0.66±0.19, respectively. Also the intercept (a) were 2.44±0.72, 3.33±0.31 and 4.16±0.24 after the first, three and seven days, respectively.

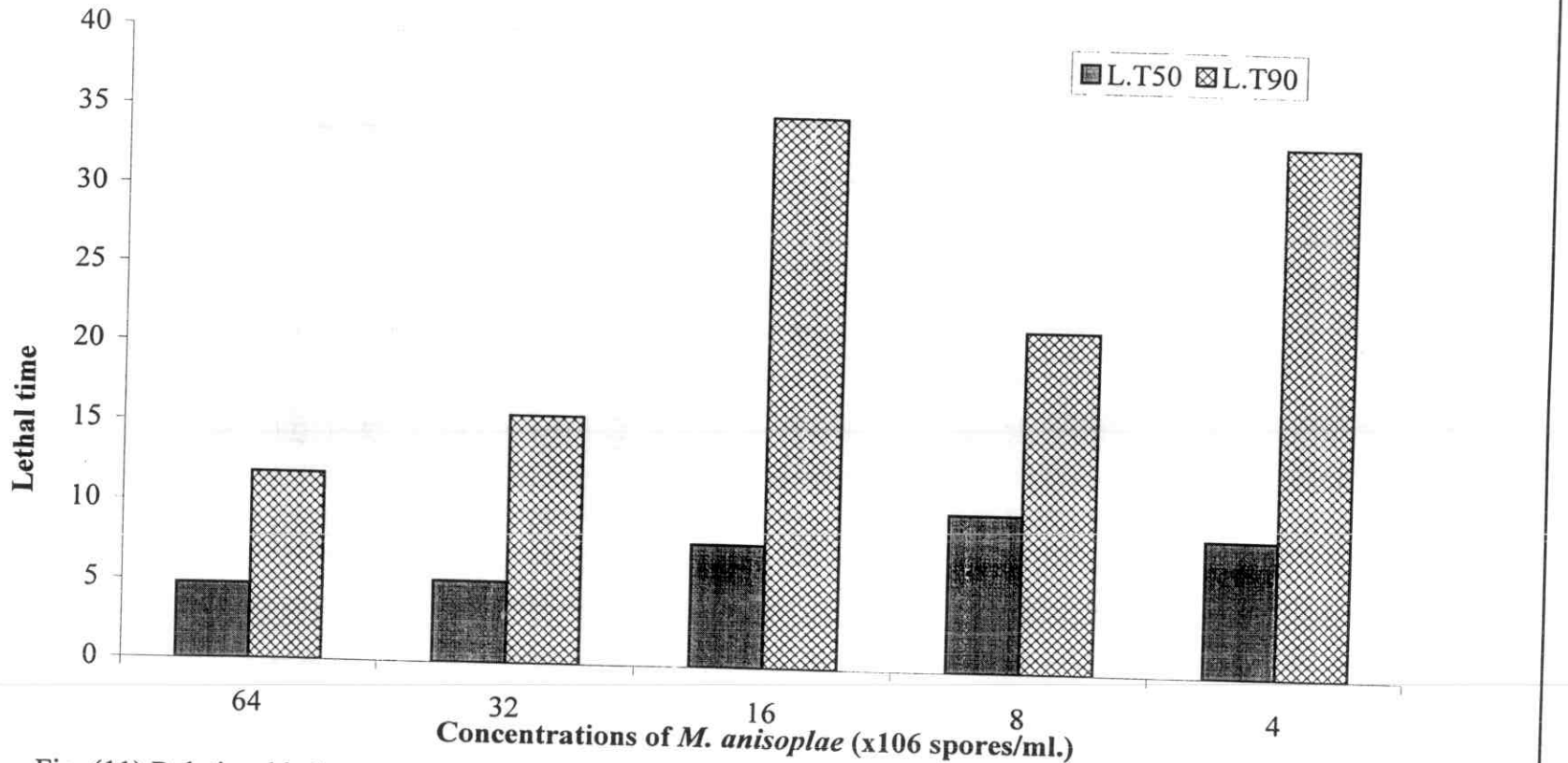

Fig. (11):Relationship between *Metarhizium anisoplae* concentrations and Lethal time (LT50 &LT90) of *T. urticae* immature stages - under laboratory condition.

Table (23) Toxicity line parameters of *T. urticae* after treatment of immature stages with different concentrations of (*M. anisoplae*).

Days after treatment	LC_{50} $\times 10^3$	Fucidal limit		LC_{90} $\times 10^3$	Intercept (a)	Slope (b)
		Lower	Upper			
1st day	4.25	ND	ND	8.98	2.44±0.72	0.24±0.53
3rd day	13.14	33.89	5.36	31.66	3.33±0.30	0.58±0.23
7th day	18.45	10.026	38.56	89.9	4.16±0.24	0.66±0.19

ND: not detected

2-2) Efficacy of *M.* anisopliae on adult stage of *T. urtcae*

Data in Table (24) show that cumulative mortality percentage in adult stages of *T. urticae* increased with increasing both the time elapsed after treatment. After first day of treatment the mortality percentage ranged between (0.34-7.02%).

Also, after three day of treatment, mortality percentage ranged between (8.76-31.59 %). On the other hand the concentration 64 $\times 10^3$ spores/ml gave the high percentage mortality after seven days (61.33%) while 4×10^3 spores/ml concentration gave 37.58 % mortality percentage after the same day.

Regarding to toxicity the LT_{50}, the LT_{90} values in Table (25) and Fig (12) increased with increasing between different concentrations (64×10^3, 32×10^3, 16×10^3, 8×10^3 and 4×10^3 spores/ml) 5.09, 5.79, 6.62, 8.73and 9.06 days, respectively.

While the LT_{90} were 20.98, 17.12, 33.06, 26.90 and 25.77 days with the same concentrations, respectively.

RESULTS AND DISCUSSION----------

Data in Table (25) Effect of *M. anisopliae* on adult stages of *T. urticae* where, there were slight differences in slope values (b) between the five tested concentrations of the same fungi. The (b) values were 2.08±0.32, 2.72±0.27, 1.83±0.23, 2.62±0.31and 2.82±0.35 for 64×10^3, 32×10^3, 16×10^3, 8×10^3 and 4×10^3 spores/ml.), respectively. Also, the intercept (a) between the same concentrations were 3.52±0.24, 2.92±0.21, 3.49±0.17, 2.53±0.25 and 2.29±0.28, respectively.

The fucidal limit lower ranged between (4.06 and 8.01).While, the fucidal limit upper ranged between (6.42 - 10.75).

Table (24): Mortality percentage of *T. urticae* adult stage after treatment with different concentrations of *M. anisopliae.*

Treatments ($\times 10^3$) spore/ml	Mortality % indicated after treatments		
	1	3	7
64	7.02	31.59	61.33
32	1.90	21.86	58.88
16	6.58	26.38	51.75
8	0.68	11.19	40.06
4	0.34	8.76	37.58
Control	0.06	1.90	11.95

Table (25): Effect of different concentrations of (*M. anisopliae*) on adult stage of *T. urticae*.

Concentrations ($\times 10^3$)spore/ml.	LT_{50}	Fucidal limit		LT_{90}	Intercept (a)	Slope (b)
		Lower	Upper			
64	5.09	4.06	6.42	20.98	3.52±0.24	2.08±0.32
32	5.79	5.22	6.45	17.12	2.92±0.21	2.72±0.27
16	6.62	5.70	7.94	33.06	3.49±0.17	1.83±0.23
8	8.73	7.69	10.37	26.90	2.53±0.25	2.62±0.31
4	9.06	8.01	10.75	25.77	2.29±0.28	2.82±0.35

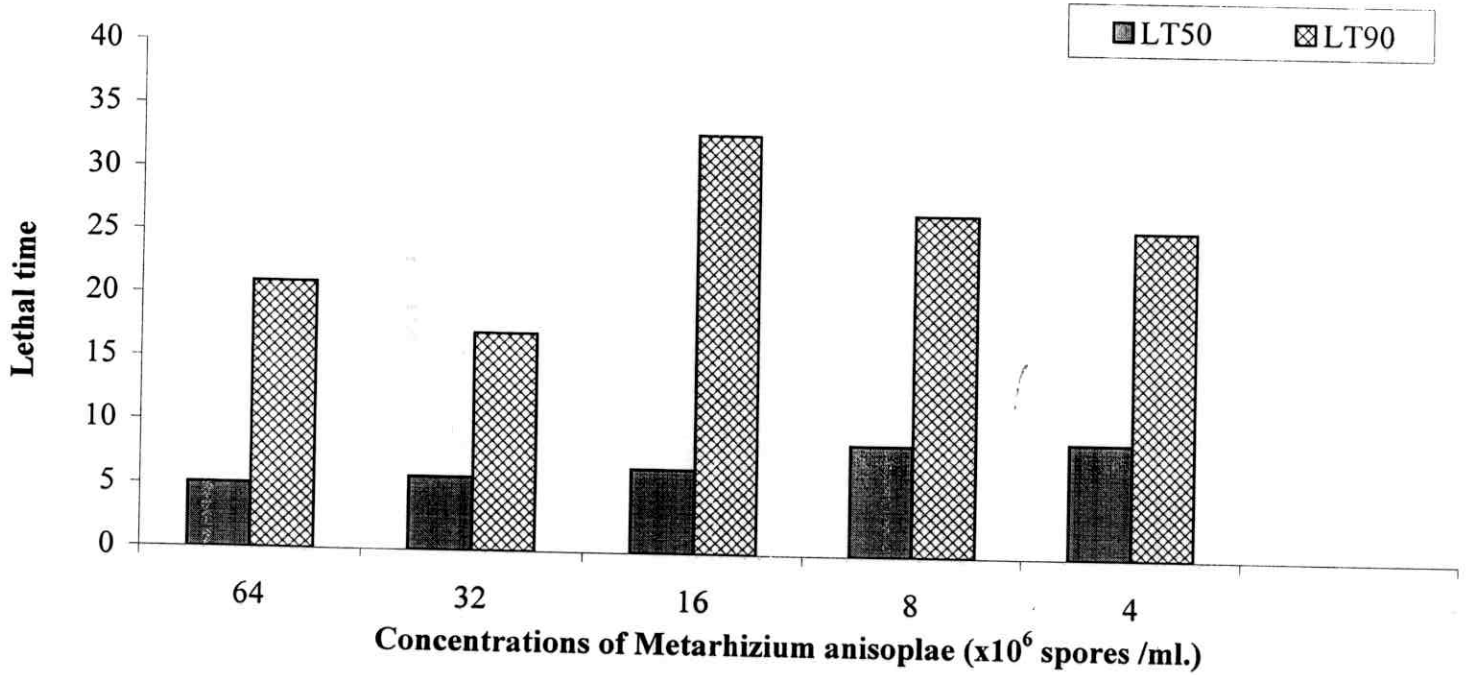

Fig. (12): Relationship between *M.anisoplae* concentration and Lethal time (LT_{50} &LT_{90}) of *T. urticae* adult treated with fungs - under laboratory condition.

On the other hand the data in Table (26) the LC_{50} values for the adult stage were 331.3×10^3, 327.90×10^3 and 18.25×10^3 spores /ml. after the first, three and seven days, respectively.

While, the LC_{90} values were 864.31×10^3, 475.40×10^3 and 90.76×10^3 spores/ ml.

Also the slope values (b) were 1.36±0.40, 0.70±0.22 and 0.54±0.19 but the intercept values (a) were 1.55±0.62, 3.22±0.30 and 4.32±0.24 respectively.

Table (26) Toxicity line parameters of *T. urticae* after treatment of adult stage with different concentrations of (*M. anisopliae*).

Days after treatments	LC_{50} $\times10^3$	Fucidal		LC_{90} $\times10^3$	Intercept (a)	Slope (b)
		Lower	Upper			
1st day	331.30	129.11	880.50	864.31	1.55±0.62	1.36±0.40
3rd day	327.90	100.11	681.40	475.40	3.22±0.30	0.70±0.22
7th day	18.25	8.03	51.96	90.76	4.32±0.24	0.54±0.19

Generally these results indicated that the fungi, *M. anisopliae* with different concentrations was highly effective on adult and immature stages, for immature stage the mortality percentage was higher than adult after seven days,

mortality percentage 70.94 % at tested concentration of 64×10^6 valuable spore/ml. while the adult stage after seven days mortality percentage was 61.33% at tested the same concentration.

The present results agreement with **El-Hady (1996), Chandler *et al.* (2000), Sewify *et al.* (2000), El-Safty (2003)** and **Hassan (2003).**

3) Effect of fungus *Beauveria bassiana* on immature and adult stages of *T. urticae* koch under laboratory conditions

3-1) **Efficacy of *B. bassiana* on immature stage *T. urticae***

Data in Table (27) show the mortality percent after the first day increased with increasing the concentration (0.05-4.86 %).

After three days of treatment, mortality percentage ranged between (1.56- 10.78 %).

After seven days of treatment, mortality percentage recorded (41.27, 19.87, 18.03, 12.51 and 9.20%) for concentrations 5.2×10^3, 2.6×10^3, 1.3×10^3, 0.65×10^3 and 0.325×10^3 spores/ml respectively with individual untreated.

Data in Table (28) and Fig (13) resulted that the LT_{50} for five concentrations 8.39, 14.54, 16.29, 19.69 and 27.40days, respectively. Also LT_{90} represented 24.11, 43.98, 52.90, 62.39 and 102.24 days, for concentrations 5.2×10^3, 2.6×10^3, 1.3×10^3, 0.65×10^3 and 0.325×10^3 spores/ml respectively.

In the same Table these were the slight differences in slope values (b) between the different concentrations .The **(b)** values were(2.79 ±0.33 , 2.64 ±0.45, 0.88 ±0.26, 2.56 ±0.53 and 2.24 ±0.56) while, the intercept **(a)** for the five concentrations gives 2.42 ±0.27, 1.90 ±0.37, 3.34 ±0.20, 1.69 ±0.46 and 1.78 ±0.47 respectively.

Also the lower results give (7.47, 11.63, 27.22, 14.16 and 16.96 days) while the upper data were (9.78, 21.93, 36.46, 41.70 and 105.02 days).

RESULTS AND DISCUSSION----------

Table (27): Cumulative mortality percentage of *T. urticae* immature stages after treatment with different concentrations of *B. bassiana*.

Concentrations ($\times 10^3$) spore /ml	Mortality % at indicated after treatment		
	1	3	7
5.2	0.49	10.57	41.27
2.6	0.10	3.38	19.87
1.3	4.86	10.78	18.03
0.65	0.05	1.82	12.51
0.325	0.06	1.56	9.20
control	0.06	1.63	9.75

Table (28): Effect of different concentrations of *B. bassiana* on immature stages of *T. urticae*.

Concentrations ($\times 10^3$)spore/ml.	LT_{50}	Fucidal limit		LT_{90}	Intercept (a)	Slope (b)
		Lower	Upper			
5.2	8.39	7.47	9.78	24.11	2.42±0.27	2.79±0.33
2.6	14.54	11.63	21.93	43.98	1.9±0.37	2.64±0.45
1.3	16.29	27.22	36.46	52.90	3.34±0.20	0.88±0.26
0.65	19.69	14.16	41.70	62.39	1.69±0.46	2.56±0.53
0.325	27.40	16.96	105.02	102.24	1.78±0.47	2.24±0.56

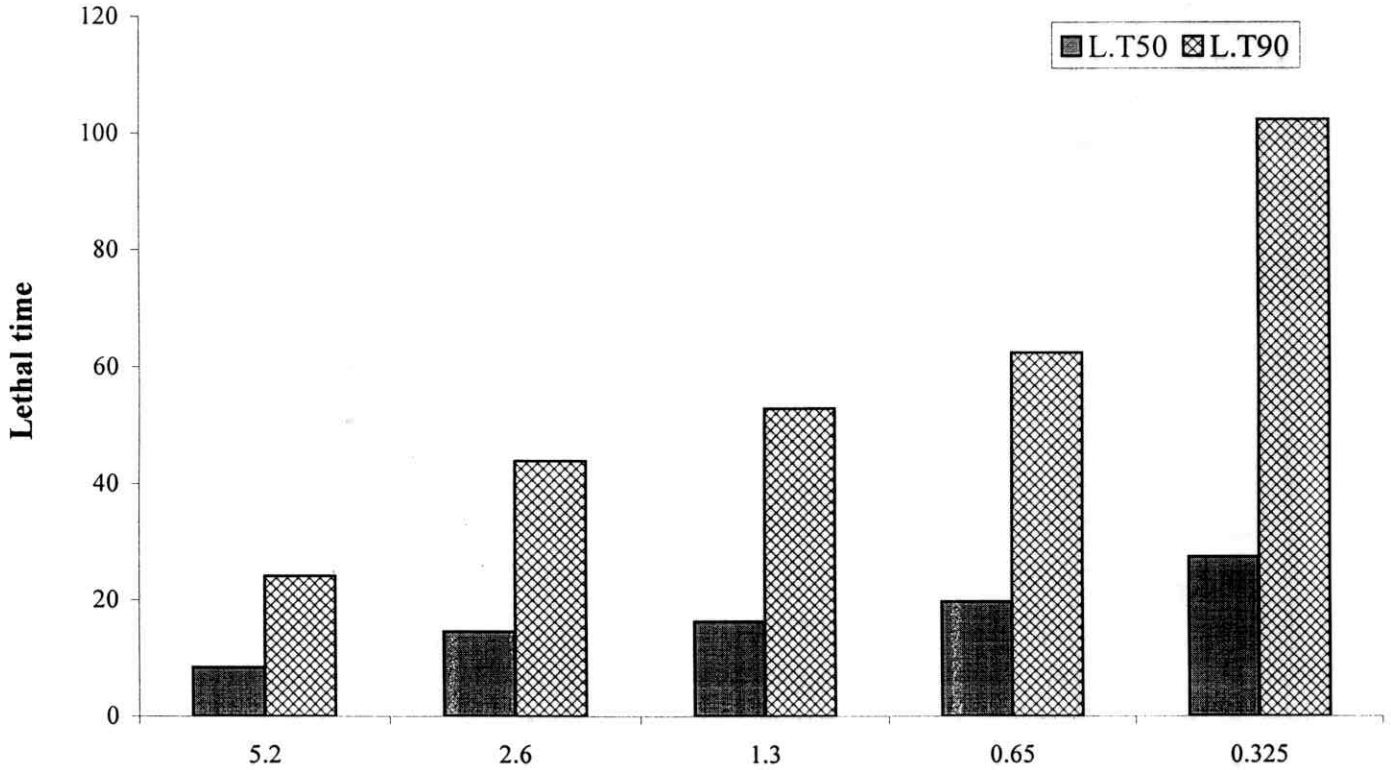

Fig. (13):Relationship between *B. bassiana* concentrations and Lethal time (LT50 &LT90) of *T. urticae* immature stages - under laboratory conditions.

Data in Table (29) showed that the LC_{50} after 1st, 3rd and 7th days (7.77×10^3, 332.6×10^3 and 13.12×10^3), respectively. The LC_{90} after first, three and seven days were (21.21, 676.94 and 50.10×10^3, respectively.

In the same table the slight differences in slope values (b) were (0.30 ±0.90, 0.72±0.35 and 0.89±0.23) after first, three and seven days, respectively. While the intercept (a) for the first, three and seven days gives (2.89±0.42, 3.17±0.17 and 3.99±0.11), respectively.

Table (29): Toxicity line parameters of *T. urticae* after treatment of immature stages with different concentrations of *B. bassiana*.

Days after treatment	LC_{50} $\times 10^3$ spore/ml	Fucidal limite		LC_{90} $\times 10^3$ spore/ml	Intercept (a)	Slope (b)
		Lower	Upper			
1st day	7.77	ND	ND	21.21	2.89±0.42	0.30±0.90
3rd day	332.6	24.94	1.00	676.94	3.17±0.17	0.72±0.35
7th day	13.12	5.95	113.65	50.10	3.99±0.11	0.89±0.23

ND: Not detected

3-2) **Efficacy of *B. bassiana* on the adult stage of *T. urticae***

Data in Table (30) showed that the mortality percentage of the adult stage *T. urticae* which increased with increasing the time elapsed after treatment.

After first day the mortality percentage ranged between 0.00-8.79 % but after three day increased the mortality percentage from 0.86-24.39%.

On the other hand after seven day the percentages become 42.68, 29.79, 26.64, 18.75 and 13.24 % for concentration, 5.2×10^3, 2.6×10^3, 1.3×10^3, 0.65×10^3 and 0.325×10^3 spores/ml., respectively compared with individual untreated.

On the other hand the adult stage lethal time (LT_{50}), the LT_{50} values in data Table (31) and Fig (14) increased with increasing between different concentrations, (5.2×10^3, 2.6×10^3, 1.3×10^3, 0.65×10^3 and 0.325×10^3 spores/ml) 9.52, 11.79, 22.75, 15.16 and 14.75 days respectively. But the LT_{90} were 80.33, 41.62, 45.43, 46.33 and 34.77 days with the same concentrations.

There were slight differences in slope values (b) data in Table (31) for adult stage showed that, between the five concentrations on the *B. bassiana.* The b values were 1.38±0.22, 2.34±0.34, 1.22±0.18, 2.64±0.45 and 3.44±0.64 for 5.2×10^6, 2.6×10^6, 1.3×10^6, 0.65×10^6 and 0.325×10^6 spores/ml respectively .While the intercept (a) between five concentration in the same Table (31) 3.65±0.17, 2.49 ±0.27, 3.35±0.15, 1.88±0.38 and 0.97±0.56.

The lower data in the same concentration for 7.55, 9.79, 15.42, 11.97 and 11.93 days. While the upper data 13.77, 15.92, 43.67, 23.69 and 22.65 days.

Table (30): Mortality percentage of *T. urticae* adult stage after application with different concentrations of *Beauveria bassiana*.

Concentrations ($\times 10^3$)spore/ml.	Mortality % at indicated after treatment.		
	1	3	7
5.2	8.79	24.39	42.68
2.6	0.61	8.20	29.79
1.3	4.91	14.18	26.64
0.65	0.09	3.15	18.75
0.325	0.00	0.86	13.24
Control	0.06	1.63	9.75

Table (31): Effect of different concentrations of (*Beauveria bassiana*) on adult stage of *T. urticae*.

Concentrations ($\times 10^3$)spore/ml.	LT_{50}	Fucidal limit		LT_{90}	Intercept (a)	Slope (b)
		Lower	Upper			
5.2	9.52	7.55	13.77	28.33	3.65±0.17	1.38±0.22
2.6	11.79	9.79	15.92	33.62	2.49±0.27	2.34±0.34
1.3	22.75	15.42	43.67	45.43	3.35±0.15	1.22±0.18
0.65	15.16	11.97	23.69	46.33	1.88±0.38	2.64±0.45
0.325	14.75	11.93	22.65	52.77	0.97±0.56	3.44±0.64

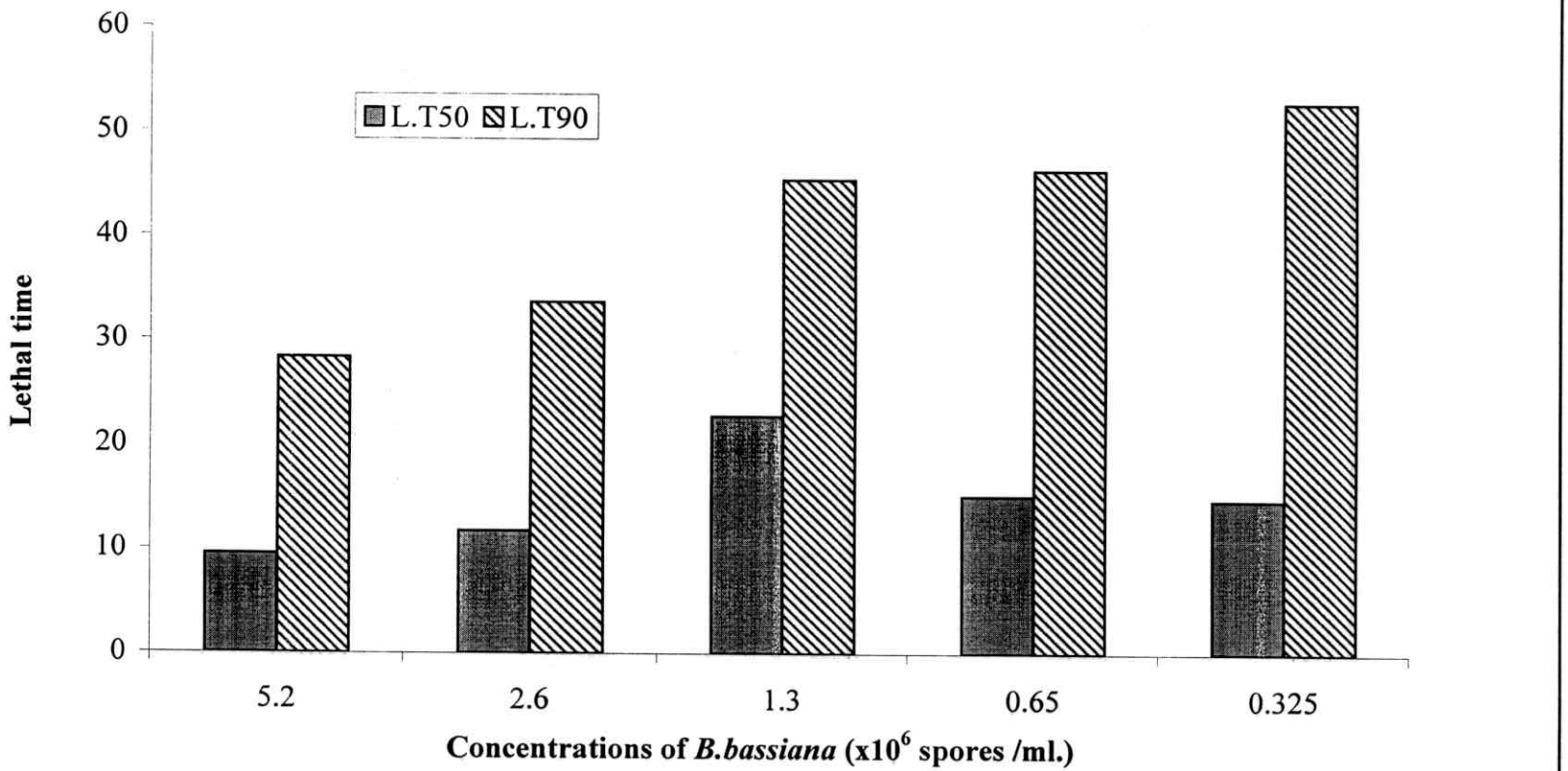

Fig. (14):Relationship between *B. bassiana* concentrations and Lethal time (LT_{50} &LT_{90}) of *T. urticae* adult stage- under laboratory conditions.

Data in Table (32) showed that the LC_{50} after the first day was 24.52 $\times 10^3$ spore/ml., after the three and seven days were 20.78×10^3 and 30.82×10^3 spore/ml., respectively.

On the other hand the LC_{90} in the same table after the first, three and seven days 182.6, 261.35 and 352.79 spore/ml., respectively.

The slight differences in slope values (b) were 1.47±0.44, 1.01±0.29 and 0.55±0.21 after first, three and seven days respectively. But the intercept (a) were 2.95±0.24, 3.51±0.14 and 4.17±0.09 after first, three and seven days, respectively.

Table (32): Toxicity line parameters of *T. urticae* after treatment of adult stage with different concentrations of (*B. bassiana*).

Days after treatment	LC_{50} $\times 10^3$ spor/ml	Fucidal limit		LC_{90} $\times 10^3$ spor/ml	Intercept (a)	Slope (b)
		Lower	Upper			
1st day	24.52	10.08	613.4	182.6	2.95±0.24	1.47±0.44
3rd day	20.78	9.75	106.47	261.35	3.51±0.14	1.01±0.29
7th day	30.82	7.53	2.40	352.79	4.17±0.09	0.55±0.21

These results reveal that the compound Biover (*B. bassiana*) was highly effective with different concentrations on different stages of *T. urticae*.

The concentrations 5.2×10^3, 2.6×10^3spor/ml gave high mortality percentage on the adult stage after seven days it was more effective (42.68% and 29.79% mortality percentage) than 1st and 3rd days, while the concentrations 5.2×10^3, 2.6×10^3spor/ml to the immature stages was highly effective after seven days (41.27% and 19.87 % mortality percentage) compared with 1st and 3rd days.

These results are in agreement with **Pellagatti *et al.* (1989), Yousri (1994), Andreeva** and **Shternshis (1995), El-Adawy *et al.* (1995), Hinz** and **Wright (1997), Yassin (1997), Tamai *et al.* (1998),Tamai *et al.* (1999)** and **Omar** and **El- Khateeb (2002)**.

2-2-Field Experiment:

Evaluation environmental safe compounds in controlling the two spotted spider mite *Tetranychus urticae* Koch on cotton plants: -

Field experiment was carried out at Giza experimental station during the season 2003 to evaluate some environmental safe compounds in controlling spider mite *T. urticae* on cotton plants.

Data in Tables (33, 34& 35) show the activity of *Beauveria bassiana* ,*Metarahizium anisoplae* and *M. flavoridae* against the two spotted mite *T. urticae* on cotton crop. It clear that all tested materials exhibited different degrees of mortality after three days of treatment.

As shown in Table (34) data cleared that *Metarhizium flavovridae* exhibited the highest initial kill activity against the motile stages of *T. urticae* (95.6%) *B. bassiana* (84.8%), while *M. anisoplae* was the lowest one (72.2%) respectively. While these compounds gave residual activity in different degrees whereas *M. flavovridae* was the highest compounds in their residual effect on motile stages of spider mite *T. urticae*, producing reduction in the population reached 88.3% *M. anisoplae* exhibited (78.4%) as residual activity, while *Beauveria bassiana* showed the lowest one in residual effect (41.16%).

The general mean of the percentage mortality could be arranged in a descending order as follows: 90.2 > 76.8 > 52.1 for, *M. fluvovridae*, *M. anisoplae* and *Beaueria bassiana*.

Regarding the initial, residual activity and the general mean of reduction percentages statistical analysis showed that there are significantly different between the tested compounds in their reduction percentages against the red spider mite *T. urticae* on cotton crop.

These results are in agreement with those obtained by several investigators **Botha *et al.* (1994)** and **Omar *et al.* (2000)**.

RESULTS AND DISCUSSION----------

Table (33): Evaluation of some biocided in controlling spider mites *Tetranychus urticae* on cotton crop at Giza experiment station during the season 2003.

Treatments	Concentration	No. of Pre-treatment	No. of Spider 160/sq.iches			
			3 days	7 days	15 days	21 days
Beauveria bassiana	10gm/5L.	2741	210	123	112	193
Metarhizium anisoplae	10gm/5L.	2038	287	66	19	61
Metarhizium lavovridae	10gm/5L.	2390	53	49	30	9
Control.	5L.D.W	3445	1741	979	187	284

Table (34): Reduction Percentages of some biocides against spider mite (*Tetranychus urticae*) on cotton crop at Giza experimental station during the season 2003.

Treatments	Concentration	%Reduction at indicated days				% Residual effect	Mean reduction %
		Initial kill	7days	15days	21days		
Beauveria bassiana	10gm/5L.	84.8	84.2	24.7	14.58	41.16	52.1
Metarhizium anisoplae	10gm/5L.	72.2	88.6	82.8	63.69	78.4	76.8
Metarhizium flavovridae	10gm/5L.	95.6	92.7	76.8	45.4	88.3	90.2
Control.	5L.D.W						

Table (35): Effect of the environmental safe compounds on *T. urticae* in the field.

Treatment		Pretreatment	No. of mites per 160/sq. inches during after treatment			
			3 days	7 days	14 days	21 days
1-	*B. bassiana*	34.263 ac	2.625 bc	1.6875 b	1.3875 b	2.4125 a
2-	*M. anisoplia*	25.663 cd	3.588 b	0.8250 b	0.2375 d	0.7625 b
3-	*M. flavovrid*	29.875 cd	0.663 c	0.6125 b	0.3750 d	0.1500 b
	Control	43.063 a	21.763a	12.2375 a	2.3375 a	3.4250 a

Means followed the same letter are not significantly different at 5% level of probability.

RESULTS AND DISCUSSION----------

3-Biological Study:

Biological aspects of spider *Nurscia albomaculata* when fed on *Tetranychus urticae* first three spiderlings and during 4^{th}, 5^{th}, 6^{th}, spiderlings on *Spodoptera littosralis*.

1- Habitat and behaviour: -

Field observation showed that the spider *Nurscia albomaculata* (Lucas, 1846) of family Titanoecidae was found in association with some economical important pests e.g. the common red spider mites, aphids and white flies especially in cotton field plantations. Therefore it was found necessary to investigate its biological aspects to determine its effectiveness as biological control agent.

2-Incubation period: -

Three egg sacs were collected from individuals occurred in cotton field in El-Fayoum governorate. The range of number of eggs was 19-30. Average number of eggs per egg sac was 24.3± 4.35 eggs.

Egg sacs were circular in shape and white in colour. They were usually covered by soil particles. This may be a kind of protection. The egg sacs, which were constructed in laboratory, were rosy white in colour.

Incubation period of eggs of *N. albomaculata* lasted for14 days under incubator condition at 30oC and 60-70% R.H. (Table 36).

3-Spiderlings: -

Data in table 36 cleared that after egg hatching; the spiderlings were very active and able to capture their prey. The duration average 35.3±7.9 & 31.5±6.1 of instar was 31.5±6.1&35.3±7.9; 21.5±11&13.1±6.15 and 11.1±4.4&10.9±2.4 days for female and male, respectively when fed on adult stage of spider mite *T. urticae*.

Similar trend occurred in the following spiderlings developmental stages from the 4^{th} to the 6^{th} for female and male which was fed on first to third instar of *Spodoptera littoralis*. Their duration is recorded in table 36. They durated 26.5±15(10-44)&15.4±6.1(9-25);29.4±12(11-47)&21.3±7.9(11-30); 35.1±10

RESULTS AND DISCUSSION----------

Table (36): Duration of different immature stages (Spiderlings) of *N. albomaculata* reared on *T. urticae* and *S. littoralis* at 30 °C and 60-70 %R.H..

Mean duration in days							
	Fed on *T. urticae*			Fed on *S. littoralis*			
Sex	1st	2nd	3rd	4th	5th	6th	Total
Female	35.3±7.9 (22-44)	21.5±11 (11-47)	11.1±4.4 (5-19)	26.5±15 (10-44)	29.4±12 (11-47)	35.1±10 (22-47)	206.5±69.2 (87-281)
Male	31.5±6.1 (22-40)	13.1±6.15 (5-22)	10.9±2.9 (7-17)	15.4±6.1 (9-25)	21.3±7.9 (11-30)	19.9±8.1 (11-30)	135.5±60.96 (78-247)

(22-47)&19.9±8.1 (11-30) days, for female and male respectively, total period of spiderlings development differed according to sex which being shorter for males than females.

The duration of instar was longer during the first instar and then decreased during the second and third instar. These results agree with **Sallam** and **El-Hennawy (2003)**.

Food consumption: -

During the biological study of the studied true spider *N. albomaculata*, adult stage of spider mite *T. urticae* and *Spodoptera littoralis* were used as the main source of food. The first prey was offered for feeding during the first three-spiderling insects, while the second was used for the other insects from the fourth immature till the rest of life.

The spider attacked the tetranychid mite from the anterior part of the body and turned the prey more than once before sucking its body contents while attacks the *Spodoptera littoralis* larva from the inter-secutar membrane between head and thorax, then sucked its contents. The first three-spiderling of female and male could consume total number of prey averaged 3915±176&3166±197 spider mite individuals for female and male respectively, Table 37. The fourth, fifth and sixth female spiderlings instars, fed total average 454±41 larva of *Spodoptera littoralis*. On the other hand, the male spiderlings devoured total average of 343.3±22.5 prey individuals, Table (37).

Table (37): Number of consumed *T. urticae* adult and *Spodoptera littoralis* devoured by *Nurscia albomaculata* (Lucas, 1846) spiderlings stages.

Prey	Predator	No. of prey individuals devoured by predators stages						
		1st	2nd	3rd	4th	5th	6th	Total
T. urticae	Female	704.6±140 (482-902)	500.3±150 (260-1106)	263.1±85.9 (141-407)	-	-	-	3915±176 (2105-5637)
	Male	778±182 (479-978)	304±143 (122-517)	274±127 (93-480)	-	-	-	3166±197 (1921-1978)
Spodoptera littoralis	Female	-	-	-	50.8±24.5 (20-90)	60±23.01 (20-80)	59.4±24.5 (20-90)	454±41 (407-480)