

SUSCEPTIBILITY OF SOME COTTON VARIETIES TO *TETRANYCHUS URTICAE* KOCH INFESTATION, WITH REFERENCE TO ITS PREDACIOUS MITES AND SPIDERS IN BENI-SUEF GOVERNORATE

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Abstract

The populations of the spider mites *Tetranychus urticae* Koch (different stages) and their natural enemies i.e. predacious mites (families, Stigmaeidae, Tydeidae and Phytoseiidae) and the true spiders (families Saltisidae, Philrodromidae, Miturigidae, Thomisidae, Lycosidae and Araneidae) were studied in Beni Suef governorate during the cotton cultivated seasons, 2010 and 2011. The population differed according to the different sampling dates on the different cotton varieties, Giza 80, 90 x ost, Dandra, Giza 83, Giza 89, Giza 90 and Giza 91 varieties. The cotton (Giza 90 variety) was the most susceptible to the spider mite infestation in the two seasons, as it harboured 96.625 and 83.5 mite individuals, per leaf in the seasons 2010 and 2011, respectively. The statistical analysis of obtained data indicated that the least significant differences for different varieties were 39.559 and 19.779 in case of season effect. Also, Giza 80 and Giza 83 varieties harboured more predacious mites during 2010 (6.5) individuals for each, while each of Giza 80 and Giza 90 harboured during 2011, 6 predacious mites. The average collected numbers of the spiders was 12.25 individuals on Dandra variety during 2010 while on Giza 83 variety during 2011 season was 8.25 individuals. The study indicated that there was generally positive correlation between the two spotted spider mite and their associated natural enemies.

INTRODUCTION

The two-spotted spider mite, *Tetranychus urticae* Koch, infests cotton fields nearly every year in Egypt and can be considered an important cause of lost revenue to cotton producers. This may be due to high reproductive potential and short generation time. The feeding damage of spider mites, concentrated primarily on the lower surface of the leaves. Under heavy infestation, severe defoliation occurs and leaves become entirely gray, curl, turn brown, and drop off. This decreases the photosynthetic capacity of plants, Kharboutli *et al.*, (2000). Loss of leaves causes shedding of small bolls and may prevent the lint from developing properly in large bolls (Davidson and Lyon, 1979). The damage caused by mites to a cotton crop depends on timing and intensity of the infestation with respect to the crop growth stage, the presence of predators able to suppress infestation, temperature, and other

factors, Wilson *et al.*, (1981). The Australian cotton industry relies almost exclusively on synthetic insecticides for control of early season pests, Wilson *et al.*, (1998). These insecticides often disrupt natural enemies activity in the field. Potential predators of the two-spotted spider mite, *T.urticae*, in cotton fields included theridiid spiders, phytoseiid mites, lacewing larvae, predatory thrips, several coccinellid and several Hemiptera. Predation is implicated as a key factor influencing the early season survival of *T. urticae*. *Phytoseiulus persimilis* Athias-Henriot is one of the most important predators of tetranychid mites and is widely found on various crops as it is used in IPM in Egypt, El-Sharabasy (2010). Spiders are also effective biological control agents, prey on several pests in agro ecosystem Hodge (1999). They feed on insects, mites, some other arthropods and play important role in pest control. More than 35000 species of spiders have been identified in the world Ghavami *et al.*, (2007). They are carnivorous arthropods, consume a large number of prey and do not damage plants. This study was conducted to throw some lights on the abundance of the two spotted spider mite, *Tetranychus urticae* Koch and their associated predators on different cotton varieties at Beni Suef governorate during the two successive years 2010 and 2011.

MATERIALS AND METHODS

This work was conducted to study the population fluctuation of the two-spotted spider mite, *Tetranychus urticae*, predacious mites (Phytoseiidae, Stigmaeidae and Tydeidae) and the spiders (different families e.g. Saltisidae, Philrodomidae, Miturigidae, Thomisidae, Lycosidae and Araneidae) in Beni Suef governorate during the two cotton cultivated seasons, 2010 and 2011. All active forms of the two-spotted spider mite, *Tetranychus urticae*, and their associated predacious mites, Phytoseiidae, Stigmaeidae and Tydeidae, were recorded per a random square inch per cotton leaf. The spiders were collected by aiding of plant-shaking method. Five cotton plants were shaken over the shaking white cloth (1m²). The surveyed spiders were kept in glass vials containing 75 % ethyl alcohol and droplets of glycerin. Environmental factors mainly maximum and minimum temperatures were recorded from Agricultural Research Center Metrological Station. Normal agricultural practices were done with no pesticidal treatments throughout the study periods. The present data were subjected to the analysis of variance (ANOVA), and simple correlation coefficient among the population densities and different factors was calculated, Duncan, 1955.

RESULTS AND DISCUSSION

1- Cotton (Giza 80 variety): As shown in Table (1), the populations of different spider mites *Tetranychus urticae* Koch and their natural enemies (predacious mites

and spiders) were differed according to the different sampling dates. During the early season, the population *T. urticae* different stages was obviously low in numbers 20 and 35 individuals during the first two counting dates of the first season 2010, respectively then sharply increased to reach its highest population level (160 mites) during the last count in late of May of the same season. In 2011, the mite population followed similar trend in the second season 2010 but with low rate, reaching its peak in late of May (140 mite). On the other hand, predacious mites and the spiders were, appeared in the vibrante numbers during the different counting dates of the study, The highest population of the predacious mites, represented by Stigmaeidae, Tydeidae and Phytoseiidae during the last two counting dates of May (9 mites for both) and the same trend was observed for spiders and represented by 10 and 12 individuals, respectively.

2- Cotton (90 x ost variety): Considering the cotton variety 90 x ost, the highest abundance of the spider mite was noticed during the late of May (140 mites) for the two seasons, (Table 2). On the other hand, the predacious mites recorded its highest abundance in the same counting date but with low number (8 & 12 mites), respectively. Also, the true spiders reached its peak in the late season before the last investigation sample recording 10 spiders during the two study seasons, respectively.

3- Cotton (Dandra variety): As shown in Table (3) the population of *T. urticae* was low in the first count of the two study seasons 2010 and 2011 (12 and 17 different stages, respectively). It then gradually increased to reach its highest level of abundance during the last sampling date of May 135 and 120 mites, respectively. On the other hand, the population of predacious mites was very low in the early sampling dates, then reached its highest abundance during the late dates (8 different predacious mites in both season). Also, true spiders were in numbers all over the counting dates in the first season but being low in the second season

4- Cotton (Giza 83 variety): Table (4) included the appearance of spider mites *T. urticae*, predacious mites (Phytoseiidae, Tydeidae and Stigmaeidae) and the spiders. The study indicated that, the two-spotted spider mite appeared during all the investigation dates, recording its highest level of abundance during late May 2010 (120 different mite stages) .The results in Table (4) also indicated weekly changes in the population of the predacious mites, spiders and lady birds.

5- Cotton (Giza 89 variety): Data as shown in Table (5) classify the natural infestation of different stages of *T.urticae* as well as the occurrence of their natural enemies on cotton leaves (Giza-89) variety during the planting seasons 2010 and 2011. The population of the commonest collected species was slight high numbers of the predacious mites and spiders. On the other hand, the spider mite, *T. urticae*

was significantly high and reached its highest abundance during 27/5/2010, 130 mite individuals.

6- Cotton (Giza 90 variety): As shown in Table (6), the same trend of the population of *T. urticae* and its associated predacious mites and true spiders was noticed on cotton Giza 90 variety during the two study seasons, 2010 and 2011. The peak of *T. urticae* abundance was noticed on 27/5/2010 and 2011 (155 and 125 different movable stages), respectively. The population of the predacious mites (Phytoseiidae, Stigmaeidae and Tydeidae) on this variety was recorded in moderate numbers during the two study seasons reaching its highest levels of abundance on 27/5/2011, 14 and 12 individuals, respectively.

7- Cotton (Giza 91 variety): The population trend of spider mite and their associated natural enemies inhabiting cotton leaves of Giza 91 variety was shown in Table (7). The population of the spider mite was similar to that on the other tested cotton varieties during seasons 2010 and 2011. The peak of *T. urticae* was noticed on 27/5/2010 (165 different mite stages). The tabulated data in Table (8), showed that the cotton (Giza 90 variety) was highly susceptible to mite infestation more than any other tested varieties in the first season 2010, whereas, it harboured 96.625 mite individuals, while in the second season 2011, Giza 90 was the highly susceptible, as infested with 83.5 mite species. The statistical analysis indicated that the least significant differences for the varieties was 39.559 and 19.779 in case of season effect. The number of collected predacious mites on cotton leaves, Giza 80 and Giza 83 varieties were during 2010 (6.5) individuals for each, while Giza 80 and Giza 90 were the most harboured varieties during 2011 (6 predacious mites for each). The statistical analysis of the obtained data showed L.S.D. at 0.05 level was 2.6676 for effect of cotton varieties on predacious mites population and was 1.3338 for effect of the environment factor of season on population (Table 9). Data in Table (10) showed that the average number of the spiders was 12.25 individuals on Dandra variety during 2010 and 8.25 on Giza 83 variety during season 2011. The statistical analysis in table 10 showed that the L.S.D. at 0.05 level was 2.745 and was 1.3727 for the effect of both cotton varieties and the season, respectively on the spider populations on cotton plants at this region. Table (11) denoted that the correlation between the two spotted spider mite and associated natural enemies. The effects of different cotton varieties on the carmine spider mite, *Tetranychus cinnabarinus* Boisd. was conducted, Sengonca *et al.*, (1986). The effects of these varieties to show the difference mite development, longevity and fecundity were investigated in the laboratory. On leaves of the Egyptian cotton, *Gossypium vitifolium*, variety Giza 75, both females and males required a longer period to complete development than on the *G. hirsutum* varieties Coker 310 and MCH H. The largest total progeny per female was observed on the varieties Coker 310 and MCH H, while the smallest was on the

varieties Aleppo 1 and Giza 75. The cotton varieties had no effect on the sex ratio of *T. cinnabarinus*. El-Heneidy *et al.*, (1996) surveyed cotton field for spiders and found that the population of the family Aranidae was highest. Osman and Zohdi (1976) mentioned that *Amblyseius gossipi* (El-Badry) occurred on cotton leaves at times of decreasing the population of phytophagous species. The study of Wilson *et al.*, (1991) addressed the potential impact of natural enemies on the abundance of spider mites, *Tetranychus* spp., on cotton in the San Joaquin Valley of California. Those natural enemies were predators, including the big-eyed bug, *Geocoris pallens* Stål and *G. punctipes* (Say), the minute pirate bug, *Orius tristicolor* (White), and the western flower thrips, *Frankliniella occidentalis* (Pergande).

Table 1. Population dynamics of *Tetranychus urticae* Koch and its predacious mites and spiders inhibiting cotton (Giza 80) variety during the growing seasons 2010 and 2011.

Sampling date	Spider mite		Predacious mites		Spiders	
	2010	2011	2010	2011	2010	2011
20/4	20	15	8	3	5	3
27/4	35	30	4	2	7	4
5/5	70	50	3	4	7	6
12/5	100	80	5	6	12	8
20/5	120	130	9	8	10	10
27/5	160	140	9	12	12	10
5/6	135	115	8	9	11	8
12/6	115	100	6	4	8	5
Total	755	660	52	48	72	54
Mean	94.375	82.5	6.5	6	9	6.75

Max. Temp. 29.0 – 38.6

Min Temp. 14-19.5

Table 2. Population dynamics of *Tetranychus urticae* Koch and its predacious mites and spiders inhibiting cotton (90 x ost) variety during the growing seasons 2010 and 2011.

Sampling date	Spider mite		Predacious mites		Spiders	
	2010	2011	2010	2011	2010	2011
20/4	17	18	2	1	7	4
27/4	40	28	3	1	9	3
5/5	60	45	6	4	8	6
12/5	105	75	7	4	10	10
20/5	115	120	7	9	12	14
27/5	140	140	8	12	10	10
5/6	130	120	5	9	7	8
12/6	100	100	4	7	3	5
Total	707	646	42	47	66	60
Mean	88.375	80.75	5.25	5.875	8.25	7.5

Max. Temp. 29.0 – 38.6

Min Temp. 14-19.5

Table 3. Population dynamics of *Tetranychus urticae* Koch and its predacious mites and spiders inhabiting cotton (Dandra) variety during the growing seasons 2010 and 2011.

Sampling date	Spider mite		Predacious mites		Spiders	
	2010	2011	2010	2011	2010	2011
20/4	12	17	1	2	14	3
27/4	28	40	3	2	16	5
5/5	80	58	5	3	10	8
12/5	120	90	4	4	12	7
20/5	120	90	6	7	12	12
27/5	135	120	8	8	14	14
5/6	108	105	6	8	12	10
12/6	79	84	4	4	8	6
Total	682	604	37	38	98	65
Mean	85.25	75.5	4.625	4.75	12.25	8.125

Max. Temp. 29.0 – 38.6

Min Temp. 14-19.5

Table 4. Population dynamics of *Tetranychus urticae* Koch and its predacious mites and spiders inhabiting cotton (Giza 83) variety during the growing seasons 2010 and 2011.

Sampling date	Spider mite		Predacious mites		Spiders	
	2010	2011	2010	2011	2010	2011
20/4	18	20	7	1	16	3
27/4	32	35	4	1	8	4
5/5	75	60	6	2	9	5
12/5	90	68	5	6	18	12
20/5	95	105	6	7	14	16
27/5	120	135	10	8	12	10
5/6	105	140	8	6	9	9
12/6	90	100	6	5	4	7
Total	625	663	52	36	90	66
Mean	78.125	82.875	6.5	4.5	11.25	8.25

Max. Temp. 29.0 – 38.6

Min Temp. 14-19.5

Table 5. Population dynamics of *Tetranychus urticae* Koch and its predacious mites and spiders inhibiting cotton (Giza 89) variety during the growing seasons 2010 and 2011.

Sampling date	Spider mite		Predacious mites		Spiders	
	2010	2011	2010	2011	2010	2011
20/4	10	15	1	1	9	5
27/4	36	30	5	3	10	2
5/5	80	65	3	2	12	8
12/5	102	77	6	6	16	12
20/5	100	120	4	6	9	10
27/5	130	130	12	12	14	8
5/6	111	135	8	9	11	7
12/6	95	85	4	8	7	4
Total	664	657	43	47	88	56
Mean	83	82.125	5.375	5.875	11	7

Max. Temp. 29.0 – 38.6

Min Temp. 14-19.5

Table 6. Population dynamics of *Tetranychus urticae* Koch and its predacious mites and spiders inhibiting cotton (Giza 90) variety during the growing seasons 2010 and 2011.

Sampling date	Spider mite		Predacious mites		Spiders	
	2010	2011	2010	2011	2010	2011
20/4	15	14	1	2	4	4
27/4	40	44	4	3	9	6
5/5	90	55	5	3	10	6
12/5	110	80	4	4	10	10
20/5	105	115	7	4	11	12
27/5	155	125	9	14	10	12
5/6	142	130	8	11	7	7
12/6	130	105	6	7	5	5
Total	787	668	44	48	66	62
Mean	98.375	83.5	5.5	6.0	8.25	7.75

Max. Temp. 29.0 – 38.6

Min Temp. 14-19.5

Table 7. Population dynamics of *Tetranychus urticae* Koch and its predacious mites and spiders inhibiting cotton (Giza 91) variety during the growing seasons 2010 and 2011.

Sampling date	Spider mite		Predacious mites		Spiders	
	2010	2011	2010	2011	2010	2011
20/4	23	12	2	2	5	2
27/4	42	40	6	2	8	5
5/5	80	10	2	3	8	7
12/5	88	85	5	6	9	10
20/5	100	125	5	4	8	14
27/5	165	140	10	8	8	10
5/6	145	119	6	7	5	4
12/6	122	77	4	6	4	3
Total	773	608	40	38	65	55
Mean	96.625	76	5	4.75	8.125	6.875

Max. Temp. 29.0 – 38.6

Min Temp. 14-19.5

Table 8. Population dynamics of the *Tetranychus urticae* Koch on different cotton varieties.

Season	Variety	Mean	S.D.	Average
2010	Giza 80	94.375	52.95	(20-160)
	90 x ost	88.375	47.79	(17-140)
	Dandra	85.25	51.99	(12-135)
	Giza 83	78.125	39.19	(18-120)
	Giza 89	83.0	45.03	(10-130)
	Giza 90	98.375	50.736	(15-155)
	Giza 91	96.625	49.65	(23-165)
2011	Giza 80	82.5	52.00	(15-140)
	90 x ost	80.75	50.02	(18-148)
	Dandra	75.5	37.81	(17-120)
	Giza 83	82.875	43.07	(20-140)
	Giza 89	82.125	46.37	(15-135)
	Giza 90	83.5	42.78	(14-130)
	Giza 91	76.0	56.57	(10-140)

L.S.D. at 0.05 level

For variety = 39.559

For season = 19.779

Table 9. Population dynamics of the predacious mites on different cotton varieties during the seasons, 2010 and 2011 at Beni-Suef Governorate.

Season	Variety	Mean	S.D.	Average
2010	Giza 80	6.5	2.65	(3-9)
	90 x ost	5.25	2.42	(2-8)
	Dandra	4.625	2.42	(1-8)
	Giza 83	6.5	2.06	(4-10)
	Giza 89	5.375	3.76	(1-12)
	Giza 90	5.5	2.75	(1-9)
	Giza 91	5.0	2.96	(2-10)
2011	Giza 80	6.0	3.71	(2-12)
	90 x ost	5.875	4.46	(1-12)
	Dandra	4.75	2.58	(2-8)
	Giza 83	4.5	3.18	(1-8)
	Giza 89	5.875	4.0	(1-12)
	Giza 90	6.0	4.47	(2-14)
	Giza 91	4.75	2.4	(2-8)

L.S.D. at 0.05 level

For variety = 2.6676

For season = 1.3338

Table 10. Population dynamics of the spiders on different cotton varieties during the seasons, 2010 and 2011 at Beni-Suef Governorate.

Season	Variety	Mean	S.D.	Average
2010	Giza 80	9.0	2.92	(5-12)
	90 x ost	8.25	1.47	(7-12)
	Dandra	12.25	2.09	(10-16)
	Giza 83	11.25	3.92	(8-18)
	Giza 89	11.0	2.87	(9-16)
	Giza 90	8.25	2.53	(4-11)
	Giza 91	8.125	1.37	(5-9)
2011	Giza 80	6.75	2.99	(3-10)
	90 x ost	7.5	3.44	(3-114)
	Dandra	8.125	4.16	(3-14)
	Giza 83	8.25	5.16	(3-16)
	Giza 89	7.50	3.56	(2-12)
	Giza 90	7.75	3.44	(4-12)
	Giza 91	6.875	4.24	(2-14)

L.S.D. at 0.05 level

For variety = 2.745

For season = 1.3727

Table 11. Correlation between different factors on the population dynamics of the collected arthropods

Arthropods	Factors	Corr. (r)	Slope
Spider mite	Predacious mites	0.772	0.053
	Spiders	0.563	0.05
Predacious mites	Spider mites	0.772	11.255
	Spiders	0.5026	0.597
Spiders	Spider mites	0.563	6.905
	Predacious mites	0.503	0.423

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حساسية بعض اصناف القطن للاصابة بالعنكبوت الاحمر ذو البقعتين مع الاشارة الى المفترسات
الاكاروسية والعناكب المصاحبة له فى محافظة بنى سويف

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العنكبوت الاحمر العادى *Tetranychus urticae* Koch والاعداء الطبيعية المصاحبة لها من اكاروسات مفترسة ومن عناكب حقيقية على نباتات القطن اصناف جيزة 80 و 90 x ost و دندرا و جيزة 83 وجيزة 89 و جيزة 90 و جيزة 91) فى محافظة بنى سويف فى موسمى 2010 و 2011. واتضح من الدراسة ان التذبذب العددى الناتج كان متماثلا فى الظهور على جميع الاصناف المختبرة ولكن الاختلاف الناتج كان فى عدد الافراد التى سجلت على كل صنف. واتضح من النتائج المتحصل عليها ان تعداد العنكبوت الاحمر والاعداء الطبيعية المصاحبة له من الاكاروسات والعناكب الحقيقية على نباتات القطن اصناف جيزة 80 و 90 x ost و دندرا وجيزة 91 كان اعلى مستوى له فى نهاية شهر مايو خلال الموسمين ثم يبدأ التعداد فى الانخفاض بعد ذلك ولكن بدرجات مختلفة. اما بالنسبة للاصناف جيزة 83 و جيزة 89 وجيزة 90 فكان اعلى معدل تعداد العنكبوت الاحمر العادى والاعداء الطبيعية المصاحبة له من المفترسات الاكاروسية والعناكب فى بداية شهر يونيو خلال موسمى الدراسة 2010 و 2011 ثم ينخفض التعداد بعد ذلك بدرجات مختلفة تبعا للصنف. واتضح من الدراسة ان صنف القطن جيزة 90 كان اعلى الاصناف المختبرة قابلية للاصابة بالعنكبوت الاحمر فى الموسم الاول 2010 والثانى 2011 وبالنسبة لتعداد الاكاروسات المفترسة اتضح انها تصل لاعلى معدل لها على صنفى القطن جيزة 80 وجيزة 83 من اى الاصناف الاخرى فى الموسم الاول بينما زادت الاعداد فى الموسم الثانى على صنفى القطن جيزة 80 وجيزة 90 اما الصنف دندرا فكان افضل الاصناف لتواجد العناكب الحقيقية فى الموسم الاول والصنف جيزة 83 فى الموسم الثانى. ووضحت الدراسة ان هنالك ارتباط موجب بين تعداد العنكبوت الاحمر والمفترسات الاخرى والعناكب خلال موسمى الدراسة.