

ALTERNATIVE METHODS IN THE CONTROL OF THE TWO SPOTTED SPIDER MITE, *TETRANYCHUS URTICAE* KOCH (ACARI: TETRANYCHIDAE) ON SOYBEAN PLANTS

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ABSTRACT: Soybean (*Glycine max* L.) has received special attention all over the world because of the great nutritive and oil values of its seeds. The spider mite, *Tetranychus urticae* Koch considered one of the main pests, which threatens the soybean crop yield. Three field experiments were conducted during the season, 2017 at Kafriklaa, El-Santta district, Gharbia Governorate, to evaluate some environmentally safe materials; some plant extracts and the efficiency of the predatory mite, *Phytoseiulus persimilis* (A.-H.) in controlling the two spotted spider mite, *T. urticae* infesting soybean.

Obtained results showed that mixture of Vertimec + Super-Misrona oil exhibited the highest reduction (94.4%) followed by Vertimec + Micro-elements (92.2%), Vertimec alone (88.55%), Super-Misrona oil + Micro-elements (78.2%), Super-Misrona alone (75.4%) and Liquid-Sulphur (70.8%).

The efficacy of the three plant extracts could be arranged in a descending order as follows: 68.7, 62.7 and 57.2% for Oshar (*Calotropis procera* Ait), Black shadenight (*Solanium nigrum* L.) Unrip- fruit and Neem (*Azadirachta indica* A. Juss) extracts. The third trail was releasing the predatory mite, *P. persimilis* with rate of 15-20 mites/hill during seedling stage of soybean plants and the level infestation 3-5 mites/plant. The population of spider mites reduces 71.5% after 8 weeks of releasing and the level of infestation had become under threshold for the end of season.

Key words : Biological control , botanical pesticides, phytophagous mites

INTRODUCTION

Soybean is considered one of the relatively new crops introduced into the Egyptian Agricultural 1960, which contribute in reducing food deficiency gap for high quality ratio of protein and oil contained in its seeds reaching up to 40% as well as approximately 20% of oil. A phenomenal increase in soybean cultivation during the period of 1980-1990, whereas more than hundred and fifty thousands Feddans were cultivated, while this area decreased during the last two decades because of some problems of marketing and manufacture. The spider mite, *T. urticae* (Acari : Tetranychidae) cause a great damage such as tiny yellow, brown or bronze and finally die and drop off. Soybean plants

injured by mites early have increased shattering produce smaller and wrinkled seeds. Early and severe mite infestation left untreated can completely element and reduce soybean yield (Taha *et al.*, 2002). Baker and Connel (1963) mentioned that spider mites damaged protective leaf surface and stoma and it might inject toxic substances into the leaf and interfere with vital processes. Recently, there is a great interest in the use of alternative methods for controlling pests infesting different crops, because of the extensive use of pesticides, which play dangerous role for human health, environmental pollution, more over different pests acquired resistance to pesticides as well as the use of the biological control agents in pest control.



The present study aims to throw light on some alternative safety materials to suppress the population of the two spotted spider mite, *Tetranychus urticae* on soybean plants, as well as to evaluate the efficiency of the predatory mite, *Phytoseiulus persimilis* in its control at Gharbia Governorate.

MATERIALS AND METHODS

An area of 1.5 Feddan (6300 m²) was cultivated with soybean (*Glycine max*), variety Giza 21 at the village Kafriklla, El-Santta district, Gharbia Governorate on May, 20, 2017. This area was 210 m long, 30 m wide, with 42 rows of 70 cm width, 25 cm between hills, two plants for each hill by two sides. A row left unseeded as a buffer between replicates. Normal agricultural practices were done during the season.

This area was divided into three experiments:

The first experiment:

An area of 2850 m² (30 X 95 m) was divided into 32 plots each of about (7.5 X 11.8 m = 89 m²).

These compounds were sprayed to evaluate their effects on *T. urticae*:

1. Vertimec 1.8% EC (V), with rate of 40 ml/100 L. water.
2. Super-Misrona oil 95% EC (SMO), with the rate of 1%.
3. Liquid-Sulphur 52% EC (LS), with rate of 250 ml/100 L. water.
4. Micro-Elements (ME) (Fe, Mn, Zn & Cu), with rate of 150 ppm.
5. V + SMO, with rate of 40 ml + 1%.
6. V + ME, with rate of 40 ml + 150 ppm.
7. SMO + ME, with rate of 1% + 150 ppm.
8. Control.

The second experiment:

An area of 1350 m² (30 X 45 m) was divided into 12 plots each of 112.5 m².

Three plant extracts were sprayed on soybean plants to evaluate their effects on *T. urticae*:

- 1- Oshar plant (*Calotropis procera* Ait) was obtained from Aswan Governorate; leaves dried, grounded, 250 g of powder were successive extracted with ethanol solvent. The Oshar extract was used with rate of 50ml / 10L, water. Freedman *et al*(1979) extract Oshar with different solvents varied in their polarity i.e. hexane, ethanol, petroleum ether and water.
- 2- Black nightshade, *Solanium nigrium* L. the fresh unripe fruits (1 kg) were extracted by macerations in water for 15 min during stirring and then filtered (Karawaya and Abd-El-Wahab, 1975).
- 3- Neem extract *Azadirachta indica* A. Juss.(Azadirachtin 40% EC). Application rate was 50ml / 10L water, the commercial formulated was obtained from Agriculture company in Egypt.

The third experiment:

Utilizing the predatory mite, *Phytoseiulus persimilis* in controlling *T. urticae* on soybean plants.

Mass production of the predator mites on common bean plants (*Phaseolus vulgaris* L.) planted in net plastic greenhouses. An area of 1/2 Feddan (2100 m²) (30 X 70 m) of soybean plants was divided into five plots A, B, C, D and untreated one as control, each of 420 m² (6X 70 m).

The predator mites released by 15-20 individuals/plant during seedling stage, when infestation level was 3-5 mites/plant. Infestation was carried out weekly; count the motile stages of spider mites using stereomicroscope, while the number of predators observed at the field by 20 X hand lens.

All treatments were replicated three times and arranged as a complete randomized block design.

For the first and second experiments, the motile stages of spider mites were counted in two sq. inches lower surfaces

of 20 leaflets/plot (160 sq. inches/treatments) using stereomicroscope at laboratory.

The investigation was carried out directly before spraying and after 3, 7, 14 and 21 days of spraying.

Henderson and Tilton (1955) equation was used to determine mortality percentages.

RESULTS AND DISCUSSION

1. Evaluation of safe compounds singly and in combination against spider mite, *T. urticae* on soybean plants in Gharbia Governorate during the season, 2017:

As shown in Table (1) data revealed that all tested compounds exhibited high

mortality after three days of treatment, whereas V + SMO exhibited the highest activity (96.5%) followed by V+ME (94.9%), V. alone (92.7%), SMO+ME (82.8%), SMO alone (81.5%), L.S. (78.9%) and ME (51.5%) respectively.

Overall reduction percentages of the tested compounds, could be arranged in a descending order as follows: 94.4, 92.2, 88.55, 78.2, 75.4, 70.8 and 42.5% for the above mentioned V.+ SMO, V.+ME,V., SMO+ME, SMO and LS respectively .

Data showed that micro-elements were the lowest mortality percentages (51.5, 45.7, 43.6 & 29.0) with a general mean 42.5%, but on the other hand, ME improved plant health and crop yield. These results are agreement with those obtained by Masis and Aguilar (1990), Botha *et al.* (1994) and Omar *et al.* (2000).

Table (1): Mite numbers and reduction % of the tested safe materials against *T. urticae* on soybean plants in Gharbia Governorate during the season 2017

Treatments & application rate	mite no. pre-treatment	No. of mites /160 sq. inches & Reduction % after :								Over all red%
		3 days		7 days		14 days		21 days		
		No.	%	No.	%	No.	%	No.	%	
V+SMO 40 ml+ 1%	556	18.0	96.9	29.0	95.1	38.0	93.8	45.0	91.7	94.4
V+ME 40 ml/ 100 L w+ 150 ppm	584	31.0	94.9	42.0	93.3	55.0	91.5	66.0	88.4	92.2
V 40 ml	590	45.0	92.7	56.0	91.1	82.0	87.5	98.0	82.9	88.55
SMO+ ME 1% + 150 ppm	602	108.0	82.8	128.0	80.0	155.0	76.8	156.0	73.4	78.2
SMO 1%	654	121.0	81.5	138.0	80.4	185.0	74.5	220.0	65.0	72.4
LS 250 ml/ 100 Lw	648	142.0	78.9	185.0	73.2	226.0	68.6	236.0	62.7	70.8
ME 150 ppm	566	285.0	51.5	328.0	45.7	354.0	43.6	382.0	29.0	42.5
Untreated area	620	645.0	-	662	-	688	-	605	-	3220

V = Vertimec, SMO = Super-Misrona oil, ME = Micro-Elements, LS = Liquid-Sulphur

2. Evaluation of plant extracts:

Obtained data in Table (2) cleared that Oshar extract exhibited the highest mortality percentages of spider mites 68.7% followed by Black nightshade extract 62.7%, while Neem extract was the lowest one 57.2%. These results are agreement with those obtained by Sawires *et al.* (1995), Hassan *et al.* (2005), Gaber *et al.* (2004) and Hegab and Abd-El-Atty (2013). On the other hand Freedman *et al.* (1979) reported that Ethanol Oshar extract induced high mortality than Oshar extracted with hexane, petroleum ether and water, respectively.

3. Effect of Utilizing the predatory mite, *P. persimilis* on the population of spider mite, *T. urticae* on soybean plants:

Obtained results in Table (3) cleared that population of spider mites ranged between 136-164 of motile stages/20 leaflets for each plot A, B, C & D before releasing the predatory mites, while the total number of mites for untreated area was 560 mites/80 leaflets before release.

As shown in Table (3) data revealed that the population of spider mites decreased slightly after releasing, whereas the average number of mites were 112, 122, 125 & 132 with reduction percentages of 24.0, 24.6, 17.9 & 23.9 a week after releasing for A, B, C & D plots, respectively The reduction percentages of spider mites increased gradually to reach 56.5, 44.8, 63.3 & 58.0% for the treated plots with average 55.70% a month later of release. This finding agreed with those obtained by Taha *et al.* (2001), Heikal *et al.* (2003) and Fouzy *et al.* (2006). After 8 weeks of release the reduction percentages of spider mites were 68.3, 74.5, 70.7 & 72.6% with general mean 71.5%, whereas the population abundance of spider mites were under threshold level infestation till the end of season. Finally, the foregoing results proved the possibility of controlling the spider mite, *T. urticae* in soybean fields by applying one release of the predatory mite, *P. persimilis* with rate of 15-20 mites/plant.

Table (2): Number of mites and reduction % of some plant extracts against *T. urticae* on soybean plants in Gharbia Governorate during the season 2017.

Treatments & application rate /10 L. water	No. of mites pre-treatment	No. of mites/160 sq. inches & % Reduction at indicated days								Over all reduction %
		3 days		7 days		14 days		21 days		
		No.	%	No.	%	No.	%	No.	%	
Oshar 50 ml	614	125	80.1	185	71.8	248	63.6	245	59.1	68.7
Black nightshade 50 ml	562	152	74.0	192	68.0	254	59.3	277	49.5	62.7
Neem 50 ml	666	216	68.8	270	62.0	315	57.4	386	40.6	57.2
Untreated area	620	645	-	662	-	688	-	605	-	-

Table (3): Efficiency of the predatory mite, *Phytoseiulus persimilis* against *T. urticae* on soybean plants in Gharbia Governorate during the 2017season.

Sampling date	No. of <i>T. urticae</i> / 80 leaflets after release of the predatory mite and reduction percentages								Cont rol	Over all Red %
	A		B		C		D			
	No.	Red %	No.	Red %	No.	Red %	No.	Red %		
July, 5 pre-count of 1 st release	136	-	153	-	144	-	164	-	560	-
July, 12 of 1 st release	112	24.0	122	24.6	125	17.9	132	23.9	592	22.6
July, 19	96	35.0	102	38.0	105	32.2	110	37.6	608	44.5
July, 26	82	45.9	89	47.8	92	42.7	78	57.3	624	48.4
August, 2	65	56.5	74	44.8	58	63.3	61	58.0	615	55.7
August, 9	62	52.5	68	53.7	58	58.1	59	53.5	538	54.5
August, 16	54	58.8	50	66.1	52	62.6	48	69.6	540	64.3
August, 23	38	70.5	46	70.0	40	72.3	45	72.6	562	71.4
August, 27	42	68.3	38	74.5	41	70.7	44	72.6	545	71.5
Total	687		742		715		746			
Mean	76.3		82		79.4		83			

No. = Number of spider mites.

Red% = Reduction percentages.

4- Effect of different treatments on soybean yield parameters:

Obtained results in Table (4) revealed that soybean yield parameters were affected by different treatments, whereas the weight of fresh pods were high with using Micro-Elements 1.99 followed by Vertimec + ME 1.97, while the lowest one was Liquid-Sulphur 1.75. The weight of dry pods were high with using Vertimec alone 0.66 and low with Black nightshade extract 0.49. In addition to, No. of pod/plant increasing with mixture

of V + ME 167 pods, while the untreated area was 93 pod/plant. Weight of 100 seeds was 13.6 g, with Vertimec and 9.79 g with Black nightshade extract. The crop yield of soybean seeds was high 1875 Kg/Feddan with ME followed by V 1827 Kg and 1803 with using V + ME.

It is clear that using ME increasing the yield of crop in addition to minimizing the population of some sucking pests because of improved plant health, quantity and quality of pods and seeds.

Table (4): Some soybean yield parameters as a result of using alternative methods in controlling spider mites.

Treatments	weight fresh pods g	weight dry pods g	No. of pod/plant	weight 100 seeds g	yield /fed kg
V+SMO	1.96	0.54	143	10.36	1560
V+ME	1.97	0.57	167	10.74	1803
V	1.96	0.66	156	13.59	1827
SMO +ME	1.76	0.60	159	12.16	1744
SMO	1.84	0.56	106	10.67	1244
LS	1.75	0.52	142	10.50	1655
ME	1.99	0.57	164	11.18	1875
Oshar	1.98	0.62	100	12.80	1264
Black night shade	1.79	0.49	139	9.79	1195
Neem	1.89	0.67	115	11.18	1100
Predatory mites	1.93	0.59	189	11.34	1353
Untreated area	1.03	0.42	93	8.22	890
Mean	1.98	0.619	127.83	12.04	1591
Min.	1.76	0.42	93	8.22	890
Max.	1.99	0.67	189	13.59	1875
SD	0.10	0.05	31	1.10	357

V = Vertimec. SMO = Super- Misrona Oil. ME = Micro – Elements. LS = Liquid Sulpher.

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الطرق البديلة في مكافحة الأكاروس العنكبوتي ذي البقعين
Tetranychus urticae Koch علي فول الصويا
(Acari : Tetranychidae)

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الملخص العربي

يعتبر فول الصويا من المحاصيل البقولية الهامة حيث يلقي اهتماماً دولياً نظراً لإحتواء بذوره علي نسبة عالية من البروتين والزيت عالي الجودة كما يعتبر العنكبوت الأحمر العادي *Tetranychus urticae* أحد الآفات الرئيسية الهامة التي تحدد إنتاجية المحصول حيث أن الإصابة الشديدة بالأكاروس تؤدي الي خسائر كبيرة في المحصول حيث تؤثر الإصابة علي حجم البذرة ومحتواها من الزيت والبروتين. أجريت ثلاث تجارب حقلية:

التجربة الأولى كانت لتقييم بعض البدائل : الفيرتيميك ١,٨ EC وزيت سوبر مصرونا والكبريت السائل وبعض العناصر الصغرى منفردة ومخلوطة في مكافحة العنكبوت الأحمر العادي علي فول الصويا. أوضحت النتائج أن مخلوط الفيرتيميك مع الزيت أعطي أعلى نسبة إبادة يليه مخلوط الفيرتيميك مع العناصر الصغرى وأقلها العناصر الصغرى منفردة .

والتجربة الثانية لتقييم بعض المستخلصات النباتية: العشار - ثمار عنب الديب النيئة والنيم وقد أعطي مستخلص العشار أعلى نسبة إبادة يليه عنب الديب وأخيراً مستخلص النيم.

أما التجربة الثالثة فكانت تقييم المفترس الأكاروسي *Phytoseiulus persimilis* في خفض تعداد العنكبوت الأحمر علي محصول فول الصويا حيث تم الإطلاق في مرحلة البادرات بمعدل ١٥-٢٠ فرداً وعند مستوى إصابة ٣-٥ أفراد/نبات وأدي إطلاق المفترس الي خفض تعداد الآفة تدريجياً حتى وصلت الي ٧١,٥٪ بعد ٨ أسابيع من الإطلاق و ظل تعداد الآفة أقل من الحد الإقتصادي الحرج حتي نهاية المحصول.

وبتقييم المعاملات السابقة علي إنتاجية المحصول من القرون الخضراء والجافة وعدد القرون ووزن الحبوب و إنتاجية الفدان ، وجد أن المعاملة بالعناصر الصغرى رغم إنخفاض نسبة الخفض في التعداد للآفة إلا أنها أدت الي تحسن كبير في حالة النبات الصحية وبالتالي تحسن في إنتاجية المحصول عن المعاملات الأخرى.

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