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The Effect of Magnetic Force and Magnetic Water on Behavior and Population of *Tetranychus urticae* and *Amblyseius gossipi* on Soybean in the Laboratory and Field.

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ABSTRACT

Two experiments were carried out to study the effects of magnetic force and magnetic water on two spotted spider mites *Tetranychus urticae* (Koch) (Acari: Tetranychidae) and its predator *Amblyseius gossipi*(El-Badry)(Acari: Phytoseiidae) .In The first experiment leaflets of infested soybean with *T.urticae* and *A. gossipi* were passed through different concentrations of magnetic force and magnetic water at different time intervals the concentrations of magnetic force and magnetic water in the laboratory were 100,200,300,400 and 500 Gausses, respectively, while Magnetic force and magnetic water in the field were 1000,2000,3000,4000 and 5000 Gausses, respectively. The second experiment was conducted by sprayed the infested leaflets with *T. urticae* and *A. gossipi* at three time intervals. The results in both experiments revealed that the numbers of two tested mite and its predator were reduced after treated with magnetic force or magnetic water. Also, the data indicated that magnetic force was the most effect on adults and the eggs stage of *T. urticae,* but was the lowest toxic effect on *A. gossipi* ,while magnetic water was moderate effect on eggs and adults of two tested mite and its predator. Under the field condition the magnetic force was the most effect on behavior and population of *T. urticae* and *A. gossipi*, while magnetic water was moderate effect on the population and behavior of eggs and moile stages to *T. urticae* and adults of *A. gossipi.*

INTRODUCTION

The wide use of the chemical compounds resulted many problems such as population out breaks and chemical resistance. The continues use of the compounds to control pests has caused environmental pollution. Therefore it has become necessary to search on safe compounds against pests. The magnate is been measured by Gauss and every 10000 G equal to tesla. The magnetic field to the earth is about 0.5 gauss (Marshall and Skitek 1987).

Tetranychus urticae (Koch) is one of the most phytophagous spider mite species and it's a major pest in many cropping system world wide (Nauwen *et al.* 2001), attacking different agricultural crops such as field crops, vegetables, fruits and ornamental plants (Dermauw *et al.* 2012). Tetranychid mites have been reported as pests of more than 300 plant species (Jeppson *et al.* 1975), ranging from green house crops to small fruit and trees.The two-spotted spider mite, *T. urticae*, considered one of the main economic pests of soybean, which cause a great damage and sever losses (El-Sanady *et al.*2008).

The use of predators had proved to be one of the most effective control method for tetranychide mites and the most effective predators have been found in the family, Phytoseiidae on various crops (McMurtary and Croft 1997). *Amblyseills gossipi* (EI Badry 1967) is an importance phytoseiids mite on various crops (Croft and Mc Grotary 1977) and it is a key predator for managing spider mites (Specht, 1968).This predator is a specialized predator of the two spotted spider mites; reproduce more quickly than the two spotted spider mites. Fed on all stages of the two spotted spider mite. Also, *Phytoseiulus persimilis* (Athias-Henriot) is an important phytoseiidae mites on various crops (Croft and McGrotary 1977),and it is a key predator for managing spider mites (Specht, 1968). The possibility of controlling phytophagous mites by a combination of biological and chemical methods had proved a less costly and more permanent method of control than had pesticides alone (Hosny *et al*. 2003b) and (Magouz and Saadoon 2005).

Soybean, *Glycine max* (L.) Merr., considered one of the relatively newcrop into the Egyptian a agricultural , which combines in one crop both the dominant supply of edible vegetable oil and dominant supply of high-protein feed supplements for livestock. Other fractions and derivatives of the seed have substantial economic importance in a wide range of industrial, food, pharmaceutical, and agricultural products (Smith and Huyser 1987). Yield and productivity of soybean can be significantly affected by some biotic factors such as insect and mite pests so, two experiments were carried out to study the effects of magnetic force and magnetic water on two spotted spider mites *Tetranychus urticae* (Koch) (Acari: Tetranychidae) its predator *Amblyseius gossipi* on soybean .

MATERIALS AND METHODS

1. Culture techniques

a.Culture techniques of *Tetranychaus urticae*

The two-spotted spider mite, *Tetranychaus urticae* was reared according to Dittrich (1962)

b.Culture technique of predatory mite *Amblyseius gossipi*:

The 1st predator used in this study was *Amblyseius gossipi* (El-Badry) (Acari; Phytoseiidae) which was collected and described by El-Badry (1967) and Overmeer *et al*. (1982).

2. Experimental techniques:

a. Effect of tested compounds to adult females of *T. urticae*:

To evaluate the toxic effect of tested chemicals to the two-spotted spider mite *T. urticae*, all compounds were evaluated by the leaf disc dip technique according to Siegler (1947). Mortality counts were made 24 hours after treatment. The mortality percentages were corrected using Abbott's formula (1925). Data were plotted on log dosage probit papers and statistically analyzed according to Litchfield and Wilcoxon (1949). Each treatment was replicated four times. In the lab after placing the disk in the plant is placed magnetic strength in the middle of these disks and then placed four pieces of metal on the edges of the dish to activate the magnetic forces and become in the image of moving magnetic field as these forces move from north to south and the area of the dish homogeneous magnetic effect. The magnetic field is placed in the middle of this piece and then four metal pieces are placed on the edges of the area to activate the magnetic forces and become in the moving image of the magnetic field as these forces move from north to south and the area of the dish is homogeneous magnetic effect.

b. Effect of tested compounds to eggs of two-Spotted spider mite *T. urticae*:

Red spider mite eggs as prey were obtained by placing approximately 10 adult females of *T. urticae* on a

clean castor bean leaf disc placed upper side upon a water soaked cotton wool pad in petri dish. Sufficient discs were set up to provide enough eggs for the following day's of experiments. The adult mites were allowed to oviposite overnight and then were removed. Prey eggs were never longer than 24 hours old at the start of an experiment. The number of eggs on each disc was counted. The discs attached with eggs were immersed in each chemical dilution on the test liquid for (5) seconds with gentle agitation. Untreated discs were immersed in distilled water. The tested eggs were kept together with untreated control, in a holiday chamber of about 25±2 °C and 70±5% R.H. Assessment of the results was made when the emergent eggs in the control have reached the protonymphal stage. A count was then made of by this formula:

Egg mortality = (a/b) × 100.

(a) untreated eggs,

(b) number of total eggs which counted before treatment with toxicant.

Mortality percentages were corrected a ccording to Abbot's formula (1925).

c. Effect of tested compounds to adult females of predatory mite; *A.gossipi* ..

The predator was reared by the same technique as described by Overmeer *et al.* (1982). The culture was kept under the same conditions of temperature and humidity.

4. Effect of compounds residues on *T. urticae* egg deposition and egg-hatching:

To assay the residual effect of each tested chemical at LC_{25} level on adult prey mites, the technique advised by Keratum and Hosny (1994).

d. Effect of compounds residues on egg consumption, egg laying and egg hatchability of predatory mite:

The method which was adopted by Keratum and Hosny (1994).

RESULTS AND DISCUSSION

I. Laboratory studies.

A. Effect of magnetic water and magnetic force against adult and eggs of two-spotted spider mite *T.urticae*:

The data represented in Table (1) indicated that concentrations (500 G) was caused the highest effects in egg deposition comparable to the control treatment through the magnetic force with (5.25 % reduction) followed by the concentrations of (400 G) by (7.25 % reduction) ,while concentrations (300 and 200 G) caused a moderate reduction in egg deposition by (11.50 and 14.50% reduction).The lowest effects in egg deposition was to concentrations (100 G) by (19.00% reduction) .

The magnetic water concentration (500 G) was caused the highest effective in egg deposition comparable to the control treatment through the magnetic force with (11.45 % reduction) followed by the concentration of (400 G) by (12.21 % reduction) while concentration (300 and 200 G) caused a moderate reduction in egg deposition by (15.20 and 15.39 % reduction). The least effective in egg deposition was the concentration of (100 G) by (20.33% reduction). Nabeel (2010) studied the effect of magnetic field on the number of *T.urticae* eggs. He found that the number of eggs was highly affected by the time of exposure.

Also, the data in Table (1) indicated that all concentrations caused decrease in egg hatchability comparable to the control treatment in the magnetic force and the magnetic water. But in the concentrations of magnetic forces were caused the highest effective in egg hatchability followed by the concentrations of magnetic water,the results suggested that concentration (500 G) was the most effective compound on egg hatchability (15.47 %) followed by the concentration (400 G) by (18.83%). While the concentrations (300) had a moderate effect on that character (29.64%). The concentration (100 G) was the least effective one (52.36 %) on this biological character to magnetic force. But the concentrations of magnetic water, results suggested that concentration (500 G) was the most effective compound on egg hatchability (21.47%) followed by concentration (400 G) by (24.13%). While concentration (300 G) had a moderate effect on that character (32.11%). The concentration (100 G) was the least effective one (55.29 %).

The data in Table (2) indicated that all concentrations caused a decrease in prey egg consumption through the magnetic force and magnetic water, the concentration (500 G)caused the highest decrease in prey egg consumption comparable to the control treatment, followed by concentrations of (400 and 300 G), while concentrations of (200 and 100 G) were the least effective in prey egg consumption but not similar to control treatment.

Table 1. Effect of magnetic force and magnetic water against adult and eggs of two-spotted spider mite *T.urticae*:

Concentrations (G)	Magnetic force(MF)			Magnetic water(MW)		
	No. of adults	Reduction of egg deposited/5 adults	Hatchability %	No. of adults	Reduction of egg deposited/5 adults	Hatchability %
Force 100	25.50±1.29b	19.00±1.51b	52.36	26.50±1.29b	20.33±0.88b	55.29
Force 200	19.25±0.50bc	14.50±1.91c	33.57	21.25±0.95bc	15.39±0.94c	36.86
Force 300	16.25±2.21c	11.50±1.91d	29.64	18.75±0.95c	15.2±1.15cd	32.11
Force 400	12.75±2.87d	7.25±0.95de	18.83	14.25±1.25e	12.21±1.00d	24.13
Force 500	11.50±1.29e	5.25±1.50e	15.47	12.50 ±0.57f	11.45±0.56e	21.47
Control	30.85±0.070a	27.25±0.75a	65.73	32.75±1.375a	29.4±1.01a	67.64

Table 2. Effect of different compounds residues on feeding capacity of predatory mite *A. gossipi.* on cotton leaf discs:

Concentrations (G)	Magnetic force(MF)			Magnetic water(MW)		
	No. of consumed egg/adult/day		Average	No. of consumed egg/adult/day		Average
	1st day	2nd day		1st day	2nd day	
Force 100	9.50±0.57b	9.50±0.57b	9.50±0.57b	8.50±0.57b	9.50±0.57b	9.00±0.57b
Force 200	9.25±0.50bc	9.00±0.81bc	9.12±0.655bc	8.00±0.81bc	8.25±0.50c	8.12±0.655bc
Force 300	8.50±0.57c	7.75±0.50c	8.12±0.535c	7.00±0.81c	7.00±0.81cd	7.00±0.81c
Force 400	6.25±1.25d	7.25±0.50cd	6.75±0.87d	6.50±1.00cd	6.75±0.95d	6.62±0.975d
Force 500	5.00±0.00e	4.75±0.50d	4.87±0.25e	4.50±0.57d	4.50±0.57e	4.50±0.57ef
Control	17.25±0.50a	16.50±1.00a	16.87±0.75a	17.25±0.95a	18.00±0.81a	17.62±0.88a

Concentrations 100 (Gausses) on eggs

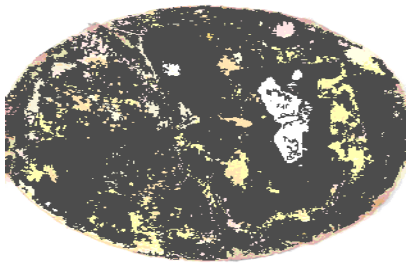

Fig. 1.

Concentrations 500 (Gausses) on eggs

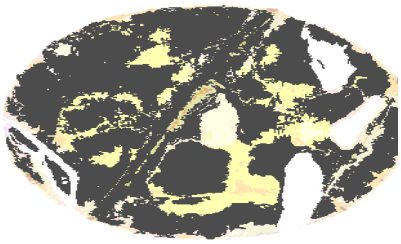

Fig. 2.

Concentrations 200 (Gausses) on eggs

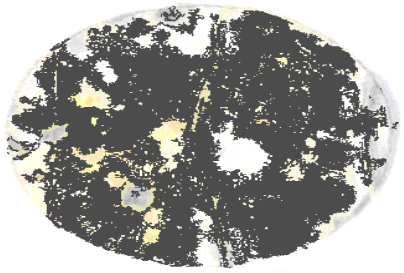

Fig. 3.

Concentrations 300 (Gausses) on eggs

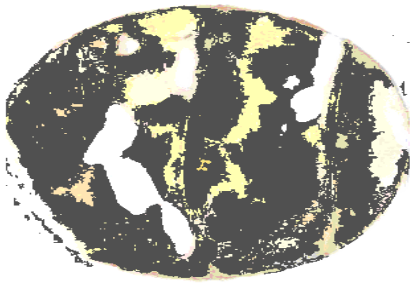

Fig. 4.

Concentrations 400 (Gausses) on eggs

Fig. 5.

The data in Figure (7) showed that concentration (500 G) was the most effective concentrations on eggs of adult females of *T.urticae*. while *c*oncentration (100 G) , figure (1), the number of eggs increased this to magnetic force the same effect found in spray with magnetic water. The data due to direct effect of magnetic field on increasing some enzymes inside the eggs which make them mature in short times as compared by the control Nabeel (2010).

Field studies

Field experiments on soybean plants were carried out in the farm of Agricultural research station , Sakha. Kafr E1-Sheikh , Egypt in order to study the effects of magnetic force and magnetic water on two spotted spider mites *Tetranychus urticae* (Koch) (Acari: Tetranychidae) and its predator *Amblyseius gossipi* to different tested concentrations. Samples of 10 soybean leaves were randomly collected from each plot before and after treatment at intervals of two weeks. The reduction percentage of infestation was calculated for each treatment according to Henderson and Tilton equation (1955). All data recorded were analyzed according to the method of Duncan's multiple range tests.

Table 3. Number of motile stages of mite *T.urticae* treated with different Concentrations on soybean plants in the field

Concentrations (G)	**Reduction % Magnetic force(MF)**					
	1 week	**3 weeks**	**5 weeks**	**7 weeks**	**9 weeks**	**11-12 weeks**
1000	18.64	23.74	26.63	29.56	32.59	30.75
2000	22.85	26.34	34.55	47.23	40.33	38.64
3000	36.71	38.22	44.59	47.71	55.35	53.44
4000	48.36	53.65	56.73	58.56	63.47	60.72
5000	61.55	63.75	66.43	70.21	77.82	73.64
Concentrations (G)	Reduction % Magnetic water(MW)					
	1 week	3 weeks	5 weeks	7 weeks	9 weeks	11-12 weeks
1000	15.69	18.43	18.58	21.45	28.62	26.99
2000	16.78	21.75	27.55	31.23	30.69	28.66
3000	31.58	33.84	38.77	42.59	46.73	46.88
4000	41.12	44.91	47.73	49.85	47.43	45.65
5000	54.45	58.55	60.01	62.27	64.33	62.46

The data presented in Table (3) show that concentrations (500 G) was the most effective concentrations in reducing the population density of motile stages of mite, *T. urticae* after two weeks of treatment, followed by concentrations (400 G) while the concentration (300 G) and (200 G) were of moderate effect, whereas concentration (100 G) was the least effective concentrations in reducing the population density of motile stages of *T. urticae*. One week after application it was observed that the population density of motile stages of *T. urticae* decreased, in general. All treatments were effective in reducing of the population density.

Data presented in Table (4) showed that the mean number of individuals of two Spotted spider mites *T. urticae* (Koch) (Acari: Tetranychidae) and *A. gossipi* were reduced by magnetic force and magnetic water concentrations with different degrees of effectiveness between them. The correlation coefficient values of the concentrations to magnetic force and magnetic water were insignificant positive values of *T. urticae* were (0.618 and 0.545 respectively).But the correlation coefficient values to *A. gossipi* were (0.205 and 0.221 respectively).

Table 4. Population of adult mites *T.urticae* on cotton plants.

Concentrations (Gausses)	Magnetic force(MF)		Magnetic water(MW)	
	T.uretace Mean No.	*A. gossipi.* Mean No.	*T.uretace* Mean No.	*A. gossipi.* Mean No.
1000	166.76	4.22	175.33	4.37
2000	138.55	3.87	146.75	3.92
3000	106.62	3.55	115.47	3.67
4000	83.92	3.04	90.47	3.20
5000	57.85	2.89	63.37	2.96
correlation	0.618	0.205	0.545	0.221

The effect of feeding and morphology of soybean plant after treatments.

Concentrations 100 (Gausses) on cotton

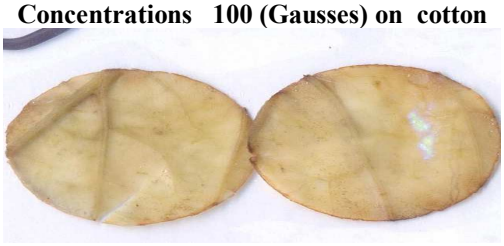

Fig. 6.

Concentrations 200 (Gausses) on cotton

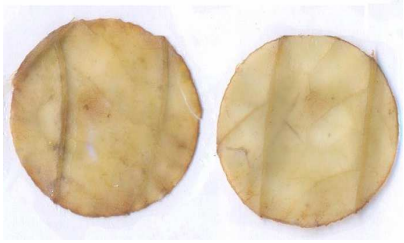

Fig. 7.

Concentrations 300 (Gausses) on cotton

Fig. 8.

Concentrations 400 (Gausses) on cotton

Fig. 9.

Concentrations 500 (Gausses) on cotton

Fig. 10.

The data in Figures (6,7,8,9 and 10) showed that soybean leaves were affected with feeding of *T. urticae* and concentration 500 G was the most effective with feeding on the leaves of soybean ; while concentration (100 G) had the least effective with feeding ,on the other hand feeding and morphology of soybean plants which effected with *T. urticae* which treated by different concentrations to magnetic force and magnetic water were different effectiveness between all concentrations.

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تأثير تفاوت القوي المغناطسيه و الماء الممغنط علي سلوك و تعداد الأكاروس النباتي (العنكبوت الأحمر ذو البقعتين) و أحد مفترساته (أمبليسيس جوسيباى) في المعمل و الحقل.

حمدي عبد الرحيم عبد الرحمن

معهد بحوث وقاية النباتات – محطة البحوث الزراعية بسخا- الدقي - مركز البحوث الزراعية - القاهرة – مصر.

الأفات الرئيسة التي تصيب نباتات فول الصويا و التي تسبب ضرر واضح في فقدان الإنتاجية للمحصول منها الأكاروس النباتي أو العنكبوت الأحمر ذو البقعتين واستخدام المركبات الأكاروسية المستمر لمكافحة هذه الأفة أعطت مناعة لها تجاه هذه المركبات و أيضا تلوث للبيئة ملحوظ.كان علينا البحث عن طرق للمكافحة في صورة أمنه علي البيئة و المحصول . لذلك تم إجراء تجربتين لدراسة تأثير القوة المغناطسيه و الماء الممغنط علي العنكبوت الأحمر ذو البقعتين و المفترس الأكاروسي (أمبليسيس جوسيباى) .في التجربة الأولي تم تمرير وريقات فول الصويا بتركيزات مختلفة من الماء الممغنط و أيضا القوة المغناطسيه علي فترات زمنية مختلفة حيث كانت التركيزات لكل منهم في المعمل (100, 200, 500,400,300) جاوسس بينما كانت التركيزات في الحقل (5000,4000,3000,2000,1000) جاوسس. التجربة الثانية أجريت برش الماء الممغنط علي النباتات المصابة و تعريضها أيضا للقوة المغناطسية لكل من الأكاروس النباتي و المفترس الأكاروسي علي فترات زمنية مختلفة .أظهرت النتائج في كلا الاختبارين أن عدد الأكاروسات النباتية و المفترس الأكاروسي قد انخفض بعد التعرض للقوة المغناطسية حيث كانت الأكثر تأثير علي الطور المتحرك و طور البيض للأكاروس و كانت أقل تأثير علي المفترس الأكاروسي .في حين كان الماء الممغنط له تأثير متوسط علي البيض و الطور المتحرك للأكاروس النباتي .و أظهرت النتائج أن القوة المغناطيسية أكثر تأثير علي سلوك الأكاروس النباتي في الحقل و المعمل و أيضا التعداد للأكاروس بالمقارنة بالماء الممغنط حيث كان تأثير الماء الممغنط متوسط علي التعداد للأكاروس سواء للبيض أو للأطوار المتحركة و سلوك الأكاروس النباتي و أيضا للطور المتحرك للمفترس الأكاروسي.