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EFFECT OF INTERCROPPING OF SOME MEDICAL AND AROMATIC PLANTS AS WELL AS SOW SPACING IN KIDNEY BEAN TO CONTROL THE TWO SPOTTED SPIDER MITE, *TETRANYCHUS URTICAE* KOCH.

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ABSTRACT: *An experiment was conducted in a field at Menoufiya Governorate to estimate the effect of intercropping of certain medical and or aromatic plants; as well as sow spacing on kidney bean plantation on the population of the two spotted spider mite, Tetranychus urticae Koch in spring period during the two successive seasons (2010 and 2011). Kidney bean plant was cultivated as a control, each plant species of mint, fennel and black cumin was intercropped with the bean plant, and four sow spacing of kidney bean were chosen 10, 20, 30 and 40cm.*

The obtained results indicated that the population average numbers of the two spotted spider mite, T. urticae was a significantly different among the four different treatments in the both seasons (LSD; P < 0.05). The fennel intercropped on bean plant showed the lowest spider mite population, followed by the mint and black cumin whereas; the bean plant alone had the highest spider mite population during the two seasons.

Results showed that there was a significant difference among the population average numbers of the two spotted spider mite, T. urticae infesting kidney bean in different spaces in each treatment (LSD; P < 0.05). Generally, the functional relationship between sow spacing and infesting was decreasing relationship (as the spacing increases, infesting decreases) so the forty cm spacing was the best spacing treated in reducing the population of the spider mite, T. urticae.

In conclusion, the discussion of the experiment suggested that intercropping fennel plants and cultivating in bean at spacing of 40cm are the best for suppression of spider mite which are important tools in integrated control program.

Key words: *Two-spotted spider mite, Tetranychus urticae, intercropping, medical and aromatic plants, Nigella Sativa L, Foeniculum vulgare Miller, Mentha Viridis Hort kidney bean, Phaseolus vulgaris L.*

INTRODUCTION

There is a high importance for the vegetable crops in Egypt, especially the kidney bean *Phaseolus vulgaris* L., as it is one of high protein content in addition to an economic importance for the farmers in Delta area, Egypt. Many pests attack the crops in the field e.g. the two spotted mite *Tetranychus urticae* Koch (Family: Tetranychidae), which cause great economical loss to many crop species allover the world (So, 1991; Abdallah *et al.*, 2001; Ragkou *et al.*, 2004). The serious pest attacks plants, *T. urticae* feeds by sucking the plant sap (one mite can feed on 18 to 22 plant cells in 1 minute). This species covers the leaves with a mass of silken webbing (Blauvelt, 1945; Grandjean, 1949; Abdallah, 2002). It has been recorded feeding on approximately 1200 described plant species in 70 genera (Bolland *et al.*, 1998; Walter and Proctor, 1999; Ragkou *et al.*, 2004). Several studies were conducted in and out of Egypt on the intercropping of several crops or pest infe station (Hassan *et al.*, 1989; Omar *et al.*, 1993 and 1994; Habashi, 2000; Megali *et al.*, 2000; Rizk, 2000; Rizk and Mikhail, 2000; Rizk *et al.*,

2002; Kong *et al.*, 2005 and Abou-zaid, 2007).

Intercropping plants of several crops is considered common practices in agriculture in Egypt, as most farmers intercropped their crops in order to obtain high income from unit area, and this procedures affect on both final yield of the major crops and on the pests community. Rizk (2000) stated that diversification of crop habitats frequently results in reduced pest increase, it is often claimed that intercropping can give better control of pests than mono-cropping.

Intercropping two crops in the same field proved its efficiency to minimize the pest population, in the same time getting additional crop.

Estimation of the liability of kidney bean plant alone in addition to the same plant species intercropped on mint, fennel and black cumin to infestation with *T. urticae* in the field in order to select the most distasteful one to *T. urticae* to avoid use any of chemical to control this pest.

There were several studies on the effect of intercropping in some vegetable crops to control pests such as; Mateeva *et al.* (1998) in Bulgaria. Also, Some Egyptian workers investigated the effect of sowing spacing in some vegetables (Conference Proceeding 2004).

The present current study aimed to throw light on role of intercropping in controlling the two spotted spider mite *T. urticae* to achieve safe agriculture environment.

MATERIALS AND METHODS

A field experiment was conducted as a completely randomized design, in spring period during the two successive seasons in kidney bean plantation. Four different treatments were: kidney bean plants alone as a control, each plant species of mint, fennel and black cumin were intercropped on the bean plants and four sow spacing of bean were chosen 10, 20, 30 and 40cm.

In order to study the effect of intercropping mint, fennel and black cumin on kidney bean plants and the effect of sowing spacing to control spider mite pest. Leaf samples were collected every two weeks: 15, 30, 45, 60, 75 and 90 days from sowing. Eight leaflets were taken randomly from each treatment and placed directly into plastic bags and transported to the laboratory. All mite stages (eggs, immatures and adults) were counted using stereoscopic binocular microscope and the average numbers of mites were tabulated. For each treatment: the average of whole numbers of spider mite, *T. urticae* under the 4 spacing used was calculated to compare the population average numbers of spider mite, *T. urticae* due to the type of the medical or aromatic plant irrespective of the spacing.

The agricultural practices were done as normal in the similar field crop, which were kept free from any pesticides. On the other side, the plants were left to the natural infestation and no artificial infestation was conducted.

One-way analysis of variance (ANOVA) and mean comparison using Fisher's least significant difference (LSD) were conducted for the numbers of phytophagous mite, using the Super ANOVA program (Gagnon *et al.*, 1989). Significance level was $P \leq 0.05$.

RESULTS AND DISCUSSION

The suppression of populations of the spider mite *Tetranychus urticae* by intercropping some medical and aromatic plants (black cumin, fennel and mint) and sow spacing was investigated on kidney bean plants in spring period during the two successive seasons in the field.

A) Influence of intercropping aromatic plants on populations of the spider mite *T. urticae*: (Table 1) shows the average numbers of spider mite, *T. urticae* due to each of the 4 chosen spacing under each of the intercropping of black cumin, fennel and mint as well as the control treatment from the data of the two cultivated seasons. The average of whole numbers of spider mite, *T. urticae* on each of kidney bean plant leaflets were significantly different among all treatments in the both seasons ($P < 0.05$). In case of fennel which was intercropped on bean plant it was the most distasteful as its leaflets harbored the lowest whole average number of spider mite stages (13.69 individuals/leaflet let in the 1st season and

Table (1): Effect of both intercropping and sow spacing of some plants with kidney bean on spider mite, *T. urticae* infestation during two successive seasons.

Spacing / Intercropping	Mean numbers of *T. urticae*/leaflets								
	First season								
	40cm		30cm		20cm		10cm		Average
plants on bean	Mean ± SD	#	Mean ± SD	#	Mean ± SD	#	Mean ± SD	#	Mean ± SD
Black cumin	$22.56 \pm 11.12_{a}$	B	$29.21 \pm 13.88_{ab}$	C	$36.79 \pm 24.58_{bc}$	B	$40.21 \pm 28.38_{c}$	B	$32.19 \pm 18.44_{b}$
Fennel	$12.88 \pm 6.71_{a}$	A	$12.50 \pm 6.56_{a}$	A	$15.98 \pm 6.80_{b}$	A	$13.40 \pm 6.74_{ab}$	A	$13.69 \pm 5.44_{a}$
Mint	$19.21 \pm 5.50_{a}$	B	$20.98 \pm 5.04_{a}$	B	$37.52 \pm 13.61_{b}$	B	$36.02 \pm 14.97_{b}$	B	$28.43 \pm 7.29_{b}$
alone (Control)	$48.65 \pm 8.37_{a}$	C	$77.83 \pm 11.38_{b}$	D	$123.25 \pm 19.72_{c}$	C	$158.40 \pm 34.34_{d}$	C	$102.03 \pm 12.87_{c}$
Second season									
Black cumin	$15.75 \pm 3.04_{a}$	B	$22.29 \pm 4.02_{b}$	C	$32.90 \pm 9.29_{c}$	B	$32.50 \pm 13.72_{c}$	B	$25.86 \pm 6.19_{b}$
Fennel	$25.86 \pm 6.19_{b}$	A	$10.63 \pm 4.63_{b}$	A	$11.98 \pm 5.33_{b}$	A	$12.13 \pm 5.49_{b}$	A	$10.54 \pm 3.09_{a}$
Mint	$15.83 \pm 4.10_{a}$	B	$18.10 \pm 3.88_{a}$	B	$35.35 \pm 6.65_{b}$	B	$45.02 \pm 9.09_{c}$	C	$28.58 \pm 3.52_{b}$
alone (Control)	$43.85 \pm 5.01_{a}$	C	$66.21 \pm 10.12_{b}$	D	$124.42 \pm 21.90_{c}$	C	$171.00 \pm 36.60_{d}$	D	$101.37 \pm 14.09_{c}$

- Mean ± SD in spacing followed by different subscript small letters within row are significantly different from each other while Mean ± SD in average of whole followed by different subscript small letters within column are significantly different from each other in each season $P < 0.05$) LSD test
- Means in column # followed by different subscript capital letters within columns are significantly different from each other in each season ($P < 0.05$) LSD test

10.54 in the 2nd season; LSD; $P < 0.05$; Table 1). They were significantly moderate infestations in cases of mint and black cumin which were intercropped on bean plant (28.43 individuals/leaflet let in the 1st season and 25.86 in the 2nd season also, 32.19 individuals/leaflet let in the 1st season and 28.58 in the 2nd season respectively; LSD; $P < 0.05$). The highest whole average number of spider mite infestations was recorded in case of bean plant alone (102.02 individuals in the 1st season and 101.37 in 2011/leaf; LSD; $P < 0.001$), which was the most liable one to the *T. urticae* stages.

The obtained results are generally in agreement with that recorded by many authors; Allam *et al.* (2009) found that the aromatic plants when were intercropped on some bean varieties played an important role to reduce population of *T. urticae* in Gharbia and Fayom Governorates. Mateeva *et al.* (1998) proved that the density of some pests including *T. urticae* was significantly reduced under intercropping compared with the sole crop. Influence of sowing spacing on populations of the spider mite *T. urticae*: The results indicated that there was a significant difference among the average numbers of spider mite, *T. urticae* infesting kidney bean plants in different spacing during the two seasons in each treatment (LSD; $P < 0.05$). The relation between the population average numbers of spider mite, *T. urticae* on kidney bean plants in each treatment and sow spacing are graphically illustrated in figure 1 for the first season, also figure 2 shows the same data for the second season.

The population remained very low in average 12.88 individuals/leaflet let at spacing of 40cm to reach to13.40 individuals/ leaflets at spacing of 10cm for bean plant which was intercropped with fennel. Likewise, the bean plant which was intercropped with mint was moderate infestation 19.21 individuals/leaflet let at spacing of 40cm to reach to 36.02 individuals/leaflet let at spacing of 10cm also; the bean plant which was intercropped with black cumin was 22.56 individuals/leaflet at spacing of 40cm to reach to 40.21 individuals/leaflet let at spacing of 10cm. In the control treatment: the spider mite populations appeared with 48.65 individuals/leaflet let for spacing 40cm while was gradually increased to reach 77.83 and it was 123.25 individuals/leaflet for spacing 20cm and it was increased to reach to the maximum number 158.40 for spacing 10cm (Table 1 and Figure 1).

The same trend of the result data in the 1st season was again confirmed in the 2nd season: as the density of mites was higher in the narrow space plantation of 10cm than those of the wider spaces 20, 30 and 40cm. There is no considerable difference between numbers of mites in the first season and that of the second season consequently there will be no significance in discussing the results represented by each of the two figures: Figure 1 and Figure 2.

The above discussion leads to:

1- Intercropping of medical or aromatic plants: fennel, mint and black cumin decreases the average numbers of mites to 13.69, 28.43 and 32.19 compared with 102.03 individuals/leaflet when the bean was cultivated alone.

2- There is no significance in the population average numbers of spider mite, *T. urticae* when intercropping mint or black cumin.

3- The best intercropping medical plant in decreasing the infesting of spider mite, *T. urticae* is fennel.

4- The best sow spacing used decreasing the infesting of the average numbers of spider mite, *T. urticae* is 40 cm.

The lowest infestation was recorded when intercropping fennel and cultivating in bean at spacing of 40cm which are important tools in integrated control program. Most classical biological control programs have been aimed to control pests in agro-ecosystems, with significant success measured in terms of long-term economic and public health.

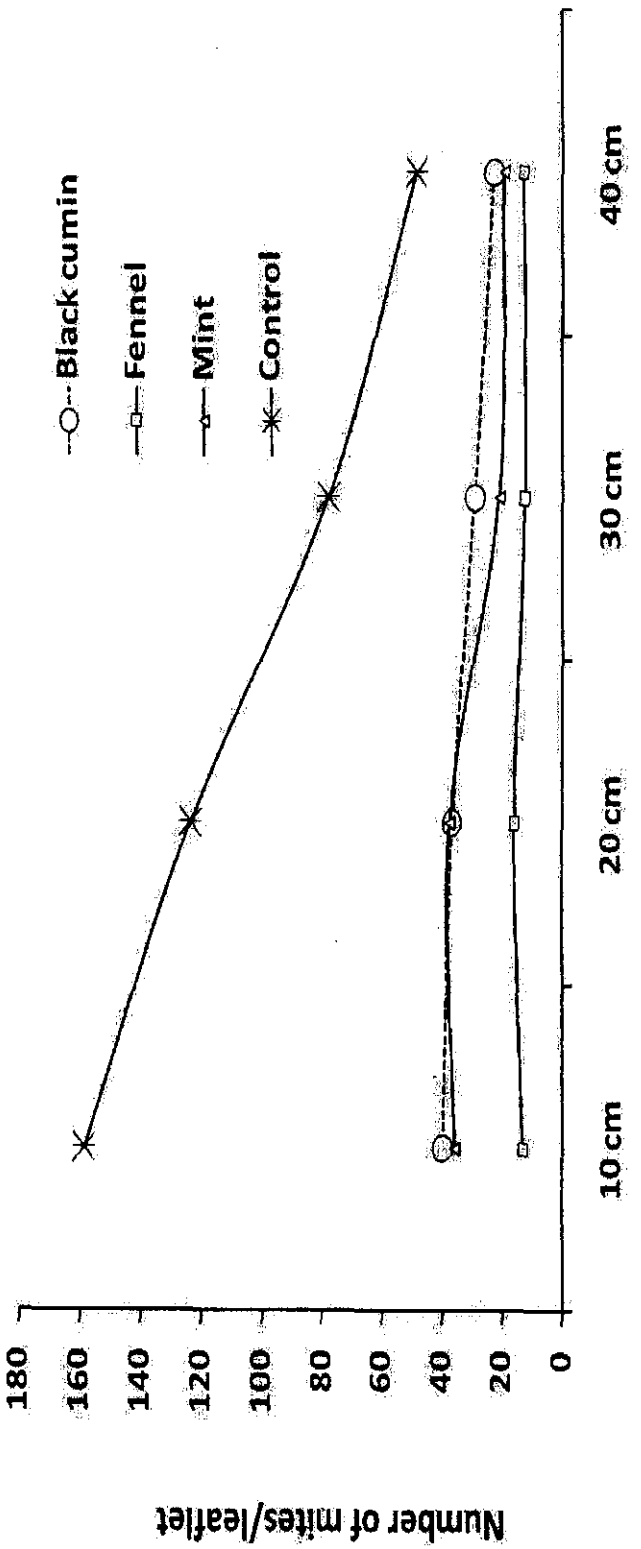

Figure 1: The relation between the population average numbers of spider mite, *T. urticae* and spacing for each medical or aromatic plant as well as for the control in the first season

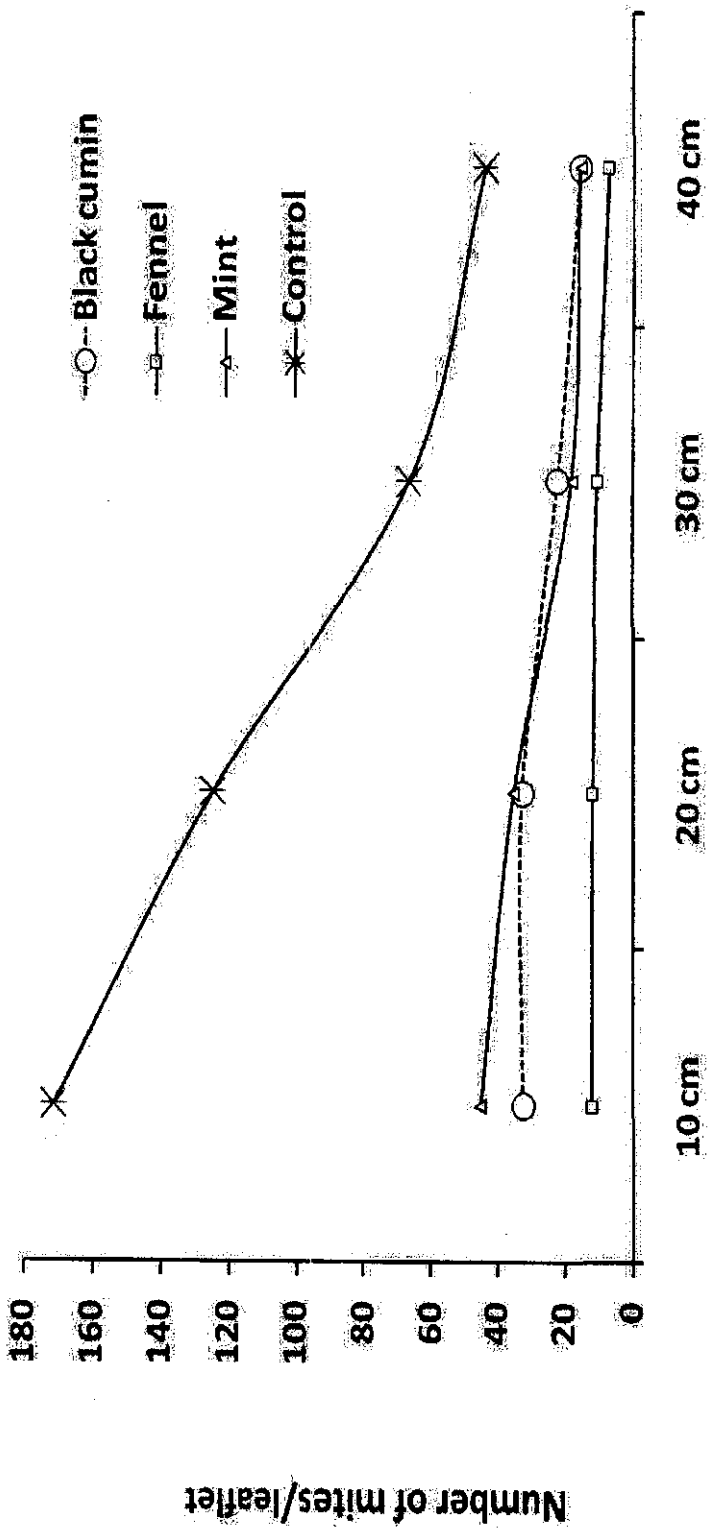

Figure 2: The relation between the average numbers of spider mite, *T. urticae* and spacing for each medical or aromatic plant as well as for the control in the second season

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تاثير تحميل بعض النباتات الطبية والعطرية ومسافات الزراعة في مكافحة أكاروس العنكبوت الأحمر ذو البقعتين على نبات الفاصوليا

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الملخص العربي

في تجربه حقليه بإحدى المزارع فى محافظة المنوفية بمصر تم اختيار ثلاثة محاصيل طبية وعطرية (النعناع والشمر وحبة البركة) زرعت محملة كلاً على حدا على المحصول الرئيسي وهو الفاصوليا (عروة الربيع فى موسمي ٢٠١٠ و٢٠١١م)، بالإضافة إى زرعة نباتات الفاصوليا بمفردها للمقارنة.

وأجريت هذه التجربة لمعرفة تأثير بعض النباتات الطبية والعطرية على تعداد آفة الأكاروس العنكبوتى على أوراق نباتات الفاصوليا وكذلك تأثير الأربع مسافات المختارة (١٠ و٢٠ و٣٠ و٤٠ سم) فى كل المعاملات.

وأظهرت النتائج أن تحميل النباتات الطبية و العطرية أدت إلى تقليل معدل إصابة أوراق نباتات الفاصوليا معنوياً بالأكاروسات العنكبوتيه مقارنة بالفاصوليا بمفردها (الكنترول ١٠١,٣٧ فرد أكاروس/ ورقة فاصوليا)، حيث سجل الأكاروسات على أوراق نباتات الفاصوليا المحمل عليها الشمر (١٠,٥٤ فرد / ورقة فاصوليا) حيث كانت معدلات الإصابة بالأكاروسات أقلهم معنوياً، تليها كل من أوراق نباتات الفاصوليا المحمل عليها حبة البركة (٢٥,٨٦ فرد أكاروس/ ورقة فاصوليا) وأخيرا أوراق نباتات الفاصوليا المحمل عليها نباتات النعناع (٢٨,٥٨ فرد أكاروس/ ورقة فاصوليا) التى أظهرت عدم اختلافا معنويا فى تعداد الآفه بهما.

وأظهرت النتائج فى الموسم الأول أيضا أن متوسط تعداد أفراد الأكاروس العنكبوتى فى المسافات المختلفة داخل كل معامله مختلف معنوياً. و أن قصر المسافات بين نباتات الفاصوليا أدت الى زيادة تعداد الأكاروس

العنكبوتى فى جميع المعاملات كانت ٤٣,٨٥، ٦٦,٢١، ١٢٤,٤٢، ١٧١,٠٠ فرد فى المسافات ٤٠ ، ٣٠ ، ٢٠ ، ١٠سم بالترتيب وكانت ذات فرق معنوي وأيصاً أكدت نتائج الموسم الثاني نفس اتجاه الزياده فى تعداد الإصابة بالأكاروس العنكبوتى بتقليل أو قصر مسافة الزراعة، ويمكن أن نلخص النتائج فى:-

١- أن زراعة بعض النباتات الطبيه والعطرية مع الفاصوليا تقلل معدلات الإصابة بالأكاروس العنكبوتى.

٢- لا يوجد فرق فى معدل الإصابة بالأكاروس العنكبوتى على نباتات الفاصوليا عند تحميل نباتات النعناع أو حبة البركه عليها.

٣- أفضل نبات عند تحميله يقلل الاصابه بالأكاروس العنكبوتى على نباتات الفاصوليا هو الشمر.

٤- أفضل مسافه لتقليل الإصابة بالأكاروس العنكبوتى هى مسافة ٤٠ سم فى كل المعاملات.

لذا أفضل نبات عند تحميله يقلل الإصابة بالأكاروس العنكبوتى على نباتات الفاصوليا المزروعة على مسافة ٤٠ سم هو الشمر.