

EFFECT OF INTERCROPPING OF FOUR AROMATIC PLANTS ON THE POPULATION OF THREE MAIN PESTS AND THEIR ASSOCIATED PREDATORS WITH THREE BEAN VARIETIES AT FAYOUM AND GHARBIA GOVERNORATES, EGYPT.

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(Received: Feb. 18, 2008)

ABSTRACT: *In this study, the effect of intercropping of four aromatic plants (mint, fennel, rocket, and black cumin), with three bean varieties (Bronco, Poliste and Nebraska), on the population of three main sucking pests (the two spotted-spider mite, *Tetranychus urticae* Koch; the tomato whitefly, *Bemisia tabaci* (Genn.) and the onion thrips, *Thrips tabaci* Lind.) and their common associated predators (*Orius* spp. and predatory mites mainly *Phytoseiulus persimilis*) was studied at two governorates; Fayoum and Gharbia governorates during 2007 growing season.*

*The obtained data proved that, in general, the infestation with the tested pests was higher at Fayoum Governorate than at Gharbia Governorates. Also, associated predators were higher at Fayoum than Gharbia governorate except with Nebraska cv. where the reverse was found. Poliste cultivar harboured the highest numbers of pests, followed by Nebraska cv. and later Bronco cv. in the two governorates. *T. urticae* was the key pest on bean plants cultivated alone or intercropped with other different plants in the two governorates, followed by whitefly and thrips, respectively, on the three cultivars, except with Nebraska cv. at Gharbia Governorate where thrips individuals was higher than whitefly. Intercropping systems showed significant differences in the infestation level on bean; however, intercropping with rocket plants harboured, generally, the highest numbers of all the previously mentioned pests compared to the bean cultivated solely (as check), while bean with mint recorded the lowest infestation on the three tested cultivars in both governorates.*

Key Words: *Intercropping, Pests, Predators.*

INTRODUCTION

Bean plants, *Phaseolus vulgaris* L. is considered one of the most important and popular leguminous vegetable crops, where it consumed freshly as green pods or consumed as dry seeds because of its higher contents from protein which is necessary for human-being. The cultivated area from bean plants increased during the last two decades especially in

winter plantation, in both open fields or protected plantation, to cover needs for local consumption and for exporting to the foreign markets.

Bean plants are subjected during vegetative growth to infestation by many pests mainly the two-spotted spider mites, whitefly, thrips and other pests, especially in the open fields during the late winter or summer plantations, because of its highest leaf nitrogen levels which encourage pest development, increased egg production and their longevity (Breukel and Post, 1959), which threaten both quality and quantity of the resultant yield. Also, at end of growing season, in case of severe infestation, members of these pests attacked the pods causing damages and lowering the marketable value of the pods. Also, these crops have various characteristics (such as compact growth with smooth hairy leaves contains high levels of nitrogen which attract mites to plants (Faris *et al.*, 1991 and Osman, 1994). Moreover, significant positive relationship was found between the infestation with sucking pests and nitrogen and protein contents of the plant, and this relation was however negative with moisture content (Sawires, 1992).

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. Several studies were conducted in and out of Egypt on the intercropping of several crops on pests infestation (Hassan *et al.*, 1989; Omar *et al.*, 1993 & 1994; Mateeva *et al.*, 1998; Habashi, 2000; Megali *et al.*, 2000; Rizk, 2000; Rizk and Mikhail, 2000, Rizk *et al.*, 2002; Kong *et al.*, 2005 and Abou-Zaid (2007).

The purpose of the present attempt deals with the relative susceptibility of three different varieties of bean (Bronco, Poliste and Nebraska) to infestation by three piercing sucking pests: mites, whitefly and thrips, in five intercropping systems; bean/mint, bean/fennel, bean/rocket, bean/black cumin and bean alone (as check control) with referring to the common predatory species associated with bean pests in Fayoum Governorate (Middle Egypt) and Gharbia Governorate (Lower Egypt).

MATERIALS AND METHODS

Two field experiments were conducted at Fayoum and Gharbia governorates, during 2007 growing season, to study the effect of intercropping of three bean varieties, *i.e.* Bronco, Poliste and Nebraska as a major crops with four aromatic plants, *i.e.* mint, *Mentha arvensis* L., fennel (*Foeniculum vulgare* L.), rocket (*Eruca sativa* Mill.) and Black cumin (*Nigella sativa* L.) as minor crops, on the population of three main sucking pests; the two spotted-spider mite, *T. urticae*; the tomato whitefly, *B. tabaci* and the

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onion thrips, *T. tabaci* Lind. and their associated predators (mainly *Orius* spp. and the predatory mite *Phytoseiulus persimilis*).

In each governorate, an area of about half feddan was divided to three parts, each of 700 m², and each part belong to one of the three tested cultivars (Bronco, Poliste and Nebraska). Each part was divided to sixty plots, and in each part, five treatments [bean alone (as check system), bean intercropped with mint, bean intercropped with fennel, bean intercropped with rocket, and bean intercropped with Black cumin] were distributed in complete randomized block design, with four replicates for each treatment. In intercropping treatments, bean was planted in one side of the row and the intercropping plant in the other side. The bean seeds and intercropped plant's seeds was sown in 25th and 26th April at Fayoum and Gharbia governorates, respectively. After one month from plantation, weekly samples of 10 leaves of bean plants/replicate were examined at early morning for whitefly and thrips nymphs and then picked randomly from three levels of the plants (40 leaves for each treatment) from the three cultivars. Each sample were kept in tight closed paper bags and transferred to the laboratory in the same day for inspection to mites and predators by the aid of the binocular microscope. Average mean numbers of spider mites (moving stages), whitefly and thrips (nymphs) and predators (*Orius* spp. individuals and the predatory mite, *P. persimilis*) for 10 leaves was recorded. Data subjected to M.Stat."C" statistical analysis to determine the difference between the tested intercropping systems for the three bean cultivars at the two governorates.

RESULTS AND DISCUSSION

Table (1) indicates the total number of *Tetranychus urticae* per sample of the three cultivars of kidney bean phasoulus plants vulgaris plants (10 leaves) in Fayoum and Gharbia governorate in 5 treatments (intercropped with mint, fennel, black cumin, and control), during the period from May to July. Means and statistical analysis of the data of Fayoum governorate for the first cultivar (Bronco) showed that there was no significant difference between the control (kidney bean without intercropping) and rocket treatment (kidney bean with rocket). There was no significant difference between the treatments of mint and fennel (666.11 and 757.67), but there was a lower significant difference between them and both of the rocket and control treatments 1117.22 and 1117.56 individuals / 10 leaves) .

At the same, time there was a significant difference between black cumin and other treatments. In respect of the second cultivar Poliste, data indicated that there was a significant difference between each of mint, fennel, rocket and black cumin (118.44 , 359.0 , 726.33 , and 551.11, respectively) , while there was no significant difference between the control (618.78) and both of black cumin and rocket with a LSD of 118.7. The third cultivar of kidney bean, Nebraska showed a clear significant difference between the treatments

Table 1

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rocket, black cumin, fennel and mint (833.0, 604.33, 467.89 and 376.67, respectively), compared with the control (kidney bean without intercropping), 687.67 individuals / 10 leaves with LSD value of 45.49. Hence, the mint treatment showed the lowest value of infection with significant deference in all the three cultivars, Bronco, poliste and Nebraska 666.11, 118.44, 376.67 individuals / 10 leaves, respectively. Data of Gharbia governorate for the same table (1) indicated that for Bronco cultivar, there was a significant difference between and each other with a value of L.S.D 38.91 , and the mean values of infection was 383.22 in the control compared with the treatments of intercropping rocket, black cumin, fennel and mint 432,261 and 109 individual / 10leaves, respectively.

For the cultivar poliste, data showed that, there was no significant difference between the control (805.78 individual /10 leaves) and intercropping treatments with black cumin (762.33), at the same time, there was a significant difference between each of the intercropping treatments with rocket , fennel and mint with the highest infection value for the rocket (1215.67) and the lowest (311.0) individuals /10 leaves with LSD value of 63.32.In Nebraska cultivar , the infection showed the same trend of Bronco reflecting a significant difference between all treatments and each other with 53.25 LSD value. Intercropping with rocket recorded the highest infection (1220 individuals / 10 leaves), followed with black cumin, fennel and mint 463.67, 358, 281.33 individuals, respectively, compared with the control (kidney bean only) 654.67, individuals.

Generally, it was noticed that rocket was related with the highest values of infestation with *T. urticae* while mint showed the lowest levels of incidence of the mint, in all treatments for all cultivars.

Table (2) shows the incidence of white fly in kidney bean without intercropping (control) in addition to cases of intercropping with mint, fennel, rocket and black cumin in the two governorates. In Fayoum, Bronco cultivar showed that there was no significant difference between the control 41.33 individuals / 10 leaves and rocket treatment 37.67 individuals. In the same time, there was no significant difference between the treatments of intercropping with black cumin, mint and fennel, 27.67, 27.33 and 27.00 individuals respectively. There was a significant difference between rocket and control from one hand the other treatments from other hand with LSD 4.78 value .Analysis of poliste cultivar data showed that, there was no significant difference between intercropping with rocket (30.33 individuals / 10 leaves), black cumin (29) and fennel (26) individuals, while mint treatment significantly decreased 22.33 in infection compared with control 50 individuals. Nebraska cultivar indicated that there was a significant difference between each of rocket and black cumin (24.67 and 21.67 individual) from the other hand and each of fennel and mint (17.33 and 15.33 individual) from the other hand. All the treatments compared with the control 36.33 individuals.

Table 2

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The same trend of high incidence of white fly in case of intercropping with rocket was, in addition low densities of the flies in case of mint treatment. The same table (2), shows the data of Garbia governorate. In Broncho cultivar the mean values of white fly population showed that there was no significant difference between intercropping between black cumin and mint (2367 and 23.0 individuals / 10 leaves), while there was significant difference between both of them and control (57) individuals with LSD value 4.31. In Poliste cultivar, there was a significant difference between all treatments and each other, the mean values of white fly population recorded 25.89, 20.33, 12.67 and 9.33 individuals respectively, compared with the control 32.33 individuals with a value of LSD 3.0. Nebraska cultivar data indicated that, there was no significant difference between treatments of black cumin and fennel (27.89 and 22.3 individuals), while both of rocket and mint were significantly lower (37.11 and 14.56) than the other treatments and control 75.11 individuals.

Table (3) show the mean number of Thrips insects per sample (10 leaves) of kidney bean either alone or intercropped with the same prementioned plants. In Fayoum governorate the mean values of Bronco cultivar recorded 29.33, 25, 20.67 and 18.33 individuals in treatments of rocket, fennel, black cumin and mint, respectively compared with the control 36 individuals. Statistical analysis showed there was black cumin and mint were significantly lower than other treatments. In respect of Poliste cultivar the mean value of Thrips incidence recorded the highest value in black cumin (27.33) and the lowest in mint (17) individuals showing significant difference between each of them and the control treatment (33.67) individuals. Nebraska cultivar showed that incidence of Thrips in the control 28.67 individuals reflecting a significant difference between control mean value and all other treatments. In the same time there was no significant difference between all treatments and each other, recording 12.11, 10 and 10 individuals for rocket, black cumin, fennel, and mint respectively. Generally in the three kidney bean cultivar intercropping with mint was the lowest infection with Thrips, while the control (kidney bean without intercropping) was the highest infected with Thrips. The same Table (3), indicate the same data at Gahrbia governorate. Bronco cultivar showed that highest value of Thrips incidence (25.0 individuals) was recorded in black cumin followed with 18.78, 16.33 and 9.33 for rocket, fennel and mint respectively. All intercropped treatments were significantly lower than the control 41 individuals. Within the Poliste cultivar intercropped treatments, the highest value of infection with Thrips 13.33 individuals was recorded in black cumin, while the lowest one 8.0 individuals only was recorded in the mint, both of them were significantly lower than control (19.33 individuals) .Among Nebraska cultivars intercropped treatments, there was no significant differences between all treatments and each other, 39.33, 33.33, 30.33 and 27.67 for rocket, black cumin, fennel and mint respectively.

Table 3

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At the same time all these treatments were significantly lower than the control which was 70.53 individuals. Hence, in the three cultivars, the lowest incidence of Thrips was in mint treatment, and the highest was in black cumin and all treatments of intercropping were lower than the control (Kidney bean alone).

Table (4) show the population of predators on the leaves of kidney bean either grown alone or intercropped with the 4 plants: black cumin, rocket, fennel and mint in Fayoum governorate. Data of Bronco cultivar the highest mean value of incidence the predaceous mites recorded 20.33, 19.89, 17.33 and 14.67 in treatments of mint, fennel, rocket and black cumin, respectively and they all were highly significantly higher than control 11.33 individuals. In respect of Poliste cultivar the highest value 23.67 individuals was in mint while the lowest one (8.33) was recorded in rocket and both were significantly different than control, 13.33 individuals. Nebraska cultivar indicated that, their highest value of the predaceous mites were 12.67 individuals, in mint followed by 11.33 in the control and both were significantly higher than their values in fennel and rocket 5.33 and 6.67, respectively. In Gharbia governorate, Broncho cultivar indicated that, incidence of thrips recorded the highest value (25 individuals /10 leaves) in black cumin followed by each of rocket and fennel (18.78 and 16.33), respectively, while mint treatment was significantly decreased 9.33, compared to the control, Kidney bean alone 41 individual / 10 leaves, which was highly significant treatment. Palliate cultivar showed that Thrips incidence in the central, also was significant 19.33 significant higher than each of black cumin and rocket 13.33 and 12.33 respectively. Thrips incidence in fennel and mint recorded 9.33 and 8 individual, with no significant difference between the two treatment. In respect of Nebraska cultivar Thrips showed no significant difference between all the 4 intercropped treatment 39.33, 33.33, 30.33 and 27.67 individuals for rockets, black cumin, fennel and mint respectively but there was a clear significant difference between all treatments and the control 70.53 individuals.

Table (5) indicates, the mean values of the *Orius albidipennis* in the same treatment of intercropping and in general (Kidney bean alone), in Fayoum and Garbia governorates. In Fayom, Bronco cultivar showed that, the highest values of *Orius bugs* were recorded in mint and fennel 12.0 and 11.33 individuals respectively, these values were significantly higher than each of control, rocket and black cumin 8.67, 8.33 and 7.34 individuals, respectively. In respect of Poliste cultivar the mean values of *Orius*, were the higher in mint and control 17.33 and 10.33 individuals and they were significantly higher than, fennel, rocket and black cumin 5.4 and 4 respectively. Nebraska cultivars gave high values in mint treatment 5.67 individuals, significantly higher than the control, black cumin and rocket 4.33, 4.33, 3.33 respectively, while the value in fennel was significantly lowest one (2.33 individuals).

Table 4

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Table 5

In Gharbia governorate, Bronco cultivar indicated that values of *Orius* recorded 7.67 individuals in control significantly higher than rocket, fennel and mint 6, 5.33 and 5.33, respectively, while black cumin gave intermediate value 6.67 individuals. Poliste cultivar indicated that black cumin and mint recorded 6.67 and 7.0 individuals significantly higher than the rocket, fennel and control 6.33, 6.33 and 5.33, respectively. Nebraska cultivars showed that *Orius bugs* recorded high values in mint treatment 5.67 individuals, significantly higher than control, black cumin and rocket 4.33, 4.33 and 3.33, respectively, while the value in fennel was significantly lowest one (2.33 individuals). In Gharbia governorate, Bronco cultivar indicated that values of *Orius* recorded 7.67 individuals in control significantly higher than rocket, fennel and mint 6, 5.33 and 5.33 respectively, while black cumin gave intermediate value 6.67 individuals. Poliste cultivar indicated that black cumin and mint treatments recorded 6.67 and 7.0 individuals significantly higher than rocket, fennel and control 6.33, 6.33 and 5.33 respectively. Nebraska cultivars, showed that *Orius* values in control 21.33, significantly higher than all mint, rocket, black cumin and fennel, (13.33, 11.66, 11.33 and 9.67 individuals, respectively).

Table (6) Shows the average mean values for the 3 months of *Tetranychus urticae* concentrated in Fayom governorate (911 individuals) against 277 in Gharbia governorate in Bronco cultivar, while Poliste cultivar in Gharbia recorded (699) against 476 in Fayoum .Thrips in Poliste cultivar was higher in Fayoum 25 individuals against 21in Gharbia.Thrips in Nebraska cultivars in Gharbia was higher than in Fayoum (37 and 14 individual,respectively). Predaceous mites and *Orius bugs*, in Nebraska cultivars showed in Gharbia (19 while it was 9 in Fayoum) and (13 against 4) individual, respectively.

Table (6): Population density of the studied pests in the 2 different governorates.

Pests	Fayoum	Gharbia
Spider mite <i>Tetranychus urticae</i> :	Bronco : 911	277
	Poliste : 476	699
	Nebraska : 593	600
	Mean 660	525
White fly	Bronco : 32	32
	Poliste : 31	20
	Nebraska : 23	35
	Mean 29	29
Thrips	Bronco : 26	22
	Poliste : 25	21
	Nebraska : 14	37
	Mean 22	23
Predacious mites	Bronco : 17	13
	Poliste : 13	13
	Nebraska : 9	19
	Mean 13	15
<i>Orius bugs</i>	Bronco : 10	6
	Poliste : 8	7
	Nebraska : 4	13
	Mean 7	9

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تأثير التحميل بأربعة من النباتات العطرية على تعداد ثلاثة من الآفات
الرئيسية وكذلك المفترسات المصاحبة لها على ثلاثة من أصناف
الفاصوليا بمحافظتى الفيوم والغربية - مصر

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تم فى هذا البحث، دراسة تأثير التحميل بأربعة من النباتات (النعناع، الشمر، الجرجير، حبة البركة) مع ثلاثة أصناف من نباتات الفاصوليا (برونكو Pronco، بوليست Poliste، نبراسكا Nebraska) على تعداد ثلاثة من الآفات الرئيسية الثاقبة (العنكبوت الأحمر *Tetranychus urticae* Koch، من القطن والبطيخ (*Bemisia tabaci* (Genn.)، تريس القطن والبصل (*Thrips tabaci* Lind. وكذلك المفترسات الرئيسية المصاحبة لهذه الآفات (بق الأوريس *Orius* spp.، والأكاروس المفترس *Phytoseiulus persimilis*) وذلك بمحافظتى الفيوم والغربية، خلال موسم ٢٠٠٧.

فى كل محافظة من المحافظتين تم تخصيص مساحة نصف فدان وتم تقسيم هذه المساحة إلى ثلاثة أقسام حيث خصص كل قسم منها لأحد الأصناف الثلاثة، وقسمت مساحة كل قسم إلى ٢٠ قطعة تجريبية (٥ معاملات × ٤ مكررات) ، وتم توزيع المعاملات الخمسة (التحميل مع النعناع، التحميل مع الشمر، التحميل مع الجرجير، التحميل مع حبة البركة، ومعاملة المقارنة وهى زراعات نباتات الصنف منفردة بدون تحميل) توزيعا عشوئيا بنظام القطاعات العشوائية الكاملة حيث وزعت كل معاملة فى أربعة مكررات، حيث تم زراعات نباتات الفاصوليا للصنف على أحد جانبي الخط وزرعت نباتات التحميل على الجانب الآخر.

أظهرت النتائج المتحصل عليها، أن متوسط تعداد الآفات الثلاثة وكذلك تعداد المفترسات المصاحبة لها كانت أعلى على أصناف الفاصوليا الثلاث بمحافظة الفيوم عنها فى محافظة الغربية. وكذلك كان صنف الفاصوليا "بوليست" هو أكثر أصناف الفاصوليا عرضة للإصابة بالآفات الثلاث وكذلك المفترسات المصاحبة لها فى كلتا المحافظتين، تلاه صنف الفاصوليا "تبراسكا"، ثم أخيرا الصنف "برونكو" والذي كان أقلها تعدادا.

كانت آفة العنكبوت الأحمر هو الآفة الرئيسية على أصناف الفاصوليا الثلاث فى كلتا المحافظتين، سواء على نباتات الفاصوليا التى زرعت منفردة، أو تلك فى نظم التحميل الأربعة (مع النعناع، الشمر، الجرجير، حبة البركة)، وتلى العنكبوت الأحمر من حيث التعداد وبفارق معنوى كلا من الذبابة البيضاء، والتريس. وكان تعداد المفترسات أعلى فى محافظة الغربية عنه فى محافظة الفيوم على الصنفين "برونكو" و "تبراسكا"، بينما كان تعداد المفترسات أعلى على الصنف "بوليست" فى محافظة الفيوم عنه فى محافظة الغربية، تعرضت نباتات الفاصوليا - للأصناف الثلاث- فى نظام التحميل مع الجرجير على أعلى تعداد من الآفات الثلاث مما يظهر أن له تأثير جاذب لهذه الآفات، تلاه وبفارق معنوى عن زراعات الفاصوليا منفردة، التحميل مع حبة البركة، الشمر، النعناع على الترتيب، وبفارق معنوى بين النظم الأربعة مع معظم الأصناف. مما يوصى معه بتجنب تحميل نباتات الفاصوليا مع الجرجير، ويفضل عند ضرورة تحميل أحد هذه النباتات مع الفاصوليا هو التحميل مع النعناع والذي إتضح أن له تأثير طارد لهذه الآفات. ويوصى بزراعة الصنف Nebraska فى الغربية لتواجد المفترسات . ولايوصى بزراعة الصنف Bronco فى الفيوم لشدة إصابته بالعنكبوت الاحمر . ويوصى بالتحميل دائما بالنعناع فهو يقلل اعداد الآفات تحت الدراسة بشكل عام ؛ كما يوصى بعدم التحميل ب Black cumin فهى تجذب الآفات وتزيدها احيانا عن ال Control .

Table (1): Effect of intercropping three bean cultivars with four aromatic plants on the population of *T. urtica*.

Average number of mites / 10 leaves										
Months	Fayoum					Gharbia				
	Bronco					Bronco				
	mint	fennel	rocket	Black cumin	C.	mint	fennel	rocket	Black cumin	C.
May	618	781	920	981	1209	111	173	423	279	417
June	674	720	1341	714	1036	99	201	453	221	390
July	654	774	1089	1003	1116	117	230	420	283	346
Mean	666.11 c	757.67 c	1117.22 a	899.33 b	1117.56 a	109 e	201.33 d	432.0 a	261.0 c	383.22 b
L.S.D.	107.7							38.91		
	Poliste					poliste				
May	111	348	802	489	619	304	411	1301	735	862
June	126	369	836	536	666	297	431	1178	811	776
July	119	360	841	485	659	338	365	1168	741	846
Mean	118.44 d	359.0 c	726.33 a	551.11 b	618.78 ba	311.0 d	402.33 c	1215.67 a	762.33 b	805.78 B
L.S.D.			118.7					63.32		
	Nebraska					Nebraska				
May	351	415	804	619	664	291	397	1178	483	638
June	417	506	903	573	728	250	412	1291	433	637
July	362	486	792	621	671	303	346	1191	475	689
Mean	376.67 e	467.89 d	833.0 a	604.33 c	687.67 b	281.33 e	385.0 d	1220 a	463.67 c	654.67 b
L.S.D.			45.49					53.25		

Table (2): Effect of intercropping three bean cultivars with four aromatic plants on the population white fly, *B. tabaci* .

Average number of white fly/ 10 leaves										
Months	Fayoum					Garbia				
	Bronco					Bronco				
	mint	fennel	rocket	Black cumin	C.	mint	fennel	rocket	Black cumin	C.
May	27	26	39	27	44	20	29	30	22	53
June	27	30	40	30	44	23	24	27	24	63
July	28	25	34	26	36	26	29	33	25	55
Mean	27.33 b	27.0 b	37.667 a	27.667 b	41.333 a	23 c	27.333 cb	30 b	23.667 c	57 a
L.S.D.	4.783					4.308				
	poliste					poliste				
May	23	29	33	30	43	8	12	27	21	29
June	20	25	29	26	53	11	15	25	20	32
July	24	24	29	31	54	9	11	23	20	36
Mean	22.333 c	26.000 cb	30.333 b	29.00 b	50.0 a	9.333 e	12.667 d	25.889 b	20.333 c	32.333 a
L.S.D.	4.509					3.001				
	Nebraska					Nebraska				
May	17	15	25	26	37	15	20	38	31	66
June	14	18	22	17	40	13	21	40	28	80
July	15	19	27	22	29	17	28	36	28	85
Mean	15.333 c	17.333 c	24.667 b	21.667 b	35.333 a	14.556 d	22.333 c	37.111 b	27.889 c	75.111 a
L.S.D.	4.109					6.561				

Table (3): Effect of intercropping three bean cultivars with four aromatic plants on the population of Thrips.

Average number ofThrips / 10 leaves										
Months	Fayoum					Garbia				
	Bronco					Bronco				
	mint	fennel	rocket	Black cumin	C.	mint	fennel	rocket	Black cumin	C.
May	18	20	28	23	37	8	18	21	26	44
	20	30	30	19	32	11	13	17	26	40
	17	25	30	20	39	9	18	18	23	39
Mean	18.333 d	25.00 c	29.333 b	20.667 d	36.00 a	9.333 d	16.333 c	18.778 c	25.0 b	41.0 a
L.S.D.	3.940					3.347				
	poliste					poliste				
June	15	24	23	29	33	8	11	13	12	21
	18	25	27	26	35	9	8	9	14	19
	18	22	24	27	33	7	9	15	14	18
Mean	17.0 d	23.607 c	24.667 cb	27.333 B	33.667 a	8.0 c	9.333 c	12.333 b	13.333 b	19.333 a
L.S.D.	3.203					2.391				
	Nebraska					Nebraska				
July	12	8	10	10	27	29	29	35	73	
	10	10	15	12	29	28	33	40	80	
	8	12	11	11	30	26	29	43	85	
Mean	10.000 b	10.00 b	12.0 b	11.00 b	28.667 a	27.667 b	30.333 b	39.333 b	33.333 b	70.533 a
L.S.D.	2.913					12.30				

Table (4): Effect of intercropping four aromatic crops on the population of predacious mites associated with three bean plants .

Average number of mites/ 10 leaves										
Months	Fayoum					Garbia				
	Bronco					Bronco				
	mint	fennel	rocket	Black cumin	C.	mint	fennel	rocket	Black cumin	C.
May	21	19	17	11	9	12	9	13	16	15
	22	22	19	18	12	11	10	14	15	16
	18	18	16	15	13	11	9	12	14	15
Mean	20.333 a	19.889 a	17.333 ab	14.667 b	11.333 c	11.333 bc	9.333 c	13.000 ba	15.0 a	15.0 a
L.S.D.	29.48					2.109				
June	poliste					poliste				
	22	12	7	9	11	17	11	9	12	11
	25	11	9	10	14	14	15	12	15	13
	24	14	8	12	15	16	11	9	12	14
Mean	23.667 a	12.333 cb	8.333 d	10.333 cd	13.333 b	15.667 a	12.333 b	11.111 b	12.333 B	15.667 a
L.S.D.	2.574					2.730				
July	Nebraska					Nebraska				
	13	6	7	7	11	19	14	18	17	32
	11	6	6	8	11	18	15	16	15	29
	14	4	7	9	12	20	16	17	17	27
Mean	12.667 a	5.333 c	6.6667 cb	8.000 b	11.333 a	19 a	15 b	17 cb	16.333 cb	29.333 a
L.S.D.	1.820					2.761				

Table (5): Effect of intercropping of four aromatic crops on the population of *Orius spp* as an insect predator "associated with three bean cultivars.

Average number of / 10 leaves										
Months	Fayoum					Garbia				
	Bronco					Bronco				
	mint	fennel	rocket	Black cumin	C.	mint	fennel	rocket	Black cumin	C.
May	10	14	9	7	8	7	3	7	7	5
	14	8	9	9	8	4	7	6	7	11
	12	12	7	6	10	5	6	5	6	7
Mean	12.00 a	11.333 a	8.333 b	7.337 b	8.666 b	5.333 b	5.333 b	6.0 b	6.6667 ab	7.6667 a
L.S.D.	1.976					1.917				
	poliste					poliste				
June	17	6	3	3	9	6	6	6	7	6
	17	4	4	5	11	7	6	6	8	4
	18	5	5	4	11	8	7	7	8	6
Mean	17.333 a	5.000 c	4.000 c	4.000 c	10.333 b	7.00 a	6.333 ba	6.333 ba	7.666 a	5.333 B
L.S.D.	1.397					1.461				
	Nebraska					Nebraska				
July	7	2	2	4	6	12	9	11	9	24
	5	3	3	5	4	14	11	11	12	21
	5	2	5	5	6	14	9	13	13	19
Mean	5.666 a	2.333 c	3.333 bc	4.333 ba	4.333 ba	13.333 b	9.666 c	11.666 bc	11.333 bc	21.333 a
L.S.D.	1.650					1.987				