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EFFECT OF INTERCROPPING SYSTEMS ON THE INCIDENCE OF SOME SAP SUCKING AND FRUIT PESTS INFESTING OKRA AND ROSELLE PLANTATIONS

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ABSTRACT:

The effect of mono and mixed culture on some okra and roselle plant characters was determined. No significant differences between the tested okra characters were recorded. However, mean numbers of roselle fruits lonely showed a significant difference among the tested cropping systems. Differences among the sap sucking pests *Bemisia tabaci* Gen. and *Tetranychus urticae* Koch infested okra and roselle planted by mono and mixed cultures were determined. The obtained data showed that okra planted in mixed culture suffer from high attack by *B. tabaci*. Similar results were obtained on roselle plantations. Results, also, showed that the intercropping system had no clear effect on the incidence of *T. urticae* that attack okra intercropped with roselle. However, mean numbers of the pest were reduced in roselle intercropped with okra.

Keywords: Intercropping, okra, roselle, *Bemisia tabaci* Gen., *Tetranychus urticae* Koch, *Oxycarenus hyalinipennis* Costa.

INTRODUCTION:

Intercropping is the agricultural practice of cultivating two or more crops in the same space at the same time. It is considered as an old and commonly used cropping practice which aims to much efficiently crop demands to the available growth resources and labor. The most common advantage of intercropping is the production of greater yield on a given piece of land by making more efficient use of the available growth resources using a mixture of crops of different rooting ability, canopy structure, height and nutrient requirements based on the complementary utilization of growth resources by the component crops (Lithourgidis et al., 2011). Intercropping of compatible plants also encourage biodiversity by providing a habitat for a variety of insects and soil organisms that would not be present in a single-crop environment. This in turn can help limit outbreaks of crop pests by increasing predator biodiversity (Altieri and Nicholls, 2004). Intercropping between different crops and its effect on The occurrence of the pests is recommended in some cases as one of agricultural practices and also as one of the integrated pest management tools (IPM). In Egypt, several investigators concerned with the intercropping system e.g.; Omar *et al*., (1993) and (1994) (cotton with cowpea); Rizk, 2000 (medicinal plants with tomato); Rizk *et al*., (2002) (guar with tomato) and Abdel-Sattar *et al*., (2008) (some aromatic plants, sweet basil; peppermint and spearmint with cucumber).

Both of okra *Abelmoschus esculentus* L. and Roselle, *Hibiscus sabdariffe* L. suffer from the same insect pests such as the whitefly (WF) *Bemisia tabaci* (Gennadius), the two spotted spider mite (TSSM) *Tetranychus urticae* Koch and the cotton seed bug (CSB) *Oxycarenus hyalinipennis* Costa. Therefore, this study has been conducted to estimate the aforementioned insect pests in both crops. Also, to determine the effect of mono and mixed cropping systems on the incidence of these pests.

MATERIALS AND METHODS:

The present study aimed to estimate the population fluctuations of the major pests attack okra and roselle planted in mono and mixed cultures. The application was done at Al-Azhar Experimental Farm, Al-Azhar University, Assiut Governorate during 2011 and 2012 growing seasons. The sowing dates was of both crops in mid May in both seasons in a complete randomized block design with 3 replicates. Plots were 3x3.5 meter. Conventional agricultural practices were performed and insecticidal applications were completely prevented. The used plots were divided into two areas. The first area was used to estimate the major pests that attack leaf and fruit of the tested crops cultivated in monoculture cultivation. The second area was used to determine the incidence of the same pests inhabiting the same crops planted in a mixed cropping system.

A- Horticulture practices:

Some morphological characters of both okra and roselle plants were determined by using plants cultivated in mono and mixed plantations. In respect to okra, mean number of fruits/plant, mean weight of seeds /fruit; mean weight of seeds/ plant (gm.) and mean weight of seeds /feddan (kg.) were estimated. On the other hand, the tested roselle characters were: mean number of fruits/plant; mean weight of dry petals (kg.)/feddan and mean weight of dry seeds (kg.)/feddan.

B- Determination of pests:

1- Effect of intercropping system on the incidence of the sap sucking pests:

Six weeks after sowing both crops in mono and mixed culture areas, five leaves of okra and roselle were picked up randomly from each plot and transferred to the laboratory in muslin bags. Samples were examined under stereomicroscope. Numbers of *B. tabaci* nymphs and *T. urticae,* mobile stages were counted at seven days intervals.

2- Effect of intercropping system on the incidence of the cotton seed bug:

Five dry fruits of okra in addition to five semi dry fruits of roselle were picked up randomly from each plot of both sites of the experiment. Weekly samples were taken from mid October till harvesting and transferred to the laboratory in muslin bags. Okra dry fruits were dissected. Numbers of both nymphs and adults of *O. hyalinipennis* were counted. Semi dry fruits of roselle were kept in the laboratory in the ambient weather factors (30±2°C and 60% RH) until the completely ripening. Roselle fruits were dissected. Numbers of both immature and mature stages of the pest were counted.

3- Statistical analysis:

Data were statistically analyzed by using F-test and means were compared according to Duncan's multiple range test as described by Steel and Torrie (1982).

RESULTS AND DISCUSSION:

A- Horticultural characters:

The effect of intercropping system on some okra and roselle horticultural characters was shown in Table (1). The obtained results showed no significant differences were observed in okra characters in mono and mixed cultures during 2011 and 2012, seasons. Similar results were recorded for roselle horticultural characters during both seasons with an exception, whereas the mean numbers of roselle fruits per plant showed a significant difference between mono and mixed culture during 2012, season (F= 13.74*) with an average of 47.80 and 55.30 fruits per plant, respectively. In this approach El-Gazar *et al* (1988) studied the effects of some intercropping systems (kidney-beans intercropped with okra) and different nitrogen levels on certain growth characters. The obtained results revealed that intercropping systems in both seasons showed significant effect on plant height of kidney-beans and on plant dry weight as well as leaf area per plant in the two tested crops. On the other hand, the plant height of okra was not affected.

B- Determination of pests:

1- Effect of intercropping system on the incidence of the sap sucking pests:

The effect of intercropping system on the incidence of the major okra and roselle sap sucking pests, presented in Tables (2-5).

1.1- The whitefly *Bemisia tabaci* Gen:

Data in Table (2) exhibited the effect of intercropping system on the incidence of *B. tabaci* on okra leaves during 2011 and 2012 growing seasons. Mean numbers of *B. tabaci* infesting okra were high during July and August with an average of 8.38 , 9.45 and 10.05 , 9.43 individual/5 leaves by using mono and mixed cropping systems, respectively. Numbers showed gradually decrease till harvesting in late November. It is clear that differences among months were highly significant (F=7.37**and 29.80**) by using both systems, respectively. On the other hand, mean numbers of *B. tabaci* were higher on okra planted in mixed than in mono culture specially in the beginning of the season. In this approach, Umeh *et al.* (2002) results, showed that intercropping tomato with crops such as cereals and other vegetables reduced infestation in some studied areas. However, most farmer's practices did not affect insect pest abundance.

Data in Table (3) exhibited the mean numbers of *B. tabaci* inhabiting roselle plantations. The number of the pest were decreased gradually was recorded from July until November in both seasons with high significant differencs among months (F= 10.19** and 11.13**) in mono and mixed cropping systems, respectively. Equal numbers of the pest were recorded on roselle leaves by using both systems.

Data in general, showed that okra planted in mixed culture suffer from highly attack by *B. tabaci* than that cultivated in mono culture system. So, plantation of okra in a mono culture system may be preferred than its cultivation in mixed plantation. Conversely, Jones and Gillett (2005) stated that the presence of sunflower in rows included in a poly culture system in-

creased the occurrence and abundance of beneficial insects in cropped fields.

1.2- The two spotted spider mite, *Tetranychus urticae* Koch:

Data presented in Table (4) showed that few numbers (Less than one individual/5 leaves) of *T. urticae* attacked okra leaves. No significant difference between seasons were recorded (F= 2.84ns and 0.01ns) by using mono and mixed cropping systems.

It is clear in Table (5), that mean numbers of *T. urticae* attacked roselle were higher than that attacked okra. The pest peak was observed during September with an average of 16.23 and 12.77 individuals/5 roselle leaves in mono and mixed culture systems, respectively. In general, it can be concluded that *T. urticae* attacks roselle with highly significant difference among months (F= 38.16** and 14.06**) and highly infestation in mono than in mixed cropping systems. In this approach, Asawalam and Chukwu (2012) showed that intercropping ginger with okra had significant (P<0.05) decrease in the population of *Bemisia tabaci*. Furthermore, the okra varieties intercropped with ginger recorded a significantly (P<0.05) higher yield than the solo okra.

2- Effect of intercropping system on the incidence of the cotton seed bug:

Data presented in Tables (6 and 7) showed the effect of intercropping system on the incidence of the cotton seed bug *O. hyalinipennis* Costa, that attack okra and roselle flowers. Data presented in Table (6) showed that the pest attacked okra flowers in the highest number with an average of 376.9 and 360.2 individuals/5 dry flowers during October by using mono and mixed cropping systems, respectively. Decrease in the number of the pest was detected till harvesting in December, with highly significant differences among months (F=19.61** and 25.40**) by using both systems. Okra cultivated in mono and/or mixed culture systems gave no clear effect on the incidence of *O. hyalinipennis* .

Concerning the effect of intercropping system on the incidence of *O. hyalinipennis* attacking roselle flowers,

data in Table (7) showed that the planting system had no clear effect on the incidence of the pest. It is clear that the pest appeared in high number at the beginning of the season with slight decrease till harvesting, and highly significant differences among months (F= 8.48 and 7.62**) by using both systems, respectively. It can be concluded that, *O. hyalinipennis* appeared in low number all over roselle growing season as compared with okra. In a similar work, Abro *et al*., (2004) studied the effect of growing cotton and okra as mono and mix crops on percent infestation of *Earias spp.***

Two years data indicated a highly significant difference in percent infestation of *Earias spp*. in different mono and mixed crops of cotton and okra.

The highest *Earias spp.* infestation (18.45%) was recorded in okra grown as mono crop followed by okra mixed with cotton with percent infestation of 10.29%. They concluded that okra could be used as a trap crop for the population management of *Earias spp.* in cotton crop.

Table 1. Effect of intercropping system on some okra and roselle horticultural characters during 2011 and 2012 growing seasons.

Horticultural characters	2011			2012		
	Solo	Inter-cropped	F value	Solo	Inter-cropped	F value
Okra						
Mean numbers of fruits/plant	9.28	8.67	1.11^{ns}	9.21	9.33	0.34^{ns}
Mean numbers of seeds/fruit (gm.)	4.58	4.49	0.36^{ns}	4.56	4.50	0.83^{ns}
Mean weight of seeds/plant (gm.)	41.98	39.07	0.88^{ns}	41.88	41.85	0.001^{ns}
Mean weight of seeds/feddan (kg.)	781.7	793.7	0.33^{ns}	754.2	752.4	0.06^{ns}
Roselle						
Mean number of fruits /plant	42.63	54.67	4.51ns	47.80	55.30	13.74*
Mean weight of dry pet-als/feddan (kg.)	260.0	275.0	0.42ns	234.7	250.7	0.79ns
Mean weight of dry seeds/feddan (kg.)	3000.0	2946.7	0.02ns	2800.0	3016.7	0.54ns

* : Significant difference between solo and mixed plantation.
ns : Non significant difference between solo and mixed plantation.

Table 2. Effect of intercropping roselle with okra on the incidence of Bemisia tabaci inhabiting okra plantations in Assiut during 2011-2012 growing seasons.

Inspection date	Solo			Inter-cropped		
	2011	2012	Mean	2011	2012	Mean
July	6.53 abc	10.23 a	8.38A	21.00a	15.10 b	10.05A
August	10.87 a	8.03 ab	9.45A	9.83 bc	9.03 c	9.43A
September	6.77 abc	4.53 abc	5.65B	4.43 cd	2.87 d	3.65B
October	0.93 bc	0.47 c	0.70C	1.27 d	1.20 d	1.25C
November	0.70 c	1.27 bc	0.73C	1.03 d	0.70 d	0.87C
Mean	5.06 A	4.91 A		7.52 A	5.78 A	
F value						
Between seasons	0.013 ns			2.153 ns		
among months	7.37**			29.80**		
In combination	0.753 ns			0.816 ns		

@ Based on 5 okra leaves.

Table 3. Effect of intercropping roselle with okra on the incidence of *Bemisia tabaci*@ inhabiting roselle plantations in Assiut during 2011-2012 growing seasons.

Inspection date	Solo			Inter-cropped		
	2011	2012	Mean	2011	2012	Mean
July	4.90 b	4.97 a	6.93A	6.43 a	4.10 ab	5.27A
August	1.77 c	1.10 c	1.43B	2.67 bc	1.20 c	1.93B
September	0.33 c	0.17 c	0.25C	0.60 c	0.33 c	0.47C
October	0.40 c	0.00 c	0.20C	0.01 c	0.00 c	0.03D
November	0.00 c	0.50 c	0.25C	0.17 c	0.43 c	0.30C
Mean	1.48 A	2.15 A		1.98 A	1.21 A	
F value						
Between seasons	1.19 ns			1.754 ns		
among months	10.19**			11.13**		
In combination	2.04 ns			0.698 ns		

@ Based on 5 roselle leaves.

Table 4. Effect of intercropping roselle with okra on the incidence of *Tetranychus urticae*@ inhabiting okra plantations in Assiut during 2011-2012 growing seasons.

Inspection date	Solo			Inter-cropped		
	2011	2012	Mean	2011	2012	Mean
July	0.10 b	0.33 b	0.28B	0.80 ab	0.77 ab	0.78B
August	0.27 b	0.60 b	0.43B	1.27 ab	1.87 a	1.57A
September	0.00 b	2.10 a	1.05A	0.77 ab	0.43 b	0.60B
October	0.60 b	0.13 b	0.38B	0.27 b	0.27 b	0.27C
November	0.30 b	0.53 b	0.42B	0.20 b	0.10 b	0.15C
Mean	0.25 A	0.74 A		0.66 A	0.69 A	
F value						
Between seasons	2.84 ns			0.010 ns		
among months	0.988 ns			3.61*		
In combination	2.195 ns			0.344 ns		

@ Based on 5 okra leaves.

Table 5. Effect of intercropping roselle with okra on the incidence of *Tetranychus urticae*@ inhabiting roselle plantations in Assiut during 2011-2012 growing seasons.

Inspection date	Solo			Inter-cropped		
	2011	2012	Mean	2011	2012	Mean
July	3.22 d	3.89 d	3.56C	2.78 cde	2.32de	2.55D
August	12.03 bc	11.03 c	11.53B	9.43 b	7.53 bcd	8.48C
September	15.53 ab	16.93 a	16.23A	15.77 a	9.77 b	12.77A
October	5.33 d	5.40 d	5.37C	12.20ab	8.33 bc	10.27B
November	1.93 d	0.87 d	1.40D	1.53 e	3.00 cde	2.27D
Mean	7.61 A	7.63 A		8.34 A	6.19 A	
F value						
Between seasons	0.0002 ns			3.70 ns		
among months	38.16**			14.06**		
In combination	0.289 ns			1.35 ns		

@ Based on 5 roselle leaves.

Table 6. Effect of intercropping roselle with okra on the incidence of *Oxycarenus hyalinipennis*@ attacking dry okra flowers in Assiut during 2011-2012 growing seasons.

Inspection date	Solo			Inter-cropped		
	2011	2012	Mean	2011	2012	Mean
October	341.1 ab	412.8 a	376.9A	340.8 a	377.7 a	360.7A
November	318.4 ab	342.0 ab	204.5C	346.5 a	343.9 a	345.2B
December	156.4 c	252.5 b	330.2B	161.0 b	208.9 b	184.95C
Mean	272.0 B	335.8 A		282.8 A	310.2 A	
F value						
Between seasons	7.51*			1.40 ns		
among months	19.61**			25.40**		
In combination	0.84 ns			0.46 ns		

@ Based on 5 dry okra fruits.

Table 7. Effect of intercropping roselle with okra on the incidence of *Oxycarenus hyalinipennis*@ attacking dry roselle flowers in Assiut during 2011-2012 growing seasons.

Inspection date	Solo			Inter-cropped		
	2011	2012	Mean	2011	2012	Mean
October	59.13 a	23.00 c	41.07A	50.43 a	26.80 c	38.62A
November	58.77 a	20.53 c	39.65A	52.53 a	16.63 d	34.85A
December	37.43 b	18.97 c	28.20B	37.67 b	17.90 d	27.78B
Mean	51.78 A	20.83 B		46.88 A	20.44 B	
F value						
Between seasons	122.4**			133.21**		
among months	8.48**			7.62**		
In combination	5.02*			4.51*		

@ Based on 5 dry roselle fruits.

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أثر التحميل علي تواجد بعض الآفات الثاقبة الماصة وآفات الثمار التي تصيب زراعات الباميا والكركديه

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تم تقدير أثر التحميل علي بعض صفات النبات لكل من الباميا والكركديه. لم تسجل فروق معنوية بين الصفات المختبرة للباميا. بينما أظهر فقط متوسط أعداد الثمار في الكركديه فرق معنوي بين نظم التحميل المختبرة. كما تم تقدير الفروق في إصابة الباميا والكركديه بكل من الذبابة البيضاء وأكاروس العنكبوت الأحمر. وقد أظهرت النتائج إصابة الباميا التي تزرع محملة علي الكركديه بأعداد كبيرة من الذبابة البيضاء إذا ما قورنت بتلك التي يتم زراعتها منفردة. وقد كانت النتائج المتحصل عليها مع الكركديه مشابهة تماماً لما تم التحصل عليه مع الباميا. كما أظهرت النتائج عدم وجود تأثير واضح لنظم التحميل علي أعداد أكاروس العنكبوت الأحمر المتواجد علي الباميا المحملة علي الكركاديه. بينما أظهرت النتائج أن متوسط أعداد الأكاروس انخفضت علي نباتات الكركديه المحمل مع الباميا عن المنزرع منفردا.