

EFFECT OF INTERCROPPING AND NEIGHBOR SYSTEMS OF COTTON PLANTS AND OTHER SUMMER CROPS ON THE OCCURRENCE OF SOME COTTON PESTS AND ASSOCIATED NATURAL ENEMIES

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ABSTRACT

*This study was conducted to evaluate the effect of intercropping and neighbor cotton plants with other summer plants on the occurrence levels of some cotton pests in Graia village at Zagazig, Sharkia Governorate during 2003 and 2004 seasons. The results show that Intercropping cotton with tomato or onion increased *Aphis gossypii* (Glover) average numbers significantly on cotton plants. While with cucumber and pepper the average numbers were decreased in both 2003 and 2004 seasons. The average numbers of *Tetranychus* spp. increased in intercropping system of cotton with tomato or cucumber, while the contrast results was found with onion or pepper intercropping system in comparing with the solid cotton plants during 2003 and 2004 seasons. The all intercropping systems increased the population density of *Thrips tabaci* (Lind.) on cotton plants in comparable with solid plants in both of seasons. The influences of intercropping systems on *Bemisia tabaci* (Genn.) and *Empoasca* sp. were differed from season to another and from system to another.*

*With respect to the occurrence of associated natural enemies under intercropping systems, the highest population density of predators, *Scymnus* spp. and *Orius* spp. were recorded on cotton plants intercropped with tomato in both seasons. While, the highest number of predators (*Syrphus* sp.,) *Paederus alfieri*, true spider mites, predator mite (*Phytoseiulus* sp.) and parasitoids, *Encarsia* sp. and *Ertmocerus* sp. were recorded on solid cotton plants compared to the intercropping systems in the two study seasons. The highest numbers of *Chrysoperla carnea* were detected on cotton plants intercropped with cucumber, whereas, the highest average number of *Coccinella* spp. recorded on cotton plants intercropped with onion in the first season and cotton plants intercropped with tomato in the second one.*

*As neighbor effect, the numbers of *Empoasca* sp. and *T.tabaci* was increased on cotton plants, while the numbers of *A. gossypii*, *B. tabaci* and *Tetranychus* spp. were decreased in both of seasons 2003 and 2004.*

*The neighbor of cotton plants by tomato, cucumber, onion or pepper was increased the numbers of predators (*Chrysoperla carnea*, *Orius* spp., *Paederus alfieri*) and parasitoid, *Encarsia* sp. on cotton plants; while the numbers of *Coccinella* spp. *Scymnus* spp., *Syrphus* spp., true spider mites and *Ertmocerns* sp. were decreased in both seasons.*

Key words: Intercropping, neighbor systems, cotton plants, summer crops occurrence cotton pests, natural enemies

INTRODUCTION

The cotton plants are infested with insects and animals pests throughout the different growth stages, i.e., *A. gossypii*; *B.tabaci*, *Empoasca* sp., *T. tabaci* and *Tetramychnus* spp.; associated with predators (*Coccinella* sp., *Chrysoperla carnea*, *Scymnus* spp., *Syrphus* spp., *Paederus alferii*, *Trus spidermites*. *Phytoseiulus* sp. and *Parasitoids* (*Encarsia* sp. and *Ertmocerns* spp). (Al-Shannaf, 1994 and Ibraheem, 2001).

Recently, many farming systems oriented to maximized the area income so, more than one crop are planted in the same area as intercropping systems that influenced the population densities of cotton pests and its associated natural enemies. Wu *et al.* (1991), Sharaf El-Din *et al.* (1993), Omar *et al.* (1994), Chakravarthy *et al.* (1997) and Al-Shannaf (2002).

This study new approach to evaluate the effect of intercropping and neighbor systems as mimic of natural farming systems on the occurrence of some cotton pests and associated natural enemies.

MATERIALS AND METHODS

Field experiments were carried out in Gria village, Zagazig, Sharkia Governorate, Egypt during 2003 and 2004 cotton growing seasons.

The experimental area was cultivated with the cotton variety Giza 85.

1-Intercropping systems

Field experiments were carried out to study the effect of intercropping systems of tomato, *Lycopersicon esculentum*; cucumber, *Cucumis sativus*; onion, *Allium cepa* L. or pepper, *Capsicum frutescens* with cotton plants using one intercropping system, 1:1 ridge. on population density of some main cotton pests compared to cotton solid plants. The area of each treatment half feddan was divided into three replicates. All agricultural practices were carried out as Agric. Min. Recommendation in due time.

2-Neighbor crop systems:

The effect of neighbor crop systems of okra, *Hibiscus esculentus* L.; Eggplant, *solanum melongena*; Squash, *cucurbita vito*, Cowpea, *Vigna sinensis* Savi; Sesame, *sesamum indicum* L.; maize, *Zea maize* L.; mallow, *Corchorus olitarius* L., pepper, *Capsicum frutescens* and coriander, *Coriandrum sativum* L. in 1-2 Kerat of each plant species on the density of cotton pests and associated natural enemies field head of cotton which were $\frac{1}{2}$ feddan for each treatment; on the population.

After four weeks of cotton sowing date, weekly samples of 25 seedlings or 25th leaves were investigated visually for each of cotton plants and different intercropped or neighbor plant species at random from different levels of plant canopy until harvest. The numbers of aphids as well as leafhoppers (nymphs and adults) and thrips (larvae and adults) were counted on the two surfaces of each leaf, while whitefly (larvae and pupae) and spider mite (moving individuals) were counted in an area of one inch² on both of two leaves surfaces.

The numbers of associated predators, (*Coccinella* spp., *Chrysoperla carnea*; *Scymnus* spp., *Orius* spp.; *Syrphus* spp., *Paederus alfieri*; true spider mites and *Phytoseiulus* sp.) and parasitoids (*Encarsia* sp. and *Ertmocerus* sp.) were recorded for all treatments.

The obtained results were statistically analyzed in accordance to Little and Hills (1975).

RESULTS AND DISCUSSION

1-Effect of intercropping:

Data in Table (1) clearly show that, the influence of intercropping systems of tomato, cucumber, onion or pepper with cotton plants where they were influenced the occurrence of some cotton pests and associated natural enemies as follows:

a-Cotton pests:

1-The cotton aphid, *Aphis gossypii* (Glover):

Data in Table (1) show that, the cotton plants intercropped with tomato were infested by *A. gossypii* more than those solid plants with relatively highest numbers of 46.35 and 52.04; 34.09 and 38.61 individ. /leaf were recorded in both of 2003 and 2004 seasons, respectively, while the lowest numbers of 22.0 and 24.44 individ. /leaf harbored cotton plants intercropped with pepper in 2003 and 2004 seasons, respectively.

On the other hand, the mean numbers of *A. gossypii* on the cucumber, tomato and pepper plants intercropped with cotton were 29.0, 17.75; 17.85, 11.39 and 2.96; 3.26 individual /leaf in both of 2003 and 2004 seasons, respectively.

The onion plants intercropped with cotton were free from *A. gossypii* infestation all over these trials.

2-The whitefly, *Bemisia tabaci* (Genn.):

Data in Table (1) clearly show that, the cotton-cucumber intercropping system increased the population density of whitefly significantly recorded, 21.39 and 32.87 individual. /inch² compared to 24.96 and 22.26 individ. /inch² for solid cotton in both of 2003 and 2004 seasons, respectively. The intercropping systems of the onion or pepper with cotton plants decreased population density of whitefly significantly on intercropped cotton plants recorded 17.65, 17.30 and 12.3, 17.22 individ./inch² on solid cotton plants compared to 24.96 and 22.26 individ. /inch² in 2003 and 2004 seasons, respectively.

On the other side the relatively highest population density of whitefly were 35.54 and 96.19 individ. /inch² recorded on cucumber plants followed by 22.74, 17.96 and 6.96, 16.17 individ. / inch² recorded on tomato and pepper in both of 2003 and 2004, seasons respectively.

3-The leafhoppers, *Empoasca* spp.

The present data in Table (4) show that, the intercropping was influenced, the occurrence of leafhoppers significantly in comparison with solid cotton plants. The highest population density were, 7.44, 6.04, 4.35 and 2.30 individ./leaf recorded on cotton plants

intercropped with cucumber, tomato, onion or pepper in the first season. As second season results, the numbers of 5.47, 5.13, 4.44 and 4.35 individ./leaf were occurred on cotton plants intercropped with tomato, cucumber, pepper or onion, respectively.

In regarded to the population density of leafhopper insects on the plant species intercropped with cotton plants, the highest numbers of (5.62, 5.3, 4.01, 3.04 and 1.26, 1.47 individ. /leaf were recorded on cucumber, pepper and tomato in both 2003 and 2004 season, respectively.

4-The cotton thrips, *Thrips tabaci* Lind:

Data in Table (1) indicate that, the intercropping systems affected thrips numbers significantly recording 9.57, 10.5.7; 9.22, 9.17; 7.87, 8.17 and 6.44, 5.74 individ./leaf on cotton plants intercropped with onion, cucumber, tomato or pepper plants, respectively; in compared with 4.0 and 4.65 individ./leaf on solid cotton during 2003 and 2004 seasons, respectively.

On the other hand, the highest average numbers of 17,92 and 62,0 were recorded on onion plants followed by 8,75, 24,42; 3.92, 5.92 and 3.42 , 2.5 individ./leaf on cucumber, tomato and pepper plants during 2003 and 2004 seasons, respectively.

5- Spider mite, *Tetranychus* spp.

The results in Table (1) show that, the intercropping systems of cucumber or tomato with cotton plants increased the population density (moving stages) of spider mite, significantly recording 17.17, 49.83 and 32.09, 27, 96 individuals inch² compared with 16.53 and 22.90 individ./inch² on solid cotton plants during 2003 and 2004 seasons, respectively. But intercropping onion or pepper with cotton plants decreased population density of spider mite recording 14.26, 18.04 and 15.04, 15.83 individ./inch², respectively; in compared with 16.53 and 22.9 individ./inch² on solid cotton plants during 2003 and 2004, respectively.

With respect to the effect of intercropping systems on population density of *Tetranychus* sp. on intercropped plant species the numbers of 52.27 and 37.89 individ./inch² followed by 22.35, 31.93 and 10.26, 9.56 individ./inch² were recorded on tomato, cucumber, and pepper during 2003 and 2004, seasons respectively.

The present results found in agreement with those of Sharaf El-Din *et al.* (1993) and Chakravarthy *et al.* (1997), who found that, intercropping onion – cotton cultivated in ridges was the most suitable culture system for reducing the infestation of *T. tabaci*, *A. gossypii* and *B. tabaci*, on onion plants. Also, Al-Shannaf (2002) found that, intercropping roselle, sunflower, okra or guar with cotton using four intercropping systems caused a decreasing in population density of *A. gossypii*, (*Tetranychus* spp. while it's increased the population density of *B.tabaci* and *Empoasca* spp. compared with solid cotton plants.

B- Effect of intercropping on natural enemies:

Data in Table (2) indicated that, the intercropping of cotton plants with plant species, i.e., tomato, cucumber, onion or pepper. Concerning the effect of intercropping were influenced on the occurrence of *Coccenella* spp.; significantly where the highest

average numbers of 2.66 and 3.01 individ./plant recorded on cotton plants intercropped with onion, whereas the relatively highest numbers of 1.64 and 1.76 individ./ plant as intercropped species occurred on tomato plants/ compared with 2.22 and 2.15 individ./ plant detected on solid cotton during 2003 and 2004 seasons, respectively. The lowest average numbers were 0.37, 0.91 and 0.0, 0.0 individ./ plant recorded on cotton and pepper as intercropping systems during 2003 and 2004 seasons, respectively.

With respect to the influence on the *Chrysoperla carnea*, the highest average numbers were 4.60, 3.48 and 2.93 , 3.01 individ. /plant detected on cotton and cucumber in both of 2003 and 2004 seasons, compared with 2.74 and 2.27 individ./plant recorded on solid cotton, whereas the lowest averages were 1.15 and 1.27 recorded on cotton intercropped with pepper and cucumber during 2003 and 2004 seasons. But the lowest average numbers of 1.09 and 1.13 individ./plant were recorded on tomato as intercropped plants with cotton during 2003 and 2004 seasons.

Data in Table (2) show the highest average numbers of *Scymnus* spp. as 2.78 and 2.96 individ./plant recorded on cotton intercropped with tomato compared with 0.0 and 0.0 individ./ plant occurred on solid cotton, whereas the lowest average 2.01 and 1.97 individ. /plant on cotton intercropped with pepper plants during 2003 and 2004 seasons, respectively.

The highest numbers were recorded on cucumber plants as rites cropped plants were 1.12 and 1.27 individ./plant during the two study seasons, respectively. On the other hand the highest average numbers of *Orius* spp. were 3.26 and 4.02 individ /plant occurred on cotton intercropped with tomato in comparable with 0.0 and 0.0 insect/plant on solid cotton, whereas the lowest average numbers were 1.96 and 1.89 individ./plant recorded on cotton intercropped with pepper plants during 2003 and 2004 seasons, respectively.

On contrary, the highest average numbers true spider mites were 2.43 and 2.53 individ. /plant occurred with the solid cotton followed by 1.82 and 1.75 individ. /plant recorded on cotton intercropped with onion plants during 2003 and 2004, respectively. In case of the parasitoids, i.e. *Encarsia* sp. ranged 0.15-0.34 individ./plant on intercropped cotton compared with 2.0 -2.03 individ /plant on solid cotton, while *Ertmoceris* sp., ranged 0.13-0.35 individ / plant on intercropped cotton in comparable.

II-Effect of neighbor on the occurrence of cotton pests and associated natural enemies

a-Cotton pests on cotton plants :

Data presented in Table (3) indicate that, the neighbor species plants (okra, eggplant, squash, cowpea, sesame, mallow, pepper and coriander) / with cotton plant as well as farming system significantly effected on population density of the cotton pests, i.e., *A.gossypii*, *B. tabaci*, *Empoasca* spp., *T.tabaci* and *Terranychus* spp. on cotton plants during 2003 and 2004 seasons.

The obtained results revealed that, the highest population density of *A. gossypii* were 21.64 and 39.60 aphids/leaf occurred on cotton plants neighbor okra plant compared with 20.82 and 35.13 aphids/leaf recorded with the cotton solid (far from other plant species in cotton area) in both of 2003 and 2004 seasons respectively. On the other hand,

the lowest population density of *A. gossypii* were 13.00 and 14.58 aphids/ leaf detected on cotton plant neighbor both of squash and sesame plants during 2003 and 2004, respectively.

The neighbor systems significantly influenced on the population density of *B. tabaci* on cotton plants during 2003 and 2004 seasons.

The highest average numbers of 30.0 and 30.61 individ / inch² were recorded on cotton plants neighbor cowpea compared with 16.26 and 16.61 individ. / inch² recorded with pure cotton, whereas the lowest population density of 4.83 and 7.70 plants occurred on cotton leaves neighbor squash and okra plants during 2003 and 2004, respectively.

On the contrary, the influence of neighbor on the population density of both *E. mpoasca* sp. and *T. tabaci* in both seasons, resulted in clearly reducing in the occurrence of these pests on cotton plants neighbor of previous mentioned plant species compared with the highest population density of 9.35, 9.04 and 20.57, 24.27 individuals/ leaf recorded with pure area cotton for both insects during 2003 and 2004, respectively.

In case of *Tetranychus* spp., the highest population density of 34.17 and 55.83 moving individuals /inch² were detected on cotton leaves neighbor eggplants compared with 21.61 and 32.91 individuals/inch² on pure area cotton during 2003 and 2004 seasons, respectively. On the other hand, the lowest population density of 7.48 and 5.91 individuals/inch² occurred on cotton leaves neighbor coriander plants during 2003 and 2004 seasons, respectively.

b- Cotton pests on the other plant species:

Data in Table (4) indicate that, the neighbor of plant species okra, egg plant, squash, cowpea, sesame, mallow, pepper and coriander to cotton plants were significantly influenced on the population density of cotton pests on these plant species in compared with pure area cotton in both of 2003 and 2004 seasons.

With respect to the population density of *A. gossypii* and *T. tabaci* the highest numbers were 20.09, 59.52 and 21.36, 24 27 individuals/leaf recorded on okra plants compared with 14.17 , 35.13 and 13.91, 23.64 individuals/leaf for pure area cotton, whereas the lowest average numbers of 1.09, 0.26 and 0.27, 0.55 individuals/leaf recorded on mallow and coriander during 2003 and 2004 seasons, respectively.

Concerning, the effect on *B.tabaci* and *Tetranychus* spp., the highest occurrence of these pests were 32.61, 72.91 individ./ inch² and 127.83, 149.22 individuals /inch² recorded on eggplant compared with 16.26, 30.61 and 21.61, 32.91 on pure area of cotton, while the lowest numbers of 0.91, 0.04 and 3.00, 4.57 were recorded with coriander plants during 2003 and 2004 seasons, respectively.

In regard to, the influence on *Empoasca* sp. the highest population densities were 12.04 and 12.00 individ./leaf occurred on cowpea compared with 9.35 and 8.04 individuals/leaf for pure area cotton, whereas the lowest averages numbers 0.36 and 0.27 individuals / leaf detected with coriander plants during 2003 and 2004 seasons, respectively..

c-Effect of neighbor on occurrence of associated natural enemies in compared with cotton neighbor:

The obtained results in Table (5) show that, the neighbor of some plant species (okra, eggplant, squash, cowpea, sesame and maize) to cotton plants was affected the population densities of associated natural enemies (predators and parasitoids) on plant species compared with cotton neighbor significantly in both of 2003 and 2004 seasons. Concerning the *Coccinella* spp., the highest average numbers of 3.78, 3.89; 2.96, 3.15 and 2.78, 3.01 individ./ leaf were occurred on okra , eggplant and maize compared with 2.96 and 3.17 recorded with neighbor cotton plants during 2003 and 2004 seasons, respectively. On contrary, each of squash, cowpea and sesame were free from predator in both seasons.

With respect to, the *Chrysoperla carnea*, the highest population densities of 2.87 and 2.93 individ./leaf were occurred with squash compared to 3.04 and 3.27 recorded with neighbor cotton/plants, where as the lowest average numbers were 0.87 and 0.96 detected with cowpea during 2003 and 2004 seasons, respectively.

Data in Table (5) show that the highest average numbers of *Scymenus* spp., 4.67 and 5.15 individ./ leaf recorded to squash followed by 2.26, 2.42 and 1.26, 1.41 individ./leaf occurred on eggplant and okra compared with 1.39 and 1.52 individ./leaf recorded with neighbor cotton plants, while did not recorded this predator on both cowpea, sesame and maize during 2003 and 2004 , respectively.

On the other hand, the highest average of *Paederus alfieri* 1.96 and 2.07 individ. /leaf recorded with maize compared with 2.44 and 2.55 individuals /leaf detected with neighbor cotton whereas did not detect this predators on Okra, eggplant, cowpea and sesame during both of 2003 and 2004 respectively. On contrary data in Table (5) cleared that the few average numbers the other predators in compared with previous mentioned natural enemies.

In sides of parasitoids, sp. the numbers ranged 0.0-0.96 individ./plant on nigh bar plants in compared with 1.56 – 1.75 individual/plant on neighbor cotton plant. The present results are agreement with those obtained by Wu *et al.* (1991) and Cui and Xia (1998) who reported that intercropping cotton plant with wheat and maize increase the average number of coccinellidae, chrysopidae and *Orius minutus* on cotton plants.

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تأثير التحميل والتجاور ببعض الأنواع النباتية مع نبات القطن على مستوى

الإصابة ببعض آفات القطن وعلاقته بالأعداء الحيوية

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أجريت هذه الدراسة في قرية كفر الجرايه- مركز الزقازيق- محافظة الشرقية في موسمي ٢٠٠٣ و ٢٠٠٤.

أولاً: تم دراسة تأثير تحميل كلاً من الطماطم والخيار والبصل والفلفل مع القطن على تعداد بعض آفات القطن وقد أظهرت الدراسة أن تحميل الطماطم والبصل يزيد من تعداد المن علي القطن معنوياً ٤٦.٣٥ و ٣٦.٠٩ و ٥٢.٠٤ و ٤٢.١٧ فرد / ورقة بينما تحميل الخيار والفلفل مع القطن يقلل من تعداد المن على القطن ٢٤.٩٦ و ٢٢.٠ و ٢٤.٥٦ و ٢٤.٤٤ فرد/ ورقة خلال موسمي الدراسة ، تحميل الطماطم والخيار مع القطن يزيد من تعداد الأكاروس علي نبات القطن ٢٠.٩٦ فرد/ نبات. بينما تحميل البصل والفلفل يقلل من تعداد الأكاروس علي القطن ٤.٠٢ فرد خلال موسمي الدراسة، وقد وجد أن تحميل الأنواع النباتية الأربعة السابقة يزيد من تعداد تريبس القطن على القطن مقارنة بالقطن المنفرد خلال موسمي الدراسة.. وأختلف التأثير على الذبابة البيضاء من موسم لآخر.

فيما يختص بتأثير التحميل علي تواجد الأعداء الحيوية علي القطن فقد أظهرت النتائج أن التحميل يزيد من تعداد مفترسات الأسكنس والأوريس علي نبات القطن عند تحميل القطن على الطماطم في موسمي الدراسة. بينما سجل أعلى تعداد من السرفس ١.٥٩ فرد/ نبات والرواغة ٢.٢٦ فرد / نبات والعناكب الحقيقية ٢.٥٣ فرد / نبات والأكاروس المفترس ٣.٦٥ فرد نبات وطفيل الإنكارسيا ٢.٠٣ فرد / نبات والأرتموسيرس ١.٧٤ فرد / نبات علي نباتات القطن المنفرد مقارنة بالقطن المحمل عليه في حين أن تحميل البصل علي القطن يزيد من تعداد أبي العيد ٢.٣٦ فرد / نبات علي القطن.

ثانياً: دراسة تأثير تجاور زراعة نباتات البازنجان والكوسة واللوبيبا والسمسسم والذرة والملوخية والكسبره مع زراعات القطن على الكثافة العددية للآفات التي تصيب القطن. أظهرت النتائج أن تجاور زراعة النباتات يزيد من الكثافة العددية لكل من جسد القطن وتربس القطن في حين التجاور يقلل تعداد من القطن والذبابة البيضاء والأكاروس خلال موسمي الدراسة. فيما يختص بتأثير التجاور على تواجد الأعداء الحيوية فقد أظهرت النتائج أن تعداد كلاً من أسد المن والأوريس والرواغة والانكارسيا يزداد على القطن وأن التجاور يقلل من تعداد أبي العيد والأسكنس والسرفس والعناكب الحقيقية والأرتموسيرس في موسمي الدراسة ٢٠٠٣ - ٢٠٠٤.