*J. Plant Prot. and Path., Mansoura Univ., Vol.9 (7): 411– 415, 2018*

# Efficiency of Colored Sticky Traps on the Population of Certain Sap-Sucking Insects on Cucumber Plants in Greenhouses

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## ABSTRACT

Experiments were conducted in the experimental Horticulture Research Station at Qaha, Qalubiya governorate under greenhouse conditions during two successive seasons (2016-2017 and 2017-2018). The study aims to evaluate some pest control methods on cucumber, *Cucumis sativus* L. and their effect on total yield. Population density of *Bemisia tabaci* (Geen.), *Frankliniella occidentalis* (Pergande) and *Phenacoccus solenopsis* Tinsley determined on cucumber plants. Blue and yellow sticky traps were settled in first greenhouse in rate of 13 traps (10 blue and 3 yellow). The second greenhouse was treated in foliar spray by (closer SC24% "Sulfoxaflor" at 10cm$^3$ /20L plus 13 traps (10 blue and 3 yellow). The third greenhouse without treatments (untreated). Results indicated that, the activity period of *B. tabaci, F. occidentalis* and *P. solenopsis* on cucumber plants during both seasons was expressed by two and three peaks. The effects of different treatments of pest control methods (traps, pesticides + traps) were high significantly in reducing pests` population and increase yield. Where, in untreated plots, *B. tabaci, F. occidentalis and P. solenopsis* were responsible for 98% and 99%, reduction in yield respectively. Maximum and minimum temperature were showed that significant negative effect on the population in first season conversely, in the second season cleared significant positive on *B. tabaci, F. occidentalis and P. solenopsis* population. The relative humidity had significant positive effect on first season however in the second season found insignificant. The combined effect (E.V) of these ecological factors on *B. tabaci, F. occidentalis and P. solenopsis* showed that these factors were responsible as a group for 94 %, 90 %, 92 during 2016-2017 and 98, 98, 99 during 2017-2018 effects on the population density of insects throughout both seasons, respectively. The obtained results revealed that, the treatment of pesticide with traps (yellow and blue) reduced effectively population of whitefly, thrips and mealy bugs and increase the yield during the two seasons of the study.

**Keywords: (**cucumber, *Cucumis sativus* L.), population density, *Bemisia tabaci* (Genn.), *Frankliniella occidentalis* (Pergande), *Phenacoccus solenopsis* Tinsley, trap, pesticides, Maximum temperature, minimum temperature, and relative humidity.

## INTRODUCTION

Greenhouse is important system agricultural production field, especially vegetables produced in the abnormal season. Greenhouse vegetables such as cucumber plants are subjected to infestation by many pests such Sap-sucking insect pests. Whitefly, *Bemisia tabaci* (Genn.) is economically important pest on cucumber (*Cucumis sativus* L.) in different parts of the world (Baiomy, 2008). These insect pests are commonly encountered as a serious pests of various crops both in the open field and greenhouses (Roll, 2004 and Alston, 2007). This pest make direct and indirect damage (Berlinger, 1986). Direct damage startups by sucking plant sap from the plant foliage, while indirect damage due to the accumulation of honeydew that is considered as a good media for sooty mold growth, and play a vector of plant viruses, a few numbers of these pests is sufficient to cause considerable damage to the importance crops ( Francki, 1979; Berlinger, 1986; Cohen and Berlinger, 1986; Conte, 1998; Devasahyam, 1998; Stansly *et al.,* 2004 Baiomy, 2008 and Hanafy *et al.* 2014). The majority of the thrips species attacking flowers in particular, including *F. occidentalis*, prefer white traps that have a better reflection of light than other trap colors such as blue or yellow (Hoddle *etal.*2002). However, Roditakis *et al*. (2001) noted that trap colors that are the most attractive to western flower thrips (WFT) are blue and fuchsia rather than yellow or other trap colors. Sticky traps, however, seem to be an effective way to control and monitor WFT populations. For instance, the use of yellow sticky traps in cucumber greenhouses attracted a large number of WFT adults and could be used to directly control or monitor WFT populations (Zepa- Coradini *et al*. 2010). Sampson *et al*. (2012) indicated that thrips in general (and WFT in specific) use scent and color to find host flowers. For this reason, the choice of trap color is important to catch WFT. In fact, among many trap colors that were used by Sampson *et al*. (2012) and Shalaby 2014, blue sticky traps caught the highest number of WFT with highly significant differences between yellow, color and black traps.

This study aimed to investigate impact of different treatments of pest management on population of some insect pests infesting cucumber plants and total yield in greenhouse.

## MATERIALS AND METHODS

Experiments were conducted in the experimental Horticulture Research Station of greenhouse, Qaha, Qalubiya governorate, during the two successive seasons 2016-2017 and 2017- 2018. Cucumber (*Cucumis sativus* L.) each greenhouse divided to three replicates, was sown in 25$^{th}$ of August . The area of each greenhouse was 9*40 m². Population density of the insect pests (*Bemisia tabaci* (Genn.), *Frankliniella occidentalis* ( Pergande) and *Phenacoccus solenopsis*(Tinsley) was determined. Inspection was started 5$^{th}$ September after sowing. Sample of 10 leaves and flowers/ replicate were collected randomly at early morning at weekly intervals until the harvest. The treatments were applied just the population of the insect pests start to appear on cucumber plants. The first greenhouse was treated by 13 traps (10 blue and 3 yellow), traps were distributed in greenhouse as 5 blue sticky traps on both two sides of the greenhouse, while the yellow sticky traps were in the middle of the greenhouse and on their longitudinal axis. The traps were but in 5$^{th}$ September in both seasons, all sticky traps were changed every 15 days in greenhouses. The second greenhouse was treated by (closer SC24% "Sulfoxaflor" at10cm$^3$ /20L + 13 traps in 5$^{th}$ September in both seasons) the insecticide was sprayed four times with A knapsack sprayer (10 litters/ replicate on sept., 27, Nov., 27, Dec., 27 and Jan.,27. The third greenhouse was control (without treatments). The leaf and flower samples were collected per replicate and put in paper bags thereafter transferred to the laboratory for examine and count of insect stages. Cucumber crop was

weighted during harvesting period. The agriculture practices were carried out according to normal recommendation. Final data were analyzed with (SAS, 1999) and appropriate error terms for the F tests of interactions were calculated separately. Comparisons of means were performed using the L.S.D. multiple range test (= 0.05). The mean of sucking insect pests` populations from treated plots were considered to be an indirect reflection of efficacy of different botanicals.

## RESULTS AND DISCUSSION

**1. Population fluctuations of certain pests infesting cucumber (*Cucumis sativus L.*) under greenhouse conditions.**

Study population density of the insect pests (*Bemisia tabaci, Frankliniella occidentalis* and *Phenacoccus solenopsis* infesting cucumber plant. Data in Fig. (1), revealed that the activity period of *B. tabaci* nymph during first season was expressed by two peaks, the lower one was 132 nymph/ 30 leaves on March and found the higher peak was 165 nymph /30 leaves on November.

In the second season, two peaks also were recorded. The lower peak was 144 nymph /30 leaves on November and the higher one was 145 nymph /30 leaves, March, respectively. The activity period of *F. occidentalis* nymphs during first season was expressed by one peak on November 66 nymph /30 leaves and the same trained in the second season found one peak on November 61 nymph /30 leaves and increased population in March with mean 22 nymph /30 leaves.

The activity period of *P. solenopsis* during first season was expressed by two peaks on October and March with means 29and 11 individuals /30 leaves. As the same train in the second season found two peaks on October and March with means 31and 23 individuals /30 leaves, respectively.

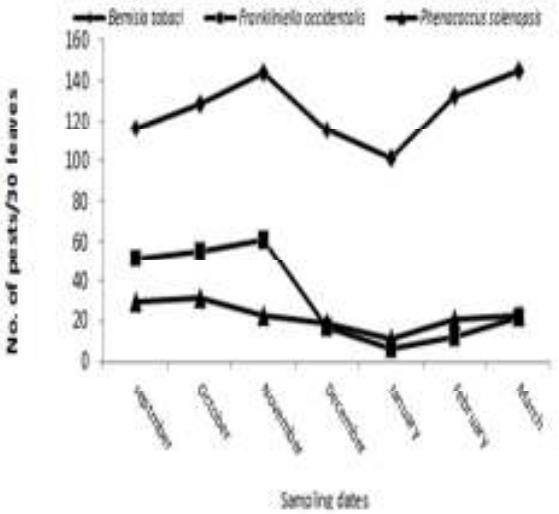


**Fig. 1. Seasonal fluctuation of pests Bemisia tabaci, Frankliniella occidentalis and Phenacoccus solenopsis on cucumber plants in greenhouse, Qaha, Qalubiya governorate during 2016 &2017seasons.**

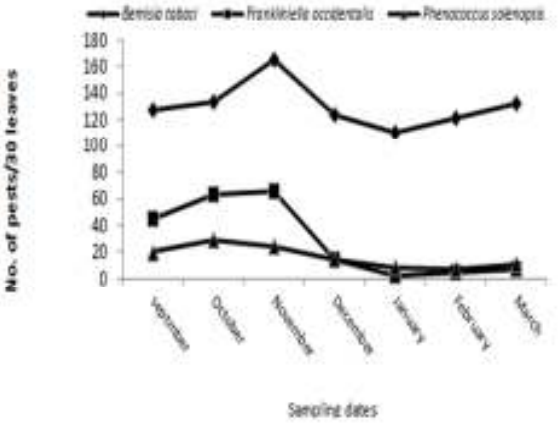


**Fig. 2. Seasonal fluctuation of pests Bemisia tabaci, Frankliniella occidentalis and Phenacoccus solenopsis on cucumber plants in greenhouse, Qaha, Qalubiya governorate during 2017&2018 seasons.**

Table (1), indicated that the *B. tabaci* was key pest infesting cucumber plant in greenhouse.

**Whitefly, *Bemisia tabaci***

The obtained results indicated that the numbers of the insect pest population fluctuations was similar trend recorded throughout the first and second seasons with treatments (trap , pesticides + trap and control) were recorded 27.1 , 25.9 , 11.0 , 11.6 ,130.7 and 126), respectively. Also, statistically analysis of the data revealed highly significant differences between the insect pest in the same treatments during two growing seasons.

**The infestation-yield relationship:**

The effect of different treatments of management (trap, pesticides + trap and control (without treatments)) on cucumber total yield was presented in Table (2) for the two successive seasons. Referring the effect using different systems of management was high significantly between insect pest population and weight yield.

Data in Table (2) revealed that pesticides + trap was the most potent treatment cause increasing weight of cucumber yield with low mean weekly number of the insect pests during the two seasons (6.6 and 5.9/ individuals), followed by trap with moderate mean weekly number of the insect pests during the two seasons (14.2 and 13.9/ individuals) and control which record the highest mean number of insect pests in both seasons (58.7 and 60.1/ individuals). Whereas recording 4100, 4210, 3890, 3900, 3540 and 3570 Kg. by the treatment pesticides + trap, trap and control, respectively in the both seasons examined.

Data in Table (2) showed that the relationship between different system of management on population density of *B. tabaci*, *F. occidentalis* and *P. solenopsis* and crop yield of cucumber were negative and highly significant whereas "r" values were -0.93 , -0.91 , and -0.92, while "b" values were -33.25 Kg,-51.02 Kg and -36.6 Kg for first season 2016&2017, respectively. As well as in the second season were negative and highly significant whereas "r" values were -0.93, -0.96 and -0.95 while "b" values were - 21.01 Kg, - 61.76Kg and - 65.33Kg, respectively.

**Table 1. Mean number of insect pests infesting cucumber plants with different treatments in greenhouse at Qaha, Qalubiya Governorate during 2016 &2017 and 2017& 2018 seasons.**

| Treatments | Months | 2016&2017 | | | 2017&2018 | | |
|---|---|---|---|---|---|---|---|
| | | *B.Tabaci* | *F.occidentalis* | *P.solenopsis* | *B.Tabaci* | *F.Occidentalis* | *P.Solenopsis* |
| Trap | September | 39 | 23 | 12 | 44 | 21 | 16 |
| | October | 19 | 12 | 5 | 21 | 17 | 11 |
| | November | 19 | 9 | 9 | 18 | 9 | 0 |
| | December | 10 | 0 | 6 | 16 | 6 | 0 |
| | January | 19 | 0 | 0 | 10 | 0 | 0 |
| | February | 36 | 7 | 0 | 33 | 3 | 9 |
| | March | 48 | 20 | 5 | 39 | 12 | 7 |
| | Total | 190 | 71 | 37 | 181 | 68 | 43 |
| | Mean | 27.1 a | 10.1 b | 5.3 b | 25.9 a | 9.7 b | 6.1 b |
| | F VALUE | 16.72*** | L.S.D =8.64 | | F VALUE | 22.72*** | L.S.D = 6.8 |
| pesticides + trap | September | 33 | 20 | 9 | 38 | 17 | 11 |
| | October | 10 | 7 | 8 | 14 | 9 | 5 |
| | November | 0 | 0 | 8 | 0 | 0 | 0 |
| | December | 9 | 0 | 0 | 0 | 0 | 0 |
| | January | 12 | 6 | 0 | 11 | 0 | 0 |
| | February | 13 | 3 | 0 | 18 | 0 | 0 |
| | March | 0 | 0 | 0 | 0 | 0 | 0 |
| | Total | 77 | 36 | 25 | 81 | 26 | 16 |
| | Mean | 11.0 a | 5.1 ab | 3.6 b | 11.6 a | 3.7 b | 2.3 b |
| | F VALUE | 3.79* | L.S.D =6.20 | | F VALUE | 5.39* | L.S.D = 6.63 |
| Control | September | 128 | 45 | 20 | 116 | 51 | 29 |
| | October | 134 | 63 | 29 | 129 | 55 | 31 |
| | November | 165 | 66 | 24 | 144 | 61 | 23 |
| | December | 124 | 15 | 15 | 115 | 17 | 19 |
| | January | 110 | 2 | 9 | 101 | 6 | 11 |
| | February | 122 | 5 | 7 | 132 | 12 | 21 |
| | March | 132 | 7 | 11 | 145 | 22 | 23 |
| | Total | 915 | 203 | 115 | 882 | 224 | 157 |
| | Mean | 130.7 a | 29.0 b | 16.4 b | 126.0 a | 32.0 b | 22.4 b |
| | F VALUE | 171.63*** | L.S.D =14.74 | | F VALUE | 134.99*** | L.S.D =15.17 |

**Table 2. Effect of different treatments management of insect pests infesting cucumber plants and total yield in greenhouse at Qaha, Qalubiya Governorate during 2016 &2017 and 2017& 2018 seasons,.**

| Season | Systems | Air temperature | | | Whitefly *Bemisia tabaci* | Thrips *Frankliniella occidentalis* | meal bags *Phenacoccus solenopsis* | Mean | Total Yield |
|---|---|---|---|---|---|---|---|---|---|
| | | Maximum temp. | Minimum temp. | relative humidity | Nymph no. | Nymph no. | individual | | (kg) |
| 2016&2017 | Trap | 28.56 | 15.99 | 67.34 | 27.1 | 10.1 | 5.3 | 14.2 b | 3890 |
| | pesticides + trap | 30.7 | 16.09 | 70.41 | 11.0 | 5.1 | 3.6 | 6.6 b | 4100 |
| | Control | 28.87 | 15.43 | 71.16 | 130.7 | 29.0 | 16.4 | 58.7 a | 3540 |
| 2017&2018 | Trap | 29.16 | 16.22 | 70.33 | 25.9 | 9.7 | 6.1 | 13.9 b | 3900 |
| | pesticides + trap | 28.86 | 17.11 | 72.11 | 11.6 | 3.7 | 2.3 | 5.9 b | 4210 |
| | Control | 29.46 | 15.92 | 71.21 | 126 | 32 | 22.4 | 60.1 a | 3570 |
| | Mean | 29.27 | 16.13 | 70.43 | 55.38 | 14.95 | 9.36 | | 3868.33 |
| | F value between treatments in the first year | | | | 24.38*** | L.S.D. | 16.18 | | |
| | F value between treatments in the second year | | | | 33.47*** | L.S.D. | 14.37 | | |
| | Correlation between insect pests and weight yield in firs season (r) | | | | -0.93* | -0.91* | -0.92* | | |
| | b value | | | | -33.25 | -51.02 | -36.6 | | |
| | Correlation between insect pests and weight yield in second season (r) | | | | -0.93* | -0.96* | -0.95* | | |
| | b value | | | | - 21.01 | -61.76 | -65.33 | | |
| | F value between insect pests and weight yield in first season | | | | 47.50* | Explained Variance ( E.V.) | 98% | | |
| | F value between insect pests and weight yield in second season | | | | 544.98** | Explained Variance ( E.V.) | 99% | | |

These values indicated that the three factors (insect pests) *B. tabaci, F. occidentalis* and *P. solenopsis* were responsible percentage for 98% and 99% in the average weight of yield in both seasons 2016&2017and 2017&2018, respectively.

**The combined effect of some weather factors:**

**Whitefly, *Bemisia tabaci* (Genn.)**

Statistical analysis for the effects of the three selected weather factors ( Maximum temp., minimum temp. and relative humidity (R.H%)) on the population density of *B. tabaci* nymphs during two seasons at Qalubiya governorate are given in Table (3).the obtained results revealed that insignificant effects of maximum temperature on the seasonal fluctuations of *B. tabaci* nymphs throughout in first season where "r" values was -0.53, but in the second season the result showed that highly significant positive effects where "r" values was 0.94, respectively. The minimum temp. recorded insignificant effects of *B. tabaci* nymphs throughout in both seasons where "r" values were -0.31 and -0.33, for the two factors, respectively. While the mean percentages of relative humidity had significant positive effect where "r" value 0.71 in the first season. But in the second season revealed that insignificant effects on *B. tabaci* nymphs where "r" value was -0.30, respectively.

The combined effect (E.V) of these weather factors on *B. tabaci* nymphs showed that these factors were responsible as a group for 94 % and 98 % effects on the population density of *B. tabaci* nymphs throughout two seasons, respectively.

**Thrips, *Frankliniella occidentalis* (Pergande)**

The obtained results revealed that insignificant effects of maximum temperature on the seasonal fluctuations of *F. occidentalis* nymphs throughout in first season where "r" values was -0.61, but in the second season showed that highly significant positive effects where "r" values was 0.96, respectively. The minimum temp. found insignificant effects of *F. occidentalis* nymphs throughout in two seasons where "r" values were -0.43 and -0.39, for the two seasons, respectively. While the mean percentages of relative humidity had insignificant positive effect where "r" value 0.58 in the first season. But in the second season revealed insignificant effects of *F. occidentalis* nymphs where "r" value was -0.37, respectively.

The combined effect (E.V) of these weather factors on *F. occidentalis* nymphs showed that these factors were responsible as a group for 90 % and 98 % effects on the population density of *F. occidentalis* nymphs throughout two seasons, respectively.

**Mealy bugs, *Phenacoccus solenopsis* Tinsley**

These results revealed that insignificant effects of maximum temperature on the seasonal fluctuations of *P. solenopsis* individual throughout in first season where "r" values was -0.52, but in the second season assured significant positive effects where "r" values was 0.95, respectively. The minimum temp. recorded insignificant effects of *P. solenopsis* individual throughout in two seasons where "r" values were -0.31 and -0.36, for the two factors, respectively. While the mean percentages of relative humidity had significant positive effect where "r" value 0.70 in the first season. But in the second season revealed that insignificant effects on *P. solenopsis* individual where "r" value was -0.34, respectively.

The combined effect (E.V) of these weather factors on *P. solenopsis* individuals showed that these factors were responsible as a group for 92 % and 99 % effects on the population density of *P. solenopsis* individual throughout two seasons, respectively.

**Table 3. Simple correlation and partial regression values to the three weather factors on some insect pests and corresponding percentages of explained variance on cucumber plants at Qaha, Qalubiya governorate during 2016&2017 and 2017& 2018 seasons,.**

| Insect pests stage | Variables | 2016&2017 | | | | | 2017& 2018 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Correlation | | Regression coefficient | | E.V% | Correlation | | Regression coefficient | | E.V% |
| | | r | p | b | p | | R | p | b | p | |
| *B .tabaci* (Nymph) | Max. temp. | -0.53 | 0.27 | 29.62 | 0.10 | 94% | 0.941 | 0.01 | 95.63 | 0.13 | 98% |
| | Min. temp. | -0.31 | 0.53 | 27.87 | 0.40 | | -0.33 | 0.58 | -6.57 | 066 | |
| | RH% | 0.71 | 0.01 | 23.40 | 0.03 | | -0.30 | 0.61 | 7.31 | 0.62 | |
| *F. occidentalis* (Nymph) | Max. temp. | -0.61 | 019 | -5.25 | 0.16 | 90% | 0.96 | 0.009 | 25.08 | 0.13 | 98% |
| | Min. temp. | -0.43 | 0.38 | -6.71 | 0.38 | | -0.39 | 0.50 | 0.24 | 0.94 | |
| | RH% | 0.58 | 0.22 | 3.45 | 0.08 | | -0.37 | 0.53 | -0.09 | 0.97 | |
| *P. solenopsis* | Max. temp. | -0.52 | 0.28 | -2.95 | 0.14 | 92% | 0.95 | 0.01 | 18.80 | 0. 13 | 99% |
| | Min. temp. | -0.31 | 0.54 | -2.89 | 0.45 | | -0.36 | 0.53 | -0.60 | 0.82 | |
| | RH% | 0.70 | 0.01 | -2.36 | 0.05 | | -0.34 | 0.59 | 0.72 | 0.79 | |

**Max. temp. = Maximum temperature Min. temp.= Minimum temperature R.H%= Relative Humidity**

These results were in line with those obtained by (Hoddle *et al.*2002, Stansly *et al.,* 2004, Baiomy, 2008, Zepa- Coradini *et al*. 2010, Sampson *et al.*2012, Hanafy *et al*. 2014 and Shalaby 2014)

## CONCLUSION

Use sticky traps (yellow and blue) or pesticides and sticky traps (yellow and blue) have a highly significant effect on cucumber growth and yield. The pesticides and sticky traps (yellow and blue) have effect on insect pests population whereas decreased mean number of insect pests. The pesticides and trap (yellow and blue) were the most efficiency method compared to control (without treatment).

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## كفاءة جذب المصائد اللاصقة الملونه لخفض تعداد بعض الحشرات الثاقبة الماصه التى تصيب نباتات الخيار فى الصوب

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**معهد بحوث وقاية النباتات – مركز البحوث الزراعية**

**قسم بحوث أفات الخضر والنباتات الطبية و العطرية و الزينة – معهد بحوث وقاية النباتات – مركز البحوث الزراعية - الدقى - الجيزة**

تم أجراء التجربة بالصوب خلال موسمي الدراسة (٢٠١٦و ٢٠١٧) , (٢٠١٧ و ٢٠١٨) في موقع الزراعات المحمية بمحطة بحوث البساتين بقها , محافظة القليوبية . تهدف الدراسة لدراسة تاثير المصائد اللاصقة الملونة و المبيدات على نسبة خفض الحشرات الثاقبة الماصة التى تصيب نباتات الخيار تحت الصوب وعلى انتاجيتها . استخدمت فى التجربة ثلاث صوب الاولى تم تعليق ١٣ مصيدة ( ٣ اصفراء و ١٠ زرقاء) ، الصوبه الثانية تم تعليق المصائد بنفس العدد و تم رش مبيد كلوزر ٤ مرات بمعدل ١٠ سم / ٢٠ لتر ماء ، اما الصوبة الاخيرة تعتبر كنترول بدون رش او تعليق مصائد. تم دراسة التذبذبات العددية لكل من الذبابة البيضاء (Genn.) *Bemisia tabaci* ، تربس الازهار (Pergande) *Frankliniella occidentalis* ،بق القطن الدقيقى *Phenacoccus solenopsis* Tinsley و أظهرت النتائج وجود جيلين الى ثلاث اجيال خلال فترة الدراسة لكل الافات محل الدراسة. وأظهرت نتائج التحليل الإحصائي وجود فروق معنوية بين استخدام المصائد و استخدام المبيدات والمصائدعلى الكثافة العددية لبعض الآفات الحشرية الذبابة البيضاء *B. tabaci* ، تربس الازهار *F. occidentalis*،بق القطن الدقيقى *P. solenopsis* وعلى زيادة المحصول. حيث اثرت تعداد الحشرات على وزن المحصول بنسبة خفض كانت ٩٨%الى ٩٩%. واظهرت نتائج التحليل الاحصائى لبيانات درجات الحرارة العظمى والصغرى انه يوجد علاقة غير معنويه سالبة فى الموسم الاول بينما وجد علاقة معنوية موجبة فى الموسم الثانى لكل من من الذبابة البيضاء (Genn.) *Bemisia tabaci* ، تربس الازهار (Pergande) *Frankliniella occidentalis* ،بق القطن الدقيقى Tinsley *Phenacoccus solenopsis* بينما وجد ان تاثير متوسط الرطوبة النسبية على التعداد فى الموسم الاول معنوى موجب اما بالنسبة للموسم الثانى كان غير معنوى سالب و كانت تاثير جميع العوامل (E.V) فى خفض تعداد الذبابة البيضاء (Genn.) *B. tabaci* ، تربس الازهار *F.occidentalis*،بق القطن الدقيقى *P. solenopsis* ( ٩٤%، ٩٠%، ٩٢%)،( ٩٨%، ٩٨%، ٩٩%)خلال موسمى الدراسةبالترتيب.