

Evaluation Efficiency Sticky Traps on Attraction *Bemisia tabaci* (Genn.) on Cucumber Plants under Greenhouses Conditions

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ABSTRACT

This study was carried out to evaluate efficiency sticky traps on attraction *Bemisia tabaci* (Genn.) on Cucumber plants var. *Cucumis sativus* L. under greenhouses conditions in two locations, Perkasah (Giza governorate) and Tokh (Qalubiya governorate) during 2018 season. This study contains three experiments, first experiment aimed to evaluation efficiency of the sticky trap color on attraction *B. tabaci* through comparison between four colors (yellow, blue, orange and red). And this experiment was carried out on Cucumber (early summer planting) during (February - March). Results showed that the traps which have yellow color more efficiency than others which have (blue color, orange color, and red color), respectively. Second experiment aimed to evaluation efficiency yellow sticky trap height on attraction *B. tabaci* through comparison between four heights (2m, 1.5m, 1m and 0.5m) above the ground. And this experiment was carried out on Cucumber (summer planting) during (April - May). Results showed that the trap which have 2m height above the ground more efficiency than others which have (1.5m, 1m and 0.5m) heights, respectively. Third experiment aimed to evaluation efficiency orientation of the yellow sticky trap on attraction *B. tabaci* through comparison between four orientations (North, South, East and West). The experiment was carried out on Cucumber (late summer planting) during (June - July). Results showed that had no clearly effect of the trap orientation on attraction *B. tabaci*.

INTRODUCTION

Cucumber considers one of the most important vegetables crops in Egypt and all over the world which cultivated in the open field and under greenhouses conditions. Also, its cultivated area increased gradually during the last years, especially in the new reclaimed areas for purposes local consumption and exportation to the foreign markets (Hanafy 2004).

Cucumber crop infested with large scale of different insects such as *Bemisia tabaci* (Genn.) which consider one of the most damaging insects infesting vegetables crops either in the open field or under greenhouses conditions, (Calvo, *et al.* 2011) who reported that *B. tabaci* (Genn.) and *Frankliniella occidentalis* (Thysanoptera : Thripidae) are major pests in greenhouses grown Cucumber crops. And Yang, *et al.* (2004) who studied the host preference of *B. tabaci* (Genn.) to four vegetables hosts. And reported that the most host preference of *B. tabaci* was Cucumber var. *Cucumis sativus* L. especially under greenhouses conditions. and Simon, *et al.* (2003) reported that the whitefly *B. tabaci* (Genn.) is an agricultural pest of global importance and is the vector of more than 100 plant viruses.

Sticky traps consider the best method which used to control and also predict of the infestation by *B. tabaci* on vegetable crops. And consider the method which more efficiency to control this insect. Shen and Ren (2003) who reported that the best method to trap *B. tabaci* adults in the Cucumber field was using yellow card. Dan and Horowitz (1984) found that yellow sticky traps were useful to monitor *B. tabaci* (Genn.) population in cotton field and some vegetables crops.

The present study aimed to evaluation efficiency sticky traps on attraction *B. tabaci* (Genn.) on Cucumber var. *Cucumis sativus* L. under greenhouses conditions. Also this study was carried out during 2018 season at two locations, Perkasah (Giza governorate) and Tokh (Qalubiya governorate) and this study contains three experiments.

First experiment aimed to evaluation efficiency color of the sticky trap on attraction *B. tabaci* (adults - nymphs) through comparison between four colors

(yellow, blue, orange and red). And this experiment was carried out on Cucumber (early summer planting) during (February - March) in both the two locations at the same time.

Second experiment aimed to evaluation efficiency height of the yellow sticky trap on attraction *B. tabaci* through comparison between four heights (2m, 1.5m, 1m and 0.5m) above the ground. And this experiment was carried out on Cucumber (summer planting) during (April – May) in both the two locations at the same time.

Third experiment aimed to evaluation efficiency orientation of the yellow sticky trap on attraction *B. tabaci* through comparison between four orientations (North, South, East and West). And this experiment was carried out on Cucumber (late summer planting) during (June – July) in both the two locations at the same time.

MATERIALS AND METHODS

Experimental design

Experiments were carried out to evaluation efficiency sticky traps on attraction *B. tabaci* on Cucumber under greenhouses conditions during 2018 season at two locations, Perkasah (Giza governorate) and Tokh (Qalubiya governorate). The greenhouses at both the two locations were covered with double – layered polyethylene and each one was divided into four parts.

First experiment aimed to evaluation efficiency color of the sticky trap on attraction *B. tabaci* through comparison between four colors (yellow, blue, orange and red). And this experiment was carried out on Cucumber (early summer planting) during (February - March) in both the two locations at the same time. Greenhouse in both the two locations divided into equal four parts. Each part contains different color of the sticky trap (yellow, blue, orange and red). With same all the agricultural operations all over the two places. And checked up all the sticky traps in both the two locations biweekly to calculate mean numbers of *B. tabaci* and recorded the data biweekly.

Second experiment aimed to evaluation efficiency height of the yellow sticky trap on attraction *B. tabaci* through comparison between four heights (2m,

1.5m, 1m and 0.5m) above the ground. And this experiment was carried out on Cucumber (summer planting) during (April - Mai) in both the two locations at the same time. Greenhouse in both the two locations divided into equal four parts. Each part contains different height of the yellow sticky traps. With same all the agricultural operations all over the two places. And checked up all the sticky traps in both the two locations biweekly to calculate mean numbers of *B. tabaci* and recorded the data biweekly.

Third experiment aimed to evaluation efficiency orientation of the yellow sticky trap on attraction *B. tabaci* through comparison between four orientations (North, South, East and West). And this experiment was carried out on Cucumber (late summer planting) during (June - July) in both the two locations at the same time. Greenhouse in both the two locations divided into equal four parts. Each part contains different orientation of the yellow sticky traps. With same all the agricultural operations all over the two places. And checked up all the yellow sticky traps in both the two locations biweekly to calculate mean numbers of *B. tabaci* and recorded the data biweekly.

Statistical analysis:

The mean numbers of *B. tabaci* were analyzed statistically using a one way analysis of variance. When ANOVA indicates that significant differences were found, ($P < 0.05$) means were separated by a Least Significant Differences Test (LSD), the simple correlation (r) and regression coefficient value (b) were adopted to clarifies the change in population due to change in each of the tested factors and the mean values compared with the Least Significant Differences (LSD) as well as, SAS program (SAS Institute 1988).

RESULTS AND DISCUSSION

The present study aimed to evaluation efficiency sticky traps on attraction *B. tabaci* on Cucumber var. *Cucumis sativus* L. under greenhouses conditions. This study was carried out during 2018 season in two locations, Perkash (Giza governorate) and Tokh (Qaluobiya governorate) and this study divided into three experiments.

First experiment:

First experiment aimed to evaluation efficiency color of the sticky trap on attraction *B. tabaci* through comparison between four colors (yellow, blue, orange and red). And this experiment was carried out on Cucumber (early summer planting) during (February - March) in both the two locations at the same time.

Data tabulated in Table (1) showed mean numbers and statically analysis of *B. tabaci* which caught by sticky traps which have different colors (yellow, blue, orange and red) in greenhouses Cucumber at both the two locations Perkash (Giza governorate) and Tokh (Qaluobiya governorate) during 2018 season

Results showed that the traps which have yellow color more efficiency than others which have (blue color, orange color, and red color), respectively. Whereas that the mean numbers of *B. tabaci* which

attracted to the yellow sticky traps in both the two locations were (10, 9 / trap), respectively, mean numbers of *B. tabaci* which attracted to the blue sticky traps in both the two locations were (8, 7 / trap), respectively, mean numbers of *B. tabaci* which attracted to the orange sticky traps in both the two locations were (5, 4 / trap), respectively. Lastly, the mean numbers of *B. tabaci* which attracted to the red sticky traps in both the two locations were (3, 2 / trap), respectively.

Table 1. Mean numbers of *B. tabaci* which caught by sticky traps which have different colors in greenhouses Cucumber at both the two locations during 2018 season.

Trap color	Mean numbers of <i>Bemisia tabaci</i>	
	Giza governorate	Qaluobiya governorate
	Adults	Adults
Yellow	10 ^a	9 ^c
Blue	8 ^b	7 ^b
Orange	5 ^c	4 ^a
Red	3 ^d	2 ^d
F	532.03	65.53
LSD	1.2313	1.352

Means within columns bearing different subscripts are significantly different ($P < 0.05$)

Statically analyses showed that were significant differences between mean numbers of *B. tabaci* which attracted to the sticky traps which have different colors in both the two locations. Whereas LSD (0.05) value for both the two locations were (1.23, 1.35), respectively.

These results agreement with Shen and Ren (2003) who reported that the best method to trap and control *B. tabaci* population in the Cucumber field was yellow card. Soon *et al.* (2015) studied efficiency yellow and blue sticky traps on attractive western flower thrips and greenhouse whitefly. And reported that the yellow sticky traps were more attractive to western flower thrips and greenhouse whitefly than blue sticky traps under greenhouses conditions. Yao and Zheng (2008) studied the tropism of *B. tabaci* imagoes to different colors, and they found that the yellow color of the traps had the best effect on alluring the insect in a period of 44 days, and the next were green color and red color, respectively. The number of the imagoes trapped by yellow board was significantly greater than that traps by other color boards (green, red) respectively. And these results also agreements with Gong, *et al.* (2011) who studied attractive effects of different colors on Q-type *B. tabaci* on Cucumber under greenhouses conditions. And they showed that *B. tabaci* was strongly attracted by yellow color traps compared with other colors (blue, red) respectively.

Second experiment:

Second experiment aimed to evaluation efficiency height of the yellow sticky trap on attraction *B. tabaci* through comparison between four heights (2m, 1.5m, 1m and 0.5m) above the ground. And this experiment was carried out on Cucumber (summer planting) during (April - Mai) in both the two locations at the same time.

Data tabulated in Table (2) showed mean numbers and statically analysis of *B. tabaci* which caught by yellow sticky traps which have different

heights (2m, 1.5m, 1m and 0.5m) above the ground in greenhouses Cucumber at both the two locations Perkash (Giza governorate) and Tokh (Qaluobiya governorate) during 2018 season.

Results showed that the yellow sticky traps which have 2m height above the ground more attractive to *B. tabaci* in both the two locations compared to the traps which have other heights (1.5m, 1m and 0.5m), respectively. Whereas that the mean numbers of *B. tabaci* which attracted to the yellow sticky traps which have 2m height above the ground in both the two locations were (13, 11 / trap), respectively, mean numbers of *B. tabaci* which attracted to the yellow sticky traps which have 1.5m height in both the two locations were (10, 9/ trap), respectively, mean numbers of *B. tabaci* which attracted to the yellow sticky traps which have 1m height in both the two locations were (8, 7 / trap), respectively. Lastly, the mean numbers of *B. tabaci* which attracted to the yellow sticky traps which have 0.5m height in both the two locations were (6, 5/ trap), respectively.

Table 2. Mean numbers of *B. tabaci* which caught by yellow sticky traps which have different heights in greenhouses Cucumber at both the two locations during 2018 season

Trap height	Mean numbers of <i>Bemisia tabaci</i>	
	Giza governorate	Qaluobiya governorate
	Adults	Adults
2m	13 ^a	11 ^b
1.5m	10 ^b	9 ^b
1m	8 ^c	7 ^c
0.5m	6 ^a	5 ^d
F	833.03	65.53
LSD	1.1932	1.2643

Means within columns bearing different subscripts are significantly different (P<0.05)

Statically analyses showed that were significant differences between mean numbers of *B. tabaci* which attracted to the yellow sticky traps which have different heights in both the two locations. Whereas LSD (0.05) value for both the two locations were (1.19, 1.26), respectively.

These results were agreement with Shen and Ren (2003) in China who reported that the best method to trap *B. tabaci* adults using yellow card in the Cucumber field. And reported also that the best method was to hang the yellow card vertically between the rows of the Cucumber plants, and the height of yellow card is almost kept the same as the top of the Cucumber plants. Maolin, *et al.* (2006) reported that trap height showed significant influence on trap catches, which that trap height 1.5m above the ground more effective than which 0.5m above the ground. And reported also that the height of the trap was effective in controlling adult population of *B. tabaci* on greenhouse Cucumber. Fu, *et al.* (2015) reported that *B. tabaci* is an important pest on vegetables in greenhouses and studied the yellow sticky cards were hung in Pepper fields and Cucumber fields. And reported that the best height of yellow sticky cards were top of the Cucumber leaves about 10cm - 50cm higher than the top of the leaves and the best height of

the yellow sticky cards were ranged from 1.5m – 2m above the ground. Dan and Horowitz (1984) found that the efficiency of the yellow trap was highly whereas in the open air they flew >2m above the ground.

Third experiment:

Third experiment aimed to evaluation efficiency orientation of the yellow sticky trap on attraction *B. tabaci* through comparison between four orientations (North, South, East and West). And this experiment was carried out on Cucumber (late summer planting) during (June - July) in both the two locations at the same time.

Data tabulated in Table (3) showed mean numbers and statically analysis of *B. tabaci* which caught by yellow sticky traps which have different orientations (North, South, East and West) in greenhouses Cucumber at both the two locations Perkash (Giza governorate) and Tokh (Qaluobiya governorate) during 2018 season.

Results showed that had no clearly effect to the orientation of the yellow sticky traps on attractive *B. tabaci* on

Table 3. Mean numbers of *B. tabaci* which caught by yellow sticky traps which have different orientations in greenhouses Cucumber for both the two locations during 2018 season.

Trap orientation	Mean numbers of <i>Bemisia tabaci</i>	
	Giza governorate	Qaluobiya governorate
	Adults	Adults
North	16 ^a	14 ^a
South	15 ^b	13 ^b
East	17 ^c	16 ^d
West	16 ^d	15 ^c
F	423.03	65.53
LSD	1.2431	1.3243

Means within columns bearing different subscripts are significantly different (P<0.05)

Cucumber plants in both the two locations. Whereas mean numbers of *B. tabaci* which attracted to the yellow sticky traps which were in North orientation in both the two locations were (16, 14 / trap) respectively, mean numbers of *B. tabaci* which attracted to the yellow sticky traps which were in South orientation in both the two locations were (15, 13 / trap), respectively, mean numbers of *B. tabaci* which attracted to the yellow sticky traps which were in East orientation in both the two locations were (17, 16 / trap), respectively. Lastly, the mean numbers of *B. tabaci* which attracted to the yellow sticky traps which were in West orientation in both the two locations were (16, 15 / trap), respectively.

Statically analyses showed that were not significant differences between mean numbers of *B. tabaci* which attracted to the yellow sticky traps which were in different orientations in both the two locations. Whereas LSD (0.05) value for both the two locations were (1.24, 1.32) respectively.

These results agreements with Maolin *et al.* (2006) who reported that the trap orientation had no effect on trap catches, but traps hanged vertically parallel to plant rows trapped slightly more *B. tabaci* adults than those hanged horizontally. And those authors also studied distribution and daily activities of

B. tabaci adults in greenhouse (East – West) oriented were investigated with yellow sticky traps. And they found that no significantly differences between East and West orientation of the yellow sticky traps in the Cucumber greenhouse. Also these results agreement with those obtained by Xi, et al. (2008) who studied the orientation of the yellow sticky traps on tomato plants in greenhouses. And reported that had no effect of the orientation of the traps (North, South, East and West) on attractive *B. tabaci* adults. But they found that the yellow sticky traps trapped *B. tabaci* adults significantly reduced when the traps were placed parallel to tomato rows more than those placed perpendicular to tomato rows on every sampling date.

Notes:

Generally, we notice from this study that the infestation by *B. tabaci* in Perakash region (Giza governorate) was higher than that in Tokh region (Qalubiya governorate). This showed from mean numbers of *B. tabaci* which caught by different traps in all steps of this study in both the two locations. And this showed also from statically analysis which indicates that were significant differences between mean numbers of that insect which caught in both the two locations.

Also, we notice from last study that the infestation by *B. tabaci* was higher in Cucumber (late summer planting) which cultivated during (June - July) than Cucumber (summer planting) which cultivated during (April - May) than Cucumber (early summer planting) which cultivated during (February - March), these results agreement with Seif (1981) who studied seasonal fluctuation of adult population of the whitefly, *B. tabaci* and found that the interaction of atmospheric temperature and relative humidity was highly correlated with the numbers of whitefly. This means that the numbers of *B. tabaci* become high when the temperature and relative humidity are high. And Dan and Horowitz (1984) found that the number of adults whiteflies caught by yellow sticky traps was the high level in months July, Augst and September. Kohji, et al. (1995) found in all six experimental plots, the maximum number of adults per trap in each sowing season showed a similar seasonal trend, the traps caught more whiteflies in the sowing seasons from July to September. Lastly, Marabi, et al. (2017), their trial was conducted to know the seasonal population dynamics of whitefly, *B. tabaci* in soybean and their relation to weather parameters during three consecutive seasons. And found that the population of whitefly adults was exhibited significantly positive correlation with maximum and minimum temperature, whereas the adults population of *B. tabaci* was gradually increased and reached at its peak on July to September.

CONCLUSION

Cucumber is one of the most important vegetables crops. *B. tabaci* is the most important insect infesting Cucumber plants either in the open field or under greenhouses conditions. Sticky traps are the best method to control of *B. tabaci* insect. Yellow sticky traps are more efficiency to caught *B. tabaci* than blue traps, orange traps and red traps, respectively. And the

yellow sticky traps which have 2m height above the ground more efficiency to caught *B. tabaci* than traps which have 1.5m, 1m and 0.5m height above the ground, respectively. Lastly, the orientation of the sticky traps had no clearly effect on the attraction of *B. tabaci*.

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تقييم فاعلية المصائد اللاصقة في جذب حشرة الذبابة البيضاء (*Bemisia tabaci* (Gennadius)) على نباتات الخيار تحت ظروف الصوب البلاستيكية

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أجريت هذه التجارب بغرض تقييم فاعلية المصائد اللاصقة في جذب حشرة الذبابة البيضاء (*Bemisia tabaci* (Genn.)) على نباتات الخيار صنف *Cucumis sativus* L. تحت ظروف الصوب البلاستيكية. كما أجريت هذه التجارب في موقعين مختلفين هما منطقة برقاش (محافظة الجيزة) وطوخ (محافظة القليوبية) خلال عام ٢٠١٨ ، حيث تنقسم هذه الدراسة إلى ثلاثة تجارب : التجربة الأولى : أجريت هذه التجربة بغرض تقييم فاعلية لون المصائد اللاصقة في جذب حشرة الذبابة البيضاء من خلال مقارنة أربعة ألوان مختلفة للمصائد اللاصقة وهي (الأصفر ، الأزرق ، البرتقالي ، الأحمر) . كما أجريت هذه التجربة على نباتات الخيار (العروة الصيفية المبكرة) وذلك خلال شهرى (فبراير، مارس) و ذلك تحت ظروف الصوب البلاستيكية في موقعى الدراسة . وتوصلت النتائج إلى ارتفاع فاعلية المصائد اللاصقة ذات اللون الأصفر بالمقارنة بالمصائد ذات الألوان الأخرى ثم يليها في الفاعلية المصائد ذات اللون الأزرق ثم المصائد ذات اللون البرتقالي وأخيرا المصائد ذات اللون الأحمر. كما أشار التحليل الإحصائى للنتائج إلى وجود فروق معنوية بين تعداد حشرة الذبابة البيضاء التى تنجذب للمصائد اللاصقة ذات الألوان الأربعة المختلفة محل الدراسة . التجربة الثانية : أجريت هذه التجربة بغرض تقييم فاعلية ارتفاع المصائد الصفراء اللاصقة في جذب حشرة الذبابة البيضاء من خلال مقارنة أربعة ارتفاعات مختلفة للمصائد الصفراء اللاصقة وهي (١م ، ١.٥ م ، ١ م ، ٥ م) عن سطح الأرض . كما أجريت هذه التجربة على نباتات الخيار (العروة الصيفية) وذلك خلال شهرى (أبريل ، مايو) و ذلك تحت ظروف الصوب البلاستيكية في موقعى الدراسة . وتوصلت النتائج إلى ارتفاع فاعلية المصائد الصفراء اللاصقة ذات الارتفاع ٢م بالمقارنة بالمصائد ذات الارتفاعات الأخرى ثم يليها في الفاعلية المصائد ذات الارتفاع ١.٥ م ثم المصائد ذات الارتفاع ١م وأخيرا المصائد ذات الارتفاع ٥ م . كما أشار التحليل الإحصائى للنتائج إلى وجود فروق معنوية بين تعداد حشرة الذبابة البيضاء التى تنجذب لكلا من المصائد الصفراء اللاصقة ذات الارتفاعات الأربعة المختلفة محل الدراسة . التجربة الثالثة : أجريت هذه التجربة بغرض تقييم فاعلية اتجاه المصائد الصفراء اللاصقة في جذب حشرة الذبابة البيضاء من خلال مقارنة أربعة اتجاهات مختلفة للمصائد الصفراء اللاصقة وهي (الشمال ، الجنوب ، الشرق ، الغرب) . كما أجريت هذه التجربة على نباتات الخيار (العروة الصيفية المتأخرة) وذلك خلال شهرى (يونيه ، يوليو) و ذلك تحت ظروف الصوب البلاستيكية في موقعى الدراسة . وتوصلت النتائج إلى عدم وجود تأثير ملموس لإتجاه المصائد الصفراء اللاصقة على معدل أو فاعلية المصائد في جذب حشرات الذبابة البيضاء . كما أشار التحليل الإحصائى للنتائج إلى عدم وجود فروق معنوية بين تعداد حشرة الذبابة البيضاء التى تنجذب لكلا من المصائد الصفراء اللاصقة في كلا من الإتجاهات الأربعة المختلفة محل الدراسة.