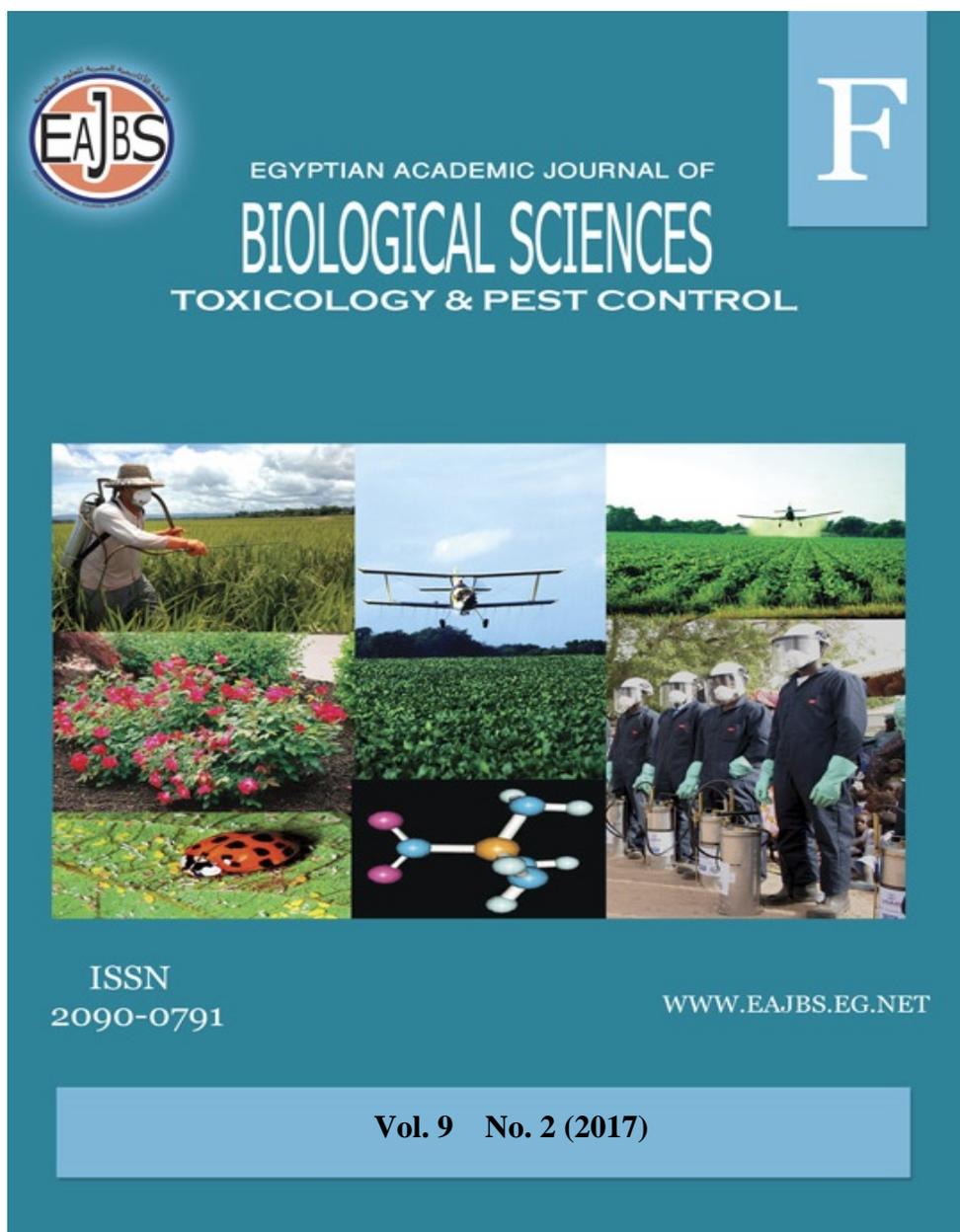


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Control of Soybean Stem Fly *Melanagromyza sojae* (Diptera: Agromyzidae) by Sticky Color Traps in Soybean Field

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ABSTRACT

Five color traps were used to study the effect of color upon the attractiveness of Soybean stem fly *Melanagromyza sojae* (Zehnter), (Diptera: Agromyzidae) in Nubaria Agriculture Research Station's farm, throughout 2015 and 2016 seasons. White, yellow, red, green, and blue sticky traps were used to estimate the attraction to suppress of *M. sojae* damage in soybean fields. White and yellow traps had great effect in suppressing the damage, there was increasing in seed's weight by using white and yellow traps which mean that the mass trapping of these two color was successful in controlling *M. sojae*, blue trap had low effect and other traps were not effective in the captivity of the adult.

INTRODUCTION

Recently, soybean (*Glycine max* L.) Merrill, has attracted the attention of the world for its many benefits and healthy effects at the highest level. It is two dimensional crop as it contains about 40-42% percent high quality protein and 20-22% percent oil, it also contains 20-30% percent carbohydrates (Harish *et al.*, 2013). Also, soybean is assumed to be a crop of potential economic importance (Jackai *et al.*, 1990). Supposed insect pest is a major biological constraint and of a basic problem in where soybean has been cultivated for several hundred years. Soybean stem fly *Melanagromyza sojae* (Zehnter), (Diptera: Agromyzidae), is very destructive pest in Egypt which causes 100% infestation of soybean plants (Abdallah *et al.*, 2014; Hanan Alfy *et al.*, 2016; and Hanan Alfy, 2016). Using insect traps was beneficial for monitoring populations in the later seasons (Robert *et al.*, 1995).

However, insecticides - traditional methods - caused observed results to suppress soybean stem fly. In the other hand, that was a great deal to impact damage of pests with special traps to avoid pollution. For this reason, this study is concerned with the effect of attractiveness color in capture of soybean stem fly for controlling it.

The aim of the present investigation was to determine the influence of colors on the attractiveness of traps to the soybean stem fly, *M. sojae* to apply color traps as nonconventional method for controlling this insect.

MATERIALS AND METHODS

This experiment was carried out at experimental farm of Nubaria Agriculture Research Station, 46 Km Cairo Alex road, Egypt, throughout 2015 and 2016 seasons. Five treatments in addition to control for three replicates divided by 18 plots with area 6 square meters/plot were used. The crop management practices were adopted as per recommendations. A randomized complete block design was used. Traps hanged on wood rod after three weeks of planting. The area of each trap was 30cm × 30cm with duple faces. Every week, traps were altered by new ones, and traps were taken to laboratory to count the population of adult fly only. At harvest, the seed weight per plot was recorded as evidence of yield components.

Data were inputted to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). The Kolmogorov-Smirnov, Shapiro, and D'agstino tests were used to verify the normality of distribution of variables, **Student t-test** was used to compare two groups for normally distributed quantitative variables while **ANOVA** was used for comparing the four studied groups and followed by **Post Hoc test (Tukey)** for pair wise comparison. **Pearson coefficient** was used to correlate between quantitative variables. Significance of the obtained results was judged at the 5% level.

RESULTS AND DISCUSSION

In this experiment, data showed that white and yellow traps had great effect in suppressing the damage occurred by *M. sojae* with high difference significant.

The presence of adult flies was decreased after two weeks from hanging traps and reached to the minimum after four weeks as showed in (Table1). The same table illustrated the different mass trapping among all traps per week in the two successive seasons in (Figures 1&2).

Comparing mass trapping of adult fly with seed's weight in two seasons, Table 2 and Figure 3 revealed that the white and yellow traps had captured the greatest number of flies with highly impress in attractiveness, while the blue one had the median number of flies with a different significance but the red and the green ones had the lowest number of flies with no significance compared with control in two seasons.

Statistical analysis assured that there was a positive correlation between the weight of the seed and the number of flies at any time in the two seasons as shown in (Figure 4 & 5).

In conclusion, treatments of white and yellow traps cause increase in weight of the seed up to 52.55, 52.35, and 52.07, with 46.86% percent with control in first and second seasons, respectively. There was a significant increase in yield caused by using blue trap evaluated by 11%. The red and green traps didn't record any different significance. Using taps are effective for their low cost and simplicity. Particularly, these data are compatible with **Michael and Vincent (1985)** who confirmed that yellow traps were effective in capturing flies specially Agromyzidae.

Table 1: Comparison between the different color of traps according to number of fly in 2015 and 2016 seasons (n = 3)

Color of traps	Number of fly in 2015 season			
	After one week	After two weeks	After three weeks	After four weeks
White	443.0 ^a ±12.77	450.7 ^a ±3.51	128.0 ^a ±7.21	84.0 ^a ±7.94
Yellow	429.7 ^a ±12.22	452.0 ^a ± 3.0	134.3 ^a ±6.03	83.33 ^a ±7.09
Blue	222.0 ^b ±3.61	199.0 ^b ±8.54	53.33 ^b ±7.09	0.0 ^b ± 0.0
Red	6.33 ^c ±3.06	1.0 ^c ± 1.0	0.0 ^c ± 0.0	0.0 ^b ± 0.0
Green	2.33 ^c ± 0.58	0.33 ^c ± 0.58	0.0 ^c ± 0.0	0.0 ^b ± 0.0
Control	0.0 ^c ± 0.0	0.0 ^c ± 0.0	0.0 ^c ± 0.0	0.0 ^b ± 0.0
F	2442.640*	9190.852*	536.529*	296.482*
P	<0.001*	<0.001*	<0.001*	<0.001*
Color of traps	Number of fly in 2016 season			
	After one week	After two weeks	After three weeks	After four weeks
White	404.3 ^a ±12.50	398.0 ^a ±16.52	118.7 ^a ±8.50	81.0 ^a ±5.57
Yellow	405.0 ^a ±10.44	405.3 ^a ±12.22	120.0 ^a ± 7.0	77.67 ^a ±4.16
Blue	205.7 ^b ±8.50	201.3 ^b ±9.02	49.0 ^b ± 5.0	8.33 ^b ±5.03
Red	2.67 ^c ±4.62	0.0 ^c ± 0.0	0.0 ^c ± 0.0	0.0 ^b ± 0.0
Green	0.67 ^c ± 1.15	0.0 ^c ± 0.0	0.0 ^c ± 0.0	0.0 ^b ± 0.0
Control	0.0 ^c ± 0.0	0.0 ^c ± 0.0	0.0 ^c ± 0.0	0.0 ^b ± 0.0
F	1968.008*	1393.839*	420.456*	391.653*
p	<0.001*	<0.001*	<0.001*	<0.001*

Data was expressed by using mean ± SD.

F: F value for ANOVA test, Sig. bet. grps was done using Post Hoc Test (Tukey)

Different superscripts are statistically significant at p<0.05.

*: Statistically significant at p ≤ 0.05

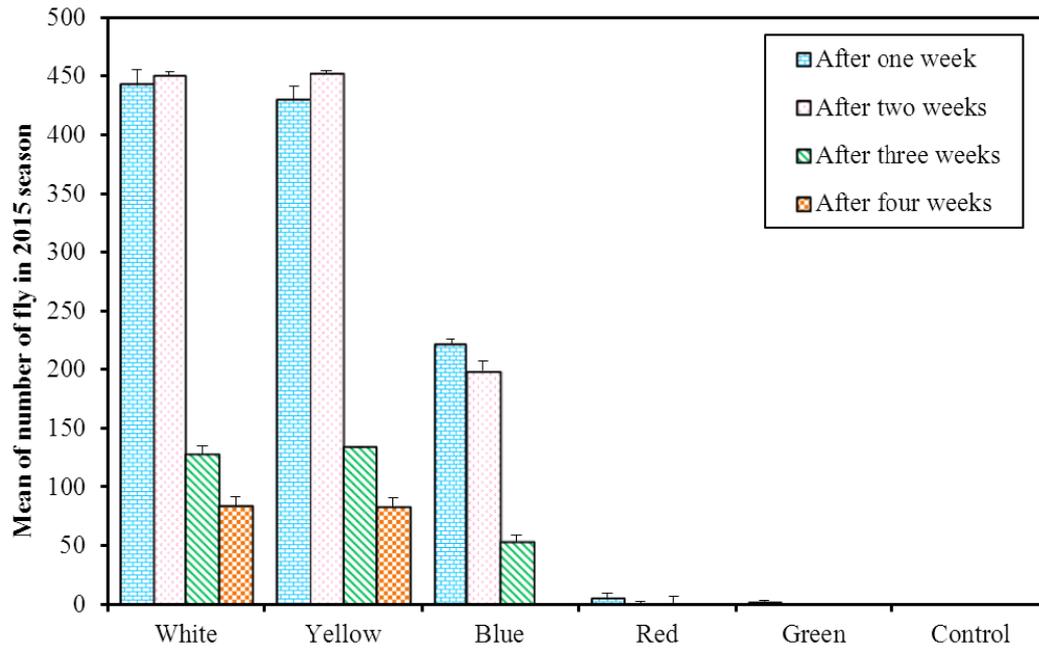


Fig. (1): Comparison between the different color of traps according to number of fly in 2015 season (n = 3)

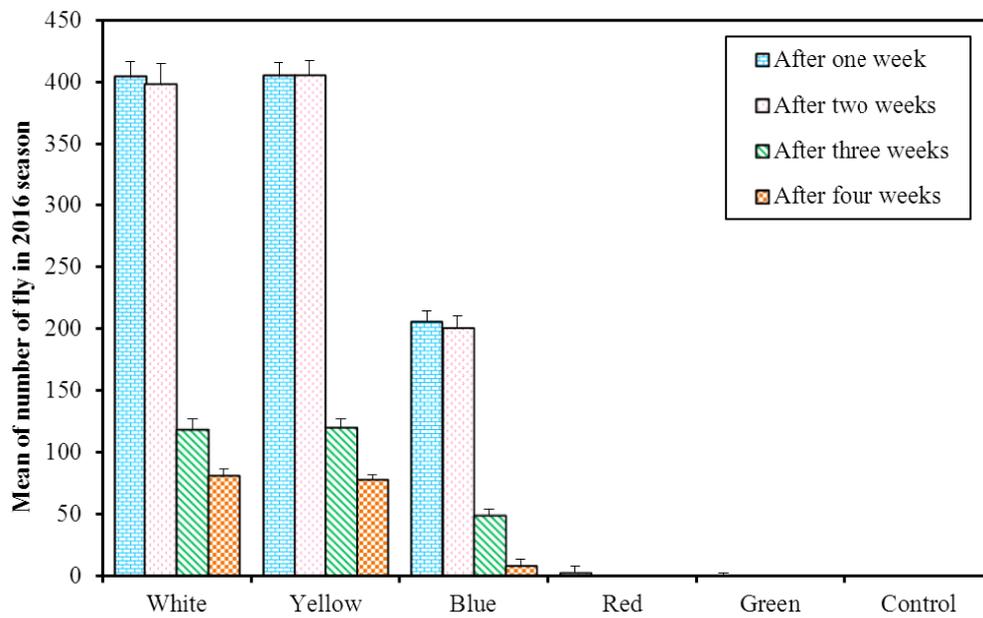


Fig. (2): Comparison between the different color of traps according to number of fly in 2016 season (n = 3)

Table (2): Comparison between the different treatment according to weight of seed in 2015 &2016 seasons (n = 3)

Treatment	Weight of seed by gm/plot				t	p
	2015		2016			
	Mean \pm SD.	%Ch.	Mean \pm SD.	%Ch.		
White	850.0 ^a \pm 4.50	\uparrow 52.55	820.7 ^a \pm 27.14	\uparrow 52.07	1.847	0.138
Yellow	848.9 ^a \pm 4.32	\uparrow 52.35	792.6 ^a \pm 59.42	\uparrow 46.86	1.635	0.242
Blue	619.4 ^b \pm 7.20	\uparrow 11.16	613.4 ^b \pm 14.51	\uparrow 13.66	0.649	0.552
Red	534.5 ^c \pm 12.68	\downarrow 4.07	535.2 ^c \pm 4.82	\downarrow 0.8	0.081	0.939
Green	564.5 ^c \pm 10.19	\uparrow 1.31	547.8 ^{bc} \pm 8.96	\uparrow 1.5	2.123	0.101
Control	557.2 ^c \pm 19.74		539.7 ^{bc} \pm 11.64		1.322	0.257
F	525.594*		65.770*			
p	<0.001*		<0.001*			

Data was expressed by using mean \pm SD.

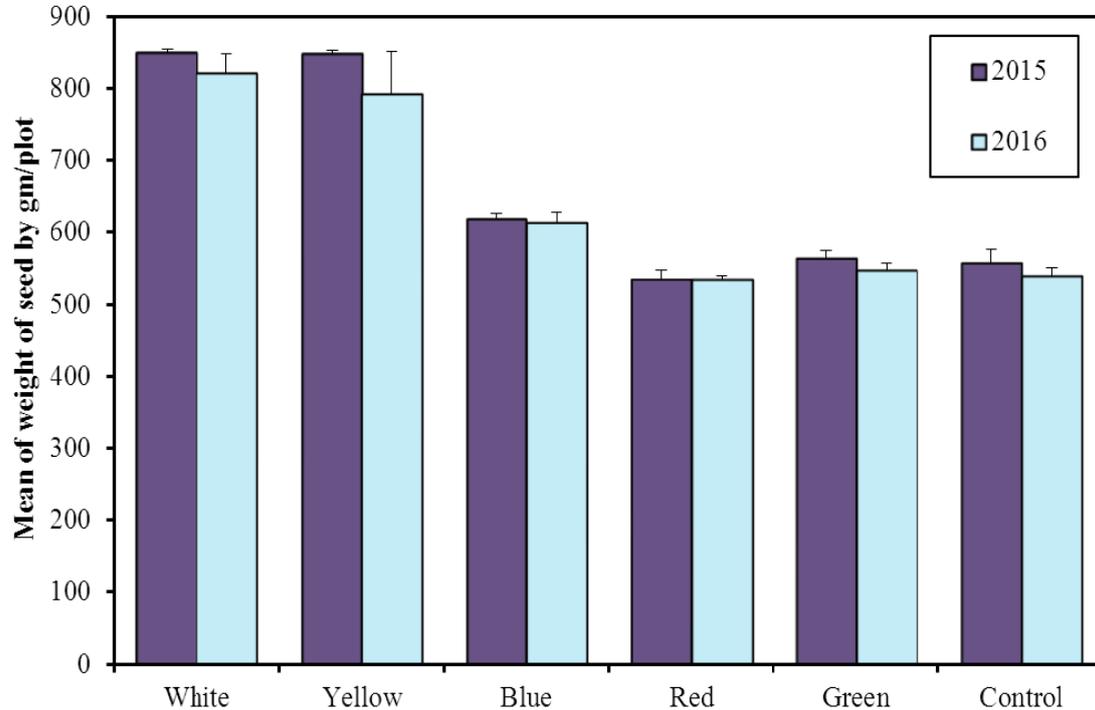
t, p: t and p values for **Student t-test**

F: F value for **ANOVA test**, Sig. bet. grps was done using Post Hoc Test (Tukey)

Different superscripts are statistically significant at $p < 0.05$.

*: Statistically significant at $p \leq 0.05$

%Ch.: Percent change from control

**Fig. (3): Comparison between the two seasons according to number of fly (n = 3)**

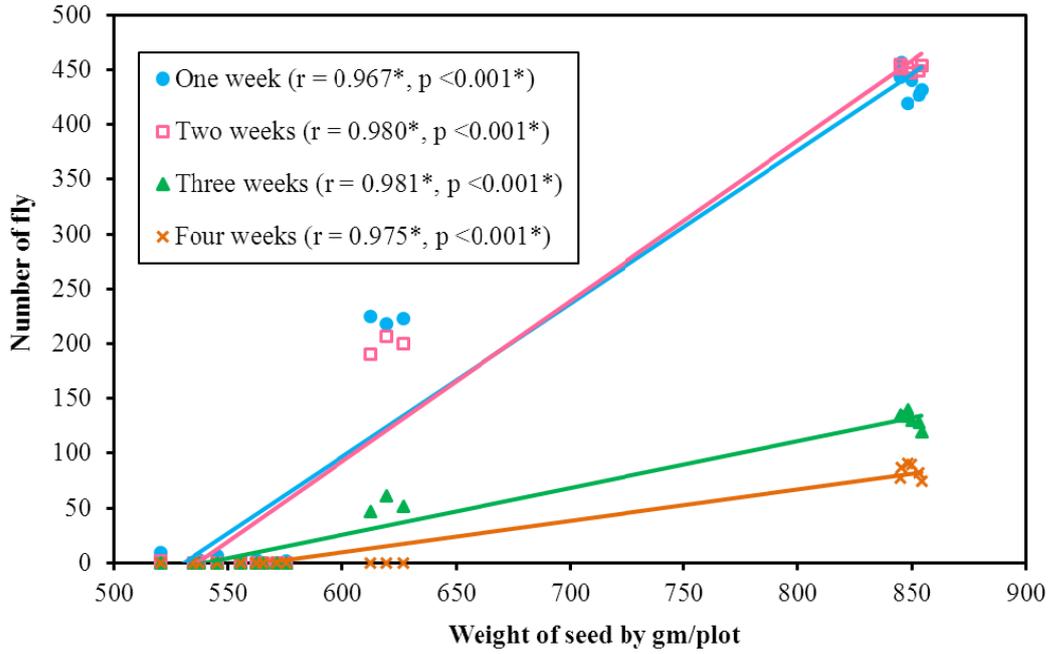
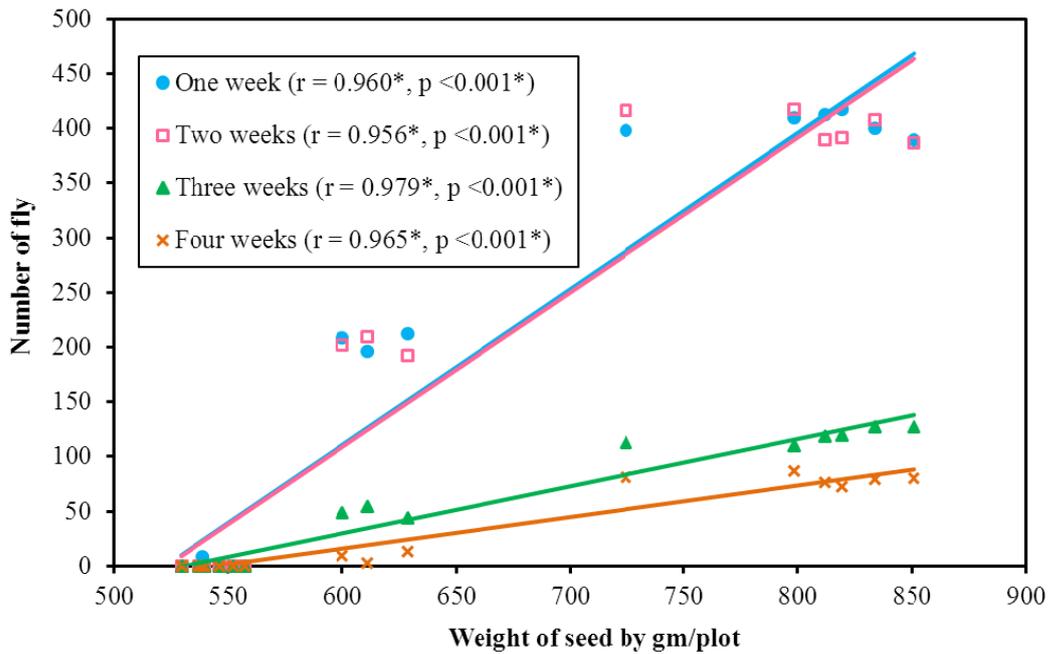


Fig. (4): Correlation between weight of seed and number of fly in 2015



Fig, (5): Correlation between weight of seed and number of fly in 2016

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ARABIC SUMMERY

مكافحة ذبابة ساق فول الصويا باستخدام المصائد اللونية في حقول فول الصويا

حنان الفى

معهد بحوث وقاية النبات – مركز البحوث الزراعية

اجريت هذه الدراسة بالمزرعة البحثية لمحطة بحوث النوبارية خلال الموسمين المتتاليين 2015، 2016 لزراعة فول الصويا حيث تم استخدام خمس مصائد لونية لدراسة تأثير اللون على جذب ذبابة ساق فول الصويا واستخدم في ذلك المصائد اللاصقة ذات الالوان التالية (ابيض – اصفر- احمر اخضر- أزرق) وكان للمصائد البيضاء والصفراء تأثير كبير في الحد من اضرار الاصابة حيث اتضح ذلك من زيادة محصول البذرة عن الكنترول بنسبة 52.3% ، 49.6% على التوالي كمتوسط للموسمين مما يعنى ان استخدام هذه المصائد نجح في تقليل الضرر الناتج من الاصابة . كما اعطت المصائد الزرقاء تأثير منخفض بينما لم تؤثر باقى المصائد نهائيا في جذب الحشرات الكاملة .