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COMPARATIVE EFFICACY OF DIFFERENT TRAP DESIGNS FOR CONTROLLING THE ORIENTAL HORNET WASP, *Vespa orientalis* L. IN APIRAY AND DATE PALM ORCHARD.

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ABSTRACT

The present study was conducted at Kafr El-Sheikh governorate, Sakha district, throughout the peak of the oriental wasp, *Vespa orientalis* L. during seasons of 2011 and 2012.

The efficacies of a modified Abou El-Enain traps with different height (0.6, o.85, 1.15 and 1.50 m) and new trap desin, wooden shish window traps were evaluated in an apiary and date palm orchard.

The obtained results revealed that shish window trap significantly attracted more numerous hornet wasps than those captured by using all heights of modified Abou El-Enain trap.

The oriental wasp, *V.orientalis* population was relatively higher in the second season than those captured in the first one. On the other hand, the weekly average number of the hornet fluctuated all over the experimental period in the apiary and date palm orchard.

Relatively higher numbers of the honey bee, Apis mellifera were caught in the modified Abou El-Enian trap, especially at 0.6 m. On the contrary, no catches of honey bee were recorded using wooden shish – window trap in both seasons.

INTRODUCTION

Wasps are predatory–carnivorous insects feeding mainly their brood with animal proteins (insects,pieces from fresh or spoiled meat and fish) while the adults are fed with carbohydrates (nectar, honeydew and ripe fruits).

The Oriental hornet (*Vespa orientalis*) is prevalent throughout the countries of the Mediterranean basin and also in the Near East. It can cause intense damages in apiaries, places where they can find the best combination of proteins from animal origin (bees and larvae) and carbohydrates (nectar and honey redatory carnivorous insect present in south Europe, Asia and North Africa. It occurs wherever water and insect prey are available throughout the summer and autumn seasons. It causes considerable damage to bee hives in late summer and autumn, when their colony sizes are peaking for the season (Tzanakakis and Katsogiannos, 1998; Ifantidis, 2003; Wegner and Jordan, 2005). At first they attack the weak bee colonies, which are the most defenseless, and then the damages are extended to the healthier ones(Ifantidis,2003). A part from the damages in the bee hives, the wasps constitute a particular problem for food industries and bother in habitants of urban areas (Day and Jeanne,2001; Wood *et al.,* 2006).

Various methods have been used based on the use of traps with insecticides to lure the oriental wasp. These traps are known to be effective for many species of social wasps (Landolt *et al.,* 2000; Reed and Landolt, 2002; Wegner and Jordan, 2005), also baits soaked with stomach insecticides have been used. In this case, the adults become victims but before they are killed they transfer the poisoning insecticide to the honey bee brood (Sackmann *et al.,* 2001).

Therefore, the objective of this study aimed to compare the efficacy of different traps design free from insecticides and chemical substances.in order to control *V. orientalis* adults in date palm orchards, and an apiaries

MATERIALS AND METHODS

Experimental traps:

A modified Abou-Enain(1999) trap:

This type of trap consistes of wooden box made of wood and wire screen with four different diameters as follows:

a: 45x45x30 cm b: 45x45x45 cm

c: 45x45x85 cm c:45x45x120 cm

At the bottom of the box a wire net had been adjusted with gaps of 0.2 cm in diameter. The net was placed in a way that creats a 25 cm tall cone up. The cone led up to a hole of 2 cm in diameter. On the top of the box a plastic queen excluders is fixed to allow the drifting bees pass through (Fig.1a)

The base of the trap stead 30 cm from the ground with the help of pieces of wood placed at the four corners. The bait (sugar syrup) is placed on the bottom and in the centre of the box. The bait attracted the wasp entering from the gaps of the box. The insects fly upwards, in their attempts to escape it passed through the wire cone into the area within the box they are it was trapped.

The new trap (Wooden – shish window trap):

The new experimental trap consistes of two wooden boxes placed one over the other (figure, 1b). The upper box was made of wood with dimensions of 30x30x30 cm covered with fine meshed screen to form an efficient, economical trap. The lower box is made of wooden bars – like window shish at three sides of the box. At the bottom part of the lower box ,a wire net is adjusted with gaps of 0.2 cm in diameter. The net is placed in a way that created a 25cm tall cone up (as previously mentioned). The base of the trap stood 4-5 cm from the ground with the help of pieces of wood placed at the four corners. The bait was placed on the bottom and in the centre of the lower box as previously mentioned.

Wasps enter through Shish slots to get the bait, then go towards the overhead skylight showing through the window-screen top, then become trapped between the cone and box space. A door in the fourth side of the box was opened for ease in removing dead wasps. The trap is placed on the top of open Langstroth brood box hold over hive stand..

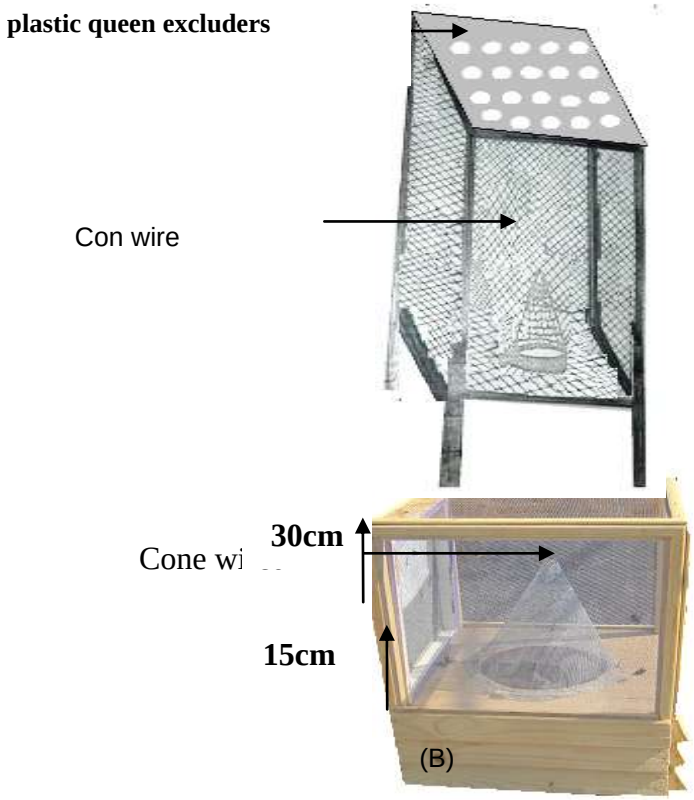

Figure 1. The pattern of the experimental trap:
(A) A modified Abou-Enain trap(1999)
(B) Wooden-window shish trap

Experimental conditions:

The present experiments were conducted at Sakha district ,Kafr El-Sheikh Governorate, throughout two successive hornet peaks during September –October of 2011 and 2012 seasons. Three traps of each design were distributed at random in the apiary and in date palm orchard.

Sugar syrup was used as a bait, and the time of the bait placement was early in the morning (Bacandritsos *et al.,* 2006). The baits were changed regularly (every 2-3 days). Samples were collected weekly and the hornets attracted and caught within the given traps were collected and counted.

RESULTS

Efficacy of the trap in the apiary:

Catches of the oriental hornet wasp,*Vespa orientalis* L.by using a modified Abou EL-Enain trap data are summarized in Table (1).

The trap catch at 1.15 m height lured higher number of the wasps with significantly differences than those fixed at 0.60, 0. 75 and 1.50 m above the ground in all periods of investigation.

As shown in Table 1, in the first and second seasons, trap catch at 1.15 m collected with an average 199.5 and 221.5 individuals /week/trap followed by those fixed at 1.50m (172 and 204.5 wasps/week/trap), in the first and second seasons, respectively. However, the weekly average numbers of captured wasps/trap in the first season were181.3±17,163±16.7,212.3±15.1,241.3±ab.and 199.7±19.7 individuals.While, in the second season (2012) the weekly average numbers were relatively higher(204.7±8.5,146±7, 211.7±14.3, 316±8.2 and 221.7±8.5 individuals/trap at the. 1st , 2nd , 3rd , 4th and 5th weeks, respectively(table 1).

The wasps exhibited the lowest preferability to 0.60 m trap height, however only 60.3and 58.2 individual/trap/week were lured in both seasons,2011 and 2012seasons,respectively. The weekly average number of captured wasps/trap was low in the first (69.33±13.3, 69±21.1, 57.3±16.6 , 45.7±14.8 and 60.3±10.7)and second seasons(. 61.3±24 , 73.7±7.2, 68.7± 4.5, 61.7 ±10 and 58.3±1.5 individuals) at the. 1st , 2nd , 3rd , 4th and 5th weeks, respectively).

In general, it could be concluded that catches in a modified Abou El-Enain trap was significantly influenced by trap height.

With respect to window shish trap, as shown in table 1, the obtained data obviously indicated that *V.orientalis* was highly captured using window shish trap in comparison with a modified Abou EL-Enain traps (with different heights) over all the experimental period. It collected averages of 188.3±1.2, 166.3±5.5 225.7±11.7, 284.3±10.7 and 217.3±8.2 (in season,2011). Also, in the second season (2012) significantly more individuals of wasps was lured by using the windows shish trap in comparison with the first season, however, the weekly average number was 215±19 163.7±20.6 , 244.3±9 352.7±9.5 226.3±20.6 individuals / trap/week at the. 1st , 2nd , 3rd , 4th and 5th weeks, respectively).

In general, the above results obviously show that catches in the trap significantly influenced by the trap height and design. On the other hand, *V.orientalis* population was relatively higher in the second season than those in the first one.

Table (1): Weekly average number of attracted wasps / trap to different height of a modified Abou El-Enain(1999) and window shish trap design , in apiary at Kafr El-Shik Governorate during September – October , 2011 (A) and 2012 (B) seasons.

Sampling date	Season	Modified Abou El-Enain trap				New Window shish trap	L.S.D. (p=5%)
		Trap height					
		0.60 m	0.75 m	1.15 m	1.50 m		
3rd week of	2011	69.33±13.3c	140± 15.1 b	181.3±17 a	165±19 ab	188.3±1.2 a	26.7
Sept.	2012	61.3±24 c	184.3±13.7b b	204± 8.5 ab	184.3±4.9 d	215±19 a	28.1
4th week of	A2011	69±21.1 c	123± 11.5 b	163± 16.7 a	137. 7±4.5b	166.3±5.5 a	21.7
Sept.	2012	41.3±12.01d	126±7 c	154.3±27.5ab	143.7±20.6b	173.3±7.2a	16.55
1st week of	2011A	57.3±16.6 d	150± 16.7c	212.3±15.1ab	194. 7±7.1b	225.7±11.7a	26.9
Oct.	2012	68.7± 4.5 d	139.7 ±13.6c	211.7±14.3ab	190.3±12.5 b	244.3 ±9 a	23.0
2nd week of	2011A	45.7±14.8 c	175±11.3c	241.3±4.7ab	191.7±54.6 bc	284.3±10.7a	27.84
Oct.	2012	61.7 ±10 e	195.3±7.1d	316±8.2 b	299.7±10.8 c	352.7± 9.5 a	7.7
3rd week of	A2011	60.3±10.7 d	147±11.3 c	199.7±19.7a	172.3±3.8 b	217.3±8.2 a	21.0
Oct.	2012	58.3±1. 5 c	156.3±39.9 b	221.7±8.5 a	204.7±8.5 a	226.3±20.6a	45.8
Genera l	2011A	60.3	147	199.5	172	216.3	
mean	2012	58.2	160.3	221.5	204.5	236.9	

Efficacy of the trap in the date palm orchard:

As shown in Table 2 the oriental hornet wasp, *V. orientalis* in date palm orchard exhibited similar trend of attractiveness to the tested trap heights of a modified Abou EL-Enain trap and windows shish traps as in apiary.

The new trap (widow shish trap) collected significantly more individuals of *V. orientalis* than any of the other tested heights of modified Abou EL-Enain traps (Table,2). However, the weekly average numbers of captured wasps/trap in the first season were 129.3±7.6,130.0±5.2,204.7±5.5,259.7±3.1and181.0±12.3individuals.
While, in 2012 season, the weekly average numbers were relatively higher(184.3±4.2,144.0±25.5,179.3±28.3,289.7±15.0and190.3±17.0 individuals/trap at the.1st, 2nd, 3rd, 4th and 5th weeks, respectively). With respect to modified Abou EL-Enain trap (Table,2), more numerous individuals were lured at 1.15 m height with significantly differences than those fixed at 0.60, 0. 75 and 1.50 m above the ground all over the period of investigation (in both seasons).

In the first season(2011), the weekly average number of captured wasps/trap fixed at 1.15 m in the date palm orchard were 125.0±10.0 , 137.7± 7.0 , 212.7± 10.9, 236.7±16.6. and 178.0±20.8 individuals. While, in season,2012 the weekly average numbers were relatively higher (139.7±11.9, 148.3±8.1 198.3±21.0, 252.7±10.3 and 185.0.7±7.0 individuals) at the. 1st , 2nd , 3rd , 4th and 5th weeks, respectively.Also, the hornet wasp in the date palm orchard showed the lowest preferability to the trap fixed at 0.65 m height (Table,2).

Statistical analysis indicated that the influence of height is high with modified Abou EL-Enain trap. So, it could be concluded that trap catches was significantly influenced by trap height and design, and *V.orientalis* population was relatively higher in the second season than the first one.

Table (2): Weekly average number of attracted wasps / trap to different height of a modified Abou El-Enain(1999) and window shish trap design , in date palm orchard at Kafr El-Shik Governorate during September – October , 2011 (A) and 2012 (B) sasons.

Sampling date	Season	Modified Abou El-Enain trap				New Window shish trap	L.S.D. (p=5 %)
		Trap height					
		0.60 m	0.75 m	1.15 m	1.50 m		
3rd week of Sept.	2011	46.7± 11 d	80.7±14 c	125±10 a	101.3± 4.7 b	129.3±7.6 a	18.2
	2012	54±10 b	127.3±13.3a	139.7±11.9a	136.3±14.6a	184.3±4.2 a	23.9
4th week of Sept.	2011	50± 9 c	93±12.3 b	137. 7± 7.02a	122.3± 9.5 a	130±5.2 a	18.2
	2012	48.3±5 c	97.3±6.7 b	148.3 ±8.1 a	135.3±6.5 a	144±25.5 a	16.8
1st week of Oct.	2011	40±4.4 d	106±13.1 c	212. 7±10.9a	189.7 ±11.2b	204.7±5.5ab	16.3
	2012	65±3.6 c	140±4.6 b	198.3±21 a	193.7±8.7 a	179.3±28.3 a	29.3
2nd week of Oct.	2011	26.7±3.2 d	136.7±11.1 c	236. 7± 16.6a	220.7±3.8 b	259.7±3.1a	17.1
	2012	37.7±4.9 d	155±40.4 c	252.7±10.3ab	238.7±28.3 b	289.7±15 a	48.6
3rd week of Oct.	2011	41±206 d	104±5.6 c	178±208 a	158.7±9.4 b	181±12.1 a	13.97
	2012	51.3±4.9 c	130±9.8 b	185±7 a	176±3.6 a	190.3±17 a	16.1
Grand mean	2011	40.9	104.1	178	158.5	180.8	
	2012	51.2	129.9	184.8	176.0	190.3	

Comparative efficacy of modified Abou El-Enian trap (at height 1.15 m) and wooden shish trap in capturing on the oriental hornet wasp:

To compare between the efficacy of the best height (1.15 m) of modified Abou El-Enain trap and the new trap wooden shish window, the general mean of the weekly captured *V. orientalis* workers and the honey bee*, Apis mellifera* were counted and illustrated in Figures(2 and 3).

efficacy of the traps on *V. orientalis* population:

In three modified Abou EL-Enain trap (at height 1.15 m) placed in apiary from the first to the last week of investigation period (September – October, 2011 and 2012 seasons), approximately 2978 and 3245 individuals of V. *orientalis* workers were caught in the first and second seasons. Also, 2670 and 2712 hornets were captured in date palm orchard in 2011 and 2012 seasons,respectively.

In respect to the wooden – shish-window trap: The trapping apparatus is more effective in collecting *V. orientalis*. However, in three traps over the entire experimental period,3323 & 3575 workers were trapped in apiary and 2772 & 2855 individuals in date palm orchard in the first and second seasons, respectively.

As shown in Figure,2 the grand means of captured hornet / trap/ week, over all the entire experimental period in apiary were 198.5 and 221.5 individuals in the first and second seasons using modified Abou EL-Enain trap (at height 1.15 m) .While, using wooden shish window trap 216.3 and 238.3 individuals were lured in 2011 and 2012 seasons,respectively Statistical analysis indicated that wooden shish window traps collected significantly high number of *V. orientalis* in comparison with the modified Abou EL-Enain trap, in both seasons.

In date palm orchard (Figure, 3): wooden shish trap collected relatively higher number of *V. orientalis* than the modified Abou EL-Enain trap in both seasons,but with no significant differences.

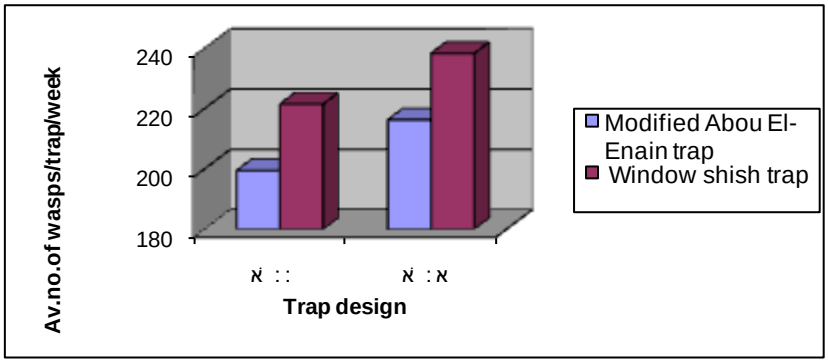

Fig.2: Grand mean number of attracted *Vespa orientalis* L.adults/ trap/week to modified Abou El-Enain trap (at 1.15 m height) and wooden shish window trap design hanged in apiary (during September-October 2011 and 2012,seasons (L.S.D.(p=5%)=17.4 and 15.2 for 2011 and2012 seasons).

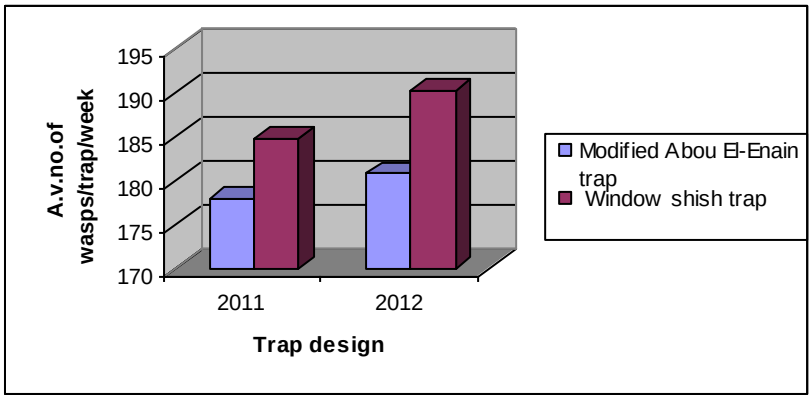

Fig.3: Grand mean number of attracted *Vespa orientalis* L.adults/ trap/week to modified Abou El-Enain trap (at 1.15 m height) and wooden shish window trap design hanged in date palm orchard during September-October 2011 and 2012,seasons (L.S.D.(p=5%)=15.9 and 25.6 for 2011 and 2012 seasons).

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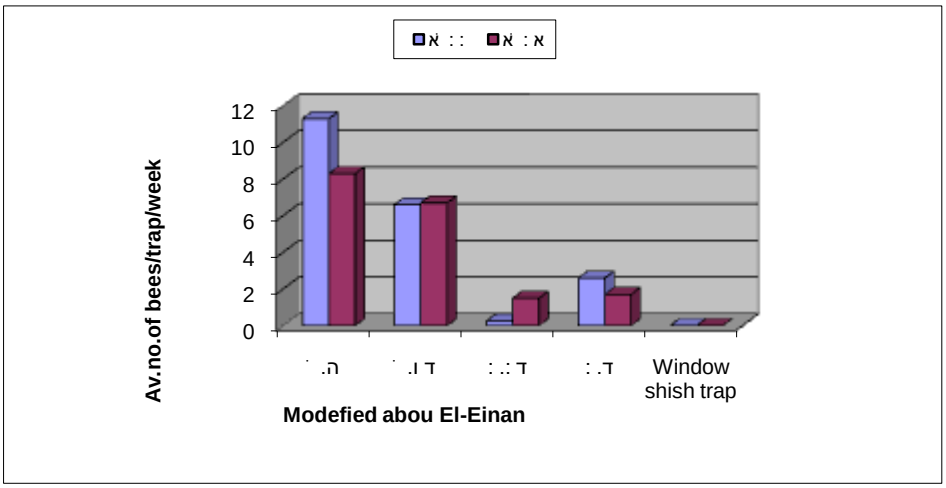
efficacy of the traps on *Apis mellifera* population:

Catches of the experimental traps to honey bee are illustrated in Figure, 4.

As seen in Fig. 4, the obtained data indicated that modified Abou El-Enian traps (at 0.6, 0.75 and 1.50 m) captured relatively high number of honey bee, especially at 0.6 m. However, at 0.6, 0.75 and 1.50 m the weekly average numbers of lured bees were 11.3±1.2, 6.6±0.5 and 2.6±0.4 (in season, 2011). In the second season (2012) they were 8.3±1.2, 6.7±0.5 and 1.7±0.5 individuals, respectively. While, trap fixed on 1.15 m height of the ground (Fig. 4) very few number of honey bee in the first (0.25±0.4) and second seasons (1.5±0.6 individuals).
On the contrary, no caches for honey bee were recorded using wooden shish – window trap (Fig.4) in the first and second seasons.



Figure(4):Weekly average number of attracted honey bee, *Apis mellifera l* trap to different height of a modified Abou El-Enain(1999) and wooden shish window trap design , in apiary at Kafr El-Shik Governorate during September – October , 2011 and 2012 seasons (L.S.D.(p=5%)= 088 and 0.76 for 2011 and 2012 seasons).

DISCUSSION

The results of this study reveal that the wooden-shish trap design was the best trap for the *V. orientalis*. This type of trap was closed and the insects had access to the bait indirectly in contrary to the other traps (modified Abou El-Enian traps) in which the bait was outside . In the second year of the experiment the numbers of trapped wasps were relatively higher than in the first one. The fluctuations of population densities of wasps may occur over one to many years (Edwards, 1980) and depends on various factors such as developmental strategy, reproductive success, distribution of colonies, dispersal of queens and mortality factors (Archer, 1980 and Bacandritsos *et*

al., 2006). The average numbers of *V. orientalis* wasps trapped, fluctuated from the first to the fifth weeks of each experimental period . According to Bacandritsos et al.(2006) this may represent the effect of trapping on populations sizes and suggests that trapping can be used to control the wasps populations.

The obtained results obviously showed that catches in the modified Abou El-Enian trap were significantly influenced by the trap height. However, the efficacy of the trap at 0.6 m was the lowest of all. In addation, the above results show that catches in the trap was significantly influenced by the trap design. Similar conclusion was obtained by Abdel-Kareim, 2008.

So, the use of the wooden-shish window trap may be an efficient solution for controlling the wasps that invade bee hives and date palm trees during summer in Egypt

Because of the wooden- shish window trap collected more numerous number of hornet wasps than modified Abou El-Enian trap in apiary and date palm orchard, in addition, there was no chance for honey bee, *A. mellifera* caches all over the period of investigation and all types of traps that have been studied are not based on the action of some insecticide that might lead to the contamination of the environment. So,. It could be concluded that shish window trap not only used for detecting the hornet wasp population swarming activity but also could be incorporated in an integrated management control program of this pest.

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مقارنة فعالية تصميمات مختلفة من المصائد لاصطياد الدبور الشرقي في المناحل وبساتاين نخيل البلح

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قد اجريت هذة الدراسة في محافظة كفر الشيخ وقت ذروة تعداد الدبور الشرقي في الفترة من سبتمبر- اكتوبر خلال موسمي 2011-2012

تم تقيم فعالية ارتفاعات مختللفة (6 و--75 و--15 و1--50 و1

لمصيدة ابو العنين التي تم تعديلها ومصيدة جديدة سميت شيش النافذة اظهرت النتائج المتحصل عليها ان مصيدة شيش النافذة جذبت بشكل ملحوظ عدد وفيرا من تلك الدبابير بالمقارنة بالارتفاعات المختلفة لمصيدة ابو العنين المعدلة وقد اوضحت الدراسة ان تعداد الدبور الشرقي كان اعلي نسبيا في الموسم الثاني مقارنة بالموسم الاول-كما سجلت تغيرات عددية في تعداد الدبور من اسبوع لاخر خلال الفترة التجريبية في المنحل وبستان النخيل

عند استخدام مصيدة ابو العنين في المنحل تم تسجيل أعداد من نحل العسل خاصةعندما وضعت المصائدعلي ارتفاع 6 وم^2 من سطح الارض بينما لم يتم تسجيل أي فرد من نحل العسل باستخدام المصيدة الجاذبة ذات الشيش الخشبي

قام بتحكيم البحث

أ.د / لبيب محمود شنب — كلية الزراعة – جامعة المنصورة

أ.د / محمود رمزى شريف — مركز البحوث الزراعية