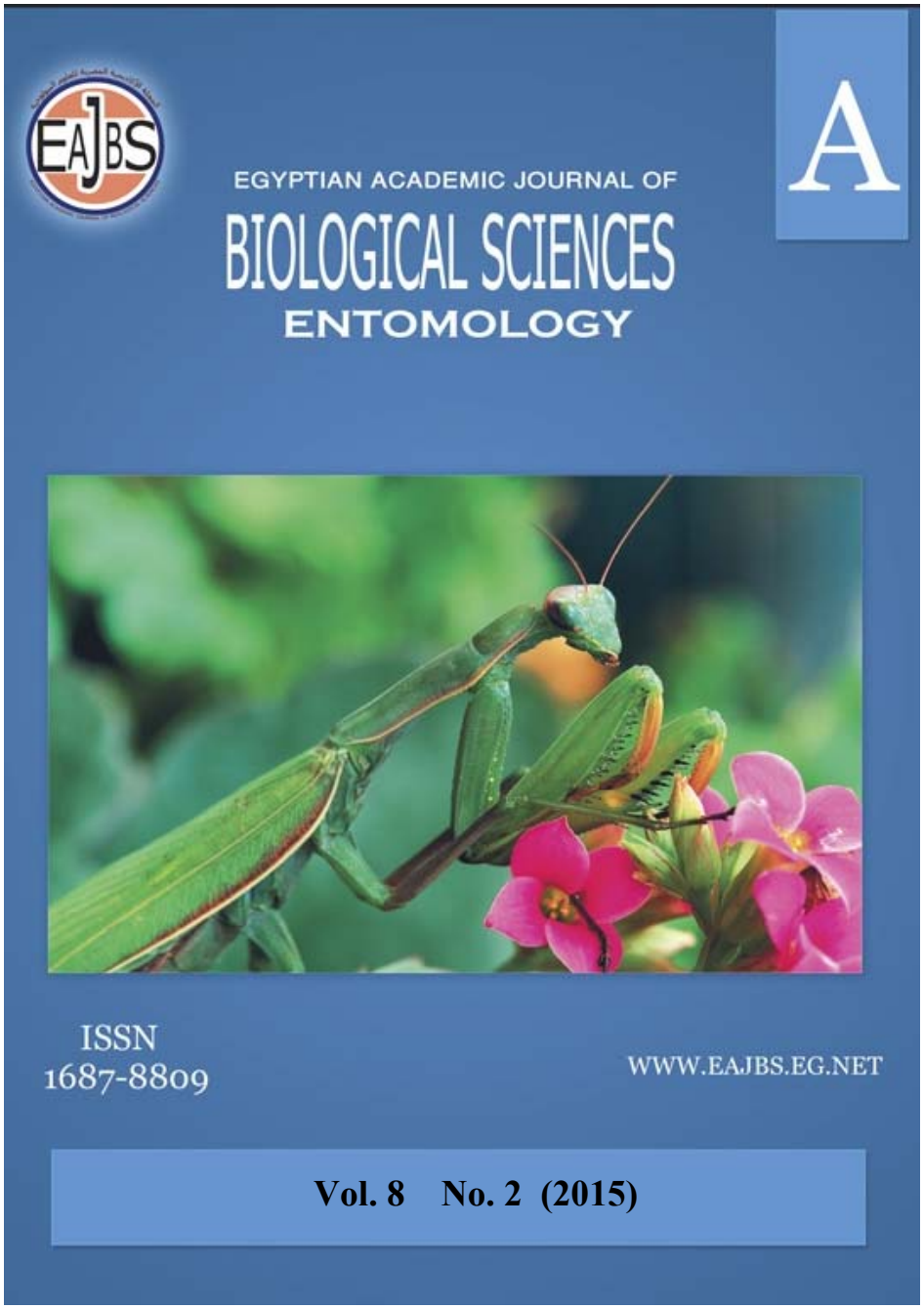

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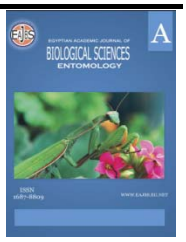

Effect of Different Coloured Light Traps on Captures and Controlling Wax Moth (Lepidoptera: Pyralidae).

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ABSTRACT

Field experiments were conducted to determine the attractive action of different colours (red, yellow, green, blue, white and black) to adult greater ,*Galleria mellonella* L. and lesser, *Achroia grisella* Fab., (Lepidoptera: Pyralidae) and to assess the influence of trap colour on their capture moths in plastic bottles baited traps. The results demonstrated, *Galleria mellonella* L. and *Achroia grisella* Fab. can distinguish between various colours , with regard to treatment colours light traps with red light, black, blue trapped significantly higher numbers of both greater and lesser wax moths followed by green, yellow and white traps. In conclusion, a trap with red and black light colour was the best attractive equipment for the wax moths. Where, the red colour traps caught the greatest number of moths, recording, 50.0% of the total moth captured, while the, white color traps caught the fewest number of moths recording only 23.27% with average 42.977% when the traps is far from the colonies by 6 meters only, while they were 50.94 and 3.7% with average 38.58 % when the distance between the colonies and light trap were 12 meters. Future research is recommended for better understanding of the effect of trap color on the diversity and abundance of non-target insects captured.

INTRODUCTION

Wax moths are serious pests of bees wax worldwide. It can be considered on extremely destructive pest that can destroy empty combs in a very short time (Burges, 1978 and Watkins, 2005) and it can cause huge problems for beekeepers by decimating storage wax combs. The moths neither cause a disease nor they parasites the individual honey bees, but they are responsible for tremendous destruction to the colony (Jedrusk *et al.*, 1999) larvae of Greater wax moth, *Galleria mellonella* (L.) and lesser wax moth, *Achroia grisella* Fab., are by far the most dander pest, especially to comb both in the weak hives and in storage. Weakened colonies by disease of other causes are particularly susceptible to invasion and take over by the larvae which cause damaging or destroying combs . These destructive combs become valueless, the spread of the moths is due to mainly to the interchange of combs and other equipment between infested and non- infested colonies, causing significant economic losses to apiarists (Morse, 1970). In addition, pollute the combs with faces, which may contain pathogenic bacteria and a mass of webbing, rendering what is left of the wax combs useless. (Atallah *et al.*, 1983 and Tucker, 2001).

Possibilities and various methods have been proposed for controlling wax moth of both for stored equipment and other treatments in the bee colonies i.e irradiation of gamma rays, will kill all development stages, but costs are high (Hornitzky,1986) and technical, physical, biological, microbial and chemical methods (Mabrouk,*et al.*, 2009). Now, Order Lepidoptera, known as butter flies and moths sucking nectar from plant.

Also, pest control strategy is mainly based on chemical pesticides ultimately environmental hazards arising fast. Highly toxic chemical pesticides, are being added in the agro-ecosystem, which are damaging for all living beings. This situation invites the attraction scientists to devise some non- chemical pest control technologies. Light traps have been successfully used against the insect pests (specially Lepidoptera insect pests).

These studies have been conducted to identify the most effective diversity and evaluate the most suitable trapping method for monitoring population wax moth.

MATERIALS AND METHODS

This experiment was achieved at the apiary of the Beekeeping research department at Dakhla Oasis, New Valley, Governorate in two sites (El-Reashda apiary and Mout City in Queen rearing station) during the two periods:

A- Active season of honey bee applying in the apiary for three months of bee research section starting from the first of April to the end of June 2014(13 weeks). B-In winter season (dearth periods) starting from the first of September till the end of November 2014 (on stored combs) in queen rearing station.

Culturing of wax moths:

Naturally infested old wax combs with greater and lesser wax moths were obtained from the apiary of beekeeping research department and were taken to a rearing in the empty hive boxes and kept in apiary under the weather condition at Dakhla Oasis (24 ± 5 °C. and 60 ±5% R.H.) till the adult emergence (Mabrouk *et al*., 2009)

Described trapping:-

Light trap:

Catcher were collect by Robinson light traps (Robinson and Robinson 1950), each of these was fitted with a 200 watt vapor lamp (Philips HPI-27236G/197).

The trap was operated once a week from sunset to sunrise through 6 months (April, May, June, Sept., Oct., and November). The trap catch was collected in the morning once a weak.

Field experiments:-

To fully understand the concept of this experiment, back ground knowledge of light and insects is essentially. There are seven color in the light Spectrum (red, orange, yellow, green, blue, indigo and violet), six of these were used in the experiment, these seven colors light, are known as visible lights (Henderson., 1996). Each light color has a different wave length and frequency. Red color has the longest wave length and lowest frequency and violet color has the shortest wave lengths and highest frequency. The wave length s of a visible lights range from 400-700 nanometers (White., 1980and Dichburn., 2001).

Two experiments were conducted to achieve this work, the first experiment was conducted to determine the attractive action of different colors,(red, yellow, green, blue , white and black).

In the first experiment two rows of traps were but randomized straight line in the front of the colonies of the apiary, two traps of each color were fixed horizontally.

The first row far from the colonies of 6 meters and the distance between the two rows was 6 meters also, while the distance between the traps in the same row was 1 meter (Taha *et al*., 2012).Wax moths (Greater and lesser) on each trap were counted once a week and removed from the traps, the counts were recorded and tabulated and analyzed.

In the second experiment, the same procedure was applied in the laboratory (on the stored combs) in queen rearing station, the old infested combs put in shading site in queen rearing stations, the catched numbers of adult wax moths was counted continuous weekly for three months (from the first of September till the end of November). The two experiments were conducted at night from 9-10 hours (Chraudhry., 1969). In the dark during year 2014. All six lights were arranged in line at 6 meters apart from each row to other to let the insect to orientate toward their most favorite light color .In the all traps, plastic Jar containing pieces of old wax and soapy water was placed under each light trap to attract and gather the insects .At the end of each week, insect material of each Jar was transferred to laboratory for identified the wax moths. (Greater and Lesser) most of the insects were identified by naked eye .The data were tabulated as percentages of insects attracted per light color and over all number of insects collected at each light.

statistical analysis:-

The resulted data were subjected to analysis of variance (ANOVA) and the means were compared by L.S.D. test at 0.05 level, using Duncan multiple rang test (Duncan,1955).

RESULTS AND DISCUSSION

The obtained results (Table1and illustrated in Fig.1) of the first experiment indicated that red and black light colour traps were the most attractive and greatest captures representing 50.0 % and 49.36 % in the first row followed by using blue and green light colours traps representing 49.24 and 47.37 % in the first row (far from the colonies about 6 meters) then they were 47.11% and 37.34% in the second row (far from the colonies 12 meters) of the total insects moths captured and different significantly from all other trap colours .While the yellow and white light color traps were the latest one which caught only 30.46 and 23.27%. On the other hand, they were 9.77 and 3.7% of the second row which far from the colonies of 12 meters of the total captures. Whereas there were no significant differences between the red and black colour trap, in the same time there no significant differences between blue and green light trap.

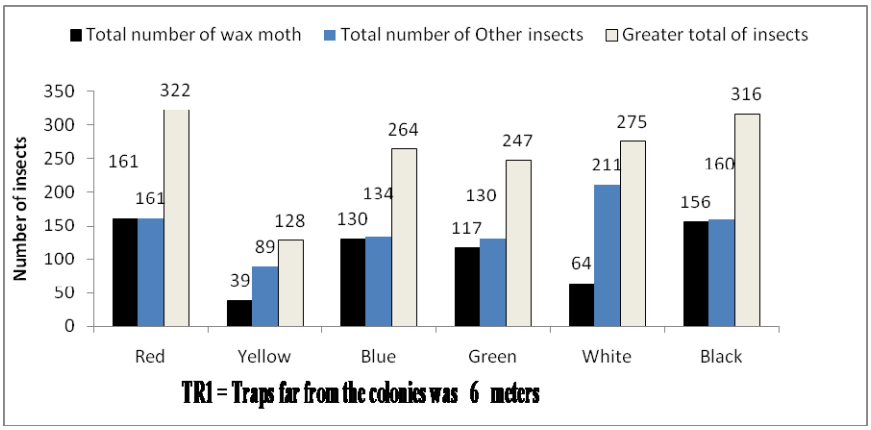
On the other hand, mean number of insects (wax moths and other insects) captured on light traps with different colour light sources exhibited a differences at all treatments.

These results clearly indicated that the high attractiveness of the insects was red light trap followed by black, blue, green, yellow and white light which consider colourless light (control) is the latest attractive on captured of the insects. Our results agreed with that obtained by Mu Mu Thein *et al*. (2011) they reported that a higher number of the Putative vectors were trapped on black, blue and yellow as compared to white, orang and colourless.

Table 1: Percentages of insects attracted at different colored light during night hours in the apiary from April, May and June months 2014 in El-Rashda apiary.

Light trap with color light	Treatment	Weekly mean number of wax moth: Gallaira	Weekly mean number of wax moth: Acharias	Weekly mean number of: Other insects	Total number of wax moth	Total number of Other insects	Greater total of insects	% percentage of wax moth /grand total
Red	TR1	10.14	2.3	12.4	161	161	322	50.00
	TR2	4.73	1.5	6.0	81	78	159	50.94
Yellow	TR1	2.6	0.4	6.85	39	89	128	30.46
	TR2	1.01	0.3	12.1	17	157	174	9.77
Blue	TR1	6.7	2.4	10.3	130	134	264	49.24
	TR2	3.4	0.4	4.23	49	55	104	47.11
Green	TR1	7.0	2.0	10.0	117	130	247	47.37
	TR2	2.4	0.0	4.0	31	52	83	37.34
White	TR1	3.41	1.5	16.3	64	211	275	23.27
	TR2	0.71	0.0	2.0	1.0	26	27	3.7
Black	TR1	8.7	3.3	12.3	156	160	316	49.36
	TR2	7.2	2.01	8.3	120	108	228	52.63
Grand total	TR1	_	_	_	667	885	1552	42.977
	TR2	_	_	_	299	476	775	38.58
L. S.D.0.05%	TR1	1.329	0.733	-	-	-	-	-
	TR2	0.874	0.423	-	-	-	-	-

TR1 = Traps far from the colonies was 6 meters
TR2 = Traps far from the colonies was 12 meters



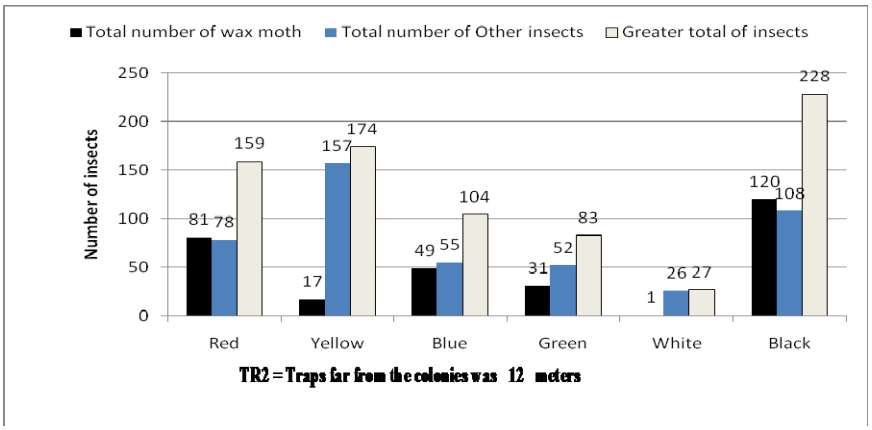


Fig. 1: The number of wax moth, other insects and total number of insects trapped at different color from April to June.

This study is the first report of using trap colour on capture of wax moths, trap colour has been reported to be significant factor affecting catches of several other moth species (Chider, *et al.*, 1979 and Michell *et al*., 1989 and Kinght and Fisher 2006).

In view of the above results, it is clear that wax moths can distinguish between red, black, blue, green, yellow, white colour ‘so the trap colour is attractive to moths (Ramamuarthy, *et al*., 2010) studied the different numbers of insects species caught by light traps with different light sources.

From the obtained data in (Table 2and illustrated in Fig. 2) the same trend was observed in the second experiment according to cumulative percentages of insect collection gathered per light trap the highest insect number of insect has been attracted to red colour flowed by black, blue, green, yellow and white colour traps then the percentages of wax moths of the total number of all insects were 52.14%، 52.42. 49.85,48.68, 35.26 and 26.76% respectively in the first row of light trap which far from the source of infested old combs by six (6) meters only while they were ranked 51.85, 41.17, 34.89, 34.40, 17.89 and 11. 98 % of red light trap, black, blue, green, white and yellow respectively, they, the lowest of insect collection gathered has been attracted at yellow colour light, while the highest numbers achieved in red colour light trap. (Melaughlin *et al*. (1975) found that, traps with low spectral reflectance were more effective in capturing the moths (Trichoplusla ni (Hubner) and Psuedopusia includes (walker). In the same direction (Knight and Miliezky 2003) mentioned that, traps with lower spectral reflectance, and longest wavelength especially at wavelength < 560 nm catch significantly more codling moths than white traps that have high levels of reflectance at wavelengths> 420 nm.

Table 2: Percentages of insects attracted at different colored light during night hours in the artificial infested of stored old combs in the queen rearing station from September, October and November 2014.

Light trap with color light	Treatment	Weekly mean number of wax moth		Other insects	Total number of wax moth	Total number of Other insects	Grand total of insects	% percentage of wax moth for grand total
		Gallaira	*Acharias*					
Red	**TR1**	**12.0**	**3.9**	**14.6**	**207**	**190**	**397**	**52.14**
	TR2	**5.55**	**2.0**	**7.0**	**98**	**91**	**189**	**51.85**
Yellow	**TR1**	**3.6**	**1.1**	**8.62**	**61**	**112**	**173**	**35.26**
	TR2	**1.5**	**0.5**	**14.7**	**26**	**191**	**217**	**11.98**
Blue	**TR1**	**9.73**	**3.5**	**13.3**	**172**	**173**	**345**	**49.85**
	TR2	**3.0**	**1.0**	**7.45**	**52**	**97**	**149**	**34.89**
Green	**TR1**	**8.0**	**3.4**	**12.00**	**148**	**156**	**304**	**48.68**
	TR2	**3.0**	**0.3**	**6.30**	**43**	**82**	**125**	**34.40**
White	**TR1**	**4.6**	**2.1**	**18.30**	**87**	**238**	**325**	**26.76**
	TR2	**1.0**	**0.3**	**6.0**	**17**	**78**	**95**	**17.89**
Black	**TR1**	**11.5**	**3.5**	**13.6**	**195**	**177**	**372**	**52.42**
	TR2	**5.0**	**2.0**	**10.0**	**91**	**130**	**221**	**41.17**
Grand Total	**TR1**	_	_	_	**870**	**1046**	**1916**	**45.40**
	TR2	_	_	_	**327**	**669**	**996**	**32.83**
L. S .D.0.05%	**TR1**	**1.891**	**0.605**	**-**	**-**	**-**	**-**	**-**
	TR2	**0.721**	**0.418**	**-**	**-**	**-**	**-**	**---**

TR1 = Traps far from stored old combs was 6 meters
TR2 = Traps far from stored old combs was 12 meters

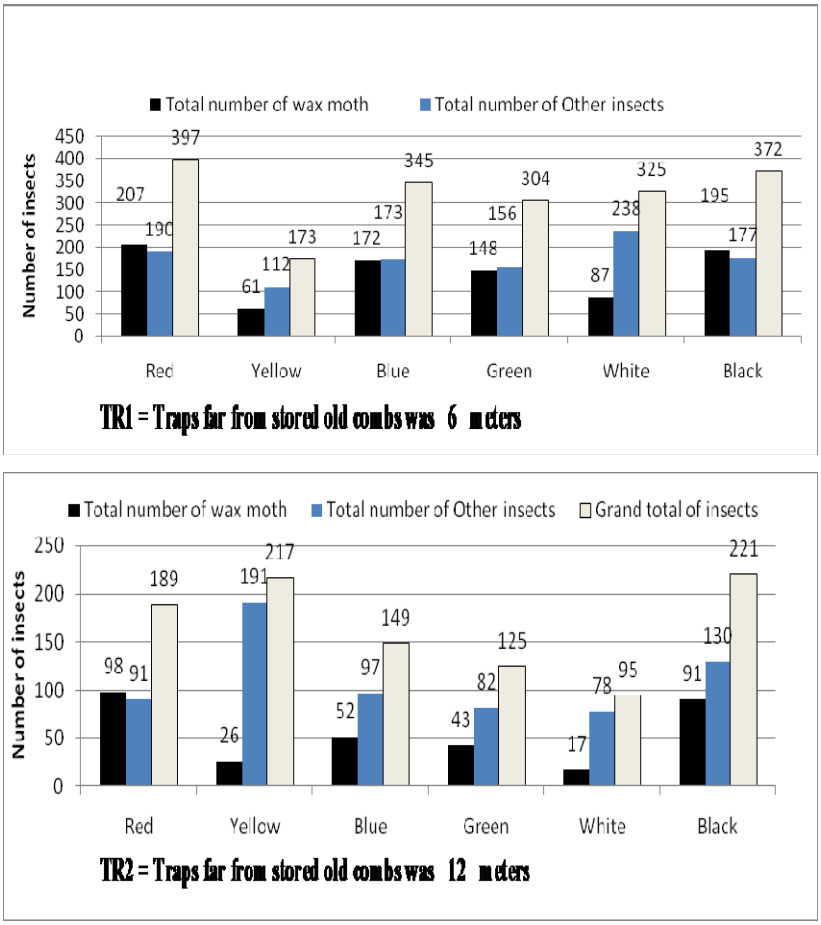


Fig. 2: The number of wax moth, other insects and total number of insects trapped at different color from September, October and November 2014.

The data collected during both the two experiments and have given similar results of insect orientation toward specific light colors, the total numbers of insects in the first experiment less than numbers of the second experiment, this indicate that in the first experiment in the apiary. The worker bees of strong colonies may be attack the pests and the all stages of wax moth from egg to adult which decreasing of insect population. while, in the second experiment the site and factors which affecting on the insect population were available then the old combs is one of the important factors of increasing the population of the wax moths.

In conclusion، red light traps in this study considered to be the most attractive color for monitoring and captured of wax moths (Taha *et al*. 2012) they reported that the red light had the longest of the wavelength 612.1 nm, this color catch the mean number 35.88, 17.58, 12.33 and 10.71of *Tuta absoluta* moths for trap colors (red, blue, green and yellow respectively.

REFERENCE

Atallah, M. A.; Abdel-Naby, A. A. and Mohamed, A. A. (1983): Duration of different developmental stages of the greater wax moths, *Galleria mellonela* L. under filed conditions in middle Egypt Proc. 5th Arab . Pesticide Conf., Tanta. Uni., Sept. 1: 104.

Burges, H. D. (1978): Control of wax moth, physical, chemical and biological methods, Bee world, 59(4) :129-138 .

Chaudhy, S. A. (1969): Flora of Lyallpur and the adjacent canal –colony districts . West Pakistan Agric.- Uni. Lyallpur, Pakistan.

Childers , S. H. ; R . I. Aollowey and D. K. Pollet (1979): Influence of pheromone trap color in capturing Peachtree borer and Peachtree males J. Econom. and Entomol, 72: 506-508.

Dancan, D.B. (1955): Multiple rang and Multiple F-test. (biometrics 111 : 1-24.

Degooyer, I. A.; Pedigo, L. P., and Rice, M.E. (1998): Development of sticky traps sampling techniques for potato leaf hoper adults. J. Agri. Ent., 15: 35– 37.

Ditchburn, R.W. (2001): Light. Encyclopedia Britannica. Retrieved July 10, 2001 from the World Wide Web www.britanica.com/eb/article?eu=119359&tocd=0 Henderson, Tom. (1996): "Color and Vision." The Physics Classroom. Retrieved July 11, 2001 from the World Wide Web. http: //www.glenbrook. k12.il.us/gbssci/phys/class/light/u1212a.htm

Hornitzky , M. (1986) : The use of gamma radiation in the control of honey bee infections . Australasian beekeeper. 88 (3): 55 – 59.

Jedruszuk , A. ; laere , O . van and wael . l. de . (1994): Can wax moth be a vector of Varroa disease? Bulletin of the Veterinary Institute in Puawy, 38(1): 40– 48.

Knight, A.l. and E. Miticzy (2003): Influence of trap color on the capture of Codling moth (Lipedoptera: Tortricidae) , Honeybees and non target flies . J. Entomol . Soc. Brit. Colombia, 100: 65-70.

Knight, A. and J. Fisher (2006): Increased catch of codling moth (Lepidoptera:Tortricidae) in semio chemical – baited orange plastic Delta – shaped traps, Environmental Entomology vol., 35 (6): 1597 – 1602.

Mabrouk, M. S. O.; Haggag . E. E. and Omran, N.S.M. (2009): Controlling the Greater and lesser wax moths using natural and chemical products J. Agrc. Sci. Mansoura. Univ., 34(1): 465 – 472.

Melaughlin , J.R., J.E.Brgdon,H.R.,Agee and E.R.Mitchell (1975) : Effect of trap color on captures of male Cabbage loppers and Soybeen loppers in doublecone phermone traps . J. of Georgia Ent, Soc, 10: 174-179.

Mu Mu , T . , Tasanee, J. andYupa , H. (2011) : Evaluation of colour traps to monitor insect vectors of sugar can white leaf phytoplasma . Bulletin of insectology 64 (supplement): S 117- S118, ISSN 1721-8861.

Morse, R . A. (1978): Honey bee pests , predators, and diseases . Cornell University Press Ithaca and London, 430 pp.

Ramamurthy , V. V.; Akhtar, M .S. ; Potankar , N. V.; Menon, P . ; Kumar , R. Singh , S . K., Ayri , S ., Parveen ,S ., and Mittal , V.(2010) : Efficiency of different light source in light traps in monitoring insect diversity – Manis Entomology and Zoology, 5 (1): 109 – 114

Robinson , H.S. and Robinson . P. J. M. (1950): Some note on the observed behavior lepidpotera in flight in the vicinity of light source with a description of a light trap designed to talk entomological sample (Ent. Gaz. I., pp, 3 – 20)

Taha , A . M.; Humam, B. H. Afsah, A. F. E. and Fatma, M . E l. Sharkawy (2012): Effect of trap color on capture of *Tuta absoluta* moths (Lepidoptera: Gelechiidae): International Jour. of Environ. Sci. and Engineering. 3: 43-48.

Tucker, J. (2001): Studies on Trichogramma evanescens for controlling way moth. Bee World, 39(4):99-108

Watkins, M. (2005): Control of wax moth, physical, chemical and biological methods. Amer. Bee J., 144 (3): 702.

White, E.G. (1989): Light trapping frequency and data analysis – a replay New Zeeland Entomologist, 12: 91– 94.

ARABIC SUMMERY

تأثير المصائد الضوئية المختلفة الألوان على اصطياد ومكافحة ديدان الشمع (رتبة حرشفيات الأجنحة : فصيلة البيراليدى)

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٢- كلية العلوم بالوادي الجديد قسم علم الحيوان والحشرات جامعة اسيوط.

اجريت هذه التجربة لتحديد مدي جذب الالوان المختلفة (الأحمر – االأصفر – االأخضر – الأزرق – الأبيض – الأسود) لديدان الشمع الكبيرة والصغيرة والتابعة لرتبة حرشفية الاجنحه فصيلة البيراليدي وكذا تأثير هذه المصائد الضوئية المختلفة الألوان علي اصطياد ديدان الشمع . وأوضحت النتائج المتحصل عليها من هذة الدراسة ان المصائد الضوئية ذات اللون الأحمر سجلت أعلي كفاءة في اصطياد وجذب الحشرات سواء ديدان الشمع او الحشرات التابعة للرتب الاخري حيث كانت النسبة المئوية % 50 لأعداد ديدان الشمع الكبيرة والصغيرة منسوبة الى المجموع الكلي للحشرات تلا هذه المصائدة في التأثير ذات اللون الأسود حيث بلغت النسبة المئوية % 49.36 و % 49.24 و% 47.37 و % 30.46 للمصائد ذات الألوان الأسود ، الأزرق ، الأخضر ، والأصفر علي التوالي بينما سجلت اقل كفاءة واقل جذب للحشرات المصائد ذات اللون الأبيض حيث كانت النسبة % 23.27 وذلك عندما ثبتت المصائد امام طوائف المنحل في صف واحد يبعد عن الطوائف بمسافة 6 امتار بمتوسط % 42.977. بينماكانت متوسط هذة النسبة اقل (% 38.58)عندما كانت المصائد علي بعد 12متر من طوائف المنحل واوضحت النتائج ايضا ان هناك سمترية للنتائج المتحصل عليها عندما صممت التجربة في المعمل على اقراص شمعية قديمة حيث سجلت النتائج أن المصائد ذات اللون الأحمر كانت افضل المصائد فى اصطياد ديدان الشمع والحشرات الاخري وكانت النسبة المئوية هى % 52.14 واقلها فى المصائد ذات اللون الابيض 26.76% علي بعد ستة امتار مع وجود فروق معنوية ما بين الوان المصائد وبعضها البعض .