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POPULATION FLUCTUATION OF THE RED PALM WEEVIL, *Rhynchophorus ferrugineus* (Oliv.), USING THE AGGREGATION PHEROMONE TRAPS, IN RASHID DISTRICT – EGYPT

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ABSTRACT

Population fluctuation of the red palm weevil, *Rhynchophorus ferrugineus* (RPW) was studied using the aggregation pheromone traps, during 2012-2013 in Rashid district. Fortnightly catches of the RPW showed that RPW existed all over the year and there are four peaks during the tested year 2012-2013, the mean of the total captured adults at the beginning of December 2012 was 6.40 adults/trap then it decreased gradually to record the lowest average of captured RPW adults (2.30 adults/trap) at 15th Jan. 2013, and it fluctuated to record four peaks the first (17.40 adults/trap) recorded at 15th April 2013, the second peak (12.80 adults/trap) recorded at 30th May 2013, the third and the highest peak (20.60 adults/trap) recorded at 15th July and the fourth peak (10.40 adults/ trap) recorded at 15th Sep. 2013 it is the last peak. The results showed that there was non-significant positive correlation between mean daily temperature and the population abundance of RPW, while there was a significant negative correlation between the means of daily relative humidity and the population abundance of the RPW adults during the tested year. The numbers of females attracted to aggregation pheromone traps were generally twice as that of males. The sex ratios of male to female were 33.4: 66.6 during the tested year 2012/2013. The results showed that the captured population of weevils in Eastern direction was the highest followed by South, center, and the least captured numbers recorded in West and North directions.

Keyword: Population fluctuation - Red palm weevil - aggregation pheromone - weather factors.

INTRODUCTION

Date palm (*Phoenix dactylifera* L.) is an important multipurpose tree. About 105 million date palms are grown in the Africa, Middle and South of America, Spain and Italy (Heselmans, 1997). The most important date palm cultivation zones are in North Africa, they were the prime source of income for about 10 million people (Zouine *et al*. (2005).The red palm weevil (RPW), *Rhynchophorus ferrugineus* (Coleoptera:Curculionidae)is the most destructive pest of the date palm in Egypt and Arab countries since its invasion coming from the east (Saleh 1992;Murphy and Briscoe 1999). Adults of the RPW are attracted to palm trees especially to wounded and soft tissues where eggs are laid. The hatched larvae tunnel into the trunk or the terminal bud leading directly to the death of the tree (Griffith 1987;Sivapragasam *et al*.,1990). Primary infestations always escape attention and symptoms may not become evident until extensive damage has already occurred. Each

infested tree may spread the infestation to other healthy trees(Hanounik *et al*.,2000) Males excrete aggregation pheromone that attract both sexes for food, shelter and egg laying. This pheromone is synthetically produced in Costa Rica and used in pheromone traps for monitoring the pest. The chemical composition of the pheromone is: 4-methyl-5-nonanol (9 parts) and 4-methyl-5-nonanon (1 part) (Sanchez *et al*., 1996; Faleiro et al., 2003). Despite the intensive efforts and the high costs of controlling RPW, it is continuously spreading everywhere and destroying the holy date palm tree. Management programs of RPW depend mainly on chemical insecticides (Girgis *et al*., 2002). Infested trees usually injected with chemical insecticides. Date palm orchards are sprayed periodically with insecticides for protection against the pest. The present investigation one year aimed to estimate the population fluctuations of RPW adults in infested regions using aggregation pheromone traps in date palm plantation.

MATERIALS AND METHODS

This work was carried out during December 2012 to November 2013 in Borg Rashid Village, Rashid District, Al- Behira Governorate - Egypt. Its aim was to study population fluctuation of adults of (RPW) *Rhynchophorus ferrugineus* (Oliv.) by using Pheromone traps. In the studied farms, pheromone traps designed and applied according to (Hanounik et al., 2000) in Arab Gulf countries.The pheromone trap consists of ten liter plastic container with three circular holes in the cover and six holes near the upper edge of side walls, Ferrugineus male aggregation pheromone containing 700 mg of the active ingredient Name P028 Ferroluree+,700mg lure ,consists of a mixture of 4-methyl 5 - nonanol and 4- methyl 5-nonanone (9:1pait purity of both components a 95% release rate 3-10 mg/day), Manufactured by ChimTica international S.A. Company, Costa Rica. Trade,) 5 L of water. The outer surface of the bucket was rough with plastic net (1-2 mm) to help the weevils cling to the trap and enter. The water was replenished every two weeks to keep sufficient moisture in each trap to avoid escaping of the adult and it helps the insects to survive. The pheromone was replaced every 2 months in summer and replaced every 3 months in winter. the distance between traps was 100 m and each trap was 4 m away from date palm trees (to avoid that any adult could missed the trap and lay egg on the palm tree) (Al-Saoud 2010) in the shade to avoid water evaporation. The traps were placed at ground level and attached to java tree stem at the height of 50 cm (aerial). Traps were put in the four cardinal directions (North, South, East, and West) and the center of the plantation. Traps were checked and trapped weevils were collected every two weeks. Trapped weevils were counted, removed, sexed and recorded every two weeks.

RESULTS AND DISCUSSION

1-Population fluctuation of *Rhynchophorus ferrugineus* attracted to pheromone traps.

Data tabulated in table (1) and illustrated by Fig. (1) Showed that

the adult *R. ferrugineus* existed and fluctuated all over the year with four peaks. The mean captured adult numbers of RPW was 6.40 adults (1.80 males + 4.60 females)/trap recorded at the beginning of Dec. 2012 then declined gradually to record the lowest mean number of captured weevils [2.60 adults (0.80 male +1.80 females)]/trap at 15th Jan.2013. The population showed four peaks throughout the tested season at 15th April, 30th May, 15th July and 15th Sep. 2013 (17.4, 12.8, 20.6 and 10.4 adults / trap) then it declined gradually to reach 7.40 adults/trap at 15th Oct. 2013 and it remained with the same rate until mid of November. The obtained results are in agreement with the findings of El-Shafi (2011) who indicated that emerging adults continue throughout the year, and stated that the lowest adults population was recorded during December and January. The population showed four peaks each year. Abdallah and Al- Khatri, (2003) also observed that RPW adults emerging continually throughout the year. The minimum number of insects was recorded during December and January. They mentioned in 1996, there were four peaks of emergence during March, May, July and October, where as in 1997 the peaks were recorded in April, May and September, In 1998, four peaks were recorded during April, May, August and October. These data insure the previous data and the same observation was obtained by Qin *et al* (2004) who found that the population monitoring of red palm weevil occurred in four peaks a year in the area of Wenchang, Hainan Province. On the other hand El-Sebaey (2003) in Egypt indicated that *R. ferrugineus* had two main active seasons annually. The first adult brood was observed in April and the second one was in November.

Fig. (1): Fortnightly numbers of *Rhynchophorus ferrugineus* attracted to aggregation pheromone traps in Rashid district during 2012/2013.

In addition, Abbas *et al.* (2006) reported that the population fluctuation of *R. ferrugineus,* using the aggregation pheromone traps, during 2000 and 2001 in the United Arab Emirates. The insect population increased gradually from January to reach its peak in March, April, or May. Saleh *et al* (2012) monitored two peaks of population abundance in Egypt; The first during October (8-10 weevils/trap) and the second during the last week of April to mid-May (3.38-4.75 weevils/trap).Total trapped reached 806 weevils throughout the season.

Table (1):Fortnightly numbers of *Rhynchophorus ferrugineus* attracted to aggregation pheromone traps in Rashid district during 2012/2013.

Inspection date	Average of RPW captured adult / aggregation pheromone trap			Mean	
	Male	Female	Total	Temperature (° C)	R.H. (%)
01/12/2012	1.80	4.60	6.40	18.97	76.20
15/12/2012	1.60	3.60	5.20	16.27	71.73
30/12/2012	1.40	2.80	4.20	15.13	73.33
15/01/2013	0.80	1.80	2.60	13.23	76.80
30/01/2013	1.00	2.20	3.20	13.77	74.93
16/02/2013	1.40	3.20	4.60	14.73	71.07
30/02/2013	2.20	3.80	6.00	15.27	72.33
16/03/2013	2.80	5.80	8.60	18.00	66.47
30/03/2013	3.40	6.20	9.60	17.83	63.33
15/04/2013	6.60	10.80	17.40	19.03	65.87
30/04/2013	3.80	7.40	11.20	20.32	61.29
17/05/2013	2.20	5.00	7.20	21.73	73.13
30/05/2013	4.80	8.00	12.80	24.93	64.27
16/06/2013	1.60	4.60	6.20	25.47	63.87
29/06/2013	2.00	3.40	5.40	26.13	72.87
15/07/2013	7.40	13.20	20.60	26.27	70.13
30/07/2013	2.80	5.40	8.20	26.90	70.93
15/08/2013	1.60	3.80	5.40	27.57	72.67
30/08/2013	2.20	3.20	5.40	27.83	71.00
14/09/2013	3.20	7.20	10.40	26.83	66.93
30/09/2013	2.40	5.00	7.40	25.43	66.87
15/10/2013	2.20	5.20	7.40	23.47	64.13
30/10/2013	1.80	4.60	6.40	21.70	67.33
14/11/2013	1.40	3.80	5.20	21.17	75.40
Total	62.4	124.6	187		
Mean ±S.D.	2.6±1.6	5.2±2.6	7.8±4.2	21.2±0.2	69.7±0.2
L.S.D at 5%	0.8	1.50	1.91		

The correlation between the weather factors (mean daily temperature & R.H. %) and the population abundance of RPW.

Data in Tables (2) showed the correlation coefficient between mean daily temperature and the population abundance of RPW was non-significant positive correlation where the correlation coefficient (r) value = 0.34 during

the tested year 2013, while the correlation between means of daily relative humidity and the population abundance of the RPW adults was significant negative correlation during the same tested year 2012 - 2013 where (r) value = - 0.5. These results is in harmony with the findings of El-Shafi (2011) who indicated that there was significant positive correlation between weather factor (mean daily temperature) and the population abundance of RPW during the two tested years. While relative humidity had negative correlation. Also the data are in agreement with Faleiro (2005) who found that Maximum temperature had a significant impact on the weevil activity in India while, the maximum temperature was positively correlated (r = 0.51) with weevil captures, In this respect, Krishnakumar and Maheswari (2003) mentioned that the infestation of RPW was significantly high during June, followed by that of September. The infestation was the least during February probably due to the higher temperature during summer season. Also, Huang *et al.,* (2008) in China indicated that the climate conditions had an obvious influence on the trapping effect of pheromone for RPW. The trapping population was significantly reduced in the conditions of low temperature. In addition, Abdallah and Al-Khatri, (2003) reported that there is an effect of the climatic conditions of maximum and minimum temperature and the Relative Humidity on the population fluctuation of RPW. Contrarily El-Sebaey (2003) found that there was no relationship between seasonal population in the field fluctuations of RPW and weather factors. El-Shafi (2011) indicated that there was significant positive correlation between average temperature and adult's population abundance of the RPW during the tested two years.

Table (2): the effect of temperature and relative humidity on the population abundance of RPW attracted to aggregation pheromone traps.

Factors		**r**	**R^2**	**S.E**
Temperature	Male	0.304	0.902	0.602
	Female	0.351	0.645	0.367
	Total	0.335	0.383	0.230
R.H.	Male	-0.478	-1.309	0.514
	Female	-0.524	-0.891	0.309
	Total	- 0.510	-0.539	0.194

r = simple correlation coefficient value
R^2 = simple regression coefficient value
R.H. = Relative Humidity. S.E = Standard error.

2- Sex ratio of *Rhynchophorus ferrugineu*s attracted to aggregation pheromone traps.

Data obtained in Fig. (2) illustrates that the sex ratio of captured adults using aggregation pheromone traps. The numbers of attracted females were generally twice as that of males in all moths of the tested year 2012 – 2013, and the sex ratios of male to female were 33.40: 66.60.

The results obtained are similar with those recorded by El-Sebaey (2003) in Egypt, reported that, female density was higher than male density and it constituted 52.8-57.35% of the total population in the field, Also Faleiro (2005) found that the weevil captures were female dominated and for every male weevil trapped two female weevils were captured Also Soroker *et al.* (2005) observed that the sex ratio of trapped adults during 3 years of study was significantly female-biased (similar to 2.5:1). Furthermore, A1-Saoud (2007) showed that the adults RPW were presented throughout the year, and the number of females was higher than the number of males. Jayanth *et al*. (2007) in India who mentioned that the pheromone traps were observed to catch significantly more numbers of females (sex ratio 1:1.99) and majority were virgins (45%), followed by gravid females (29%) that had not started laying eggs, indicating the potential of area- wide adoption of mass trapping in bringing down the population density of RPW. In Spain Sansano Javaloys *et al* (2008) found that during one year, the average number of trapped female was 2.5 times higher than the male's one El-Shafi (2011) indicated that significantly more females were caught by 1.43 times than males during the whole year of 2009, and the results also indicated that significantly more females were caught by 1.76 times than males during the whole year of 2010.

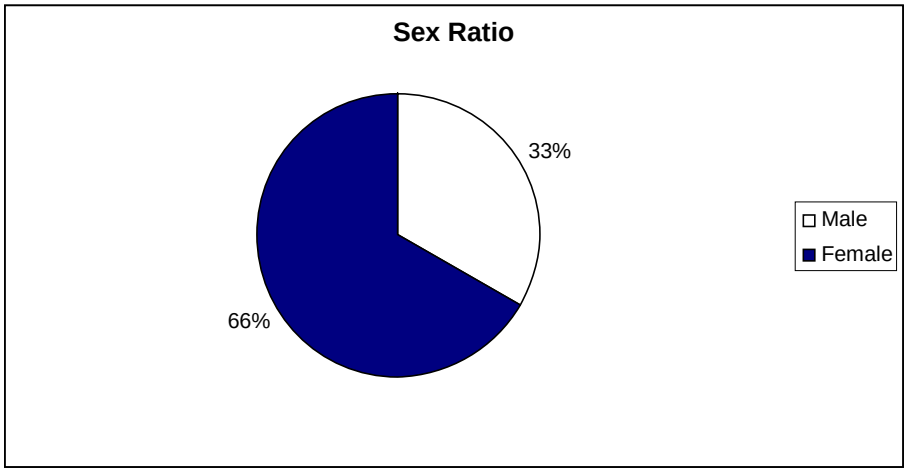

Fig (2):Sex ratio (Males : Females) of *R. ferrugineus* obtained from aggregation pheromone traps.

The effect of pheromone traps direction on the captured population of weevils.

Data in Table (3) showed the effect of pheromone traps direction on attraction of RPW the results showed that the captured population of weevils recorded in Eastern direction was the highest {33.9 adults (11.02 males +22.89 females)} followed by South direction (27.49 adults (9.09 males +18.4 females), West & North directions. Recorded the least average of the

total catches of adult numbers 11.44 and 9.63 adults respectively while center direction ranked the third order where the total captured population of weevils recorded 17.54 adults. Statistical analyses showed that there were significant differences between the average of the total catches of adult numbers in east direction and other directions except south direction. Also there were significant differences between the average of the total catches of adult numbers in south direction and each of west and north directions these results show the effect of the northern west of the wind direction these results in agreement with results of Abbas (1999) who studied the effect of trap direction on pheromone release and its catch. He stated that the captured population of weevils in Eastern direction was the highest although the pheromone release was lower than the other directions, where the trap captures were as follows in descending order: 26.63, 18.13, 17.93 and 15.7 adults/trap and the respective quantities of released pheromone were 8.95, 8.28, 9.37 and 9.37 mg/trap for East, West, North and South directions, respectively. Also, he mentioned that trap direction had severe effects on caught numbers with little effect on pheromone releases.Abbas (2005) studied the relationship between the population fluctuation of weevils and the direction of pheromone traps. He found that the highest population caught in the eastern direction followed by West, North and South directions. Jayanth *et al.* (2007) in India stated that a total of 9370 adults were caught in pheromone traps installed over 50 acres each in Muthukulam (Alappuzha District) and Pullad (Pathanamthitta District) during the 10 month study period from May 2006 to February 2007. More numbers of adults were caught in traps installed along the periphery, particularly in the south and south-eastern directions. El-Shafi (2011) showed that the highest population caught at different trap directions was in the eastern direction followed by the center South, North and west directions.

Table (3): Effect of pheromone traps direction on attraction of *Rhynchophorus ferrugineus* adults during 2012-2013.

Treatments	Average captured RPW adults/trap		
	Male	**Female**	**Total**
East	11.02 a	22.89 a	33.90 a
South	9.09 ab	18.40 ab	27.49 ab
Center	5.99 bc	11.55 bc	17.54 bc
West	3.85 c	7.59 bc	11.44 c
North	3.42 c	6.20 bc	9.63 c
Total	33.37	66.63	100
Mean	6.67	13.33	20
F value	1.94		

Different litters between raws indicated significant difference.

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التذبذبات العددية لحشرة سوسة النخيل الحمراء علي نخيل البلح بإستخدام المصائد الفرمونية بمنطقة رشيد . مصر

عبدربه عيد حسين ، محمد كمال الدين الأنصاري و عبدالله عبده احمد زهره
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اجريت هذه الدراسة ابتداء من ديسمبر 2012 وحتي نوفمبر 2013 بمنطقة برج رشيد محافظة البحيرة بهدف دراسة تعداد سوسة النخيل الحمراء وتأثير العوامل الجوية (حرارة ورطوبة نسبية) على تذبذب تعداد الحشرة. وقد أظهرت نتائج هذه الدراسة تواجد الحشرة طوال العام وأن تعدادها يتذبذب خلال السنة حيث تبين وجود اربع قمم للتعداد خلال الدراسة. حيث سجلت القمة الأولى فى نهاية النصف الأول من شهر ابريل بينما سجلت القمة الثانية في نهاية النصف الثانى من شهر مايو . بينما القمة الثالثة وهي الأعلي سجلت في نهاية النصف الأول من شهر يوليو وأخيرا سجلت القمة الرابعة في نهاية النصف الأول من شهر سبتمبر. كذلك اظهرت النتائج ان درجة الحرارة كان لها تأثير غير معنوى موجب علي تذبذب تعداد الحشرة وأن الرطوبة النسبة كان لها تأثير معنوى سالب علي تذبذب تعداد الحشرة خلال فترة الدراسة كما اظهرت النتائج أن نسبة الإناث المنجذبة لمصائد الفرمون كانت ضعف نسبة الذكور تقريبا. وقد أظهرت النتائج ان أعلى تعداد من الحشرات المنجذبة كان ناحية الاتجاه الشرقى يليه الاتجاه الجنوبى يليه اتجاه وسط الحقل يليه الاتجاه الغربى وأقلهم كان الاتجاه الشمالى انجذاباً لمصائد الفرمون.

قام بتحكيم البحث

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