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**Fluctuations in the population density of the red palm weevil
Rhynchophorus ferrugineus (Curculionidae : Coleoptera) in Ismailia Governorate,
Egypt**

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Abstract:

The Regional Research Station for Delta East, Qassasin, Ismailia Governorate, Egypt., planted with four varieties of date palm trees (Zaghloom, barhi, hayani and samani). Eight aggregation pheromone traps were uniformly distributed around 200 of palm trees (50 of each variety). Adult of red palm weevil (RPW) *Rhynchophorus ferrugineus* (Olivier) (Curculionidae : Coleoptera) was collected twice monthly during the two successive years (2017-2018 and 2018-2019) to study the fluctuations in the population density of the red palm weevil *R. ferrugineus* on four types of date palm trees. Results were conducted on the percentages of date palm trees affected by red palm weevil. The percentages of infection with RPW were recorded, 48%, 42%, 34% and 30% for zaghloom, barhi, hayani and samani, respectively. In the first year of study total collected adults of RPW by pheromone traps were recorded 937 from all varieties. Zaghloom, barhi, hayani and samani varieties were recorded, 29.5% , 25.8% , 23.2% and 21.6%, respectively. In the second year of study total collected adults of RPW by pheromone traps were recorded 1114 from all varieties. Zaghloom, barhi, hayani and samani varieties were recorded, 28.5% , 24.7% , 23.9% and 23%, respectively. The results were showed that, April and May recorded the highest percentage of collected adults of RPW on zaghloom, barhi and samani varieties, while hayani variety was recorded the highest percentage of collected adults of RPW in March during the two successive years of study. Also, the correlations between the percentage of collected adults of RPW and climatic factors (Temperature and humidity) were studied.

Introduction

Date palm trees (*Phoenix dactylifera* L.) are one of the important ecosystems for number of living organisms especially red palm weevil (RPW) *Rhynchophorus ferrugineus*

(Olivier) (Coleoptera: Curculionidae). Date palm trees are cultivated and distributed all over Egypt. They are one of the major and earliest fruit crops. The RPW is an economically important tissue borer pest of date palm in many

pests of the world. The insect is a major pest of date palm in some of the Arabian gulf states including Saudi Arabia, United Arab Emirates, Sultanate of Oman and Egypt (Cox, 1993 and Abraham *et al.*, 1998). The agro climatic conditions prevalent in this region and the unique morphology of the crop coupled with intensive modern date palm forming have offered the pest an ideal ecological habitat (Abraham *et al.*, 1998). Aggregation pheromone traps have been reported as effective tools for monitoring and trapping the RPW in the field (Gunnawardena and Badarage, 1995). El-Lakwah *et al.* (2011), used attracting pheromone traps on date palm to study the population dynamics of RPW in Wardan and Abu-Ghalep villages, 6th October Governorate, Egypt. The recent discovery of the male of RPW produced aggregation pheromone trade name ferrugineol, (4-methyl- 5-nonanol) (Hallet *et al.*, 1993). According to Abd El-Kareim (1997 and 1998), pheromone traps not only used for detecting population activity of adult pest in the field but also could be incorporate in the management control program of this pest. The aim of this research work is to study the population density of adult RPW using aggregation pheromone traps at Ismailia Governorates, Egypt, during two successive years.

Materials and methods

Field experiments were carried out at date palm farm of area 25 feddan at the Regional Research Station for Delta East, Qassasin, Ismailia Governorate, Egypt. The chosen farm was cultivated with four varieties of date palm trees, zaghlool, barhi, hayani and samani aged from 10 to 15 years. From 200 date palm trees were chosen randomly and divided into 50 date palm trees for each variety, to study fluctuations in the population density of adult RPW *R. ferrugineus*. Eight

aggregation pheromone traps (Two traps for each variety) were used during two successive years (From April 2017 till March 2019). Trap design was a volume of 10 liters plastic bucket. It was punctured around its wall with four circular holes, each one of them was 5cm in diameter on distance of 20 cm from the bottom to facilitate entrance of adult RPW. Trap was covered on top with a plastic cover to avoid sun light and liquid evaporation. It was contained the following materials:

1. Aggregation pheromone:

Each trap contained the synthetic aggregation pheromone lures "Ferrugineol". It was a mixture of 4-methyl-5-nonanol manufactured by Chem Tica international S.A. company, Costa Rica. Pheromone bag was hanged underside the top cover surface of trap it released the active chemicals lures (Aggregation pheromone) via plastic membrane with average release rate (3 -10 mg/day).

2. Kairomone:

Dispenser of kairomone was a bottle containing 50 ml of liquid ethyl acetate. It used as a botanical synergist attractive to attract the adult of RPW to the trap. Bottle of kairomone was hanged underside the top cover surface of trap and the releasing rate of kairomone was (150-200 mg/day).

3. Liquid soap:

Liquid soap was mixed with 2 liters of water level in the inside bucket trap to catch and kill the adult of RPW.

4. Application method:

Eight aggregation pheromone traps were uniformly distributed in the infested study area by placed two traps in each variety of date palm under study. Traps were buried in the ground down to the level of 20 cm and arranged at equally spaced 100 meters between each other's and 5 meters away from date palm. Monitoring fluctuations in the population density of adult RPW were appreciated through the numbers

of collected adults of RPW from traps for each variety. The pheromone bag and dispenser of kairomone were replaced every two months, while the liquid soap mixed with water were replaced every two weeks. Collected adults of RPW from traps were counted and recorded twice monthly and calculated the monthly average for each variety separately during the two successive years of study.

Results and discussion

1. Estimating the rates of infection with red palm weevil *Rhyncophorus ferrugineus* on date palm varieties under study:

From 200 date palm trees were chosen randomly representing the four varieties zaghlool, barhi, hayani and samani at the Regional Research Station for Delta East, Qassasin, Ismailia Governorate, Egypt. Zaghlool and barhi varieties were recorded the highest rate of infection with RPW, 48% and 42%, respectively, while the hayani variety was recorded 34% of infection with RPW from infested palm. On the other hand, samani variety was recorded the lowest rate of infection with RPW 30%.

2. Total collected adult of red palm weevil *Rhyncophorus ferrugineus* from traps on date palm varieties under study:

The results of total collected adult of RPW during two successive years (2017-2018 and 2018-2019) by used aggregation pheromone traps were tabulated in Table (1). From total 937 adult of RPW were collected in the first year of study, zaghlool variety was recorded the highest percentage of total collected adult of RPW 29.5% followed by barhi, hayani and samani varieties

,25.8%, 23.2% and 21.6%, respectively. In the second year of study; From total 1114 adult of RPW were collected, zaghlool variety was recorded the highest percentage of total collected adult of RPW 28.5% followed by barhi, hayani and samani varieties, 24.7%, 23.9% and 23%, respectively. The results also indicated that, total collected adult of RPW in the second year of study during (2018-2019) was slightly higher than total collected adult of RPW in the first year of study during (2017-2018), which could be due to slight variation in the mean temperature during (2018-2019).

3. Fluctuations in the population density of adult red palm weevil *Rhyncophorus ferrugineus* on date palm varieties:

Results presented in Table (1) and illustrated in Figure (1, 2, 3 and 4) showed that, the fluctuations in the population density and percentage of collected adult of RPW from four varieties of date palms, zaghlool, barhi, hayani and samani by used aggregation pheromone traps during the two successive years of study (2017-2018 and 2018-2019).

3.1. On zaghlool variety in the first year of study, April and October were recorded the highest percentage of collected adult of RPW, 16.30% and 13.04%, respectively. On the other hand, August was recorded the lowest percentage of collected adult of RPW (1.44%). In the second year, May and October were recorded the highest percentage of collected adult of RPW, 15.77% and 12.61%, respectively. On the other hand; January was recorded the lowest percentage of collected adult of RPW 3.78% (Figure 1).

Table (1): Population density of total collected adults of *Rhynchophorus ferrugineus* by pheromone traps from four varieties of date palm trees during two successive years.

Years	2017/2018				2018/2019			
Varieties	Zaghlool (%)	Barhi (%)	Hayani (%)	Samani (%)	Zaghlool (%)	Barhi (%)	Hayani (%)	Samani (%)
Months								
April	16.30%	9.50 %	1.84%	19.30%	9.14%	13.45%	4.88%	10.93%
May	7.24%	16.52 %	3.22%	8.91%	15.77%	5.45%	12.40%	16.40%
June	9.78%	1.65%	2.30%	5.44%	6.94%	7.27%	10.90%	9.76%
July	2.53%	3.71%	8.75%	3.96%	4.10%	6.18%	6.01%	9.37%
August	1.44%	10.33 %	11.05%	7.92%	9.46%	8%	4.13%	7.42%
September	6.88%	9.09%	12.44%	10.39%	9.14%	11.27%	1.50%	3.12%
October	13.04%	10.74 %	8.29%	15.84%	12.61%	10.54%	12.78%	1.17%
November	5.43%	7.02%	6.91%	10.89%	7.88%	6.90%	12.03%	11.32%
December	3.98%	8.67%	11.52%	8.41%	9.77%	9.45%	6.76%	10.15%
January	12.68%	7.43%	10.59%	1.98%	3.78%	9.09%	4.51%	8.59%
February	8.69%	6.61%	9.21%	2.47%	5.04%	9.09%	10.52%	4.68%
March	11.95%	8.67%	13.82%	4.45%	6.30%	3.27%	13.53%	7.03%
Total	276	242	217	202	317	275	266	256
(%)	29.5	25.8	23.2	21.6	28.5	24.7	23.9	23

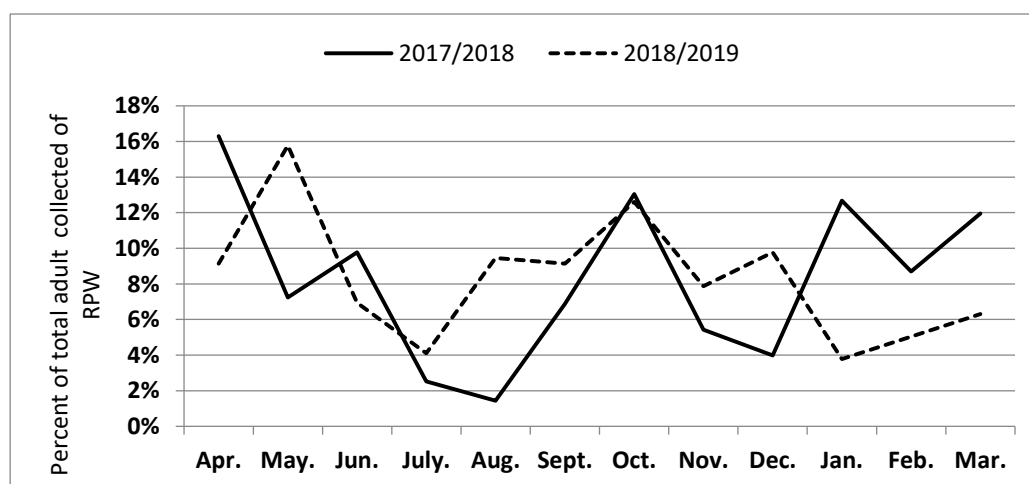


Figure (1): Fluctuations in the population density of adult RPW on Zaghlool date palm variety during two successive years.

3.2. On barhi variety in the first year of study, May and October were recorded the highest percentage of collected adult of RPW ,16.52% and 10.74%, respectively. On the other hand, June was recorded the lowest percentage of collected adult of RPW 1.65%. In the

second year, April and September were recorded the highest percentage of collected adult of RPW ,13.45% and 11.27%, respectively. On the other hand, March was recorded the lowest percentage of collected adult of RPW 3.27% (Figure 2).

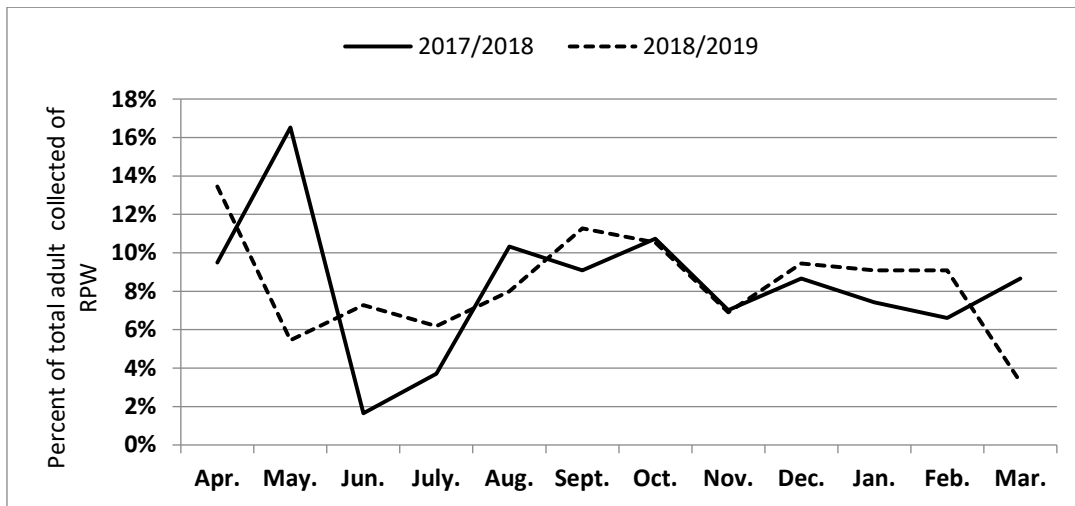


Figure (2): Fluctuations in the population density of adult *Rhynchophorus ferrugineus* on barhi date palm variety during two successive years.

3.3. On hayani variety in the first year of study, March and September were recorded the highest percentage of collected adult of RPW,13.82% and 12.44%, respectively. On the other hand, April was recorded the lowest percentage of collected adult of RPW 1.84%. In the second year, March and

October were recorded the highest percentage of collected adult of RPW,13.53% and 12.78%, respectively. On the other hand, September was recorded the lowest percentage of collected adult of RPW 1.50% (Figure 3).

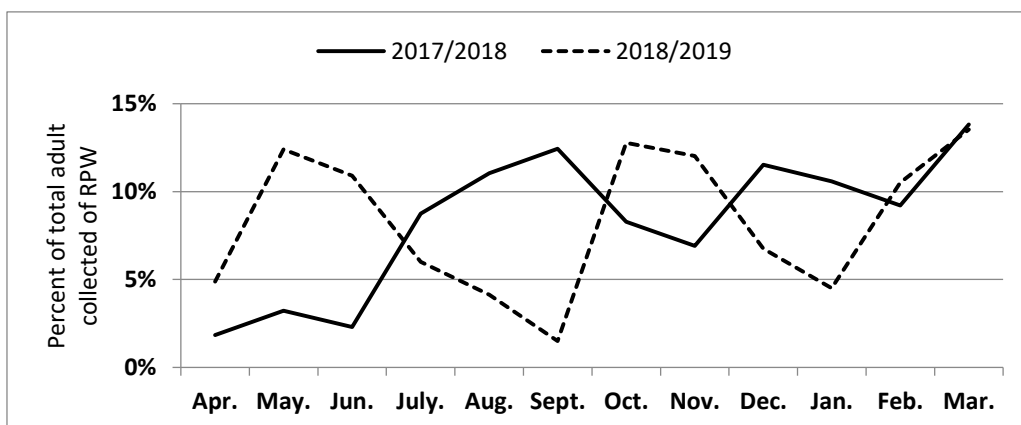


Figure (3): Fluctuations in the population density of adult *Rhynchophorus ferrugineus* on hayani date palm variety during two successive years.

3.4. On samani variety in the first year of study, April and October were recorded the highest percentage of collected adult of RPW , 19.30% and 15.84%, respectively. On the other hand, January was recorded the lowest percentage of collected adult of RPW 1.98%. In the second year, May and

November were recorded the highest percentage of collected adult of RPW, 16.40% and 11.32%, respectively. On the other hand, October was recorded the lowest percentage of collected adult of RPW 1.17% (Figure 4).

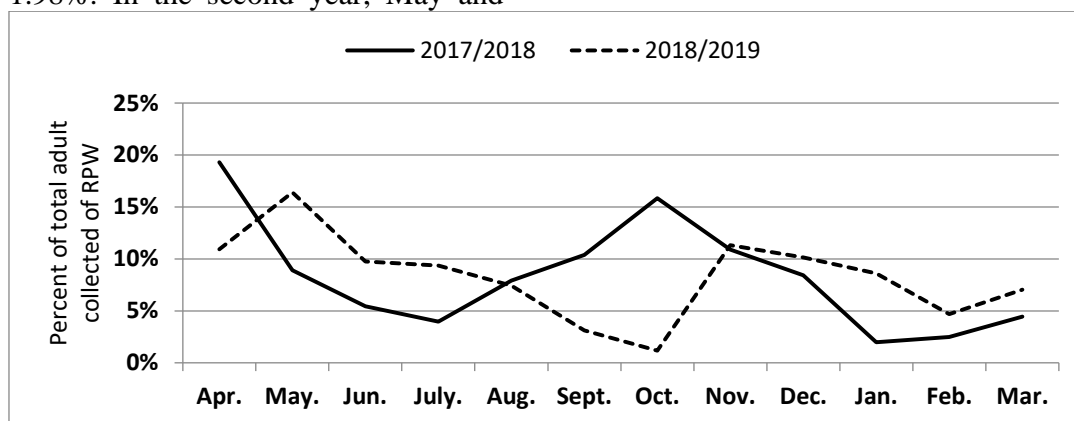


Figure (4): Fluctuations in the population density of adult *Rhynchophorus ferrugineus* on samani date palm variety during two successive years.

From previous results we can concluded that; the population dynamics of the adult RPW *R. ferrugineus* were existed in study area all over the year, in addition to the highest percentages of collected adult of RPW were recorded on April and May for zaghlool, barhi and samani varieties during the two successive years of study, while Hayani variety was recorded the highest percentage of collected adult of RPW on March during the two successive years of study. On the other hand, in the first year of study the lowest percentages of collected adult of RPW were recorded on months, August, June, April and January for zaghlool, barhi, hayani and samani varieties respectively, while in the second year of study, the lowest percentages of collected adult of RPW were recorded on months, January, March, September and October for zaghlool, barhi, hayani and samani varieties, respectively.

The obtained results agree with the findings of Abdallah and Al-Khatiri

(2003) who observed that adult of RPW emerging continually throughout the year. Also, Abd El-Kareim (1997 and 1998) mentioned that, the minimum number of insects was recorded during December and January. 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 confirm the previous data obtained by Qin *et al.* (2004) who found that, the population monitoring of red palm weevil occurred in four peaks during 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. In addition, Al-Saoud (2007) and Faleiro (2005) also found that the adult of RPW were present throughout the year. Furthermore, El-Lakwah *et al.* (2011)

studied the population dynamics of the adult RPW in Wardan and Abu-Ghalep village, 6th October Governorate, they indicated that, adults emerging continually throughout the year. The lowest adults population was recorded during December and January. The population showed four peaks on months, June, August, November and March.

4.The effect of climatic conditions (Temperature and humidity) on the population density of adult red palm weevil *Rhynchophorus ferrugineus* during the two successive years of study:

The results of mean temperatures in Ismailia Governorate, throughout two successive years of study (From April 2017 until March 2019) were shown that, mean temperatures increased during the

months, June, July and August, as they ranged between,30.8 , 32.8 and 32°C, respectively. While January was shown the coldest month 16°C (Figure 5). On the other hand, the relative humidity on January was recorded the highest rate 60% RH., compared to the summer months, as the humidity ranged between 40% to 45% RH. during the two successive years of study (Figure 6). Obtained data indicated that there was significant positive correlation between mean temperatures and population dynamics of the adult of RPW during the two successive years of study, while the relative humidity had negative effect. Also, Abd El-Kareim *et al.* (2018) reported that, there was an effect of the climatic conditions of maximum and minimum temperature and the Relative Humidity on the population dynamics of adult RPW.

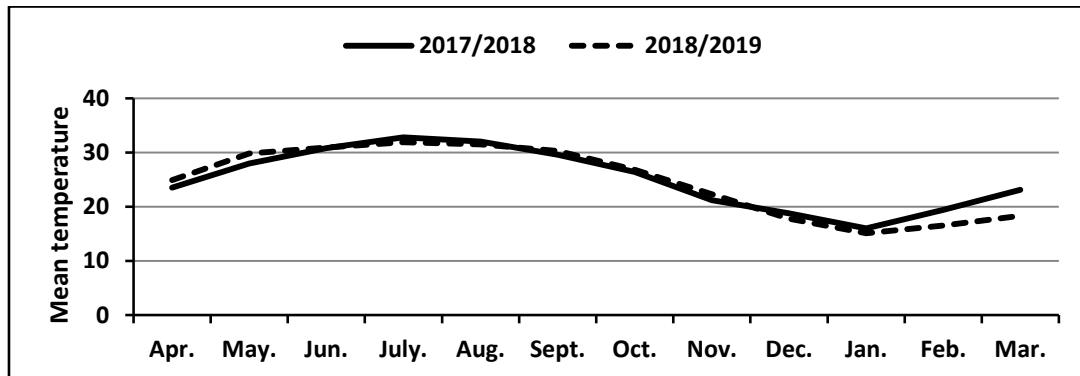


Figure (5): Mean temperature of Ismailia Governorate, throughout two successive years from April 2017 until March 2019.

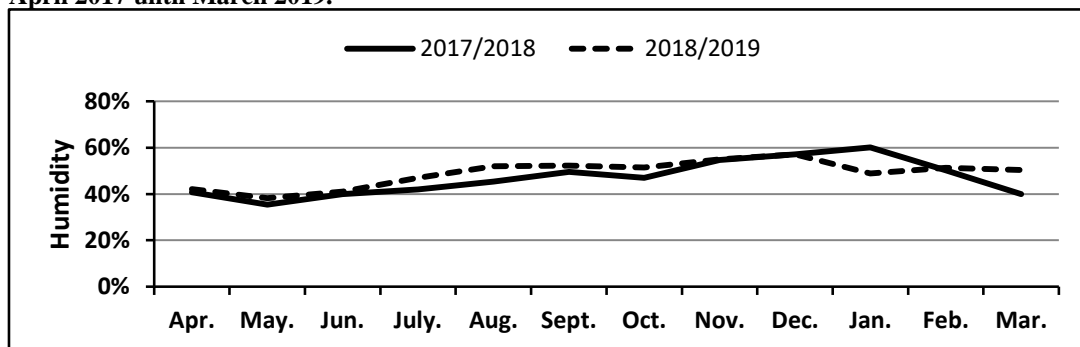


Figure (6): Mean humidity of Ismailia governorate, throughout two successive years from early April 2017 until late March 2019.

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