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Ecological Studies and Effect Pruning Operator on Infestation of Date Palm Trees with Red Palm Weevil, *Rhynchophorus ferrugineus* (Oliv.) in Sharkia Governorate, Egypt

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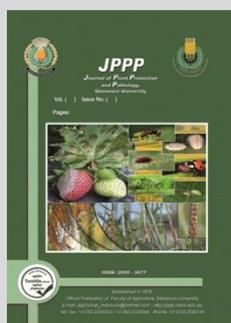
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ABSTRACT

The red palm weevil (RPW), *Rhynchophorus ferrugineus*, (Olive.) (Coleoptera: Curculionidae) is considered destructive insect pest of the date palm trees plantations of different Governorates in Egypt. The field experiments were carried out in Abo-Hammad district, Sharkia Governorate, Egypt, during successive years 2018-2019. Results indicated that the infestations of RPW were existed in two farms. The percentage of infestation reached to 6.73% in the first season, 2018 while reached to 4.76% in the second season, 2019. The percentage of infestation of severity both seasons cleared that most the infestations were highly severity. The highest infestation was found in Zaghloul variety followed by hayani, while the weakest infestation was in the varieties Aglan, Amry, Bent-Esha and Samani during the two seasons and the infestation of RPW in different ages of palms was the highest in young palms, that RPW preferred trees in age ranged between (6-10 years), while the lowest in age ranged between (10-15years). The infestation reached its maximum in the infested palms in the height ranged between 0.0-2.0 m., while it was minimum with infestation height from 2.1 to above 3.5 from the ground during the two seasons. The highest infestation of RPW were found in suckers, followed by of infestation in off-shoots, while it was decreased in the base of pruning leaves during the two seasons. Palm tree pruning without dusting with agricultural sulfur showed the highest infestation rate while, pruning of date palm and dusting with agricultural sulfur resulted in lower infestation rate during the two seasons.

Keywords: red palm weevil; date palm; infestation height; varieties; pruning leaves.



INTRODUCTION

Red palm weevil (RPW), *Rhynchophorus ferrugineus* (Olivier) has been identified by the FAO of the United Nations as a 'category-1' insect pest of date palm in the Middle-East and is a key pest of date palm in Egypt, the introduction of RPW was caused by an importation of offshoots from the United Arab Emirates. RPW was first discovered in date palms in the Governorate of Ismailia in 1992Saleh, (1992).

Therefore, farmers are advised to prevent wetting the stripe next to the offshoots. *R. ferrugineus* is preferentially attracted by wound-emitted volatiles and oviposit in soft tissue, for date palm trees, it is suggested to cover the wounds with pitch or with chemicals that efficiently seal and dry the wounded tissue (Soroker *et al.*, 2012). Various farming practices *viz.* varietal selection, age of palms are known to impact infestation levels due to RPW in date palm (Abraham *et al.* 1998; Aldryhim and Al- Bukiri, 2003; Al-Ayedh, 2008; Azam *et al.* 2000). Alhudaib *et al.*2008) highlighted the importance of understanding and regulating date palm farming practices for the successful management of RPW.

The present work aimed to evaluate of different effect ecological studies (infestation severity or degree of infestation (low, moderate and high), infestation height in infested trees, variety preference, number of healthy and

infested palms place of infested palm, total numbers of infested date palms and infestation percentage, the suitable tree age for infestation) and agricultural practices pruning on the level of infestation of date palm trees with red palm weevil, *Rhynchophorus ferrugineus* (Oliv.) in Sharkia Governorate, Egypt.

MATERIALS AND METHODS

The field experiments concerning the red palm weevil (RPW), *Rhynchophorus ferrugineus* (Oliv.) were carried out in two farms (Ahmed Nabil Eltilay farm and hamdy abd el Rahim Sleiman farm) cultivated with date palm trees age ranged from 10 to 15 years at El Gafria village, Abo- hammed districts, Sharkia Governorate, East Delta Egypt, during the two successive seasons, 2018 and 2019.

1. Ecological studies:

Percentage of infestation of red palm weevil, *Rhynchophorus ferrugineus* (Oliv.) in date palm trees.

Percentage of infestation of red palm weevil were conducted in village namely, El-Gafaria at Abo hammed district, El Sharkia Governorate during two successive seasons (2018 and 2019).

The experiment included information about the orchard, its location, the monthly total number of date palms, and total number of infested palm trees.

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Effect of degree of infestation on of date palm tree.

Three degree of the point of entry, external symptoms of infestation or infestation level severity of infestation, the size of the oozing were recorded as follows:

- **Low infestation:** Little of oozing and no found cocoons in the infested palm trees.
- **Moderate of infestation:** Large volume of oozing contains and found cocoon inside infested trees also adult inside cocoon.
- **High infestation:** Large volume of oozing contain, found cocoons, adults inside cocoons, adults outside cocoon and cavities.
- **Uninfected trees** (control) were used. Ten replicates of each treatment

contain, Besides 5 date palm trees during two seasons and treatment of infested palms after directly infestation by pesticide were used and date of recording months in each infested palm, the heavily infested site was dissected and recorded monthly.

Susceptibility of date palm trees varieties to infestation:

Experiment included the infestation of different varieties i.e. Hayani, Zaghoul, Aglan, Amry Bent-asha and Samani and infestations due to varieties were recorded. Total number in each variety and number of infestation palms was recorded under each variety. Four hundred of uninfected palm trees (100 of each variety) state and vigor of trees under field conditions were chosen. variety with RPW were counted and avoided from the previous monthly number remainder of health trees of chosen trees and Percentage of infestation was determined as follows:

$$\text{Percentage of infestation} = \frac{\text{Number of infested trees / variety}}{\text{Total number of chosen trees}} \times 100$$

The suitable tree age for infestation:

To study the relation of date palm trees, age and red palm weevil infestation, the palms were categorized approximately into 3 age groups: as 1-5, 6-10, 11-15. Total numbers of total palms as well as number of infested trees were recorded for each age group.

The height levels of infestation:

Experiment concerned with infestation sites on tree trunk. The height levels were categorized approximately into eight levels: 0-0.5, 0.6-1.0, 1.1-1.5, 1.6-2.0, 2.1-2.5, 2.6-3.0, 3.1-3.5 and < 3.5 m. Height above the ground. The numbers of infested palms of each height group were recorded during two year, 2018 and 2019.

The site of infestations in date palm trunk:

To study red palm weevil infestation in relation to as off-shoots, suckers, leaf bases. Total number of palms and number of infested palms were counted under each site of infestation. The above mentioned technique was used according to Azam *et al.*, (2003).

2. Agriculture practices:

Effect of pruning on date palm infestation by RPW:

In order to study the effect of the pruning on the percentage of the infestation by RPW, two farms (Ahmed Nabil Eltilay farm and hamdy abd el Rahim Sleiman farm) were chosen at El Gafria village, Abo Hammad district, Sharkia Governorate, Egypt, during two successive season of 2018&2019 with respect to variety (Zaghlole) and age of palm tree (10-15) year, 45 palms in each farm were

determined, 15 palms were marked for each treatment. The treatments were as follows.

- a- Palm plantation in which pruning was practiced without spraying insecticides.
- b- Palm plantation which pruning was not conducted.
- c- Palm plantation in which pruning was practiced with spraying insecticides. The insecticide used was Agricultural sulfur as powder. The palm trees which marked were pruned in March and checked by looking for the symptoms of the infestation during March and April every 2 weeks, and the result was recorded. The experiment was designed as randomized completely block design with five different locations as replicates.

RESULTES AND DISCUSSION

1. Ecological studies

Infestation Degree by red palm weevil in date palms trees plantation:

Total numbers of infested date palms and infestation percentage of red palm weevil in different villages during the two seasons 2018 and 2019.

Date presented in Table (1) showed that the red palm weevil infestation was found in most date palm orchard, among the experimented orchard, the infestation of RPW was existed in orchard.

Date palm orchard in Abo hammad district considered as the highly infested, where the percentage of infestation reached to 13.75% (40 infested trees/360 total number) in the first season, 2018.while the percentage of infestation reached to 10.28% (28 infested trees / 332 total number) in the second season, 2019.Data agreed with obtained by Sekhar(2000) who found that red palm weevil was the most important pest in India ,with 11.65% of trees being attacked. Alkhazal *et al.*, (2009) mentioned that the red palm weevil(RPW) *Rhynchophorus ferruginous* (Coleoptera: Curculionidae) is the most destructive pest of date palm *Phoenix dactylifera* L.in Middle East particularly in Arab Gulf countries. Severe or deep infestations formed 13% of total infestations.

Infestation severity:

The date recorded in Table (1) according to the scale of infestation mentioned revealed that degree of infestation was differed significantly in farms. The high degree infestation recorded 20 palms in the first season 2018, while in the second season 2019 degree of infestation was 17 palms differed significantly in farms, than the first season, where the high severity recorded in first season, 2018.the obtained results are inagreement with data obtained by other investigators Azam, *et al.* (2003) mentioned that out of 652 infested palms recorded in Oman during the survey ,503 palms were with old infestation and 149 with new infestation. Among the old infested palms 241 palms had medium level of infestation and 262 palms with high level of infestation and among the palms with new infestation two palms had low level of infestation, 75 medium and 72 with high level of infestation. Alkhazal *et al.*(2009) mentioned that the red palm weevil (RPW) *Rhynchophorus ferruginous* (Coleoptera: Curculionidae) is the most destructive pest of date palm *Phoenix dactylifera* l.in Middle East particularly in Arab Gulf countries .Light or surface infestations formed 45% while severe or deep infestations formed 19% of total infestations.

Table 1. Monthly mean number of infested date palm trees, number of healthy and infested palms ,infestation percentage and infestation degree by red palm weevil, *Rhynchophorus ferrugineus* (Oliv.) in date palm trees at Abo-Hammad district at Sharkia Governorate during the two successive seasons 2018and 2019.

| Months | The first season,2018 | | | | | | The second season ,2019 | | | | | |
|-----------|-----------------------|----------------------------|---------------|---------------------------------------|-----------------|-----------------|-------------------------|----------------------------|---------------|---------------------------------------|----------------|-----------------|
| | Total No. of palms | Total No.of infested palms | Infestation % | Infestation Degree by red palm weevil | | | Total No. of palms | Total No.of infested palms | Infestation % | Infestation Degree by red palm weevil | | |
| | | | | L. | M. | H. | | | | L. | M. | H. |
| January | 400 | 1 | 0.25% | 0 | 1 | 0 | 360 | 1 | 0.28% | 0 | 0 | 1 |
| February. | 399 | 2 | 0.5% | 0 | 0 | 2 | 359 | 1 | 0.28% | 0 | 1 | 0 |
| March | 397 | 7 | 1.76% | 2 | 2 | 3 | 358 | 4 | 1.12% | 1 | 0 | 3 |
| April | 390 | 0 | 1.76% | 0 | 0 | 0 | 354 | 0 | 1.12% | 0 | 0 | 0 |
| May | 390 | 3 | 0.77% | 1 | 0 | 2 | 354 | 2 | 0.56% | 1 | 0 | 1 |
| June | 387 | 0 | 0.77% | 0 | 0 | 0 | 352 | 0 | 0.56% | 0 | 0 | 0 |
| July | 387 | 0 | 0.77% | 0 | 0 | 0 | 352 | 0 | 0.56% | 0 | 0 | 0 |
| August | 387 | 2 | 0.52% | 0 | 1 | 1 | 352 | 1 | 0.28% | 0 | 1 | 0 |
| September | 385 | 4 | 1.04% | 0 | 2 | 2 | 351 | 2 | 0.57% | 0 | 1 | 1 |
| October | 381 | 6 | 1.57% | 2 | 2 | 2 | 349 | 4 | 1.15% | 0 | 1 | 3 |
| November | 375 | 10 | 2.67% | 1 | 4 | 5 | 345 | 9 | 2.61% | 2 | 1 | 6 |
| December | 365 | 5 | 1.37% | 1 | 1 | 3 | 336 | 4 | 1.19% | 1 | 1 | 2 |
| Total | 360 | 40 | 13.75% | 7 ^c | 13 ^b | 20 ^a | 332 | 28 | 10.28% | 5 ^c | 6 ^b | 17 ^a |
| Mean | 30 | 3.33 | 1.15% | 0.58 | 1.08 | 1.67 | 351.83 | 2.33 | 0.86% | 0.5 | 0.42 | 1.42 |
| S.E. ± | 2.89 | 0.92 | 0.201 | 0.23 | 0.36 | 0.45 | 1.89 | 0.75 | 1.99 | 0.19 | 0.15 | 0.53 |

S.E. =stander Error L=low M=medium H=high No.=number

Variety preference:

Infestation of RPW of different examined date palm varieties (Hayani, Zaghoul, Aglan, Amry Bent-asha and Samani during two successive seasons 2018 and 2019 were recorded in Tables (2) .Results cleared that the preferences were varied as total number of infested date palm trees in each variety through seasons. Zaghoul and Hayani varieties were the more susceptible for infestation than other varieties, where the percentage of infestation during

two successive seasons were 18 and 15 % for Zagloul and and %, for Hayani 15 and 10%, for Aglane 11.7 and 7.5 % for Amry 5 and 3.3 % for Bent -Esha 3.3 and 2.5 % , for Samani 1.7 and 1.7 % , , respectively. Highly infestation of date palm trees during the first season reached 18 %. Data agree with those Abd El-Fattah (2010) and Olfat (2015) found that the highest infestation varieties were Zaghoul, followed by Hayani, Aglany , Amry, Bent-Esha and Samani had much lower infestation during the two seasons.

Table 2. Host preference of date palm varieties to infestation with red palm weevil, *Rhynchophorus ferrugineus* (Oliv.) at Abo-Hamad district, Sharkia during the two successive 2018and 2019.

| Months | The first season,2018 | | | | | | | The Second season,2019 | | | | | | |
|-------------------------------------------------|---------------------------------|-----------------|----------------|----------------|----------------|----------------|----------------|---------------------------------|-----------------|----------------|----------------|----------------|----------------|----------------|
| | The varieties of infested palms | | | | | | Infested palms | The varieties of infested palms | | | | | | Infested palms |
| | H. | Z. | Ag. | Am. | B. | S. | | H. | Z. | Ag. | Am. | B. | S. | |
| January | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| February. | 0 | 2 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| March | 1 | 3 | 1 | 1 | 1 | 0 | 7 | 1 | 2 | 1 | 0 | 0 | 0 | 4 |
| April | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 1 | 1 | 1 | 0 | 0 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| June | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| July | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| August | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| September | 1 | 2 | 1 | 0 | 0 | 0 | 4 | 0 | 2 | 0 | 0 | 0 | 0 | 2 |
| October | 2 | 2 | 2 | 0 | 0 | 0 | 6 | 1 | 3 | 0 | 0 | 0 | 0 | 4 |
| November | 1 | 4 | 2 | 2 | 1 | 0 | 10 | 2 | 3 | 1 | 2 | 1 | 0 | 9 |
| December | 1 | 3 | 0 | 0 | 0 | 1 | 5 | 1 | 1 | 1 | 0 | 0 | 1 | 4 |
| Total | 9 ^b | 18 ^a | 7 ^c | 3 ^d | 2 ^e | 1 ^f | 40 | 6 ^b | 15 ^a | 3 ^c | 2 ^d | 1 ^e | 1 ^f | 28 |
| Seasonal total number percentage of infestation | 15 | 18 | 11.7 | 5 | 3.3 | 1.7 | 6.7 | 10 | 15 | 7.5 | 3.3 | 2.5 | 1.7 | 4.7 |
| S.E.± | 0.18 | 0.39 | 0.29 | 0.18 | 0.11 | 0.08 | 0.92 | 0.19 | 0.30 | 0.13 | 0.08 | 0.17 | 0.08 | 0.75 |

H=Hayani Z=Zaghioul B=Bent Esha S=Samani Am=Amry

S.E.=Stander Error

The suitable tree age for infestation:

The infestation of red palm weevil of different palm ages was recorded in Table (3) .During this course of study the result showed that the red palm weevil preferred trees yang ages ranged between (6-10 years), where the percentage of infestation was reached 19 and 9.4 %, followed by 13 & 8 % for age of 1-5 years and 4 & 5 % of 11-15 years old during the first and the second seasons, respectively. Such finding were also mentioned by other investigators such as Giblin Davis, *et al.*(1989), Farazmand ,*et al.*(2001) Longo and Tamburino(2005) and Justin ,*et al.* (2008) .They cleared that coconut palms in India, The

infestation by the weevil is more predominant in younger plantations between the age group of 5 and 20 years. Cox(1993) recorded that the RPW, *Rhynchophorus ferrugineus* is reported infesting the trunks and growing points of young date palm trees in Egypt .Muralidharan *et al.*(2000) revealed that the infestation was more in areas away from the coast and young plants(2-5 years) are more prone to weevil infestation. The presence of more suckers and sappy nature of young alms may contribute for the increased infestation in young palms .Moreover young palms were more prone to injuries during field operations which helped the weevil to eggs in the exposed tissues.

Sekhar (2000) found that the attack by red palm weevil (*Rhynchophorus ferrugineus*) on 5-to 10 –year-old coconut palms was assessed in India. Azam *et al.* (2003) found that young date palms of age between 6-15 years are prone

to attack by RPW and needs protection and Alkhalazal *et al.* (2009) mentioned that the trees of 5-10 years old were the most infested while trees over 15 years were the least infested.

Table 3. Effect of date palm trees age on infestation of red palm weevil , *Rhynchophorus ferrugineus* (Oliv.) at Abo-Hamad district at Sharkia Governorate during the two successive seasons, 2018 and 2019.

| Months | The first season ,2018 | | | | The first season ,2019 | | | |
|-------------------------------------------------|-----------------------------|---------------------------|-----------------|----------------|-----------------------------|---------------------------|-----------------|----------------|
| | Total No. of infested palms | The age of infested palms | | | Total No. of infested palms | The age of infested palms | | |
| | | 1-5 | 6-10 | 11-15 | | 1-5 | 6-10 | 11-15 |
| January | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| February. | 2 | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| March | 7 | 2 | 4 | 1 | 4 | 1 | 2 | 1 |
| April | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 3 | 1 | 1 | 1 | 2 | 0 | 1 | 1 |
| June | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| July | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| August | 2 | 1 | 1 | 0 | 1 | 0 | 1 | 0 |
| September | 4 | 1 | 2 | 1 | 2 | 1 | 1 | 0 |
| October | 6 | 2 | 2 | 2 | 4 | 1 | 2 | 1 |
| November | 10 | 3 | 5 | 2 | 9 | 2 | 5 | 2 |
| December | 5 | 2 | 2 | 1 | 4 | 2 | 2 | 0 |
| Total | 40 | 13 ^b | 19 ^a | 8 ^c | 28 | 8 ^b | 15 ^a | 5 ^c |
| Seasonal total number percentage of infestation | 13.3 | 13 | 19 | 4 | 9.3 | 8 | 9.4 | 5 |
| Mean | 3.33 | 1.08 | 1.58 | 0.67 | 2.33 | 0.67 | 1.25 | 0.42 |
| S.E.± | 0.92 | 0.29 | 0.45 | 0.22 | 0.75 | 0.22 | 0.41 | 0.19 |

S.E. =stander Error

Infestation height in infestation trees:

Data recorded in Table (4) .cleared that the heights of trees were scaled to eight levels, where, the first and height infestation was 16 &14 in the height ranged between 0.6-1.0m for two seasons, while it was 9& 7% in the second height 1.1-1.5m., while it was 8&5in the infestation height of 0.0-0.5m. above the ground surface followed by 7&2in the infestation height 1.6-2.0m., during the two seasons, respectively.

The data here revealed that the infestation reached the maximum 16&14 in height ranged between 0.6-1.0m., while 0&0 were happened in the top of palms height from 2.1 to above 3.5 during the two seasons, respectively. The data are in general agreement with those obtained by Azam, *et al.* (2003) who, found in Oman that the maximum infestation of 35.95% of RPW was found in palm with trunk height of 0.6 to 1.0m. followed by 22.22%

in trunk height of 1.1 to 1.5 m, 15.69 % in trunk height of 1.6 to 2.0 while it was 12.42% in palms with trunk height of 0.0 to 0.5 m. The infestation decreased with trunk height of 0.0 to 0.5 m.the infestation decreased with the increase in trunk height and became nil in palms with trunk height above 3.5 m. Alkhalazal *et al.*, (2009) mentioned that the red palm weevil (RPW) *Rhynchophorus ferruginous* (Coleoptera: Curculionidae) is the most destructive pest of date palm *Phoenix dactylifera* L.in Middle East particularly in Arab Gulf countries. Over 42% of infestations were concentrated at or below the soil surface.

Light or surface infestations formed 45% while severe or deep infestations formed 13% of total infestations. Sallam, *et al* (2012) found that nearly 90% of the infestations occurred on the palm trunk between 0-100 cm from the ground surface with maximum infestations (36%) being recorded in the age group of 6 to 10 years.

Table 4. Heights of RPW infestation on the date palm trunk in relation with heights of date palm trees at Abo-Hamad district, Sharkia during the two successive seasons, 2018 &2019.

| Months | The first season ,2018 | | | | | | | | | The first season ,2019 | | | | | | | | |
|-----------|-----------------------------|-----------------------------------------------------------|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------------------|-----------------------------------------------------------|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | Total No. of infested palms | The infestation height on the trunk of the infested palms | | | | | | | | Total No. of infested palms | The infestation height on the trunk of the infested palms | | | | | | | |
| | | 0-05 | 06-10 | 11-15 | 16-20 | 21-25 | 26-30 | 31-35 | <35 | | 0-05 | 06-10 | 11-15 | 16-20 | 21-25 | 26-30 | 31-35 | <35 |
| January | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| February | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| March | 7 | 2 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 4 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| April | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 3 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| June | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| July | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| August | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| September | 4 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| October | 6 | 1 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 4 | 1 | 2 | 1 | 0 | 0 | 0 | 0 | 0 |
| November | 10 | 1 | 5 | 2 | 2 | 0 | 0 | 0 | 0 | 9 | 2 | 3 | 2 | 2 | 0 | 0 | 0 | 0 |
| December | 5 | 1 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 4 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 |
| Total | 40 | 8 ^c | 16 ^a | 9 ^b | 7 ^d | 0 ^e | 0 ^e | 0 ^e | 0 ^e | 28 | 5 ^c | 14 ^a | 7 ^b | 2 ^d | 0 ^e | 0 ^e | 0 ^e | 0 ^e |
| Mean | 3.33 | 0.67 | 1.33 | 0.75 | 0.58 | 0 | 0 | 0 | 0 | 2.33 | 0.42 | 1.17 | 0.58 | 0.17 | 0 | 0 | 0 | 0 |
| ±S.E. | 0.92 | 0.19 | 0.41 | 0.22 | 0.23 | 0 | 0 | 0 | 0 | 0.75 | 0.23 | 0.27 | 0.23 | 0.17 | 0 | 0 | 0 | 0 |

S.E. =stander Error

Red palms weevil infestation in relation to site of infestation on date palm trunk:

Date recorded in Table (5) indicated that the highest infestation 20& 14 % of RPW were found in suckers (attached to mother trunk followed by 13 & 9 % of infestation in off-shoots (attached in region mother roots),while it was decreased to 7& 5 % in the base of pruning leaves during the two seasons ,respectively .Our observation ,during the present survey indicated that the point of attachment of suckers (off-shoots &suckers) to mother trees was most favorable site to attack .This observation may be help to early detection of infestation .There is another favorable site to infestation in the terminal bud by entering through pruning leaves around its . The data agreement with those obtained by Abraham and Kurian (1975); Abraham, *et al.*(1998) in general, females lay eggs in wounds, cracks and crevices on the trunk from the collar region near the roots to the base of frond petioles/axils near the crown. In coconut, damage due to

the RPW of frond rot and bud rot may predispose the RPW females to oviposit into the palm .In date palm, infested offshoots become dry Muralidharn, *et al.*(2000) generally ,the field behavior in mode of entry of the adult weevil is almost similar in all varieties and ages of date palms .As in all palms ,the early detection of this pest is very difficult .Our observation ,during survey indicated that the point of attachment of suckers to mother palm was most vulnerable portion of the weevil attack in date palm .Like in coconut it never enters through the cut portion of the petiole or the crown (if crown is already infested with rhinoceros beetle, there is a possibility of entry from the top).Out of the 430 infested palms observed ,only two were found infested from the top..Longo and Tamburino (2005) reported that in a square in Catanin 5 mature palm trees have been attacked by *R.ferrugineus*, causing the crown to collapse, Verde *et al.* (2008) cleared that eggs of red palm weevil (*Rhynchophorus ferrugineus*) are deposited at the base or in the axis of the leaves or in small holes in the trunk.

Table 5. Red palm weevil infestation in relation to the site of infestation on date palm trunk to infestation with red palm weevil, *Rhynchophorus ferrugineus* (Oliv.) at Abo-Hamad district, Sharkia during the two successive seasons 2018/2019 &2019/2020 .

| Months | The First season,2018 | | | | The second season ,2019 | | | |
|-------------------------------------------------|-----------------------------|------------------------------------------------------|-----------------|----------------|-----------------------------|------------------------------------------------------|-----------------|----------------|
| | Total No. of Infested palms | The infestation local on the trunk of infested palms | | | Total No. of Infested palms | The infestation local on the trunk of infested palms | | |
| | | Off-shoots | Suckers | Leaf bases | | Off-shoots | Suckers | Leaf bases |
| January | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 |
| February. | 2 | 1 | 1 | 0 | 1 | 0 | 1 | 0 |
| March | 7 | 2 | 4 | 1 | 4 | 2 | 2 | 0 |
| April | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| May | 3 | 1 | 2 | 0 | 2 | 1 | 1 | 0 |
| June | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| July | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| August | 2 | 1 | 0 | 1 | 1 | 0 | 1 | 0 |
| September | 4 | 1 | 2 | 1 | 2 | 1 | 1 | 0 |
| October | 6 | 2 | 2 | 2 | 4 | 1 | 2 | 1 |
| November | 10 | 4 | 6 | 0 | 9 | 3 | 3 | 3 |
| December | 5 | 1 | 2 | 2 | 4 | 1 | 2 | 1 |
| Total | 40 | 13 ^b | 20 ^a | 7 ^c | 28 | 9 ^b | 14 ^a | 5 ^c |
| Seasonal total number percentage of infestation | 13.33 | 13 | 20 | 3.5 | 9.3 | 9 | 14 | 3.125 |
| Mean | 3.33 | 1.08 | 1.67 | 0.58 | 2.33 | 0.75 | 1.17 | 0.42 |
| ±S.E. | 0.92 | 0.34 | 0.53 | 0.23 | 0.75 | 0.28 | 0.27 | 0.26 |

S.E. =stander Error

II- agriculture practices:

Effect of pruning on date palm infestation by RPW:

Data in Table (6) showed that palm pruning without dusting with agricultural sulfur showed the highest infestation rate by RPW (30%) and (25%). On the other hand, pruning of date palm and adding of agricultural sulfur resulted in lower infestation rate by RPW (4.33%) and (3.00%). Moderate percentage of infestation (11%) and (9.67%) was recorded for the non-pruned date palm. In this context, Zagatti, *et. al.* (1997) attracted the curculionids by allelochemicals released by the fermenting tissues of wounded host-plants. Male adults on palms emitted an aggregation pheromone that attracted adults of both sexes. This pheromone acted in synergy with plant allelochemicals. By collecting the effluvia produced by males, the aggregation pheromones were identified and synthesized.

Table 6. Effect of pruning on date palm Infestation by RPW during 2018 and 2019.

| Treatments | Infestation by RPW% | |
|-----------------------------------------|---------------------|---------|
| | 2018 | 2019 |
| T1(Pruned Without Treating with Sulfur) | 30.00 a | 25.00 a |
| T2(Pruned and Treated with Sulfur) | 4.33 c | 3.00 b |
| T3(non Pruned) | 11.00 b | 9.67 b |
| LSD 0.05 | 5.80 | 6.70 |

CONCLUSION

The early detection of infestation, treatment of palm infestation, get rid of the air offshoots and treatment by anywhere removal and moderation in purring leads to prevention large proportion of the palms from the infestation, thereby reduce the use of pesticides.

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دراسات بيئية وتأثير عمليه التقليم على اصابه اشجار نخيل البلح بحشره سوسه النخيل الحمراء في محافظه الشرقيه مصر.

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تعتبر سوسه النخيل الحمراء التي تتبع (رتبه غمديه الاجنحه فصيله السوس) أفه حشريه مدمره لزراعات اشجار نخيل البلح في مختلف محافظات مصر. لذلك اجريت هذه الدراسه في مزارع نخيل بلح مصابه بسوسه النخيل الحمراء في مركز ابوحماد بمحافظه الشرقيه مصر لمدته عامين متتاليين 2018 و2019م. وأشارت النتائج المتحصل عليها ان الاصابه بسوسه النخيل الحمراء كانت موجوده في مزرعتين تحت الدراسه وان النسبه المئوية للاصابه في الموسم الاول أعلى من الموسم الثاني حيث كانت نسبه الاصابه 6.73% في موسم 2018 وبينما كانت 4.76% في موسم 2019. وأتضح من مستوى شدة الاصابه (المنخفضه-المتوسطه-العاليه) خلال موسمي الدراسه أن معظم الاصابه بسوسه النخيل الحمراء كانت ذات مستوى عالي في شدة الاصابه كما اظهرت النتائج المتحصل عليها ايضا ان اعلى نسبة اصابه بالسوسه كانت موجوده في صنف الزغلول يليها الحياني بينما الاصابه الادنى في الاصناف عجلان وعامري وبنيت عيشه والسمانى خلال موسمي الدراسه، أظهرت النتائج المتحصل عليها ايضا أن الاصابه الاعلى في مختلف أعمار النخيل كانت في النخيل الصغير وان سوسه النخيل الحمراء تفضل النخيل الذي يتراوح أعماراه من (6-10 سنوات) بينما كانت الاصابه الادنى في اشجار النخيل في المرحله العمريه التي تتراوح ما بين (10 الى 15 سنه) وتبين أن الاصابه بسوسه النخيل الحمراء وصلت الى أعلى مستويات الاصابه في الارتفاع ما بين (صفر-2م) من سطح الارض بينما كانت الاصابه الادنى على ارتفاع من 1.2-3.5 متر من سطح الارض خلال موسمي الدراسه. كما أشارت النتائج المتحصل عليها ان الاصابه بسوسه النخيل الحمراء كانت الاعلى في الفصائل عند اتصال الفصيله بجسم الام عند منطقه الجذور بينما كانت الاصابه منخفضه في حاله قواعد الاوراق المقلمه خلال موسمي الدراسه. كما ان اعلى نسبة اصابه حدثت في النخيل المقلم بدون تعفير بالكبريت الزراعي يليها النخيل الغير مقلم وكانت اقل نسبه اصابه في النخيل المقلم وتم تعفيره مباشره بالكبريت الزراعي عقب التقليم مباشره خلال موسمي الدراسه.