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Original Research Paper

The Relationship Between Environmental Factors And Cultural Practices And Red Palm Weevil *Rhynchophorus Ferrugineus* Olivier Infestation

Salem, S.A* and Ahmed S. Reda

Plant Protection Department, National Research Centre, Dokki, Cairo, Egypt.

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Ambient atmosphere; soil structures; flooding irrigation; fertilization and some agricultural practices were investigated for their effects on Red Palm Weevil (RPW) infestation. Thus, the aim of the present work was to study the effect of certain agricultural practices on the % of infestation of date palm trees by the RPW, *Rhynchophorusferrugineus* Olivier. Results show that the pruning of trees without dusting application by agricultural sulfur recorded a highest % infestation in the experimental area (desert and agricultural areas), while the pruning processes followed by dusting application of trees gave a lower percentage of infestation rate. Flooding the irrigation area resulted in a significantly higher % of infestation level, compared to desert area (non-irrigated). The RPW infestation rates in the experimental farm were observed in stem position of 0-50 cm which ranged between 45.3 to 48.28 (desert land, 2013) and between 48.32 to 55.21 (reclaimed area, 2014), while the percentage of infestation in the top recorded the lowest rate. On the other hand, all degrees of percentage of infestations by RPW in agricultural areas were higher than those investigated in desert areas. The ambient atmosphere surrounding the date trees is a very important factor affecting the biology and behavior of RPW adults, because of its effect on egg laying; hatchability and larval capacity to penetrate inside trunk. After pruning processes, the dusting application must be taken immediately.

Keywords: *Rhynchophorusferrugineus*Olivier, *Phoenix dactylifera*L., cultural practices, environmental factors, Egypt.

INTRODUCTION

The largest weevil in Egypt is the red palm weevil *Rhynchophorusferrugineus*Oliv. It is a minor pest, attacking only severely wounded date palm trees. However, it is now known to be a pest of stress nursery and transplanted palms as well as apparently healthy date palms (*Phoenix dactylifera* L.). The red palm weevil (*Rhynchophorusferrugineus* Olivier) is the most dangerous and deadly pest of the date palm and 13 other palm species. Globally, the RPW infest 40 palm species in diverse agro-ecosystems (Anonymous 2013).

The symptoms of *Rhynchophorusferrugineus*Oliv.attack to date palm was summarized by Kaakeh et al, 2001. Infestation on date palm starts when females lay eggs on wounded, or cracks and crevices on the trunk around the collar region near the roots or offshoots, or the fronds in young date palms, with trunks less than 20 years old being most preferred (Faleiro 2006). The damage was categorized by the presence of tunnels on the trunk and pass of leaf petiole, oozing out of thick yellow brown fluid from the tunnels, appearance of frass in and around the opening of tunnels, fermented odor of the fluid inside the infested tunnel, the appearance of a dried offshoot, producing of a gnawing sound by the grubs, presence of cocoon/adult in the leaf axils, and breaking off the stem or toppling of the crown when the palm is severely infested. Several preventive and remedial control methods were adopted against RPW including pesticides (Soroker et al, 2005). Many authors studied the relation between the length of trees and the beginning of the RPW infestation (Sallam et al., 2012).

Little information is available of the cultural control practices of the RPW. The date palm thrives in sandy land and other heavy soils. It needs good drainage and aeration. The crop is remarkably tolerant of alkali, a moderate degree of salinity is not harmful, but excessive salt may cause stunted growth and low quality of fruit, (Arar, 1975; Lukmah et al, 2002). On the other hand, because of the environmental pollution and economic costs, continuous insecticide spraying, more environmentally and economically acceptable alternative are being sought to aid in the management of the target pest.

The objective of the present investigation was to determine the effect of environmental factors such as temperatures; relative humidity; soil structures; cultural practices (flooding irrigation; dominant crops, fertilization and pruning processes) and the effect of ambient atmosphere on the date palm tree infestation on the progression of RPW infestations.

**Corresponding Author: Dr. Salem S.A*
Email: *sadeksalem2002@yahoo.com*

MATERIALS AND METHODS

In order to study the effect of cultural practices (irrigation system; dominant crops growing under date palm tree; fertilization; soil structures ; pruning and environmental conditions) on the percentage of infestation by RPW, Two farms (adjacent together, the distance between them about 3 km.), one represent sandy soil (desert) and the second represent, reclaimed area cultivated with different crops, such as Egyptian clover; wheat and vegetables were chosen at Giza Governorate during two successive seasons, 2013 and 2014 with respect to variety ,, Hayyani ,, and age of palm tree ,, 10 -15,, years ,, were selected.

At this age, date trees are most liable to RPW infestation (Abraham, 1998; Sallam et al., 2012) The soil structures of desert are: sand, 70%; silt, 16% and clay 14% with pH 7.9 and moisture holding capacity (MHC) of 31%, while the structures of reclaimed or agriculture area are: sand 57%; silt 11% and clay 32%. Most of the trees were on fruiting stage with nearly a distance of 5 m between the two adjacent trees. Fifty palm trees for both farms were chosen, and labeled, 25 palm trees for each farm were divided into three groups. The insecticide used to be the agriculture sulfur as powder with a rate of two kg. /Tree. The treatments were carried out as follow:

A: Desert farm (agricultural practices not applied):

1- Ten palm plantation in which pruning only without dusting insecticides.
2- Ten palm plantation which pruning and dusting with insecticides.
3- Five palm plantation marked and used as control (without any cultural practices).

B: Cultivated area (a reclaimed area which received all agricultural practices):

1- Ten palm plantation in which pruning was practiced without dusting insecticides.
2- Ten palm plantation in which pruning was practiced with dusting insecticides.
3- Five palm plantation left without pruning and dusting

A survey was conducted to determine the infested palm trees, the infested palms were grouped according to the position of infestation at the height of (0.5; 50-100; 100-150; 150-200 cm and the top infestation).

Statistical analysis

The obtained data were subjected to regular analysis of variance of randomized complete block design (RCBD), T test distribution outlined by Gomes and Gomez 1984.

RESULTS AND DISCUSSION

Effect of pruning on date palm infestation by RPW during the experimental time (2013 and 2014):

Data in Table (1) clearly indicated that the date palm trees pruning only without dusting applications, showed the highest infestation by the RPW. 35.2% in the sandy land (desert area), and 31.9% in reclaimed or agricultural area in 2013, while in 2014, the results recorded nearly the same data investigated at 2013 (reclaimed area, 33.1% and 26.7% in the sandy area). On the other hand, pruning date trees + dusting applications (agriculture sulfur) resulted in lower infestation rate by RPW (7.35% in sandy or desert are ; 5.1% in reclaimed area at 201 , while in 2014, the data recorded indicated that there was no significant differentiation between the two seasons, 2013 and 2014. A moderate percentage of infestation (13.4%; 15.1% and 12.33%; 10.03%) in desert and reclaimed areas at 2013, 2014 respectively.

Zagatti et al. 1997, recorded the attracted weevil of curculionids by allelochemicals released by the fermenting tissues of wounded host-plant. The data in the same table (1) revealed that the infestation percentage increased in reclaimed land than those observed in sandy land due to the variation in environmental conditions and cultural practices in both farm, without significant variation between the data recorded in the two seasons (2013 & 2014).

Influence of flooding irrigation (reclaimed area) and non-irrigation (desert) system on the percentage of infestation of date palm trees by RPW during the two years, 2013 & 2014.

Results in Table (2) showed that flooding irrigation system used in agricultural or reclaimed area chosen shows significantly higher percentage of infestation of the date trees by RPW (19.7% in 2013 and 17.82% in 2014 without pruning processes, compared to the % of infestation in the desert area which showed lower percentage of infestation (7.63% in 2013 and 9.31%in 2014, without pruning). The recorded results are in harmony with the finding by (Krishnakumar and Maheswari 2003b and Al-Ayedh and Rasool 2009).

In this context, some authors showed that the mean number of RPW caught by pheromone baited trap was significantly higher in lowlands followed by that in garden lands and uplands in most of the trapping periods, which may be due to the succulence of the tissues of the trunk in those palms in wetlands and garden lands, facilitating easy egg laying, and penetration of larvae into the trunk. Also, Al-Ayedh et al. 2009 mentioned that the RH had influence on the mating behavior; egg laying and egg hatching.

The relation between natural infestation site from ground level and trunk length from ground level:

Data summarized in Table (3) revealed that there is significant relationship between infestation site and trunk length. The females prefer to lay their eggs near to the ground surface, and also there is correlation between percentage of infestation and environmental factors. The high percentage of infestation recorded on date trees between 0-50cm (45.3 to 48.2) followed by 50-100 cm, (27.2 to 33.6) while the top infestation (2.6 to 3.5) recorded the least site observed in the two years, 2013 & 2014. The obtained and recorded data are in agreement with the data obtained by many authors (Luqman,et al. 2002; Al-Dryhim et al. 2003). The infestation mostly occurred in the lower part of the trunk, less than 1 m above the ground surface. In this respect, Azamet el al. 2001 recorded that infestation by RPW at different trunk heights of palm trees showed maximum (35.95%) infestation at high of 0.6 to 1 m, and then decreased shortly to 22.22% at 1.5 m.

Table (1): Effect of pruning on date palm infestation by red palm weevil during the experimental period

Treatments	Infestation by RPW %			
	2013		2014	
	Sandy land	Reclaimed land	Sandy land	Reclaimed land
T 1 " pruned only "	35.2	31.9	26.7	33.1
T 2 " pruned + dusting sulfur "	7.35	5.1	8.1	5.6
T 3 " non pruned "	13.4	15.1	12.33	10.03
LSD 0.05	5.91 %	5.12 %	6.81 %	5.41 %

Table (2) Effect of some cultural practices "irrigation and growing crops" on the infestation of date palm trees by RPW during 2013, 2014 seasons.

Treatments	% Infestation by RPW	
	2013	2014
Reclaimed land " non pruned "	19.7 ± 4.35	17.82 ± 3.71
Sandy land " non – pruned "	7.63 ± 5.48	9.31 ± 2.36
T value	- 2.00	- 2.31
Probability	0.034	0.023

Table (3) The relation between % of stem infestation and date tree's length

Infestation position on date palm stem	Date palm stem infestation by RPW %			
	2013		2014	
	Desert land	Reclaimed land	Desert land	Reclaimed land
0 – 50 cm	45.3 %	48.32 %	48.28 %	55.21 %
50 – 100 cm	27.2 %	33.6 %	32.6 %	38.3 %
100 – 150 cm	11.3 %	16.8 %	10.7 %	14.32 %
150 – 200 cm	4.9 %	6.66 %	5.4 %	7.42 %
Top	2.6 %	2.8	3.5 %	2.1 %

CONCLUSION

It is concluded from the present investigation that the percentage of infestation was significantly different between the two different experimental areas (desert or cultivated area). Another finding which strengthens the potentiality of early detection of RPW infestation depended on ambient atmosphere differences, was that all damaging insect activities that significantly affected the ambient atmosphere surrounded the trees, because the temperature in reclaimed or cultivated land is less than that in the desert land. It appears that date palm trees have an inherent characteristic of adaptability to diverse and harsh environmental conditions especially to ambient air temperature.

Interesting, the date palm capacity of adaptability enables healthy trees to damp down the temperature fluctuations of its surrounding environment by keeping its internal temperature almost equal to the mean of that of the ambient atmosphere, these data are in agreement with data obtained by Mohammed et al. 2013. Growers managing nursery planting of palms may have the greater potential to control the RPW by an integrated program. First, trees should be grown using cultural practices that promote vigor. This means following proper fertilization and irrigation guidelines. Secondly, wounding of trees, such as by pruning, should be avoided. Following these two steps may help to prevent an infestation.

Therefore, sanitation in removing and destroying infested plant materials, dusting agricultural sulfur; choose optimal time of pruning is crucial in preventing or reducing subsequent infestations to adjacent palms. On the other hand, many authors (Siddiqui et al. 2007) reported that the fertilization of date palm trees influenced the parasitic nematodes population densities and may also give a good growing to nursery to build good trunk to resist larval penetration.

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