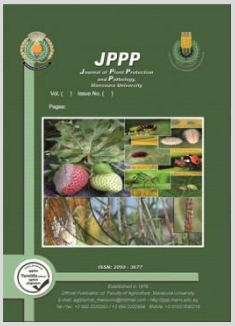
**Journal of Plant Protection and Pathology**

**Journal homepage & Available online at: www.jppp.journals.ekb.eg**

# Relationship Between Palm Frond Borer Adult Catched by Light Traps and Both of Infested Palm Trees Number and Captures of *Rhynchophorous ferrugineus* (Olivier) in Pheromone Traps in Egypt

**Olfat E. Arafa[1*]; M. M. Abd Barakatt [2]and M. A. M. Hegab[3]**

[1]Plant Protection Res. Inst., ARC, Dokki, Giza, Egypt.
[2]Central Laboratory for Date Palm Research and Development, Agric. Res. Center, Ministry of Agriculture, Giza, Egypt.
[3]Department of Plant Protection, Faculty of Agriculture, Zagazig University, Egypt.




## ABSTRACT

Monitoring palm frond borer (PFB) beetles, *Phonapate frontalis* and red palm weevils (RPW), *Rhynchophorous ferrugineus* adults were performed at Abo hezian village, Kassassen district, Ismailia Governorate during the period from January, 2020 to December 31, 2021. The results obtained during the two successive seasons of study showed that the simple correlation (r) values were positive and highly significant during two seasons, 2020 and 2021 between number of PFB beetles attracted to light trap and number of infested palm with red palm weevils &adult number of red palm weevils captured in pheromone traps where the number of infested palm were increased by increasing the number of PFB beetles in same zone. For example in first season, 2020 the highest average number of infested palm trees with RPW during July (35) accompanied with the highest average number of PFB adult attracted to light trap during July (93) and RPW adult during April (89) while in the second season ,2021 the highest average number of infested palm trees with RPW during August (42) accompanied also with the highest average number of PFB adult attracted to light trap during July (98) accompanied with the highest average number of RPW adult during April (92).Generally, to achieve more capturing effectiveness of aggregation pheromone traps and light trap in controlling RPW and PFB also infested number of date palm trees in palm plantation.

***Keywords:*** Palm frond borer, light and pheromone traps, red palm weevil, Egypt

## INTRODUCTION

Date palm trees are attacked by many insect pests, as the two new most serious insect pests, namely red palm weevil , Rhynchophorus ferrugineus (Olivier) and palm frond borer, Phonapate frontalis. (Fah.) (Coleoptera: Bostrichidae) which caused severely damage to palm trees as a total loss of the palms and rotting of the trunk, which lead to the death of the tree. R. ferrugineus was first recorded in date palm plantations of Ismailia and siwa Governorates in Egypt by (Salah, 1992). Also, Adults of P. frontalis were recently recorded by the light trap in May 2015 in oasis siwa. (Al-Ogale, 2003) recorded that the period of infestations occurred during May, June, July and August months, respectively. And the flight period of adults extended from May to October (Khattab and Helal, 1978) or from March to October (Al-Ogale, 2003) according to the difference of weather conditions. The highest catch of Phonapate adults was recorded between June and September. Adults of P. frontalis have the ability to make tunnels with in the tissue of the fronds and excreted a viscous liquid, which pairs meet to mate. The appearance of frond fracture symptoms was observed in March with a noticeable increase in the fracture rates in the period from May to August, coinciding with the period of adult flight (Bitaw and Ben Saad, 1990) Palm frond borer Phonapate frontalis F. (Coleoptera: Bostrichidae) has been recently detected as an economic pest of date palm orchards at Siwa Oasis, Egypt. The infestation symptoms appeared in the form of frond break and viscous oozes at the fracture points (Immam, 2019).

The aim of the present study was to estimate relationship between palm frond borer adult catched by light traps and both of infested palm trees number and capture of R. ferrugineus in pheromone traps, Egypt.

## MATERIALS AND METHODS

**1. Experimental area and trapping system.**

Trapping system using light traps were applied in the experimental field (3 feddans) area, were chosen in Abo hezian village, Kassassen district, Ismailia Governorate during two successive seasons, 2020 and 2021 in a heavily infested zone with both palm frond borer beetles and red palm weevils.

**Light trap.**

Monitoring of palm frond borer beetles were performed at Abo hezian village, Kassassen district, Ismailia Governorate during the period from January, 2020 to December 31, 2021. One light trap [Robinson (1950) light trap previously proposed by Williams (1923)] was placed in an open cultivated area in the experimental farm (Abo hezian) at the height of 3 meters. It was provided with 200 watt ultraviolet lamp (Mercury – vapor lamp) and was run daily for a period of 12 hours, from sunset to sunrise. Glass jar was used to collect the insects attracted to trap. The trap catch was collected weekly and examined at the laboratory

* **Corresponding author.**
**E-mail address: olfatelsayed@yahoo.com**
**DOI: 10.21608/jppp.2022.221143**

of plant protection research instuite, Sharkia branch, Zagazig city, agriculture research center were identified and counted (plate 1)

**Plate 2. light trap design and related compounds**

**Pheromone traps**

Standard Saudi bucket pheromone traps of red palm weevils (R. ferrugineus) were placed in open cultivated area in the experimental farm (Abo hezian) during the period from January, 2020 to December 31, 2021.The used traps commonly consists of plastic bucket (9 liter in size). The bucket was punctured around its wall with 4 holes each of 2.5 cm diameter at 15 cm from the bottom were made to allow adult weevils entry inside the trap safely and easily. Traps were with cover and buried in the ground down to the level of 15 cm. Each trap was 4 meter away from date palm trees.

The commercially used pheromone "Ferrugineol" is a synthetic pheromone lures. It is a mixture of 4-methyl–5-nanol and 4–methyl–5- nanone (9:1). It is imported from Chem Tica Natural; Costa Rica was used for the present field study. Pheromone sac was placed underside trap top surface. The pheromone releases its active chemicals blames through a plastic membrane (3-10 mg/day) from 400 and 1500 N/tube, respectively under laboratory conditions of 27°C and 50 % R.H.

Selected kairomone was used as a synergist to activate the potent ability of releasing ethyl acetate blooms. Ethyl acetate bags however were hanged from the underside surface of the trap top releasing chemicals through a fine plastic tube (as 100 and 128 mg /day).

Liquid soap was mixed with top water used in the inside bucket trap. 9 traps were distribution in the experimental orchard, for one season, total 18 traps in two seasons, each trap were placed equally spaced and a part 100 m., as one in each block.The changes in the population size were determined by numbers of captured RPW adults based on aggregation pheromone traps. Number of collected weevils caught in the pheromone traps was counted weekly; sexed. The mixture (water soap) was replaced weekly. Ethyl acetate kairomone and pheromone capsules within each trap were replaced by another new fresh one bi monthly(plate 2 and Fig1).

**Plate 2. Trap design and related compounds**

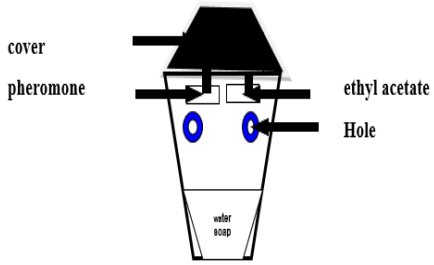



**Fig. 1. Diagrammatic drawing of bucket pheromone trap**

**2. Relationship between the numbers of *Phonapate frontalis* captures in light and baited traps and both of infested palm trees number and captures of *R. ferrugineus* in pheromone traps**

The relationship between numbers of. Phonapate frontalis captured in light trap, and their relation with number of R. ferrugineus adult captured in pheromone traps and the total number of infested palm trees with red palm weevils sited in date palm orchards at (Abo hezian) farm, El- Kassassen district, Ismailia Governorate during two successive seasons, 2020 and 2021 were planed and undertaken.

**3. Statistical analysis**

All the obtained data were statisticaly analysed according to a computer Costat programs where: analysis of variance, correlation, regression were Performa (Costat, software, 1990).

## RESULTS AND DISCUSSION

**1. Relationship between *Phonapate frontalis* captures in light trap and both of infested palm trees number and captures of *R. ferrugineus* in pheromone traps**

Data tabulated in Tables (1 to 2) and illustrated in Figures (2 to 4) revealed the relationship between numbers of. Phonapate frontalis captured in light trap, and their relation with number of R. ferrugineus adult captured in pheromone traps and the total number of infested palm trees with red palm weevils sited in date palm orchards at Abo hezian farm, El-Kassassen district, Ismailia Governorate during two successive seasons, 2020 and 2021.

**1. Light traps**

***Phonapate frontalis*.**

The simple correlation recorded in Tables (2) and illustrated in Figures (1 to 4) appeared that the simple correlation (r) values were positive and highly significant where r value =0.3826**& 0.3625 **and b=0.1293 &0.1272 during two seasons 2020 and 2021 between number of Phonapate frontalis adult attracted to light trap and number of infested palm with red palm weevils. Also, the simple correlation of the relationship between number of Phonapate frontalis adult attracted to light trap and number of R. ferrugineus captured in pheromone traps was positive and non significant where r value =0.1868 n.s. and b=0.1487 during season, 2020 and positive and significant where r value =0.3073* and b=0.2478 during season, 2021. Where the number of infested palm were increased by increasing the number of Phonapate frontalis adult in same zone. For example in first season, 2020 the highest average number of infested palm trees with red palm weevils during July (35)

accompanied with the highest average number of Phonapate frontalis adult attracted to light trap during July (93) accompanied with the highest average number of R. ferrugineus adult during April (89) while in the second season ,2021 the highest average number of infested palm trees with red palm weevils during August (42) accompanied also with the highest average number of Phonapate frontalis adult attracted to light trap during July (98) accompanied with the highest average number of R. ferrugineus adult during April (92) and the explained variance percentage (E.v.%) for the Phonapate frontalis adult attracted to light trap was 17.64% & 14.47% on number of infested palm trees and R. ferrugineus during two seasons 2020 and 2021,respectively. These results are in agreement with the finding of Morin et al. (1997) stated that their work on Curculionidae (Rhynchophorus) has resulted in the identification of aggregation pheromones, which have been synthesized and are currently being used in combination with the plant to trap adults and reduced the damage caused by these pests. Research is continuing with a views to developing an entirely synthetic attracted capable of trapping Rhynchophorus without the plant. which is the main component of the aggregation pheromone and opens up new prospects for controlling the pest. Hallett et al. (1999) reported that the Asian palm weevil was captured in the same traps their respective pheromones. These results have led in part to pheromone based mass – trapping of the Asian palm weevil throughout the Middle East where the weevil is a serious introduced pest of date palms.

**Table 1. Monthly average number of *Phonapate frontalis* adult attracted to light trap, number of *Rhynchophorus ferrugineus* adult captured in pheromone traps and total number of infested palm with red palm weevils sited in date palm orchard at Abo hezian farm, El- Kassassen district, Ismailia Governorate during two successive seasons, 2020 and 2021.**

| Date | Season 2020 | | | Season 2021 | | | General total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Adults *Phonapate frontalis* attracted to Light trap | Infestation with *R. ferrugineus* | | Adults *Phonapate frontalis* attracted to light trap | Infestation with *R. ferrugineus* | | Adults *Phonapate frontalis* attracted to light trap | Infestation with *R. ferrugineus* | |
| Monthly | | No. of infested trees | No. of captured adults to pheromone trap | | No. of infested trees | No. of captured adults to pheromone trap | | No. of infested trees | No. of captured adults to pheromone trap |
| Jan. | 0 | 20 | 4 | 0 | 31 | 7 | 0 | 51 | 11 |
| Feb. | 5 | 28 | 10 | 9 | 32 | 12 | 14 | 60 | 22 |
| March | 20 | 25 | 59 | 24 | 28 | 62 | 44 | 53 | 121 |
| April | 38 | 12 | 89 | 43 | 16 | 92 | 81 | 28 | 181 |
| May | 60 | 23 | 52 | 63 | 25 | 57 | 123 | 48 | 109 |
| June | 84 | 6 | 42 | 87 | 11 | 47 | 177 | 17 | 89 |
| July | 93 | 35 | 23 | 98 | 19 | 28 | 191 | 54 | 50 |
| Aug. | 87 | 21 | 15 | 90 | 42 | 19 | 177 | 63 | 34 |
| Sep. | 80 | 20 | 7 | 83 | 28 | 11 | 162 | 48 | 18 |
| Oct. | 45 | 15 | 24 | 48 | 20 | 27 | 93 | 35 | 51 |
| Nov. | 26 | 21 | 78 | 30 | 23 | 85 | 58 | 44 | 163 |
| Dec. | 0 | 17 | 14 | 0 | 19 | 21 | 0 | 36 | 35 |

**Total 2. Simple correlation between different population parameter affected by number of *Phonapate frontalis* and both of captured adult of *Rhynchophorus ferrugineus* in pheromone traps and the total number of infested palm with red palm weevils sited in date palm orchard at Abo hezian farm, El- Kassassen district, Ismailia Governorate during two successive seasons, 2020 and 2021.**

| X | Y | 2020 | | | | 2021 | | | | General total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Simple correlation | | Regression | | Simple correlation | | Regression | | Simple correlation | | Regression | |
| | | | | Simple | Multiple | | | Simple | Multiple | | | Simple | Multiple |
| | | r | p | b | E.v.% ($R^2$x 100) | r | p | b | E.v.% ($R^2$x 100) | r | p | b | E.v.% ($R^2$x 100) |
| Adults of *Phonapate frontalis* attracted to light trap | No. of infested palm. trees | 0.3826 | .0047 ** | 0.1293 | 17.64% | 0.3625 | .0076 ** | 0.1272 | 14.47% | 0.4104 | .0023 ** | 0.1319 | 18.76% |
| | No. of. *R.ferrugineus* | 0.1868 | .1803 ns | 0.1487 | | 0.3073 | .0252 * | 0.2478 | | 0.2226 | .1091 ns | 0.1783 | |

**r = Correlation coeficient. p = Probability. n.s. = non- significant *=significant**

Similar note was also observed at Siwa's date palm groves. The chewing behavior of this bostrichid beetle induces powder-like material of the internal frond tissues that could extremely affect the photosynthesis process and also makes the fronds unsuitable for handcraft manufactures or wood industries (Liu et al. 2008 and Al-Deeb and Khalaf 2015). The deterioration of sapwood due to the excavation behavior of both larval and adult stages of P. frontalis beside the absence of vascular cambium or lateral meristem in the date palm tree (monocotyledonous species) may exacerbate the pro as there is no chance for the compensation or formation of newly vascular bundles instead of the destroyed ones (Broschat, 2013).

Generally, data recorded in Tables (1 & 2) showed that the correlation values were positive and significant between number of infested palm and number of R. ferrugineus adult during whole studying period, where the highest average number of infested palm trees with red palm weevils during August (63) accompanied with the highest average number of Phonapate frontalis adults attracted to both light trap. During July it was (191 insects) accompanied with the highest average number of R. ferrugineus adult during April (181). Also, the essential factors in infestation trees with R. ferrugineus may be due to the Phonapate frontalis adults attracted to light traps. Also it can be understood that the free adults attracted to light more help to cause infestation in date palm trees with R. ferrugineus . The simple correlation recorded in Tables (2) and illustrated in Figures (1 to 3) appeared that the simple correlation (r) values were positive and highly significant where r value =0.4104**and b= 0.1319 between number of Phonapate frontalis adult attracted to light trap and number of

infested palm with red palm weevils. Also, the simple correlation of the relationship was positive and non-significant where r value=0.2226 n.s. and b=0.1783 between number of Phonapate frontalis adult attracted to light trap and adult number of R. ferrugineus captured in pheromone traps and the explained variance percentage (E.v.%) for the Phonapate frontalis adult attracted to light trap was 18.76% on number of infested palm trees and R. ferrugineus. From preceding studies these results agreed with the finding of Abraham (1975) showed that wounding of the palms like cutting steps into the stem to facilitate climbing should be avoided. When the leaves are cut for domestic use, the grubs may tunnel their way into the stem through the cut end of the petiole where eggs will be laid. If the leaves are cut at or beyond the area in which the first leaflets emerge, the petiole length will be long enough to prevent.

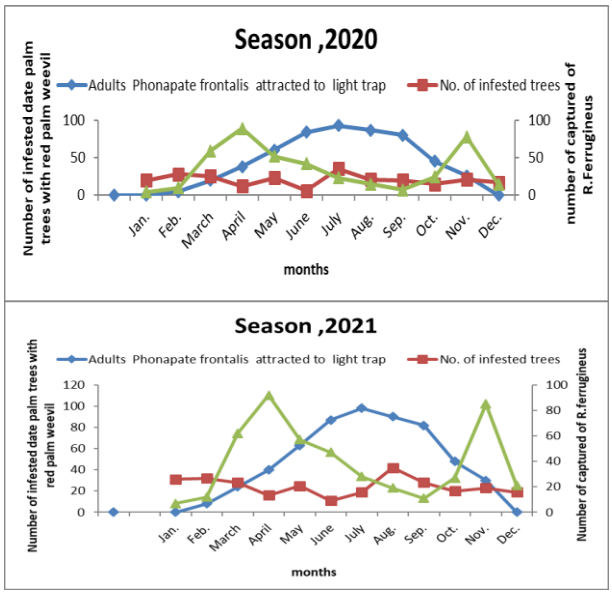



**Fig. 2. Seasonal fluctuation of *Phonapate frontalis* adult attracted to light trap, number of *Rhynchophorus ferrugineus* adult captured in pheromone traps and total number of infested palm with red palm weevils sited in date palm orchard at Abo hezian farm, El-Kassassen district, Ismailia Governorate during two successive seasons, 2020, and 2021.**

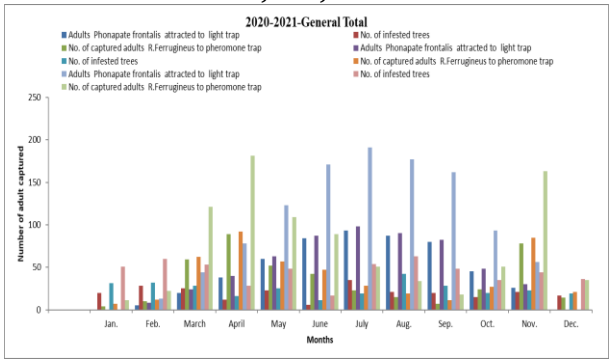



**Fig. 3.Seasonal fluctuation of *Phonapate frontalis* adult attracted to light trap, number of *Rhynchophorus ferrugineus* adult captured in pheromone traps and total number of infested palm with red palm weevils sited in date palm orchard at Abo hezian farm, El- Kassassen district, Ismailia Governorate during two successive seasons, 2020, and 2021.**

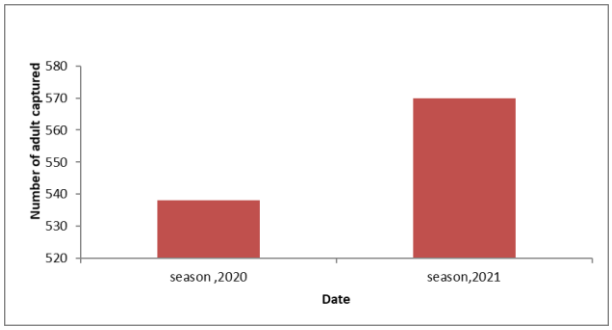



**Fig. 4. Total number of *Phonapate frontalis* adult attracted to light trap, sited in date palm orchard at Abo hezian farm, El- Kassassen district, Ismailia Governorate during two successive seasons, 2020, and 2021.**

## CONCLUSION

Generally, to achieve more capturing effectiveness of aggregation pheromone traps and light trap in controlling red palm weevil and palm frond borer also infested number of date palm trees in palm plantation in Egypt.

## REFERENCES

Abraham, V.A.; K.M. Abdulla Koya and C. Kurian (1975). Evaluation of seven insecticides for control of red palm weevil *Rhynchophorus ferrugineus* Fabr. Journal of plantation crops, 3 (2): 71 – 72.

Al-Deeb MA, Khalaf MZ (2015) Longhorn Stem Borer and Frond Borer of Date Palm. In: Wakil W, Faleiro JR, Miller TA (eds) Sustainable pest management in date palm: Current status and emerging challenges, sustainability in plant and crop protection. Springer Cham, Heidelberg New York Dordrecht London. https://doi.org/10.1007/978-3-319-24397-9_1, Library of Congress Control Number: 2015958728.

Al-Ogale SM (2003) Biological study of the palm frond borer *Phonapate frontalis* (Fahraeus), Coleoptera: Bostrichidae. M.Sc., Fac. Sci., Tripoli Univ, at Al-Wahat, p 58.

Bitaw AA, Ben-Saad AA (1990) Survey of date palm trees insect pests in Libya. Arab J Plant Prot 8(2):72–76.

Broschat TK (2013) Palm morphology and anatomy. The environmental Horticulture Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. ENH1212 available at: https: // edis. ifas. Ufl.edu/ep473. Accessed 24 Apr 2016

Costat, Software (1990).Micro computer program analysis version 4-20, CoHort Software, Berkley, C.A.

Hallett, R.H.; A.C.; Oehlschlager and J.H. Borden (1999). Pheromone trapping protocols for the Asian palm weevil, *Rhynchophorus ferrugineus* (Coleoptera: Curculionidae). International – Journal – of – Pest-Management, 45 (3): 231 – 237.

Imam AI (2012) Evaluation of some integrated managements to combat the greater date moth, *Arenipses sabella* Hmps. (Lepidoptera: Pyralidae), on date palm trees under Siwa Oasis conditions in Egypt. Egypt J Biol Pest Control 22(2):157–160

Khattab AA, Helal H (1978) Population of *Bostricopsis reichei* Mars. and *Phonapate frontalis* F. caught by a light trap in Giza region as related to temperature and relative humidity. Agricultural research review 56:83–90

Liu LY, Schönitzer K, Yang JT (2008) A review of the literature on the life history of Bostrichidae (Coleoptera). Mitt Münch Ent Ges 98:91–97

Morin, J.P.; P. Zagatti; D. Rochat; C. Descoins and D. Mariau (1997). The pheromones of insect pests affecting palms. Research under way and prospects. Plantations, Recherche, Development., 4 (2): 91 – 103.

Robinson HS, Robinson PJM (1950). Some notes on the observed behavior of Lepidoptera in flight in the vicinity of light-sources together with a description of a light trap designed to take entomological samples. Entomol Gaz 1:3–20.

Saleh, M.R.A. (1992). Red palm weevil, *Rhynchophorus ferrugineus* (Olivier). The first record for Egypt and indeed the African Continent, List No. 10634 Africa, Collection No. 22563. British Museum Report of International Institute of Entomology, 56 Queen's Gate, London, SW 75 JR UK: 1p.

Williams, C.B. (1923). A new type of light – trap for insects. Bull. 28, Tech. and Scientific service, Ministry of Agriculture, Cairo. C.F. Rev. App. Ent., (1973) 61 (11): 1130.

## العلاقه بين حفارسعف النخيل المنجذب للمصائد الضوئيه وكلا من سوسه النخيل الحمراء المنجذبه للمصائد الفرمونيه وعدد اشجار النخيل المصاب فى مصر

**الفت السيد عرفة[1] ، ماهرمحمد عبدالحافظ بركات [2] ومحمد على مرسى حجاب[3]**

**[1]معهد بحوث وقاية النباتات-مركز البحوث الزراعية - الدقى -الجيزة- مصر.**

**[2]المعمل المركزلابحاث وتطوير نخيل البلح -مركز البحوث الزراعيه –وزاره الزراعه -جيزه –مصر**

**[3]قسم وقاية النبات – كلية الزراعة – جامعة الزقازيق**

أوضحت الدراسه التى اجريت لمعرفه التغيرات فى تعداد حفار سعف النخيل فى قريه ابوحزين مركز القصاصين محافظه الاسماعيليه لمده موسيميين متتاليين من يناير 2020 حتى ديسمبر 2021 م انه يوجد ارتباط معنوى وموجب خلال موسمى الدراسه 2020 و2021 بين اعداد الحشرات الكامله لحفار سعف النخيل المنجذبه للمصيده الضوئيه واعداد سوسه النخيل الحمراء المصاده بالمصائد الفرمونيه وايضا وجد ارتباط بسيط موجب ومعنوى للعلاقه بين اعداد الحشرات الكامله لحفار سعف النخيل المنجذبه للمصيده الضوئيه واعداد النخيل المصاب بسوسه النخيل الحمراء خلال موسمى الدراسه 2020 و2021 حيث زادت اعداد النخيل المصاب بزياده اعداد الحشرات الكامله لحفار سعف النخيل فى نفس المنطقه على سبيل المثال فى الموسم الاول لعام 2020م سجل اعلى تعداد لاشجار النخيل المصابه بسوسه النخيل الحمراء فى يوليو بمعدل 35 نخله بالمثل سجل اعلى تعداد للحشرات الكامله لحفار سعف النخيل المنجذبه للمصيده الضوئيه فى يوليو بمعدل 93حشره وبالمثل سجل اعلى تعداد للحشرات الكامله لسوسه النخيل الحمراء فى ابريل بمعدل 89 سوسه بينما فى الموسم الثانى لعام 2021 م سجل اعلى تعداد لاشجار النخيل المصابه بسوسه النخيل الحمراء فى اغسطس بمعدل 42 نخله بالمثل سجل اعلى تعداد للحشرات الكامله لحفار سعف النخيل المنجذبه للمصيده الضوئيه فى يوليو بمعدل 98حشره وبالمثل سجل اعلى تعداد للحشرات الكامله لسوسه النخيل الحمراء المصاده بالمصائد الفرمونيه فى ابريل بمعدل 92 سوسهوهذا يوضح العلاقه بين الحشرتين عموما لمكافحة سوسة النخيل الحمراء وحفارسعف الخيل والحصول على أعلى تأثيرللاصطياد لابد من استخدام المصائد الفرمونيه والمصائد الضوئيه وذلك خفض اعداد النخيل المصاب بسوسه النخيل الحمراء وحفار سعف النخيل فى مزارع النخيل فى مصروتعتبر احد طرق المكافحه المتكامله لهذه الافه0