# STUDIES ON HOST PREFERENCE AND ITS BIOLOGICAL EFFECTS ON THE RED PALM WEEVIL, *RHYNCHOPHORUS FERRUGINEUS* OLIVIER IN EGYPT
## A. THE WOODEN HOST PLANTS

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## ABSTRACT

The red palm weevil, *Rhynchophorus ferrugineus* Oliv. is the most serious pest of date palm trees in Egypt.Facultative and obligative feeding were carried out under laboratory conditions.

Results of choice test showed that Mulberry.*Morus alba* L. and Tafla, *Nerium oleander* are rejected, *while* Date palm and ornamental palm were the most attractive food to the insect.

Obligative feeding of *R.ferrugineus* larvae on wooden hosts caused decrease in larval body weight ,which larvae fed on Sespan, *S. aculeata* and Casuarina, *C. equisetifolia* L. reached 6.44 and 5.16 mg/larva.comparing with18.10mg/larva, when larvae fed on ornamental palm trees .

The fresh bark of sespan, tamarack, casuarinas, Egyptian willow and mulberry were accepted food . Injured site and interior tissues of ornamental palm, date palm and Oleander plant were preferred , while all parts of mulberry trees were favourable food to the larvae The results showed that the tested wooden plants not preferable as food and affected the biology of *Rhynchophorus ferrugineus* larvae

## INTRODUCTION

The red palm weevil, *Rhynchophorus ferrugineus* Olivier is the most destructive insect pest amongst all the arthropod pests. A heavily infested palm trees become hollow and fall on the ground. It is rather difficult to detect the infestation of this pest, *R. ferrugineus* in the initial stage but noticed in advanced stage, the loss caused is irreparable (Dhamo, 1975). Since latter decade of twentieth century, red palm weevil, *R. ferrugineus* oliv. Had become a serious pest of date palm, *Phoenix dactylefera* Linn. In Egypt.

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Studies have so far been carried out on different aspects of its biology population growth and chemical control in India, Pakistan, Saudi Arabia and else where by many research workers (Haque and Akmal, 1972; Haider, 1980; Jilani and Anwar, 1984; Chughtai, 1986; Baloch *et al.*, 1992 and El-Ezaby, 1997; Gunawardena *et al.* (1998); Muralidharan *et al.* (1999); Faleiro *et al.* (2002); Salama and Abdel-Razek (2002); Faleiro *et al.* (2003); Hallett *et al.* (2004); Abbas *et al.* (2006).

Till this year, no information is available on hosts, host preference and relationship between host plant and the development of this insect as serious pest in Egypt.

The aim of this study is to explore the host range and active host preference of *R. ferrugineus* insect to Egyptian Local plants with notes on its development under laboratory conditions. Research was also, oriented to test the efficiency of different preferred host plants to attack the weevils to elucidate these host plants to incorporate in integrated pest management programmers against red palm weevil, *R. ferrugineus* in Egypt.

## MATERIAL AND METHODS

**Insect Colony:**

The original culture of red palm weevil, *Rhynchophorus ferrugineus* Olivier was obtained from the infested palm trees. The sample of *R. ferrugineus* insect comprising eggs, larvae and adult weevils. The collected eggs were kept in glass bottles with the soft Succulent tissues of the palm trees. The glass bottles were covered with double layers of black mousseline and tied with rubber band. The plant fibers were moisted with water day by day till egg hatch. The collected larvae were kept in plastic trays. An external surface of the trays was painted with black colour. The trays provided with fresh pieces of seedlings of ornamental palm and supplied with coarse palm fibers over the source of food to facilitate cocoon formation for pupation of grubs. The cocoons were removed and kept in plastic trays (40 cm length x 25 cm width x 10 cm height) with soft coarse palm fibers till adult emergence.

Newly emerged adults were kept in cages with wired walls and supplied with inner pieces of palm trees as oviposition site and for providing food. To study the effect of host preference, two experiments (.Facultative and obligative feeding) were carried out under laboratory conditions using 3rd larval instar of the insect.

**Host plants:**

The tested wooden plants were sespan, *Sesbania aculeaata* Poir., tamarack, *Tamarix articulate*, casuarina, *Casuarina equiosetifolia* L., Egyptian willow, *Salix*

*subserrata*, mulberry, *Morus alba* L., Tafla, *Nerium oleander* L. and ornamental palm ( *Phoenix* spp.).

**A. Facultative experiments:**

Laboratory trails with different wooden plants were carried out in order to study preference of host plants localized in Egypt to the larvae of red palm weevil, *Rhynchophorus ferrugineus* Oliv., and to evaluate the attractive host plants to the insect larvae. All the experiments were performed at 29° ± 1°C and 70 ± 5 % R.H. Five experiments were conducted using fresh branches of wooden plants. Each experiment was represented by five replicates. Each replicate (aluminum tray 40 X 40 X 20 $cm^3$) contained three pieces (10 – 15 cm length) of each wooden plant. Each replicate was provided by 25 larvae ($3^{rd}$ instar) of *R. ferrugineus*. The trays were closed with plastic covers having perforations (1mm diameter). After 7 days, the pieces of tested plants were examined. The quantities of feeding were determinate as percentages of weight (mg) of consumed food from the piece of wooden plant . Mean percentage of *R. ferrugineus* larvae attracted to each host plant were recorded.

**B. Obligative experiments:**

To study the effect of exposing the larvae of *R. ferrugineus* Oliv. on the wooden plant in obligative technique, five experiments were carried out under laboratory conditions, using different wooden host plants. Each experiment contained five replicates. In each experiment, fresh branches of wooden plants were cut into small pieces (10 – 15 cm length) and placed in each glass jars painted with black colour from external surface. Each Jar (5 liter capacity) was supplied with 5 pieces of single wooden plant and provided with 10 larvae ($3^{rd}$ instar) of *R. ferrugineus*. Jars were covered with mousseline and plastic covers with small holes for ventilation and kept under laboratory conditions. The pieces of wooden branches were examined weekly. Food consumption was recorded as quantity (mg). Biological aspects and adult emergence were recorded and statistically analysed using analysis of variance (F- test).

**C. Preference site of food:**

Experiments were conducted under laboratory conditions to express the suitable site of wooden plant for feeding the larvae of red palm weevil, *R. ferrugineus*. Freshly stem pieces and shreded stem pieces were prepared by peeling longitudinal part of the peel of the host sections. Each experiment contained 5 replicates supplied with 5 pieces of single plant. Each replicate (glass Jar, 5 liter

capacity) provided with 10 larvae (3rd instar) of red palm weevil. Preferred site of host plant for the insect larvae was recorded.

**D. Biological experiments:**

For comparing the development of the larvae of red palm weevil fed on fresh branches of wooden trees, experiments were carried out by using different wooden host plants. Each experiment contained 5 replicates (plastic trays 25 X 25 X 10 $cm^3$ in each). Each replicate was provided with 5 pieces (10 – 15 cm length) of a single host plant and supplied with ten larvae (3rd instar) of *R. ferrugineus*. A piece of moistened cotton was placed in each tray and renewed day by day till emergence. The trays were covered with double layers of black moussline and kept under laboratory conditions. Larvae were observed and biological aspects were recorded till pupation (forming cocoon). Pupae were removed daily and placed on moisted coarse fibers of palm trees till adult emergence. Body weights (mg) of treated larvae were recorded. Pupation percentages and adult emergence were recorded. The obtained data were subjected to statistical analysis (analysis of variance, F-test).

## RESULTS AND DISCUSSION

**Facultative experiments:**

Data in Table (1): showed that significantly highest attraction for insect larvae was recorded on ornamental palm seedlings, which food consumption reached 100 % followed by 25% food consumption of *Morus alba* L., and *Nerium oleander* L., plants. However, wooden plants such sespan, *Sesbania aculeaata* Poir., tamarack, *Tamarix articulate*, casuarina, *Casuarina equiosetifolia* L. and Egyptian willow, *Salix subserrata* seemed to be less suitable food to the red palm weevil .

**Preferred site for feeding larvae:**

The obtained results (Table 2) demonstrated that the fresh bark of the wooden hosts such sespan, *Sesbania aculeaata* Poir., tamarack, *Tamarix articulate*, casuarina, *Casuarina equiosetifolia* L., Egyptian willow, *Salix subserrata* and mulberry, *Morus alba* L. was the attractiveness part as food to the larvae of *R. ferrugineus* insect, while fresh bark of ornamental palm trees and tafla, *Nerium oleander* L palnts were not accepted. The most preferred parts of ornamental palm trees and tafla were injured site and interior tissues of the trees. The fresh bark, injured site and inner soft tissues of mulberry, *Morus alba* L. plant were favourable food for the larvae of red palm weevil.

**TABLE (I)**

Food selection of wooden trees by the larvae of red palm weevil, *R. ferrugineus*.

| Range of food consum. Weight (mg) (%)* | Freshly branches of wooden trees | | | | | | |
|---|---|---|---|---|---|---|---|
| | *S. aculeata* Poir. | *T. articulate* | *C. equisetifolia* L. | *S. subserrata* | *M. alba* L. | *N. oleander* L. | Ornamental Palm (*Phoenix* spp.) |
| 1 % - 10 % | + | + | + | + | - | - | - |
| 11 % - 25 % | - | - | - | - | + | + | - |
| 26 % - 50 % | - | - | - | - | - | - | - |
| 51 % - 75 % | - | - | - | - | - | - | - |
| 76 % - 100 % | - | - | - | - | - | - | + |

- : Rejected host plants. + : Accepted host plants.

**TABLE (I)**

Preferred site of host plant for feeding of red palm weevil, *R. ferrugineus* larvae.

| Consumed Site * | Freshly branches of wooden trees | | | | | | |
|---|---|---|---|---|---|---|---|
| | *S. aculeata* Poir | *T. articulate* | *C.equisetifolia* L. | *S. subserrata* | *M. alba* L. | *N. oleander* L. | Ornamental palm (*Phoenix* spp.) |
| Fresh bark | + | + | + | + | + | - | - |
| Injured site of host plant | - | - | - | - | + | + | + |
| Inner soft tissues | - | - | - | - | + | + | + |

- : Rejected site of host plant. + : Accepted site of host plant.

**Biological experiments:**

**a) Obligatory feeding of larvae:**

Data in Table (3) showed that, The heaviest larval body weight was obtained when larvae were fed on seedlings of ornamental palm 18.10 mg/larva followed by those fed on Sespan, *S. aculeata* and Casuarina *C. equisetifolia*, averaging , 6.44 and 5.16 mg/larva respectively. However, it was recorded that in the case of larvae fed on *M. alba* and *N. oleander* plants which drastically decreased the larval body weight. The results presented in Table (3) cleared that body weights of the larvae of *R. ferrugineus*, fed on Egyptian willow, *Salix subserrata* (3.68 mg/larva) were heavier than those fed on Mulberry, *Morus alba* L. (1.28 mg /larva) and those fed on Tafla, *N. oleander* (1.04 mg /larva) comparing with the larvae fed on the ornamental palm, so that the average weights of larvae of red palm weevil, *R. ferrugineus* Oliv. Were highly significant affected by the source of larval food which considerable consumption rate of food were recorded when larvae fed on were sespan, *Sesbania aculeaata* Poir., tamarack, *Tamarix articulate*, casuarina, *Casuarina equiosetifolia* L.

It is interesting to notice that, the larval mortality was appreciably increased (97 % - 100% mortality) by feeding insect larvae on the tested wooden plants comparing with those fed on the seedlings of ornamental palm as control (1 % mortality). It was noticed that the percentage of larval mortality and larvae that failed to pupate or adults, which failed to emerge were higher in insect fed on wooden trees than those fed on ornamental palm or date palm trees (control)

Based on the results of feeding tests under Laboratory conditions, it was show that obligative feeding of the red weevil did not show a significant difference in the response to the branches of wooden trees.

One possible explanation is that the hardened barks of wooden trees have fever injuries become attractive to the weevils and the terminal cut of the protion of the plant when are tapped and this indicates the high potency of the injured portion of the plant as attraction sites once they are injured.

Toward, the wooden plant, the fresh bark was acceptable food to larvae of the red palm weevils. If an insect is forced to feed on non preferred host plant, the results would be the death of the insect often during the larval stage or decrease of pupation or failing adult emergence.

**TABLE (I)**

Biological effect of obligatory feeding of red palm weevil larvae on local Egyptian wooden plants

| Host plant | No. of larvae | Aver. of initial weights of larvae (gm) before feeding | Aver. % consum. Weight (mg) of host plant after 7 days of feeding | Aver.body weight of treated larvae (mg/larva) after 7 days of feeding | % Larval mort. after 7 days of trees | % Pup. | % Adult emerg. |
|---|---|---|---|---|---|---|---|
| *S.aculeata* Poir. | 10 | 10.3(±0.201)*a | 9.06(±0.04)b | 6.44(±0.05)bc | 100 | 0.0 | 0.0 |
| *T.articulate* | 10 | 10.2(±0.20)a | 6.44(±0.07)c | 4.12(±0.06)d | 100 | 0.0 | 0.0 |
| *C.equisetifolia L.* | 10 | 10.3(±0.30)a | 6.34(±0.15)c | 5.16(±0.10)cd | 100 | 0.0 | 0.0 |
| *S. subserrata* | 10 | 10.4(±0.19)a | 1.06(±0.04)e | 3.68(±1.70)d | 100 | 0.0 | 0.0 |
| *M. alba L.* | 10 | 10.6(±0.18)a | 2.56(±0.07)d | 1.28(±0.14)e | 97 | 3.0 | 0.0 |
| *N. oleander* L. | 10 | 10.5(±0.22)a | 1.04(±0.04)e | 1.04(±0.05)e | 100 | 0.0 | 0.0 |
| *Phoenix* spp. | 10 | 10.6(±0.16)a | 97.30(±0.44)a | 18.10(±0.25)a | 1.00 | 99.0 | 96.2 |
| F-values | | $0.442^{NS}$ | 336.613** | 77.640** | | | |
| L.S.D. | | - | 0.514 | 1.766 | | | |

*Values in brackets are the standard error.
** : Highly significant.
NS : Not significant.

According to the preceding results, it could be suggest that, wooden hosts were failed to be suitable or susceptible to attack. Also, these hosts affected the biology of larval stage of the insect by preventing their development for survival and minimized number of pupae were resulted or failed to adult emerge.

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