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# EVALUATION OF INFESTATION DEGREES, AGE, STEM HEIGHT AND OCCURRENCE OF THE RED PALM WEEVIL, *Rhynchophorus ferrugineus* (COLEOPTERA: CURCULIONIDAE) ON CERTAIN DATE PALM ULTIVARS IN EGYPT

**Abdel-Salam, A. H.[1]; S.S. Awadalla[1] and K. M. Abdel-Hamid[2]**

**[1]Economic Entomology Department, Faculty of Agriculture, Mansoura University, Mansoura 35516,, Egypt.**

**E-mail: adhabdelus@yahoo.com**

**[2]Central Laboratory for Date Palm Research and Development, Agricultural Research Center, Ministry of Agriculture, Egypt**

## ABSTRACT

The infestation degrees, age, and stem height by the red palm weevil (RPW), *Rhynchophorus ferrugineus* (Olivier) were evaluated on two cultivars (Zaglol and Samany) in four Governorates (Dakahlia, Qaluobia, Behera, and Giza) during four years (2003, 2004, 2005, and 2006) and occurrence of the insect stages was also recorded.

Based on the data from the four Governorates, the infestation by RPW was high in Giza Governorate, moderate in both Behera and Qaluobia, whereas the infestation was low in Dakahlia Governorate. The obtained results indicate that 4348 (16.88%) and 3132 (12.94%) date palms were found infested by RPW on Zaglol and Samany cultivars. The infestation was the highest in Giza Governorate while it was the lowest in Dakahlia Governorate on Zaglol and Samany cultivars. Out of 4348 infested date palms recorded during the survey, 3228 (74.24%) date palms were with low infestation, 725 (16.67%) with medium infestation, and 390 (8.96%) with high infestation on Zaglol cultivar. Meanwhile, with respect to Samany cultivar, 2356 (75.22%) date palms were with low infestation, 471 (15.04%) with medium infestation, and 305 (9.74%) with high infestation.

During the study period, the red palm weevil infestation on both cultivars was high in date palms belonging to the age group of 6-10 years followed by the date palms belonging to the age group of 1-5 years. Meanwhile, it was very low in the age group of 16-20 and >20 years.

The results indicated that the maximum infestation by RPW on Zaglol and Samany cultivars was found in date palms with stem height of 4.0 to 6.0 m, followed by the stem height of 0.0 to 3.0 m, 7.0 to 9.0 m, and 10.0 to 12.0 m, while it was low in date palms with stem height of >12 m. Based on the statistical analysis, there were significance differences between the different stem heights of date palms in all years among the Governorate. In addition, there were significance variations between Governorates among the same year in each stem height.

In conclusion, the data suggest that the insect had two main active seasons annually. The first adult brood was observed in February and the second one was in August.

**Keywords**: Thorough survey, *Rhynchophorus ferrugineus*, date palm cultivars, infestation degrees, occurrence, Egyptian Governorates

## INTRODUCTION

The Red Palm Weevil (RPW), *Rhynchophorus ferrugineus* (Olivier) is one of the most serious palm pests in recent years in the Middle East countries and has caused a great damage (Farazmand *et al.*, 2000; Sacchetti

*et al.*, 2006; Al-Ayedh, 2008; Bozbuga and Hazir, 2008). The RPW was discovered attacking palms in Sharkia region of Egypt in 1992 (Cox, 1993).

The larval stage of this insect feed within the trunk of palms and this behavior frequently kills the trees. The larvae can only bore in soft tissue; for example, in the tree crown, upper part of the trunk and at the base of petioles. They can also bore into the trunk of young palms and the decaying tissue of dying palms. The pest affects stems and growing points. It is very difficult to detect the RPW in the early stages of infestation. Generally, it is detected only after the palm has been severely damaged. Careful observation may reveal the following signs which are indicative of the presence of the pest: holes in the crown or trunk from which chewed-up fibers are ejected (this may be accompanied by the oozing of brown viscous liquid); crunching noise produced by the larvae feeding can be heard when the ear is placed to the trunk of the palm; withered bud/crown. The weevils are attracted to dying or damaged parts of palms but it is possible that undamaged palms are also attacked (Farazmand *et al.*, 2000; Sacchetti *et al.*, 2006; Al-Ayedh, 2008).

*Rhynchophorus ferrugineus* can reared in a wide range of climates, and this is largely because the larvae feed protected within their host palms (Wattanapongsiri, 1966). This weevil is able to complete several generations in a year (Rajamanickam *et al.*, 1995); frequently, several generations can be passed in the same host tree before the tree collapses. In addition, in the Middle East, the bulk and quick movement of date palm offshoots as planting material has led to the rapid spread of the pest (Abraham *et al.*, 1998). All of these factors (along with others, such as being polyphagous) contribute to the weevil's ability to colonize and breed at new sites and for populations to reach outbreak levels. The main factor limiting numbers is the number of suitable breeding sites (Kalshoven, 1981). These will be far more numerous in a managed plantation than in a natural habitat. Under some circumstances, natural enemies are also very likely to be important in limiting the distribution and incidence of the red palm weevil. The excessive use of insecticides is likely to limit the activity of natural enemies in plantations (Sacchetti *et al.*, 2006; Bozbuga and Hazir, 2008). The apparent general absence of natural enemies in the date palm plantations in the countries of the Middle East would explain why the red palm weevil has a particularly devastating impact in this region (Cox, 1993; Sacchetti *et al.*, 2006; Bozbuga and Hazir, 2008).

The survey studied in this work classifying infestation levels due to *R. ferrugineus* on date palm and provide pest managers a valuable tool to confidently decide on initiating area-wide management of *R. ferrugineus* in date palm plantations of Egypt, besides assisting assessment of the impact of on going management programs thereby optimizing the use of resources available and will enable to formulate an integrated pest management (IPM) program for controlling the RPW infestation. Scarce information is available on the seasonal abundance, infestation degrees, and susceptibility of certain date palm cultivars to RPW. Therefore, the objective of this study was to evaluate a thorough survey of RPW infestation in different Governorates to provide knowledge about the susceptibility of different date palm cultivars to infestation, place of infestation on the stem, and most susceptible age group

of the date palm to gather certain information about the pest incidence and to describe the occurrence of RPW.

## MATERIALS AND METHODS

The infestation of RPW was carried out from thorough survey during 2003, 2004, 2005 and 2006 years in four Governorates (Dakahlia, Behera, Qaluobia, and Giza) on the two cultivars namely Zaglol and Samany. The total number of date palms, level of infestation, and date of recording months were recorded half monthly. The infestation degrees were recorded as follows: low=dryness of the outer leaves and slight or no odor, Medium=oozing of brown fluid from the holes in the stem, medium to large larvae are present after removing leaf base cover, damage stem tissues, and no cocoon-if present, they will be only 1-5 cocoons and high=presence of chewed fibers mainly in stem, with bad smell, many cocoons are noticeable, yellowing of the third leaf-row, sometimes yellowing of internal leaves and the flag leaf, trunk lodging, and death of palm.

The infestation by RPW on certain date palm cultivars were categorized into 5 age groups as: 1-5, 6-10, 11-15, 16-20 and >20 years. Total number of date palms and number of infested palms were recorded under each age group. In addition, data were collected on RPW infestation in relation to stem height of date palm. The height levels were categorized into 8 levels as: 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 from ground level. The number of date palms infested under each height group was recorded.

All stages (eggs, larvae, and adults, as well as empty and occupied cocoons) were removed and counted from infested date palms. All cocoons were opened to determine the stadium of the weevil (last instar larva, pre-pupa, pupa, or adult). Infested date palm cultivar (Zaglol) stems were sectioned with a chainsaw and a sharp and heavy-bladed knife.

**Statistical analysis**

Data for RPW infestation in different Governorates, the susceptibility of different date palm cultivars to infestation, place of infestation on the stem, and most susceptible age group of the date palm were subjected to an analysis of variance (ANOVA) and means were separated by a Duncan's Multiple Range test when the ANOVA was significant at $P < 0.01$ (CoHort Software, 2004).

## RESULTS AND DISCUSSION

**Infestation by RPW in certain Governorates:**

From 2003 to 2006, a total 49940 date palms were observed on the two cultivars (Zaglol and Samany) in four Governorates to determine the infestation percentage of red palm weevil (Tables 1 and 2). The infestation level during the period of study on the two cultivars was 16.88 and 12.94%.

During 2003 on Zaglol cultivar, 847 (12.52%) date palms were found infested by RPW. The infestation was the highest (14.39%) in Giza Governorate while it was the lowest (11.11%) in Dakahlia Governorate.

The infestation ranged from 13.72 to 18.62% in 2004 in the four Governorates with the same trend of 2003 (Table 1). Out of 1214 infested

date palms recorded during the survey in 2005, 355 (22.46%) date palms were in Giza Governorate, while 248 (16.75%) were infested in Dakahlia Governorate. Among the infested date palms in 2006, 354 (22.54%) date palms had infested in Giza Governorate and 276 (17.08%) date palms in Dakahlia Governorate (Table 1).

**Table (1): Infestation degrees by red palm weevil in certain Governorates on Zaglol cultivar during 2003 till 2006.**

| Governorates | Year | Infestation degrees | | | | | | | | Non infested date palm | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | | Medium | | High | | Total Infested date palm | | | |
| | | No. (mean) | % | No. (mean) | % | No. (mean) | % | No. | % | | |
| Dakahlia | 2003 | 134 (11.2) $A^{c}$ | 74.44 | 30 (2.5) $B^{b}$ | 16.66 | 16 (1.3) $B^{b}$ | 8.88 | 180 | 11.11 | 1440 | 1620 |
| Qaluobia | | 142 (11.8) $A^{c}$ | 72.82 | 37 (3.1) $B^{a}$ | 18.90 | 16 (1.3) $C^{b}$ | 8.21 | 195 | 11.78 | 1460 | 1655 |
| Behera | | 166 (13.8) $A^{b}$ | 74.43 | 35 (2.9) $B^{b}$ | 15.60 | 22 (1.8) $B^{a}$ | 9.86 | 223 | 12.67 | 1537 | 1760 |
| Giza | | 182 (15.2) $A^{a}$ | 73.09 | 40 (3.3) $B^{a}$ | 16.06 | 27 (2.2) $B^{a}$ | 10.84 | 249 | 14.39 | 1481 | 1730 |
| Total | | 624 | 73.67 | 142 | 16.76 | 81 | 9.56 | 847 | 12.52 | 5918 | 6765 |
| Dakahlia | 2004 | 170 (13.3) $A^{b}$ | 72.64 | 41 (3.4) $B^{a}$ | 17.52 | 23 (1.9) $C^{a}$ | 9.82 | 234 | 13.72 | 1471 | 1705 |
| Qaluobia | | 167 (13.9) $A^{b}$ | 69.87 | 47 (3.9) $B^{a}$ | 19.66 | 25 (2.1) $C^{a}$ | 10.46 | 239 | 14.61 | 1396 | 1635 |
| Behera | | 185 (15.4) $A^{a}$ | 70.34 | 48 (4.0) $B^{a}$ | 18.25 | 30 (2.5) $C^{a}$ | 11.40 | 263 | 16.18 | 1362 | 1625 |
| Giza | | 201 (16.7) $A^{a}$ | 67.67 | 57 (4.7) $B^{a}$ | 19.19 | 39 (3.2) $B^{a}$ | 13.13 | 297 | 18.62 | 1298 | 1595 |
| Total | | 723 | 69.99 | 193 | 18.68 | 117 | 11.32 | 1033 | 15.74 | 5527 | 6560 |
| Dakahlia | 2005 | 190 (15.8) $A^{c}$ | 76.61 | 39 (3.2) $B^{a}$ | 15.72 | 19 (1.6) $C^{a}$ | 7.66 | 248 | 16.75 | 5527 | 1480 |
| Qaluobia | | 218 (18.2) $A^{b}$ | 75.69 | 44 (3.7) $B^{a}$ | 15.27 | 26 (2.2) $B^{a}$ | 9.02 | 288 | 19.86 | 1232 | 1450 |
| Behera | | 244 (20.3) $A^{ab}$ | 75.54 | 53 (4.4) $B^{a}$ | 16.41 | 26 (2.2) $C^{a}$ | 8.04 | 323 | 20.37 | 1162 | 1585 |
| Giza | | 266 (22.1) $A^{a}$ | 74.92 | 57 (4.9) $B^{a}$ | 16.05 | 32 (2.7) $C^{a}$ | 9.01 | 355 | 22.46 | 1225 | 1580 |
| Total | | 918 | 75.61 | 193 | 15.89 | 103 | 8.48 | 1214 | 19.91 | 4881 | 6095 |
| Dakahlia | 2006 | 213 (17.7) $A^{c}$ | 77.17 | 43 (3.6) $B^{a}$ | 15.57 | 20 (1.7) $C^{a}$ | 7.24 | 276 | 17.08 | 1339 | 1615 |
| Qaluobia | | 231 (19.2) $A^{b}$ | 76.49 | 49 (4.1) $B^{a}$ | 16.22 | 22 (1.8) $C^{a}$ | 7.28 | 302 | 18.99 | 1288 | 1590 |
| Behera | | 244 (20.3) $A^{ab}$ | 75.77 | 50 (4.2) $B^{a}$ | 15.52 | 28 (2.3) $C^{a}$ | 8.69 | 322 | 20.77 | 1228 | 1550 |
| Giza | | 275 (22.9) $A^{a}$ | 77.68 | 55 (4.6) $B^{a}$ | 15.53 | 24 (2.0) $C^{a}$ | 6.77 | 354 | 22.54 | 1216 | 1570 |
| Total | | 963 | 76.79 | 197 | 15.70 | 89 | 7.09 | 1254 | 19.82 | 5071 | 6325 |
| General Total | | 3228 | 74.24 | 725 | 16.67 | 390 | 8.96 | 4348 | 16.88 | 21397 | 25745 |

**Means followed by the same capital letter in a row between the different degrees of infestation in the same year while the same small letter in a column between the same degrees in the same year in the different Governorates.**

During 2003 on Samany cultivar, 609 (9.78%) date palms were found infested by RPW (Table 2). The infestation was the highest (11.66%) in Giza Governorate while it was the lowest (8.18%) in Dakahlia Governorate. The infestation ranged from 11.61 to 13.31% in 2004 in the four Governorates with the same trend of 2003 (Table 1). Out of 854 infested date palms recorded during the survey in 2005, 248 (16.47%) date palms were in Giza Governorate, while 179 (12.26%) were infested in Dakahlia Governorate. Among the infested date palms in 2006, 269 (17.93%) date palms had infested in Giza Governorate and 195 (13.13%) date palms in Dakahlia Governorate (Table 2).

**Infestation degrees by RPW:**

The infestation by RPW on Zaglol date palms cultivar between 2003 and 2006 in four Governorates was shown in Table (1). Out of 847 infested date palms recorded during the survey of 2003 year, 624 (73.67%) date palms were with low infestation,142 (16.76%) with medium infestation, and 81 (9.56%) with high infestation. Among the infested date palms, 723 (69.99%) date palms had low level of infestation, 193 (18.68%) date palms with medium level, and 117 (11.32%) date palms with high level of infestation during 2004. Among the infested date palms during 2005 year, 918 (75.61%) date palms had low level of infestation, 193 (15.89%) medium and 103 (8.48%) with high level of infestation. Among the infested date palms, 963 (76.79%) date palms had low level of infestation, 197 (15.70%) date palms with medium level, and 89 (7.09%) date palms with high level of infestation during 2006 (Table 1). Based on the statistical analysis, the low infestation was significant higher than the other two levels of infestation.

Red palm weevil infestation on Samany date palms cultivar between 2003 and 2006 in four Governorates is shown in Table (2). Out of 609 infested date palms during the survey of 2003 year, 465 (76.35%) date palms were with low infestation, 81 (13.30%) with medium infestation, and 63 (10.34%) with high infestation. Among the infested date palms during 2004, 547 (74.21%) date palms had low level of infestation, 110 (14.92%) date palms with medium level, and 80 (10.85%) date palms with high level of infestation. Among the infested date palms during 2005 year, 647 (75.76%) date palms had low level of infestation, 127 (14.87%) medium and 80 (9.36%) with high level of infestation. Among the infested date palms, 697 (74.78%) date palms had low level of infestation, 153 (16.41%) date palms with medium level, and 82 (8.79%) date palms with high level of infestation during 2006 (Table 2). The ANOVA indicated Means followed by the same capital letter in a row between the different degrees of infestation in the same year while the same small letter in a column between the same degrees in the same year in the different Governorates.

That the low infestation was significant higher than the other two levels of infestation. The infestation by RPW was increased from year to another year, and the later year was higher than other years on the two surveyed cultivars (Tables 1 and 2).Data obtained from the four different Governorates determined that the infestation by RPW was high in Giza Governorate, moderate in both Behera and Qaluobia, whereas the infestation was low in Dakahlia Governorate (Tables 1 and 2). Among the surveyed cultivars, the

infestation by RPW was high on Zaglol than Samany in the four surveyed Governorates during the four years (Tables 1 and 2).

**Table (2): Infestation degrees by red palm weevil in certain Governorates on Samany cultivar during 2003 till 2006.**

| Governorates | Year | Infestation degrees | | | | | | | | Non infested date palm | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low | | Medium | | Height | | Total infested date palm | | | |
| | | No. (mean) | % | No. (mean) | % | No. mean) | % | No | % | | |
| Dakahlia | 2003 | 94 (7.8)A$^{c}$ | 80.34 | 13 (1.1)B$^{b}$ | 11.11 | 10 (1.7)B$^{a}$ | 8.5 | 117 | 8.18 | 1313 | 1430 |
| Qaluobia | 2003 | 98 (8.2)A$^{c}$ | 73.13 | 20 (1.7)B$^{b}$ | 14.92 | 16 (1.3)B$^{a}$ | 11.9 | 134 | 9.21 | 1321 | 1455 |
| Behera | 2003 | 122 (10.2)A$^{b}$ | 75.30 | 23 (1.9)B$^{ab}$ | 14.19 | 17 (1.4)B$^{a}$ | 10.4 | 162 | 9.75 | 1498 | 1660 |
| Giza | 2003 | 151 (12.6)A$^{a}$ | 77.04 | 25 (2.1)B$^{a}$ | 12.75 | 20 (1.7)B$^{a}$ | 10.20 | 196 | 11.66 | 1484 | 1680 |
| Total | 2003 | 465 | 76.35 | 81 | 13.30 | 63 | 10.34 | 609 | 9.78 | 5616 | 6225 |
| Dakahlia | 2004 | 122 (10.2)A$^{b}$ | 78.70 | 17 (1.4)B$^{a}$ | 10.96 | 16 (1.3)B$^{a}$ | 10.32 | 155 | 11.61 | 1180 | 1335 |
| Qaluobia | 2004 | 131 (10.9)A$^{a}$ | 72.77 | 29 (2.4)B$^{a}$ | 16.11 | 20 (1.7)B$^{a}$ | 11.11 | 180 | 12.12 | 1305 | 1485 |
| Behera | 2004 | 140 (11.7)A$^{a}$ | 72.53 | 32 (2.7)B$^{a}$ | 16.58 | 21 (1.7)C$^{a}$ | 10.88 | 193 | 12.33 | 1372 | 1565 |
| Giza | 2004 | 154 (12.8)A$^{a}$ | 73.68 | 32 (2.7)B$^{a}$ | 15.31 | 23 (1.9)B$^{a}$ | 11.01 | 209 | 13.31 | 1361 | 1570 |
| Total | 2004 | 547 | 74.21 | 110 | 14.92 | 80 | 10.85 | 737 | 12.37 | 5218 | 5955 |
| Dakahlia | 2005 | 134 (11.2)A$^{b}$ | 74.86 | 27 (2.2)B$^{a}$ | 15.08 | 18 (1.5)B$^{a}$ | 10.05 | 179 | 12.26 | 1281 | 1460 |
| Qaluobia | 2005 | 140 (11.7)A$^{b}$ | 74.46 | 30 (2.5)B$^{a}$ | 15.95 | 18 (1.5)C$^{a}$ | 9.57 | 188 | 12.45 | 1322 | 1510 |
| Behera | 2005 | 183 (15.2)A$^{a}$ | 76.56 | 35 (2.9)B$^{a}$ | 14.64 | 21 (1.7)B$^{a}$ | 8.78 | 239 | 15.67 | 1286 | 1525 |
| Giza | 2005 | 190 (15.8)A$^{a}$ | 76.61 | 35 (2.9)B$^{a}$ | 14.11 | 23 (1.9)C$^{a}$ | 9.27 | 248 | 16.47 | 1257 | 1505 |
| Total | 2005 | 647 | 75.76 | 127 | 14.87 | 80 | 9.36 | 854 | 14.23 | 5146 | 6000 |
| Dakahlia | 2006 | 145 (12.1)A$^{b}$ | 74.35 | 31 (2.6)B$^{a}$ | 15.89 | 19 (1.6)C$^{a}$ | 9.74 | 195 | 13.13 | 1290 | 1485 |
| Qaluobia | 2006 | 155 (12.9)A$^{b}$ | 73.45 | 35 (2.9)B$^{a}$ | 16.58 | 21 (1.7)B$^{a}$ | 9.95 | 211 | 13.88 | 1309 | 1520 |
| Behera | 2006 | 194 (16.2)A$^{a}$ | 75.48 | 42 (3.5)B$^{a}$ | 16.34 | 21 (1.7)C$^{a}$ | 8.17 | 257 | 17.02 | 1253 | 1510 |
| Giza | 2006 | 203 (16.9)A$^{a}$ | 75.46 | 45 (3.7)B$^{a}$ | 16.72 | 21 (1.7)C$^{a}$ | 7.80 | 269 | 17.93 | 1231 | 1500 |
| Total | 2006 | 697 | 74.78 | 153 | 16.41 | 82 | 8.79 | 932 | 15.49 | 5083 | 6015 |
| General Total | | 2356 | 75.22 | 471 | 15.04 | 305 | 9.74 | 3132 | 12.94 | 21063 | 24195 |

**Means followed by the same capital letter in a row between the different degrees of infestation in the same year while the same small letter in a column between the same degrees in the same year in the different Governorates.**

**Infestation by RPW in different age groups of date palms:**

During 2003, red palm weevil infestation on Zaglol cultivar was high being 30.69% in date palms belonging to the age group of 6-10 years followed by 25.38% in date palms belonging to the age group of 1-5 years. Meanwhile, it was very low (11.80%) in the age group of 16-20 and >20 years

(Table 3). These results indicated that young date palms of age between 6-15 years are preferred to attack by RPW and needs protection. The same trend was recorded in 2004, 2005, and 2006 in the four surveyed Governorates.

Red palm weevil infestation on Samany cultivar was high being 33.01, 29.57, 31.14, and 30.57% in date palms belonging to the age group of 6-10 years during 2003, 2004, 2005, and 2006, respectively, followed by 22.82, 24.83, 24.70, and 23.28% in date palms belonging to the age group of 1-5 years during 2003, 2004, 2005, and 2006, respectively. Meanwhile, it was very low (6.73, 8.14, 8.89, and 10.62%) in the age group of above 20 years during 2003, 2004, 2005, and 2006, respectively (Table 4). The same trend was recorded in the four surveyed Governorates.

**Red palm weevil infestation at different stem heights of date palms:**

The relationship between infestation by RPW and the stem height of the date palms is illustrated in Tables (5 and 6) for two cultivars (Zaglol and Samany) in four Governorates during four years (from 2003 till 2006).

Maximum infestation of 28.68% of RPW on Zaglol cultivar in 2003 was found in date palms with stem height of 4.0 to 6.0 m, followed by 24.79% in stem height of 0.0 to 3.0 m, 20.07% in stem height of 7.0 to 9.0 m, 14.87% in stem height of 10.0 to 12.0 m, while it was 11.57% in date palms with stem height of >12 m. As shown in Table (5), maximum infestation of 27.01% of RPW on Zaglol cultivar in 2004 was found in date palms with stem height of 4.0 to 6.0 m, followed by 24.87% in stem height of 0.0 to 3.0 m, 18.29% in stem height of 7.0 to 9.0 m, 15.97% in stem height of 10.0 to 12.0 m, while it was 13.84% in date palms with stem height of >12 m. The results presented in Table (5) indicated that maximum infestation of 28.41% of RPW on Zaglol cultivar was found in date palms with stem height of 4.0 to 6.0 m in 2005, followed by 22.65% in stem height of 0.0 to 3.0 m, 18.53% in stem height of 7.0 to 9.0 m, 16.06% in stem height of 10.0 to 12.0 m, while it was 14.33% in date palms with stem height of >12 m. In season 2006, maximum infestation of 27.91% of RPW on Zaglol cultivar was found in date palms with stem height of 4.0 to 6.0 m, followed by 23.44% in stem height of 0.0 to 3.0 m, 19.21% in stem height of 7.0 to 9.0 m, 15.23% in stem height of 10.0 to 12.0 m, while it was 14.19% in date palms with stem height of >12 m.

Maximum infestation of 27.98% of RPW on Zaglol cultivar in all years was found in date palms with stem height of 4.0 to 6.0 m, while it was 13.63% in date palms with stem height of >12 m. Based on the statistical analysis, there were significance differences between the different stem height of Zaglol cultivar in all years among the Governorate (Table 5). In addition, there were significance variations between Governorates among the same year in each stem height.

The data in Table (6) showed that maximum infestation of 37.76% of RPW on Samany cultivar in 2003 was found in date palms with stem height of 4.0 to 6.0 m, followed by 24.79% in stem height of 0.0 to 3.0 m, 17.89% in stem height of 7.0 to 9.0 m, 11.49% in stem height of 10.0 to 12.0 m, while it was 8.04% in date palms with stem height of >12 m.

**Table (3): Effect of tree age of Zaglol cultivar on infestation by red palm weevil in certain Governorates during 2003 till 2006.**

| Governorates | Year | Age (years) 1-5 No. (mean) | % | 6-10 No. (mean) | % | 11-15 No. (mean) | % | 16-20 No. (mean) | % | >20 No. (mean) | % | Total of infested palm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dakahlia | 2003 | 49 (4.08) $A^{a}$ | 27.2 | 54 (4.5) $A^{b}$ | 30.0 | 31 (2.58) $B^{c}$ | 17.22 | 23 (1.92)$B^{a}$ | 12.77 | 23 (1.92)$B^{a}$ | 12.77 | 180 |
| Qaluobia | | 50 (4.16)$A^{a}$ | 25.64 | 59 (4.91)$A^{b}$ | 30.25 | 37 (3.08)$AB^{b}$ | 18.97 | 24 (2.0)$B^{a}$ | 12.31 | 25 (2.08)$B^{a}$ | 12.82 | 195 |
| Behera | | 58 (4.83)$AB^{a}$ | 26.01 | 72 (6.0)$A^{a}$ | 32.28 | 41 (3.42)$BC^{b}$ | 18.38 | 26 (2.16)$C^{a}$ | 11.65 | 26 (2.16)$C^{a}$ | 11.65 | 223 |
| Giza | | 58 (4.83)$A^{a}$ | 23.29 | 75 (6.25)$A^{a}$ | 30.12 | 63 (5.25)$A^{a}$ | 25.30 | 27 (2.25)$B^{a}$ | 10.84 | 26 (2.16)$B^{a}$ | 10.44 | 249 |
| Total | | 215 | 25.38 | 260 | 30.69 | 172 | 20.30 | 100 | 11.80 | 100 | 11.80 | 847 |
| Dakahlia | 2004 | 60 (5.0)$AB^{a}$ | 25.64 | 70 (5.83)$A^{a}$ | 29.91 | 41 (3.42)$BC^{b}$ | 17.52 | 34 (2.83)$C^{a}$ | 14.52 | 29 (2.42)$C^{a}$ | 12.39 | 234 |
| Qaluobia | | 62 (5.16)$AB^{a}$ | 25.94 | 72 (6.0)$A^{a}$ | 30.12 | 45 (3.75)$BC^{b}$ | 18.82 | 35 (2.92)$C^{a}$ | 14.64 | 25 (2.08)$C^{b}$ | 10.46 | 239 |
| Behera | | 65 (5.42)$AB^{a}$ | 24.71 | 79 (6.58)$A^{a}$ | 30.03 | 49 (4.08)$BC^{a}$ | 18.63 | 40 (3.33)$C^{a}$ | 15.21 | 30 (2.5)$C^{a}$ | 11.41 | 263 |
| Giza | | 70 (5.83) $AB^{a}$ | 23.56 | 82 (6.83) $A^{a}$ | 27.60 | 64 (5.33)$AB^{a}$ | 21.54 | 44 (3.66)$B^{a}$ | 14.81 | 37 (3.08)$B^{a}$ | 12.45 | 297 |
| Total | | 257 | 24.87 | 303 | 29.33 | 199 | 19.26 | 153 | 14.81 | 121 | 11.71 | 1033 |
| Dakahlia | 2005 | 62 (5.17)$AB^{b}$ | 25.00 | 74 (6.16)$A^{c}$ | 29.83 | 48 (4.00)$BC^{b}$ | 19.35 | 36 (3.00)$C^{a}$ | 14.51 | 28 (2.33)$C^{a}$ | 11.29 | 248 |
| Qaluobia | | 71 (5.92)$AB^{ab}$ | 24.65 | 86 (7.16)$A^{b}$ | 29.86 | 60 (5.00)$BC^{b}$ | 20.83 | 40 (3.33)$C^{a}$ | 13.88 | 31 (2.58)$C^{a}$ | 10.76 | 288 |
| Behera | | 75 (6.25)$AB^{a}$ | 23.22 | 93 (7.75)$A^{b}$ | 28.79 | 67 (5.58)$B^{a}$ | 20.74 | 44 (3.66)$C^{a}$ | 13.62 | 44 (3.66)$C^{a}$ | 13.62 | 323 |
| Giza | | 80 (6.66)$B^{a}$ | 22.53 | 108 (9.00)$A^{a}$ | 30.42 | 73 (6.08)$B^{a}$ | 20.56 | 50 (4.16)$C^{a}$ | 14.08 | 44 (3.66)$C^{a}$ | 12.39 | 355 |
| Total | | 288 | 23.72 | 361 | 29.73 | 248 | 20.42 | 170 | 14.00 | 147 | 12.10 | 1214 |
| Dakahlia | 2006 | 66 (5.50)$B^{b}$ | 23.91 | 89 (7.42)$A^{b}$ | 32.24 | 55 (4.58)$BC^{b}$ | 19.92 | 38 (3.16)$CD^{a}$ | 13.76 | 28 (2.33)$D^{a}$ | 10.14 | 276 |
| Qaluobia | | 79 (6.58)$A^{ab}$ | 26.15 | 90 (7.5)$A^{ab}$ | 29.80 | 57 (4.75)$B^{b}$ | 18.87 | 42 (3.50)$BC^{a}$ | 13.91 | 34 (2.83)$C^{a}$ | 11.25 | 302 |
| Behera | | 80 (6.66)$AB^{a}$ | 24.84 | 93 (7.75)$A^{ab}$ | 28.88 | 68 (5.66)$B^{ab}$ | 21.12 | 45 (3.75)$C^{a}$ | 13.97 | 36 (3.00)$C^{a}$ | 11.18 | 322 |
| Giza | | 85 (7.08)$A^{a}$ | 24.01 | 100 (8.33)$A^{a}$ | 28.24 | 77 (6.42)$A^{a}$ | 21.75 | 47 (3.92)$B^{a}$ | 13.27 | 45 (3.75)$B^{a}$ | 12.71 | 354 |
| Total | | 310 | 24.72 | 372 | 29.66 | 257 | 20.49 | 172 | 13.71 | 143 | 11.40 | 1254 |
| General Total | | 1070 | 24.61 | 1296 | 29.80 | 876 | 20.14 | 595 | 13.68 | 511 | 11.75 | 4348 |

Means followed by the same capital letter in a row between the different ages in the same year while the same small letter in a column between the same age in the same year in the different Governorates

**Table (4). Effect of tree age of Samany cultivar on infestation by red palm weevil in certain Governorates during 2003 till 2006.**

| Governorates | Year | Tree age | | | | | | | | | | Total of infested palm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1-5 | | 6-10 | | 11-15 | | 16-20 | | >20 | | |
| | | No. (mean) | % | No. (mean) | % | No. (mean) | % | No. (mean) | % | No. (mean) | % | |
| Dakahlia | 2003 | 27 (2.25)A$^{a}$ | 23.07 | 44 (3.66)A$^{a}$ | 37.61 | 27 (2.25)A$^{b}$ | 23.07 | 15 (1.25)B$^{a}$ | 12.82 | 4 (0.33)C$^{a}$ | 3.41 | 117 |
| Qaluobia | | 30 (2.50)B$^{a}$ | 22.38 | 49 (4.08)A$^{a}$ | 36.56 | 30 (2.50)B$^{ab}$ | 22.38 | 19 (1.58)BC$^{a}$ | 14.17 | 6 (0.50)C$^{a}$ | 4.47 | 134 |
| Behera | | 36 (3.0)AB$^{a}$ | 22.22 | 52 (4.33)A$^{a}$ | 32.09 | 38 (3.16)AB$^{a}$ | 23.45 | 22 (1.83)B$^{a}$ | 13.58 | 14 (1.16)B$^{a}$ | 8.64 | 162 |
| Giza | | 46 (3.83)AB$^{a}$ | 23.46 | 56 (4.66)A$^{a}$ | 28.57 | 49 (4.08)A$^{a}$ | 25.00 | 28 (2.33)B$^{a}$ | 14.28 | 17 (1.41)B$^{a}$ | 8.67 | 196 |
| Total | | 139 | 22.82 | 201 | 33.01 | 144 | 23.64 | 84 | 13.79 | 41 | 6.73 | 609 |
| Dakahlia | 2004 | 37 (3.08)A$^{a}$ | 23.87 | 49 (4.08)A$^{a}$ | 31.61 | 33 (2.75)B$^{b}$ | 21.29 | 24 (2.00)B$^{a}$ | 15.48 | 12 (1.00)C$^{a}$ | 7.74 | 155 |
| Qaluobia | | 48 (4.00)A$^{a}$ | 26.66 | 52 (4.33)A$^{a}$ | 28.88 | 39 (3.25)AB$^{a}$ | 21.66 | 26 (2.16)B$^{a}$ | 14.44 | 15 (1.25)B$^{a}$ | 8.33 | 180 |
| Behera | | 48 (4.00)A$^{a}$ | 24.87 | 55 (4.58)A$^{a}$ | 28.49 | 48 (4.00)A$^{a}$ | 24.87 | 26 (2.16)B$^{a}$ | 13.47 | 16 (1.33)B$^{a}$ | 8.29 | 193 |
| Giza | | 50 (4.16)AB$^{a}$ | 23.92 | 62 (5.16)A$^{a}$ | 29.66 | 51 (4.25)A$^{a}$ | 24.40 | 29 (2.41)B$^{a}$ | 13.87 | 17 (1.42)B$^{a}$ | 8.13 | 209 |
| Total | | 183 | 24.83 | 218 | 29.57 | 171 | 23.20 | 105 | 14.24 | 60 | 8.14 | 737 |
| Dakahlia | 2005 | 43 (3.58)A$^{a}$ | 24.02 | 56 (4.66)A$^{b}$ | 31.28 | 35 (2.91)B$^{b}$ | 19.55 | 27 (2.25)B$^{a}$ | 15.08 | 18 (1.50)C$^{a}$ | 10.05 | 179 |
| Qaluobia | | 50 (4.16)A$^{a}$ | 26.59 | 57 (4.75)A$^{b}$ | 30.31 | 40 (3.33)B$^{ab}$ | 21.27 | 27 (2.25)B$^{a}$ | 14.36 | 14 (1.16)C$^{a}$ | 7.44 | 188 |
| Behera | | 58 (4.83)B$^{a}$ | 24.26 | 76 (6.33)A$^{a}$ | 31.79 | 54 (4.50)B$^{a}$ | 22.59 | 30 (2.50)C$^{a}$ | 12.55 | 21 (1.75)C$^{a}$ | 8.78 | 239 |
| Giza | | 60 (5.00)A$^{a}$ | 24.19 | 77 (6.41)A$^{a}$ | 31.04 | 56 (4.66)B$^{a}$ | 22.58 | 32 (2.66)C$^{a}$ | 12.90 | 23 (1.92)C$^{a}$ | 9.27 | 248 |
| Total | | 211 | 24.70 | 266 | 31.14 | 185 | 21.66 | 116 | 13.58 | 76 | 8.89 | 854 |
| Dakahlia | 2006 | 45 (3.75)B$^{b}$ | 23.07 | 62 (5.16)A$^{b}$ | 31.79 | 39 (3.25)B$^{a}$ | 20.00 | 29 (2.42)C$^{b}$ | 14.87 | 20 (1.66)C$^{b}$ | 10.25 | 195 |
| Qaluobia | | 51 (4.25)A$^{a}$ | 24.17 | 63 (5.25)A$^{b}$ | 29.85 | 45 (3.75)B$^{a}$ | 21.32 | 30 (2.50)C$^{ab}$ | 14.21 | 22 (1.83)C$^{ab}$ | 10.42 | 211 |
| Behera | | 58 (4.83)AB$^{a}$ | 22.56 | 80 (6.66)A$^{a}$ | 31.12 | 56 (4.66)B$^{a}$ | 21.78 | 36 (3.00)BC$^{a}$ | 14.01 | 27 (2.25)C$^{a}$ | 10.50 | 257 |
| Giza | | 63 (5.25)AB$^{a}$ | 23.42 | 80 (6.66)A$^{a}$ | 29.73 | 58 (4.83)B$^{a}$ | 21.56 | 38 (3.16)B$^{a}$ | 14.12 | 30 (2.50)C$^{a}$ | 11.15 | 269 |
| Total | | 217 | 23.28 | 285 | 30.57 | 198 | 21.24 | 133 | 14.27 | 99 | 10.62 | 932 |
| General Total | | 750 | 23.94 | 970 | 30.97 | 698 | 22.28 | 438 | 13.98 | 276 | 8.81 | 3132 |

Means followed by the same capital letter in a row between the different ages in the same year while the same small letter in a column between the same age in the same year in the different Governorates.

**Table (5): Effect of stem height of Zaglol cultivar on infestation by red palm weevil in certain Governorates during 2003 till 2006.**

| Governorates | Year | Stem height | | | | | | | | | | Total of infested palm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-3 m | | 4-6 m | | 7-9 m | | 10-12 m | | >12 m | | |
| | | No. (mean) | % | No. (mean) | % | No. (mean) | % | No. (mean) | % | No. (mean) | % | |
| Dakahlia | 2003 | 48 (4.00)A$^{a}$ | 26.66 | 57 (4.75)A$^{a}$ | 31.66 | 35 (2.91)AB$^{a}$ | 19.44 | 25 (2.08)B$^{a}$ | 13.88 | 15 (1.25)B$^{b}$ | 8.33 | 180 |
| Qaluobia | | 50 (4.16)AB$^{a}$ | 25.64 | 57 (4.75)A$^{a}$ | 29.23 | 40 (3.33)ABC$^{a}$ | 20.51 | 28 (2.33)BC$^{a}$ | 14.35 | 20 (1.66)C$^{ab}$ | 10.25 | 195 |
| Behera | | 53 (4.42)AB$^{a}$ | 23.76 | 60 (5.00)A$^{a}$ | 26.90 | 45 (3.75)AB$^{a}$ | 20.17 | 35 (2.92)B$^{a}$ | 15.69 | 30 (2.50)B$^{a}$ | 13.45 | 223 |
| Giza | | 59 (4.92)AB$^{a}$ | 23.69 | 69 (5.75)A$^{a}$ | 27.71 | 50 (4.16)ABC$^{a}$ | 20.08 | 38 (3.16)BC$^{a}$ | 15.26 | 33 (2.75)C$^{a}$ | 13.25 | 249 |
| Total | | 210 | 24.79 | 243 | 28.68 | 170 | 20.07 | 126 | 14.87 | 98 | 11.57 | 847 |
| Dakahlia | 2004 | 59 (4.92)A$^{a}$ | 25.21 | 66 (5.50)A$^{a}$ | 28.20 | 44 (3.66)AB$^{a}$ | 18.80 | 35 (2.91)B$^{b}$ | 14.95 | 30 (2.50)B$^{a}$ | 12.82 | 234 |
| Qaluobia | | 60 (5.00)A$^{a}$ | 25.10 | 66 (5.50)A$^{a}$ | 27.61 | 44 (3.66)AB$^{a}$ | 18.41 | 37 (3.08)B$^{ab}$ | 15.48 | 32 (2.66)B$^{a}$ | 13.38 | 239 |
| Behera | | 66 (5.50)A$^{a}$ | 25.09 | 68 (5.66)A$^{a}$ | 25.85 | 48 (4.00)AB$^{a}$ | 18.25 | 45 (3.75)AB$^{a}$ | 17.11 | 36 (3.00)B$^{a}$ | 13.68 | 263 |
| Giza | | 72 (6.00)AB$^{a}$ | 24.24 | 79 (6.58)A$^{a}$ | 26.59 | 53 (4.41)BC$^{a}$ | 17.84 | 48 (4.00)C$^{a}$ | 16.16 | 45 (3.75)C$^{a}$ | 15.15 | 297 |
| Total | | 257 | 24.87 | 279 | 27.01 | 189 | 18.29 | 165 | 15.97 | 143 | 13.84 | 1033 |
| Dakahlia | 2005 | 62 (5.16)AB$^{a}$ | 25.00 | 70 (5.83)A$^{b}$ | 28.22 | 46 (3.83)BC$^{b}$ | 18.54 | 36 (3.00)C$^{b}$ | 14.51 | 34 (2.83)C$^{b}$ | 13.70 | 248 |
| Qaluobia | | 65 (5.42)AB$^{a}$ | 22.56 | 84 (7.00)A$^{ab}$ | 29.16 | 50 (4.16)B$^{ab}$ | 17.36 | 47 (3.92)B$^{b}$ | 16.31 | 42 (3.50)B$^{ab}$ | 14.58 | 288 |
| Behera | | 70 (5.83)B$^{a}$ | 21.67 | 92 (7.66)A$^{a}$ | 28.48 | 60 (5.00)B$^{a}$ | 18.57 | 53 (4.42)B$^{a}$ | 16.40 | 48 (4.00)B$^{a}$ | 14.86 | 323 |
| Giza | | 78 (6.50)AB$^{a}$ | 21.97 | 99 (8.25)A$^{a}$ | 27.88 | 69 (5.75)BC$^{a}$ | 19.43 | 59 (4.92)BC$^{a}$ | 16.61 | 50 (4.16)C$^{a}$ | 14.08 | 355 |
| Total | | 275 | 22.65 | 345 | 28.41 | 225 | 18.53 | 195 | 16.06 | 174 | 14.33 | 1214 |
| Dakahlia | 2006 | 68 (5.66)AB$^{a}$ | 24.63 | 80 (6.66)A$^{a}$ | 28.98 | 50 (4.16)BC$^{a}$ | 18.11 | 40 (3.33)C$^{a}$ | 14.49 | 38 (3.16)C$^{a}$ | 13.76 | 276 |
| Qaluobia | | 72 (6.00)AB$^{a}$ | 23.84 | 84 (7.00)A$^{a}$ | 27.81 | 58 (4.83)BC$^{a}$ | 19.20 | 46 (3.83)C$^{a}$ | 15.23 | 42 (3.50)C$^{a}$ | 13.90 | 302 |
| Behera | | 75 (6.25)AB$^{a}$ | 23.29 | 86 (7.16)A$^{a}$ | 26.71 | 65 (5.41)AB$^{a}$ | 20.18 | 50 (4.16)B$^{a}$ | 15.52 | 46 (3.83)B$^{a}$ | 14.28 | 322 |
| Giza | | 79 (6.58)AB$^{a}$ | 22.31 | 100 (8.33)A$^{a}$ | 28.24 | 68 (5.66)BC$^{a}$ | 19.21 | 55 (4.58)C$^{a}$ | 15.53 | 52 (4.33)C$^{a}$ | 14.68 | 354 |
| Total | | 294 | 23.44 | 350 | 27.91 | 241 | 19.21 | 191 | 15.23 | 178 | 14.19 | 1254 |
| General Total | | 1036 | 23.82 | 1217 | 27.98 | 825 | 18.97 | 677 | 15.57 | 593 | 13.63 | 4348 |

**Means followed by the same capital letter in a row between the different stem height in the same year while the same small letter in a column between the same stem height in the same year in the different Governorate**

**Table (6). Effect of stem height of Samany cultivar on infestation by red palm weevil in certain Governorates during 2003 till 2006.**

| Governorates | Year | Stem height | | | | | | | | | | Total of infested palm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0-3 m | | 4-6 m | | 7-9 m | | 10-12 m | | >12 m | | |
| | | No. (mean) | % | No. (mean) | % | No. (mean) | % | No. (mean) | % | No. (mean) | % | |
| Dakahlia | 2003 | 30 (2.50)B$^{a}$ | 25.64 | 50 (4.16)A$^{a}$ | 42.73 | 20 (1.66)C$^{b}$ | 17.09 | 10 (0.83)D$^{b}$ | 8.54 | 7 (0.58)D$^{b}$ | 5.98 | 117 |
| Qaluobia | 2003 | 35 (2.92)B$^{a}$ | 26.11 | 57 (4.75)A$^{a}$ | 42.53 | 22 (1.83)C$^{b}$ | 16.41 | 11 (0.92)D$^{b}$ | 8.20 | 9 (0.75)D$^{b}$ | 6.71 | 134 |
| Behera | 2003 | 40 (3.33)B$^{a}$ | 24.69 | 59 (4.92)A$^{a}$ | 36.41 | 30 (2.50)C$^{a}$ | 18.51 | 20 (1.66)D$^{a}$ | 12.34 | 13 (1.08)D$^{a}$ | 8.02 | 162 |
| Giza | 2003 | 46 (3.83)B$^{a}$ | 23.46 | 46 (5.33)A$^{a}$ | 32.65 | 37 (3.10)B$^{a}$ | 18.87 | 29 (2.42)C$^{a}$ | 14.79 | 20 (1.66)D$^{a}$ | 10.20 | 196 |
| Total | 2003 | 151 | 24.79 | 230 | 37.76 | 109 | 17.89 | 70 | 11.49 | 49 | 8.04 | 609 |
| Dakahlia | 2004 | 40 (3.33)A$^{a}$ | 25.80 | 58 (4.83)A$^{a}$ | 37.41 | 30 (2.50)B$^{a}$ | 19.35 | 16 (1.33)C$^{a}$ | 10.32 | 11 (0.92)C$^{a}$ | 7.09 | 155 |
| Qaluobia | 2004 | 47 (3.92)B$^{a}$ | 26.11 | 60 (5.00)A$^{a}$ | 33.33 | 38 (3.16)C$^{a}$ | 21.11 | 22 (1.83)D$^{a}$ | 12.22 | 13 (1.08)D$^{a}$ | 7.22 | 180 |
| Behera | 2004 | 51 (4.25)A$^{a}$ | 26.42 | 64 (5.33)A$^{a}$ | 33.16 | 39 (3.25)B$^{a}$ | 20.20 | 24 (2.00)C$^{a}$ | 12.43 | 15 (1.25)C$^{a}$ | 7.77 | 193 |
| Giza | 2004 | 55 (4.58)A$^{a}$ | 26.31 | 68 (5.66)A$^{a}$ | 32.53 | 42 (3.50)B$^{a}$ | 20.09 | 27 (2.25)C$^{a}$ | 12.91 | 17 (1.42)C$^{a}$ | 8.13 | 209 |
| Total | 2004 | 193 | 26.18 | 250 | 33.92 | 149 | 20.21 | 89 | 12.07 | 56 | 7.59 | 737 |
| Dakahlia | 2005 | 46 (3.83)AB$^{b}$ | 25.69 | 64 (5.33)A$^{b}$ | 35.75 | 35 (2.92)B$^{a}$ | 19.55 | 20 (1.66)C$^{b}$ | 11.17 | 14 (1.16)C$^{a}$ | 7.82 | 179 |
| Qaluobia | 2005 | 48 (4.00)A$^{ab}$ | 25.53 | 65 (5.42)A$^{ab}$ | 34.57 | 39 (3.25)B$^{a}$ | 20.74 | 22 (1.83)C$^{ab}$ | 11.70 | 14 (1.16)C$^{a}$ | 7.44 | 188 |
| Behera | 2005 | 64 (5.33)A$^{a}$ | 26.77 | 78 (6.50)A$^{a}$ | 32.63 | 44 (3.66)B$^{a}$ | 18.41 | 32 (2.66)C$^{a}$ | 13.38 | 21 (1.75)C$^{a}$ | 8.78 | 239 |
| Giza | 2005 | 66 (5.50)AB$^{a}$ | 26.61 | 80 (6.66)A$^{a}$ | 32.25 | 46 (3.83)B$^{a}$ | 18.54 | 34 (2.83)B$^{a}$ | 13.70 | 22 (1.83)C$^{a}$ | 8.87 | 248 |
| Total | 2005 | 224 | 26.22 | 287 | 33.60 | 164 | 19.20 | 108 | 12.64 | 71 | 8.31 | 854 |
| Dakahlia | 2006 | 50 (4.16)AB$^{b}$ | 25.64 | 69 (5..75)A$^{b}$ | 35.38 | 38 (3.16)B$^{b}$ | 19.48 | 22 (1.83)C$^{a}$ | 11.28 | 16 (1.33)C$^{a}$ | 8.20 | 195 |
| Qaluobia | 2006 | 53 (4.42)B$^{ab}$ | 25.11 | 72 (6.00)A$^{ab}$ | 34.12 | 42 (3.50)C$^{ab}$ | 19.90 | 25 (2.08)D$^{a}$ | 11.84 | 19 (1.58)D$^{a}$ | 9.01 | 211 |
| Behera | 2006 | 69 (5.75)B$^{a}$ | 26.84 | 84 (7.00)A$^{a}$ | 32.68 | 51 (4.25)B$^{a}$ | 14.84 | 31 (2.58)C$^{a}$ | 12.06 | 22 (1.83)C$^{a}$ | 8.56 | 257 |
| Giza | 2006 | 70 (5.83)B$^{a}$ | 26.02 | 86 (7.16)A$^{a}$ | 31.97 | 53 (4.42)B$^{a}$ | 19.70 | 35 (2.92)BC$^{a}$ | 13.01 | 25 (2.08)C$^{a}$ | 9.29 | 269 |
| Total | 2006 | 242 | 25.96 | 311 | 33.36 | 184 | 19.74 | 113 | 12.12 | 82 | 8.79 | 932 |
| General Total | | 810 | 25.86 | 1078 | 34.41 | 606 | 19.34 | 380 | 12.13 | 258 | 8.23 | 3132 |

**Means followed by the same capital letter in a row between the different stem height in the same year while the same small letter in a column between the same stem height in the same year in the different Governorates.**

The results indicated that maximum infestation of 33.92% of RPW on Samany cultivar was found in date palms with stem height of 4.0 to 6.0 m, followed by 26.18% in stem height of 0.0 to 3.0 m, 20.21% in stem height of 7.0 to 9.0 m, 12.07% in stem height of 10.0 to 12.0 m, while it was 7.59% in date palms with stem height of >12 m. As shown in Table (5), maximum infestation of 33.60% of RPW on Samany cultivar in 2005 was found in date palms with stem height of 4.0 to 6.0 m, followed by 26.22% in stem height of 0.0 to 3.0 m, 19.20% in stem height of 7.0 to 9.0 m, 12.64% in stem height of 10.0 to 12.0 m, while it was 8.31% in date palms with stem height of >12 m. In season 2006, maximum infestation of 33.36% of RPW on Samany cultivar was found in date palms with stem height of 4.0 to 6.0 m, followed by 25.96% in stem height of 0.0 to 3.0 m, 19.74% in stem height of 7.0 to 9.0 m, 12.12% in stem height of 10.0 to 12.0 m, while it was 8.79% in date palms with stem height of >12 m. Average of maximum infestation of 34.41% of RPW on Samany cultivar in all years was found in date palms with stem height of 4.0 to 6.0 m, while it was 8.23% in date palms with stem height of >12 m. The ANOVA indicated that there were significance differences between the different stem heights of Samany cultivar in all years among the Governorate (Table 6). Statistically, there were significance variations between Governorates among the same year in each stem height.

**Occurrence of RPW:**

In Dakahlia Governorate, eggs, larvae at different instars, pupae, and adults of *R. ferrugineus* were recorded during 2003 till 2006 on Zaglol cultivar only to determine the population density. The data in fig. (1) showed that In 2003, the insect population increased in the first week of January to reach its first peak.

The population of insect stages increased gradually from the first week of February to reach its second peak in the first week of August. Total numbers of insect stages were decreased during September, October, November, and December. The seasonal pattern was similar to observations during 2004 till 2006.

On Zaglol cultivar, eggs, larvae at different instars, pupae, and adults of *R. ferrugineus* were recorded during 2003 till 2006 on in Qaluobia Governorate. As appears from Fig. (2), In 2003, the insect population increased in the second week of February to reach its first peak. The population of insect stages increased gradually to reach its second peak in the second week of August. Total numbers of insect stages were decreased during September, October, November, and December. The seasonal pattern was similar to observations during 2004 till 2006.

Means followed by the same capital letter in a row between the different stem height in the same year while the same small letter in a column between the same stem height in the same year in the different Governorates.

In Behera Governorate, eggs, larvae at different instars, pupae, and adults of *R. ferrugineus* were recorded during 2003 till 2006 on Zaglol cultivar. From the data illustrated in Fig. (3), it could be noted that In 2003, the insect population increased in the third week of February to reach its first peak.

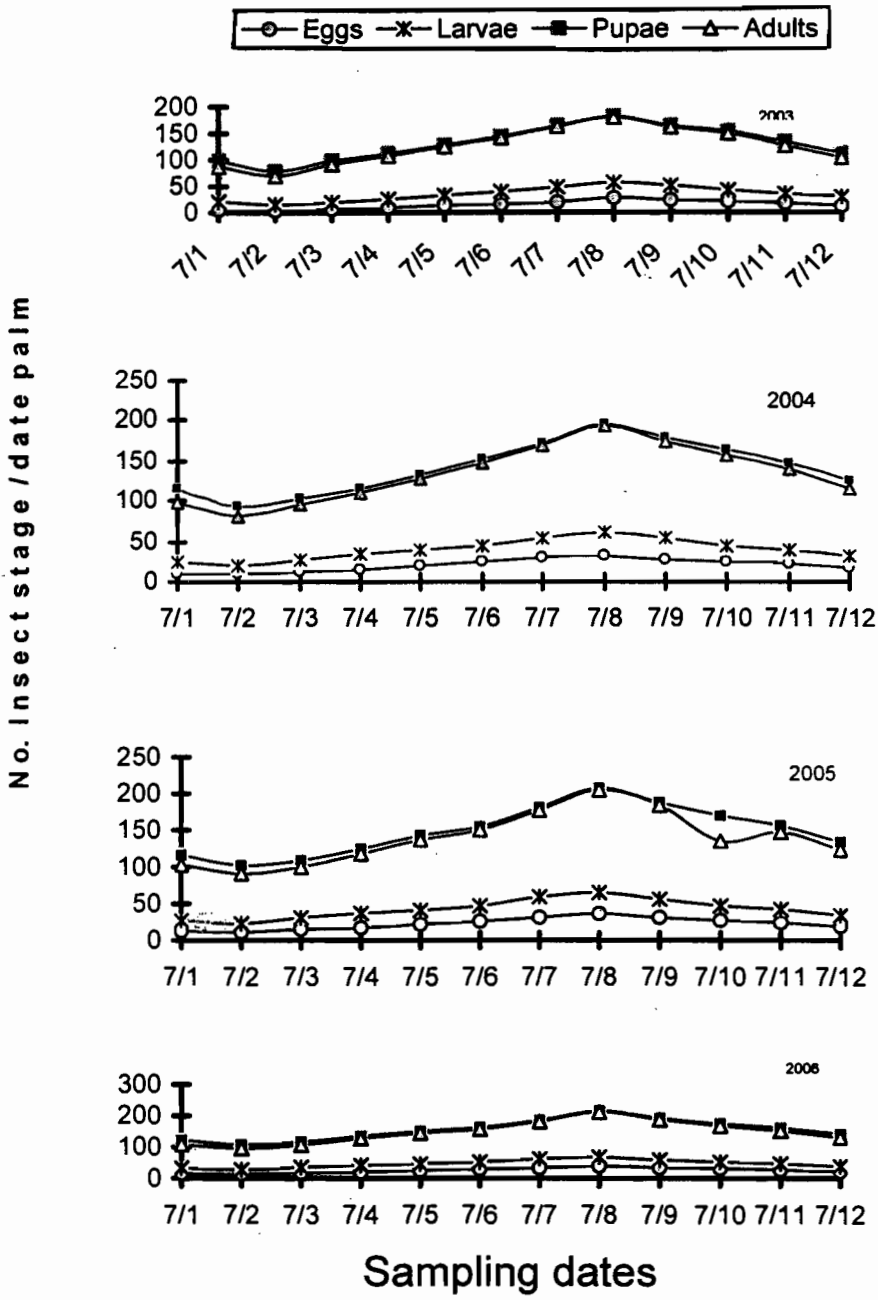


**Figure1. Numbers of insect stages for RPW /date palm reared on Zaglol cultivar in Dakahlia Governorate for four years.**

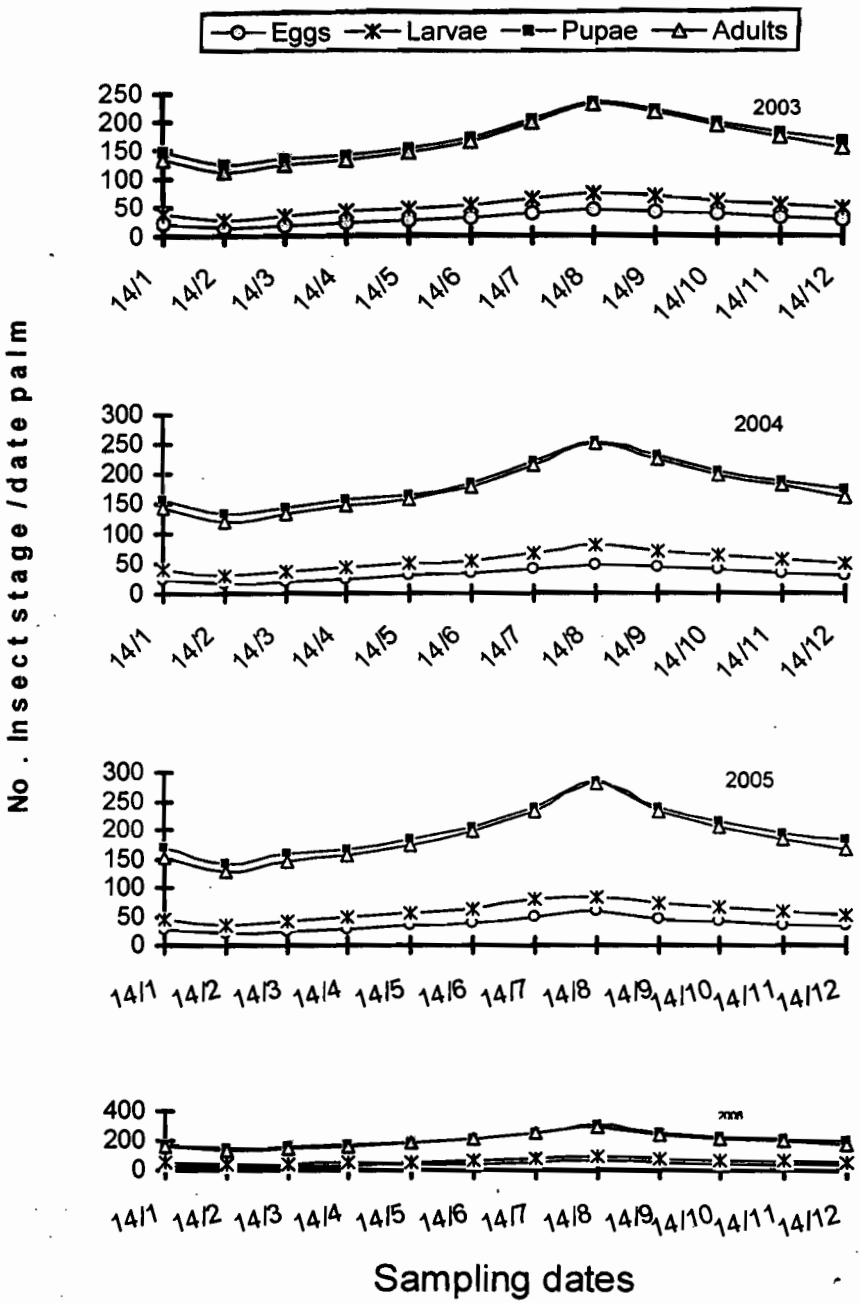


**Figure 2. Numbers of insect stages for RPW /date palm reared on Zaglol cultivar in Qaluobia Governorate for four years.**

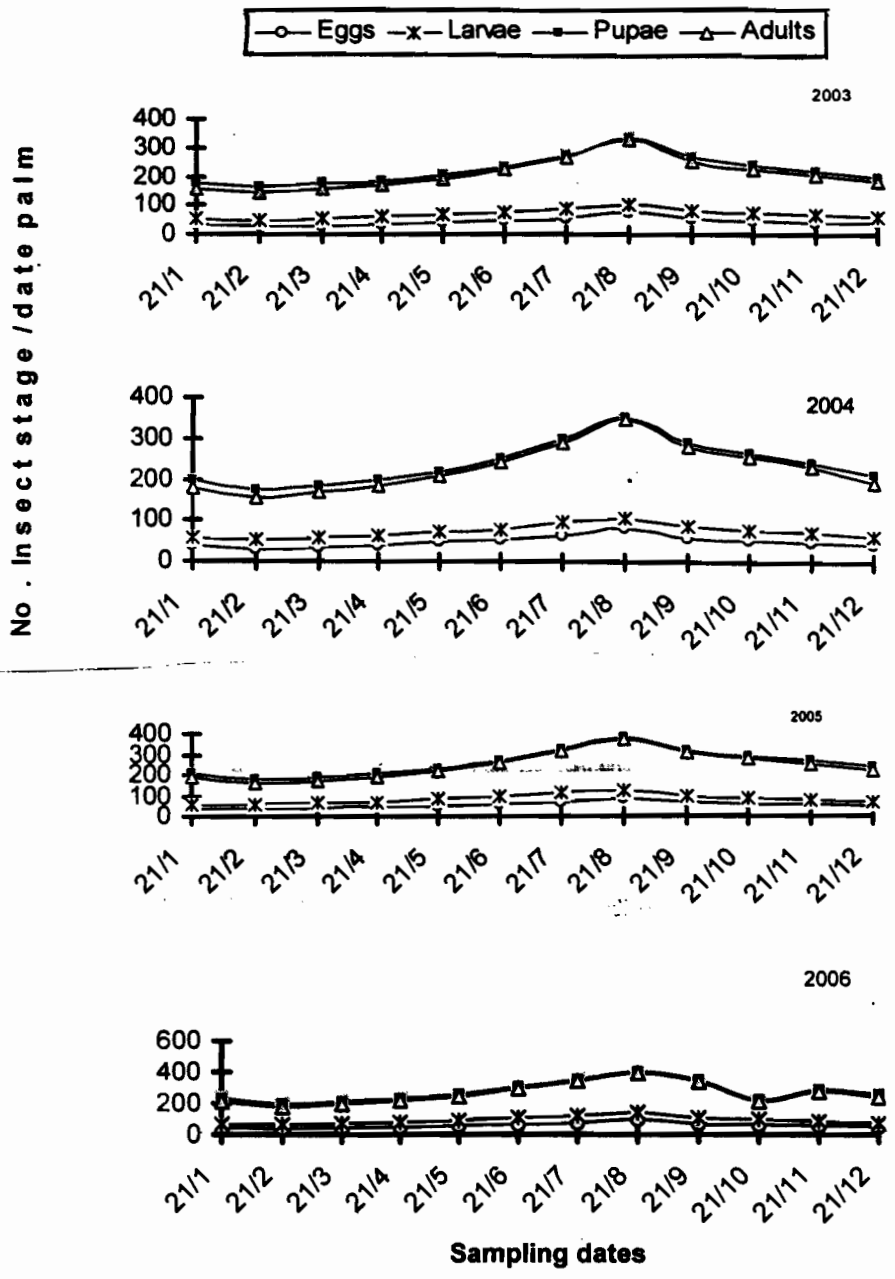


**Figure 3. Numbers of insect stages for RPW /date palm reared on Zaglol cultivar in Behera Governorate for four years.**

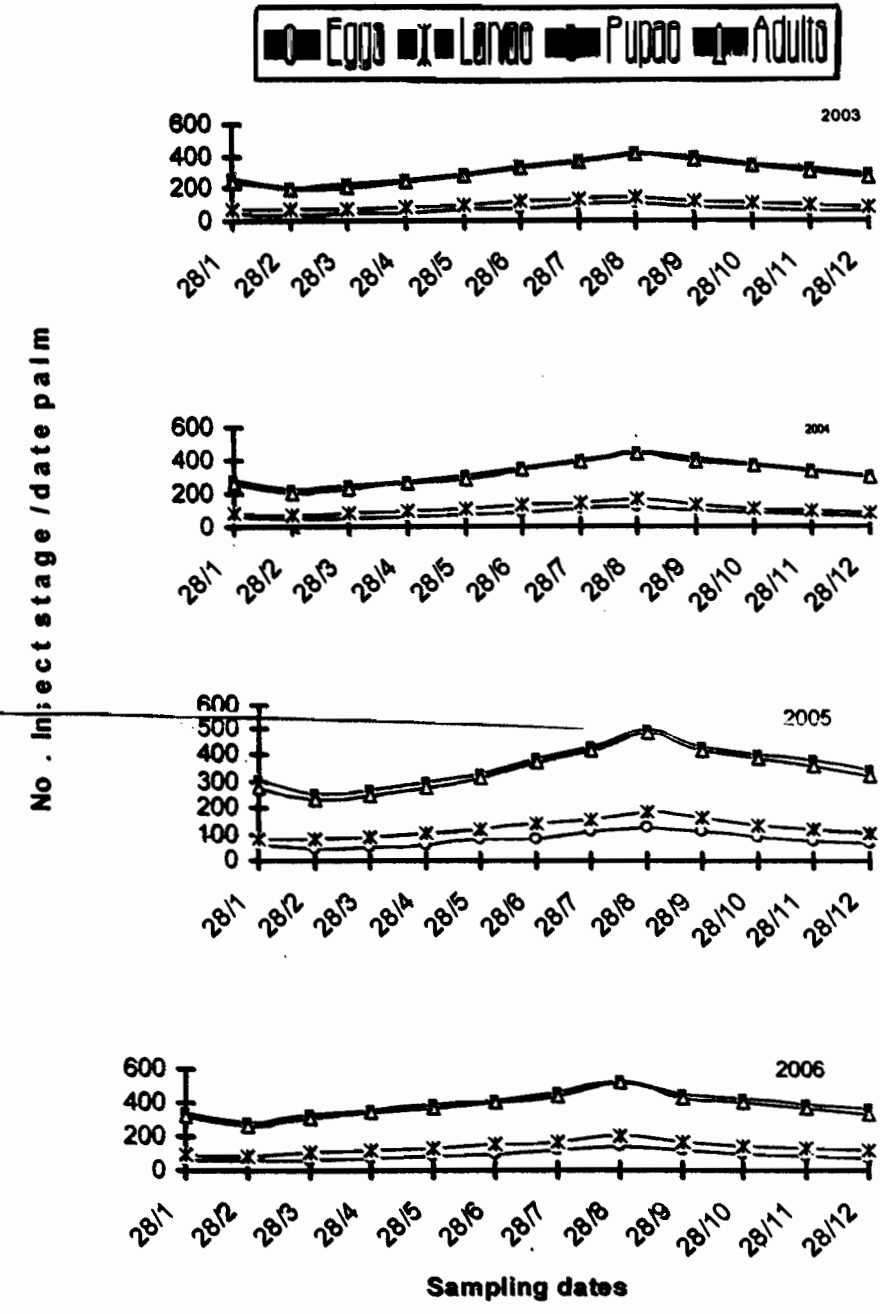


**Figure. 4. Numbers of insect stages for RPW /date palm reared on Zaglol cultivar in Giza Governorate for four years.**

The population of insect stages increased gradually to reach its second peak in the third week of August. Total numbers of insect stages were decreased during September, October, November, and December. The seasonal pattern was similar to observations during 2004 till 2006.

On Zaglol cultivar, eggs, larvae at different instars, pupae, and adults of *R. ferrugineus* were recorded during 2003 till 2006 on in Giza Governorate. Data presented in Table (4) illustrated that In 2003, the insect population increased in the fourth week of February to reach its first peak. The population of insect stages increased gradually to reach its second peak in the fourth week of August. Total numbers of insect stages were decreased during September, October, November, and December. The seasonal pattern was similar to observations during 2004 till 2006.

In Egypt, El-Garhy (1996) noted that captures rates of *R. ferrugineus* adult were highest in the months of April, May and June, which corresponds to the onset of warmer weather. The higher capture rates during this period were probably due to the emergence of broods whose development was slowed by the cooler winter months. In addition, El-Sebay (2003) in Egypt, determined the seasonal abundance and seasonal activity of *R. ferrugineus* during 1996-2001. He 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.

While in India, Muralidharan *et al.* (1999) mentioned that the highest populations were observed in May, March and December during 1995, 1996 and 1997, respectively at Kachchh in Gujarat. In addition, Muralidharan *et al.* (2000) noted that the infestation was more in areas away from the coast and young plants (2-5 years) are more prone to weevil infestation.The point of attachment of suckers to mother palm is the most vulnerable portion to weevil attack and many generations are completed in a single palm. Also, Krishnakumar and Maheswari (2003) mentioned that the infestation of red palm weevil was significantly higher during June in all the districts surveyed, followed by that in September. The infestation was the lowest during February which may be due to higher temperature during the summer season. The district-wise infestation of weevil showed that significantly higher infestation was in Alappuzha in all the seasons and significantly less infestation was found in Thiruvnanthapuram.

In Saudi Arabia, Vidyasagar *et al.* (2000) reported that the peak adult population trapped was immediately after winter season during the months of April and May. A much smaller second peak was observed during October and November months just before the onset of winter. When the weather parameters were correlated with the weevil catch in different months, it was found that there was a drop in capture rate of weevils at the beginning of winter season. Also, Al-Ajlan and Abdulsalam (2005) in Saudi Arabia reported that the monthly mean number of captured adults increased gradually from February to April, reaching the peak in April, and then decreased from May to November on date palms in Al Qatif district, Al Jush. The highest mean number of captured adults was recorded in April. The population of *R. ferrugineus* was lowest from September to October and highest during April.

According to Abbas *et al.* (2006), the insect population increased gradually from January to reach its peak in March, April, or May in the United Arab Emirates.

In general, the insect had two main active seasons annually. The first adult brood was observed in February and the second one was in August. The active seasons varied from Governorate to another and from season to another season due to the climatic conditions.

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## تقييم درجات الإصابة وتأثير عمر وإرتفاع ساق النخلة والتواجد لحشرة سوسة النخيل الحمراء على بعض أصناف نخيل البلح فى مصر

**عادل حسن عبدالسلام[١] ، سمير صالح عوض الله[١] و خالد محمد عبدالحميد[٢]**

١- قسم الحشرات الإقتصادية - كلية الزراعـــــة - جامعة المنصورة

٢- المعمل المركزى للأبحاث وتطوير نخيل البلح - مركز البحوث الزراعية - وزارة الزراعة

تم دراسة تقييم درجات الأصابة وتأثير عمر وإرتفاع ساق النخلة والتواجد لحشرة سوسة النخيل الحمراء على صنفى زغلول وسمانى فى محافظات الدقهلية ، القليوبية ، البحيرة والجيزة لمدة أربع سنوات متتالية فى ٢٠٠٣ ، ٢٠٠٤ ، ٢٠٠٥ ، ٢٠٠٦.

أظهرت النتائج أن درجات الإصابة كانت مرتفعة فى محافظة الجيزة ومتوسطة فى محافظتى البحيرة والقليوبية بينما كانت أقل مايمكن فى محافظة الدقهلية. من خلال الدراسة إتضح أيضا أن نسبة الإصابة على كل من صنفى زغلول وسمانى كانت ١٦,٨٨ ، ١٢,٩٤ %. وكانت نسبة الإصابة مرتفعة فى محافظة الجيزة وكانت منخفضة فى محافظة الدقهلية. أوضحت النتائج أن من ٤٣٤٨ نخلة مصابة من صنف الزغلول كانت ٣٢٢٨ نخلة مصابة بنسبة ٧٤,٢٤% بالمستوى المنخفض (Low) ، ٧٢٥ نخلة مصابة بنسبة ١٦,٦٧% بالمستوى المتوسط (Medium) ، ٣٩٠ نخلة بنسبة ٨,٩٦% مصابة بالمستوى المرتفع (High) أما على صنف السمانى فأوضحت النتائج أن ٢٣٥٦ نخلة مصابة بنسبة ٧٥,٢٢% بالمستوى المنخفض (Low) ، ٤٧١ نخلة مصابة بنسبة ١٥,٠٤% بالمستوى المتوسط (Medium) ، ٣٠٥ نخلة بنسبة ٩,٧٤% مصابة بالمستوى المرتفع (High) .

وأظهرت النتائج أيضا أن نسبة الإصابة كانت مرتفعة فى عمر النخلة من ٦-١٠ سنوات يليها عمر من ١-٥ سنة بينما كانت أقل نسبة إصابة فى عمر من ١٦-٢٠ ، وأكبر من ٢٠ سنة. وأوضحت النتائج أن نسبة الإصابة المرتفعة مرتبطة عندما كان إرتفاع الساق من صفر إلى ٣ متر ، من ٧ إلى ٩ متر . من ١٠ إلى ١٢ متر بينما كانت أقل عندما كان إرتفاع الساق أكبر من ١٢ متر. بناءا على نتائج التحليل الأحصائى يمكن أن نستنتج أنه يوجد فروق معنوية بين نسب الإصابة لإرتفاعات ساق النخلة وبين سنوات الدراسة لكل محافظة من محافظات الدراسة إلى جانب ذلك يوجد فرق معنوى بين المحافظات المختلفة لنفس السنة . أشارت الدراسة أنه يوجد فترتين سنويا لتربية الحشرة ، الأولى فى فبراير والثانية فى أغسطس.