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# Mango tree varieties' susceptibility to invasion by the *Parlatoria oleae* (Colvee) insect in Aswan, Egypt

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## Abstract:

Field experiments were conducted at a private mango orchard in Edfu district, Aswan Governorate, Egypt. The orchard was sampled twice monthly from the beginning of August 2020 until mid-July 2022 to study the performance of some mango varieties (Sedik, Balady and Zebda) to infestation with the plum scale insect *Parlatoria oleae* (Colvee) (Hemiptera: Diaspididae). The total population by pest and the incidence percentages of *P. oleae* were recorded in January for each of the two mango kinds under study, according to the results. It seemed that the variability in these physical elements in both study years had an impact on the annual changes in the population density during the two years. Overall, it was determined that the Sediek variety of mango was the most favored in terms of population density and the frequency of infestation by *P. oleae*, the plum scale insect; Zebda and Balady were the next in line.

***Keywords*:** *Parlatoria oleae*, Mango varieties, population density, infestation incidence.

## 1- Introduction

Pest infestation of Mango trees (*Mangifera indica* L.) occurs in Egypt due to several reasons. Of these pests, *Parlatoria oleae*, the plum-scale bug, it's recorded the most damaging to mango trees **(Bakr *et al.*, 2009)**. By sucking out plant sap with its mouthparts, this pest species damages mango tree shoots, twigs, leaves, branches, and fruits. This result in deformities, defoliation, drying up of young twigs, dieback, poor blossoming, and twig death from the action of the toxic saliva. Consequently, it affects the commercial value of fruits where it causes noticeable pink blemishes around the scales' feeding sites. The emergence and accumulation of the pest's scales on the mango sections that have been attacked is a telltale sign of an infestation **(El-Amir, 2002**). For Integrated Pest Management (IPM), comprehensive knowledge of the pest's distribution patterns is necessary. Insect dispersal habits aid in the development of specific pest control monitoring and management strategies. The pest's affects must be under direct observation **(Karar *et al.*, 2013)**. In a private orchard in Edfu district, Aswan Governorate, Egypt, the study's goal was to estimate the distribution pattern of *P. oleae* to the cardinal directions of the tree and different strata of the tree during two successive years, from the beginning of August 2020 to the middle of July 2022.

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Mango growers can better manage this pest if they have knowledge about *P. oleae* density and population oscillations throughout the year, as well as the variables that influence these fluctuations and their consequences. The literature contained only fragments of information about how host preference affected *P. oleae* infestation levels. Thus, using the general mean number of insect population or *P. oleae* infestation by variety as the standard of classification, the current study was conducted to assess the degrees of susceptibility among three mango varieties to *P. oleae* infestation at Edfu district, Aswan Governorate, Egypt. The findings of this study may be utilized to develop *P. oleae* pest management program techniques.

## 2- Materials and Methods

The present study was carried out in A private mango orchard *Mangifera indica* L., of approximately 20 feddans, 10 years old was selected at Wadi El-Saida (Amro bn Elas Village), Edfu district, Aswan Governorate, Egypt, for sampling Sedik, Balady and Zebda were different mango varieties from the beginning of August 2020 until mid of July 2022, to study the population density of the Plum scale insect, *Parlatoria oleae* infesting mango trees (*Mangifera indica* L.), Seasonal fluctuations in population were assessed to determine if the factors affecting behavior patterns of *P. oleae*. Ten mango trees were selected and labeled, almost uniform and of similar size, height and vegetative growth and received the same horticultural practices. Before and throughout the experiment, these randomly selected mango trees were not treated with pesticides and sampling was collected every two weeks

### 2.1- Susceptibility of Certain Mango Varieties to Infestation by Different Stages of *P. oleae*:

#### 2.1.1- Study Area:

The orchard was sampled twice monthly from the beginning of August 2020 until mid-July 2022. Ten mango trees per variety were chosen and tagged based on their almost identical size, height, and vegetative growth. All of the trees also got the same horticultural treatments, such as watering, fertilizer and trimming. Two once every month, samples of thirty leaves from each tree were chosen at random to represent the three levels (heights) and four directions of each tree. Leaf samples were selected at random from the tree's terminal shoots. Samples of all dates were transferred to the laboratory and each was placed in a plastic bag for stereomicroscope inspection. Numerous writers employed various bug idioms to convey the pest's population level. Two insect expressions were used in this investigation: insect numbers and the pest's percentage of infestation occurrence. On the upper and bottom surfaces of the leaves of the mango tree, there were several living insects:

The pest population size was expressed as a mean number of individuals per leaf ± standard error (SE), which was determined by sorting each individual into immature stages (Pre-adult), mature stages (adult females, gravid) and total population, means of population. The data were then counted, recorded, and linked to the inspection date. However, the data were discussed through bimonthly records

The infestation incidence or the percentages of infested leaves by pest were calculated according to the formula described by **Facylate (1971)**:

$$A = (n / N) \times 100.$$

Were,

A = The infestation incidence percentage.

n = No. of infested leaves in which the pest appeared.

N = Total number of leaves (Uninfested + Infested) taken on each inspection date.

**2.1.2- General sampling method:**

All sampling was conducted from 43200 leaves on 48 dates over 2 years, i.e. (10 trees × 30 leaves × 3 varieties × 48 dates) over two years from the terminal shoots of the tree. Samples were frozen to preserve them for subsequent processing.

**2.1.3- Levels of Susceptibility:**

The examined mango types were categorized according to the degree of their susceptibility using a quantitative method based on the following assumptions According to **(Semeada, 1985 and Nosser, 1996)**.

A- The varieties were divided into five groups: Highly Susceptible (HS), Susceptible (S), Resistant (R), Moderate Resistant (MR), and Relative Resistant (RR).

B- General mean number of individuals = (MN)

C- The range of change (RC) between the varieties' maximum and minimum mean number values was determined using the following formula:

RC = MN max – MN min

Were,

MN max = the maximum number of individuals/ varieties.

MN min = the minimum number of individuals/ varieties.

D- The amount of variation in varieties from one degree of resistance or susceptibility to the previous degree (from MR to R or from MR to RR, etc.) was known as the unit change in varieties (UC).

Based on the equation shown above, the examined varieties might be categorized as follows:

1. First, the highly susceptible group (HS) consists of types that have greater infestation than (MN+ UC).
2. Varieties with infection ranging from MN to (MN+UC) comprise the susceptible group (S).
3. 3. Varieties with less infection than MN to (MN-UC) are the relative resistance group (RR).
4. 4- The cultivars with infestations ranging from < (MN-UC) to < (MN-2UC) are the moderate resistant group (MR).
5. 5. The verities with infestation less than (MN–2UC) comprise the resistant group (R).

It is crucial to note that the pest mean numbers must correspond to and/or coincide with the variety's resistance degree.

**2.2-** Influence of the primary meteorological weather variables on the density of the insect population at various phases, as well as on the percentages of intensity and infestation incidence of the plum scale insect, *P. oleae***:**

**2.3- Statistical analysis**

The statistical analysis was carried out using Two-way ANOVA using SPSS, ver. 27 **(IBM Corp. Released 2013)**. Data were treated as a complete randomization design according to **Steel *et al.* (1997)**. Multiple comparisons were carried out applying **Duncun test (1955)**. The significance level was set at < 0.05

# 3- Results and Discussion

## 3.1- Total Population of *P. oleae* (pre-adult + adult females + gravid):

The mean population density of *P. oleae* total population / leaf from each of the three mango types (Sediek, Balady and Zebda). Data shown in **Tables (1, 2) and Figs. (1-6)**. When compared to the other tested varieties, the Sediek mango variety had the highest average number of *P. oleae* individuals / leaf over the first and second years (333.97±30.92 and 672.67±54.90), respectively **(Figs., 3 and 6)**. It also appeared to be highly susceptible (HS). However, the lowest number was recorded on the Balady variety with an average of 106.35±8.04 and 104.96±7.87 individuals / leaf. It was seen as moderately resistant (MR) through the first and second years, respectively **(Figs., 3** and **6)**. On the other hand, the Zebda variety had a modest population of pests throughout the first and second years **(Figs., 3 and 6)**, with an average of 142.75±7.63 and 152.46±10.96 individuals / leaf, respectively. For each of the two years, this variety was noted as being reasonably resistant (RR). Based on statistical analysis, there were notable variations across the three mango types that were tested (Sediek, Balady and Zebda) during the course of two years. Throughout the course of the two years, the degree of *P. oleae* gravid infestation was determined (L.S.D. values were 26.54 and 46.15, respectively). The data shows that, in comparison to the first year (194.36±12.85 / leaf), the mean number of nymphs was larger in the second year (310.03±25.68 / leaf) .**Dako (2023)** studied the mango scale in the two countries in Kenya, the results reveres that numbers of crawlers stages were researched about thousand per leave in almost variates .

**Table (1): The average (mean±SE) *P. oleae* counts for all the mango types in first season (2020/2021)**

| Date | Mango varieties | | | Mean of date |
|---|---|---|---|---|
| | Sediek | Balady | Zebda | |
| 1/8/2020 | $85.33\pm2.40^{lB}$ | $83.00\pm14.57^{cdeB}$ | $172.67\pm20.53^{bcdA}$ | $113.67\pm16.46^{hi}$ |
| 16/8 | $185.00\pm44.55^{hijA}$ | $65.33\pm4.18^{cdeC}$ | $139.33\pm31.76^{b-gB}$ | $129.89\pm23.55^{h}$ |
| 1/9 | $204.67\pm48.99^{hijA}$ | $166.33\pm19.81^{bB}$ | $123.33\pm14.86^{b-gC}$ | $164.78\pm19.73^{e-i}$ |
| 16/9 | $180.33\pm33.69^{hijA}$ | $106.00\pm8.08^{b-eB}$ | $94.67\pm18.21^{efgB}$ | $127.00\pm17.55^{hi}$ |
| 1/10 | $169.00\pm40.38^{ijA}$ | $73.00\pm3.06^{cdeC}$ | $102.33\pm6.39^{d-gB}$ | $114.78\pm18.49^{hi}$ |
| 16/10 | $481.33\pm50.28^{dA}$ | $119.67\pm14.5^{bcdB}$ | $143.00\pm21.00^{b-gB}$ | $248.00\pm60.66^{cd}$ |
| 1/11 | $341.00\pm59.43^{gA}$ | $95.00\pm23.39^{cdeB}$ | $110.00\pm23.46^{d-gB}$ | $182.00\pm44.39^{d-h}$ |
| 16/11 | $170.00\pm20.53^{ijA}$ | $96.00\pm11.15^{cdeB}$ | $112.00\pm6.56^{c-gB}$ | $126.00\pm13.24^{hi}$ |
| 1/12 | $363.33\pm6.39^{fgA}$ | $324.67\pm33.47^{aB}$ | $316.67\pm30.07^{aB}$ | $334.89\pm14.97^{b}$ |
| 16/12 | $569.33\pm80.54^{cA}$ | $272.67\pm6.67^{aB}$ | $277.67\pm25.10^{aB}$ | $373.22\pm54.78^{b}$ |
| 1/1/2021 | $88.00\pm3.21^{klB}$ | $86.33\pm6.94^{cdeB}$ | $122.67\pm31.75^{b-gA}$ | $99.00\pm11.13^{i}$ |
| 16/1 | $161.33\pm8.21^{ijkA}$ | $66.67\pm13.37^{cdeC}$ | $115.00\pm19.66^{c-gB}$ | $114.33\pm15.47^{hi}$ |
| 1/2 | $188.67\pm15.9^{hijA}$ | $91.33\pm4.18^{cdeC}$ | $131.00\pm2.31^{b-gB}$ | $137.00\pm14.92^{f-i}$ |
| 16/2 | $232.67\pm13.93^{hiA}$ | $57.33\pm5.70^{deB}$ | $83.67\pm11.89^{fgB}$ | $124.56\pm27.85^{hi}$ |
| 1/3 | $216.67\pm25.10^{hijA}$ | $75.33\pm9.17^{cdeC}$ | $105.00\pm12.22^{d-gB}$ | $132.33\pm23.13^{ghi}$ |
| 16/3 | $253.00\pm30.05^{hA}$ | $77.00\pm9.45^{cdeC}$ | $117.33\pm18.89^{c-gB}$ | $149.11\pm28.65^{f-i}$ |
| 1/4 | $146.00\pm34.08^{jklB}$ | $94.33\pm24.06^{cdeC}$ | $192.67\pm60.17^{bA}$ | $144.33\pm25.46^{f-i}$ |
| 16/4 | $412.67\pm42.22^{d-gA}$ | $84.67\pm16.76^{cdeC}$ | $186.67\pm4.67^{bcB}$ | $228.00\pm50.22^{de}$ |
| 1/5 | $428.67\pm66.90^{defA}$ | $45.00\pm12.29^{deC}$ | $149.67\pm10.9^{b-fB}$ | $207.78\pm60.61^{def}$ |
| 16/5 | $396.33\pm174.72^{efgA}$ | $37.00\pm4.16^{eC}$ | $74.33\pm9.02^{gB}$ | $169.22\pm76.19^{e-i}$ |
| 1/6 | $459.67\pm16.15^{deA}$ | $88.33\pm11.86^{cdeC}$ | $166.00\pm36.00^{b-eB}$ | $238.00\pm57.78^{cde}$ |
| 16/6 | $671.33\pm47.30^{bA}$ | $111.00\pm23.07^{b-eB}$ | $132.33\pm25.21^{b-gB}$ | $304.89\pm93.20^{bc}$ |

| | | | | |
|---|---|---|---|---|
| **1/7** | **404.67±145.79$^{efgA}$** | **98.67±16.33$^{b-eB}$** | **116.33±18.85$^{c-gB}$** | **206.56±65.44$^{d-g}$** |
| **16/7** | **1206.33±237.07$^{aA}$** | **137.67±5.78$^{bcB}$** | **141.67±18.37$^{b-gB}$** | **495.22±190.58$^{a}$** |
| **Mean of Varieties** | **333.97±30.92$^{A}$** | **106.35±8.04$^{C}$** | **142.75±7.63$^{B}$** | **194.36±12.85** |

**a, b and c: There is no significant difference (P>0.05) between any two means, within the same column that has the same superscript letter;**

**A, B and C: No significant difference (P>0.05) exists between any two means, within the same row with the same superscript letter.**

| LSD at 0.05 for | Varieties (V) | Date (D) |
|---|---|---|
| | 26.54 | 75.07 |

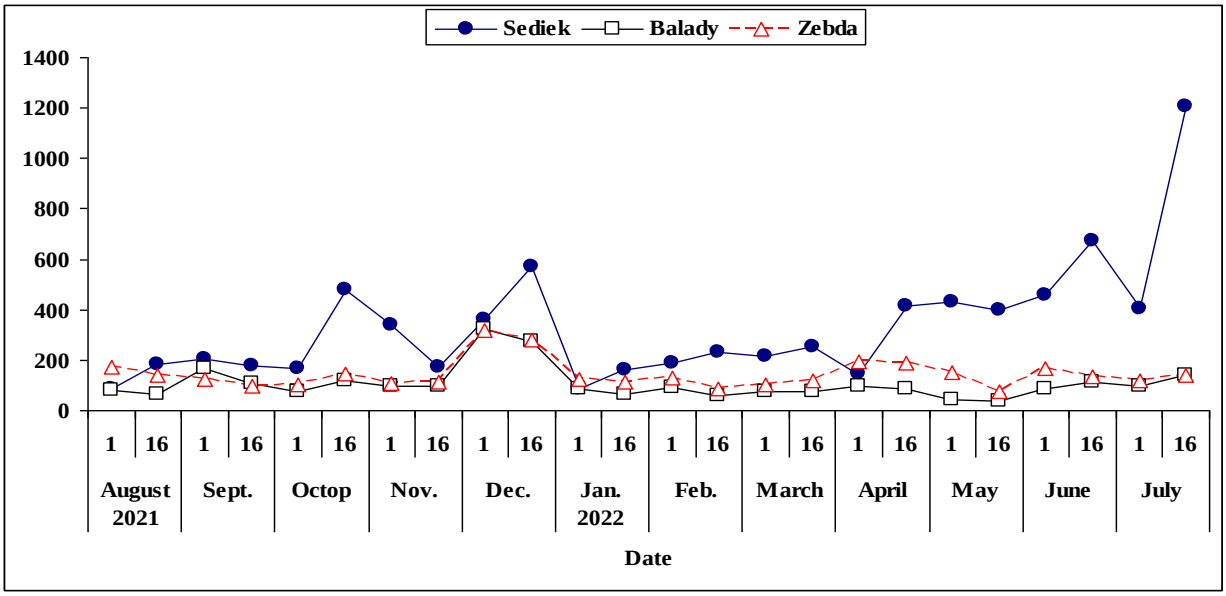


**Figure (1): Seasonal abundance (Mean) of *P. oleae* (total population) and the percentages of infestation incidence on specific mango kinds during first season (2020/2021).**

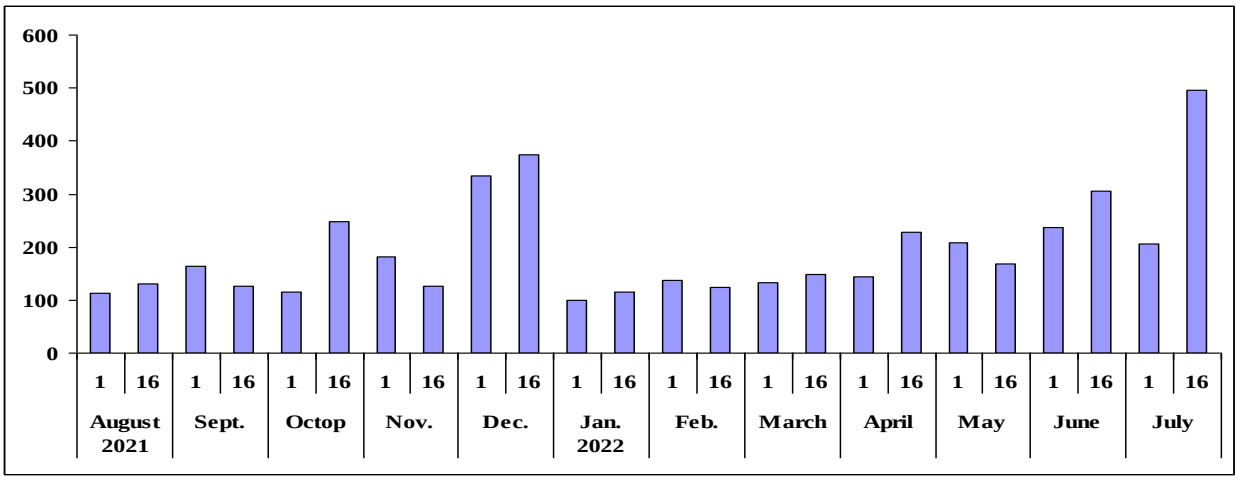


**Figure (2): Seasonal abundance (Mean) of *P. oleae* (total population) and first season infestation incidence percentages (2020/2021)**

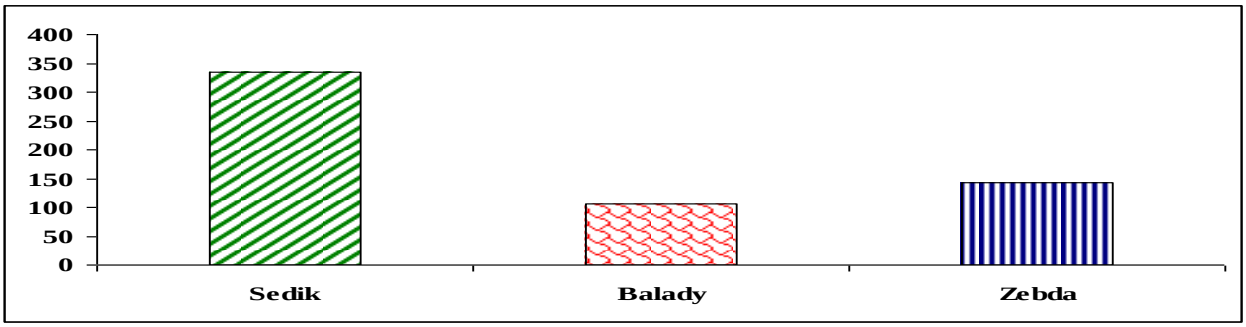


**Figure (3): Degree of susceptibility of three mango cultivars (Sediek, Balady and Zebda) to *P. oleae* infection in first season of cultivation (2020/2021)**

**Table (2): The average (mean±SE) *P. oleae* counts for all the mango types in second season (2021/2022).**

| Date | Mango varieties | | | Mean of date |
|---|---|---|---|---|
| | Sediek | Balady | Zebda | |
| 1/8/2021 | 630.33±239.07$^{hiA}$ | 91.33±19.84$^{a-eC}$ | 325.67±107.79$^{aB}$ | 349.11±108.86$^{cde}$ |
| 16/8 | 1272.33±186.06$^{cA}$ | 107.00±11.36$^{a-eB}$ | 150.00±57.19$^{cdeB}$ | 509.78±198.87$^{b}$ |
| 1/9 | 1126.67±282.63$^{dA}$ | 136.00±11.79$^{a-dB}$ | 135.33±14.62$^{cdeB}$ | 466.00±184.3$^{bc}$ |
| 16/9 | 852.67±341.48$^{eA}$ | 95.67±8.11$^{a-eC}$ | 190.67±70.78$^{cdB}$ | 379.67±155.92$^{bc}$ |
| 1/10 | 188.00±17.06$^{mnoA}$ | 70.33±7.33$^{a-eB}$ | 71.00±8.50$^{deB}$ | 109.78±20.43$^{hi}$ |
| 16/10 | 284.67±16.48$^{lmA}$ | 53.67±12.6$^{b-eB}$ | 59.33±12.98$^{eB}$ | 132.56±38.69$^{hi}$ |
| 1/11 | 361.67±78.33$^{klA}$ | 93.67±19.2$^{a-eC}$ | 147.00±28.29$^{cdeB}$ | 200.78±47.81$^{ghi}$ |
| 16/11 | 340.67±7.88$^{klA}$ | 69.33±2.73$^{a-eC}$ | 147.33±39.94$^{cdeB}$ | 185.78±42.01$^{ghi}$ |
| 1/12 | 695.00±37.54$^{fghA}$ | 38.33±3.93$^{cdeC}$ | 141.00±40.28$^{cdeB}$ | 291.44±103.21$^{efg}$ |
| 16/12 | 761.00±29.37$^{efgA}$ | 106.33±37.65$^{a-eB}$ | 151.00±54.68$^{cdeB}$ | 339.44±107.65$^{cde}$ |
| 1/1/2022 | 142.33±13.86$^{noA}$ | 0.00±0.00$^{eC}$ | 77.00±21.78$^{deB}$ | 73.11±21.88$^{i}$ |
| 16/1 | 117.00±30.02$^{oB}$ | 192.67±20.70$^{aA}$ | 109.33±10.35$^{cdeB}$ | 139.67±17.22$^{hi}$ |
| ½ | 457.33±42.84$^{jkA}$ | 26.33±7.13$^{deC}$ | 85.67±31.70$^{deB}$ | 189.78±69.20$^{ghi}$ |
| 16/2 | 495.67±54.04$^{jA}$ | 49.00±16.92$^{b-eC}$ | 99.00±48.77$^{cdeB}$ | 214.56±73.87$^{fgh}$ |
| 1/3 | 196.00±19.05$^{mnoA}$ | 68.33±26.03$^{a-eB}$ | 104.33±4.06$^{cdeB}$ | 122.89±21.19$^{hi}$ |
| 16/3 | 518.67±147.09$^{ijA}$ | 169.67±83.32$^{abB}$ | 182.33±28.72$^{cdeB}$ | 290.22±75.60$^{efg}$ |
| ¼ | 354.00±53.31$^{klA}$ | 58.67±15.19$^{b-eC}$ | 172.33±27.64$^{cdeB}$ | 195.00±46.57$^{ghi}$ |
| 16/4 | 692.33±93.30$^{bA}$ | 84.00±7.77$^{a-eC}$ | 220.33±19.24$^{abcB}$ | 332.22±96.19$^{def}$ |
| 1/5 | 1458.33±128.5$^{a}$1$^{A}$ | 170.00±49.66$^{abC}$ | 321.67±126.77$^{abB}$ | 650.00±210.33$^{a}$ |
| 16/5 | 1798.33±203.18$^{dA}$ | 192.33±28.88$^{aB}$ | 159.67±10.04$^{cdeB}$ | 716.78±276.86$^{a}$ |
| 1/6 | 1061.67±64.31$^{efA}$ | 162.00±15.87$^{abcB}$ | 134.33±7.80$^{cdeB}$ | 452.67±153.51$^{bcd}$ |
| 16/6 | 821.00±79.56$^{eA}$ | 177.67±33.07$^{abB}$ | 104.33±21.46$^{cdeC}$ | 367.67±116.68$^{cde}$ |
| 1/7 | 853.67±71.75$^{ghA}$ | 136.00±14.64$^{a-dC}$ | 192.67±10.90$^{bcdB}$ | 394.11±117.15$^{b-e}$ |
| 16/7 | 664.67±45.24$^{A}$ | 170.67±13.42$^{abB}$ | 177.67±18.98$^{cdeB}$ | 337.67±83.06$^{c-f}$ |
| Mean of Varieties | 672.67±54.90$^{A}$ | 104.96±7.87$^{C}$ | 152.46±10.96$^{B}$ | 310.03±25.68 |

**a, b and c: There is no significant difference (P>0.05) between any two means, within the same column that have the same superscript letter;**

**A, B and C: No significant difference (P>0.05) exists between any two means, within the same row with the same superscript letter.**

| LSD at 0.05 for | Varieties (V) | Date (D) |
|---|---|---|
| | 46.15 | 130.54 |

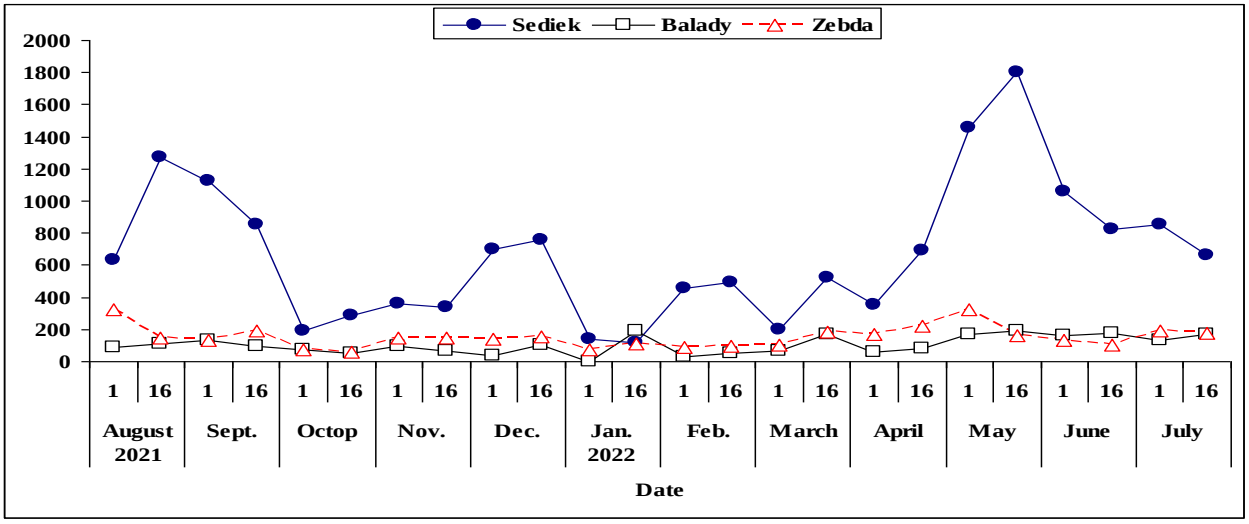


**Figure (4): Seasonal abundance (Mean) of *P. oleae* (total population) and the percentages of infestation incidence on specific mango kinds during second season (2021/2022).**

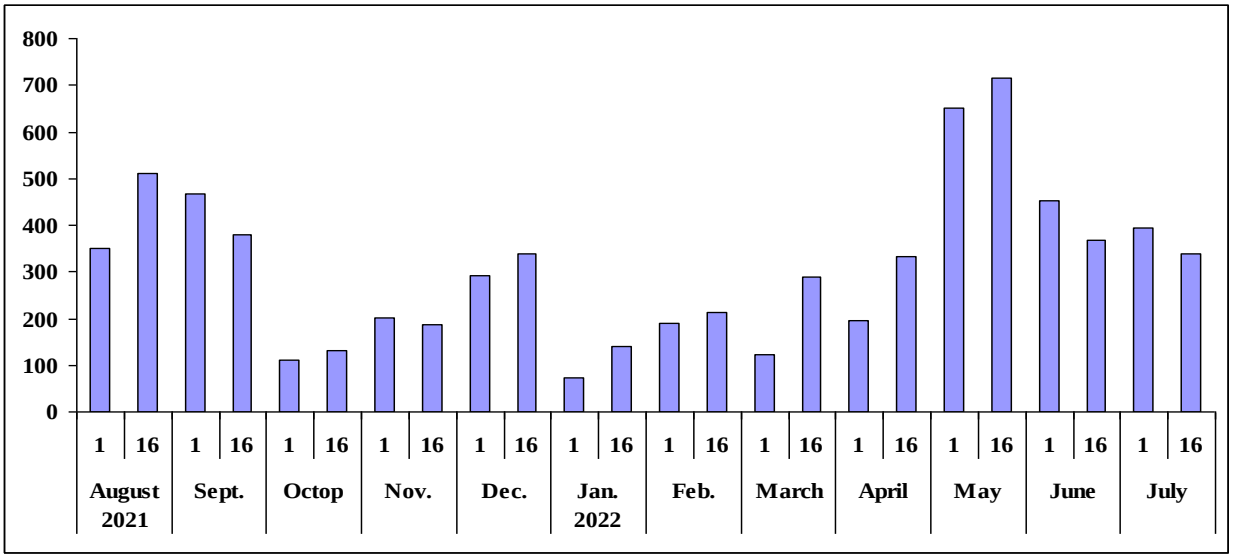


**Figure (5): Seasonal abundance (Mean) of *P. oleae* (total population) and second season infestation incidence percentages (2021/2022).**

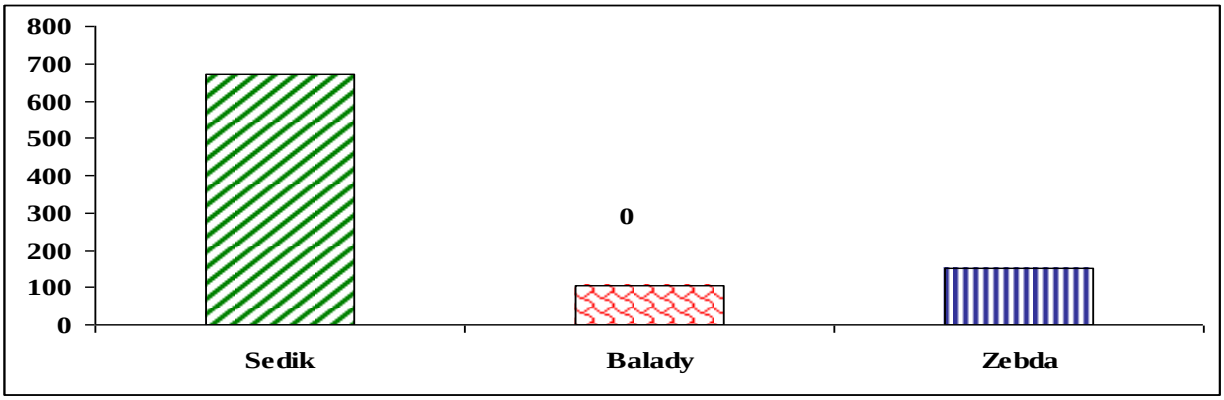


**Figure (6): Degree of susceptibility of three mango cultivars (Sediek, Balady and Zebda) to *P. oleae* infection in second season of cultivation (2021/2022).**

### 3.2- Average *P. oleae* population density and the percentages of infestation occurrence on specific mango cultivars:

The mean population density of *P. oleae* per leaf from each of the three mango types (Sediek, Balady and Zebda) were cleared in **Tables (3 and 4)** and Figs. **(7 - 12)**. When compared to the other tested varieties, the Sediek mango variety had the highest average number of *P. oleae* individuals / leaf over the first and second years (111.32±10.31 and 224.22±18.30), respectively (Figs., 7 and 10 individuals / leaf). It also appeared to be highly susceptible (HS).

On the other hand, the Balady variety had the lowest number, averaging 35.45±2.68 and 34.99±2.62 individuals / leaf. During the first and second years, it was considered to be moderately resistant (MR) (Figs., 7 and 10). In the meantime, during the first and second years, the Zebda variety had a modest population of pests, with an average of 47.58±2.54 and 50.82±3.65 individuals / leaf, respectively (**Tables, 3 and 4**). For each of the two years, this variety was noted as being reasonably resistant (RR).

Based on statistical analysis, there were notable variations across the three mango types that were tested (Sediek, Balady and Zebd) a during the course of two years. Throughout the course of the two years, the degree of *P. oleae* bug infestation was determined (L.S.D. values were 8.85 and 15.38, respectively). The data clearly showed that, in comparison to the first year (64.79±4.28 / leaf), the mean numbers of *P. oleae* were greater in the second year (103.34±8.56 / leaf).

Figs. (7–12) showed the monthly counts of *P. oleae* at various stages on several mango types and the percentages of infestation incidence by pest at Edfu district, Aswan Governorate, which were recorded over the course of two consecutive years (2020/2021 and 2021/2022).

**Table (3): Seasonal abundance (Mean), prevalence *P. oleae* and the proportion of cases of infestation on different mango cultivars in first season (2020/2021).**

| Date | Mango varieties | | | Mean of date |
|---|---|---|---|---|
| | Sediek | Balady | Zebda | |
| 1/8/2020 | 28.44±0.80$^{lB}$ | 27.67±4.86$^{cdeB}$ | 57.55±6.84$^{bcdA}$ | 37.89±5.49$^{hi}$ |
| 16/8 | 61.67±14.85$^{hijA}$ | 21.78±1.39$^{cdeC}$ | 46.44±10.59$^{b-gB}$ | 43.30±7.85$^{hi}$ |
| 1/9 | 68.22±16.33$^{hijA}$ | 55.45±6.60$^{bB}$ | 41.11±4.95$^{b-gC}$ | 54.93±6.57$^{e-i}$ |
| 16/9 | 60.11±11.23$^{hijA}$ | 35.33±2.70$^{b-eB}$ | 31.55±6.07$^{efgB}$ | 42.33±5.85$^{hi}$ |
| 1/10 | 56.33±13.46$^{ijA}$ | 24.33±1.02$^{cdeC}$ | 34.11±2.13$^{d-gB}$ | 38.26±6.16$^{hi}$ |
| 16/10 | 160.44±16.76$^{dA}$ | 39.89±4.83$^{bcdB}$ | 47.67±7.00$^{b-gB}$ | 82.67±20.22$^{cd}$ |
| 1/11 | 113.66±19.81$^{gA}$ | 31.66±7.80$^{b-eB}$ | 36.67±7.82$^{d-gB}$ | 60.66±14.80$^{d-h}$ |
| 16/11 | 56.67±6.84$^{ijA}$ | 32.00±3.72$^{b-eB}$ | 37.34±2.19$^{c-gB}$ | 42.00±4.41$^{hi}$ |
| 1/12 | 121.11±2.13$^{fgA}$ | 108.22±11.16$^{aB}$ | 105.56±10.02$^{aB}$ | 111.63±4.99$^{b}$ |
| 16/12 | 189.78±26.85$^{cA}$ | 90.89±2.22$^{aB}$ | 92.56±8.36$^{aB}$ | 124.41±18.26$^{b}$ |
| 1/1/2021 | 29.33±1.07$^{klB}$ | 28.78±2.31$^{cdeB}$ | 40.89±10.58$^{b-gA}$ | 33.00±3.71$^{i}$ |
| 16/1 | 53.78±2.74$^{ijkA}$ | 22.22±4.46$^{cdeC}$ | 38.33±6.55$^{c-gB}$ | 38.11±5.16$^{hi}$ |
| ½ | 62.89±5.30$^{hijA}$ | 30.45±1.39$^{b-eC}$ | 43.67±0.77$^{b-gB}$ | 45.67±4.97$^{f-i}$ |
| 16/2 | 77.56±4.64$^{hiA}$ | 19.11±1.90$^{deC}$ | 27.89±3.97$^{fgB}$ | 41.52±9.28$^{hi}$ |
| 1/3 | 72.22±8.37$^{hijA}$ | 25.11±3.06$^{cdeB}$ | 35.00±4.07$^{d-gB}$ | 44.11±7.71$^{ghi}$ |
| 16/3 | 84.33±10.02$^{hA}$ | 25.67±3.15$^{cdeC}$ | 39.11±6.30$^{c-gB}$ | 49.70±9.55$^{f-i}$ |
| ¼ | 48.67±11.36$^{iklB}$ | 31.44±8.02$^{b-eC}$ | 64.22±20.06$^{bA}$ | 48.11±8.49$^{f-i}$ |
| 16/4 | 137.56±14.07$^{d-gA}$ | 28.22±5.58$^{cdeC}$ | 62.22±1.56$^{bcB}$ | 76.00±16.74$^{de}$ |

| | | | | |
|---|---|---|---|---|
| **1/5** | **142.89±22.30$^{defA}$** | **15.00±4.10$^{deC}$** | **49.89±3.63$^{b-fB}$** | **69.26±20.20$^{def}$** |
| **16/5** | **132.11±58.24$^{efgA}$** | **12.33±1.39$^{eC}$** | **24.78±3.01$^{gB}$** | **56.41±25.40$^{e-h}$** |
| **1/6** | **153.22±5.38$^{deA}$** | **29.44±3.95$^{cdeC}$** | **55.33±12.00$^{b-eB}$** | **79.33±19.26$^{cde}$** |
| **16/6** | **223.78±15.77$^{bA}$** | **37.00±7.69$^{b-eB}$** | **44.11±8.40$^{b-gB}$** | **101.63±31.07$^{bc}$** |
| **1/7** | **134.89±48.60$^{efgA}$** | **32.89±5.45$^{b-eB}$** | **38.78±6.28$^{c-gB}$** | **68.85±21.81$^{d-g}$** |
| **16/7** | **402.11±79.02$^{aA}$** | **45.89±1.93$^{bcB}$** | **47.22±6.12$^{b-gB}$** | **165.07±63.53$^{a}$** |
| **Mean of Varieties** | **111.32±10.31$^{A}$** | **35.45±2.68$^{C}$** | **47.58±2.54$^{B}$** | **64.79±4.28** |

**a, b and c: There is no significant difference (P>0.05) between any two means, within the same column have the same superscript letter;**
**A, B and C: No significant difference (P>0.05) exists between any two means, within the same row with the same superscript letter.**

| LSD at 0.05 for | Varieties (V) | Date (D) |
|---|---|---|
| | 8.85 | 25.02 |

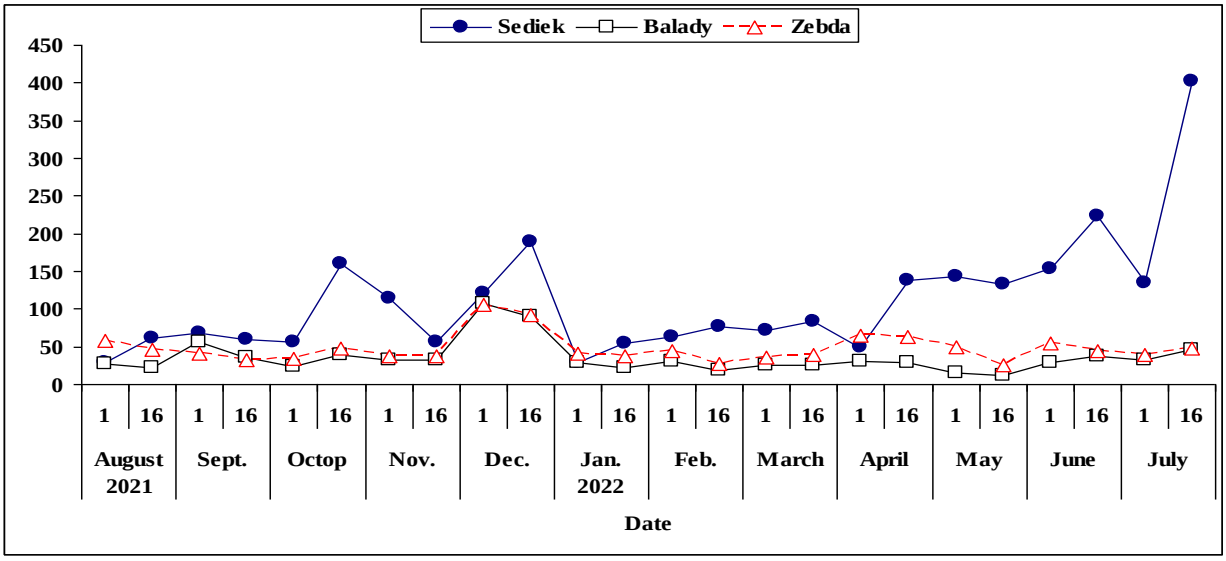


**Figure (7): Seasonal abundance (Mean), considering various *P. oleae* stages and the proportion of infection incidence on particular mango types in first season (2020/2021).**

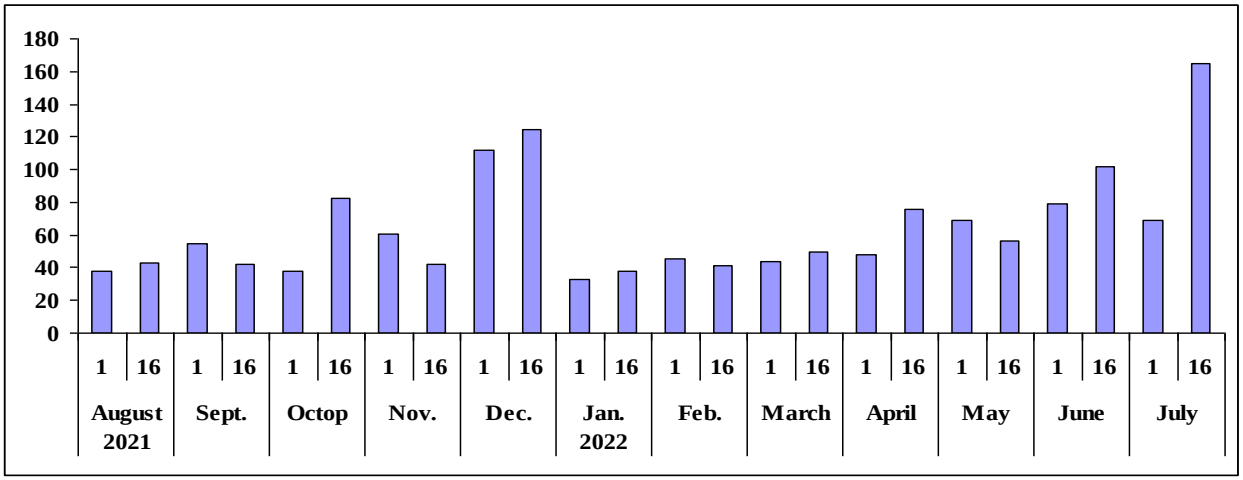


**Figure (8): Seasonal abundance (Mean), considering various *P. oleae* stages and the proportion of infection incidence on particular mango types in first season (2020/2021).**

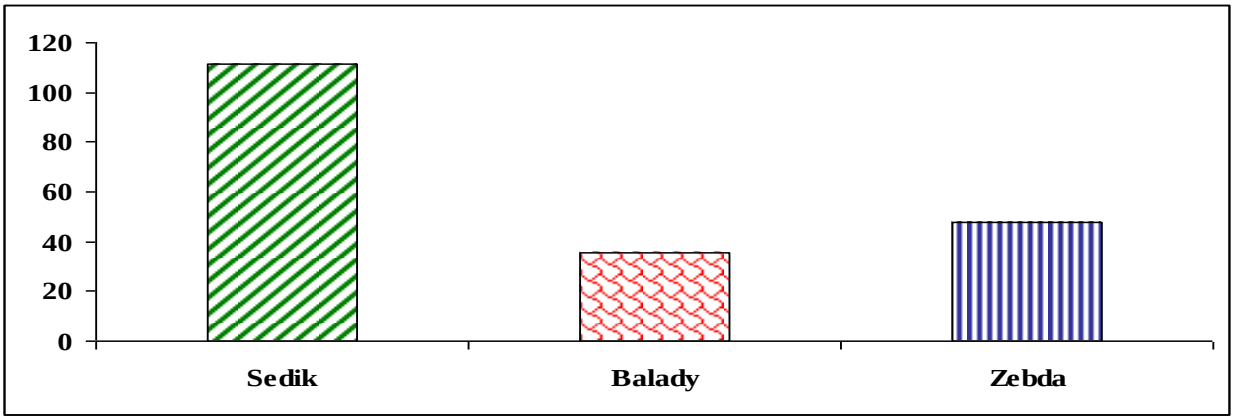


**Figure (9): Degrees of *P. oleae* infection susceptibility among the investigated mango types (Sediek, Balady and Zebda) in first season of growth (2020/2021).**

**Table (4): Seasonal abundance (Mean), prevalence *P. oleae* and the proportion of cases of infestation on different mango cultivars in second season (2021/2022).**

| Date | Mango varieties | | | Mean of date |
|---|---|---|---|---|
| | Sediek | Balady | Zebda | |
| 1/8/2021 | 210.11±79.69$^{hiA}$ | 30.45±6.61$^{a-eC}$ | 108.56±35.93$^{aB}$ | 116.37±36.29$^{cde}$ |
| 16/8 | 424.11±62.02$^{cA}$ | 35.67±3.79$^{a-eB}$ | 50.00±19.06$^{cdeB}$ | 169.93±66.29$^{b}$ |
| 1/9 | 375.56±94.21$^{dA}$ | 45.34±3.93$^{a-dB}$ | 45.11±4.87$^{cdeB}$ | 155.34±61.43$^{bc}$ |
| 16/9 | 284.22±113.83$^{eA}$ | 31.89±2.70$^{a-eC}$ | 63.56±23.60$^{a-dB}$ | 126.55±51.97$^{b-e}$ |
| 1/10 | 62.67±5.69$^{mnA}$ | 23.44±2.44$^{a-eB}$ | 23.67±2.84$^{deB}$ | 36.59±6.81$^{hi}$ |
| 16/10 | 94.89±5.49$^{lmA}$ | 17.89±4.20$^{b-eB}$ | 19.78±4.33$^{eB}$ | 44.18±12.90$^{hi}$ |
| 1/11 | 120.55±26.11$^{klA}$ | 31.22±6.40$^{a-eC}$ | 49.00±9.43$^{cdeB}$ | 66.93±15.94$^{ghi}$ |
| 16/11 | 113.56±2.63$^{klA}$ | 23.11±0.91$^{a-eC}$ | 49.11±13.31$^{cdeB}$ | 61.93±14.00$^{ghi}$ |
| 1/12 | 231.67±12.51$^{fghA}$ | 12.78±1.31$^{cdeC}$ | 47.00±13.43$^{cdeB}$ | 97.15±34.40$^{efg}$ |
| 16/12 | 253.67±9.79$^{efgA}$ | 35.45±12.55$^{a-eB}$ | 50.33±18.23$^{cdeB}$ | 113.15±35.88$^{c-f}$ |
| 1/1/2022 | 47.44±4.62$^{nA}$ | 0.00±0.00$^{eC}$ | 25.67±7.26$^{deB}$ | 24.37±7.29$^{i}$ |
| 16/1 | 39.00±10.01$^{nB}$ | 64.22±6.90$^{aA}$ | 36.44±3.45$^{cdeB}$ | 46.56±5.74$^{hi}$ |
| ½ | 152.44±14.28$^{jkA}$ | 8.78±2.37$^{deC}$ | 28.56±10.57$^{deB}$ | 63.26±23.07$^{ghi}$ |
| 16/2 | 165.22±18.01$^{jA}$ | 16.33±5.64$^{b-eC}$ | 33.00±16.26$^{cdeB}$ | 71.52±24.62$^{fgh}$ |
| 1/3 | 65.33±6.35$^{mnA}$ | 22.78±8.67$^{a-eB}$ | 34.78±1.35$^{cdeB}$ | 40.96±7.06$^{hi}$ |
| 16/3 | 172.89±49.03$^{ijA}$ | 56.56±27.77$^{abB}$ | 60.78±9.57$^{b-eB}$ | 96.74±25.20$^{efg}$ |
| ¼ | 118.00±17.77$^{klA}$ | 19.56±5.06$^{b-eC}$ | 57.44±9.21$^{cdeB}$ | 65.00±15.52$^{gh}$ |
| 16/4 | 230.78±31.10$^{fghA}$ | 28.00±2.59$^{a-eC}$ | 73.44±6.41$^{abcB}$ | 110.74±32.07$^{def}$ |
| 1/5 | 486.11±42.84$^{bA}$ | 56.67±16.55$^{abC}$ | 107.22±42.26$^{aB}$ | 216.67±70.11$^{a}$ |
| 16/5 | 599.45±67.73$^{aA}$ | 64.11±9.62$^{aB}$ | 53.22±3.35$^{cdeB}$ | 238.93±92.29$^{a}$ |
| 1/6 | 353.89±21.44$^{dA}$ | 54.00±5.29$^{abcB}$ | 44.78±2.60$^{cdeB}$ | 150.89±51.17$^{bcd}$ |
| 16/6 | 273.67±26.52$^{efA}$ | 59.22±11.02$^{abB}$ | 34.78±7.15$^{cdeC}$ | 122.56±38.89$^{b-e}$ |
| 1/7 | 284.56±23.91$^{eA}$ | 45.33±4.88$^{a-dC}$ | 64.22±3.63$^{a-dB}$ | 131.37±39.05$^{b-e}$ |
| 16/7 | 221.56±15.08$^{ghA}$ | 56.89±4.47$^{abB}$ | 59.22±6.32$^{cdeB}$ | 112.56±27.69$^{c-f}$ |
| **Mean of Verities** | 224.22±18.30$^{A}$ | 34.99±2.62$^{C}$ | 50.82±3.65$^{B}$ | 103.34±8.56 |

**a, b and c: There is no significant difference (P>0.05) between any two means, within the same column that has the same superscript letter;**
**A, B and C: No significant difference (P>0.05) exists between any two means, within the same row with the same superscript letter.**

| LSD at 0.05 for | Varieties (V) | Date (D) |
|---|---|---|
| | 15.38 | 43.51 |

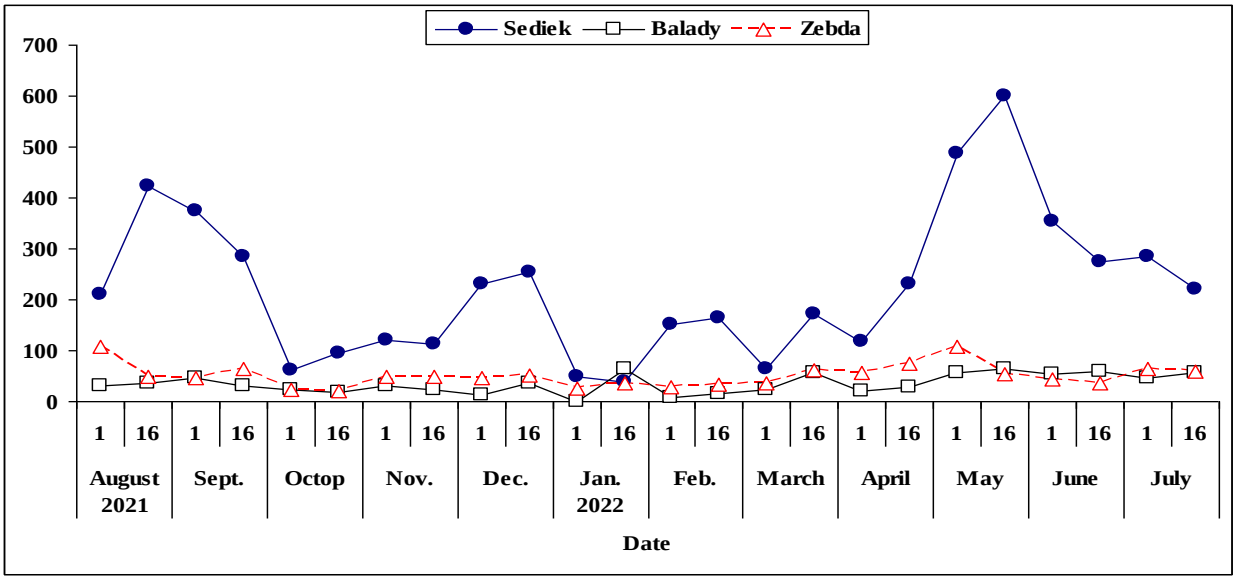


**Figure (10): Seasonal abundance (Mean), considering various *P. oleae* stages and the proportion of infection incidence on particular mango types in second season (2021/2022).**

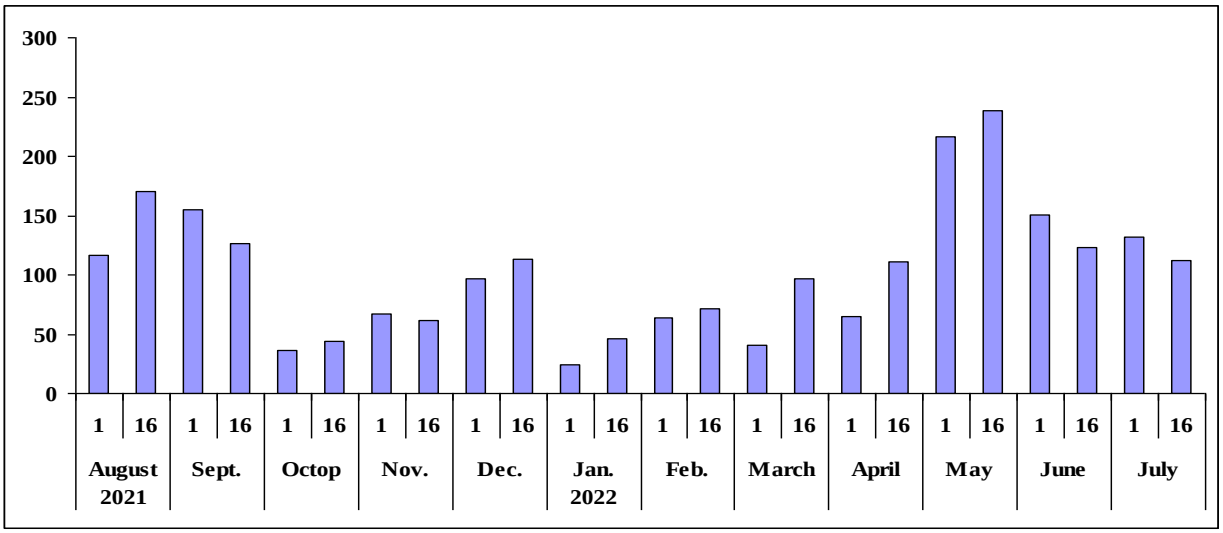


**Figure (11): Seasonal abundance (Mean), considering various *P. oleae* stages and the proportion of infection incidence on particular mango types in second season (2021/2022).**

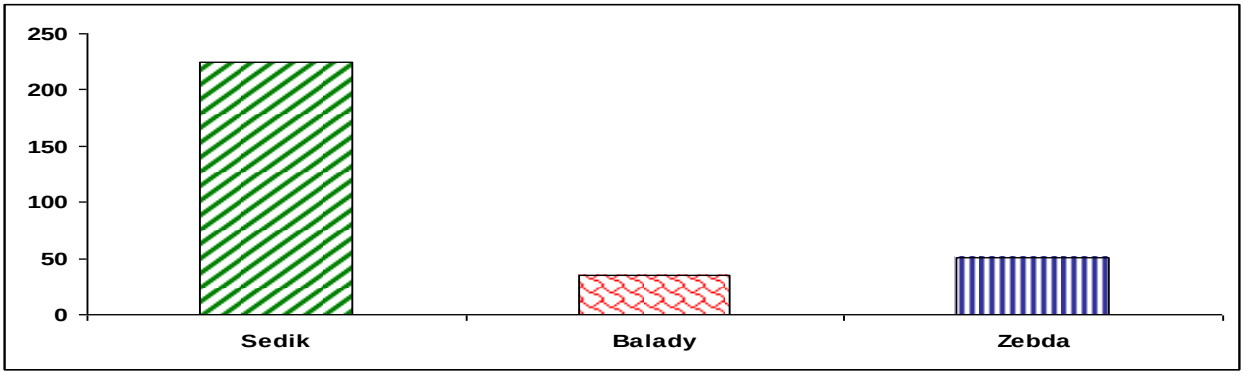


**Figure (12): Degrees of *P. oleae* infection susceptibility among the investigated mango types (Sediek, Balady and Zebda) in second season (2021/2022).**

**3.2.1. The first year (2020/2021):**

Figure (8) presents the data, which indicate that *P. oleae* caused an average insect population on all evaluated mango cultivars throughout the year. In October, December and July of each year, however, there were three peaks of seasonal activity in the percentages of infection incidence that occurred on all examined mango varieties (Fig. 8).

**3.2.2-The second year (2021/2022):**

The data acquired, as shown in Figure (11) indicate that *P. oleae*'s mean insect population was seen year-round on all examined mango cultivars. Nonetheless, the percentages of infection incidence occurred year-round on all studied mango kinds, with August, December and May recording the three seasonal activity peaks. (Fig. 11).winter

The findings showed that over the two years of the study, January records for all mango types included the total population by pest and the incidence percentages of *P. oleae*. This could be related to the high relative humidity, the slow temperature decrease, and the winter dormancy of the trees. It is anticipated that these factors will have a major effect on the behavior of the insects as well as their rate of growth and infestation. **Abdel-Rahman (2021) and Kamel (2023)** recorded that, the total population in all stages of the *A. ourantii* increased in summer seasons and be in a decreas numbers in winter . **Shakl *et al*.(2024)** reported that, there were a positive correlation between the total population of *A. ourantii* with the maximum temperature in the two determination study.

On the other hand, the highest values of the insect population for each variety of mango that was assessed happened in July of the first year and in May of the second year. The variability of these physical variables appeared to have an impact on the annual variations in population density over the course of the two years of inquiry. The differences in the values of population densities and percentages of *P. oleae* infestation incidence on particular mango varieties may be due to a variety of factors, such as differences in the growth characteristics (growing period, softness of tissues, and leaf size) and environmental conditions (temperature, relative humidity and leaf size and density) for the mango varieties that were tested. In terms of population density and incidence of infection by the *P. oleae* plum scale insect, it was feasible to conclude that the Sediek mango variety was the most favored variety overall. Zebda and Balady were the next most favored varieties, with the Balady variety being less favored by this insect. Grouping the studied cultivars according to decreasing susceptibility order would be as follows: Zebda > Balady > Sediek.

We concluded that, because the host plant affects the growth of pests, choosing the most suitable variety can help minimize pest infestation and ought to be taken into consideration as an additional component of integrated mango pest management. Mango varieties vary in the extent of their infection depending on the type of insect.

Three species of scale *Kilifia acuminata* (Signoret) (Homoptera: Coccidae), *Parlatoria oleae* (Colvee) (Homoptera: Diaspididae) and *Insulaspis pallidula* (Green) (Hemiptera: Diaspididae) have the potential to infest five types of mangos. **Salem (1994**) discovered that the cultivars of Dabsha, Timour and Alphonso were particularly resistant to infestation by the aforementioned scale insects, whereas the Hindy and Zebda varieties were extremely susceptible. And suggested that the differences in susceptibility may be caused by the physical traits of these cultivars' leaves.

**Bakry, *et al.* (2020)** reported that each of Zebda and Fagri Kalan mango varieties were divided as susceptible (S), the relatively resistant (RR) were observed in Balady variety. Until Ewaise one recorded a highly susceptible (H.S)

The vulnerability of five distinct varieties of mangoes to infection by *I. pallidula* and *A. aurantii*, two pest species that are armored scale insects, was investigated. *I. pallidula* harmed all types more frequently than *A. aurantii* ( **Selim, 2002**). On the other hand, the variety Hindy was the most sensitive, followed by Mabrouka, Kobania and Taimour and the variety Dabsha was the least susceptible to infection with both scale insects.

**Bakry (2009)** examined the variations between four varieties of mangoes in two armored-scale insect infestation levels: *I. pallidula* and *A. aurantii*. Compared to *I. pallidula*, he observed that *A. aurantii* had a larger population density. On the other hand, the grafted Balady variety was the most infested, followed by Hindy and Goleck; the least infested type was the seedy Balady variety. Our results corroborated those of **El-Hakim and Helmy (1982)** who reported finding *P. oleae* on olive trees in Cairo, Fayoum and two peaks in Alexandria.

**Asfoor (1997)** reports that *P. oleae* produces three generations year on pear trees but only two on plum, pear, and apple trees. Three annual peaks for the Hollywood plum, mariposa plum, apricot, and peach were noted in May, August, and October. **Ezz (1997)** noted that on four deciduous trees, there were three generations: the first appeared on May 1$^{st}$, the second on August 1$^{st}$, and the third on October 1$^{st}$. **Bakry and Dahi (2020)** indicated that the mango varieties varied significantly in their susceptibility to population density and the percentages of infestation incidence by *P. oleae*. Balady mango variety was the highest population density and was rated as highly susceptible (H.S.) to infestation by the total population density of *P. oleae*, followed by Ewaise and Goleck mango varieties were appeared as susceptible (S), then by Zebda variety was seemed asrelative resistant (RR). In contrast, Sediek variety had the lowest population density and was rated as moderate resistant (MR) of pest over the entire year. The results of this research here could be used as a tool for establishing IPM strategies against this pest.

## 4- CONCLUSION

Based on the data from the last two years, it was possible to determine that the Sediek mango variety was the most favored for both population density and infestation incidence by *P. oleae*, the plum scale insect. Zebda and Balady were the next most preferred varieties, while Balady was the least preferred variety for this insect. In declining order of susceptibility, the examined cultivars could be grouped as follows: Sediek > Zebda > Balady. The findings of this study may be helpful in developing integrated pest management (IPM) plans to combat this insect.

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