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# Modeling the Impacts of Certain Climatic Factors on Population Density of the Plum Scale Insect, *Parlatoria oleae* (COLVEE) Infesting Mango Trees in Luxor Governorate, Egypt.

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## ABSTRACT

The study was carried out throughout two successive years (2016/2017 and 2017/2018) at Esna district, Luxor Governorate, to recognize the ecological effects of certain climatic factors on the plum scale insect pest, *Parlatoria oleae* (Colvee) on mango trees to specify the proper timing for control. The obtained results showed that the pest population of *P. oleae* occurred on mango trees all the years and had three peaks of seasonal activity per year, which was recorded in October, April and July during the first year (2016/2017) and through in November, April and July during the second year (2017/2018). Furthermore, the percentages of infestation incidence by pest showed three peaks per year, during November, April and July in both years. It seems that, the climatic conditions of autumn months during the two years were more suitable for the total population density and its activity and the maximum values of the infestation incidence by *P. oleae*. The obtained results showed that, the effect of weather factors (mean daily of air temperature, mean of relative humidity and mean of dew point) on the pest population and on the percentages of infestation incidence during the two successive years emphasized that the effect of these factors varied from year to another. Also, the dew point was the most effective variable for the changes in the pest population and the percentages of infestation incidence by the pest during both years and on the two cumulative years.

**Keywords:** *Parlatoria oleae*, seasonal activity, environmental conditions, mango trees.

## INTRODUCTION

Mango trees, *Mangier indica* L. (Anacardiaceae), are considered one of the most popular fruit in Egypt. Egyptian mangoes occupied an economic importance in the world market for its rich flavor and taste. Among several pests infesting mango trees, *Parlatoria oleae* (Colvee) is considered one of the most main destructive pests of mango trees (Bakr *et al*., 2009). This pest injures the shoots, twigs, leaves, branches and fruits by sucking the plant sap causing deformations, defoliation, drying up of young twigs, dieback, poor blossoming, and death of twigs by its toxic saliva and so affecting the commercial value of the fruits where it causes conspicuous pink blemishes around the feeding sites. In addition, a characteristic symptom of infestation of the pest is the appearance and the accumulation of its scales on attacked mango parts (El-Amir, 2002 and Hassan *et al*., 2009).

The objectives of the study are to estimate the seasonal abundance, the percentages of infestation incidence, the rate of monthly variation and the effect of the main weather factors on the population density of different stages of the pest and on the percentages of infestation incidence by the pest.

## MATERIALS AND METHODS

Many authors used different insect expressions, which articulated the population density of this pest. In this investigation, two expressions of insect were utilized, i.e., insect numbers and the percentages of infestation incidence by the pest. The population fluctuations were estimated half-monthly intervals at Esna district, Luxor Governorate during two successive years extending from the beginning of September, 2016 until the mid of August, 2018. The selected orchard received the normal agricultural practices without application of any chemical control before and during the period of the study. Ten mango trees of Balady variety similar in age and as uniform as possible in size, shape, height, vegetative growth were selected. Regular half-monthly samples were picked up randomly from different directions and stratums of tree with a rate of 40 leaves per tree. The samples were collected regularly and immediately transferred to the laboratory in polyethylene bags for inspection using a stereo-microscope. Numbers of alive insects on upper and lower surfaces of mango leaves were individually sorted into immature stages (pre-adults) and mature stages (adult females) and then were counted and recorded.

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

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

**Where,**

**A = The infestation incidence percentage.**

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

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

Also, the rate monthly variation in the population (R.M.V.P) was calculated according to the formula reported by Serag-El-Din (1998):

$$(R.M.V.P) = \frac{\text{Av. count of insect at a month}}{\text{Av. count given at the preceding month}}$$

Concerning, the effect of the main weather factors on the different stages of *P. oleae* population and percentages of infestation incidence. The meteorological data, viz. mean daily of air temperature, mean of % relative humidity and mean of dew point °C, for the conditions of Luxor governorate were obtained from the Central Laboratory for Agricultural Climate, Agriculture Research Center, Ministry of Agriculture in Giza.

According to the results of the simple correlation, regression coefficient and the partial regression formulas which were adopted to find out the simultaneous effects of tested main weather factors on *P. oleae*. The partial regression method termed the C-multipliers was adopted according to Fisher (1950). Statistical analysis was carried out using MSTATC software (1980).

## RESULTS AND DISCUSSION

**1- Seasonal abundance of *P. oleae* on mango trees:**

The monthly counts of *P. oleae* different stages infested mango trees and the infestation incidence percentages of the pest at Esna district, Luxor Governorate were recorded through the two successive years, 2016/2017 and 2017/2018. Also, the means of the monthly recorded temperature, relative humidity and dew point throughout the two years of the investigations are represented in Tables (1 and 2). The trends of the fluctuation in nymphs and adult female populations were almost similar. However, the data were discussed through the monthly records.

**The first year (2016/2017):**

The obtained results in Table (1) showed that the mean population size was 58.75 ± 1.56 and 46.32 ± 1.03 individuals per leaf for pre-adults and adult females, respectively. Also, the percentage of infestation incidence was 82.57 ± 0.74%. The seasonal abundance of the total population of the pest was recorded; three peaks of activity were observed in October, April and July when the mean population density was 151.39 ± 2.15, 106.46 ± 2.28 and 136.59 ± 1.25 individuals per leaf, respectively. Also, a similar trend in the seasonal abundance of nymphs was observed in the same months with a mean population density of 88.33 ± 2.42, 61.53 ± 1.25 and 79.15 ± 1.96 individuals per leaf, respectively. As well as, the adult females has the same three peaks with a population density of 63.06 ± 0.85, 44.93 ± 1.03 and 57.45 ± 1.44 individuals per leaf, respectively. While, the percentages of infestation incidence had three peaks in November, April and July and the percentages of abundance were 95.50 ± 0.83, 84.67 ± 1.19 and 84.00 ± 1.17 %, respectively.

**Table 1. Monthly mean numbers of different stages of *P. oleae* (Colvee) and the percentages of infestation incidence on mango trees in relation to the climatic factors at Esna district, Luxor Governorate during the first year of (2016/2017).**

| Season | Date of inspection | Mean number of individuals per leaf ± S.E. | | | Infestation incidence (%) | Climatic factors | | |
|---|---|---|---|---|---|---|---|---|
| | | Nymphs (Immature stages) | Adult females (Mature stages) | Total | | Mean temp. °C | % R.H. | Dew point °C |
| Autumn | Sept., 2016 | 67.54 ± 1.23 | 53.06 ± 2.27 | 120.60 ± 2.63 | 80.50 ± 1.11 | 32.29 | 24.26 | 14.83 |
| | Oct. | 88.33 ± 2.42 | 63.06 ± 0.85 | 151.39 ± 2.15 | 93.83 ± 1.03 | 29.33 | 28.76 | 14.29 |
| | Nov. | 72.83 ± 1.52 | 60.28 ± 1.27 | 133.12 ± 2.55 | 95.50 ± 0.83 | 23.50 | 33.97 | 11.07 |
| | Average | 76.23 ± 1.92 | 58.80 ± 1.18 | 135.03 ± 2.72 | 89.94 ± 1.36 | 28.37 | 29.00 | 13.40 |
| Winter | Dec. | 51.06 ± 0.79 | 44.37 ± 0.54 | 95.43 ± 1.30 | 89.83 ± 1.01 | 17.75 | 48.73 | 11.27 |
| | Jan., 2017 | 37.38 ± 0.67 | 31.66 ± 0.32 | 69.05 ± 0.94 | 83.83 ± 1.08 | 16.06 | 44.50 | 5.69 |
| | Feb. | 32.52 ± 0.39 | 28.62 ± 0.50 | 61.14 ± 0.78 | 72.67 ± 1.20 | 17.84 | 45.57 | 6.66 |
| | Average | 40.32 ± 1.50 | 34.89 ± 1.29 | 75.21 ± 2.78 | 82.11 ± 1.46 | 17.22 | 46.27 | 7.87 |
| Spring | Mar. | 38.09 ± 0.85 | 33.52 ± 0.83 | 71.60 ± 1.65 | 70.67 ± 0.57 | 19.33 | 36.07 | 4.55 |
| | April | 61.53 ± 1.25 | 44.93 ± 1.03 | 106.46 ± 2.28 | 84.67 ± 1.19 | 22.94 | 29.07 | 6.00 |
| | May | 55.87 ± 0.83 | 40.63 ± 1.16 | 96.50 ± 1.79 | 78.83 ± 1.17 | 27.41 | 18.82 | 6.97 |
| | Average | 51.83 ± 1.94 | 39.69 ± 1.04 | 91.52 ± 2.93 | 78.06 ± 1.21 | 23.23 | 27.98 | 5.84 |
| Summer | June | 67.66 ± 0.32 | 50.14 ± 0.61 | 117.80 ± 0.69 | 81.67 ± 1.19 | 32.11 | 17.93 | 10.21 |
| | July | 79.15 ± 1.96 | 57.45 ± 1.44 | 136.59 ± 1.25 | 84.00 ± 1.17 | 33.01 | 19.87 | 12.33 |
| | Aug. | 53.04 ± 0.37 | 48.16 ± 1.26 | 101.20 ± 1.39 | 74.83 ± 0.68 | 35.01 | 20.66 | 14.00 |
| | Average | 66.61 ± 2.07 | 51.92 ± 1.11 | 118.53 ± 2.87 | 80.17 ± 0.88 | 33.38 | 19.49 | 12.18 |
| Total | | 705.00 | 555.88 | 1260.88 | | | | |
| General average | | 58.75 ± 1.56 | 46.32 ± 1.03 | 105.07 ± 2.54 | 82.57 ± 0.74 | 25.55 | 30.68 | 9.82 |
| % | | 55.91 | 44.09 | 100.00 | | | | |

**The second year (2017/2018):**

Data in Table (2) showed that the mean population density was 65.42 ± 1.54 and 54.36 ± 1.33 individuals per leaf for pre-adults and adult females, respectively. Also, the percentage of infestation incidence was 81.13 ± 1.10%. The seasonal activity of the pest nymphs occurred in three peaks in November, April and July and thier mean population densities were 85.96 ± 1.68, 69.93 ± 1.47 and 81.77 ± 0.60 individuals per leaf, respectively.

The adult female seasonal activities had the same way with three peaks happened in November, April and June with a mean population density of 68.77 ± 1.39, 61.54 ± 1.42 and 69.90 ± 0.76 individuals per leaf, respectively. The variance in different stages abundance reflected on the total mixed population per leaf which has three peaks of activity occurred in November, April and July and the mean population density was 154.73 ± 2.83, 131.46 ± 2.88 and 147.19 ± 2.11 individuals per leaf, respectively. Though, the percentages of infestation incidence showed three peaks during November, April and July and the percentages of abundance were 97.00 ± 0.60, 82.00 ± 1.84 and 84.67 ± 1.19% respectively.

Results in Tables (1 and 2) showed that the mean total population per leaf through the whole year was 105.07 ± 2.54 and 119.78 ± 2.81 individuals during the first and the second years, respectively. The result also showed that the nymph populations were relatively higher than the adult female populations during the two successive years. Also, the least population density of different stages and total population of the pest and the percentages of incidence of *P. oleae* were recorded during February of the two years.That may be attributed to the high relative humidity with the gradual decrease in temperature and the dormancy of the trees during the winter season which caused a dramatically nymphal stage mortality. In contrary, the maximum values of the pest population was in October in the first year and November in the second year. It appeared that, the annual fluctuations in the population density during the two years were affected by the variability in the environmental factors in the both years of investigation. In similar to our results, Dent (1991) stated that the seasonal phenology of the pest numbers, the number of generations, and the level of the pest abundance at any location are influenced by the environmental factors at that location.

From the previously mentioned results, it could concluded that the pest population and its percentages of infestation occurred on mango trees had three peaks of seasonal activity per year for the different stages and the total population of the pest. As well as, the total population of insect through the second year was higher in comparison to the first year. In contrary, the percentages of infestation incidence were higher in the first year as compared to the second year, which might be due to the influence of the environmental conditions and others factors. These results were coincided with those obtained by El-Hakim and Helmy (1982) in Egypt. They mentioned that *P. oleae* had three peaks in Cairo and Fayoum, and two peaks in Alexandria on olive trees. Asfoor (1997), in Qalyobia Governorate, Egypt, reported three generations of *P. oleae* annually on pear trees, but only two generations on plum, pear and apple trees. He also, recorded three annual peaks on Hollywood plum, maribosa plum, apricot and peach these peaks occurred in May, August and October.

Ezz (1997) in Egypt, found three generations on four deciduous trees, the first generation appeared in May first, the second appeared in August first and the third generation appeared in October first.

The obtained results illustrated in Fig. (1), showed that the highest population density for *P. oleae* and nymphal stage were 76.23 ± 1.92 and 78.96 ± 1.61 individuals/leaf, for adult females were 58.80 ± 1.18 and 63.17 ± 1.37 individuals/leaf ,for total population was 135.03 ± 2.72 and 142.13 ± 2.65 individuals/leaf and for the percentage of infestation incidence was 89.94 ± 1.36 and 93.41 ± 0.66% during autumn season (more active), throughout the two years, respectively, thus due to the environmental conditions which were more suitable for the pest activity. But, the lowest values were observed in winter season which might be due to the unsuitable environmental conditions. These results were concurred with those obtained by Hassan *et al*. (2009). they reported that autumn was the optimum season for *P. oleae* activity.

**Table 2. Monthly mean numbers of different stages of *P. oleae* (Colvee) and the percentages of infestation incidence on mango trees in relation to climatic factors at Esna district, Luxor Governorate during the second year (2017/2018).**

| Season | Date of inspection | Mean number of individuals per leaf ± S.E. | | | Infestation incidence (%) | Climatic factors | | |
|---|---|---|---|---|---|---|---|---|
| | | Nymphs (Immature stages) | Adult females (Mature stages) | Total | | Mean temp. °C | % R.H. | Dew point °C |
| Autumn | Sept., 2017 | 69.78 ± 1.37 | 55.82 ± 2.38 | 125.60 ± 2.52 | 90.50 ± 0.90 | 35.52 | 26.62 | 15.65 |
| | Oct. | 81.15 ± 2.22 | 64.92 ± 0.82 | 146.07 ± 1.92 | 92.72 ± 0.77 | 32.27 | 29.63 | 13.54 |
| | Nov. | 85.96 ± 1.68 | 68.77 ± 1.39 | 154.73 ± 2.83 | 97.00 ± 0.60 | 25.85 | 37.83 | 11.87 |
| | Average | 78.96 ± 1.61 | 63.17 ± 1.37 | 142.13 ± 2.65 | 93.41 ± 0.66 | 31.21 ± | 31.36 | 13.68 |
| Winter | Dec. | 81.92 ± 1.23 | 65.53 ± 0.87 | 147.45 ± 2.04 | 95.67 ± 0.71 | 19.52 | 45.69 | 10.94 |
| | Jan., 2018 | 38.62 ± 0.41 | 30.90 ± 0.38 | 69.52 ± 0.47 | 70.33 ± 1.26 | 17.67 | 46.87 | 6.27 |
| | Feb. | 33.60 ± 1.04 | 26.88 ± 0.47 | 60.48 ± 1.50 | 55.00 ± 1.45 | 19.63 | 42.45 | 4.89 |
| | Average | 51.38 ± 4.06 | 41.10 ± 3.24 | 92.49 ± 7.30 | 73.67 ± 3.10 | 18.94 | 45.01 | 7.37 |
| Spring | Mar. | 59.85 ± 1.37 | 52.67 ± 1.40 | 112.52 ± 2.65 | 78.83 ± 1.17 | 21.27 | 32.50 | 8.11 |
| | April | 69.93 ± 1.47 | 61.54 ± 1.42 | 131.46 ± 2.88 | 82.00 ± 1.84 | 25.23 | 23.55 | 6.93 |
| | May | 57.72 ± 0.85 | 46.18 ± 1.11 | 103.89 ± 1.49 | 73.33 ± 0.10 | 30.15 | 18.44 | 8.12 |
| | Average | 62.50 ± 1.21 | 53.46 ± 1.38 | 115.96 ± 2.53 | 78.06 ± 1.02 | 25.55 | 24.83 | 7.72 |
| Summer | June | 69.90 ± 0.33 | 69.90 ± 0.76 | 139.80 ± 0.87 | 75.00 ± 1.17 | 35.32 | 16.16 | 10.68 |
| | July | 81.77 ± 0.60 | 65.42 ± 1.78 | 147.19 ± 2.11 | 84.67 ± 1.19 | 36.32 | 20.66 | 14.33 |
| | Aug. | 54.80 ± 1.54 | 43.84 ± 1.28 | 98.64 ± 2.31 | 78.50 ± 1.58 | 38.51 | 22.84 | 14.97 |
| | Average | 68.82 ± 2.12 | 59.72 ± 2.23 | 128.54 ± 4.10 | 79.39 ± 1.05 | 36.72 | 19.89 | 13.33 |
| Total | | 784.99 | 652.36 | 1437.35 | - | - | - | - |
| General average | | 65.42 ± 1.54 | 54.36 ± 1.33 | 119.78 ± 2.81 | 81.13 ± 1.10 | 28.10 | 30.27 | 10.52 |
| % | | 54.61 | 45.39 | 100.00 | | | | |

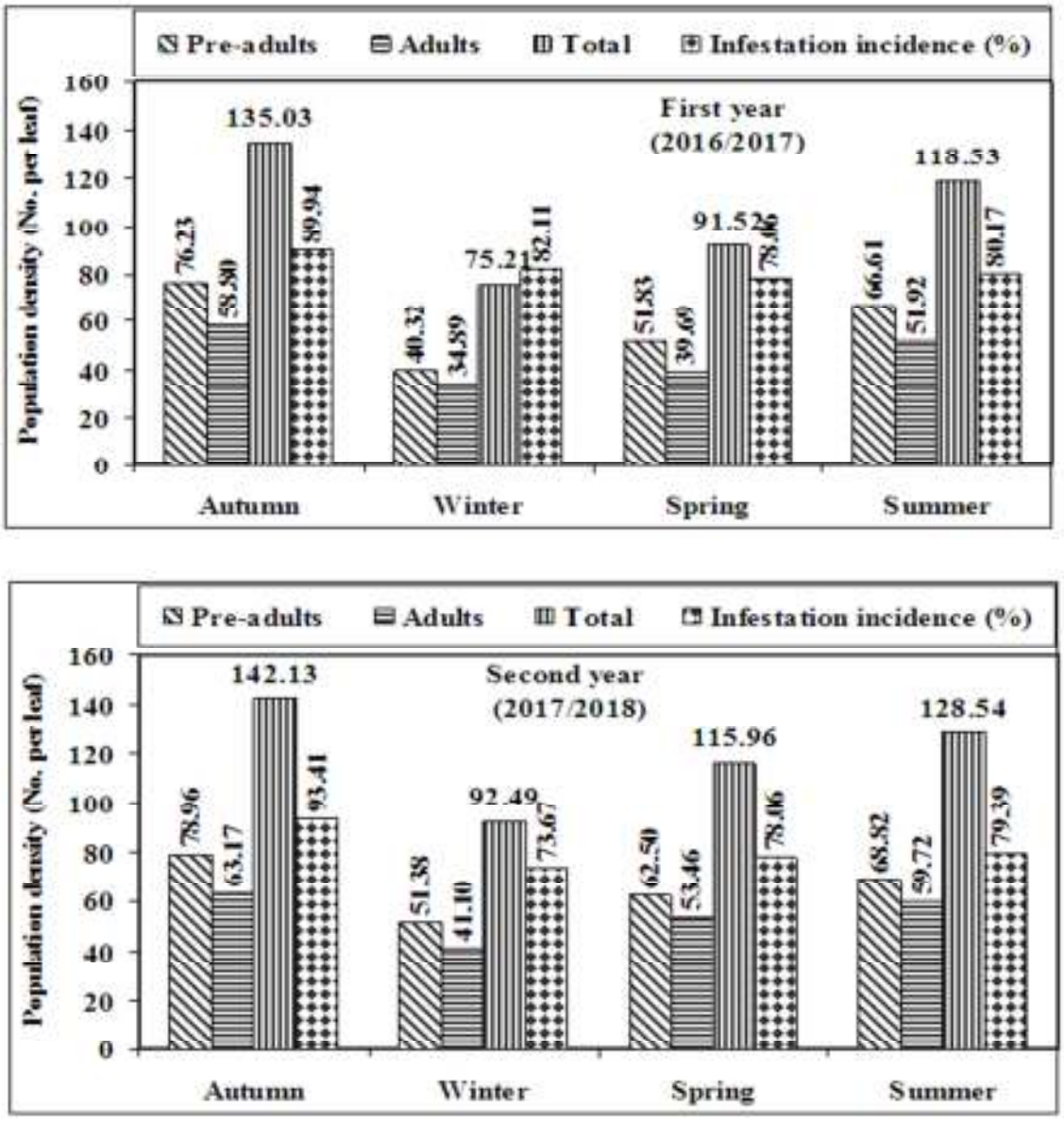


**Fig. 1. Population density of different stages of *P. oleae* and the percentages of infestation incidence counted on mango leaves at Esna district, Luxor Governorate during the two successive years (2016/2017 and 2017/2018).**

**2- Rate of monthly variation (R.M.V.P.) in the population of the plum scale insect, *P. oleae*:**

The monthly variation rates for the total population of *P. oleae* and the percentages of infestation incidence were calculated (Table, 3). The rate of monthly variation in the population is considered as an indicator to the favourable month for insect activity and expressed as R.M.V.P. > 1 means more activity, < 1 means less activity and = 1 means no change in the population density during the two successive months.

It was shown as recorded in Table (3) that the favourable times of annual increase for the total population appeared to be in October, March, April, June and July during the first year (2016/2017), when the rates of monthly variation were 1.26, 1.17, 1.49, 1.22 and 1.16, respectively, while during the second year (2017/2018) the favourable times of annual increase for the total population appeared to be in October, November, March, April, June and July when the rates of monthly variation were 1.16, 1.06, 1.86, 1.17, 1.35 and 1.05, respectively. Also, the rates of monthly variation (R.M.V.P) for the percentages of infestation incidence was in October, November, April, June and July during the first year when the rates of monthly variation were 1.17, 1.02, 1.20, 1.04 and 1.03 respectively, but through the second year of study, the favourable times of annual increase for the percentages of infestation incidence appeared to be in October, November, March, April, June and July when the rates monthly variation were 1.02, 1.05, 1.43, 1.04, 1.02 and 1.13, respectively. Generally, it seems that the climatic conditions of autumn months during the two years were the optimal for the insect multiplication and build up, since the highest R.M.V.P value was achieved during both years. These results were coincided with those obtained by Hassan *et al.* (2009).

**Table 3. Rate of monthly variation (R.M.V.P) in the mean number of *P. oleae* (Colvee) and the infestation incidence percentages counted on mango trees at Esna district, Luxor Governorate through the first year.**

| Month of inspection | Total population of the pest | | Infestation incidence | |
|---|---|---|---|---|
| | First year | Second year | First year | Second year |
| Sept. | — | — | — | — |
| Oct. | 1.26 | 1.16 | 1.17 | 1.02 |
| Nov. | 0.88 | 1.06 | 1.02 | 1.05 |
| Dec. | 0.72 | 0.95 | 0.94 | 0.99 |
| Jan. | 0.72 | 0.47 | 0.93 | 0.74 |
| Feb. | 0.89 | 0.87 | 0.87 | 0.78 |
| Mar. | 1.17 | 1.86 | 0.97 | 1.43 |
| April | 1.49 | 1.17 | 1.20 | 1.04 |
| May | 0.91 | 0.79 | 0.93 | 0.89 |
| June | 1.22 | 1.35 | 1.04 | 1.02 |
| July | 1.16 | 1.05 | 1.03 | 1.13 |
| Aug. | 0.74 | 0.00 | 0.89 | 0.00 |

**3- Effect of the main weather factors on *P. oleae*:**

**Insect population:**

**Nymph population:**

**A- Effect of daily mean temperature:**

The results of the statistical analysis of simple correlation (Table 4) showed a highly significant positive, a significant positive or insignificant positive correlation between the daily mean temperature and nymphs population of *P. oleae* during both study years separately and the two cumulative years. The unit effect regression coefficient (b) indicates that an increase of 1°C in the daily mean temperature, would increase the population by 1.72, 0.85 and 1.29 individuals per leaf for the two years singly and during the two cumulative years, respectively. Concerning, the partial regression values ( Table 5) emphasized a significant negative relations. The obtained results revealed that, the daily mean temperature is above the optimum range of nymphs' activity and this factor was responsible for certain changes in the nymphs' population by 16.52, 30.85 and 9.84 % during the first and second years and on the two cumulative years, respectively (Table 5).

**B- Effect of the mean relative humidity:**

Data Table (4), showed that the mean relative humidity had a significant negative effect on nymphs activity, since the correlation coefficient (r values) were -0.59 and -0.43 for the first year and on the two cumulative years, respectively and insignificant negative relation (-0.27) through the second year. The unit effect (regression coefficient) indicates that an increase of 1% in the mean relative humidity, would decrease the population density by 0.93, 0.43 and 0.69 individuals per leaf for the two years individually and during the two cumulative years, respectively.

The real effect of this climatic factor appeared from the partial regression (P. reg.) values (Table 5), which showed that it was significant negative effects (P. reg. values were -3.84, -2.26 and -1.66) and the values of the partial correlation were -0.70, -0.69 and -0.48 when the mean daily temperature and dew point become around their means, for the 1st and the 2nd years, and on the two cumulative years, respectively. The obtained results revealed that, the mean relative humidity is above the optimum range of nymphs activity and this climatic factor was responsible for certain changes of the nymphs activity by 22.02, 27.05 and 12.94% during the first and the second years separately and on the two cumulative years, respectively.

**C- Effect of mean dew point:**

Data in Table (4) showed that, the correlations between the mean dew point and the nymphpopulation was significantly positive (r values were 0.69 and 0.63) during the first and second years, respectively and highly significant positive (r = 0.67) through the two cumulative years. The calculated regression coefficient (b) for the effect of this factor indicated that for every 1°C increase, the population would increase by 3.27, 2.94 and 3.17 individuals per leaf during the first and the second years, and on the cumulative years, respectively.

The exact relationship between this climatic factor and the activity of the nymphs was determined by the partial regression values (Table, 5), which emphasized a significant positive relation between mean dew point and the nymphs activity (P. reg. was 8.15) during the first year and highly significant positive effects (P. reg. were 8.71 and 5.77) through the second year and on the two cumulative years, respectively. The values of the partial correlation were 0.76, +0.81 and +0.63, when the mean daily temperature and relative humidity become around their means, during both study years separately and on the two cumulative years, respectively(Table 5).

The obtained results revealed that, the mean dew point is under the optimum range of nymph population during the first year, the second year and on the two cumulative years. This climatic factor was the most effective variable for the changes in the nymphs' population by 30.92, 55.90 and 28.57 % during the first, second years and on the two cumulative years, respectively (Table 5).

**D- The combined effect of the tested climatic factors on the nymphs activity:**

The combined effect of these climatic factors on the nymphs population was highly significant during the first year and on the cumulative years, respectively and significant through the second year (Table 5). The percentage of variability that could be attributed to the combined effect of these tested factors on the nymphs population were 76.65, 70.32 and 57.44% for the two years individually and during the two cumulative years, respectively. The remaining unexplained variances are assumed to be due to the influences of other unconsidered and undetermined factors that were not included in this study in addition to the experimental error.

**Table 4. Simple correlation and regression values of the climatic factors in relation to the population density of different stages of *P. oleae* during the two years (2016/2017 and 2017/2018).**

| Years | Stages | Tested factors | Simple correlation and regression values | | | | | C.V. |
|---|---|---|---|---|---|---|---|---|
| | | | a | r | b | S.E | t | |
| 2016/2017 | Nymphs | Mean temp. | 14.81 | 0.67 | 1.72 | 0.60 | 2.89 * | 0.23 |
| | | R.H.% | 87.23 | -0.59 | -0.93 | 0.40 | -2.31 * | 0.25 |
| | | Dew Point | 26.64 | 0.69 | 3.27 | 1.07 | 3.06 * | 0.22 |
| | Adult females | Mean temp. | 17.90 | 0.67 | 1.11 | 0.39 | 2.89 * | 0.19 |
| | | R.H.% | 62.67 | -0.52 | -0.53 | 0.27 | -1.94 | 0.22 |
| | | Dew Point | 22.41 | 0.80 | 2.43 | 0.58 | 4.21 ** | 0.15 |
| | Total | Mean temp. | 32.72 | 0.68 | 2.83 | 0.96 | 2.94 * | 0.21 |
| | | R.H.% | 149.90 | -0.57 | -1.46 | 0.67 | -2.19 | 0.23 |
| | | Dew Point | 49.06 | 0.74 | 5.70 | 1.63 | 3.51 ** | 0.19 |
| 2017/2018 | Nymphs | Mean temp. | 41.59 | 0.37 | 0.85 | 0.67 | 1.27 | 0.25 |
| | | R.H.% | 78.33 | -0.27 | -0.43 | 0.48 | -0.88 | 0.26 |
| | | Dew Point | 34.49 | 0.63 | 2.94 | 1.15 | 2.55 * | 0.21 |
| | Adult females | Mean temp. | 32.94 | 0.39 | 0.76 | 0.57 | 1.35 | 0.26 |
| | | R.H.% | 70.04 | -0.38 | -0.52 | 0.40 | -1.30 | 0.26 |
| | | Dew Point | 31.75 | 0.54 | 2.15 | 1.07 | 2.01 | 0.24 |
| | Total | Mean temp. | 74.53 | 0.39 | 1.61 | 1.22 | 1.32 | 0.25 |
| | | R.H.% | 148.38 | -0.32 | -0.94 | 0.87 | -1.08 | 0.26 |
| | | Dew Point | 66.24 | 0.59 | 5.09 | 2.19 | 2.32 * | 0.22 |
| Two cumulative years | Nymphs | Mean temp. | 27.53 | 0.53 | 1.29 | 0.43 | 2.97 ** | 0.24 |
| | | R.H.% | 83.14 | -0.43 | -0.69 | 0.31 | -2.23 * | 0.26 |
| | | Dew Point | 29.84 | 0.67 | 3.17 | 0.76 | 4.18 ** | 0.21 |
| | Adult females | Mean temp. | 23.64 | 0.53 | 1.00 | 0.34 | 2.93 ** | 0.23 |
| | | R.H.% | 66.59 | -0.42 | -0.53 | 0.24 | -2.20 * | 0.25 |
| | | Dew Point | 26.09 | 0.64 | 2.38 | 0.61 | 3.93 ** | 0.21 |
| | Total | Mean temp. | 51.17 | 0.54 | 2.28 | 0.76 | 3.01 ** | 0.23 |
| | | R.H.% | 149.73 | -0.43 | -1.22 | 0.54 | -2.25 * | 0.25 |
| | | Dew Point | 55.93 | 0.66 | 5.55 | 1.33 | 4.16** | 0.21 |

**a = Constant r = Simple correlation b = Simple regression**

**S.E = standard error; P = Probablility, * Significant at P ≤ 0.05, ** highly significant at P ≤ 0.01**

**C.V.= Coefficient of variation is a relative measure of dispersion, computed by the diving root mean square error by the mean of the dependent variable; but, it can be useful in comparative studies.**

**Adult female population:**

**A- Effect of daily mean temperature:**

Results in Table (4) showed that the simple correlation (r) between the daily mean temperature and the population density of adult females was significant positive, (r= 0.67), insignificant positive (r= 0.39) and highly significant positive (r= 0.53) during the first and the second years as well as on the two cumulative years, respectively. as Also , the calculated regression coefficient (b) for the effect of this factor indicated that, every 1˚C increase in the daily mean temperature, would increase the population by 1.11, 0.76 and 1.00 individuals per leaf for the first, second years and on the two cumulative years, respectively.

The precise effect of this factor on the adult females population (Table 5) showed that it was significant negative P. reg. values (-4.23 and -4.42) for the first and second years, respectively and insignificant negative P. reg. (-2.07) for the two cumulative years. In addition, the values of partial correlation were -0.67, -0.67 and -0.37 when the mean relative humidity and dew point become around their means, during the first, second years and on the two cumulative years, respectively. The obtained results revealed that, daily mean temperature above the optimum range of adult females activity during the first and second years and around the optimum range of adult female population on the two cumulative years. This climate factor was responsible for certain changes in the population of adult females by 13.96, 30.87 and 7.54% during the first and second years and on the two cumulative years, respectively(Table 5).

**B- Effect of the mean relative humidity:**

As shown in Table (4), it was noticed that a insignificant negative correlation between this climatic factor and the adult female population (r values were -0.52 and -0.38) for the first and second years, respectively and a significant positive value –(0.42) in during the two cumulative years. In the same time, the simple regression coefficients indicate that an increase of 1% in the mean relative humidity, would decrease the population by 0.53, 0.52 and 0.53 individuals per leaf for the first, second years and on the two cumulative years.

The real effect of this factor appeared from the partial regression value that, referred to the significant negatively effects (P. reg. values were -2.19, -2.17 and -1.17) and the values of the partial correlation were -0.71, -0.69 and -0.43 when the mean daily temperature and dew point become around their means, for the 1st, 2nd years and on the two cumulative years, respectively. Results revealed that, mean relative humidity was above the optimum range of adult femaleactivity and this climatic factor was responsible for certain changes in the population of the adult females by 17.03, 34.12 and 10.59% during the first

and second years, and on the two cumulative years, respectively (Table 5).

**C- Effect of mean dew point:**

Data in Table (4) revealed that, the effect of mean dew point on adult female activity was highly significantly positive (0.80 and 0.64) during the first year and on the two cumulative years, respectively and insignificant positive (0.54) during the second year. The calculated regression coefficient (b) for the effect of this factor indicated that, for every 1˚C increase the population would increase by 2.43, 2.15 and 2.38 individuals per leaf during the first, second years and on the two cumulative years, respectively.

The partial regression coefficient for the effect of mean dew point on the adult female population are represented in Table (5), and revealed that there was highly significant positive relations (P. reg. were 5.45 and 4.11) during the first year and on the two cumulative years, respectively and a significant positive effect (P. reg. was +6.82) for the second year. The values of the partial correlation were 0.81, 0.75 and 0.58,when the mean daily temperature and the relative humidity become around their means during the two study years separately and on the cumulative years, respectively. The obtained results revealed that, mean dew point was entirely under the optimum range of adult female population during the first year and on the cumulative years and under the optimum range of the adult female activity during the second year. This climatic factor was the most effective variable for the changes in the adult females' population by 33.06, 46.72 and 23.91 % during the first and second years, and on the two cumulative years, respectively (Table 5).

**Table 5. Multiple regression and correlation analyses between three climatic factors and the population density of different stages of *P. oleae* during two years (2016 - 2018).**

| Years | Stages | Tested factors | Partial regression values | | | | Partial correlation | Efficiency % | Rank | Analysis of variance | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Constant | P. reg. | S.E | t | | | | F values | C.V. | MR | $R^2$ | E.V.% |
| 2016/2017 | Nymphs | Mean temp. | 278.419 | -7.11 | 3.00 | -2.37 * | -0.64 | 16.52 | 3 | 8.75 ** | 0.17 | 0.88 | 0.77 | 76.65 |
| | | R.H.% | | -3.84 | 1.40 | -2.74 * | -0.70 | 22.02 | 2 | | | | | |
| | | Dew Point | | 8.15 | 2.51 | 3.25 * | 0.76 | 30.92 | 1 | | | | | |
| | Adult females | Mean temp. | 168.01 | -4.23 | 1.65 | -2.56 * | -0.67 | 13.96 | 3 | 13.05 ** | 0.12 | 0.91 | 0.83 | 83.04 |
| | | R.H.% | | -2.19 | 0.77 | -2.83 * | -0.71 | 17.03 | 2 | | | | | |
| | | Dew Point | | 5.45 | 1.38 | 3.95 ** | 0.81 | 33.06 | 1 | | | | | |
| | Total | Mean temp. | 446.43 | -11.34 | 4.53 | -2.50 * | -0.66 | 15.78 | 3 | 10.65 ** | 0.14 | 0.89 | 0.80 | 79.97 |
| | | R.H.% | | -6.03 | 2.12 | -2.85 * | -0.71 | 20.36 | 2 | | | | | |
| | | Dew Point | | 13.60 | 3.79 | 3.59 ** | 0.79 | 32.34 | 1 | | | | | |
| 2017/2018 | Nymphs | Mean temp. | 187.17 | -5.16 | 1.79 | -2.89 * | -0.71 | 30.85 | 2 | 6.32 * | 0.17 | 0.84 | 0.70 | 70.32 |
| | | R.H.% | | -2.26 | 0.84 | -2.70 * | -0.69 | 27.05 | 3 | | | | | |
| | | Dew Point | | 8.71 | 2.24 | 3.88 ** | 0.81 | 55.9 | 1 | | | | | |
| | Adult females | Mean temp. | 172.55 | -4.42 | 1.71 | -2.59 * | -0.67 | 30.87 | 3 | 4.56 * | 0.19 | 0.79 | 0.63 | 63.10 |
| | | R.H.% | | -2.17 | 0.80 | -2.72 * | -0.69 | 34.12 | 2 | | | | | |
| | | Dew Point | | 6.82 | 2.14 | 3.18 * | 0.75 | 46.72 | 1 | | | | | |
| | Total | Mean temp. | 359.73 | -9.58 | 3.43 | -2.79 * | -0.70 | 31.55 | 2 | 5.56 * | 0.17 | 0.82 | 0.68 | 67.60 |
| | | R.H.% | | -4.43 | 1.60 | -2.76 * | -0.70 | 30.88 | 3 | | | | | |
| | | Dew Point | | 15.53 | 4.30 | 3.61 ** | 0.79 | 52.69 | 1 | | | | | |
| Two cumulative years | Nymphs | Mean temp. | 135.30 | -3.03 | 1.41 | -2.15 * | -0.43 | 9.84 | 3 | 9.00 ** | 0.19 | 0.76 | 0.57 | 57.44 |
| | | R.H.% | | -1.66 | 0.67 | -2.47 * | -0.48 | 12.94 | 2 | | | | | |
| | | Dew Point | | 5.77 | 1.57 | 3.67 ** | 0.63 | 28.57 | 1 | | | | | |
| | Adult females | Mean temp. | 99.68 | -2.07 | 1.16 | -1.78 | -0.37 | 7.54 | 3 | 7.31 ** | 0.20 | 0.72 | 0.52 | 52.30 |
| | | R.H.% | | -1.17 | 0.56 | -2.11 * | -0.43 | 10.59 | 2 | | | | | |
| | | Dew Point | | 4.11 | 1.30 | 3.17 ** | 0.58 | 23.91 | 1 | | | | | |
| | Total | Mean temp. | 234.98 | -5.10 | 2.50 | -2.04 | -0.42 | 9.03 | 3 | 8.70 ** | 0.19 | 0.75 | 0.57 | 56.61 |
| | | R.H.% | | -2.83 | 1.19 | -2.37 * | -0.47 | 12.2 | 2 | | | | | |
| | | Dew Point | | 9.88 | 2.79 | 3.54 ** | 0.62 | 27.19 | 1 | | | | | |

**D- The combined effect of the tested climatic factors on the adult females:**

The results showed that the combined effect of these tested factors on the adult female population was highly significant during the first year and on the two cumulative years, respectively and significant through the second year(Table 5). The multiple regression analysis revealed that the tested variables were together responsible of the changes in the adult females' population. The percentages of explained variance (E.V.%) were 83.04,

63.10 and 52.30% for the two years individually and during the two cumulative years, respectively. The remaining unexplained variances are assumed to be due to the influences of other unconsidered and undetermined factors that were not included in this study in addition to the experimental error.

**Total population of *P. oleae*:**

**A- Effect of mean daily temperature:**

As reported in Table (4), the correlation coefficient (r) between the mean daily temperature and the total population was significant positive (0.68) in the first year, insignificant positive (0.39) during the second year and highly significant positive (0.54) through the two cumulative years. The unit effect regression coefficient (b) indicates that an increase of 1°C in the mean daily temperature increased the population by 2.83, 1.61 and 2.28 individuals per leaf during the first, second years and on the two cumulative years, respectively.

The partial regression values emphasized an significant negative relations (-11.34 and -9.58) during the two years, respectively and insignificant negative effect (-5.10) on the two cumulative years. Similarly, with different values, the partial correlation values were -0.66, -0.70 and -0.42,when the mean relative humidity and dew point become around their means during the first, second years and on the two cumulative years, respectively. An increase of one degree in the mean daily temperature, would decrease the population by 11.34, 9.58 and 9.58 individuals per leaf where that other two factors remain constant during the first, second years and on the two cumulative years, respectively (Table 5). The obtained results indicate that, mean daily temperature above the optimum range of total population activity during the two years and around the optimum range of total population activity on the two cumulative years. This climatic factor was responsible for certain changes in the pest total population by 15.78, 31.55 and 9.03% during the first, second years and through the two cumulative years, respectively (Table 5).

**B- Effect of the mean relative humidity:**

Results in Table (4) showed that the correlation coefficient (r) was insignificant negative (-0.57 and -0.32) for the first and second years, respectively and significant negative (-0.43) on the two cumulative years. The calculated regression coefficient (b) for the effect of this factor indicated that for every 1% R.H. increase, the population would decrease by 1.46, 0.94 and 1.22 individuals for the two years of study and on the cumulative years, respectively.

The exactly relationship between this climatic factor and total population of pest was determined by the partial regression values (Table 5), which emphasized significant negative values (-6.03, -4.43 and -2.83) for the two years of study and on the two cumulative years, respectively. An increase of one degree in the mean relative humidity, would decrease the population by 6.03, 4.43 and 2.83 individuals per leaf in case of other two factors remain constant during the first, second years and on the two cumulative years, respectively. Also, the values of the partial correlation were -0.71, -0.70 and -0.47, when the mean daily temperature and dew point become around their means during both study years separately and on the two cumulative years, respectively (Table 5). The obtained results revealed that, mean relative humidity above the optimum range of total population activity during the two year of study and on the two cumulative years. This factor was responsible for the certain changes in the population of the adult females by 20.36, 30.88 and 12.20% during the first and second years separately and on the two cumulative years, respectively (Table 5).

**C- Effect of mean dew point:**

Data in Table (4) showed that, the effect of mean dew point on total population activity was highly significantly positive relations (0.74 and 0.66) during the first year and on the two cumulative years, respectively and significant positively effect through the second year(0.59). The calculated regression coefficient (b) for the effect of this factor indicated that for every 1˚C increase, the population would be increased by 5.70, 5.09 and 5.55 individuals per leaf during the first, second years and on the two cumulative years, respectively (Table 4).

The exact relationship between this climatic factor and the activity of the total population was determined by the partial regression values (Table 5), which emphasized highly significant positive relations (13.60, 15.53 and 9.88), where the values of the partial correlation were 0.79, 0.79 and 0.62), when the mean daily temperature and relative humidity become around their means during both study years separately and on the two cumulative years, respectively. The results revealed that, mean dew point was entirely under the optimum range of total population and this climatic factor was the most effective variable for the changes in the total population by 32.34, 52.69 and 27.19 % during the first, second years and during the two cumulative years, respectively (Table 5).

**D- The combined effect of the tested climatic factors on the total population of *P. oleae*:**

The results in Table (5) showed that, the combined effect of these tested factors on the total population of *P. oleae* was highly significant during the first year and on the cumulative years, respectively and significant during the second year (Table 5). The amount of variability that could be attributed to the combined effect of these tested factors on the total population of insect was 79.97, 67.60 and 56.61% for the two years individually and on the two cumulative years, respectively. The remaining unexplained variances are assumed to be due to the influences of other undetermined and unconsidered factors that were not included in this study in addition to the experimental error.

**Effect on the percentage of infestation incidence by *P. oleae*:**

**A- Effect of daily mean temperature:**

Results in Table (6) showed that the simple correlation (r) between the daily mean temperature and the infestation incidence was insignificant positive (0.01, 0.25 and 0.14) during the first, second years and on the cumulative years, respectively. As well as, the calculated regression coefficient (b) for the effect of this factor indicated that every 1˚C increase in the daily mean temperature, would increase the percentages of infestation incidence by 0.01, 0.40 and 0.19 % for the first, second years and on the two cumulative years, respectively(Table 6).

The precise effect of this factor on the percentages of infestation incidence (Table 7) showed that, there was highly significant negative P. reg. values (-5.47, -3.74 and -2.63) for both years separately and on the cumulative years, respectively. Also, the values of partial correlation were -0.79, -0.82 and -0.58, when the mean relative humidity and

dew point become around their means during the first, second years and on the two cumulative years, respectively (Table 7). The obtained results revealed that, daily mean temperature entirely above the optimum range of infestation incidence by pest during the first, second years and on the two cumulative years. This climatic factor was responsible for certain changes in the infestation incidence of the pest by 47.93, 32.33 and 21.94% during both of first and second years separately and on the two cumulative years, respectively (Table 7).

**B- Effect of the mean relative humidity:**

Data in Table (6) showed that the mean relative humidity had insignificant positive effect on the percentages of infestation incidence, since the correlation coefficients were 0.09 and 0.02during the first year and on the two cumulative years, respectively and insignificant negative (r = -0.03) through the second year. The unit effect (regression coefficient) indicates that an increase of 1% in the mean relative humidity, would increase the percentages of infestation incidence by 0.06 and 0.02% for the first year and on the two cumulative years, respectively and would be decreased by 0.03% during the second year (Table 6).

The real effect of this climatic factor appeared from the partial regression (P. reg.) values in Table (7) which showed that there was highly significant negative effect (-2.29) for the first year and significant negative effect (P. reg. values were -1.30 and -0.91) during the second year and on the two cumulative years, respectively. Also, the values of partial correlation were -0.76, -0.72 and -0.46, when the mean daily temperature and dew point become around their means, during the first, second years and on the two cumulative years, respectively (Table 7).

The obtained results revealed that the mean relative humidity was entirely above the optimum range of infestation incidence activity of the pest for the first year and above the optimum range during the second year and on the two cumulative years. So, this climatic factor was responsible for certain changes in the infestation incidence by 38.54, 17.75 and 11.41% during the first, second years and on the two cumulative years, respectively (Table 7).

**Table 6. Simple correlation and regression values when the counts of the climatic factors were plotted versus the infestation intensity (%) and incidence (%) of *P. oleae* through the two successive years (2017/2018 and 2018/2019).**

| Years | | Independent variables (X) | Simple correlation and regression values | | | | | C.V. |
|---|---|---|---|---|---|---|---|---|
| | | | a | r | b | S.E. | t | |
| 2016/ 2017 | Infestation incidence (%) | Mean temp. | 82.43 | 0.005 | 0.006 | 0.36 | 0.02 | 0.10 |
| | | R.H.% | 80.62 | 0.090 | 0.064 | 0.22 | 0.29 | 0.10 |
| | | Dew Point | 74.13 | 0.406 | 0.064 | 0.22 | 0.29 | 0.09 |
| 2017/ 2018 | | Mean temp. | 69.96 | 0.25 | 0.40 | 0.49 | 0.80 | 0.15 |
| | | R.H.% | 82.12 | -0.03 | -0.03 | 0.36 | -0.09 | 0.16 |
| | | Dew Point | 57.67 | -0.67 | -0.03 | 0.36 | -0.09 * | 0.12 |
| 2016 to 2018 | | Mean temp. | 76.65 | 0.14 | 0.19 | 0.30 | 0.66 | 0.12 |
| | | R.H.% | 81.30 | 0.02 | 0.02 | 0.20 | 0.09 | 0.12 |
| | | Dew Point | 66.60 | 0.54 | 0.02 | 0.20 | 0.09 ** | 0.10 |

**C- Effect of mean dew point:**

Data in Table (6) showed that the effect of mean dew point on the percentages of infestation incidence by pest was insignificant positive (0.41) in the first year, significant negative (-0.67) during the second year and highly significant positive (0.54) through the two cumulative years. Also, the calculated regression coefficient (b) for the effect of this factor indicated that for every 1˚C increase, the percentages of infestation incidence would be increased by 0.06 and 0.02% during the first year and on the two cumulative years, respectively and would be decreased by 0.03% through the second year (Table 6).

The exactly relationship between this climatic factor and the infestation incidence by pest was determined by the partial regression values (Table 7), which emphasized highly significant positive relation (P. reg. values were 5.39, 6.81 and 4.37) during the first, second years and on the two cumulative years, respectively. The values of the partial correlation were 0.84, 0.90 and 0.73, when the mean daily temperature and relative humidity become around their means, during both study years separately and on the cumulative years, respectively (Table 7). The obtained results revealed that, mean dew point entirely under the optimum range of infestation incidence activity of the pest thought the first, second years and on the two cumulative years. This climatic factor was the most effective variable for the changes in the infestation incidence by 66.59, 68.03 and 48.62 % during the first, second years and on the two cumulative years (Table 7).

**Table 7. Multiple regression and correlation analysis between three climatic factors and the percentages of infestation incidence by *P. oleae* through the two successive years (2016/2017 and 2017/2018).**

| Years | Y | Independent variables (X) | Partial regression values | | | | Partial correlation | * Efficiency % | Rank | Analysis variance | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Constant | P. reg. | S.E | t | | | | F values | C.V. | MR | $R^2$ | E.V. % |
| 2016/ 2017 | Infestation incidence (%) | Mean temp. | 239.68 | -5.47 | 1.48 | -3.69 ** | -0.79 | 47.93 | 2 | 6.79 * | 0.06 | 0.85 | 0.72 | 71.79 |
| | | R.H.% | | -2.29 | 0.69 | -3.31 ** | -0.76 | 38.54 | 3 | | | | | |
| | | Dew Point | | 5.39 | 1.24 | 4.35 ** | 0.84 | 66.59 | 1 | | | | | |
| 2017/ 2018 | | Mean temp. | 153.96 | -3.74 | 0.93 | -4.00 ** | -0.82 | 32.33 | 2 | 13.85 ** | 0.07 | 0.92 | 0.84 | 83.86 |
| | | R.H.% | | -1.30 | 0.44 | -2.97 * | -0.72 | 17.75 | 3 | | | | | |
| | | Dew Point | | 6.81 | 1.17 | 5.81 ** | 0.90 | 68.03 | 1 | | | | | |
| 2016 to 2018 | | Mean temp. | 135.59 | -2.63 | 0.82 | -3.22 ** | -0.58 | 21.94 | 2 | 9.06 ** | 0.09 | 0.76 | 0.58 | 57.60 |
| | | R.H.% | | -0.91 | 0.39 | -2.32 * | -0.46 | 11.41 | 3 | | | | | |
| | | Dew Point | | 4.37 | 0.91 | 4.79 ** | 0.73 | 48.62 | 1 | | | | | |

**D- The combined effect of the tested climatic factors on the percentage of infestation incidence by pest:**

The results showed that the combined effect of these tested factors on the infestation incidence by the pest was significant (Table 7). The multiple regression analysis revealed that the studied variables were responsible for the changes in the infestation incidence by pest. The percentages of explained variance (E.V.%) were 71.79, 83.86 and 57.60% for the two years individually and during the two cumulative years. The remaining unexplained variances are assumed to be due to the influences of other unconsidered and undetermined factors that were not included in this study in addition to the experimental error.

**Prediction of different alive stages of *P. oleae*:**

Furthermore, the most effective climatic factors, which could be used to predict different alive stages and the percentages of infestation incidence by *P. oleae* were daily mean air temperature, relative humidity and dew point. Prediction equation for different stages of insect population and on the percentages of infestation incidence by *P. oleae* were concluded according to the mentioned statistical analysis between the two accumulated years in Tables (5 and 7) and presented as follow:

**For nymphs population:**

$$Y = 135.50 - 3.03\ x_1 - 1.66\ x_2 + 5.77\ x_3$$

**E.V.= 57.44%**

**For adult females population**

$$Y = 99.68 - 2.07\ x_1 - 1.17\ x_2 + 4.11\ x_3$$

**E.V.= 52.30 %**

**For total population of pest:**

$$Y = 234.98 - 5.10\ x_1 - 2.83\ x_2 + 9.88\ x_3$$

**E.V.= 56.61 %**

**For the percentage of infestation incidence:**

$$Y = 135.59 - 2.63\ x_1 - 0.91\ x_2 + 4.37\ x_3$$

**E.V.= 57.60%**

**Where is,**

**Y= Prediction value.** **$X_1$= Daily mean air. temperature**

**$X_2$= Relative humidity.** **$X_3$= Dew point.**

**E.V.% = Explained variance**

The aforementioned results on the effect of the three climatic factors on the pest population and on the percentages of infestation incidence by *P. oleae* during the two successive years emphasized that the effect of these factors varied from year to another. Also, the dew point was the most effective variable for the changes in the population density of the different stages of *P. oleae* and on the percentages of infestation incidence by the pest during the two years individually and on the two cumulative years.

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## نماذج تأثير بعض العوامل البيئية على الكثافة العددية لحشرة البرقوق القشرية التى تصيب أشجار المانجو فى مركز إسنا- محافظة الأقصر - مصر


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أجريت الدراسة خلال عامين متتاليين (2016/2017 و2017/2018) فى مركز إسنا محافظة الأقصر للتعرف علي التأثيرات البيئية لبعض عوامل الطقس علي حشرة البرقوق القشرية التى تصيب أشجار المانجو وذلك لتحديد الوقت المناسب للمكافحة. ذلك أظهرت النتائج إلى أن حشرة البرقوق القشرية تتواجد على أشجار المانجو على مدار العام، ولها ثلاثة قمَم لنشاط التعداد الكليّ للحشرة خلال العام والتي سجلت فى أكتوبر وأبريل ويوليو خلال العام الأول من الدراسة، و فى شهر نوفمبر وأبريل ويوليو خلال العامِ الثانى من الدراسة. أيضا، أظهرت نسب حدوث الإصابة بالأفة أن لها ثلاثة قمَمٍ خلال العام والتى سجلت فى نوفمبر وأبريل ويوليو على مدار العام. لوحظ أن الظروف البيئية فى الشهورَ الخريفيةَ خلال العامِين كَانتْ أكثر الشهور تفضيلا وملائمة لنمو ونشاط التعداد الكلى للأفة وأعلى نسب مئوية لحدوث الإصابة بالآفة تحت الظروف المناخيةِ لمنطقة الدراسة. أوضحت نتائج الدراسة، أن تأثير عوامل الطقس كان واضحا (متوسط درجة الحرارة اليومية ومتوسط نسبة الرطوبة النسبية ومتوسط نقطة الندى) على تعداد الآفة وعلى نسب حدوث الإصابة خلال العامين ، وأن تأثير هذه العوامل يختلف من عام إلى أخر، وأظهر التحليل الأحصائى باستخدام طريقة الانحدار المتعدد أن متوسط نقطة الندى كان المتغير الاكثر فعالية لتغير تعداد الآفة وعلى نسب حدوث الإصابة خلال كل عام بشكل منفصل عن الأخر وخلال العامين المتراكمين معا.