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Seasonal activity of the guava long scale insect *Lepidosaphes tapleyi* (Hemiptera: Diaspidiae) infesting guava trees in Luxor Governorate, Egypt.

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Abstract:

The present work was carried out throughout two successive years (2017/2018 and 2018/2019) at Esna district, Luxor Governorate. As a basic study for developing future management of the guava long scale insect, *Lepidosaphes tapleyi* (Williams) (Hemiptera: Diaspidiae), to determine the seasonal activity of this insect. In this investigation, two insect expressions were utilized, *i.e*., Insect numbers and incidence of infestation, which articulated the population density of this pest. The obtained results showed that insect population of *L. tapleyi* occurred on guava trees all the year round and has four to five peaks of seasonal activity per year, which was recorded on the beginning of April, mid-May, mid-July, beginning of October and mid-November during the first year (2017/2018) and through the mid-April, mid-July, mid-September and beginning of November during the second year (2018/2019). Furthermore, the percentages of infestation incidence by pests showed, also, have four to five peaks per year. Also, the total population density by *L. taplyi* was higher through the second year in compared to the first year of study, which may be due to the influence of favorable factors (such as environmental conditions…. etc.). It seems that, the climatic conditions of autumn and summer months during the two years were more suitable for the population density and its activity and the maximum values of the infestation incidence by *L. taplyi*. As well, it was generally found that autumn season was more favorable for the insect multiplication and build up, than the remaining three seasons in each year during the two years. 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 insect population and on the percentages of infestation incidence by *L. taplyi* were, highly significant during the two successive years, and these factors varied from year to another. Also, the dew point was the most effective variable for the changes in the insect population and the percentages of infestation incidence under the studied years.

Introduction

The guava long scale insect *Lepidosaphes tapleyi* (Williams) (Hemiptera: Diaspidiae) has a wide range of host plants, it attacks 28 host plants in 17 countries (Williams , 1960; Williams and Watson, 1988 ; Muniappan *et al*. , 2012 and Malumphy *et al*., 2012) and Egypt (Swailem, 1974 and Ghabbour, 2001). It was dangerous pest of economic crops on mango trees in Benin (Germain *et al*., 2010) and guava in Mali and Senegal (Muniappan *et al*. , 2012). This pest injures the shoots, twigs, leaves, branches and fruits by sucking the plant sap with the mouth parts, causing thereafter deformations, defoliation, drying up of young twigs, dieback, poor blossoming, death of twig by the action of the toxic saliva. A characteristic symptom of infestation by pest is the appearance and accumulation of its scales on attacked guava parts (Swailem, 1974; El-Nahal *et al*., 1980 and Williams and Watson, 1988).

The objective of this study is to estimate the seasonal activity, the percentages of infestation incidence by pest, the rate of monthly variation and the effect of main weather factors on insect numbers and incidence of infestation of pest, to select an effective program for its control.

Materials and methods

Many authors used different insect expressions, which articulated the population density of this pest. In this investigation, two insect expressions were utilized, *i.e*., insect numbers and the percentages of infestation incidence. The population fluctuations of this scale found infesting guava trees in a private orchard of about one feddan were carried out at half-monthly intervals at Esna district, Luxor Governorate during two successive years extending from March 2017 until mid-February 2019. The selected orchard received the normal agricultural practices without application any chemical control measures before and during the period of study.

Four guava trees of Balady variety, almost uniform and of similar in age and as possible in size, shape, height, vegetative growth was selected. Regular half-monthly samples were picked up to random from different directions and stratums of tree with rate of 40 leaves per tree. The samples were collected regularly and immediately transferred to laboratory in polyethylene bags for inspection using a stereomicroscope. Numbers of alive insects on upper and lower surfaces of guava leaves were individually sorted into immature stages (nymphs) and mature stages (adult females) and then were counted and recorded together opposite to each inspected date.

The *L. tapleyi* population density was estimated, while its infestation incidence percentages were calculated according to the formula of Facylate (1971):

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

Where, A = Percentage of infestation incidence.
n = No. of infested leaves in which the pest appeared.
N = Total number of picked leaves (Uninfested + Infested) in 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 *L. tapleyi* population and percentages of infestation incidence. The meteorological data of some climatic factors (daily mean temperature, mean of % relative humidity and mean of dew point °C) for conditions of Luxor governorate were obtained from the Central Laboratory for Agricultural climate, Agriculture Research Center, Ministry of Agricultural in Giza. The altitude, latitude and longitude of this weather region of Luxor were 99 m, 25.67ºN and 32.71ºE, respectively. According to the results of the simple correlation, regression coefficient and the partial regression formula, which was adopted to find out the simultaneous effects of, tested main weather factors on *L. tapleyi*. The partial regression method termed the C-multipliers was adopted according to Fisher (1950). All obtained data were subjected to calculations and were depicted graphically using Microsoft Excel 2010. Statistical analysis was carried out with Computer using (MSTATC Program Software, 1980) to determine the preferable time for the insect activity and the proper time for its control.

Results and discussion

1. Seasonal abundance of *Lepidosaphes tapleyi* infesting guava trees:

The half-monthly counts of *L. tapleyi* stages which infested guava trees and the percentages of infestation incidence by pest at Esna district, Luxor Governorate were recorded through the two successive years (2017/2018 and 2018/2019). Also, half-monthly mean records of climatic weather factors throughout the two years of investigation are tabulated in Tables (1 and 2) and graphically illustrated in Figures (1 and 2). The trends of fluctuation in nymphs and adult females populations were almost similar. Accordingly, its better to discuss the seasonal activity were estimated based on average number of immature (nymphs) and mature stage (adult females) counts per leaf in the successive sampling dates.

1.1.The first year (2017/2018):

Concerning, the data in the first year of (2017/2018), as recorded in Table (1) and graphed illustrated in Figure (1), it was observed that the total population of insect started to increase gradually to reach the first peak. The first peak was recorded in the beginning of April with mean numbers of 15.52 ± 0.75 individuals/leaf under field conditions at 22.06°C, 32.41% and 5.24°C for daily mean of temp., relative humidity and dew point, respectively. After that, the population decreased took place in mid-April. Then, the population increased gradually to reach the second peak of this insect, was recorded in mid-May when the mean population reached 24.93 ± 1.22 individuals/leaf with means of 28.18°C, 18.07% and 7.43°C for mean temp., relative humidity and dew point, respectively. Thereafter, the population decreased gradually until reached in mid of June and then reincreased gradually to reach third peak in mid-July, when 28.69 ± 1.40 individuals per leaf were recorded under the means field conditions of 33.5°C, 19.79% and 12.79°C for mean temp., relative humidity and dew point, respectively. Then, the population decreased at the beginning of August and then increased gradually to reach the fourth peak at the beginning of October, where 47.98 ± 2.36 individuals/ leaf were recorded under the mean field conditions of 31.75°C, 25.5% and 14.31°C for mean temp., relative humidity and dew point, respectively. Thereafter, it decreased in mid-October and then highly increased continuously to reach the fifth peak in mid- November when the mean population reached 52.33 ± 2.57 individuals/leaf with means of 25°C, 33.64% and 11.71°C for mean temp., relative humidity and dew point, respectively. A continues decrease was observed in insect population during December until reached to the mid of February are shown in Table (1) and illustrated in Figure (1).

A similar trend in the seasonal fluctuation of nymphs (immature stages) and adult (mature stages) populations was observed. Five peaks of nymphs population were recorded in the beginning of April, mid-May, mid-July, beginning of October and mid-November when the mean population density was 11.76 ± 0.55, 16.39 ± 0.76, 18.47 ± 0.86, 29.89 ± 1.39 and 32.19 ± 1.49 individuals/leaf, respectively. Similarly, however with different values the adult females had five peaks that were recorded in the beginning of April, mid-May, mid-July, beginning of October and mid- November when the mean population density was 3.76 ± 0.20, 8.54 ± 0.47, 10.22 ± 0.56, 18.08 ± 0.99 and 20.14 ± 1.10 individuals/leaf, respectively, Table (1) and illustrated in Figure (1).

Differently, the percentages of infestation incidence occurred five peaks were recorded in mid of April, mid-May, mid–July, beginning of October and mid- November when the percentages of abundance were 57.50 ± 3.23, 70.00 ± 4.56, 66.25 ± 3.75, 72.50 ± 3.23 and 71.25 ± 3.75 % respectively, Table (1) and illustrated in Figure (1).

1.2.The second year (2018/2019):

The obtained results in Table (2) and illustrated in Figure (2) showed that the total population by *L. tapleyi* during the second year started to increase gradually to reach the first peak. The first peak was observed in the mid-April with mean population of 26.36 ± 1.28 individuals/leaf under field conditions at 24.46°C, 21.93% and 6.71°C for mean daily of temp., relative humidity and dew point, respectively. After that, the population decreased gradually until reached in mid of June and then reincreased gradually to reach the second peak in mid-July when the mean population reached 38.11 ± 1.84 individuals/leaf with means of 32.64°C, 26.21% and 15.57°C for mean daily of temp., relative humidity and dew point, respectively. In early August, the insect population decreased and then increased gradually again to reach the third peak in mid-September when the mean population reached 51.11 ± 2.49 individuals/leaf with means of 32.14°C, 27.36% and 15.57°C for mean daily of temp., relative humidity and dew point, respectively. Then after, it decreased in the beginning of October and then it highly increased continuously to reach the fourth maximum peak was occurred in beginning of November when the mean population reached 54.86 ± 2.67 individuals/leaf with means of 24.75°C, 35.56% and 11.94°C for mean temp., relative humidity and dew point, respectively. Followed by a dramatic decline and gradual decrease for population during December until reached to the mid of February are shown in Table (2) and illustrated in Figure (2).

A similar trend in the seasonal abundance of nymphs was observed. Four peaks of activity were recorded in mid of April, mid-July, mid of September and beginning of November when the mean population density was 18.46 ± 0.86, 28.06 ± 1.30, 33.94 ± 1.57 and 37.92 ± 1.76 individuals/leaf, respectively. Differently, however with different values, the adult females had four peaks that were occurred in mid of April, beginning of August, mid of September and beginning of November when the population density was 7.90 ± 0.43, 10.20 ± 0.56, 17.17 ± 0.94 and 16.94 ± 0.92 individuals per leaf, respectively. Also, the adult population was relatively higher than the nymphs population in winter months (January and February) and this may referred to the cold weather and most the nymphs attained to the adults stage which sheltered on stems bark or in the stem cracks in Table (2) and illustrated in Figure (2).

Differently, the percentages of infestation incidence (abundance) showed that four peaks were occurred in April, beginning of June, mid of September and beginning of November when the percentages of abundance was 55.00 ± 2.89, 56.25 ± 2.39, 71.25 ± 3.75 and 70.00 ± 2.89 % respectively, Table (2) and illustrated in Figure (2).

Higher maximum population by *L. tapleyi* in November during the two years, when crawlers emerged after egg laying and their population decreased during several months due to mortality of nymphs during in the winter months. Thus, the least population density of different stages and total population of pest and the percentages of infestation incidence which were recorded during January and February during the two years of study, which may be attributed to the high relative humidity with the gradual decrease in temperature and dormancy of the trees during winter time which is expected to effect dramatically the insect behavior and on rate of growth and infestation. It obvious that the annual fluctuations in the population density during the two years were affected by the variability in these physical factors in the both years of investigation. According to Dent (1991) clarified that the rate of insect's population abundance at any location and the number of generations are influenced by the environmental factors at that location.

From the previously mentioned results, it could conclude that insect population occurred on guava trees all the year round and has four to five peaks of seasonal activity per year for different stages and total population of pest. Also, a same trend in both the percentages of infestation incidence by pests have four to five peaks. As well as, the total population of insect and the percentages of infestation incidence through the second year was higher in comparison to the first year of study, which may due to the influence of favorable factors (such as environmental conditions, etc.).

These results were coincided with those obtained by Swailem (1974) in Egypt, reported that the guava long scale insect, *L. tapleyi* had five generations per year. A few females of the last generation began to oviposit in December, but most entered diapause and did not resume activity until March. Populations were much reduced by unfavorable weather, particularly by hot winds, and large numbers fell from the trees when the leaves dropped in April. Also, Swailem (1973) recoded that the overwintering females began to oviposit in late May and continued to lay eggs until the temperature rose in July and August. Oviposition was resumed when the temperature dropped. Females laid 8-35 eggs each (average 20). The crawlers settled mainly on the upper surface of the leaves, especially on the parts of the trees exposed to the sun. After hatching, the two immature female stages averaged 15-35 and 9-26 days, respectively, and the immature stages of the males after hatching averaged 30-52 days. Adult females lived for 55-120 days and adult males for 1-2 days.

The obtained results are illustrated in Figure (3), showed that the highest population density of *L. tapleyi*, the nymphs stage (23.49 and 28.31 individuals/leaf), adult females (15.06 and 14.51 individuals/leaf), total mixed population (38.55 and 42.82 individuals/leaf), the percentage of infestation incidence (67.71 and 67.08%) were recorded in autumn during the two years, respectively, than those of the remaining seasons of the year, may be due to the environmental conditions which were more favorable for the insect activity.

2. Rate of monthly variation in population (R.M.V.P.) of the guava long scale insect *Lepidosaphes tapleyi*:

The monthly variation rates in the population of different stages and total population of *L. tapleyi* and the percentages of infestation incidence were calculated (Table, 3). The rate of monthly variation in the population is considered an indicator to the favorable month for insect activity expressed as the month of higher increase of this insect population through the year. When R.M.V.P. is > 1 it means more activity, < 1 means less activity and = 1 means no change in the insect activity. As shown as recorded in Table (1), the favorable months of annual increase for nymphs stage and total mixed population appeared to be in April, May, July, September, October and November during the first year (2017/2018), when the rates of monthly variation were (1.41, 1.26, 1.72, 1.33, 1.28 and 1.09), and (1.39, 1.40, 1.65, 1.45, 1.20 and 1.06), respectively. As well, the rates of monthly variation (R.M.V.P) for adult females showed that the favorable times for annual increase appeared to be in April, May and from July to

November during the first year when the rates of monthly variation were 1.32, 1.85 and 1.01 to 1.64, respectively. Similarly, the infestation incidence percentages were higher in months, April, May, July to September and November during the second year of study, when the rates of monthly variation were 1.17, 1.09, 1.01 to 1.13 and 1.06, respectively.

As for the second year (2018/2019) the favorable times of annual increase for nymphs stage and total population of *L. tapleyi* appeared to be in April, July, September and November when the rates of monthly variation were (2.30, 2.50, 1.55 and 1.46) and (2.26, 2.09, 1.58 and 1.49), respectively. Also, for adult females it was shown that the favorable times for annual increase observed in months, April, July, September, November and January during the second year when the rates of monthly variation were 2.17,1.10 -1.63, 1.55 and 1.06, respectively. While, the infestation incidence was occurred in April, June, August, and September during the second year, when the rates of monthly variation were 1.10, 1.17, 1.20 and 1.12, respectively (Table, 3).

Generally, it seems that the climatic conditions of autumn months during the two years were more optimum for the insect multiplication and build up.

3. Effect of the main weather factors on the different insect expressions by *Lepidosaphes tapleyi*:

3.1. Insect population:

3.1.1. Nymphs population:

3.1.1.1. Effect of daily mean temperature:

The results of statistical analysis of simple correlation in Table (4) showed highly positively significant correlation between the daily mean temperature and nymphs population of *L. tapleyi* for the first year (r-value was 0.55), positively significantly effect (0.41) during the second year and highly positively significant relation (0.47) on the two cumulative years. The unit effect regression coefficient (b) indicated that an increase of 1°C in the daily mean temperature, would increase the population by 0.62, 0.62 and 0.61 individuals per leaf during the two years of study separately and on the two cumulative years altogether, respectively.

The recorded partial regression values emphasized a significantly negative effect of daily mean temperature and nymphs population in the two successive years (-2.32 and -4.08), respectively and highly significantly negative relation (-2.32) on the cumulative years. As well, the partial correlation values were (-0.48, -0.47 and -0.41) and (t-test) values were (-2.43, -2.35 and -3.01) when the mean relative humidity and dew point become around their means, during the first and second years and on the cumulative years, respectively, Table (4). The obtained results revealed that, daily mean temperature above the optimum range of nymphs' activity and this factor was responsible for the certain changes in the nymphs' population by 10.56 and 11.42 % during the first and second years, respectively. While, through the two cumulative years, the daily mean temperature entirely above the optimum range and was responsible by 8.54% from changes in population.

3.1.1.2. Effect of the mean relative humidity:

Data obtained are presented in Table (4), showed that the mean relative humidity had insignificant negative effects on nymphs activity, since the correlation coefficient were (r = -0.37, -0.02 and -0.17) for the 1st, 2nd years and concerning both years, respectively. As well as, the simple regression coefficient indicated that an increase of 1% in the mean relative humidity, would decrease the population density by 0.28, 0.02 and 0.15 individuals per leaf for the two years of study separately and on the two cumulative years altogether, respectively.

The real effect of R.H. is clear from the partial regression (P. reg.) values in Table

(4). Data showed that it had significantly negative effects (P. reg. values were -0.86, -1.51 and -0.82) for the 1st, 2nd years and on the two cumulative years, respectively. Also, the values of the partial correlation were (-0.44, -0.43 and -0.36) and t-test values were (-2.17, -2.14 and -2.57) when the daily mean temperature and dew point become around their means, respectively (Table, 4). The obtained results revealed that, mean relative humidity was above the optimum range of nymphs activity and this climatic factor was the least effective variable in population changes of the nymphs by 8.48, 9.43 and 6.24% during the both the first and second years and both years, respectively.

3.1.1.3. Effect of mean dew point:

Regarding the data in Table (4) the effect of mean dew point on nymphs population was highly significantly positive (r-values were 0.73, 0.68 and 0.70) during the first, second years and on the cumulative years, respectively. Also, the calculated regression coefficient (b) for the effect of this factor indicated that for every 1°C increase, the population would increase by 1.52, 1.72 and 1.63 individuals per leaf during the three periods of study, respectively.

The partial regression values (Table, 4), emphasized highly significantly positive relations between mean dew point and the nymphs activity (P. reg. values were 3.92, 6.35 and 4.16) during the two years of study separately and on the two cumulative years altogether, respectively. As well as, the values of the partial correlation were (0.65, 0.58 and 0.60), also (t-test) values were (3.86, 3.21 and 4.93) when the daily mean temperature and relative humidity become around their means, during the both the first and second years and both years, respectively (Table, 4).

The obtained results revealed that, mean dew point entirely under the optimum range of nymphs population and this climatic factor was the most effective variable for the changes in the nymphs' population by 26.76, 21.26 and 22.93 %, respectively (Table, 4).

3.1.1.4. 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 where the "F" values, were 11.92, 9.44 and 20.64 during the three periods of study, respectively, Table (4). The percentage of variability that could be attributed to the combined effect of these tested factors on the nymphs population which were 64.13, 58.62 and 58.46% during the two years of study separately and for both years altogether, 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.

3.1.2. Adult females population:

3.1.2.1. Effect of daily mean temperature:

Results are presented in Table (4) showed that the simple correlation (r) between the daily mean temperature and the population density of adult females were insignificantly positive (r-values were 0.39 and 0.17) during the first and second years, respectively and significantly positive relation (0.29) on the two cumulative years. 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 population by 0.31, 0.11 and 0.22 individuals per leaf for the first and second years and two cumulative years altogether, respectively.

The precise effect of this factor on the adult females population (Table, 4) showed that it had highly significantly negative (P. reg. values were -1.74 and -1.20) for the first year and both years, respectively, while, it was insignificant negative relation (P. reg. was -0.99) during the second year. Also, the values of partial correlation were (-0.55, -0.27 and -0.40) and the values of t-test were

(-2.92, -1.27 and -2.86) when the mean relative humidity and dew point become around their means, during the first and second years and on the two cumulative years, respectively. The obtained results revealed that, daily mean temperature entirely above the optimum range of adult females activity and was responsible for the certain changes in the population of adult females by 11.69 and 7.44% during the first year and on the two cumulative years, respectively. While, it was around the optimum range during the second year and this climatic factor was responsible by 3.51% from changes in population, Table (4).

3.1.2.2. Effect of the mean relative humidity:

As shown in Table (4), the correlation between relative humidity and the adult females population was insignificantly negative (r value was -0.11) for the first year and insignificantly positive relations (r values were 0.31 and 0.07) during the second year and both years, respectively. Also, the simple regression coefficient indicated that an increase of 1% in the mean relative humidity, would decrease the population by 0.06 individuals per leaf for the first year and would increase the population by 0.13 and 0.03 individuals per leaf through the second year and on the two cumulative years altogether, respectively.

The real effect of this factor appeared from the partial regression values which showed that the effect of relative humidity was insignificantly negative (P. reg. values were -0.45, -0.21 and -0.30) during the three periods of study, respectively. As well as, the values of the partial correlation were (-0.38, -0.15 and -0.25) and t values were (-1.85, -0.66 and -1.72) when the daily mean temperature and dew point become around their means, respectively. Results revealed that, mean relative humidity was around the optimum range of adult females activity and it was the least effective variable in population changes of the nymphs by 4.69, 0.96 and 2.68% during the two years of study separately and on the two cumulative years, respectively (Table, 4).

3.1.2.3. Effect of mean dew point:

Data in Table (4) indicated that, the effect of mean dew point on adult females activity was highly significantly positive (r values were 0.70, 0.58 and 0.64) during the two years of study separately and on the two cumulative years altogether, respectively. Also, the calculated regression coefficient (b) for the effect of this factor indicated that for every 1˚C increase, the population would increase by 1.04, 0.65 and 0.84 individuals per leaf during the first and second years and on the two cumulative years, respectively.

The partial regression coefficient values for the effect of mean dew point on the adult females population are shown in Table (4), revealed that this factor had highly significant positive relations (P. reg. values were 3.13 and 2.28) during the first year and on the two cumulative years, respectively. While, the relation was insignificantly positive (P. reg. was 1.86) for the second year. Also, the partial correlation values were (0.74, 0.42 and 0.60) and the values of "t-test" were (4.94, 2.08 and 4.93) when the daily mean temperature and relative humidity become around their means, during the two years of study separately and on the two cumulative years altogether, respectively.

The obtained results revealed that, the mean dew point was entirely under the optimum range of adult females population during the first year and both years and under the optimum range of the adult females activity during the second year. This climatic factor was the most effective variable for the changes in the adult females' population by 33.61, 9.47 and 22.13 % during the three research periods, respectively in Table (4).

3.1.2.4. The combined effect of the all tests climatic factors on the adult females:

The results showed that the combined effect of these tested factors on the insect population of adult females was highly significant where the "F" values, were 17. 57, 8.52 and 21.98 during the first, second years and on the cumulative years in Table (4). The multiple regression analysis revealed that the tested studied variables together were responsible for the changes in the adult females' population. The percentages of explained variance (E.V.%) were 72.50, 56.09 and 59.97% respectively for the two years separately and during the two cumulative years altogether. 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.

3.1.3- Total population of *Lepidosaphes tapleyi*:

3.1.3.1. Effect of daily mean temperature:

As shown in Table (4), the correlation coefficient (r) between the daily mean temperature and total population was significantly positive (0.50) in the first year, insignificantly positive effect (0.35) during the second year and highly significantly positive relation (0.42) through the two cumulative years. As well as, the effect regression coefficient (b) indicated that an increase of 1°C in the daily mean temperature increased the population by 0.94, 0.73 and 0.83 individuals per leaf during the first and second years and both cumulative years, respectively.

The partial regression value emphasized significantly negative relation (P. reg. was -4.06) during the first year, insignificant negative effect (P. reg. was -5.07) for the second year and highly significantly negative relation (P. reg. was -3.52) for the two cumulative years. Also, the values of the partial correlation were (-0.53, -0.42 and -0.43) and (t-test) values were (-2.78, -2.08 and -3.18) when the mean relative humidity and dew point become around their means during the two years of study separately and on the two cumulative years altogether, respectively. An increase of one degree in the daily mean temperature, would decrease the population by 4.06, 5.07 and 3.52 individuals per leaf provided that other two factors remain constant during the three periods of study, respectively.

The obtained results indicated that, daily mean temperature above the optimum range of total population activity during the first year, but, it was around the optimum range for the second year and while, it was entirely above the optimum range for the two cumulative years altogether. This climatic factor was responsible for the certain changes in the total population of insect by 11.72, 9.00 and 8.74% during either of three periods, respectively (Table, 4).

3.1.3.2. Effect of the mean relative humidity:

The effect of mean relative humidity on total population of *L. tapleyi* was insignificantly negative (r values were -0.27 and -0.09) for the first year and on the cumulative years altogether, respectively and insignificantly positive correlation (r-value was 0.08) for the second year. The calculated regression coefficient (b) for the effect of this factor indicated that an increase of 1% in the mean relative humidity, the population would decrease by 0.34 and 0.11 individuals for the first year and on the two cumulative years, respectively and would increase by 0.11 individuals per leaf during the second year (Table, 4).

The partial regression values (Table, 4), were significantly negative (P. reg. were -1.31 and -1.11) for the first year and on the two cumulative years, respectively and insignificantly negative during the second year (P. reg. was -1.73). An increase of one degree in the mean relative humidity would decrease the population by 1.31, 1.73 and 1.11 individuals per leaf provided that 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 (-0.44, -0.36 and -0.35) and (t-test) values were (-2.18, -1.73 and -2.44) when the daily mean temperature and dew point become around their means, during either of three periods, respectively (Table ,4).

The obtained results revealed that, mean relative humidity above the optimum range of total population activity during the first year and on the cumulative years, while, it was around the optimum range through the second year. This factor was the least effective variable in the total population of insect by 7.20, 6.25 and 5.15% during the both the first and second years and both years, respectively (Table, 4).

3.1.3.3. Effect of mean dew point:

Data in Table (4) indicated that, the effect of mean dew point on total population activity was highly significantly positive (0.74, 0.67 and 0.70) during the three periods of study, respectively. As well as, the calculated regression coefficient (b) for the effect of this factor indicated that for every 1˚C increase, the population would increase by 2.56, 2.37 and 2.47 individuals per leaf during the first and second years and concerning both years, respectively (Table, 4). The partial regression coefficient values for the effect of mean dew point on total population activity are shown in Table (4). Data revealed that this factor had highly significantly positive relations (P. reg. values were 7.05, 8.22 and 6.44) during the three periods of study, respectively. The values of the partial correlation were (0.71, 0.55 and 0.62) and (t-test) values were (4.55, 2.95 and 5.30) when the daily mean temperature and relative humidity become around their means, during the both the study years separately and both years, respectively. The results revealed that the mean dew point was entirely under the optimum range of total population and it was the most effective variable for the changes in the total population by 31.37, 18.13 and 24.32 % during the first and second years and for the two cumulative years altogether, respectively in Table (4).

3.1.3.4. The combined effect of the tested climatic factors on the total population of *Lepidosaphes tapleyi*:

As shown in Table (4), the combined effect of these tested factors on *L. tapleyi* total population of was highly significant where the "F" values were 15.33, 9.29 and 23.88 during the first and second years and both cumulative years, respectively. The amount of variability that could be attributed to the combined effect of these tested factors on the total population of insect was 69.70, 58.21 and 61.95% during either of three periods, respectively (Table, 4). 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.

3.2. Effect on the percentages of infestation incidence:

3.2.1. Effect of daily mean temperature:

Results presented in Table (5) showed that the simple correlation (r) between the daily mean temperature and the infestation incidence was significantly positive effect (0.51) during the first year and highly significantly positive relations (0.69 and 0.59) through the second year and the two cumulative year's altogether. 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 percentage of infestation incidence by 0.64, 1.23 and 0.94 % during either of the three periods, respectively (Table, 5). The precise effect of this factor on the infestation incidence (Table, 5) showed that it had highly significantly negative (P. reg. value was -3.42) for the first year and insignificantly negative relations (P. reg. values were -3.43 and -0.79) for the second year and the two cumulative years, respectively. Also, the partial correlation values were (-0.54, -0.39 and -0.11) and the values of t-test were (-2.87, -1.87 and -0.74) when the mean relative humidity and dew point become around their means, during the first and second years and concerning both years, respectively (Table,5). The obtained results revealed that, daily mean temperature entirely above the optimum range of infestation incidence by pest during the first year, while, it was around the optimum range during the second year and on the cumulative years. This climatic factor was the least effective variable in changes in the percentages of infestation incidence by 18.09, 5.64 and 0.70 % during the three periods of study, respectively (Table, 5).

3.2.2. Effect of the mean relative humidity:

Data in Table (5), showed that the mean relative humidity had significantly negative effect on infestation incidence, since the correlation coefficient was (r-value was -0.43) during the first year, insignificantly negative relation (r= -0.36) through the second year and highly significantly negative effect (r= -0.38) for the two cumulative years altogether. The unit effect (regression coefficient) indicated that an 1% increase in the mean relative humidity, would decrease the percentage of infestation incidence by 0.37, 0.41 and 0.39 % for the first and second years and during the two cumulative years, respectively (Table, 5).

The real effect of mean relative humidity appeared from the partial regression (P. reg.) values in Table (5), which showed that it had highly significantly negative effect was (-1.44) for the first year, significantly negative relation (P. reg. value was -1.62) during the second year and insignificantly negative effect (P. reg. value was -0.47) for the two cumulative years. Also, the partial correlation values were (-0.55, -0.43 and -0.16) and the values of t-test were (-2.94, -2.15 and -1.08) when the daily mean temperature and dew point become around their means, during the two years of study separately and on the two cumulative years altogether, respectively, Table (5). The obtained results revealed that, mean relative humidity was entirely above the optimum range of infestation incidence activity by pest for the first year, while, it was above the optimum range during the second year and but, it was around the optimum range of infestation incidence activity on the two cumulative years. This climatic factor was responsible for the certain changes in the infestation incidence by 18.91, 7.48 and 1.46% during the three periods of study, respectively (Table,5).

3.2.3. Effect of mean dew point:

Regarding the data in Table (5), the effect of mean dew point on infestation incidence by *L. taplyi* was highly significantly positive (r- values were 0.61, 0.76 and 0.65) during the two years of study separately and on the two cumulative years altogether, respectively. Also, the calculated regression coefficient (b) for the effect of this factor indicated that for every 1˚C increase, the percentage of infestation incidence would increase by 1.43, 2.31 and 1.81% during either of three periods, respectively (Table,5). The partial regression values (Table, 5), emphasized highly significantly positive relations (P. reg. values were 4.69 and 6.03) during the first and second years, respectively and significantly positive relation (P. reg. was 2.48) for the two cumulative years altogether. The partial correlation values were (0.64, 0.54 and 0.30), also (t-test) values were (3.71, 2.87 and 2.12) when the daily mean temperature and relative humidity become around their means, during the three periods of study, respectively, Table (5). The obtained results revealed that, mean dew point entirely under the optimum range of infestation incidence activity by pest thought the first and second years, while, it was under the optimum range for the two cumulative years. This climatic factor was the most effective variable for changes in the percentages of infestation incidence by 30.21, 13.35 and 5.67 % during the first and second years and through the two cumulative years (Table ,5).

3.2.4. The combined effect of the tested climatic factors on the infestation incidence:

The results showed that the combined effect of these tested factors on the infestation incidence by pest was highly significant where the "F" value, were 8.54, 13.92 and 11.78 during either of three periods, respectively (Table, 5). The multiple regression analysis revealed that the tested studied variables together were responsible for the changes in the infestation incidence by pest. The percentages of explained variance (E.V. %) were 56.17, 67.62 and 44.55% during the two years of study separately and on the two cumulative years altogether, respectively.

3.3. Prediction of different *Lepidosaphes tapleyi* alive stages and the percentages of infestation incidence:

Furthermore, the most effective climatic factors, which could be used to predict of different *L. tapleyi* alive stages and the percentages of infestation incidence, were daily mean air temperature, relative humidity and dew point. Prediction equations were used according to the mentioned statistical analysis on basis the two cumulative years altogether in Tables (4 and 5) and presented as follow:

For nymphs' population:

$Y = 57.74^{**} – 2.32\ x_1^{**} – 0.82\ x_2^{*} + 4.16\ x_3^{**}$

E.V.= 58.46%

For adult females population:

$Y = 26.10^{*} – 1.20\ x_1^{**} - 0.30\ x_2 + 2.28\ x_3^{**}$

E.V.= 59.97 %

For total population:

$Y = 83.84^{**} – 3.52\ x^{**}_1 - 1.11\ x_2^{*} + 6.44\ x_3^{**}$

E.V.= 61.95 %

For the percentages of infestation incidence:

$Y = 66.06^{*} – 0.79\ x_1 – 0.47\ x_2 + 2.48\ x_3^{*}$

E.V.= 44.55%

Where is,

Y= Prediction value.

X_1= Daily mean air. temperature

X_2= Relative humidity.

X_3= Dew point**.**

E.V.% = Explained variance

***** Significant at $P \leq 0.05$

****** Highly significant at $P \leq 0.01$

The results on the effect of three considered weather factors on the insect population and on the percentages of infestation its incidence by *L. taplyi* 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 insect population and on the percentages of infestation incidence by pest during either of three periods of study

Table (1): Half-monthly mean numbers of different stages of *Lepidosaphes tapleyi* and the percentages of infestation incidence on guava trees, with climatic factors affecting at Esna district, Luxor Governorate during the first year of (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
Spring	March, 2017	1	5.95 ± 0.28	2.39 ± 0.13	8.34 ± 0.40	45.00 ± 2.04	18.96	41.36	4.64
		15	8.25 ± 0.38	2.24 ± 0.12	10.49 ± 0.50	51.25 ± 2.39	19.32	30.07	4.36
	April	1	11.76 ± 0.55	3.76 ± 0.20	15.52 ± 0.75	55.00 ± 2.04	22.06	32.41	5.24
		15	8.24 ± 0.38	2.35 ± 0.13	10.59 ± 0.51	57.50 ± 3.23	23.36	25.14	6.64
	May	1	8.78 ± 0.41	2.76 ± 0.15	11.54 ± 0.55	52.50 ± 3.23	26.09	19.19	6.38
		15	16.39 ± 0.76	8.54 ± 0.47	24.93 ± 1.22	70.00 ± 4.56	28.18	18.07	7.43
Average			**9.90 ± 0.72**	**3.67 ± 0.47**	**13.57 ± 1.18**	**55.21 ± 1.94**	**23.00**	**27.71**	**5.78**
Summer	June	1	11.30 ± 0.52	5.51 ± 0.30	16.81 ± 0.82	62.50 ± 3.23	30.26	18.29	9.35
		15	8.98 ± 0.42	4.76 ± 0.26	13.75 ± 0.67	50.00 ± 2.04	33.32	17.21	10.86
	July	1	16.35 ± 0.76	5.48 ± 0.30	21.83 ± 1.05	51.25 ± 2.39	31.88	19.56	11.63
		15	18.47 ± 0.86	10.22 ± 0.56	28.69 ± 1.40	66.25 ± 3.75	33.50	19.79	12.79
	August	1	11.15 ± 0.52	9.09 ± 0.50	20.24 ± 1.01	62.50 ± 3.23	35.00	20.06	13.65
		15	17.70 ± 0.82	8.14 ± 0.44	25.84 ± 1.26	56.25 ± 3.75	34.30	20.86	14.07
Average			**13.99 ± 0.80**	**7.20 ± 0.45**	**21.19 ± 1.12**	**58.13 ± 1.70**	**33.04**	**19.30**	**12.06**
Autumn	September	1	17.85 ± 0.83	14.55 ± 0.79	32.40 ± 1.61	63.75 ± 2.39	34.76	21.71	14.88
		15	20.43 ± 0.95	13.76 ± 0.75	34.19 ± 1.69	70.00 ± 2.04	32.36	23.64	14.07
	October	1	29.89 ± 1.39	18.08 ± 0.99	47.98 ± 2.36	72.50 ± 3.23	31.75	25.50	14.31
		15	19.12 ± 0.89	12.82 ± 0.70	31.94 ± 1.57	60.00 ± 2.89	30.61	25.64	13.00
	November	1	21.45 ± 1.00	11.03 ± 0.60	32.47 ± 1.59	68.75 ± 2.39	29.35	26.94	12.41
		15	32.19 ± 1.49	20.14 ± 1.10	52.33 ± 2.57	71.25 ± 3.75	25.00	33.64	11.71
Average			**23.49 ± 1.21**	**15.06 ± 0.72**	**38.55 ± 1.87**	**67.71 ± 1.38**	**30.64**	**26.18**	**13.40**
Winter	December	1	20.25 ± 0.94	17.85 ± 0.97	38.10 ± 1.90	62.50 ± 3.23	23.91	35.88	10.69
		15	9.29 ± 0.43	9.54 ± 0.52	18.83 ± 0.94	58.75 ± 2.39	18.11	38.50	6.79
	January, 2018	1	7.56 ± 0.35	7.03 ± 0.38	14.59 ± 0.73	56.25 ± 3.75	17.09	39.82	5.06
		15	6.77 ± 0.31	6.45 ± 0.35	13.22 ± 0.66	53.75 ± 2.39	14.71	48.29	6.21
	February	1	4.66 ± 0.22	3.79 ± 0.21	8.45 ± 0.42	48.75 ± 2.39	15.76	45.88	5.82
		15	4.11 ± 0.19	3.61 ± 0.20	7.72 ± 0.38	42.50 ± 1.44	19.57	44.36	7.36
Average			**8.77 ± 1.14**	**8.05 ± 1.02**	**16.82 ± 2.16**	**53.75 ± 1.68**	**18.19**	**42.12**	**6.99**
Total			**336.89**	**203.89**	**540.77**				
General average			**14.04 ± 0.77**	**8.50 ± 0.55**	**22.53 ± 1.28**	**58.70 ± 1.00**	**26.22**	**28.83**	**9.56**
%			**62.30**	**37.70**					

Table (2): Half-monthly mean numbers of different stages of *Lepidosaphes tapleyi* and the percentages of infestation incidence on guava trees, with climatic factors affecting at Esna district, Luxor Governorate during the second year of (2018/2019).

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
Spring	March, 2018	1	4.99 ± 0.23	2.78 ± 0.15	7.77 ± 0.39	50.00 ± 2.89	19.39	28.86	4.86
		15	7.96 ± 0.37	3.29 ± 0.18	11.25 ± 0.55	50.00 ± 2.89	22.29	24.93	6.14
	April	1	11.34 ± 0.53	5.29 ± 0.29	16.63 ± 0.81	55.00 ± 2.04	23.53	24.71	7.00
		15	18.46 ± 0.86	7.90 ± 0.43	26.36 ± 1.28	55.00 ± 2.89	24.46	21.93	6.71
	May	1	16.05 ± 0.74	7.39 ± 0.40	23.45 ± 1.14	50.00 ± 2.89	25.34	19.94	6.94
		15	11.95 ± 0.55	5.12 ± 0.28	17.06 ± 0.83	45.00 ± 2.04	30.14	16.57	9.14
Average			**11.79 ± 0.97**	**5.30 ± 0.41**	**17.09 ± 1.38**	**50.83 ± 1.19**	**24.19**	**22.82**	**6.80**
Summer	June	1	9.10 ± 0.42	5.94 ± 0.32	15.04 ± 0.74	56.25 ± 2.39	32.24	16.35	9.94
		15	7.58 ± 0.35	5.31 ± 0.29	12.89 ± 0.64	55.00 ± 2.89	34.32	15.64	11.21
	July	1	13.59 ± 0.63	6.57 ± 0.36	20.16 ± 0.98	50.00 ± 2.89	32.53	21.88	13.31
		15	28.06 ± 1.30	10.05 ± 0.55	38.11 ± 1.84	55.00 ± 2.89	32.64	26.21	15.57
	August	1	16.08 ± 0.75	10.20 ± 0.56	26.28 ± 1.29	60.00 ± 2.89	32.26	23.41	14.06
		15	18.60 ± 0.86	8.03 ± 0.44	26.62 ± 1.29	66.25 ± 3.75	32.11	22.36	14.00
Average			**15.50 ± 1.44**	**7.68 ± 0.43**	**23.19 ± 1.81**	**57.08 ± 1.50**	**32.68**	**20.98**	**13.02**
Autumn	September	1	19.75 ± 0.92	12.52 ± 0.68	32.28 ± 1.59	70.00 ± 4.56	32.65	25.35	15.41
		15	33.94 ± 1.57	17.17 ± 0.94	51.11 ± 2.49	71.25 ± 3.75	32.14	27.36	15.57
	October	1	22.18 ± 1.03	9.86 ± 0.54	32.04 ± 1.56	66.25 ± 3.75	31.31	28.25	14.88
		15	25.12 ± 1.17	12.64 ± 0.69	37.77 ± 1.84	65.00 ± 4.56	26.61	30.43	11.93
	November	1	37.92 ± 1.76	16.94 ± 0.92	54.86 ± 2.67	70.00 ± 2.89	24.75	35.56	11.94
		15	30.93 ± 1.43	17.91 ± 0.98	48.84 ± 2.40	60.00 ± 3.54	22.93	39.36	11.57
Average			**28.31 ± 1.44**	**14.51 ± 0.69**	**42.82 ± 2.06**	**67.08 ± 1.62**	**28.40**	**31.05**	**13.55**
Winter	December	1	13.90 ± 0.65	9.48 ± 0.52	23.39 ± 1.15	56.25 ± 2.39	21.22	45.06	11.69
		15	9.35 ± 0.43	7.71 ± 0.42	17.06 ± 0.85	40.00 ± 2.04	18.29	45.79	9.29
	January, 2019	1	8.06 ± 0.37	9.21 ± 0.50	17.27 ± 0.87	38.75 ± 2.39	14.94	46.18	5.88
		15	7.67 ± 0.36	8.97 ± 0.49	16.64 ± 0.84	35.00 ± 2.04	16.18	49.07	7.36
	February	1	7.68 ± 0.36	7.80 ± 0.42	15.48 ± 0.78	36.25 ± 1.25	17.12	32.35	4.41
		15	3.67 ± 0.17	3.98 ± 0.22	7.65 ± 0.38	33.75 ± 2.39	17.07	35.36	5.29
Average			**8.39 ± 0.65**	**7.86 ± 0.42**	**16.25 ± 1.01**	**40.00 ± 1.75**	**17.47**	**42.30**	**7.32**
Total			**383.95**	**212.08**	**596.02**				
General average			**16.00 ± 0.96**	**8.84 ± 0.43**	**24.83 ± 1.36**	**53.75 ± 1.26**	**25.69**	**29.29**	**10.17**
%			**64.42**	**35.58**	**100.00**				

Table (3): Rate of monthly variation (R.M.V.P) in the mean number of *Lepidosaphes tapleyi* and the and the percentages of infestation incidence counted on guava trees at Esna district, Luxor Governorate through the two years of (2017/2018 and 2018/2019).

Years	Month of inspection	Immature stages (Nymphs)	Mature stages (Adult females)	Total	Infestation incidence (%)
2017/2018	Mar.	—	—	—	—
	April	1.41	1.32	1.39	1.17
	May	1.26	1.85	1.40	1.09
	June	0.81	0.91	0.84	0.92
	July	1.72	1.53	1.65	1.04
	Aug.	0.83	1.10	0.91	1.01
	Sept.	1.33	1.64	1.45	1.13
	Oct.	1.28	1.09	1.20	0.99
	Nov.	1.09	1.01	1.06	1.06
	Dec.	0.55	0.88	0.67	0.87
	Jan.	0.49	0.49	0.49	0.91
	Feb.	0.61	0.55	0.58	0.83
2018/2019	Mar.	—	—	—	—
	April	2.30	2.17	2.26	1.10
	May	0.94	0.95	0.94	0.86
	June	0.60	0.90	0.69	1.17
	July	2.50	1.48	2.09	0.94
	Aug.	0.83	1.10	0.91	1.20
	Sept.	1.55	1.63	1.58	1.12
	Oct.	0.88	0.76	0.84	0.93
	Nov.	1.46	1.55	1.49	0.99
	Dec.	0.34	0.49	0.39	0.74
	Jan.	0.68	1.06	0.84	0.77
	Feb.	0.72	0.65	0.68	0.95

Table (4): Different models of correlation and regression analyses for describing the relationship between the main weather factors and the population density of different stages of *Lepidosaphes tapleyi* during the two years from 2017 to 2019.

Years	Stages (Y)	Tested counts (X)	Sample correlation and regression values				Partial correlation and regression values				Efficiency %	Rank	Analysis variance			
			r	b	S.E	t	P. cor.	P. reg.	S.E	t			F values	MR	R^2	E.V.%
First year (2017/2018)	Nymphs	Mean temp.	0.55	0.62	0.20	3.13 **	-0.48	-2.32	0.96	-2.43 *	10.56	2	11.92 **	0.80	0.64	64.13
		R.H.%	-0.37	-0.28	0.15	-1.86	-0.44	-0.86	0.39	-2.17 *	8.48	3				
		Dew Point	0.73	1.52	0.30	5.01 **	0.65	3.92	1.02	3.86 **	26.76	1				
	Adult females	Mean temp.	0.39	0.31	0.16	1.99	-0.55	-1.74	0.60	-2.92 **	11.69	2	17.57 **	0.85	0.73	72.50
		R.H.%	-0.11	-0.06	0.12	-0.54	-0.38	-0.45	0.25	-1.85	4.69	3				
		Dew Point	0.70	1.04	0.23	4.60 **	0.74	3.13	0.63	4.94 **	33.61	1				
	Total	Mean temp.	0.50	0.94	0.34	2.72 *	-0.53	-4.06	1.46	-2.78 *	11.72	2	15.33 **	0.83	0.70	69.70
		R.H.%	-0.27	-0.34	0.26	-1.32	-0.44	-1.31	0.60	-2.18 *	7.20	3				
		Dew Point	0.74	2.56	0.50	5.16 **	0.71	7.05	1.55	4.55 **	31.37	1				
Second year (2018/2019)	Nymphs	Mean temp.	0.41	0.62	0.29	2.14 *	-0.47	-4.08	1.73	-2.35 *	11.42	2	9.44 **	0.77	0.59	58.62
		R.H.%	-0.02	-0.02	0.20	-0.09	-0.43	-1.51	0.71	-2.14 *	9.43	3				
		Dew Point	0.68	1.72	0.40	4.31 **	0.58	6.35	1.98	3.21 **	21.26	1				
	Adult females	Mean temp.	0.17	0.11	0.14	0.81	-0.27	-0.99	0.79	-1.27	3.51	2	8.52 **	0.75	0.56	56.09
		R.H.%	0.31	0.13	0.09	1.50	-0.15	-0.21	0.32	-0.66	0.96	3				
		Dew Point	0.58	0.65	0.19	3.36 **	0.42	1.86	0.90	2.08	9.47	1				
	Total	Mean temp.	0.35	0.73	0.42	1.75	-0.42	-5.07	2.44	-2.08	9.00	2	9.29 **	0.76	0.58	58.21
		R.H.%	0.08	0.11	0.29	0.39	-0.36	-1.73	1.00	-1.73	6.25	3				
		Dew Point	0.67	2.37	0.57	4.18 **	0.55	8.22	2.79	2.95 **	18.13	1				
Two cumulative years (2017 to 2019)	Nymphs	Mean temp.	0.47	0.61	0.17	3.57 **	-0.41	-2.32	0.77	-3.01 **	8.54	2	20.64 **	0.76	0.58	58.46
		R.H.%	-0.17	-0.15	0.13	-1.16	-0.36	-0.82	0.32	-2.57 *	6.24	3				
		Dew Point	0.70	1.63	0.25	6.63 **	0.60	4.16	0.84	4.93 **	22.93	1				
	Adult females	Mean temp.	0.29	0.22	0.10	2.08 *	-0.40	-1.20	0.42	-2.86 **	7.44	2	21.98 **	0.77	0.60	59.97
		R.H.%	0.07	0.03	0.07	0.47	-0.25	-0.30	0.17	-1.72	2.68	3				
		Dew Point	0.64	0.84	0.15	5.67 **	0.60	2.28	0.46	4.93 **	22.13	1				
	Total	Mean temp.	0.42	0.83	0.27	3.13 **	-0.43	-3.52	1.11	-3.18 **	8.74	2	23.88 **	0.79	0.62	61.95
		R.H.%	-0.09	-0.11	0.19	-0.59	-0.35	-1.11	0.46	-2.44 *	5.15	3				
		Dew Point	0.70	2.47	0.37	6.71 **	0.62	6.44	1.22	5.30 **	24.32	1				

Table (5): Different models of correlation and regression analyses for describing the relationship between the main weather factors and the percentages of infestation incidence by *Lepidosaphes tapleyi* through the two successive years (2017/2018and 2018/2019).

Years	Dependent variables (Y)	Independent variables (X)	Sample correlation and regression values				Partial correlation and regression values				Efficiency %	Rank	Analysis variance			
			r	b	S.E	t	P. cor.	P. reg.	S.E	t			F values	MR	R^2	E.V. %
First	Infestation incidence (%)	Mean temp.	0.51	0.64	0.23	2.76 *	-0.54	- 3.42	1.19	-2.87 **	18.09	3	8.54 **	0.75	0.56	56.17
		R.H.%	-0.43	-0.37	0.17	-2.21 *	-0.55	-1.44	0.49	-2.94 **	18.91	2				
		Dew Point	0.61	1.43	0.40	3.60 **	0.64	4.69	1.26	3.71 **	30.21	1				
Second		Mean temp.	0.69	1.23	0.27	4.49 **	-0.39	-3.43	1.84	-1.87	5.64	3	13.92 **	0.82	0.68	67.62
		R.H.%	-0.36	-0.41	0.23	-1.78	-0.43	-1.62	0.75	-2.15 *	7.48	2				
		Dew Point	0.76	2.31	0.42	5.48 **	0.54	6.03	2.10	2.87 **	13.35	1				
Two Cumulative		Mean temp.	0.59	0.94	0.19	5.00 **	-0.11	-0.79	1.07	-0.74	0.70	3	11.78 **	0.67	0.45	44.55
		R.H.%	-0.38	-0.39	0.14	-2.75 **	-0.16	-0.47	0.44	-1.08	1.46	2				
		Dew Point	0.65	1.81	0.32	5.75 **	0.30	2.48	1.17	2.12 *	5.67	1				

r = Simple correlation; b = Simple regression; P. cor. = Partial correlation; MR = Multiple correlation; P. reg.= Partial regression R^2= Coefficient of determination; E.V% = Explained variance; S.E = Standard error
*** Significant at P ≤ 0.05 ** Highly significant at P ≤ 0.01**

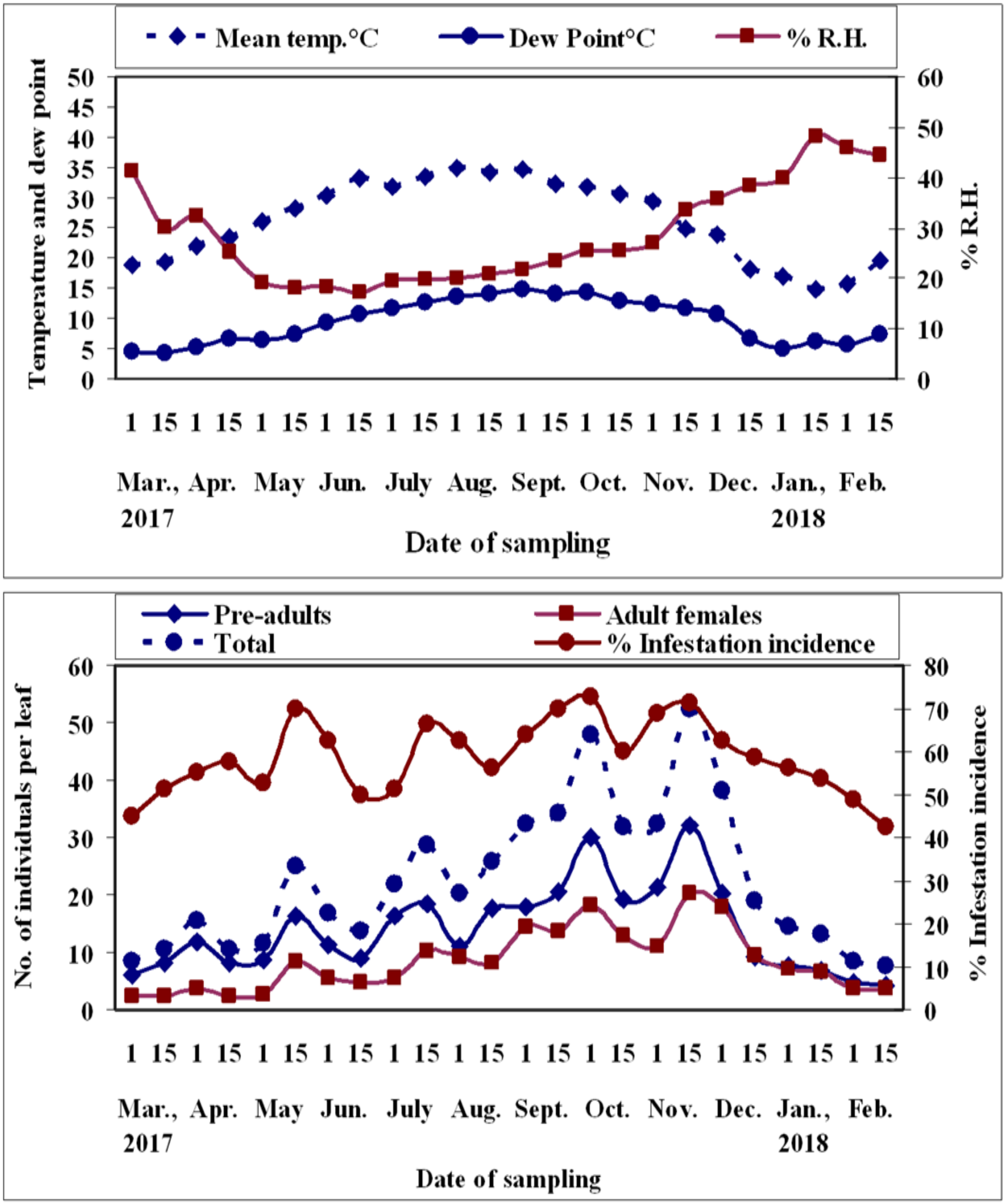


Figure (1): Means of half-monthly counts of different stages and the percentages of infestation incidence by *Lepidosaphes tapleyi* on guava trees, with climatic factors affecting at Esna district, Luxor Governorate during the first year of (2017/2018).

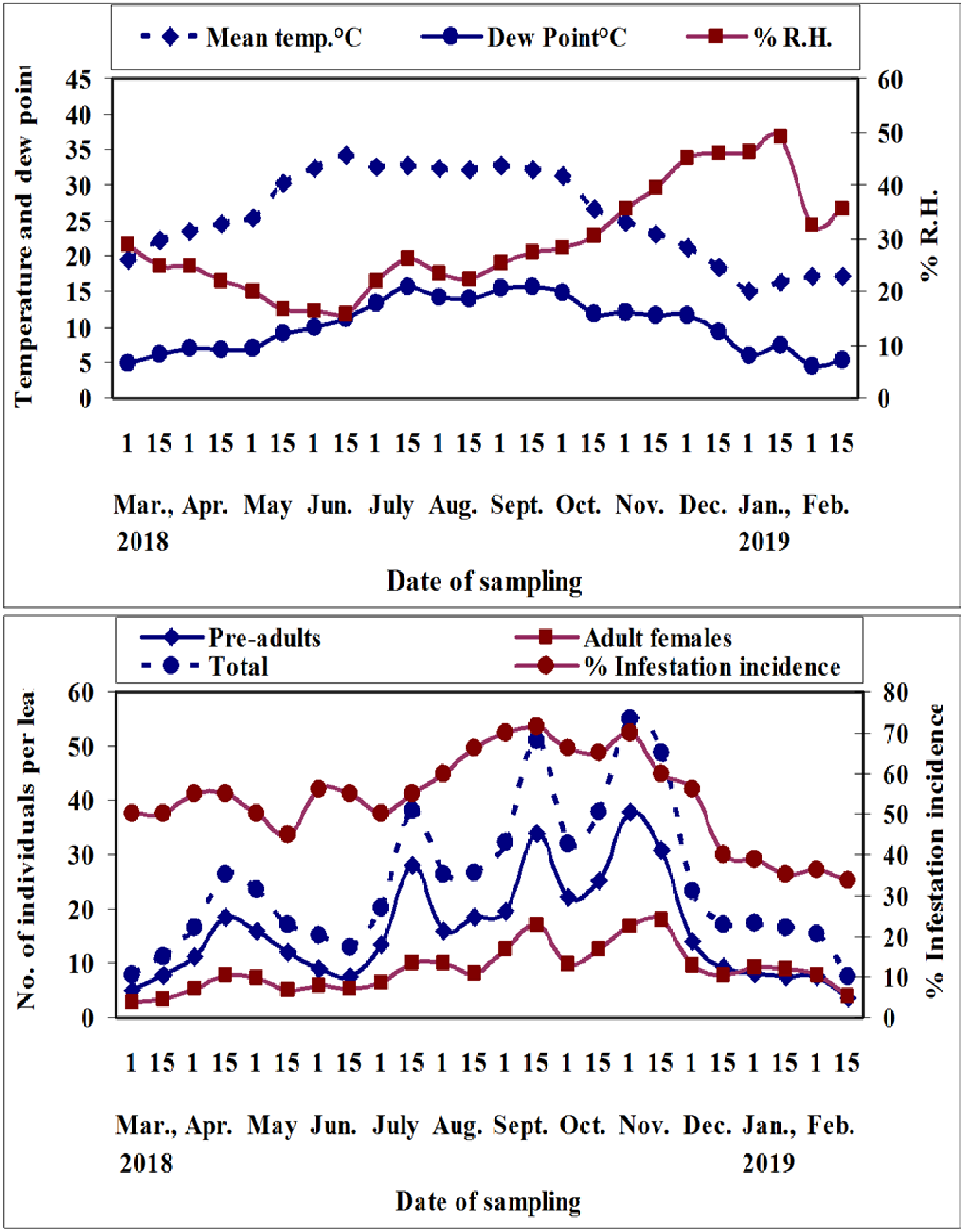
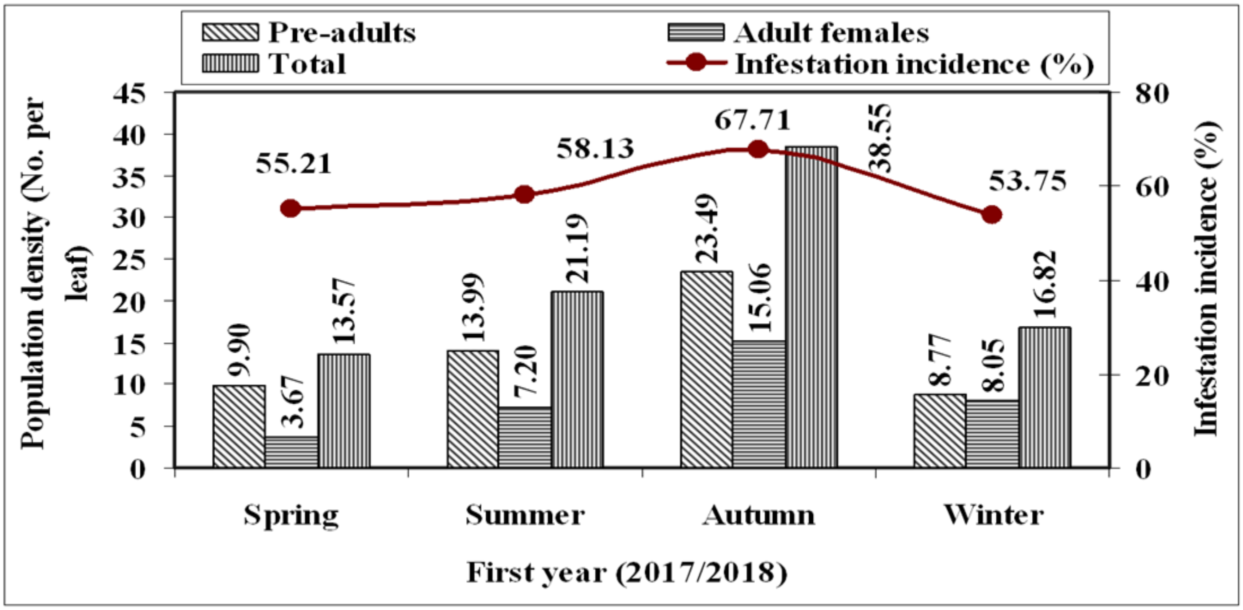


Figure (2): Means of half-monthly counts of different stages and the percentages of infestation incidence by *Lepidosaphes tapleyi* on guava trees, with climatic factors affecting at Esna district, Luxor Governorate during the second year of (2018/2019).



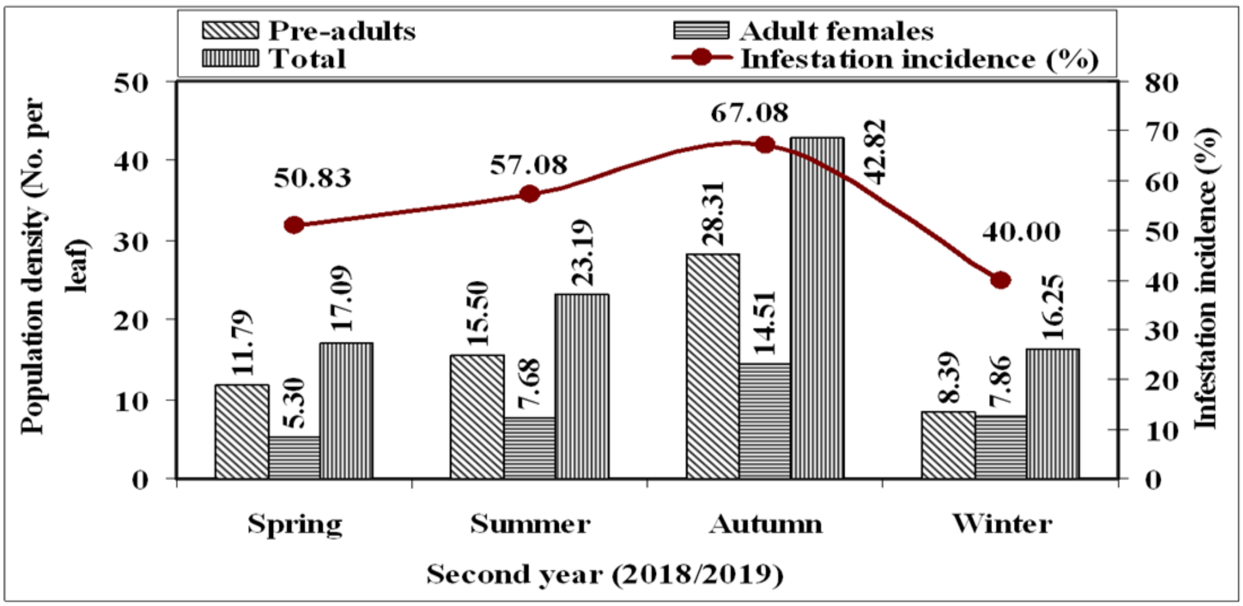


Figure (3): Population density of *Lepidosaphes tapleyi* different stages and the percentages of infestation incidence counted on guava leaves at Esna district, Luxor Governorate during the two successive years (2017/2018 and 2018/2019).

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