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# SEASONAL ABUNDANCE AND FLUCTUATION OF CERTAIN SCALE INSECTS IN CITRUS ORCHARDS AT QUALUBIA AND FAYOUM GOVERNORATES

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***Abstract***

Some biological and ecological aspects of certain scale insects in citrus orchards at Qualubia and Fayoum governorates are reported. The dominant scale insect in Qualubia is *Lepidosaphes beckii* while in Fayoum is *Aonidiella aurantii*. Both scale insects have four generations per year. Climatic conditions have great infleunce on population variability and distribution. Generally, the scale insects (either adult or nymph) prefer the central part of the tree especially in spring and summer seasons.

## INTRODUCTION

Citrus trees are subject to a variety of insect pests among which are scale insects. Host preference, and intensity of infestation differ from one country to another , location to location and from year to year (Bodenheimer 1951; Rawhy 1966; Habib *et al.*, 1971; Helmy 1975, 1982; Abou-Setta 1981). The present work was carried out to shed additional light on certain scale insects attacking citrus trees at Qualubia and Fayoum governorates.

## MATERIALS AND METHODS

Two navel orange orchards were selected at Qualubia and Fayoum governorates similar in area, age of trees, fruit variety and surrounding plantations. Samples of leaves were collected from four trees infested with scale insects (five samples from each tree). Each sample consisted of 10 leaves representing the four cardinal directions plus the centre of the tree. Intervals between every two successive samples were 1-2 weeks at the two locations. Samples were checked under binocular, and the number of either adults or nymphs of scale insects were counted and recorded. The number of generations was investigated according to Audemard (1975) and Jacob (1977) by plotting cummulative percentage of adult and nymph populations on scale gause papers.

## RESULTS AND DISCUSSION

The regular inspections of citrus trees throughout the period of the experiment revealed that the dominant scale insect at Qualubia governorate was the citrus purple scale (*Lepidosaphes beckii* Newman), while at Fayoum governorate was the California red scale (*Aonidiella aurantii* Mask.). Therefore, most attention has been focused on these two pests throughout this study.

### 1 . Population dynamics and seasonal fluctuations

Data presented in Table 1 and illustrated in Fig. 1 show four peaks representing overlapping generations per year of *L. beckii* in Qualubia . The first peak representing the 1st generation appeared on mid July, the 2nd peak on mid September, the 3rd peak at the end of November and the beginning of December and the 4th peak on mid April.

The cummulative percentage of *L.beckii* population throughout the period of experiment is illustrated in Fig. 2. Data clearly showed four correlation lines representing 4 overlapping generations as follows:

Table 1. Fluctuation in population density of *L.beckii* (nymphs & adults) on 10 leaves of navel orange trees in Qualubia governorate during 1990-1991 season.

| Date | average no. of nymphs | | | | | Total | General average | average no. of nymphs | | | | | Total | General average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | E | W | N | S | C | | | E | W | N | S | C | | |
| 26/6/90 | - | 2.1 | - | - | - | 2.10 | 0.42 | 14.10 | - | - | - | 0.20 | 14.30 | 2.86 |
| 5/7 | - | 0.5 | 3.7 | - | - | 4.20 | 0.84 | - | 0.60 | 8.20 | - | 12.00 | 20.80 | 4.16 |
| 15/7 | 2.25 | 1.8 | 7.4 | 33.7 | 15.6 | 60.75 | 12.15 | 15.0 | 0.75 | 6.65 | 1.95 | 9.80 | 34.80 | 6.83 |
| 24/7 | 2.40 | 1.6 | 7.25 | 42.0 | 17.0 | 70.25 | 14.05 | 6.3 | 0.85 | 7.30 | 1.80 | 18.50 | 34.15 | 6.95 |
| 3/8 | - | 0.6 | 3.1 | - | 0.25 | 3.95 | 0.79 | 7.5 | 1.14 | 9.10 | 2.0 | 10.35 | 34.75 | 6.02 |
| 12/8 | - | - | - | - | - | - | - | 7.55 | 2.55 | 12.60 | 13.70 | 7.45 | 30.09 | 8.77 |
| 20/8 | - | - | - | - | - | - | - | 3.4 | - | 5.16 | - | 10.90 | 43.85 | 3.89 |
| 30/8 | - | - | - | - | - | - | - | 3.6 | 0.5 | 8.60 | 18.1 | 0.13 | 19.46 | 6.20 |
| 15/8 | - | - | - | - | - | - | - | - | - | 11.05 | 4.75 | 4.65 | 30.93 | 4.09 |
| 29/9 | - | - | - | - | 14.9 | 14.90 | 2.98 | 3.10 | 0.5 | 6.20 | 12.10 | 8.20 | 20.45 | 6.02 |
| 10/10 | 0.40 | 0.1 | 0.63 | 0.43 | - | 1.56 | 0.31 | 1.7 | 1.5 | 0.26 | 1.66 | 0.3 | 30.10 | 1.17 |
| 25/10 | - | 4.2 | 1.2 | - | 1.1 | 6.50 | 1.30 | 0.26 | 2.7 | 11.10 | 4.10 | 9.03 | 5.85 | 5.44 |
| 10/11 | - | - | 0.7 | - | 0.03 | 0.73 | 0.15 | 9.7 | 13.8 | 6.60 | 6.06 | 21.00 | 27.19 | 11.43 |
| 25/11 | - | 0.7 | 1.5 | 0.50 | 2.10 | 4.80 | 0.96 | 4.5 | 6.5 | 8.2 | 5.10 | 10.00 | 27.16 | 14.89 |
| 10/12 | 0.33 | 0.2 | 0.06 | 0.07 | 9.32 | 0.98 | 0.19 | 1.06 | 4.03 | 4.30 | 2.1 | 3.40 | 34.30 | 2.97 |
| 24/12 | 0.11 | 0.33 | - | 0.10 | 0.47 | 1.01 | 0.20 | 1.5 | 3.7 | 3.1 | 1.8 | 3.7 | 14.89 | 2.76 |
| 9/1/91 | 0.25 | 0.1 | 0.9 | 0.22 | 0.51 | 1.98 | 0.40 | 0.6 | 0.6 | 2.00 | 0.3 | 5.10 | 8.60 | 1.75 |
| 25/1 | - | - | 0.3 | 0.17 | 2.00 | 2.47 | 0.49 | 1.2 | 1.2 | 5.20 | 0.9 | 7.60 | 16.10 | 3.22 |
| 10/2 | - | 0.8 | 1.0 | 0.07 | - | 1.87 | 0.37 | 1.7 | 5.7 | 2.10 | 2.3 | 6.80 | 18.60 | 3.72 |
| 25/2 | - | - | - | 2.9 | 3.2 | 6.10 | 1.22 | 1.5 | 3.3 | 3.00 | 1.7 | 4.30 | 13.80 | 2.76 |
| 6/3 | - | - | 0.13 | - | - | 0.13 | 0.02 | 1.4 | 0.4 | 1.00 | 1.2 | 1.70 | 8.70 | 1.74 |
| 16/3 | 1.50 | 3.5 | 0.7 | 3.9 | 1.3 | 10.90 | 2.18 | 0.8 | 1.5 | 0.60 | 0.3 | 4.90 | 15.80 | 1.62 |
| 1/4 | 0.75 | 0.5 | 1.4 | 3.45 | 0.60 | 6.70 | 1.34 | 0.95 | 1.25 | 6.60 | 6.10 | 0.90 | 15.80 | 3.16 |
| 11/4 | 1.40 | 1.8 | 0.6 | 0.8 | 1.10 | 5.70 | 1.14 | 1.9 | 3.3 | 3.30 | 3.3 | 4.00 | 12.04 | 3.16 |
| 26/4 | 1.90 | 5.2 | 0.77 | 0.40 | 4.80 | 13.07 | 2.61 | 3.0 | 3.27 | 1.43 | 2.17 | 2.17 | | 2.41 |

E = EAst direction W = West direction N = North direction S = South direction C = Center of the tree

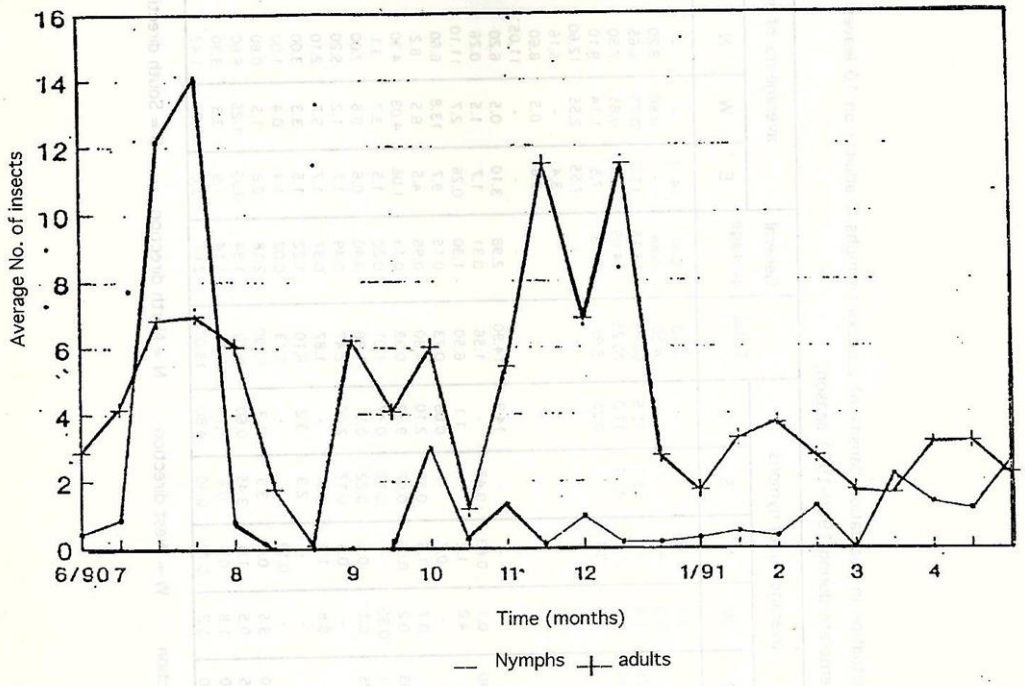


Fig. 1. Seasonal abundance of *L.beckii* at Qualubia governorate (1990 - 1991)

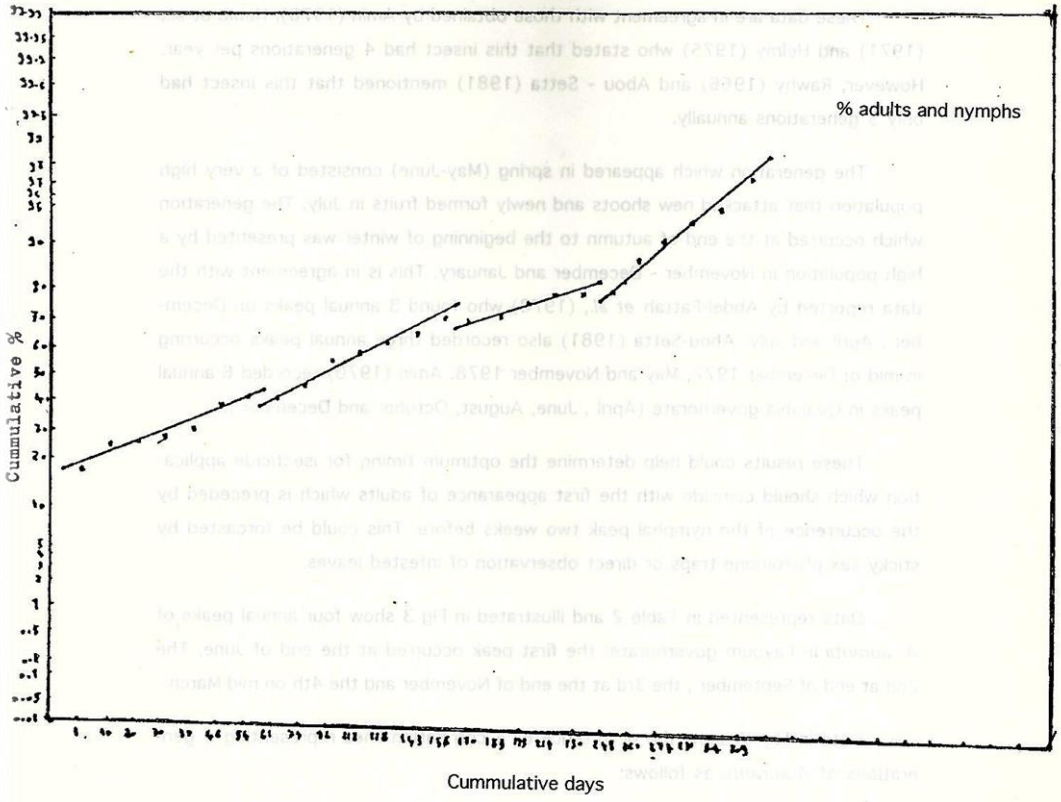


Fig. 2. Approximate number of *L.beckii* generations through the period from June 1990- April 1991.

1st generation lasted about 48 days (end of June-mid August)
2nd generation lasted about 60 days (mid August -mid October)
3rd generation lasted about 80 days (mid October-beginning of January)
4th generation lasted about 100 days (mid January-end of April and the beginning of June).

These data are in agreement with those obtained by Amin (1970), Habib *et al.*, (1971) and Helmy (1975) who stated that this insect had 4 generations per year. However, Rawhy (1966) and Abou - Setta (1981) mentioned that this insect had only 3 generations annually.

The generation which appeared in spring (May-June) consisted of a very high population that attacked new shoots and newly formed fruits in July. The generation which occurred at the end of autumn to the beginning of winter was presented by a high population in November - December and January. This is in agreement with the data reported by Abdel-Fattah *et al.*, (1978) who found 3 annual peaks on December., April and July. Abou-Setta (1981) also recorded three annual peaks occurring in mid of December 1977, May and November 1978. Amin (1970) recorded 6 annual peaks in Qualubia governorate (April , June, August, October and December.).

These results could help determine the optimum timing for isecticide application which should coincide with the first appearance of adults which is preceded by the occurrence of the nymphal peak two weeks before. This could be forcasted by sticky sex pheromone traps or direct observation of infested leaves.

Data represented in Table 2 and illustrated in Fig 3 show four annual peaks of *A. aurantii* in Fayoum governorate; the first peak occurred at the end of June, The 2nd at end of September , the 3rd at the end of November and the 4th on mid March.

Data in Fig. 4 show the occurrence of 4 correlation lines representing 4 generations of *A.aurantii* as follows:

1st generation occurred at the beginning of April until mid July.
2nd generation occurred at mid of July until mid October.
3rd generation occurred at the end of October until the beginning of December.
4th generation occurred at the mid of February until mid May.

Table 2. Fluctuation in population density of *A. aurantii* (nymphs & adults) on 10 leaves of navel orange trees in Qualubia governorate during 1990-1991 season.

| Date | average no. of nymphs | | | | | Total | General average | average no. of nymphs | | | | | Total | General average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | E | W | N | S | C | | | E | W | N | S | C | | |
| 26/6/90 | 2.40 | 3.10 | 2.00 | 6.70 | 23.10 | 37.30 | 7.46 | - | - | - | - | - | - | - |
| 5/7 | 1.50 | 2.10 | 0.70 | 3.40 | 7.50 | 15.20 | 3.04 | - | - | - | - | - | - | - |
| 15/7 | 0.30 | 0.05 | 0.25 | 0.25 | 0.85 | 1.70 | 0.34 | - | - | - | - | - | - | - |
| 25/7 | 0.45 | 1.90 | 1.15 | 1.45 | 0.60 | 5.55 | 1.11 | - | - | - | - | - | - | - |
| 3/8 | 0.20 | 0.50 | 2.00 | 2.80 | 1.60 | 7.10 | 1.40 | 0.60 | 0.30 | 0.70 | 0.70 | 1.10 | 3.40 | 0.68 |
| 10/8 | 1.50 | 1.45 | 0.50 | 3.15 | 2.50 | 9.10 | 1.82 | 0.50 | 1.00 | 0.30 | 0.80 | 0.45 | 3.05 | 0.61 |
| 18.8 | - | - | - | 0.05 | - | 0.05 | 0.01 | 0.80 | 0.70 | 0.60 | 2.80 | 1.80 | 3.70 | 1.34 |
| 25/8 | 0.80 | 1.70 | 1.30 | 0.05 | 0.50 | 4.35 | 0.11 | 0.05 | 0.25 | 0.15 | - | 0.10 | 0.55 | 0.11 |
| 12/9 | 1.10 | 2.60 | 1.20 | 0.25 | 1.50 | 6.65 | 1.33 | 0.75 | 1.20 | 0.20 | 0.60 | 0.10 | 4.75 | 0.95 |
| 29/9 | 2.85 | 11.80 | 0.85 | 0.90 | 0.75 | 17.15 | 4.23 | - | - | - | - | 2.00 | - | - |
| 15/10 | 1.60 | 1.50 | 0.50 | 1.20 | 0.50 | 5.30 | 1.06 | - | - | - | - | - | - | - |
| 31/10 | 0.63 | 2.30 | 2.60 | 0.80 | 1.20 | 7.53 | 1.50 | - | - | - | - | - | - | - |
| 15/11 | 0.75 | 1.70 | 1.30 | 0.50 | 3.40 | 7.65 | 1.53 | - | - | - | - | - | - | - |
| 30/11 | 0.60 | 0.20 | 2.50 | 0.70 | 6.10 | 10.10 | 2.02 | - | - | - | - | - | - | - |
| 12/12 | 0.05 | 0.35 | 0.05 | 0.05 | 0.65 | 1.05 | 0.20 | 0.25 | - | 0.05 | - | - | 0.30 | 0.06 |
| 27/12 | 0.10 | 0.15 | 0.07 | 1.00 | 1.30 | 2.74 | 0.57 | 0.25 | - | - | - | 0.80 | 1.05 | 0.21 |
| 10/1/91 | - | - | 0.16 | 2.10 | 1.20 | 3.61 | 0.72 | - | 0.72 | 0.20 | 0.62 | 0.50 | 2.04 | 0.41 |
| 25/1 | 0.70 | 0.50 | 0.25 | 0.82 | 1.60 | 3.37 | 0.67 | 0.20 | - | 1.10 | 0.56 | 1.60 | 3.47 | 0.69 |
| 10/2 | - | 0.40 | - | - | 1.00 | 1.50 | 0.30 | - | 0.60 | - | - | 0.35 | 0.95 | 0.19 |
| 25/2 | - | 2.53 | 0.20 | - | 0.60 | 1.20 | 0.24 | 0.10 | - | - | - | 0.80 | 0.90 | 0.18 |
| 12/3 | 1.20 | 1.50 | 2.20 | 1.38 | 2.80 | 10.11 | 0.02 | 0.60 | 0.45 | 0.80 | 0.35 | 0.70 | 2.90 | 0.58 |
| 28/3 | 1.30 | 0.65 | - | 0.60 | 2.00 | 5.40 | 1.10 | 1.00 | 1.10 | 0.65 | 0.12 | 0.80 | 3.67 | 0.73 |
| 14/4 | 0.45 | 0.03 | 0.85 | 0.03 | 1.50 | 3.48 | 0.77 | 0.43 | 0.63 | 0.38 | 0.08 | 1.02 | 2.54 | 0.51 |
| 27/4 | 0.27 | 1.40 | 0.57 | 0.17 | 0.80 | 1.84 | 0.39 | 0.27 | 0.17 | 0.30 | 0.63 | 0.80 | 2.17 | 0.43 |
| 2/5 | 0.85 | | 0.40 | 0.70 | 1.90 | 5.25 | 1.05 | 0.67 | 0.38 | 0.52 | 0.30 | 1.07 | 2.94 | 0.59 |

E = East direction W = West direction N = North direction S = South direction C = Center of the tree

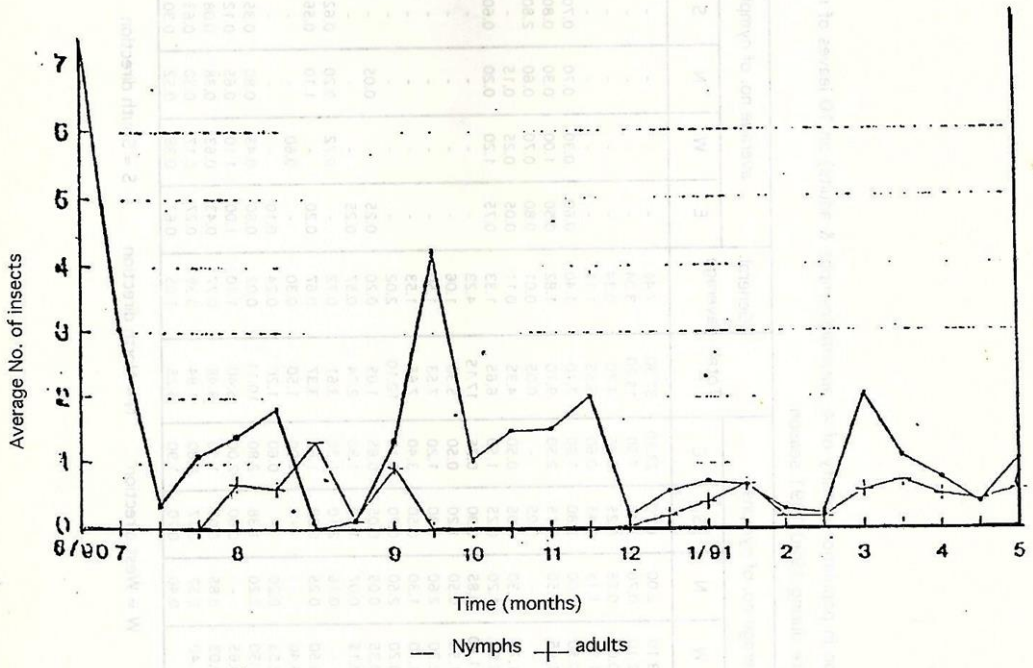


Fig. 3. Seasonal abundance of *A. aurantii* in Fayoum governorate (1990 - 1991)

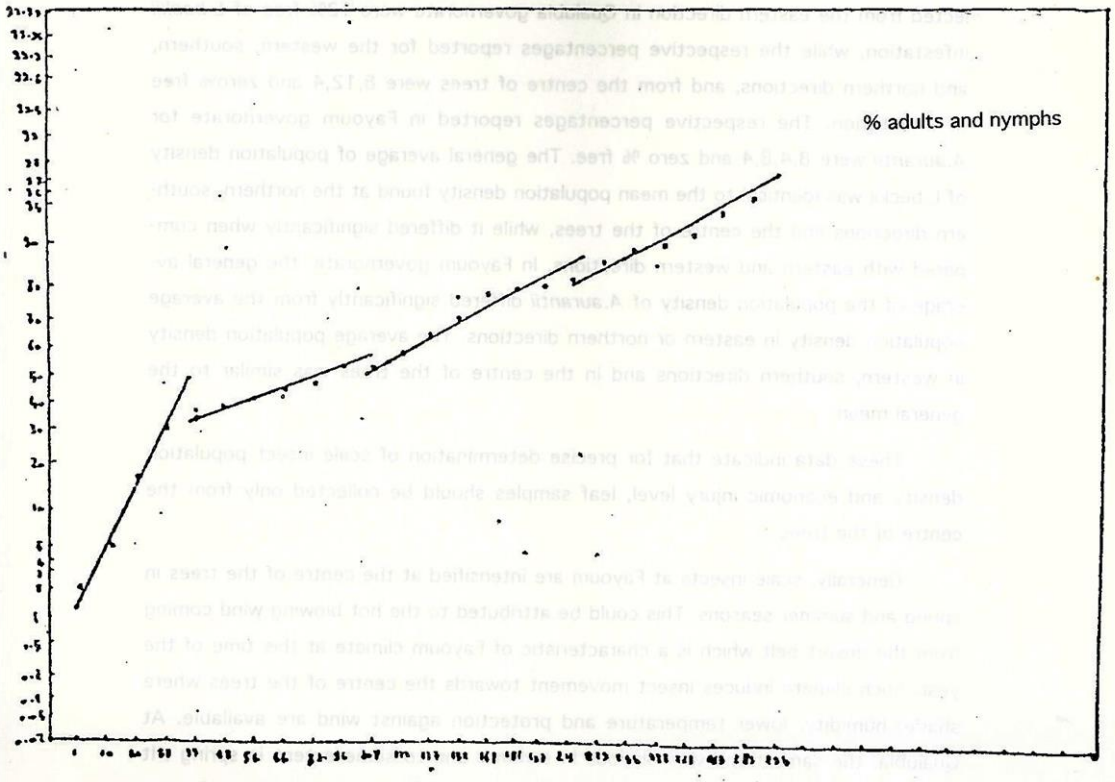


Fig. 4. Approximate number of *A. aurantii* generations through the period from June 1990 - May 1991.

These data are in agreement with those of Amin (1970) and Habib *et al.*, (1971) who found 4 annual generations in the Delta region in Egypt, while Helmy (1982) recorded 4-5 generations.

## 2 . Distribution of scale insects on infested trees

Data presented in Tables (1&2) show clearly that scale insects (adults or nymphs) generally prefer the central part of the tree. Weekly samples of leaves collected from the eastern direction in Qualubia governorate were 12% free of *L.beckii* infestation, while the respective percentages reported for the western, southern, and northern directions, and from the centre of trees were 8,12,4 and zero% free of infestation. The respective percentages reported in Fayoum governorate for *A.aurantii* were 8,4,8,4 and zero % free. The general average of population density of L.beckii was identical to the mean population density found at the northern, southern directions and the centre of the trees, while it differed significantly when compared with eastern and western directions. In Fayoum governorate, the general average of the population density of *A.aurantii* differed significantly from the average population density in eastern or northern directions. The average population density in western, southern directions and in the centre of the trees was similar to the general mean.

These data indicate that for precise determination of scale insect population density and economic injury level, leaf samples should be collected only from the centre of the trees.

Generally, scale insects at Fayoum are intensified at the centre of the trees in spring and summer seasons. This could be attributed to the hot blowing wind coming from the desert belt which is a characteristic of Fayoum climate at this time of the year. Such climate induces insect movement towards the centre of the trees where shade, humidity, lower temperature and protection against wind are available. At Qualubia, the same trend was obvious in summer and to some extent in spring . It could be concluded that temperature, wind velocity and relative humidity influence population distribution of scale insects.

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# التغيرات الموسمية وتذبذب تعداد بعض الحشرات القشرية في بساتين الموالح بمحافظتي القليوبية والفيوم

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يشمل البحث بعض الدراسات البيولوجية والبيئية الخاصة ببعض الحشرات القشرية التي تصيب بساتين الموالح في محافظتي القليوبية والفيوم. أظهرت الدراسة أن الحشرة القشرية الأرجوانية هي أهم الحشرات القشرية التي تصيب بساتين الموالح في محافظة القليوبية ، بينما كانت الحشرة القشرية الحمراء هي الأكثر انتشاراً في محافظة الفيوم . كما أظهرت النتائج وجود أربعة أجيال سنويا لكل حشرة . وأوضحت الدراسة أيضا تأثير العوامل الجوية علي تغير وتوزيع تعداد الحشرات ، وكانت الأجزاء الوسطية من الشجره هي أنسب أماكن تواجد كل من الحشرات الكامله والحوريات خاصه في فصلي الربيع والصيف.