Results and Discussion

IV- RESULTS AND DISCUSSION

4.1- Population Studies on the Plum Scale Insects, *Parlatoria oleae* (Colveé) in Pear, Plum and Apple Orchards :

4.1.1- Seasonal fluctuation :

The seasonal fluctuations in the population density of the plum scale insect, ***P. oleae***, was estimated by monthly samples of 30 branches of 10-15 cm long and one year old of pear, plum and apple trees (3 replicates), which selected at random from orchards at El-Quanater El-Khairiya, Menia El-Kamh and Nobariya locations, throughout three successive years (1993-1995). The mean number of alive individuals on 30 branches was calculated and considered as the population index for one month.

A- On pear trees, at El-Quanater El-Khairiya location :

a- Seasonal fluctuation of the total population :

Data given in Table (1) and Fig. (1), clearly show the fluctuation of the total population of the plum scale insect, ***P. oleae*** on pear branches at El-Quanater El-Khairiya location (Qualubiya governorate). These data indicated a pattern with two peaks of seasonal activity. In the first season of 1993, the total population of the scale insect slightly decreased in February, then began sharply to increase during March and April, reaching its maximum first peak of 10392 total individuals/30 branches in May, at mean temperature of 21.55°C and 58 % R.H. A gradual decrease followed in June, July and August. During September, the total population sharply increased again to reach its second maximum peak of 8184 total individuals/30 branches (25.05°C and 63 % R.H.). A gradual decrease followed in October, November and December. The lowest abundance (2919 total individulas/30 branches) was observed during February at 11.85°C and R.H. of 66 %. In the second season, during 1994, counts of total individuals in February decreased than that of January, then increased rapidly starting from April to reach its highest peak of 10008 individuals/30 branches in May (at

Table (1) : Monthly counts of total alive population of *P. oleae* on 30 pear branches, throughout 1993-1995 successive years in Qualubiya, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	2943	-	11.40	75	3215	-	11.75	64	2859	-	12.60	72
Feb.	2919	0.99	11.85	66	2697	0.84	13.40	63	2847	0.97	13.50	69
Mar.	5622	1.93	16.95	67	5526	2.04	17.75	64	5193	1.86	16.05	68
Apr.	8151	1.45	20.20	62	7830	1.42	20.35	62	8148	1.57	19.70	59
May	10392	1.27	21.55	58	10008	1.28	22.00	55	10143	1.24	20.90	60
Jun.	6108	0.59	24.60	62	6450	0.64	25.05	64	6312	0.62	25.75	65
Jul.	4554	0.75	26.50	62	4599	0.71	26.80	70	4425	0.70	26.70	68
Aug.	3708	0.81	27.05	75	4092	0.89	27.20	73	3540	0.80	27.15	73
Sept.	8184	2.21	25.05	63	7695	1.88	24.45	65	8607	2.43	23.60	69
Oct.	7212	0.88	22.30	66	7185	0.93	22.85	62	7146	0.83	21.85	64
Nov.	5574	0.77	20.20	64	5703	0.79	19.00	66	5895	0.82	19.40	66
Dec.	4245	0.76	15.40	68	4152	0.73	15.25	71	4599	0.78	14.40	70
Total	69612	-	243.05	788	69147	-	245.85	784	69714	-	241.6	803
Mean	5801.0	-	20.25	65.66	5762.3	-	20.48	65.33	5809.5	-	20.13	66.92

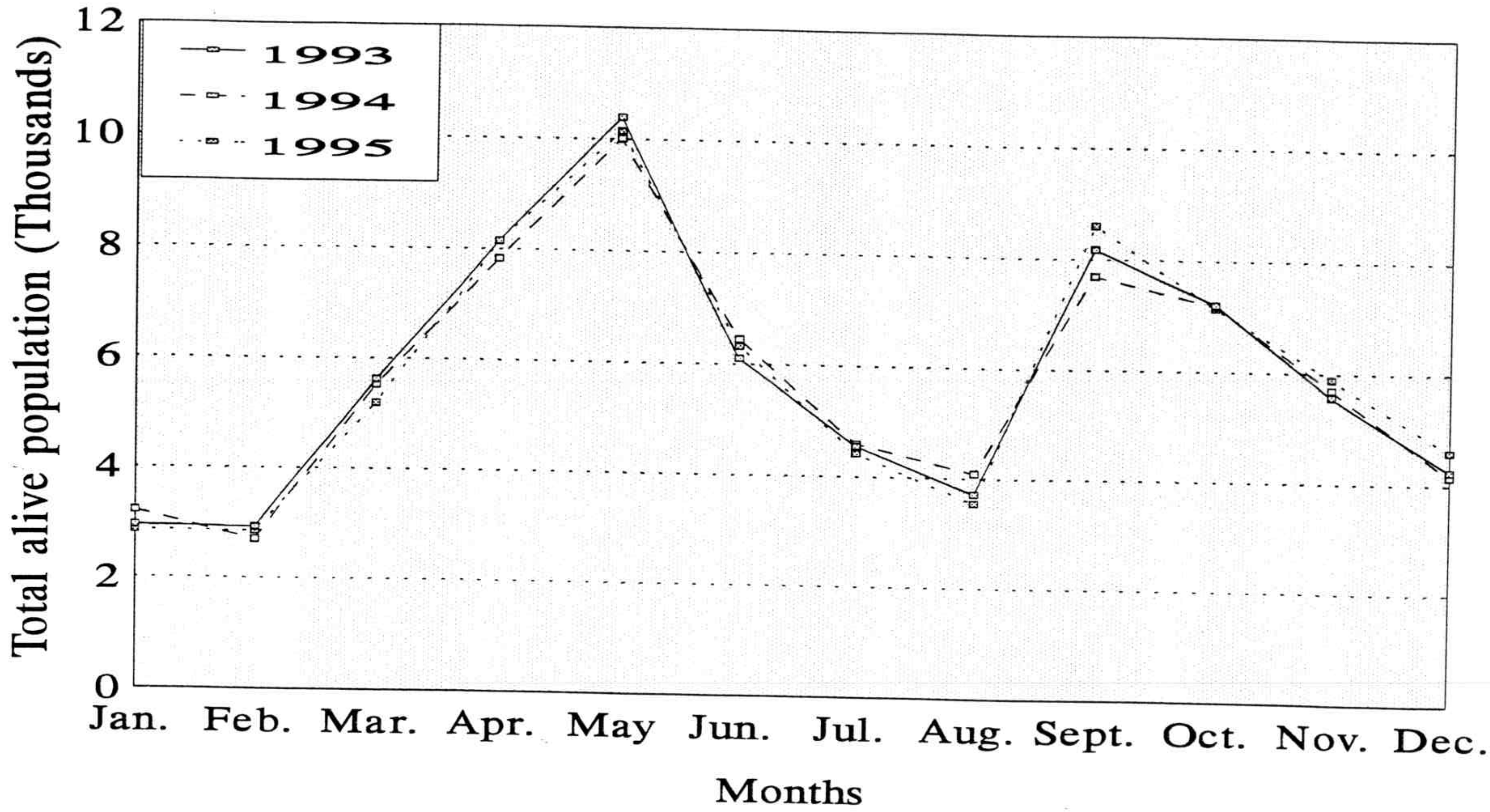

Fig. (1) : Relative abundance of total alive population of ***P. oleae***, on pear at El-Quanater location throughout 1993-1995 years.

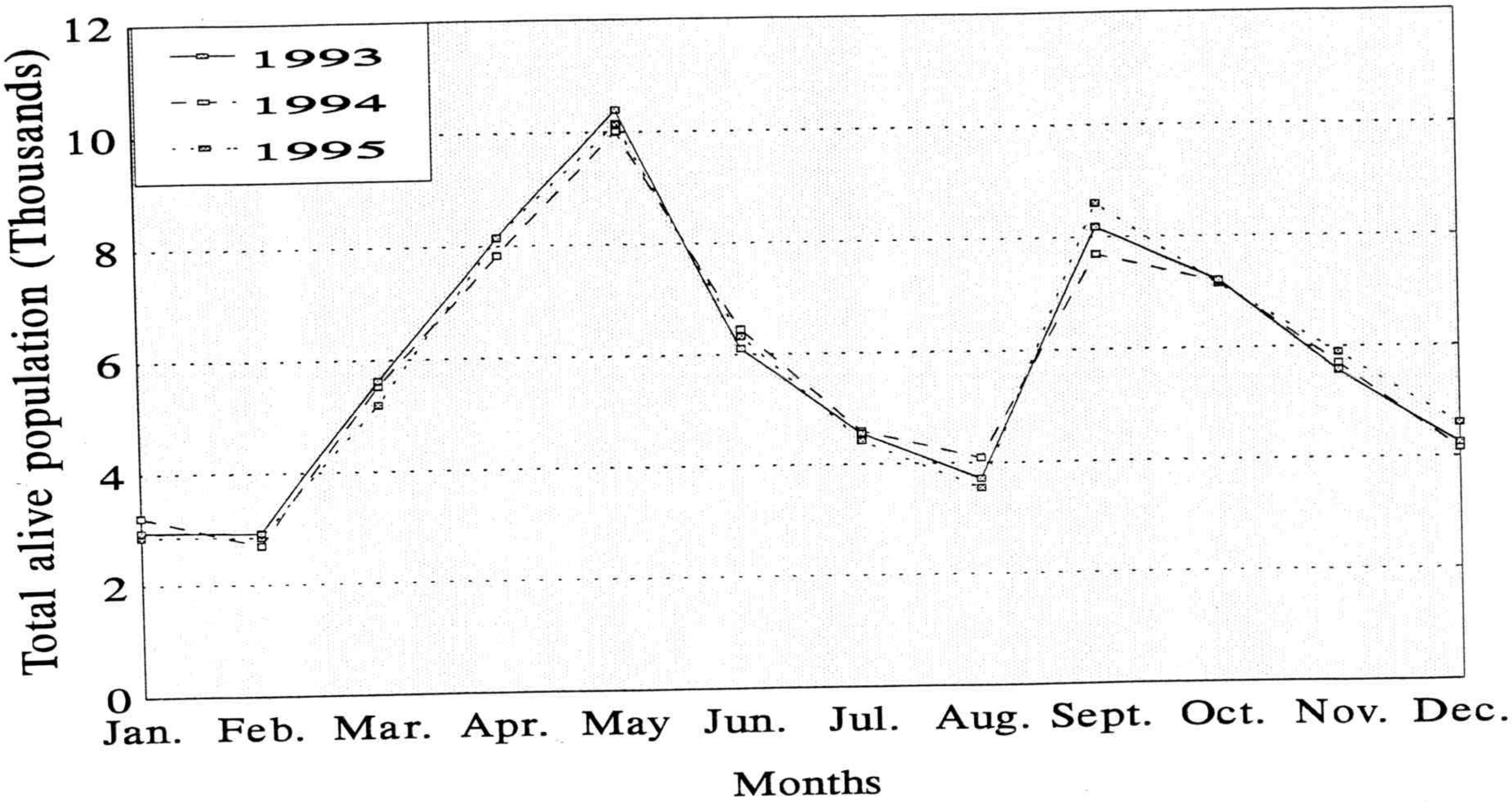

Fig. (1) : Relative abundance of total alive population of ***P. oleae***, on pear at El-Quanater location throughout 1993-1995 years.

22.0°C and 55 % R.H.). The total population of the plum scale insect started to decrease in June and continued decreasing in July and August, then sharply increased in September, to reach its second peak of abundance (7695 total individuals/30 branches at 24.45°C and 65 % R.H.). In October, a gradual decrease in the population was observed, followed by significant decrease in November and December. The lowest abundance was observed also in February (2697 individuals/30 branches at 13.40°C and 63 % R.H.). In the third season, in 1995, almost the same sequence of population fluctuation in the total individual numbers of the plum scale insect was observed. Population of the total insect individuals showedahigh peak of 10143 individuals/30 branches during May, at mean temperature of 20.90°C and 60 % R.H. The second peak of 8607 individuals/30 branches occurred during September at 23.60°C and 69 % R.H. The lowest peak of 2847 individuals/30 branches was always attained in February, at 13.50°C and 69 % R.H. The rate of monthly change in population (rate of change) of the plum scale insect population, as calculated by dividing the number of insect individuals at any count by that of the preceding one, indicated that, the plum scale insect at that location, throughout the three years of study (1993-1995), had four favourable periods for increase, in March, April, May and September. The highest rate of increase occurred in September during 1993 and 1995, but in March during 1994. This may be attributed to the relatively low numbers of insect individuals in the preceding counts. The three years data indicated that, on pear trees, in Qualubiya, the total population of the plum scale insect reaches its highest abundance during May, followed by September; while its lowest abundance occurs during February followed by January, with the highest rate of increase in September and March, while severest rate of decrease, was during June. The obtained results are in agreement with those of **Ezzat (1957),** who stated that crawlers of ***P. oleae***, started to come out in May to form the first peak of population (of the spring brood), where crawlers of the fall brood came out in August and ended before October, forming the second peak of insect population (of the fall brood). Also results are almost on the same line with those of **Huffaker *et al.* (1962),** who reported that ***P. oleae*** has two generations a year, with two maximum peaks of population, the first was observed in May and the second in August. **Applebaum and Rosen (1964)** observed, in Israel, two peaks of the plum scale insect population, the first was during June, while the other was in September, almost the same obtained results.

b- Seasonal fluctuation of different stages of *P. oleae* on pear trees in Qualubiya governorate :

1- The adult females (females without laying eggs) :

Data obtained throughout the three years of the study are given in Table (2), and illustrated in Fig. (2). From the obtained data on monthly counts of adult females of ***P. oleae*** infesting 30 branches of pear trees at El-Quanater El-Khairiya location, during the first season of the study, in 1993, it was clearly observed that the adult females has two peaks of annual activity. Mean total population of adult females/30 branches decreased gradually during January, February, March, April and May, then rapidly increased during June to reach its first peak with 3213 females/30 branches, at mean temperature 24.60°C and 62 % R.H. Females showed also their highest rate of increase of 2.68 during the same month (June). Population of adult females started to decrease steadily during July and August, then sharply increased in September and October to reach its second highest peak in November (4764 adult females/30 branches at 20.20°C and 64 % R.H.). The lower peak (1200 females/30 branches) was observed in May at 21.55°C and 58 % R.H. The severest rates of decrease, were observed during May (0.65) and July (0.63). The gradual decreases in adult females population during December, January and February, could be attributed to the cold weather prevailing during these months, but decreases occurred in March, April, May, July and August, could be attributed to the development of the adult

Table (2) : Monthly counts of alive adult females of *P. oleae* on 30 pear branches, throughout 1993-1995 successive years in Qualubiya, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	2943	-	11.40	75	3210	-	11.75	69	2859	-	12.60	72
Feb.	2739	0.93	11.85	66	2487	0.77	13.40	63	2787	0.97	13.50	69
Mar.	2640	0.96	16.95	67	2763	1.11	17.75	64	2487	0.89	16.05	68
Apr.	1845	0.70	20.20	62	1929	0.70	20.35	62	1893	0.76	19.70	59
May	1200	0.65	21.55	58	1113	0.58	22.00	55	1143	0.60	20.90	60
Jun.	3213	2.68	24.60	62	3423	3.07	25.05	64	3111	2.72	25.75	65
Jul.	2040	0.63	26.50	62	1830	0.53	26.80	70	1563	0.50	26.70	68
Aug.	1518	0.74	27.05	75	1836	1.00	27.20	73	1303	0.83	27.15	73
Sept.	2409	1.59	25.05	63	2304	1.25	24.45	65	2553	1.96	23.60	69
Oct.	3873	1.61	22.30	66	3738	1.62	22.85	62	3996	1.57	21.85	64
Nov.	4764	1.23	20.20	64	4551	1.22	19.00	66	4860	1.22	19.40	66
Dec.	4245	0.89	15.40	68	4032	0.89	15.25	71	4307	0.89	14.40	70
Total	33429	-	243.05	788	33216	-	245.85	784	32862	-	241.6	803
Mean	2785.75	-	20.25	65.66	2768.00	-	20.48	65.33	2738.50	-	20.13	66.92

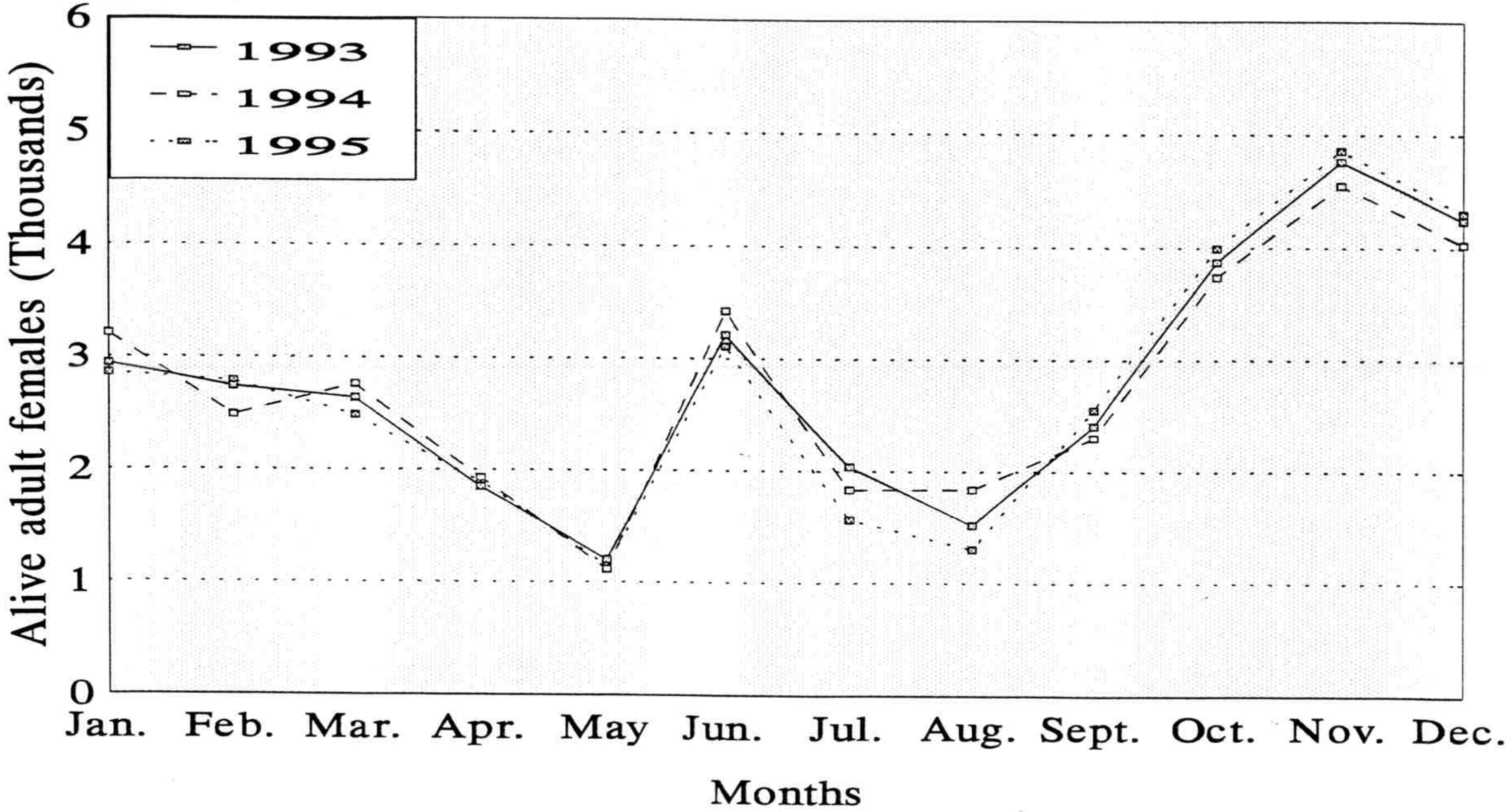

Fig. (2) : Relative abundance of alive adult females of ***P. oleae***, on pear at El-Quanater location throughout 1993-1995 years.

females to the next ovipositing females which will be discussed later. Also, the lowest abundance of adult females' population during May, with a severe rate of decrease, indicated that the highest conversion rate from adult females to ovipositing females occurred in this month.

During 1994, the fluctuation in the population of ***P. oleae*** adult females followed the same trend of fluctuation. Counts of adult females decreased steadily in January, February, March, April and sharply in May (where most of adult females developed to ovipositing female individuals), then rapidly increased during June showing the first peak of the adult females abundance (3423 females/30 branches) combined with the highest rate of increase (3.07), at means of 25.05°C and 64 % R.H., the same sequence of events occurred as in 1993. The population of adult females rapidly decreased during July and August, and consequently raised in September, and continued to raise during October to reach the second peak of abundance (4551 females/30 branches) during November, at means of 19.00°C and 66 % R.H. The lowest abundance (1113 females/30 branches) was also observed in May combined with a severe rate of decrease (0.58) at 22.00°C and 55 % R.H.

During the third season of the study, in 1995, the population of ***P. oleae*** females, followed the same fluctuations, showing two peaks, the first of 3111 females/30 branches was during June, at 25.75°C and 65 % R.H., where the second of 4860 females/30 branches was during November, at 19.4°C and 66 % R.H., as shown in Table (2). Results obtained throughout three years of study, at El-Quanater El-Khairiya location, indicated in general that, these females have a pattern with two peaks of annual activity, the first occurs in June, accompanied with the highest rate of increase, followed by another peak occurring in November, which also accompanied with a high rate of increase in the population of these individuals.

2- The ovipositing female individuals :

Data tabulated in Table (3) and illustrated in Fig. (3), show the monthly counts of ovipositing females individuals of ***P. oleae*** infesting 30 branches of pear, at El-Quanater El-Khairiya location throughout the three years of study (1993-1995). During the first season, 1993, it was observed that the ovipositing females individuals has two peaks of annual activity. These females were completely absent in January and began to appear during February in comparatively low numbers. A rapid increase in numbers of these females occurred in March and continued to increase reaching its first and higher peak of abundance (2214 ovipositing individuals/30 branches) in April at means of 20.20°C and 62 % R.H. A gradual decrease in number occurred in May, followed by sharp decrease during June and July, then started a rapid increase in August, to reach its second peak of 1665 ovipositing individuals/30 branches in September, at 25.05°C and 63 % R.H. The second high peak of the ovipositing females declined sharply in October and November and completely vanished in December. The highest rate of increase was observed in August (2.75), and may be due to the low numbers of these individuals in the preceding month, in July. Ovipositing females were of low abundance in February, at means of 11.85°C and 66 % R.H., also in November 1993 (20.2°C and 64 % R.H.), as only 180 individuals/30 branches were counted in each month. The first peak of abundance (in April), was higher as compared with that occurred in September, indicating that high percentage of females laid their eggs in that month. The same sequence of fluctuations occurred in the second (1994) and third (1995) seasons almost at the same times, but in different numbers of ovipositing females depending on the weather and biotic factors, which naturally changes from year to another.

From the obtained data, it could be concluded that in January and December, the ovipositing females were nearly completely absent, and the ovipositing females begins to appear in few numbers during February and reaches

Table (3) : Monthly counts of alive ovipositing individuals of *P. oleae* on 30 pear branches, throughout 1993-1995 successive years in Qualubiya, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	-	-	11.40	75	-	-	11.75	69	-	-	12.60	72
Feb.	180	-	11.85	66	210	-	13.40	63	60	-	13.50	69
Mar.	1980	11.0	16.95	67	1671	7.96	17.75	64	1749	29.15	16.05	68
Apr.	2214	1.12	20.20	62	1899	1.36	20.35	62	2055	1.18	19.70	59
May	1644	0.74	21.55	58	1473	0.78	22.00	55	1404	0.68	20.90	60
Jun.	654	0.40	24.60	62	642	0.44	25.05	64	723	0.51	25.75	65
Jul.	414	0.63	26.50	62	426	0.66	26.80	70	399	0.55	26.70	68
Aug.	1140	2.75	27.05	75	1122	2.653	27.20	73	1251	3.14	27.15	73
Sept.	1665	1.46	25.05	63	1404	1.25	24.45	65	1869	1.49	23.60	69
Oct.	399	0.24	22.30	66	423	0.30	22.85	62	648	0.35	21.85	64
Nov.	180	0.45	20.20	64	540	1.28	19.00	66	360	0.55	14.40	66
Dec.	-	0.00	15.40	68	-	0.00	15.25	71	24.00	0.07	14.40	70
Total	10470	-	243.05	788	9810	-	245.85	784	10542	-	241.6	803
Mean	872.5	-	20.25	65.66	817.5	-	20.48	65.33	878.5	-	20.13	66.92

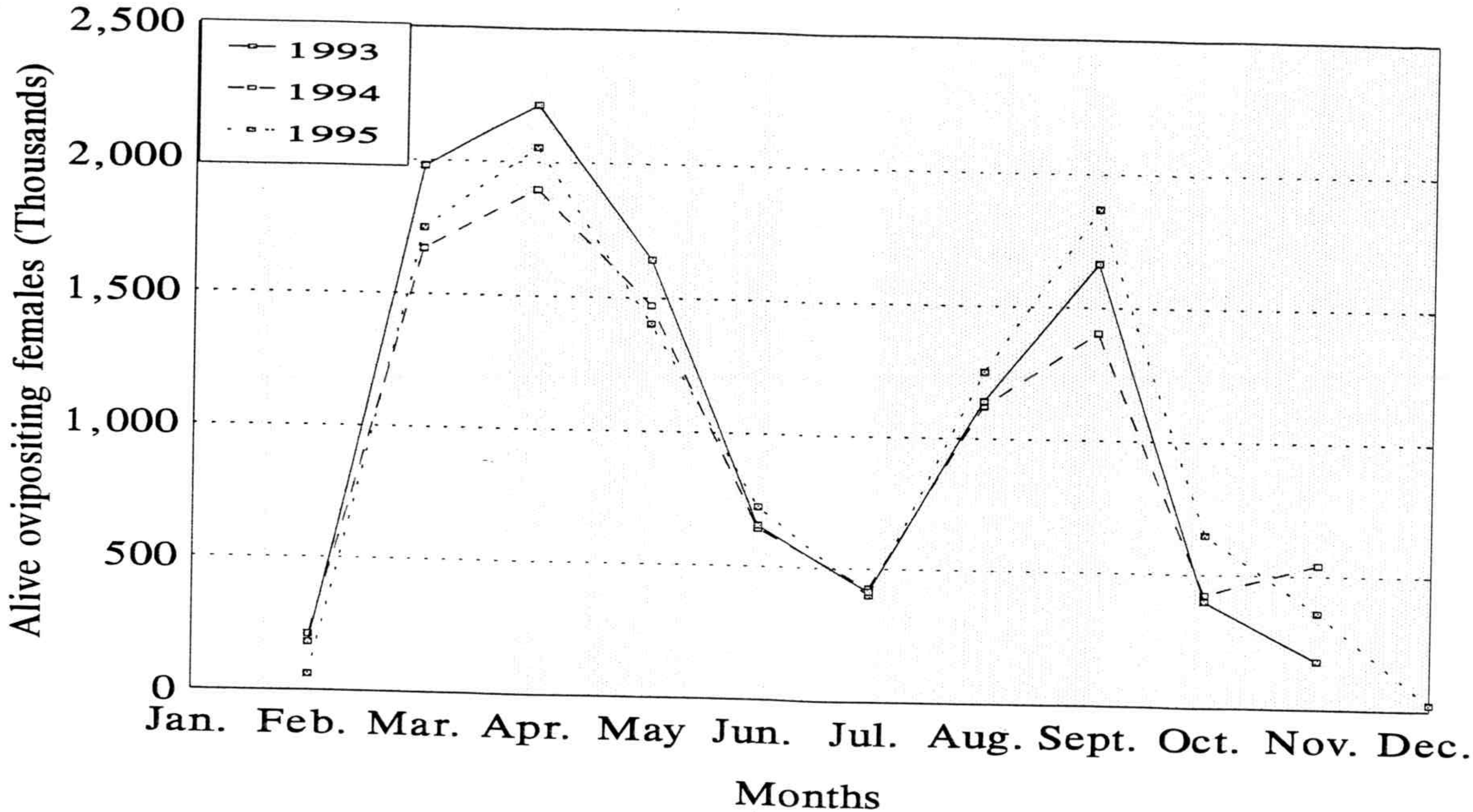

Fig. (3) : Relative abundance of alive ovipositing females of ***P. oleae***, on pear at El-Quanater location throughout 1993-1995 years.

two peaks of abundance a year; the first, which is the higher in April, and the second in September.

3- The nymphal stage (crawlers and immature individulas) :

Data given in Table (4) and represented in Fig. (4) showed that the fluctuation in the population of nymphal stage of the plum scale insect, ***P. oleae*** throughout three years of study, has a pattern with two peaks of annual activity. During the first season of 1993, this nymphal stage was, completely absent during January and February months, where they started to appear in March in moderate numbers (1002 individuals/30 branches). A rapid increase in population followed in April, combined with the highest rate of increase in the population of 4.08. A sharp second increase in the nymphs population recorded during May, reaching the first and highest peak of this stage, being 7548 nymphs/30 branches of pear trees, at El-Quanater El-Khairiya location, at means of 21.55°C and 58 % R.H. A sharp decline in the nymphs population followed and occurred during June (2241 nymphs/30 branches), then followed by a moderate decrease in the population number in July (2100 nymphs/30 branches). This tendency to decrease continued up to the end of August (1050 nymphs/30 branches). In September, a rapid reincrease in population started to reach the second high peak of this stage of 4110 nymphs/30 branches at means of 25.05°C and 63 % R.H. In October month, a significant decrease in the nymphs population was observed, followed by a sharp drop in the population during November (630 nymphs/30 branches) at 20.20°C and 64 % R.H. Afterwards, this stage disappeared and rarely counted starting from December and up to next March mainly due to the conversion to the adult hibernating females. No individuals of this stage were observed between late December and next early February. the lowest abundance of 630 nymphs/30 branches that occurred in November, was found also associated with the severest rate of population decrease of 0.21. Population fluctuation of this stage, during the second and the third studied years of 1994

Table (4) : Monthly counts of nymphal stage individuals of *P. oleae* on 30 pear branches, throughout 1993-1995 successive years in Qualubiya, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	-	-	11.40	75	-	-	11.75	69	-	-	12.60	72
Feb.	-	-	11.85	66	-	-	13.40	63	-	-	13.50	69
Mar.	1002	-	16.95	67	1092	-	17.75	64	957	-	16.05	68
Apr.	4092	4.08	20.20	62	4002	3.66	20.35	62	4200	4.38	19.70	59
May	7548	1.84	21.55	58	7422	1.85	22.00	55	7596	1.81	20.90	60
Jun.	2241	0.29	24.60	62	2385	0.32	25.05	64	2478	0.33	25.75	65
Jul.	2100	0.94	26.50	62	2343	0.98	26.80	70	2463	0.99	26.70	68
Aug.	1050	0.50	27.05	75	1134	0.48	27.20	73	984	0.40	27.15	73
Sept.	4110	3.91	25.05	63	3987	3.52	24.45	65	4185	4.25	23.60	69
Oct.	2940	0.72	22.30	66	3024	0.76	22.85	62	2502	0.60	21.85	64
Nov.	630	0.21	20.20	64	612	0.20	19.00	66	675	0.30	19.40	66
Dec.	-	0.00	15.40	68	120	0.20	15.25	71	270	0.40	14.40	70
Total	25713	-	243.05	788	26121	-	245.85	784	26310	-	241.6	803
Mean	214.75	-	20.25	65.66	2176.75	-	20.48	65.33	2192.50	-	20.13	66.92

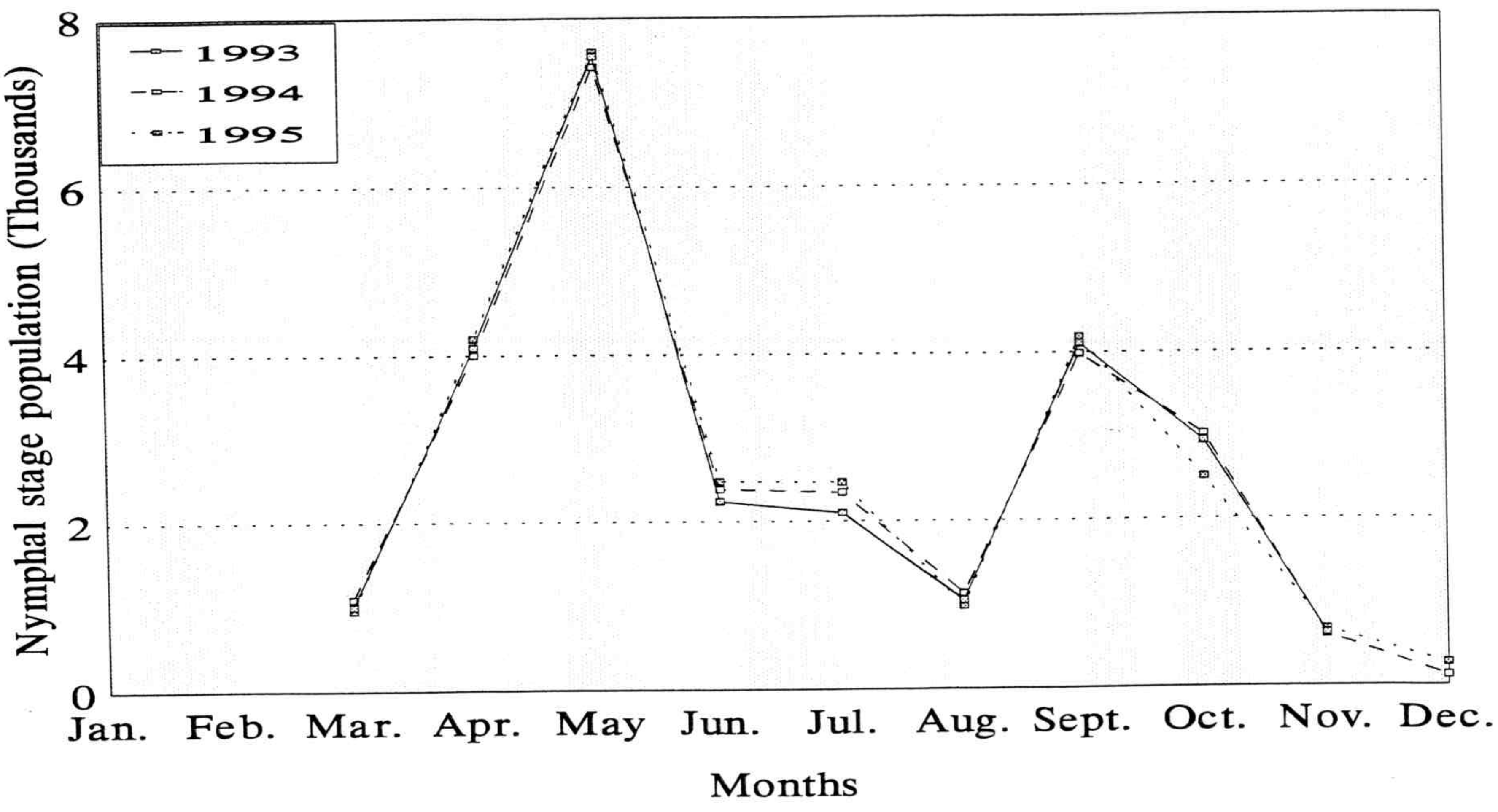

Fig. (4) : Relative abundance of nymphal stage individuals of ***P. oleae***, on pear at El-Quanater location throughout 1993-1995 years.

and 1995, followed the same tendency of the first studied year of 1993, except for the lowest peak which occurred during December in seasons of 1994 and 1995, whereas it occurred in November of 1993.

From results obtained, it could be concluded that the nymphal stage of the plum scale insect, ***P. oleae***, has two main periods of annual activity in which the population size of these immature individuals (mobile crawlers and other immature but settled ones) reaches two peaks of abundance. The first and higher peak occurs in May, whereas the second often occurs during September. The population size of this stage represented 28.9 % and 14.7 % of the total population of ***P. oleae*** of the whole three years of study in the first and second peaks, respectively. From the obtained results, it could be also observed that the lowest abundance of this stage mainly occurs in November, but if recorded in December due to the presence of very few numbers of unexpected individuals during this month, it could be neglected and it may be safely concluded that the lowest abundance of the nymphal stage occurs in November.

Observation indicated that the first and highest peak of this stage resulted from the first and highest peak of the ovipositing females, which prevails in April, while the second high peak resulted from the second high peak of the ovipositing females which arised during August and September of the same year. Decreases in population of the nymphal stage which observed to occur during June, July and August, could be attributed to the hot summer days, in which the day maximum temperature reached 32.8, 33.9 and 33.2°C during June, July and August 1994, for instance. On the other hand, decreases in the population of this stage, beginning from October to complete disappearance in December, January and often February, could be due to two main factors, the first is the adverse effect of the low temperature during winter months on this delicate stage (especially crawlers), whereas the second is the successive development to the next adult stage (males and females), where adult females hibernate as gravid females **(Gmoaa, 1978 and Huang *et al.*, 1989).**

c- The rates of monthly changes in population of different stages of *P. oleae* on pear trees, at El-Quanater El-Khairiya location :

This rate was calculated by dividing the population of each month by the population of the preceding month, whereas the quotient would express any increase (if more than one) or decrease (if less than one) in the population size according to the surrounding factors.

On pear trees, concerning the total insect population during the first season of 1993, the highest rate reached 2.12, was observed in September (this means that, the total population in September was 2.21 times the total population of August of the same year) at 25.05°C and 63 % R.H., followed by another high rate observed in March (1.93), at means of 16.95°C and 67 % R.H. The same sequence in this concern occurred in 1995 season, where the highest rate of increase in the total population (2.43), occurred in September at 23.60°C and 69 % R.H., followed by that of March (1.86 at 16.05°C and 68 % R.H.). In the second season, in 1994, the situation was different whereas the highest rate of increase in the total population occurred in March (2.04), at means temperature of 17.75°C and 64 % R.H., followed by a second high rate in September (1.88), at means of 24.45°C and 65 % R.H. (Table, 1). This difference seems to be a temporarily conversion and occurred due to the comparatively small population size during February of 1994. The obtained results indicated that, the mean temperature lays between 23°C and 25°C combined with 63-69 % R.H., could be considered as partial factors that may induce a considerable increase in the population of the plum scale insect.

Concerning the adult female stage, the highest rate of increase was observed in June throughout the three seasons of study, being 2.68, 3.07 and

2.72, respectively. The means of temperature were 24.6°C, 25.05°C & 25.75°C and of 62, 64 & 65 % R.H. in 1993, 1994 & 1995, respectively. This showing that the mean temperature ranged between 24.60°C and 25.75°C, and R.H. between 62 and 65 %, were the optimal temperature degrees and percentage of relative humidity, which could enhance the development of the immature nymphal stage to the mature adult females (Table, 2).

In case of ovipositing females, the highest rate of increase was observed in March, being 11.0, 7.96 and 29.15, at means 16.96, 17.,75 & 16.05°C and 67, 64 & 68 % R.H. during 1993, 1994 and 1995, respectively. The calculated values in this case seems very high due to the numbers of the ovipositing females which counted in February when compared with those of March. In August, allover the three years of the study, another high rates of increase (but lower than the former ones), concerning this stage were observed, being 2.75, 2.63 and 3.14 at means of 27.05, 27.20 & 27.15°C and 75, 73 & 73 % R.H., in the three successive years of the study, respectively (Table, 3).

In case of the nymphal stage, two high rates of population increase of almost equal values were observed throughout the three years of the study (Table, 4). The first high rate of nymphal population increase occurred in April and was calculated as 4.08, 3.66 and 4.38, at means of 20.20, 20.35 & 19.17°C and 62, 62 & 59 % R.H., in 1993, 1994 and 1995, respectively. The second high rate of increase occurred in September along the three seasons of the study, where it was 3.91, 3.52 and 4.25 at means of 25.05, 24.45 & 23.60°C and 63, 65 & 69 % R.H., respectively. The obtained data indicated that the plum scale insect has two main periods of egg hatching, the first is in April and May (which occupied with the greatest numbers of nymphal stage, but not accompanied with the highest rate of increase) and the second is in September.

d- Number of generations of *P. oleae* per year, on pear trees at Qualubiya governorate :

The number of generations of ***P. oleae*** was calculated depending on the relative abundance of nymphs in the total population **(Bodenheimer, 1951),** on pear trees at El-Quanater El-Khairiya location throughout the three successive years of 1993, 1994 and 1995. Data recorded in Table (5) and illustrated in Fig. (5), showed that there was a general trend of an increasing rate of the nymphal stage within the insect total population to reach its maximal percentages in May during the three years of the study, represented by 72.63, 74.16 and 74.89 %, respectively. A significant fall occurred in June to reach 36.68, 36.93 and 39.26 % of the total population during 1993, 1994 and 1995, respectively. A second peak of relative nymphal abundance was observed in July during the three seasons of study, constituting 46.11, 50.95 and 55.66 % of the total counts, respectively. A sharp fall was observed to occur in August within the percentage of the nymphal stage to reach 28.32, 27.71 and 27.80 % of the total population in the three studied successive years. A third peak of nymphal abundance appeared in September when nymphs counted 50.22, 52.82 and 48.62 % of total population in 1993, 1994 and 1995, respectively. A gradual fall in the percentages of nymphs occurred in October to reach 40.77, 42.09 and 35.01 %, followed by a sharp drop in November, to reach only 6.46, 10.73 and 11.45 % of the total population, subsequently continued falling during December to reach zero, 2.89 and 5.87 % of the total population in 1993, 1994 and 1995, respectively. Accordingly, on pear trees at El-Quanater El-Khairiya location, representing Qualubiya governorate, ***P. oleae*** mostly has three integral generations a year, the first, which is the abundant one, starts in March, reaches its peak of abundance during May and ends during late June. The second one starts in June, reaches its peak of abundance during July and starts to degenerate in August. The third generation, the longest one, starts in August, and continues to the next March, where most of its individuals hibernate and overwinter as gravid females.

Table (5) : **Relative abundance of the nymphal stage of *P. oleae* on pear trees at El-Quanater location, Qualubiya, indicating number of generations/year.**

Year	1993			1994			1995		
Date of sampling	**Total No. of insects**	**Total No. of nymphs**	**% of nymphs**	**Total No. of insects**	**Total No. of nymphs**	**% of nymphs**	**Total No. of insects**	**Total No. of nymphs**	**% of nymphs**
Jan.	2943	-	0	3210	-	0	2859	-	-
Feb.	2919	-	0	2697	-	0	2847	-	-
Mar.	5622	1002	17.82	5526	1092	19.76	5193	957	18.43
Apr.	8151	4092	50.20	7830	4002	51.20	8148	4200	51.55
May	10392	7548	*72.63	10008	7422	*74.16	10143	7596	*74.89
Jun.	6108	2241	36.68	6450	2385	36.98	6312	2478	39.26
Jul.	4554	2100	*46.11	4599	2345	*50.95	4425	2463	*55.66
Aug.	3708	1050	28.32	4092	1134	27.71	3540	984	27.80
Sept.	8184	4110	*50.22	7695	3987	*51.81	8607	4185	*48.62
Oct.	7212	2940	40.77	7185	3024	42.09	7146	2502	35.01
Nov.	5574	630	6.45	5703	612	10.73	5895	675	11.45
Dec.	4245	-	0	4152	120	2.89	4599	270	5.87

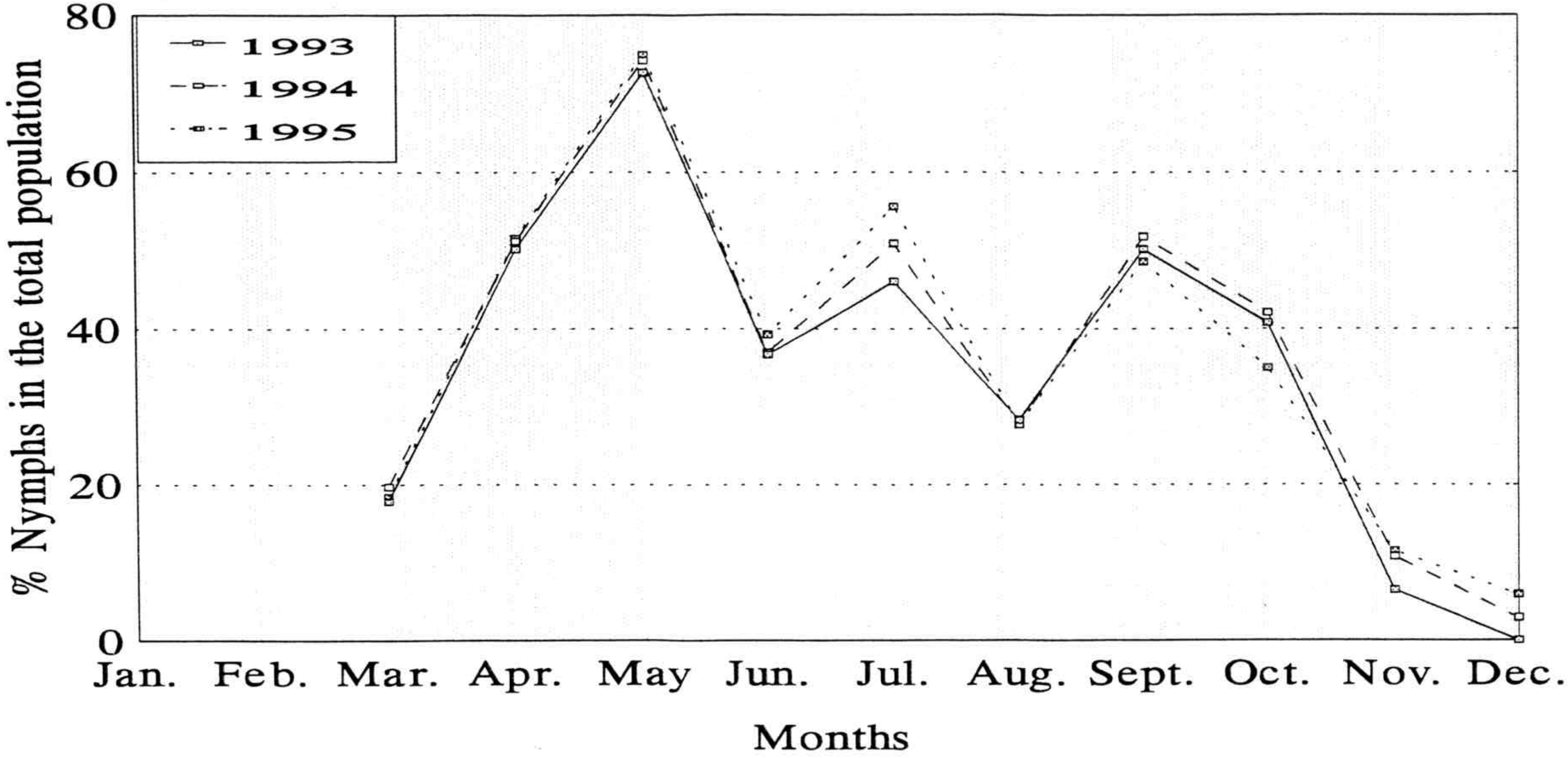

Fig. (5) : Number of generations of ***P. oleae***, on pear at El-Quanater location throughout 1993-1995 years.

e- Age-structure of *P. oleae* on pear trees, at El-Quanater El-Khairiya location :

Due to results reported in Tables (1, 2, 3 and 4) and represented in Figs. (1, 2, 3 and 4), the compost-age structure of ***P. oleae*** on pear trees showed total populations of 69612, 69147 and 69714 individuals in 1993, 1994 and 1995, respectively. Adult females represented 48.02 %, 48.03 % and 47.14 % during the three studied years, respectively. Ovipositing females was represented by 15.04 %, 14.19 % and 15.12 % during the three seasons, with the same sequence. Nymphal stage was represented by 36.94, 37.77 % and 37.74 %, respectively. the reported data and the obtained results, showed that the adult female stage prevails throughout the season, constituting range between 47.14 and 48.03 % of the total population, followed by the nymphal stage, which occupied a percentage ranged between 36.94 and 37.77 of the insect total population. Ovipositing females comprised the least abundant stage allover the three studied seasons, where its percentage within the total population, did not anyhow exceed 15.12 % throughout the whole period of the study.

B- On plum trees, at El-Quanater El-Khairiya location :

a- Seasonal fluctuation of the total population :

Data given in Table (6) and Fig. (6), showed that the fluctuation of the total population of the plum scale insect, ***P. oleae*** on plum trees, in El-Quanater El-Khairiya location (Qualubiya governorate), indicated a pattern with two main peaks of annual activity. During 1993, 1994 and 1995 seasons, the total population of the scale insect showed a slight decrease during February to reach about 87 % of January population. In March of the three studied seasons, the total population started to increase in a considerable rate of increase (where it reached an average of 2.2 during March), and continued increasing in April to reach its first peak of 3684, 3972 and 4266 individuals/30 branches during May

Table (6) : Monthly counts of total alive population of *P. oleae* on 30 plum branches, throughout 1993-1995 successive years in Qualubiya, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	1386	-	11.40	75	1521	-	11.75	69	1659	-	12.60	72
Feb.	1224	0.88	11.85	66	1278	0.84	13.40	63	1479	0.89	13.50	69
Mar.	2484	2.03	16.95	67	3144	2.46	17.75	64	3063	2.10	16.05	68
Apr.	3639	1.34	20.20	62	3336	1.06	20.35	62	3561	1.10	19.70	59
May	3684	1.10	21.55	58	3972	1.19	22.00	55	4266	1.31	20.90	60
Jun.	2895	0.79	24.60	62	3435	0.86	25.05	64	3348	0.78	25.75	65
Jul.	2457	0.85	26.50	62	2535	0.74	26.80	70	2676	0.80	26.70	68
Aug.	1749	0.71	27.05	75	2184	0.86	27.20	73	1809	0.70	27.15	73
Sept.	4020	2.30	25.05	63	4323	1.98	24.45	65	4431	2.44	23.60	69
Oct.	3132	0.78	22.30	66	2778	0.64	22.85	62	3444	0.78	21.85	64
Nov.	3138	1.01	20.20	64	3520	1.27	19.00	66	3639	1.10	19.40	66
Dec.	2088	0.67	15.40	68	2112	0.60	15.25	71	2229	0.61	14.40	70
Total	31896	-	243.05	788	34138	-	245.85	784	35604	-	241.6	803
Mean	2633	-	20.25	65.66	2845.25	-	20.48	65.33	2967	-	20.13	66.92

Table (6) : Monthly counts of total alive population of *P. oleae* on 30 plum branches, throughout 1993-1995 successive years in Qualubiya, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	1386	-	11.40	75	1521	-	11.75	69	1659	-	12.60	72
Feb.	1224	0.88	11.85	66	1278	0.84	13.40	63	1479	0.89	13.50	69
Mar.	2484	2.03	16.95	67	3144	2.46	17.75	64	3063	2.10	16.05	68
Apr.	3639	1.34	20.20	62	3336	1.06	20.35	62	3561	1.10	19.70	59
May	3684	1.10	21.55	58	3972	1.19	22.00	55	4266	1.31	20.90	60
Jun.	2895	0.79	24.60	62	3435	0.86	25.05	64	3348	0.78	25.75	65
Jul.	2457	0.85	26.50	62	2535	0.74	26.80	70	2676	0.80	26.70	68
Aug.	1749	0.71	27.05	75	2184	0.86	27.20	73	1809	0.70	27.15	73
Sept.	4020	2.30	25.05	63	4323	1.98	24.45	65	4431	2.44	23.60	69
Oct.	3132	0.78	22.30	66	2778	0.64	22.85	62	3444	0.78	21.85	64
Nov.	3138	1.01	20.20	64	3520	1.27	19.00	66	3639	1.10	19.40	66
Dec.	2088	0.67	15.40	68	2112	0.60	15.25	71	2229	0.61	14.40	70
Total	31896	-	243.05	788	34138	-	245.85	784	35604	-	241.6	803
Mean	2633	-	20.25	65.66	2845.25	-	20.48	65.33	2967	-	20.13	66.92

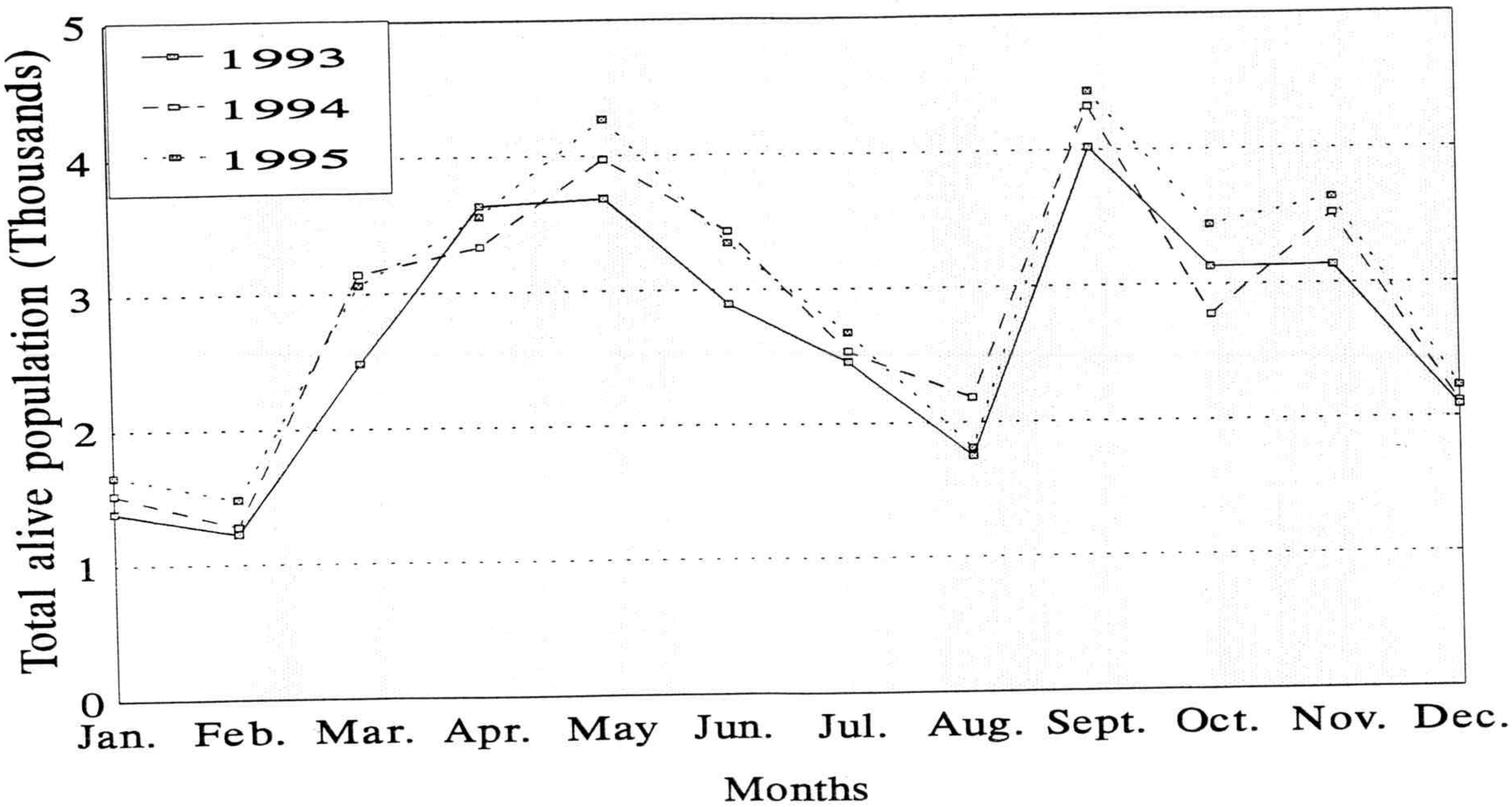

Fig. (6) : Relative abundance of total alive population of ***P. oleae***, on plum at El-Quanater location throughout 1993-1995 years.

month at means of 21.55°C, 22.00°C & 20.90°C and 58, 55 & 60 % R.H. in 1993, 1994 and 1995, respectively. A gradual decrease in the total population was observed during June, July and August. In September, a sharp and sudden increase in the total population occurred to reach the second and highest peak of 4020, 4323 and 4431 individuals/30 branches at 25.05, 24.45 & 23.60°C and 63, 65 & 69 % R.H. in 1993, 1994 and 1995, respectively. Gradual decreases occurred within the subsequent months, until another cycle of increase started in the next March. Paradoxial to what occurred on pear trees, the highest peak of total population on plum trees, was the second one (during September) allover the three seasons of study. The lowest population (1224. 1278 and 1478 total individuals/30 branches, respectively) was observed in February, as on pear trees at means of 11.85, 13.40 & 13.50°C, and 66, 63 & 69 % R.H., in 1993, 1994 and 1995, respectively.

b- Seasonal fluctuation of different stages of *P. oleae* on plum trees, in Qualubiya governorate :

1- The adult females (females without laying eggs) :

Data given in Table (7) and represented in Fig. (7), indicated that the adult females of the plum scale insect, ***P. oleae*** on plum trees, at El-Quanater El-Khairiya location, has two main peaks of annual activity. The mean total population of adult females/30 branches of plum observed to decrease gradually during January, February and sharply decreased in March and April. The population of these individuals rapidly increased during June to reach the first peak of adult females abundance of 1284, 1356 and 1389 individuals/30 branches at means of 24.60, 25.05 & 25.75°C and 62, 64 & 65 % R.H., during 1993, 1994 and 1995, respectively. In July, the adult females population, significantly decreased and continued another slight decrease in August. However, in September, October and November, a rapid increase in the population occurred to reach the second and highest peak of abundance (2652, 2919 and 3186

Table (7) : Monthly counts of alive adult females of *P. oleae* infesting 30 plum branches, throughout 1993-1995 successive years in Qualubiya, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	1386	-	11.40	75	1521	-	11.75	69	1659	-	12.60	72
Feb.	1224	0.88	11.85	66	1188	0.78	13.40	63	1299	0.78	13.50	69
Mar.	765	0.63	16.95	67	900	0.76	17.75	64	1026	0.79	16.05	68
Apr.	435	0.57	20.20	62	546	0.61	20.35	62	621	0.61	19.70	59
May	609	1.40	21.55	58	414	0.76	22.00	55	477	0.77	20.90	60
Jun.	1284	2.12	24.60	62	1356	3.28	25.05	64	1389	2.91	25.75	65
Jul.	849	0.66	26.50	62	735	0.54	26.80	70	858	0.62	26.70	68
Aug.	621	0.73	27.05	75	729	0.99	27.20	73	561	0.65	27.15	73
Sept.	1278	2.10	25.05	63	1218	1.70	24.45	65	1113	1.98	23.60	69
Oct.	1713	1.34	22.30	66	1560	1.28	22.85	62	1692	1.52	21.85	64
Nov.	2652	1.55	20.20	64	2919	1.87	19.00	66	3186	1.88	19.40	66
Dec.	1872	0.71	15.40	68	2112	0.72	15.25	71	2034	0.64	14.40	70
Total	14688	-	243.05	788	15198	-	245.85	784	15915	-	241.6	803
Mean	1224	-	20.25	65.66	1266.50	-	20.48	65.33	1326.20	-	20.13	66.92

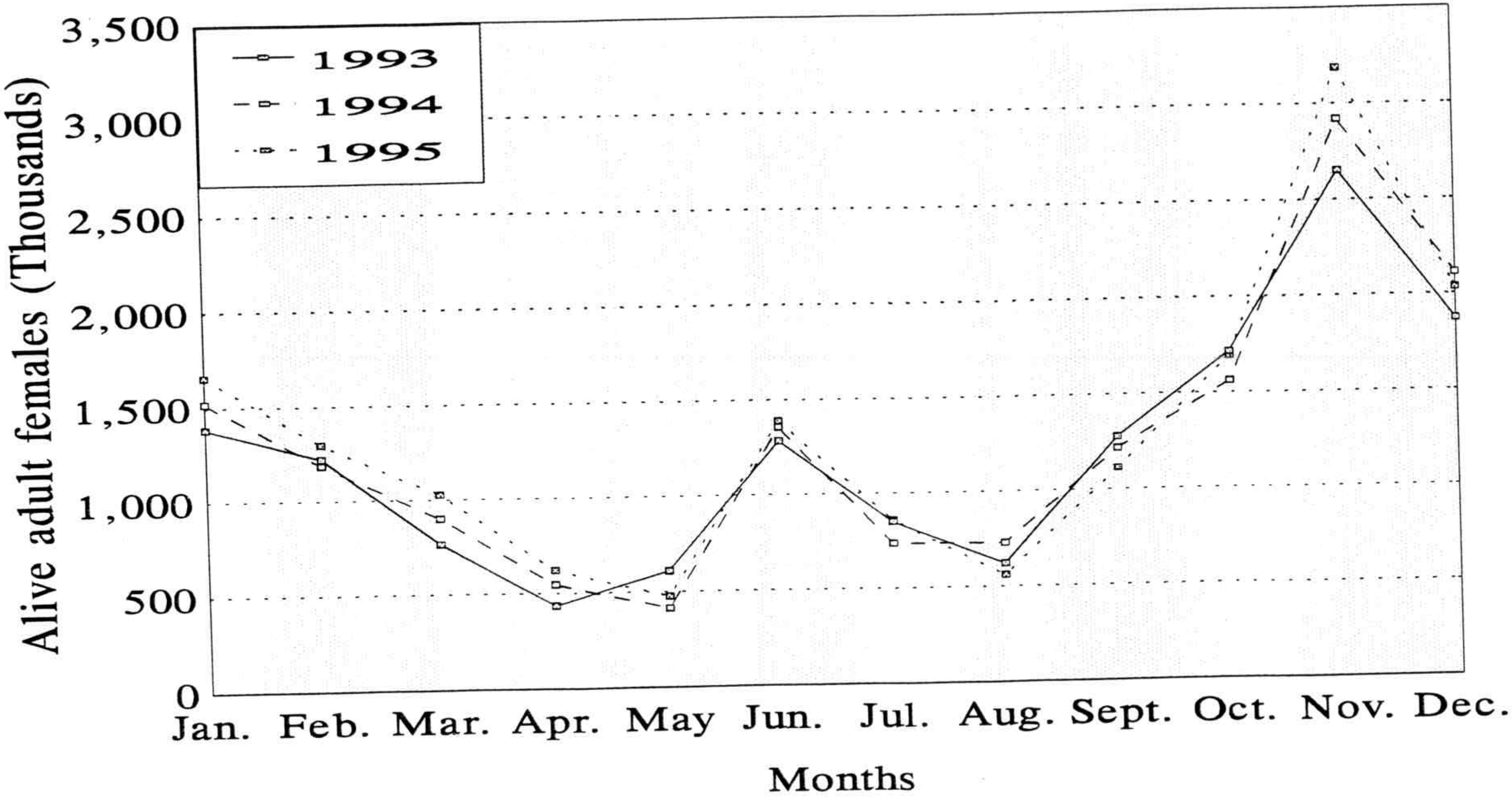

Fig. (7) : Relative abundance of alive adult females of ***P. oleae***, on plum at El-Quanater location throughout 1993-1995 years.

individuals/30 branches) in November at 20.20, 19.00 & 19.40°C and 64. 66 & 66 % R.H. in the three seasons, respectively.

2- The ovipositing female individuals :

Monthly mean numbers of the ovipositing females counted on 30 branches of plum trees at El-Quanater El-Khairiya location are shown in Table (8) and represented in Fig. (8). The presented data indicated that the ovipositing females, on plum trees at this location has three main peaks of annual activity throughout the whole period of study. The ovipositing females disappeared completely in January of the three years, also they were almost absent during February, as the ovipositing females were observed and counted but in comparatively low numbers. In March, at the beginning of spring, considerable numbers of the ovipositing females were counted throughout the three studied years. In April, the first highest peak of abundance was detected (1749, 1551 and 1686 individuals/30 branches) at 20.20, 20.35 & 19.70°C and 62, 62 & 59 % R.H., in the three seasons, respectively. A sharp decrease in population of these individuals occurred in May month, reaching less than the half population of the preceding month, where the rates of change were 0.41, 0.43 and 0.44 during the three consecutive years. These marked decreases of the ovipositing females population throughout the three seasons of study, which occurred during May on plum trees, were significantly different than those occurred on pear trees (rates of change were 0.74, 0.78 and 0.68). Another sharp drop in population abundance occurred in June, followed with a significant increase in July, forming the second peak of the ovipositing females abundance, being 900, 936 and 1038 individuals/30 branches, at means of 26.50, 26.80 & 26.70°C and 62, 70 & 68 % R.H., in the three successive years, respectively. In September, the third high peak of 1236, 1383 and 1329 ovipositing female individuals/30 branches of plum trees was observed, at 25.05, 24.45 & 23.60°C and 63, 65 & 69 % R.H., during the three consecutive years of study, to be synchronized with the second peak

Table (8) : Monthly counts of alive ovipositing individuals of *P. oleae* on 30 plum branches, throughout 1993-1995 successive years in Qualubiya, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	-	-	11.40	75	-	-	11.75	69	-	-	12.60	72
Feb.	-	-	11.82	66	-	-	13.40	63	60	-	13.50	69
Mar.	1101	-	16.95	67	1524	-	17.75	64	1428	23.8	16.05	68
Apr.	1749	1.60	20.20	62	1551	1.02	20.35	62	1686	1.20	19.70	59
May	714	0.41	21.55	58	660	0.43	22.00	55	741	0.44	20.90	60
Jun.	405	0.60	24.60	62	498	0.75	25.05	64	495	0.66	25.75	65
Jul.	900	2.22	26.50	62	936	1.88	26.80	70	1038	2.10	26.70	68
Aug.	768	0.85	27.05	75	927	0.99	27.20	73	840	0.81	27.15	73
Sept.	1236	1.60	25.05	63	1383	1.50	24.45	65	1329	1.58	23.60	69
Oct.	411	0.33	22.30	66	429	0.30	22.85	62	501	0.38	21.85	64
Nov.	159	0.39	20.20	64	210	0.49	19.00	66	-	-	19.40	66
Dec.	-	-	15.40	68	-	-	15.25	71	96	-	14.40	70
Total	7443	-	243.05	788	8118	-	245.85	784	8214	-	241.6	803
Mean	620.25	-	20.25	65.66	676.5	-	20.48	65.33	684.5	-	20.13	66.92

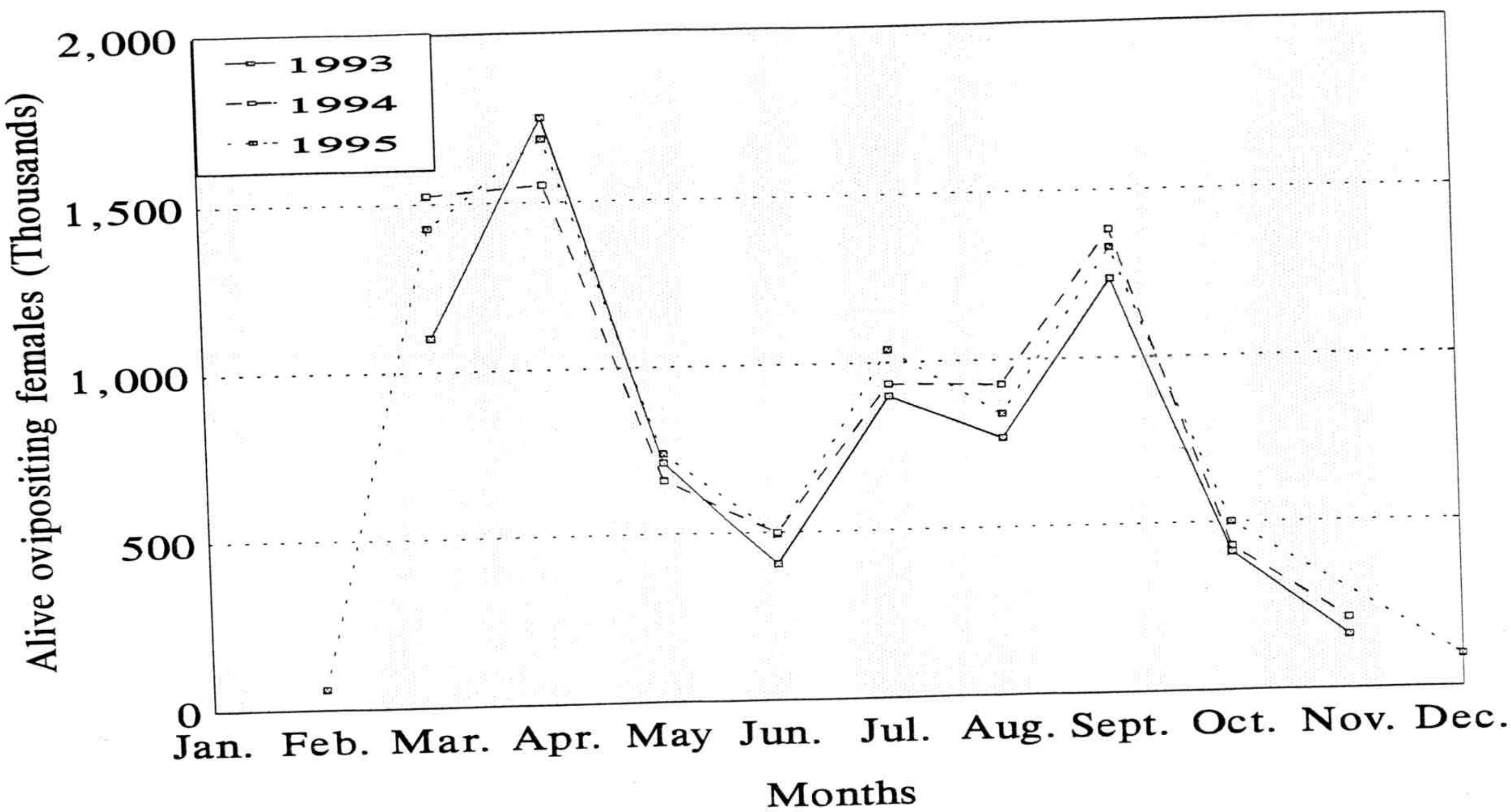

Fig. (8) : Relative abundance of alive ovipositing females of ***P. oleae***, on plum at El-Quanater location throughout 1993-1995 years.

that occurred on pear trees, at the same location. The population of the ovipositing females fell drastically during October, November to reach almost zero in December. The lower abundance of 159 and 210 ovipositing individuals/30 branches of plum trees were attained in November at 20.20 &19.00°C and 64 & 66 % R.H. during 1993 and 194, respectively; whereas it occurred in December 1995 being 96 individuals/30 branches at 15.25°C and 71 % R.H.

3- The nymphal stage :

As shown in Table (9) and represented by Fig. (9), the population of the nymphal stage of ***P. oleae***, on plum trees, at El-Quanater El-Khairiya location were nearly absent from December to next February, with few exceptions, while few of them were detected mainly during early December and late February. Considerable numbers of nymphs (mainly crawlers) were counted on the plum branches at the beginning of spring, in March during the three studied years. In April, the population was found to be almost doubled, subsequently followed by another rapid increase in nymphs abundance during May month to reach the first and higher peak of abundance when 2361, 2893 and 3048 individuals/30 branches of plum were counted, at means of 21.55, 22.00 & 20.90°C and 58, 55 & 60 % R.H., during 1993, 1994 and 1995 seasons, respectively. In June, a significant decrease in population was observed, followed by rapid and sharp fall during July and August. As occurred on pear trees, a considerable increase in nymphs population recorded in September to reach the second peak of abundance of 1506, 1722 and 1989 nymphs/30 branches of plum at 25.05, 24.45 & 23.60°C and 63, 65 & 69 % R.H., during the three successive years of the study. The population started to decrease within October and sharply dropped in November and December.

Table (9) : Monthly counts of nymphal stage individuals of *P. oleae* on 30 plum branches, throughout 1993-1995 successive years in Qualubiya, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.
Jan.	-	-	11.40	75	-	-	11.75	69	-	-	12.60	72
Feb.	-	-	11.85	66	90	-	13.40	63	120	-	13.50	69
Mar.	618	-	16.95	67	693	7.7	17.75	64	609	5.10	16.05	68
Apr.	1455	2.35	20.20	62	1266	1.8	20.35	62	1254	2.10	19.70	59
May	2361	1.62	21.55	58	2893	2.29	22.00	55	3048	2.43	20.90	60
Jun.	1206	0.51	24.60	62	1581	0.55	25.05	64	1464	0.48	25.75	65
Jul.	708	0.59	26.50	62	864	0.55	26.80	70	780	0.53	26.70	68
Aug.	360	0.51	27.05	72	528	0.61	27.20	73	408	0.52	27.15	73
Sept.	1506	4.18	25.05	63	1722	3.26	24.45	65	1989	4.88	23.60	69
Oct.	1008	0.67	22.30	66	789	0.46	22.85	62	1251	0.63	21.85	64
Nov.	327	0.32	20.20	64	396	0.50	19.00	66	453	0.36	19.40	66
Dec.	216	0.66	15.40	68	-	-	15.25	71	99	0.22	14.40	70
Total	9765	-	243.05	788	10822	-	245.85	784	11475	-	241.6	803
Mean	813.75	-	20.25	65.66	901.83	-	20.48	65.33	956.25	-	20.13	66.92

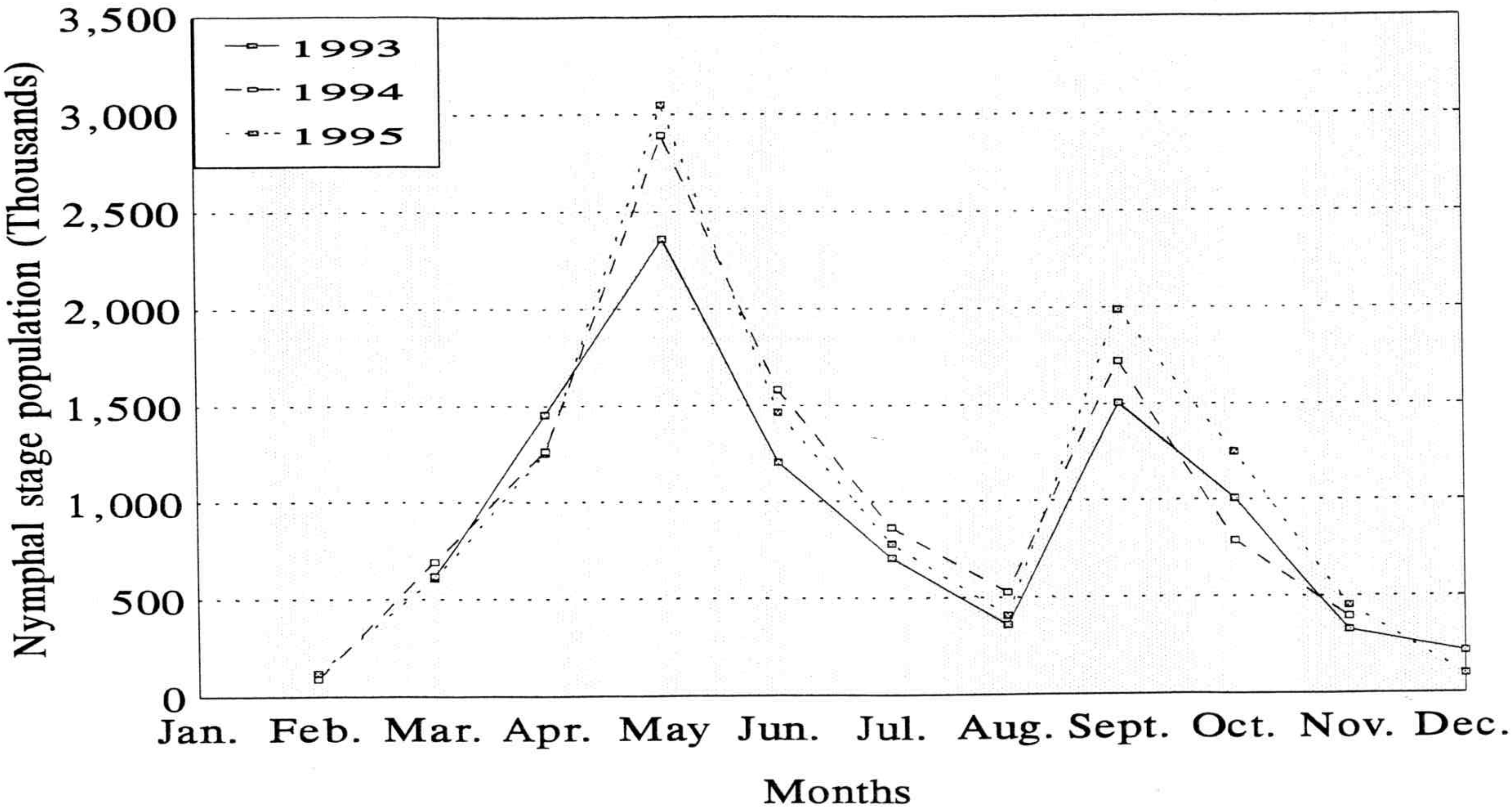

Fig. (9) : Relative abundance of nymphal stage individuals of ***P. oleae***, on plum at El-Quanater location throughout 1993-1995 years.

From the results obtained, it could be clearly concluded that the nymphal stage of ***P. oleae*** on plum trees at El-Quanater El-Khairiya location undergo two periods of annual activity, the first was the higher and occurred in May, while the second occurred in September.

c- The rates of monthly changes in population of different stages of *P. oleae*, on plum trees, at El-Quanater El-Khairiya location :

On plum trees, concerning the total population of ***P. oleae***, as shown in Table (6), during the first and the third studied seasons (1993 and 1995), the highest rates of population increase of 2.30 and 2.44, were observed during September, at means of 25.05 & 23.60°C and 63 & 69 % R.H.; while the second high rates of increase in the total population of 2.03 and 2.10 within the first and the third studied seasons were detected in March, at 16.95 & 16.05°C and 67 & 68 % R.H.. respectively. During the second season (1994), the sequence of the two high rates of increase in the total population increase of 2.46 occurred in March at 17.75°C and 64 % R.H., while the second high rate of 1.98 was recorded in September at 24.45°C and 65 % R.H. Differences occurred in the timing of occurrence of high rates of increase during the second seasons, probably could be attributed to the increase in the total population which occurred in March and August 1994 when compared with those of the other two studied seasons (1993 and 1995). The severest low rates of the population decrease of 0.67, 0.60 and 0.61 were observed during December, at mean of 15.40, 15.25 & 14.40°C and 68, 71 & 70 % R.H., in the three studied years, respectively.

Concerning the adult females of ***P. oleae,*** on plum trees, at El-Quanater El-Khairiya location, as shown in Table (7), the highest rates of increase of 2.12, 3.28 and 2.91 were detected -as occurred on pear trees- during June at 24.60, 25.05 & 25.75°C and 62, 64 & 65 % R.H., during 1993, 1994 and 1995, respectively. Another two comparatively high rates of increase were observed in September and November throughout the three years of the study.

Results indicated that, the means of temperature and % R.H. prevailing during June, followed by those of September and November, could be favourable climatic conditions -combined with other biotic and abiotic factors- which could enhance the development of the nymphal stage to the settled adult female stage. On the other hand, the severest rates of the adult females decrease in population of an average of 0.60, were observed in April and July throughout the three studied years. The rapid conversion of the adult females to ovipositing females during April may explain the severe rate of decrease of the adult females that occurred in this month, but concerning the other low rate of July, it could be explained by the harmful effect of the comparatively high temperature during late June and July on nymphs and newly developed adult females causing a considerable mortality percentage amongst the nymphs and the adult females populations, subsequently reduced the population of the adult females during July.

In case of the ovipositing female individuals, on plum trees, at El-Quanater El-Khairiya location, it was observed that no oviposition occurred before March, except of few cases that occurred during late February in the third season of 1995. Data and results in Table (8) and Fig. (8) showed that, within the three seasons of study, the highest rate of increase in numbers of the ovipositing female individuals occurred in July (where in case of pear, it was during August), being 2.22, 1.88 and 2.10 at means of 26.50, 26.80 & 26.70°C and 62, 70 & 68 % R.H., during the three successive years of study, respectively. The occurrence of the highest rate of increase within the population of the ovipositing females in July in all studied seasons, indicated to favourable factors prevail during this month for the fertilized females to initiate oviposition. Two other high rates of increase concerning the ovipositing females were observed in April and

September, the first of 1.60, 1.02 and 1.20 occurred at means of 20.25, 20.35 & 19.70°C and 62, 62 & 59 % R.H., while the second of 1.60, 1.50 and 1.58 occurred at means of 25.05, 24.45 & 23.60°C and 63, 65 & 69 % R.H., during 1993, 1994 and 1995, respectively. The severe rates of population decrease was observed in October and May, respectively and could be occurred due to the sharp decreases in the numbers of the ovipositing females in October and May, when compared with those of the preceding months of September and April during the three seasons of the study.

Concerning the insect nymphal stage, as shown in Table (9) and Fig. (9), two main high rates of increase in the population were observed. The first rate was observed to occur in April, being 2.35, 1.80 and 2.10, at means of 20.20, 20.35 & 19.70°C and 62, 62 & 59 % R.H., in the three successive seasons, respectively. This high rate of nymphs increase seems to be a real indicator in expressing changes taking place in the population of nymphs between March and April, due to the high percentage of eggs hatching in April, when compared with that of March. The second and highest rate, was detected in September, being 4.18, 3.26 and 4.88 at 25.05, 24.45 & 23.60°C and 63, 65 & 69 % R.H., during 1993, 1994 and 1995, respectively. This highest rate of nymphs increase of September, is a misleading indicator in expressing changes in population due to presence of these individuals in comparatively low numbers in August (the preceding month) when compared with the population of September. The severest rates of nymphs decrease in the first and second seasons calculated as 0.32 (it means that the population constitutes 32 % of population of the preceding month) and 0.50 were observed in November, at mean temperature of 20.20 & 19.00°C and means R.H. of 64 & 66 %, while the severest rate of decrease during the third studied season (1995) of 0.22 was observed in December, at mean temperature of 14.40°C and 70 % R.H.

d- Number of generations of *P. oleae* per year on plum trees, at El-Quanater El-Khairiya location :

Depending on the percentage of the nymphs to the total population of the plum scale insect on plum trees, at El-Quanater El-Khairiya location throughout the three years of the study, data given in Table (10), and illustrated in Fig. (10), showed that there was an increasing rate of ***P. oleae*** nymphal stage starting from about late February to reach maximum percentage during May, throughout the three years of the study represented by 64.1, 72.83 and 71.45, respectively. A gradual fall in the percentage of nymphs occurred within June, July and August during 1993, 1994 and 1995, consecutively. Another peak of relative nymphal abundance was observed and recorded during September, representing 37.46, 39.83 and 44.88 % of total population, along the three seasons of the study, respectively. A significant fall in the nymphal abundance started in October and continued up in November and December until the nearly completely absence of nymphs during the next January and early February. The obtained results indicated that the plum scale insect, ***P. oleae***, on plum trees, at El-Quanater El-Khairiya location (Qualubiya governorate), has two integral generations a year, the first starts in March (or late February) and reaches its peak during May, subsequently ends during August. The other generation starts in late August and prevails to next February or March, reaching its peak of abundance during September.

From the previous data, the obtained results indicated that the plum scale insect ***P. oleae*** has three generations on pear trees, but only has two on plum trees, at the same location of El-Quanater El-Khairiya. these results magnify the role of the host plant in determining the number of generations of scale insects and other insect pests.

Table (10) : **Relative abundance of the nymphal stage of *P. oleae* on plum trees at El-Quanater location, Qualubiya, indicating number of generations/year.**

Year	1993			1994			1995		
Date of sampling	**Total No. of insects**	**Total No. of nymphs**	**% of nymphs**	**Total No. of insects**	**Total No. of nymphs**	**% of nymphs**	**Total No. of insects**	**Total No. of nymphs**	**% of nymphs**
Jan.	1386	-	0	1521	-	-	1659	-	0
Feb.	1224	-	0	1278	90	7	1479	120	8.11
Mar.	2484	618	24.88	3144	693	22.04	3063	609	19.88
Apr.	3639	1455	39.98	3336	1266	37.95	3561	1254	35.21
May	3684	2361	*64.1	3972	2893	*72.83	4266	3048	*71.45
Jun.	2895	1206	41.66	3435	1581	46.03	3348	1464	43.73
Jul.	2457	708	28.82	2535	864	29.40	2676	780	29.15
Aug.	1749	360	20.58	2184	528	24.18	1809	408	22.55
Sept.	4020	1506	*37.46	4323	1722	*39.83	4431	1989	*44.88
Oct.	3132	1008	32.18	2778	789	28.40	3444	1251	36.32
Nov.	3138	327	10.42	3520	396	11.25	3639	453	12.45
Dec.	2088	216	10.34	2112	-	0	2229	99	4.44

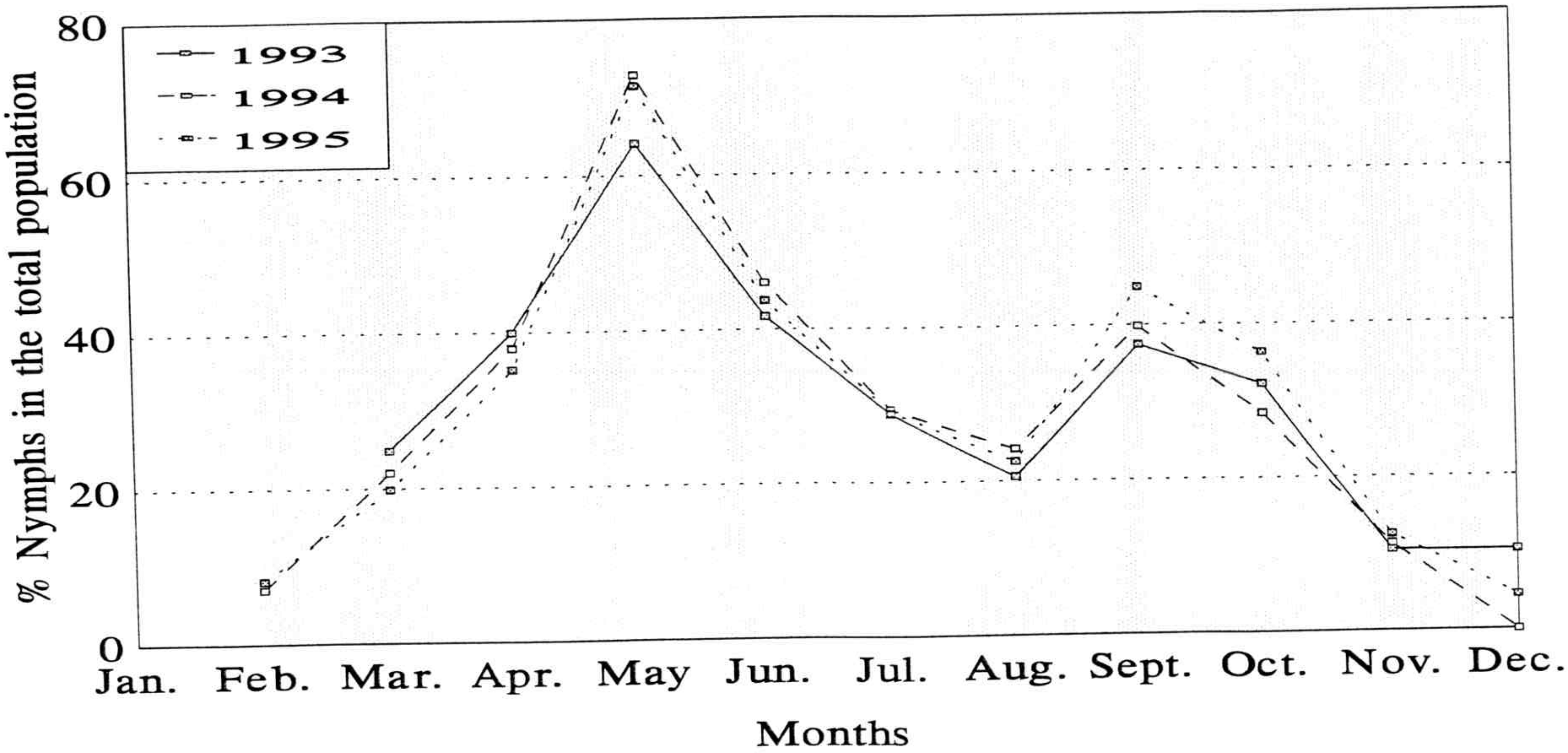

Fig. (10) : Number of generations of ***P. oleae***, on plum at El-Quanater location throughout 1993-1995 years.

c- Age-structure of *P. oleae* on plum trees at El-Quanater El-Khairiya location :

According to results in tables (6, 7, 8 & 9) and also illustrated in Figs. (6, 7, 8 & 9), the compost-age structure on plum trees showed a total population of 31896, 34138 and 35604 individuals, in 1993, 1994 and 1995, respectively. The ovipositing females represented by 23.34 %, 23.78 % and 23.07 %, respectively, while the nymphal stage represented 30.61 %, 31.70 % and 32.23 % of the three seasons total population, respectively. The obtained results showed that, on plum trees -as occurred on pear trees- the adult females dominated throughout the season in a percentage ranging between 44.52 % and 46.04 % of ***P. oleae*** total population, followed in abundance by the nymphal stage, which ranged between 30.61 % and 32,23 % of the total population, while the ovipositing females were found to be the least abundant individuals, occupying percentage of existence ranging between 23.07 % and 23.78 % of the three years total population, respectively.

C- On pear trees at Menia El-Kamh location, Sharkiya governorate :

a- Seasonal fluctuation of the total population :

Data tabulated in Table (11) and illustrated in Fig. (11), concerning the fluctuation of ***P. oleae*** total population on pear trees, at Menia El-Kamh location (Sharkiya governorate), indicated that this pest had two peaks of seasonal activity during each of the three successive years of 1993, 1994 and 1995. Throughout the three years, the total population of the plum scale insect decreased gradually from January to February, afterwards, in March, the population sharply increased (due to the beginning of nymphs emergence) and continued ascending during April to reach the top of the first -and the highest peak- of abundance with 4017, 4317 and 4731 individuals/30 branches, in May month, at means of 21.45, 21.90 & 21.20°C and 67, 68 & 67 % R.H., during 1993, 1994 and 1995, respectively.

Table (11) : Monthly counts of total alive population of *P. oleae* on 30 pear branches, throughout 1993-1995 successive years in Sharkia, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	2004	-	10.00	74	2217	-	9.90	73	2148	-	10.00	72
Feb.	1578	0.79	11.30	68	1623	0.73	10.90	68	1665	0.78	11.70	70
Mar.	3024	1.92	14.35	66	3288	2.03	14.05	67	3504	2.10	14.10	68
Apr.	3246	1.10	18.40	62	3423	1.04	19.15	66	3783	1.08	19.40	64
May	4017	1.24	21.45	67	4317	1.26	21.90	68	4731	1.25	21.20	67
Jun.	2670	0.66	23.65	63	2835	0.66	25.05	64	2958	0.63	23.60	66
Jul.	2028	0.76	25.60	64	2226	0.79	25.25	66	1995	0.67	26.80	68
Aug.	2004	0.99	26.60	76	2112	0.45	26.75	75	2184	1.09	27.40	73
Sept.	3882	1.94	24.70	65	4095	1.93	24.45	66	3648	1.68	24.50	69
Oct.	2829	0.73	20.75	66	2802	0.68	21.30	64	3072	0.84	21.10	63
Nov.	2571	0.91	19.20	64	2270	0.81	18.75	63	2880	0.94	18.80	65
Dec.	2487	0.97	14.35	67	2224	0.98	14.15	71	2541	0.88	14.55	69
Total	32340	-	230.35	802	33432	-	231.60	811	35109	-	233.15	814
Mean	2695.1	-	19.20	66.80	2786	-	19.30	67.60	2925.75	-	19.43	6.83

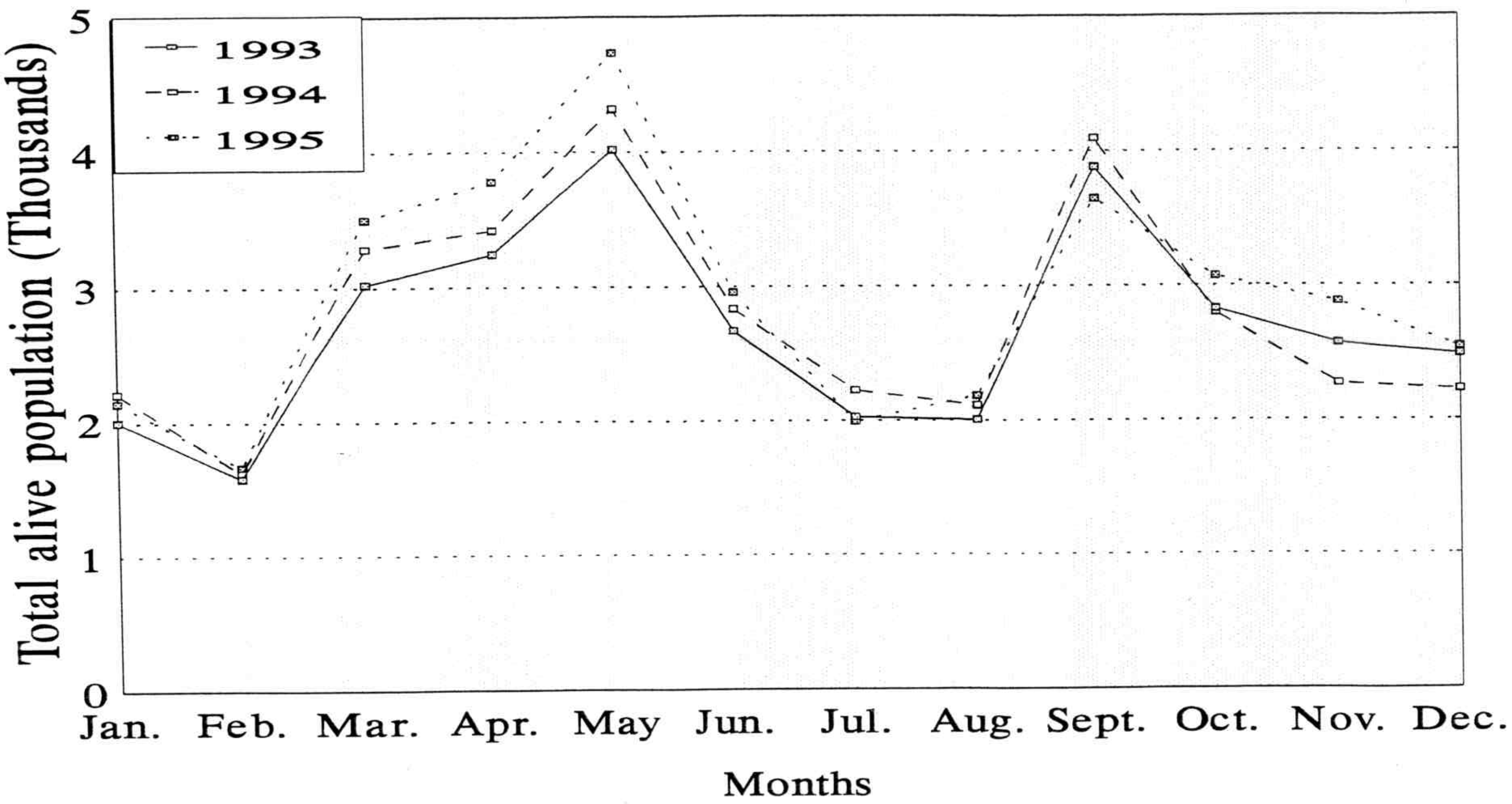

Fig. (11) : Relative abundance of total alive population of ***P. oleae***, on pear at Menia El-Kamh location throughout 1993-1995 years.

This first high peak of abundance was found to be simultaneous with that occurred on pear trees, at El-Quanater location, but with less number of total individuals, approaching less than its half value. Significant decrease in the total population started in June, followed by another fall during July-August, throughout the three seasons of study. In September, a sharp and rapid increase occurred in the total population when 3882, 4095 and 3648 individuals were counted/30 branches of pear indicating the second peak of abundance, at 24.70, 24.45 & 24.50°C and 65, 66 & 69 % R.H., during the three successive years, respectively. That was followed by a gradual decrease that was observed in October, November, December and continued decreasing up to next March. The lowest population of the plum scale insect was observed in February, being 1578, 1623 and 1665 total individuals/30 branches of pear at Menia El-Kamh location, at 11.30, 10.90 & 11.70°C and 68, 68 & 70 % R.H., during the three years, respectively. The obtained results on pear trees, in Sharkiya governorate, throughout the three seasons of study, indicated that the total population of ***P. oleae***, reaches its highest abundance during May month, followed by another -but smaller peak- in September, while the lowest population in abundance was observed during February.

b- Seasonal fluctuation of different stages of *P. oleae* on pear trees in Sharkiya governorate :

1- The adult females (females without laying eggs) :

Data given in Table (12) and Fig. (12), showed that the adult females have two main peaks per annum. Total population/30 branches of pear decreased gradually from January to February, subsequently rapidly decreased during March and April, followed by a sharp drop in May. In June, the population of adult females increased and continued to increase until reached the first peak of abundance by 804, 837 and 708 adult females/30 branches in July, at 25.60,

Table (12) : Monthly counts of alive adult females of *P. oleae* infesting 30 pear branches, throughout 1993-1995 successive years in Sharkia, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	2004	-	10.00	74	2217	-	9.90	73	2148	-	10.00	72
Feb.	1497	0.75	11.30	68	1623	0.73	10.90	68	1575	0.73	11.70	70
Mar.	795	0.53	14.35	66	840	0.52	14.05	67	894	0.57	14.10	68
Apr.	618	0.78	18.40	62	642	0.76	19.15	66	582	0.65	14.40	64
May	360	0.60	21.45	67	423	0.66	21.90	68	309	0.53	21.20	67
Jun.	750	2.1	23.0	63	798	1.89	25.05	64	678	2.20	23.60	66
Jul.	804	1.07	25.60	64	837	1.05	25.25	66	708	1.04	26.80	68
Aug.	612	0.76	26.60	76	726	0.87	26.75	75	669	0.94	27.40	73
Sept.	798	1.30	24.70	65	849	1.17	24.45	66	825	1.23	24.50	69
Oct.	1125	1.41	20.75	66	1074	1.27	21.30	64	1161	1.41	21.10	63
Nov.	1875	1.67	19.20	64	1515	1.41	18.75	63	1698	1.46	18.80	65
Dec.	2421	1.29	14.35	67	2169	1.43	14.15	71	2619	1.54	14.55	69
Total	13659	-	230.35	802	13713	-	231.60	811	13866	-	233.15	814
Mean	1138.25	-	19.20	66.80	1142.75	-	19.30	67.60	1155.5	-	19.43	67.83

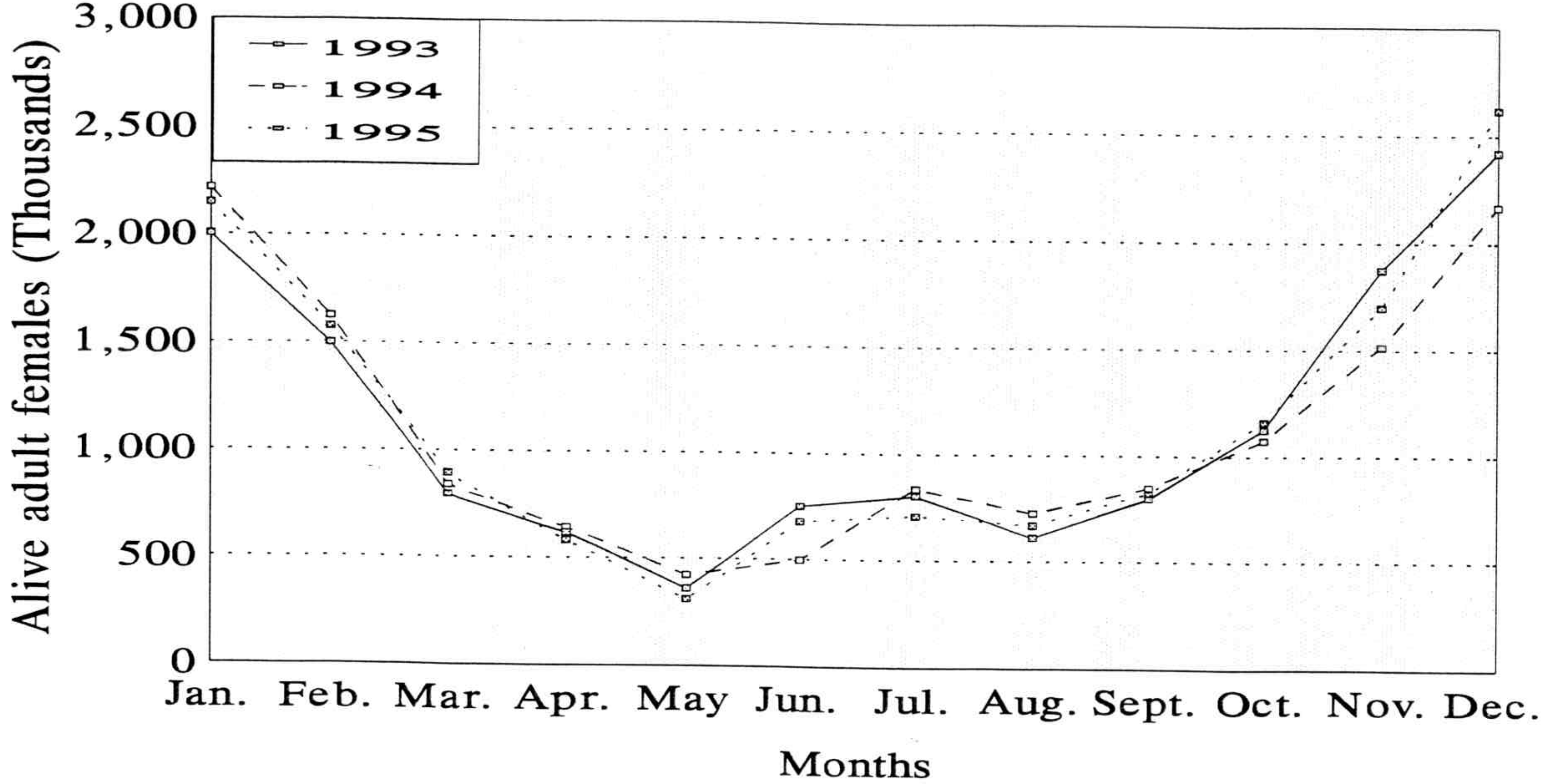

Fig. (12) : Relative abundance of alive adult females of ***P. oleae***, on pear at Menia El-Kamh location throughout 1993-1995 years.

25.25 & 26.80°C and 64, 66 & 68 % R.H., during 1993, 1994 & 1995, respectively. A slight decrease in the adult females population was observed in August, then, in September, the population gradually reincreased, followed by sharp increase in October and November, to reach its second and highest peak of abundance when 2421, 2169 and 2619 individuals were counted/30 branches in December, at 14.35 14.15 & 14.55°C and 67, 71 & 69 % R.H., during 1993, 1994 and 1995, respectively. The lowest population density of this stage occurred in May, being 360, 423 and 309 individuals/30 branches of pear, correlated with the associated mean temperature degrees and percentage of relative humidity, shown in Table (12). Comparison of results obtained from pear orchard located in Qualubiya and Sharkiya governorates, revealed that the timing of the two peaks of the adult female occurrence, was not synchronized in the two governorates. The first peak of adult females in Qualubiya occurred in June in a considerably higher value, while the corresponding peak in Sharkiya occurred in July, the second peak took place within November in Qualubiya, while it occurred in December in Sharkiya governorate. Differences in climatic factors, crop structure, percentage of parasitism and many other different unstudied factors, may cause these variabilities in population and timing of peaks occurrence in the two different governorates.

b- The ovipositing female individuals :

Data in Table (13) and Fig. (13), revealed two peaks of the ovipositing female individuals abundance per annum on pear trees in Sharkiya governorate. Ovipositing females were nearly absent in January and February (except few of them observed in late February, 1993). The ovipositing female individuals sharply increased in March to form the sudden first peak, being 1500, 1626 and 1812 individuals/30 branches of pear trees, at means of 14.35, 14.05 & 14.10°C and 66, 67 & 68 % R.H., in 1993, 1994 and 1995, respectively. A gradual decrease in numbers of these individuals was observed in April, followed by

25.25 & 26.80°C and 64, 66 & 68 % R.H., during 1993, 1994 & 1995, respectively. A slight decrease in the adult females population was observed in August, then, in September, the population gradually reincreased, followed by sharp increase in October and November, to reach its second and highest peak of abundance when 2421, 2169 and 2619 individuals were counted/30 branches in December, at 14.35 14.15 & 14.55°C and 67, 71 & 69 % R.H., during 1993, 1994 and 1995, respectively. The lowest population density of this stage occurred in May, being 360, 423 and 309 individuals/30 branches of pear, correlated with the associated mean temperature degrees and percentage of relative humidity, shown in Table (12). Comparison of results obtained from pear orchard located in Qualubiya and Sharkiya governorates, revealed that the timing of the two peaks of the adult female occurrence, was not synchronized in the two governorates. The first peak of adult females in Qualubiya occurred in June in a considerably higher value, while the corresponding peak in Sharkiya occurred in July, the second peak took place within November in Qualubiya, while it occurred in December in Sharkiya governorate. Differences in climatic factors, crop structure, percentage of parasitism and many other different unstudied factors, may cause these variabilities in population and timing of peaks occurrence in the two different governorates.

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Table (13) : Monthly counts of alive ovipositing individuals of *P. oleae* on 30 pear branches, throughout 1993-1995 successive years in Sharkia, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	-	-	10.00	74	-	-	9.90	73	-	-	10.00	72
Feb.	27	-	11.30	6.8	-	-	10.90	68	-	-	11.70	70
Mar.	1500	55.60	14.35	66	1626	-	14.05	67	1812	-	14.10	68
Apr.	1044	0.70	18.40	62	951	0.58	19.15	66	1206	0.67	14.40	64
May	789	0.76	21.45	67	720	0.76	21.90	68	813	0.67	21.20	67
Jun.	498	0.63	23.65	63	549	0.76	25.05	64	606	0.75	23.60	66
Jul.	459	0.92	25.60	64	480	0.87	25.25	66	441	0.73	26.80	68
Aug.	864	1.88	26.60	76	1008	2.10	26.75	75	954	2.16	27.40	73
Sept.	1155	1.34	24.70	65	1263	1.25	24.45	66	1068	1.12	24.50	69
Oct.	555	0.48	20.75	66	489	0.39	21.30	64	594	0.56	21.10	63
Nov.	258	0.46	19.20	64	-	-	18.75	63	216	0.36	18.80	65
Dec.	-	-	14.35	67	-	-	14.15	71	108	0.50	14.55	69
Total	7149	-	230.35	802	7086	-	231.60	811	7818	-	233.15	814
Mean	595.75	-	19.20	66.80	590.50	-	19.30	6.60	651.50	-	19.43	67.83

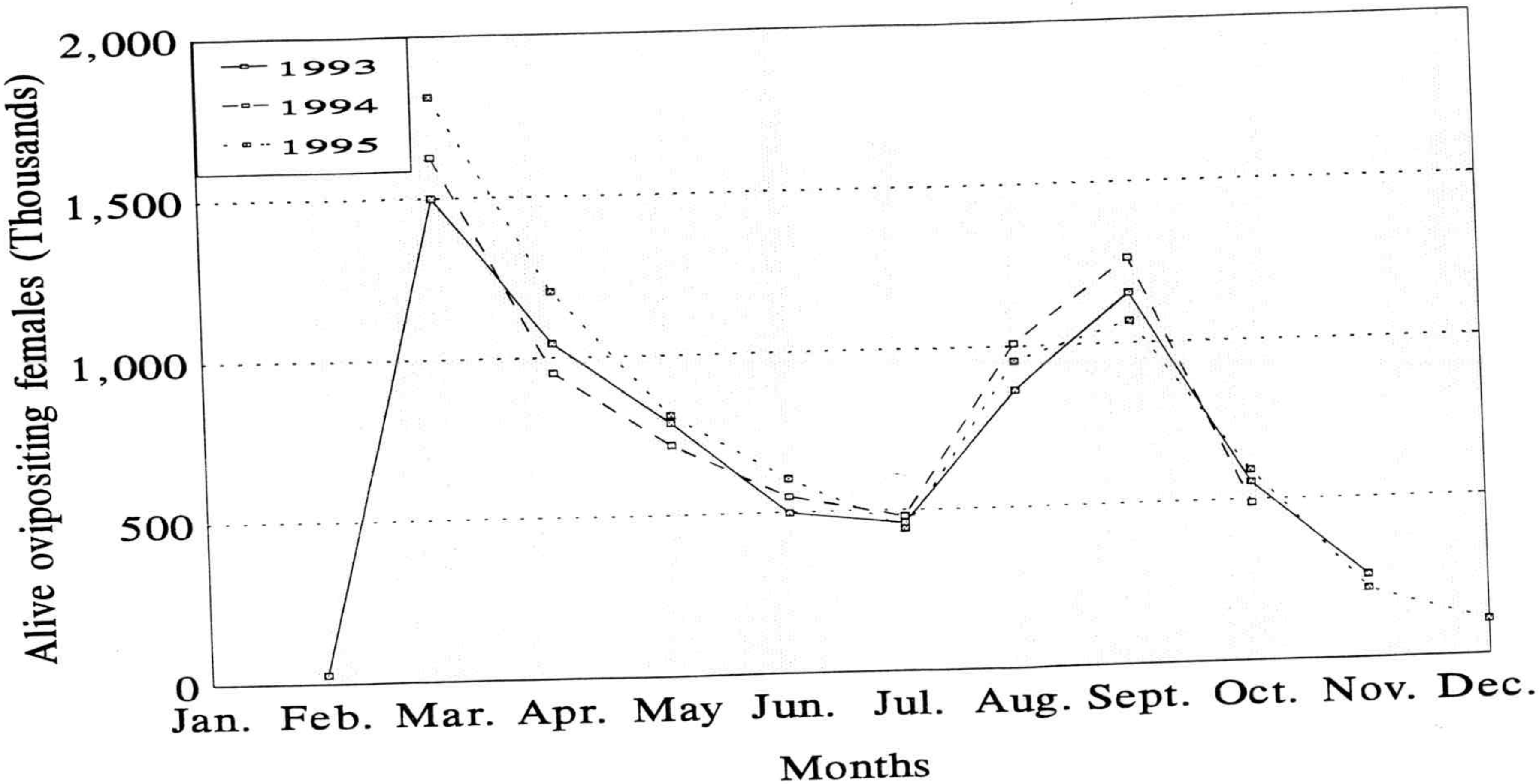


Fig. (13) : Relative abundance of alive ovipositing females of ***P. oleae***, on pear at Menia El-Kamh location throughout 1993-1995 years.

sharp decreases in May and June and continued by a moderate decrease in July. In August, the population of the ovipositing female individuals started to reincrease significantly and continued to increase reaching the second peak of abundance of 1155, 1263 and 1068 individuals/30 branches in September, at 24.70, 24.45 & 24.50°C and 65, 66 & 69 % R.H., during the three consecutive years of study. Successive decrease in abundance of the ovipositing females population occurred in October, November, until they became nil during December. The lower abundance was observed to occur in November (258 and 216 individuals/30 branches during the first and the third seasons, at 19.20 & 18.80°C and 64 & 65 % R.H., in 1993 and 1995 years; while it was almost zero in 1994). In comparison with pear in Qualubiya, the second peak of the ovipositing female individuals occurred simultaneously during September. As for the first peak, it occurred in March in Sharkiya, but in April in Qualubiya. This may be due to the slight differences in temperature means, % R.H. and other undetermined factors occurring in March and April in both governorates.

3- The nymphal stage :

Data represented in Table (14) and Fig. (14), indicated that the nymphal stage abundance of ***P. oleae*** on pear trees, at Menia El-Kamh location (Sharkiya governorate), has two main peaks of annual activity. In January, counts showed no evidence for these stage to exist, subsequently in February, counts showed random individuals spread on branches of pear trees. In March, considerable numbers were observed and continued to increase rapidly during April to be the most abundant stage, with the first and higher peak of abundance abtained in May, being 2868, 3174 and 3609 nymphs/30 branches of pear trees, at 21.45, 21.90 & 21.20°C and 67, 68 & 67 % R.H., along the three successive years, respectively. During June, the population of these individuals started to fall and continued sharp falling during July and August. Population of nymphs

Table (14) : Monthly counts of nymphal stage individuals of *P. oleae* on 30 pear branches, throughout 1993-1995 successive years in Sharkia, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.
Jan.	-	-	10.00	74	-	-	9.90	73	-	-	10.00	72
Feb.	54	-	11.30	68	-	-	10.90	68	90	-	11.70	70
Mar.	729	13.5	14.35	66	822	-	14.05	67	798	8.87	14.10	68
Apr.	1584	2.17	18.40	62	1830	2.23	19.15	66	1995	2.5	19.40	64
May	2868	1.81	21.45	67	3174	1.73	21.90	68	3609	1.81	21.20	67
Jun.	1422	0.49	23.65	63	1488	0.47	25.05	64	1674	0.46	23.60	66
Jul.	765	0.54	25.60	64	909	0.61	25.25	66	846	0.51	26.80	68
Aug.	528	0.70	26.60	76	378	0.42	26.75	75	561	0.66	27.40	73
Sept.	1929	3.65	24.70	65	1983	5.25	24.45	66	1755	3.13	24.50	69
Oct.	1149	0.60	20.75	66	1239	0.62	21.30	64	1317	0.75	21.10	63
Nov.	438	0.38	19.20	64	609	0.49	18.75	63	666	0.51	18.80	65
Dec.	66	0.15	14.35	67	201	0.33	14.15	71	114	0.17	14.55	69
Total	11532	-	230.35	802	12633	-	231.60	811	13425	-	233.15	814
Mean	961.00	-	19.20	66.80	1052.75	-	19.30	67.60	1118.75	-	19.43	67.83

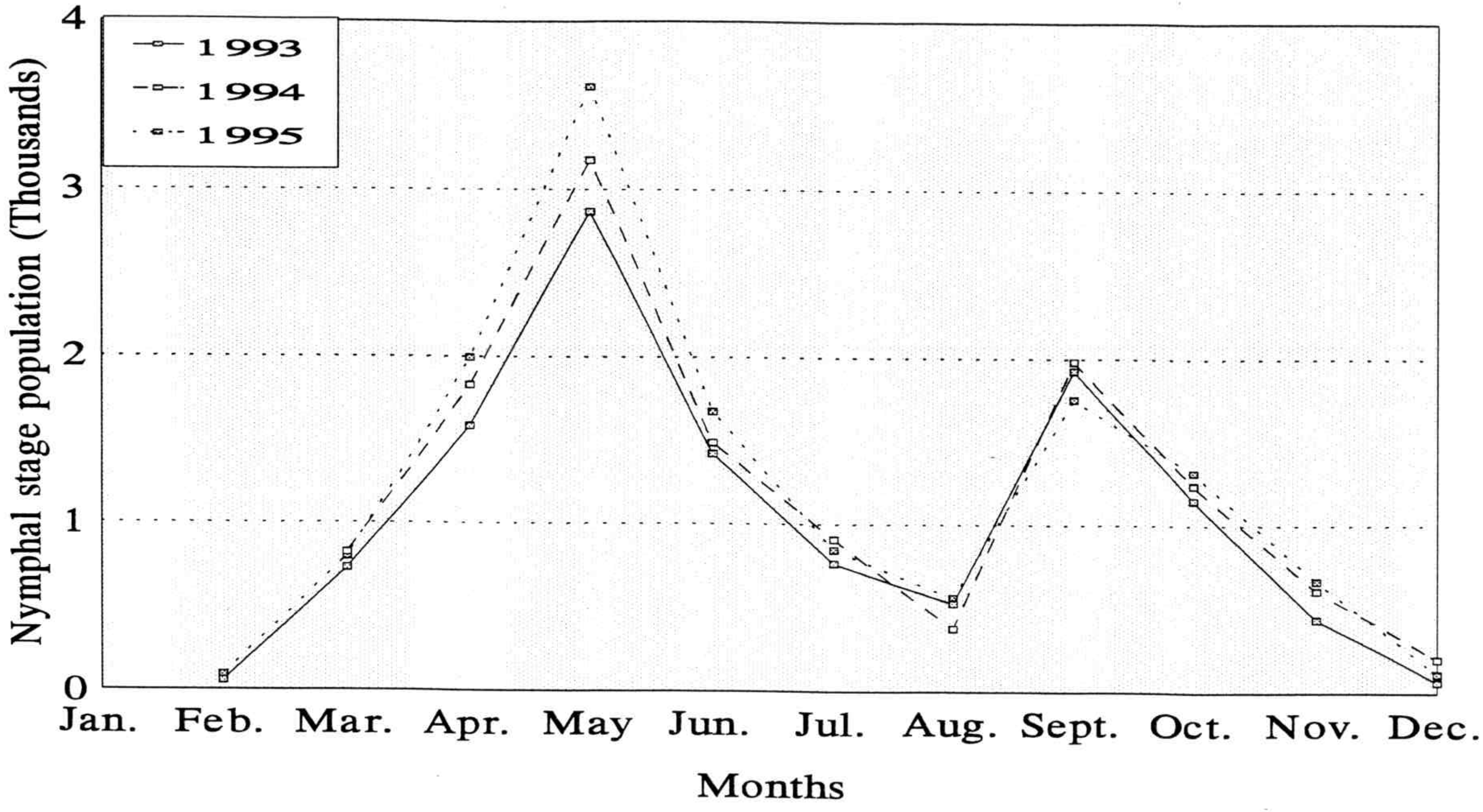


Fig. (14) : Relative abundance of nymphal stage individuals of ***P. oleae***, on pear at Menia El-Kamh location throughout 1993-1995 years.

reincreased again in September when the second peak of abundance could be detected (1929, 1983 and 1755 individuals/30 branches of pear trees; at 24.70, 24.45 & 24.50°C and 65, 66 & 69 % R.H., allover the three years, respectively). Moderate decline in the population of nymphs occurred in October, followed by significant fall during November. In December, only few individuals were randomly scattered on branches. On pear trees, in Qualubiya governorate, the same simultaneous peaks were observed, as previously shown in the concerned tables.

c- The rates of monthly changes in population of different stages of *P. oleae* on pear trees, at Menia El-Kamh location :

The highest rates of increase within the total population were detected in March and September Table, 11). In 1993 season, the highest rate of increase which occurred in September, being 1.94, at means of 24.70°C and 65 % R.H. The second high rate of the total population increase (1.92) occurred in March at 14.35°C and 66 % R.H. In the second and third seasons, the highest rate of increase in total population was detected in March, being 2.03 and 2.10, respectively at means of 14.05 & 14.10°C and 67 & 68 % R.H., respectively. The difference in peak position between 1993 season and seasons of 1994 and 1995 seems to be not really significant due to the low difference in the peak values. The occurrence of the two high rates of total population increase, could be attributed to the high rate of nymphal emergence that took place in March and September when compared with those of the preceding months (February & August), where the population of nymphs were very low.

In case of the adult female stage as shown in Table (12), the highest rate of increase in population was observed in June month, similar to that occurring at El-Quanater El-Khairyia location, being 2.10, 1.89 and 2.20, at means of 23.00, 25.05 & 23.60°C and 63, 64 & 66 % R.H., during 1993, 1994 and 1995, reincreased again in September when the second peak of abundance could be detected (1929, 1983 and 1755 individuals/30 branches of pear trees; at 24.70, 24.45 & 24.50°C and 65, 66 & 69 % R.H., allover the three years, respectively). Moderate decline in the population of nymphs occurred in October, followed by significant fall during November. In December, only few individuals were randomly scattered on branches. On pear trees, in Qualubiya governorate, the same simultaneous peaks were observed, as previously shown in the concerned tables.

c- The rates of monthly changes in population of different stages of *P. oleae* on pear trees, at Menia El-Kamh location :

The highest rates of increase within the total population were detected in March and September Table, 11). In 1993 season, the highest rate of increase which occurred in September, being 1.94, at means of 24.70°C and 65 % R.H. The second high rate of the total population increase (1.92) occurred in March at 14.35°C and 66 % R.H. In the second and third seasons, the highest rate of increase in total population was detected in March, being 2.03 and 2.10, respectively at means of 14.05 & 14.10°C and 67 & 68 % R.H., respectively. The difference in peak position between 1993 season and seasons of 1994 and 1995 seems to be not really significant due to the low difference in the peak values. The occurrence of the two high rates of total population increase, could be attributed to the high rate of nymphal emergence that took place in March and September when compared with those of the preceding months (February & August), where the population of nymphs were very low.

In case of the adult female stage as shown in Table (12), the highest rate of increase in population was observed in June month, similar to that occurring at El-Quanater El-Khairyia location, being 2.10, 1.89 and 2.20, at means of 23.00, 25.05 & 23.60°C and 63, 64 & 66 % R.H., during 1993, 1994 and 1995, respecrtively. The second high rate of increase in the adult females population, was recorded in November (at El-Quanater location, it was in October), being 1.67, 1.41 and 1.46 along the three seasons, respectively. The severest rate of decrease, concerning these females was observed to occur in March during the first and second studied seasons, being 0.53 and 0.52 at 14.35 & 14.05°C and 66 & 67 % R.H., while the lowest rate in 1995 season (0.53), occurred in May at 21.0°C and 67 % R.H. In fact, almost all rates of increase concerning the adult females, were observed to be low, starting from February up to next May, and any slight increase, or decrease, may occur within the population of the adult females due to the different surrounding factors, may shift the occurrence of these low rates from a particular month to the preceding or to the subsequent one.

As for the ovipositing female individuals, the highest rate of increase in population was observed in August, being 1.88, 2.10 and 2.16 at means of 26.60, 26.75 & 27.40°C and 76,75 & 73 % R.H., during 1993, 1994 and 1995, respectively (Table, 13). Contrarily in Sharkiya governorate, no high rates of increase concerning these females were observed to occur in March, as recorded in Qualubiya governorate, this mostly due to the complete absence of the ovipositing females at Menia El-Kamh location during February allover the three studied years. The obtained results indicated that the average optimum temperature and % R.H., which prevail during July, may enhance the development of the adult females to the next ovipositing female individuals during August, while the high population of the ovipositing females which was recorded during March and April, could be explained by the occurrence of high rate of oviposition in spring after the adult females have passed the winter as fertilized gravid females. Concerning the nymphal stage, on pear branches in Sharkiya governorate, data given in Table (14) show two high rate of increase, those occurred annually on pear trees, and this stage was completely absent during January. As previously observed in Qualubiya governorate (at El-Quanater

El-Khairiya location), on pear trees, the first high rate of nymphs increase occurred in April, being 2.17, 2.23 and 2.50 at means of 18.40, 19.15 & 19.40°C and 62, 66 & 64 % R.H., during 1993, 1994 and 1995, respectively. The highest second rate of increase (3.65, 5.25 and 3.13), was observed to occur in September, similarly as previously observed at El-Quanater location, at means of 24.70, 24.45 & 24.50°C and 65, 66 & 69 % R.H., throughout the three years, respectively. Another very high -but not real rate of increase- was detected during March, that could be mainly attributed to the faint population size of nymphs in February.

d- Number of generations of *P. oleae* per year, on pear trees at Sharkiya governorate :

Depending on data in Table (15) and Fig. (15), which showed the relative abundance of the nymphal stage in the total population of ***P. oleae*** on pear trees, at Menia El-Kamh location, throughout 1993, 1994 and 1995, it was observed a trend of a rapid increase of this stage beginning from March to reach their maximum percentage in May, during the three studied seasons, represented by 71.40, 73.52 and 76.28 % of total insect population, respectively. A significant decrease occurred in the percentage of nymphs as compared to the total population during June, July and August, to reach 26.35, 17.40 and 25.69 % in August of 1993, 1994 and 1995, respectively, Table (15). A second peak of relative abundance was detected in September, when the nymphal stage occupied 49.69, 48.42 and 48.11 % of the total population, during the three successive years of the study. Gradual decrease in the nymphal percentage being 40.62, 44.22 and 42.87 % occurred in October followed by a rapid decrease in November (17.04, 26.83 and 23.13 %) of the total population, respectively. The population of nymphs dropped drastically in December, to reach only 2.65, 9.03 and 4.49 % of the total population, during the three studied years. That was followed by another sharp drop in population of nymphs when the branches were

Table (15) : Relative abundance of the nymphal stage of *P. oleae* on pear trees at Menia El-Kamh location, Sharkiya, indicating number of generations/year.

Year	1993			1994			1995		
Date of sampling	Total No. of insects	Total No. of nymphs	% of nymphs	Total No. of insects	Total No. of nymphs	% of nymphs	Total No. of insects	Total No. of nymphs	% of nymphs
Jan.	2004	-	0	2217	-	0	2148	-	0
Feb.	1578	54	3.42	1623	-	0	1665	90	5.41
Mar.	3024	729	24.11	3288	822	25	3504	798	22.77
Apr.	3246	1584	48.80	3423	1830	53.46	3783	1995	52.74
May	4017	2868	*71.40	4317	3174	*73.52	4731	3609	*76.28
Jun.	2670	1422	53.26	2835	1488	52.49	2958	1674	56.59
Jul.	2028	765	37.72	2226	909	40.84	1995	846	42.41
Aug.	2004	528	26.35	2112	378	17.90	2184	561	25.69
Sept.	3882	1929	*49.69	4095	1983	*48.42	3648	1755	*48.11
Oct.	2829	1149	40.62	2802	1239	44.22	3072	1317	42.87
Nov.	2571	438	17.04	2270	609	26.83	2880	666	23.13
Dec.	2487	66	2.65	2224	201	9.03	2541	114	4.49

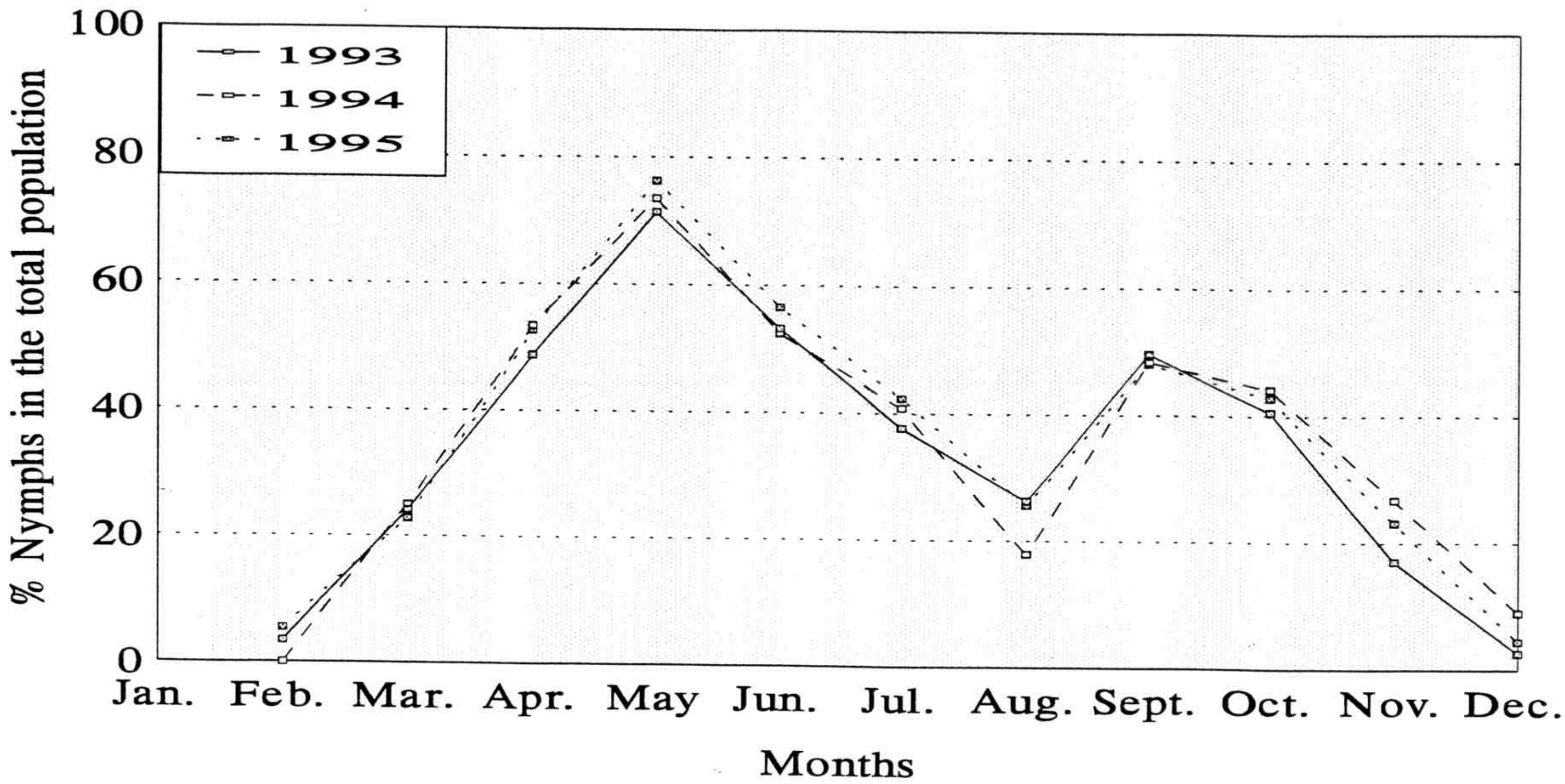


Fig. (15) : Number of generations of ***P. oleae***, on pear at Menia El-Kamh location throughout 1993-1995 years.

found completely free from any nymphs in the next January. The obtained results lead to the conclusion that ***P. oleae*** has two main generations a year on pear trees at Menia El-Kamh location (Sharkiya governorate). The first generation starts almost during late February and March, reaching its peak of abundance in May, while the second starts in August, reaching a peak of abundance in September and continued to next February or March. In comparison with pear in Qualubiya, where the insect manifested three generations a year, it seems that the second generation that was detected at El-Quanater El-Khairiya location and extended from June to August, has combined with the first and the third generations, the matter which decreased the sharp falling of the nymphal percentage occurred during June, at Menia El-Kamh location.

e- Age-structure of *P. oleae* on pear trees, at Menia El-Kamh location :

Data represented in Tables (11, 12, 13 & 14) and graphically illustrated in Figs. (11, 12, 13 & 14) indicated that, the compost-age structure of ***P. oleae*** on pear trees, at Menia El-Kamh location, showed total population of 32340, 33432 and 35109/30 branches (about half of population which was estimated on pear branches at El-Quanater location), during 1993, 1994 and 1995, respectively. Adult females represented 42.24 %, 41.02 % and 39.40 % of the population during the three successive years of the study. Ovipositing females were represented by 22.10 %, 21.19 % and 22.20 %, with the same sequence. Nymphal stage represented by 35.66 %, 37.79 % and 38.40 % of the total population, respectively. As observed on pear trees, at El-Quanater location, adult females on pear trees at Menia El-Kamh location showed the highest percentage of existence throughout the three seasons of the study (39.40-42.24 % of the total population), followed by the nymphal stage (35.66-38.40 %), while the ovipositing female individuals comprised the least existence (21.19-22.10 %).

D- On plum trees at Menia El-Kamh location, Sharkiya governorate :

a- Seasonal fluctuation of the total population :

Data given in Table (16) and Fig. (16), clearly indicated two main peaks of annual activity of ***P. oleae*** on plum trees, at Menia El-Kamh location (Sharkiya governorate). In the first season (1993), the total population of the plum scale insect showed a gradual increase from January to February (opposite to what was observed on pear trees), subsequently followed by a significant increase during March and continued with moderate increases within April and May, to reach the first maximum peak of abundance during May, when 3177 individuals/30 branches of plum were counted, at mean of 21.45°C and 67 % R.H. Afterwards, a slight decrease occurred in June, followed by moderate decrease in July, subsequently the decrease in population continued sharply during August. In September, the second peak of total population abundance was recorded, being 2697 individuals/30 branches of plum, at means of 24.70°C and 65 % R.H. Gradual successive decreases in population followed during October, November, December and next January. In 1994 season, the population of ***P. oleae*** was relatively low in January and February (1101 and 1035 individuals/30 branches, respectively), then started to increase gradually during March and April to reach the first peak of abundance by 2820 individuals/30 branches of plum in May, at means of 21.90°C and 68 % R.H. As occurred during the first season, the second peak of abundance occurred in September 1994, being 2850 individuals/30 branches of plum, at 24.45°C and 66 % R.H. In the third season of the study, the population fluctuation followed the same sequence as occurred in the first season. No drop in the population was observed in February, but increases continued gradually to reach the first and highest peak of abundance in May, when 3120 individuals/30 branches were counted at 21.20°C and 67 % R.H. The second peak was observed later in September, being 2949 individuals/30 branches, at means of 24.50°C and 69 % R.H. The obtained results indicated that the plum scale insect total population at Menia El-Kamh

Table (16) : Monthly counts of total alive population of *P. oleae* on 30 plum branches, throughout 1993-1995 successive years in Sharkia, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	1206	-	10.00	74	1101	-	9.90	73	1356	-	10.00	72
Feb.	1305	1.08	11.30	68	1035	0.94	10.90	6.8	1533	1.13	11.70	70
Mar.	2187	2.37	14.35	66	2133	2.06	14.05	67	2466	1.61	14.10	68
Apr.	2445	1.12	18.40	62	2091	0.98	19.15	66	2208	0.89	19.40	64
May	3177	1.30	21.45	67	2820	1.35	21.90	68	3120	1.41	21.20	67
Jun.	2886	0.91	23.65	63	2544	0.90	25.05	64	2253	0.72	23.60	66
Jul.	2187	0.76	25.60	64	2343	0.92	25.25	66	2103	0.93	26.80	68
Aug.	1392	0.64	26.60	76	1440	0.61	26.75	75	1356	0.64	27.40	73
Sept.	2697	1.94	24.70	65	2850	1.98	24.45	66	2949	2.17	24.50	69
Oct.	1962	0.73	20.75	66	1881	0.66	21.30	64	1731	0.59	21.10	63
Nov.	1776	0.91	19.20	64	1806	0.96	18.75	63	1659	0.96	18.80	65
Dec.	1611	0.91	14.35	67	1347	0.75	14.15	71	1560	0.94	14.55	69
Total	24447	-	230.35	802	23391	-	231.60	811	24294	-	233.15	814
Mean	2037.25	-	19.20	66.80	1949.25	-	19.30	67.60	2024.50	-	19.43	67.83

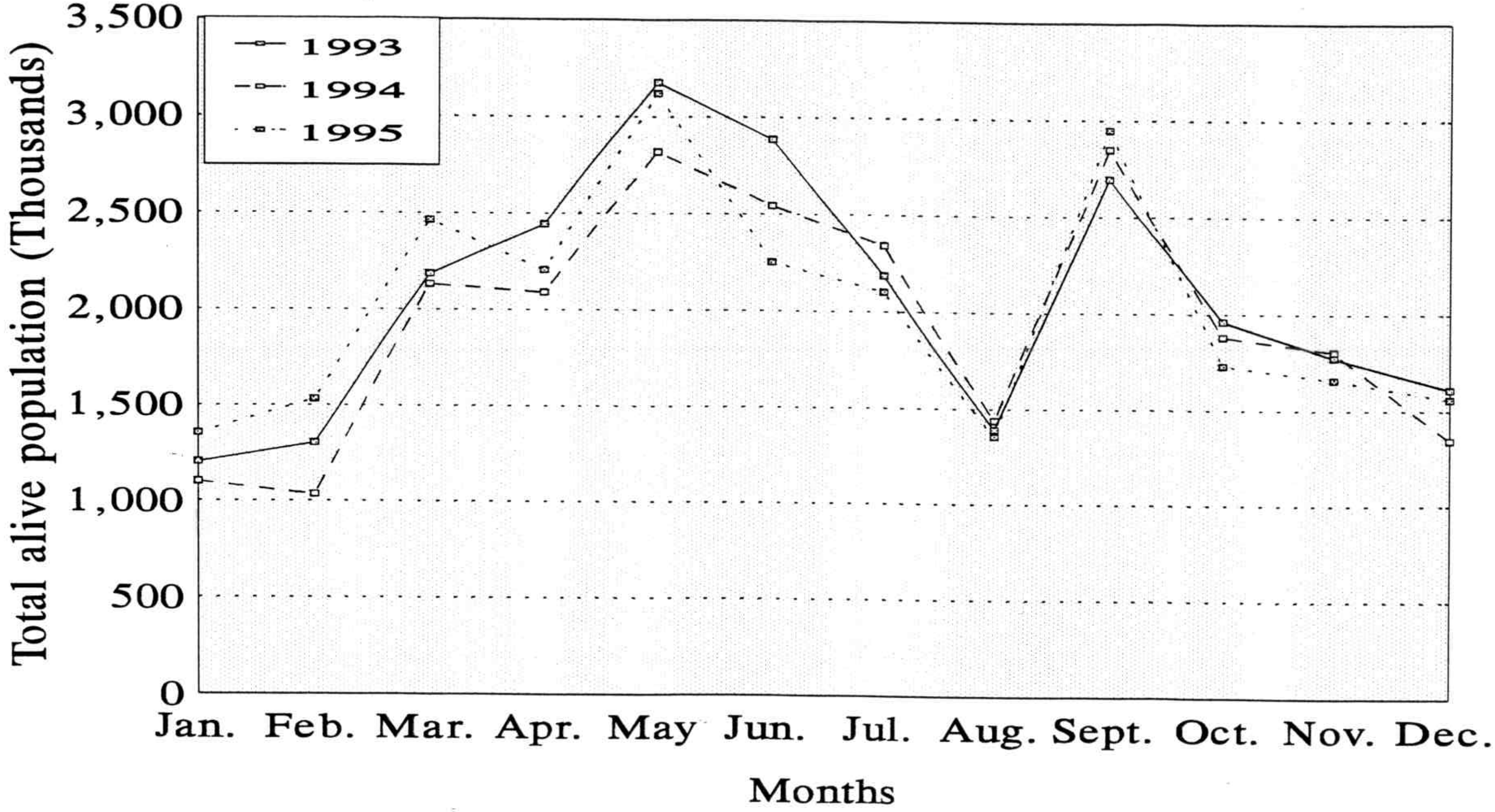


Fig. (16) : Relative abundance of total alive population of ***P. oleae***, on plum at Menia El-Kamh location throughout 1993-1995 years.

location has two main peaks of abundance on plum trees, the first occurred in May, while the second took place within September, and both of them with more or less the same population size.

b- Seasonal fluctuation of different stages of *P. oleae* on plum trees in Sharkiya governorate :

1- The adult females (females without laying eggs) :

Data represented in Table (17) and Fig. (17), indicated that the adult females of ***P. oleae***, at Menia El-Kamh location, has almost three peaks of annual activity on plum trees. In 1993 season, the first peak of adult females abundance was observed in June, being 1116 females/30 branches of plum, at means of 23.65°C and 63 % R.H. Other peak occurred in December, at 14.35°C and 67 % R.H., when 1611 individuals were counted/30 branches. This peak of female abundance, was observed to be delayed one month as compared to the corresponding peak on plum trees in Qualubiya. In 1994 season, the first peak of females' abundance was detected in July, when 1008 females were counted/30 branches, at means of 25.25°C and 66 % R.H. This first peak came latter by one month than that of 1993 season or the first peak on plum trees in Qualubiya.

The second peak of females' abundance was detected in November, by 1518 adult females/30 branches, at 18.75°C and 63 % R.H., corespondent in time with the second peak at El-Quanater El-Khairiya location, on plum trees. In the third year of study (1995), the peaks of the adult females' abundance, could be detected in July (801 females/30 branches, at 26.8°C and 68 % R.H.), and December (highest peak of 1536 females/30 branches, at 14.55°C and 69 % R.H.). A third common peak was detected in September, when 1059, 1131 and 1248 females/30 branches were counted during 1993, 1994 and 1995, respectively. On the other hand, the lowest abundance of females occurred in May within the whole period of study.

Table (17) : Monthly counts of alive adult females of *P. oleae* infesting 30 plum branches, throughout 1993-1995 successive years in Sharkia, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	1206	-	10.00	74	1101	-	9.90	73	1356	-	10.00	72
Feb.	981	0.81	11.30	68	897	0.81	10.90	68	1239	0.91	11.70	70
Mar.	759	0.77	14.35	66	774	0.86	14.05	67	903	0.73	14.10	68
Apr.	549	0.72	18.40	62	666	0.86	19.15	66	501	0.55	19.40	64
May	501	0.91	21.45	67	600	0.90	21.90	68	477	0.95	21.20	67
Jun.	1116	2.23	23.65	63	789	1.32	25.05	64	705	1.48	23.60	66
Jul.	855	0.77	25.60	64	1008	1.28	25.25	66	801	1.14	26.80	68
Aug.	630	0.74	26.60	76	672	0.66	26.75	75	561	0.70	27.40	73
Sept.	1059	1.68	24.70	65	1131	1.68	24.45	66	1248	2.22	25.50	69
Oct.	858	0.81	20.75	66	882	0.78	21.30	64	756	0.61	21.10	63
Nov.	1467	1.71	19.20	64	1518	1.72	18.75	63	1314	1.74	18.80	65
Dec.	1611	1.10	14.35	67	1260	0.83	14.15	71	1536	1.17	14.55	69
Total	11592	-	230.35	802	11298	-	231.60	811	11397	-	233.15	814
Mean	966.00	-	19.20	66.80	941.50	-	19.30	67.60	949.75	-	19.43	67.83

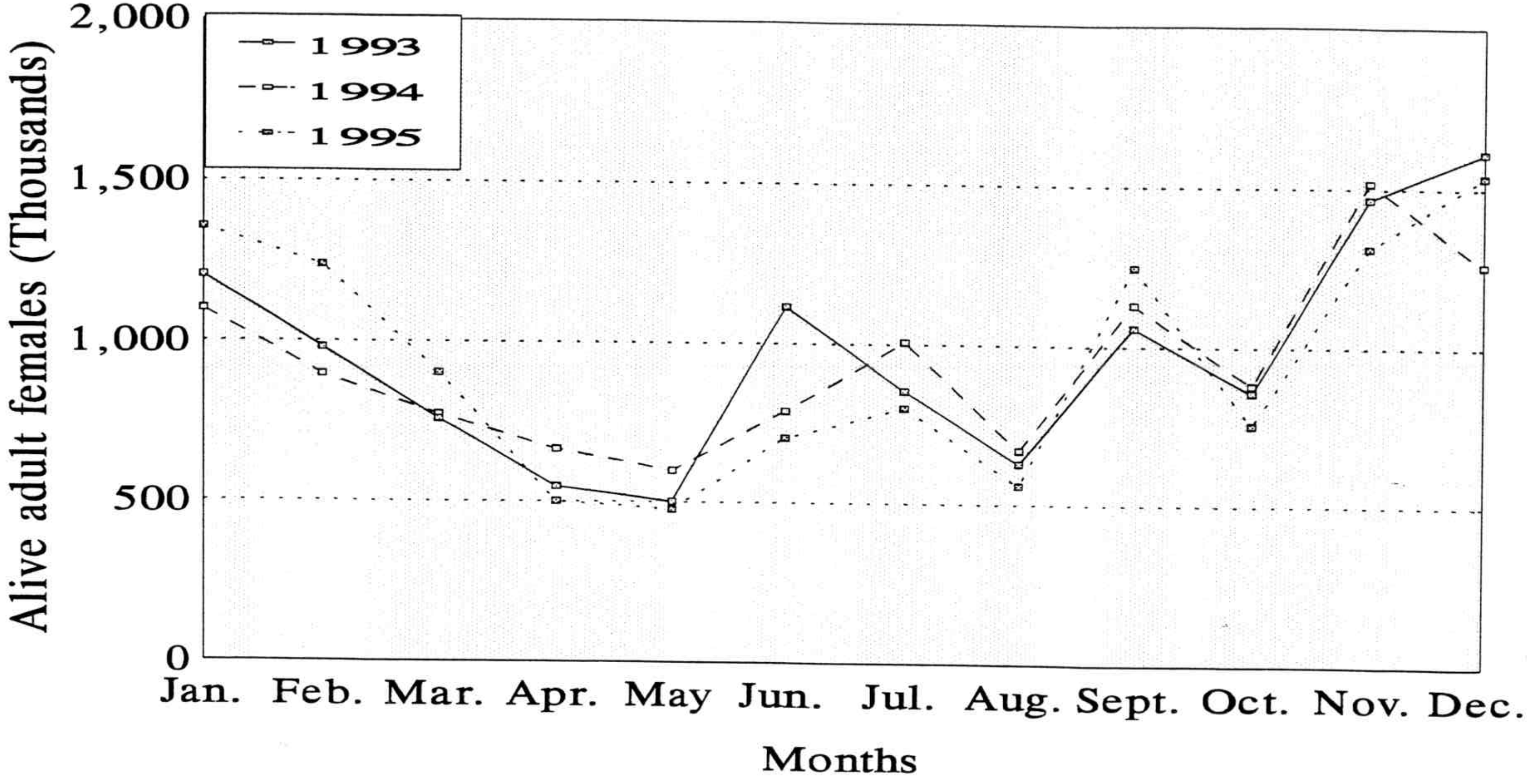


Fig. (17) : Relative abundance of alive adult females of ***P. oleae***, on plum at Menia El-Kamh location throughout 1993-1995 years.

2- The ovipositing female individuals :

Data on monthly total counts of the ovipositing female individuals/30 branches of plum, at Menia El-Kamh location, sharkiya governorate, are shown in Table (18) and Fig. (18). The obtained results indicated that these individuals have three peaks of annual activity a year. First peak of them occurred in April, similar to that on plum at El-Quanater location, being 696, 588 and 621 individuals/30 branches, (significantly lower than that counted at El-Quanater) at means of 18.40, 19.15 & 19.40°C and 62, 66 & 64 % R.H., during 1993, 1994 and 1995, respectively. The second peak of the ovipositing females' abundance took place in July, being 840, 795 and 936 individuals/30 branches of plum trees, at 25.60, 25.25 & 26.80°C and 64, 66 & 68 % R.H., respectively, while the third peak occurred in September, when 969, 1161 and 939 individuals were counted/30 branches of plum trees, at 24.70, 24.45 & 24.50°C and 65, 66 & 69 % R.H., respectively. Branches were free from any ovipositing females in January, but scanty numbers were found in February and December. The comparatively lower population of the ovipositing female individuals was observed in November, being 129, 180 and 90 individuals/30 branches, at 19.20, 18.75 & 18.80°C and 64, 63 & 65 % R.H., during the three studied years, respectively.

3- The nymphal stage :

Results in Table (19) and Fig. (19), indicated two main peaks of ***P. oleae*** nymphs abundance occurred annually in each of the three years of the study. The two peaks which recorded during May and September, were correspondent to those observed on plum trees, at El-Quanater location, but with comparatively lower population. The first peak, in May, of 2121, 1881 and 2412 nymphs/30 branches of plum was higher than that occurred in September, indicating that the climatic conditions during April and May were more favourable in enhancing eggs hatching than those prevailing during August and September months. The nymphal stage in May, peaked at means of 21.45, 21.90 & 21.20°C and 67, 68

Table (18) : Monthly counts of alive ovipositing individuals of *P. oleae* on 30 plum branches, throughout 1993-1995 successive years in Sharkia, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.
Jan.	-	-	10.00	74	-	-	9.90	73	-	-	10.00	72
Feb.	180	-	11.30	68	-	-	10.90	68	60	-	11.70	70
Mar.	459	2.55	14.35	66	510	-	14.05	67	438	3.7	14.10	68
Apr.	696	1.52	18.40	62	588	1.15	19.15	66	621	1.42	19.40	64
May	555	0.80	21.45	67	339	0.58	21.90	68	231	0.37	21.20	67
Jun.	642	1.16	23.65	63	786	2.32	25.05	64	681	2.94	23.60	66
Jul.	840	1.31	25.60	64	795	1.01	25.25	66	936	1.37	26.80	68
Aug.	573	0.68	26.60	76	510	0.64	26.75	75	597	0.64	27.40	73
Sept.	969	1.70	24.70	65	1161	2.77	24.45	66	939	1.57	24.50	69
Oct.	390	0.40	20.75	66	468	0.40	21.30	64	321	0.34	21.10	63
Nov.	129	0.33	19.20	64	180	0.38	18.75	63	90	0.28	18.80	65
Dec.	-	-	14.35	67	27	0.15	14.15	71	-	-	14.55	69
Total	5433	-	230.35	802	5364	-	231.60	811	4914	-	233.15	814
Mean	452.75	-	19.20	66.80	447	-	19.30	67.60	4095	-	19.43	67.83

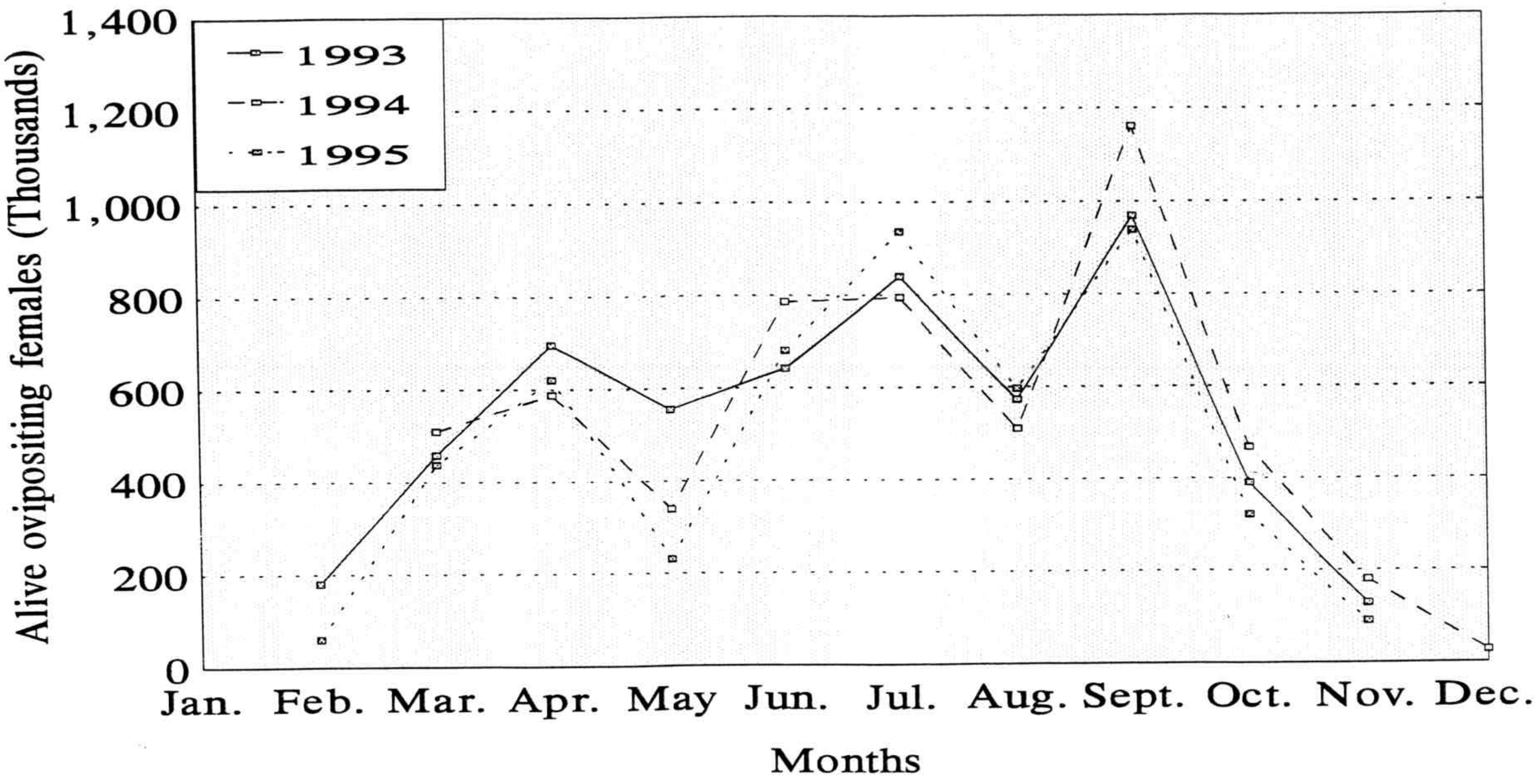


Fig. (18) : Relative abundance of alive ovipositing females of ***P. oleae***, on plum at Menia El-Kamh location throughout 1993-1995 years.

Table (19) : Monthly counts of nymphal stage individuals of *P. oleae* on 30 plum branches, throughout 1993-1995 successive years in Sharkia, with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.
Jan.	-	-	10.00	74	-	-	9.90	73	-	-	10.00	72
Feb.	144	-	11.30	68	138	-	10.90	68	234	-	11.70	70
Mar.	969	6.73	14.35	66	849	6.15	14.05	67	1125	4.81	14.10	68
Apr.	1200	1.24	18.40	62	837	0.98	19.15	66	1086	0.97	19.40	64
May	2121	1.77	21.45	67	1881	2.25	21.90	68	2412	2.22	21.20	67
Jun.	1128	0.53	23.65	63	969	0.52	25.05	64	867	0.36	23.60	66
Jul.	492	0.44	25.60	64	540	0.56	25.25	66	366	0.42	26.80	68
Aug.	189	0.38	26.60	76	258	0.48	26.75	75	198	0.54	27.40	73
Sept.	669	3.54	24.70	65	558	2.16	24.45	66	762	3.85	24.50	69
Oct.	573	0.86	20.75	66	531	0.95	21.30	64	654	0.86	21.10	63
Nov.	180	0.31	19.20	64	108	0.20	18.75	63	255	0.39	18.80	65
Dec.	-	-	14.35	67	60	0.55	14.15	71	24	0.10	14.55	69
Total	7665	-	230.35	802	6729	-	231.60	811	7983	-	233.15	814
Mean	638.75	-	14.20	66.80	560.75	-	19.30	67.60	665.25	-	19.43	67.83

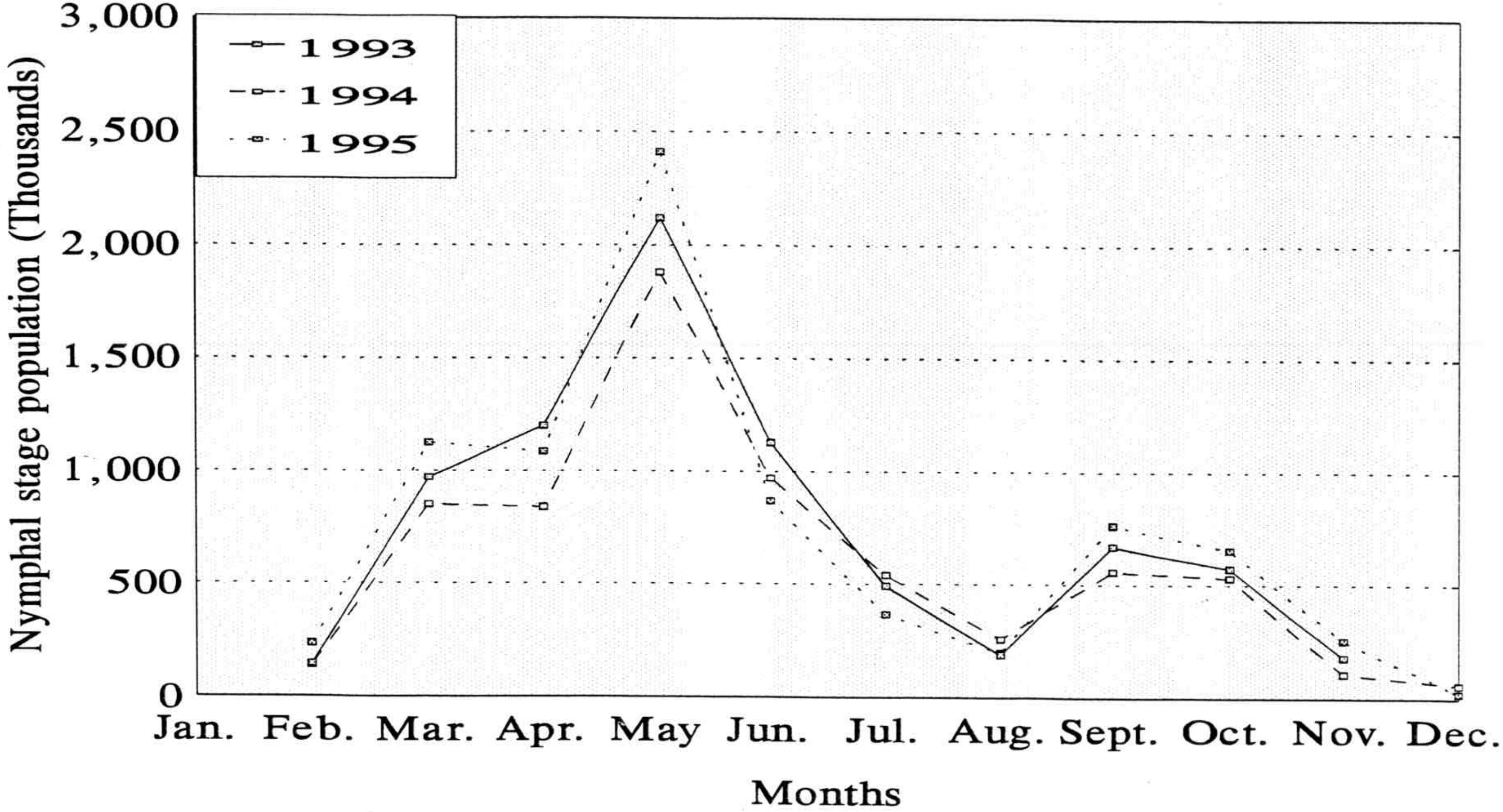


Fig. (19) : Relative abundance of nymphal stage individuals of ***P. oleae***, on plum at Menia El-Kamh location throughout 1993-1995 years.

& 67 % R.H., during 1993, 1994 and 1995, respectively. The peak of September was significantly lower than the first peak, being 669, 558 and 762 nymphs/30 branches of plum trees, at 24.70, 24.45 & 24.50°C and 65, 66 & 69 % R.H., during the three studied years, respectively. According to the aforementioned data, which indicated three peaks of ovipositing females' abundance per year, the same pattern of three peaks of nymphs abundance was normally expected to occur, but it is thought that the high temperature that usually prevails during July and August may caused high mortality rates amongst the crawlers and that, subsequently caused the absence of the third peak of nymphs' abundance that expected to occur during August. The lower population of this stage occurred in November and December & February and they were completely absent in January.

c- The rate of monthly changes in population of different stages of *P. oleae* on plum trees, at Menia El-Kamh location :

Throughout 1993 and 1994 seasons, the highest rate of increase concerning the total population, was observed to occur during March, being 2.37 and 2.06, at mean of 14.35 & 14.05°C and 66 & 67 % R.H., respectively. Another, but lower, high rate of increase of total population (1.94 and 1.98) occurred in September, at 24.70 & 24.45°C and 65 & 66 % R.H., during 1993 and 1994, respectively. In the third season, however, the highest rate of population increase was observed to occur in September, being 2.17, at 24.50°C and 69 % R.H., followed with another high rate of population increase of 1.61 occurred in March, at 14.10°C and 68 % R.H. The severest rate of decrease in the total population was observed to occur in August, being 0.64 and 0.61, during 1993 and 1994, respectively, while in the third season, the lowest rate occurred in October and reached 0.59 (Table, 16). Fluctuations observed in the timing of the high rates occurrence, mainly attributed to the positive or negative fluctuations taking place in the population size of the preceding month, which certainly was affected with the normal and accidental weather factors that may prevail at the location of the study. Concerning the adult stage, high rates of 2.23 and 1.32 increase in population were estimated in June of the first and second seasons, at 23.65 & 25.05°C and 63 & 64 % R.H., respectively (Table, 17). In the same seasons, other high rates of increase that were estimated by 1.71 and 1.72, respectively were estimated in November, at 14.20 & 18.75°C and 64 & 63 % R.H. In the third season of study, the highest rate of adult females increase was observed to occur in September, being 2.22 at 24.50°C and 69 % R.H. The second high rate of 1.74 increase occurred during November, at 18.20°C and 65 % R.H. (Table, 17).

From the obtained data, it could be concluded that, in November, along the three seasons, there was a sure comparatively high rate of adult females increase, while the other high rates may occur mainly during June, after the development of nymphs of the spring brood to adults, and/or in September, due to the accumulation of the adult females of the spring brood with the newly developed females of the fall brood.

Almost, the severest rates of decrease of adult females was observed in April, due to the starting of oviposition in this month, the matter in which, the adult females changed to the next ovipositing female individuals, consequently, decreasing the population size of the adult females and producing this severe low rate.

Concerning the ovipositing female individuals, the highest rate observed within the first and third seasons, was in March, being 2.55 and 3.70 at means of 14.32 & 14.10°C and 66 & 68 % R.H., respectively. This high rate of increase that raised in March, mainly was attributed to the presence of a small population of the ovipositing females within February. Two other high rates were recorded during June and September, associated with the correlative temperature degrees and percentage of relative humidity, as in Table (18). The severest rate of decrease in the ovipositing females population was observed in November, being 0.33, 0.38 and 0.28, at means of 19.20, 18.75 & 18.80°C and 64, 63 & 65 % R.H., indicating that oviposition started to decline and completely stopped before adult females commenced hibernation in winter **(Ezzat, 1957).**

As for the nymphal stage, three high rates of increase were detected annually. The first high rate (6.73, 6.15 & 4.81 during 1993, 1994 and 1995, respectively), occurred in March, at 14.35, 14.05 & 14.10°C and 66, 67 & 68 % R.H., respectively (Table, 19). This highest rate of increase, could be attributed to the small population of nymphs recorded during February. The second high rate of increase in nymphs population, occurred in May and was included with the highest population size of nymphs. The rates of increase were calculated as 1.77, 2.25 and 2.22 at means of 21.45, 21.90 & 21.20°C and 67, 68 & 67 % R.H., during the three seasons, respectively. This second high rate, resulted from the outbreak of eggs hatching within May. The third high rate of increase of the nymphal stage, was observed during September, being 3.54, 2.16 and 3.85 at 24.70, 24.45 & 24.50°C and 65, 66 & 69 % R.H., in 1993, 1994 and 1995, respectively. The severest rate of decrease in the nymphs population was in December, being zero, 0.55 and 0.10 during the three successive years, respectively.

d- Number of generations of *P. oleae* on plum trees at Menia El-Kamh location :

Data in Table (20) and Fig. (20) show the relative abundance of ***P. oleae*** nymphal stage within the total population of the pest on plum trees at Menia El-Kamh location, throughout 1993, 1994 and 1995, respectively. Results indicated two peaks of relative abundance of the nymphal stage throughout the three seasons of the study, indicating two generations per annum. The first generation started in February and reached its peak of abundance during May, where the

Table (20) : **Relative abundance of the nymphal stage of *P. oleae* on plum trees at Menia El-Kamh location, Sharkiya, indicating number of generations/year.**

Year	1993			1994			1995		
Date of sampling	**Total No. of insects**	**Total No. of nymphs**	**% of nymphs**	**Total No. of insects**	**Total No. of nymphs**	**% of nymphs**	**Total No. of insects**	**Total No. of nymphs**	**% of nymphs**
Jan.	1206	-	0	1101	-	0	1356	-	0
Feb.	1305	144	11.03	1035	138	13.33	1533	234	15.26
Mar.	2187	969	44.31	2133	849	39.80	2466	1125	45.62
Apr.	2445	1200	44.10	2091	837	40.03	2208	1086	49.18
May	3177	2121	*66.76	2820	1881	*66.70	3120	2412	*77.31
Jun.	2886	1128	39.10	2544	969	38.09	2253	867	38.48
Jul.	2187	492	22.50	2343	540	23.05	2103	366	17.40
Aug.	1392	189	13.58	1440	258	17.92	1356	198	14.60
Sept.	2697	669	24.81	2850	558	19.58	2999	762	25.84
Oct.	1962	573	*29.20	1881	531	*28.23	1731	654	*37.78
Nov.	1776	180	10.13	1806	108	5.90	1659	255	15.37
Dec.	1611	-	0	1347	60	4.45	1560	24	1.53

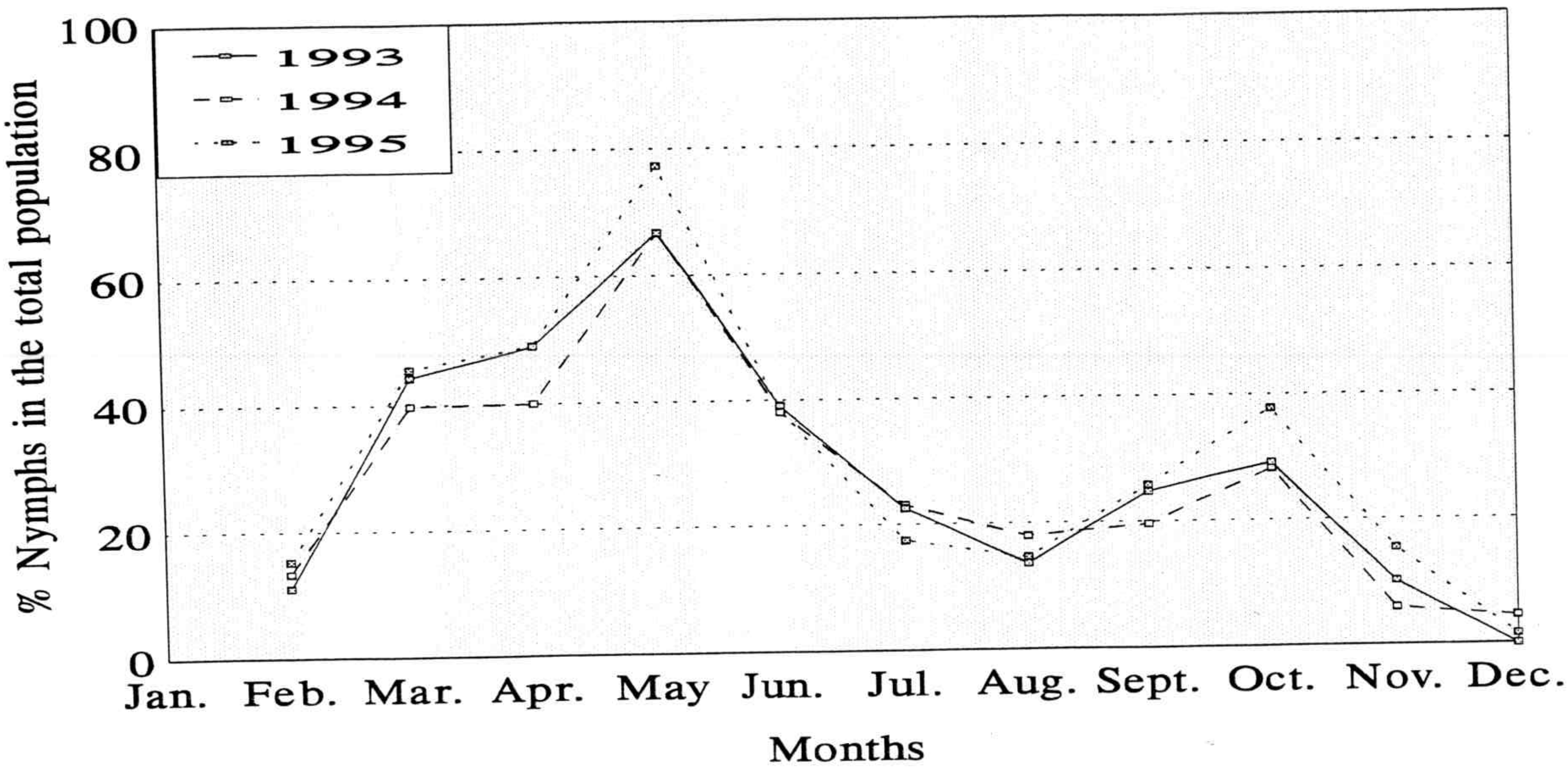


Fig. (20) : Number of generations of ***P. oleae***, on plum at Menia El-Kamh location throughout 1993-1995 years.

percentage of the nymphal stage occupied 66.76, 66.70 and 77.31 % of the total population during the three successive years, respectively. The second smaller generation started within August to reach the peak of abundance in October, when the percentages of the nymphal stages in the three successive years were 29.20, 28.23 and 37.78 %. It was clearly evident that the first generation which was occupied with high percentage of crawlers and accordingly could be considered the most important and care deserving generation of the plum scale insect either on plum or on pear trees. These 1*st* nymphal instar individuals (crawlers), are normally responsible for the insect dispersion.

e- Age-structure of *P. oleae* on plum trees, at Menia El-Kamh location :

Data in Table (16) and Fig. (16), showed a total population of ***P. oleae*** on plum trees, was counted by 24447, 23391 and 24294 individuals/30 branches in each of 1993, 1994 and 1995, respectively. The adult females whole population represented 46.41, 48.30 and 46.91 % of the total population, respectively (Table, 17), while the ovipositing females occupied 22.24, 22.93 and 20.23 %, with the same sequence (Table, 18). The yearly percentage of the nymphal stage comprised 31.35, 28.77 and 32.86 % of the total population, respectively (Table, 20). As observed at El-Quanater location throughout the three years of study, the adult female individuals on plum trees, at Menia El-Kamh location, dominated the remaining stages (46.41-48.3 % of the total population), followed by the nymphal stages (28.77-32.86 %), whereas the ovipositing female individuals manifested the least population size in relation to the total population (20.23-22.24 %; Table, 18).

E- On apple trees, at Nobariya location :

a- Seasonal fluctuation of the total population :

Data given in Table (21), and illustrated in Fig. (21), showed a pattern with two peaks of annual activity occurred in the total population of ***P. oleae***, throughout the three studied seasons of 1993, 1994 and 1995. A slight decrease was observed to occur in total population during February, subsequently followed by gradual incraeses during March and April and continued by a significant increase during May to reach the first and highest peak of total population abundance by 12069, 12039 and 12618 individuals/30 branches of apple trees, at Nobariya location (Behera governorate), at means of 25.50, 24.30 & 23.95°C and 41, 45 & 44 % R.H., during the three successive years. A moderate fall in the total population was detected in June, followed by another during July and August. Sharp increases in total population occurred during September, when the second maximum peak of 8355, 9258 and 8955 individuals/30 branches of apple were detected, at means of 24.80, 24.20 & 24.90°C and 57, 58 & 56 % R.H., during the three successive years, consecutively. On apple trees, the total population of the plum scale insect was constantly significantly higher than those on pear and plum trees, allover the three seasons of the study, the matter that indicated the effect of host plant and probably the location of growing on the rate of infestation with a particular pest. The lowest abundance in the population on apple trees was observed in February, as 2130, 2382 and 2295 total individuals were counted/30 branches, at 13.00, 12.10 & 13.65°C and 49, 51 & 50 % R.H., during 1993, 1994 and 1995, respectively.

Table (21) : Monthly counts of total population of *P. oleae* on 30 apple branches throughout 1993-1995 successive years in Nobariya district (Behera governorate), with the corresponding means of temperature, and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. C	Mean % R.H.
Jan.	2259	-	10.85	54	2406	-	11.00	56	2586	-	10.25	56
Feb.	2130	0.94	13.00	49	2382	0.99	12.10	51	2295	0.89	13.65	50
Mar.	2853	1.34	15.72	49	3042	1.28	16.20	52	2931	1.30	16.4	48
Apr.	5478	1.92	20.50	43	5052	1.66	21.20	47	5364	1.83	20.00	45
May	12069	2.20	25.50	41	12039	2.40	24.30	45	12618	2.35	23.95	44
Jun.	8955	0.74	28.50	36	10881	0.90	27.55	41	10233	0.81	28.00	41
Jul.	5256	0.59	29.55	46	5877	0.54	30.50	45	6219	0.61	29.55	44
Aug.	2853	0.54	28.50	56	2997	0.51	28.45	55	3150	0.51	28.10	56
Sept.	8355	2.93	24.80	57	9258	3.10	24.20	58	8955	2.84	24.90	56
Oct.	6984	0.84	22.55	55	8055	0.87	21.25	56	7866	0.89	21.95	54
Nov.	4029	0.58	17.65	63	4272	0.53	17.20	59	3921	0.49	18.10	62
Dec.	2934	0.73	13.75	61	29.82	0.70	12.70	60	2505	0.64	13.49	58
Total	64155	-	250.85	604	69243	-	246.56	625	68643	-	248.25	614
Mean	5346.25	-	20.90	50.33	5770.25	-	20.55	52.10	5720.25	-	20.69	51.20

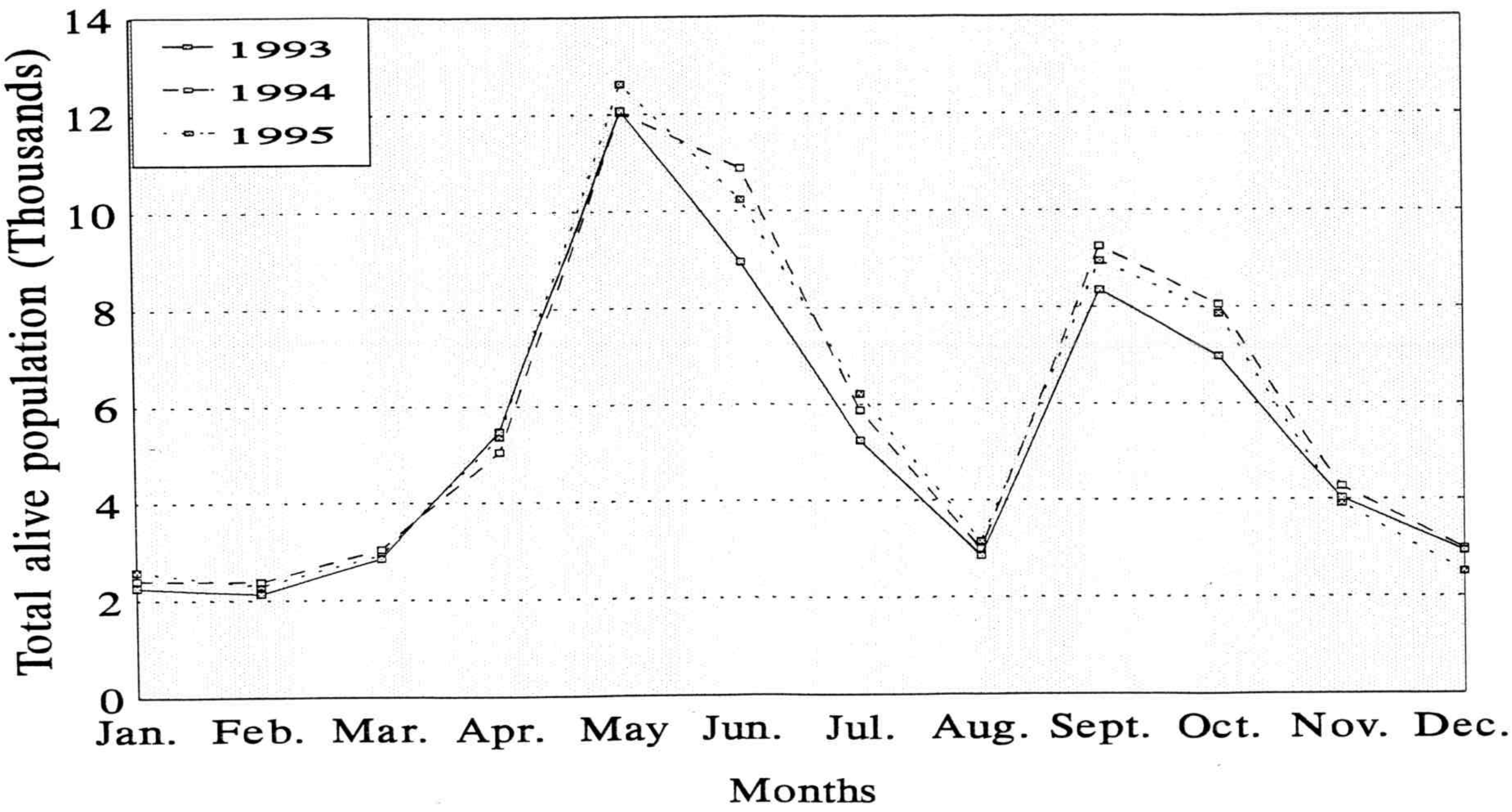


Fig. (21) : Relative abundance of total alive population of ***P. oleae***, on apple at Nobariya district throughout 1993-1995 years.

b- Seasonal fluctuation of different stages of *P. oleae* on apple trees in Behera governorate :

1- The adult females (females without laying eggs) :

Data represented in Table (22), and Fig. (22) indicated two confirmed peaks of adult females' abundance on apple trees/year, at Nobariya location. The first peak occurred during June, as commonly occurred on pear trees, at El-Quanater location, nearly with the same population size, being 2478, 3312 and 2784 adult females/30 branches of apple at means of 28.50, 27.55 & 28.00°C and 36, 41 & 41 % R.H., respectively. A gradual moderate fall was observed to occur during July and August, followed with high increase in population size during September, subsequently continued to reach the second and higher peak of abundance in October, a timing which differed from that recorded at the other two locations on plums or pears, being 3246, 3810 and 3924 adult females/30 branches of apple, at 22.55, 21.25 & 21.95°C and 55, 56 & 54 %, respectively. The lowest population of these individuals, at Nobariya, was observed to occur within May, due to the development of most of adult females to the next ovipositing female individuals, which prevailed during the month of May. The minimum population of this stage, was represented by 672, 759 and 654 adult females/30 branches of apple, correlated with the correspondent degrees of temperature, % R.H., as shown in Table (22).

2- The ovipositing female individuals :

Results in Table (23) and Fig. (23), indicated no existence of any ovipositing female individuals on apple trees, at Nobariya location during January and almost during February too. Results indicated also that two main peaks of abundance occurred within May and September annually in each of the three seasons of the study. The first peak of abundance of May, which occurred by 2478, 2262 and 2595 ovipositing individuals/30 branches of apple, was at 25.50, 24.30 & 23.95°C and 41, 45 & 44 % R.H., during 1993, 1994 and 1995,

Table (22) : Monthly counts of alive adult females of *P. oleae* infesting 30 apple branches, throughout 1993-1995 successive years in Nobariya district (Behera governorate), with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	2259	-	10.85	54	2406	-	11.00	56	2586	-	10.25	56
Feb.	2130	0.44	13.00	49	2313	0.96	12.10	51	2274	0.88	13.65	50
Mar.	1509	0.71	15.72	49	1701	0.74	16.20	52	1497	0.66	16.4	48
Apr.	1041	0.69	20.50	43	1080	0.63	21.20	47	1011	0.68	20.00	45
May	672	0.65	25.50	41	759	0.70	24.30	45	654	0.65	23.95	44
Jun.	2478	3.69	28.50	36	3312	4.36	27.55	41	2784	4.27	28.00	41
Jul.	1515	0.61	29.55	40	2406	0.73	30.50	45	2388	0.86	29.55	44
Aug.	1224	0.81	28.50	56	885	0.40	28.45	55	1131	0.47	28.10	56
Sept.	2781	2.27	24.80	57	3009	3.4	24.20	58	2724	2.41	24.90	56
Oct.	3246	1.17	22.55	55	3810	1.27	21.25	56	3924	1.44	21.95	54
Nov.	2919	0.90	17.65	63	3006	0.79	17.20	59	2718	0.69	18.10	62
Dec.	2751	0.94	13.75	61	2910	0.97	12.70	60	2505	0.92	13.49	58
Total	24525	-	250.85	604	27597	-	246.65	625	26196	-	248.25	614
Mean	2043.75	-	20.90	50.33	2299.75	-	20.55	52.10	2183	-	20.69	51.20

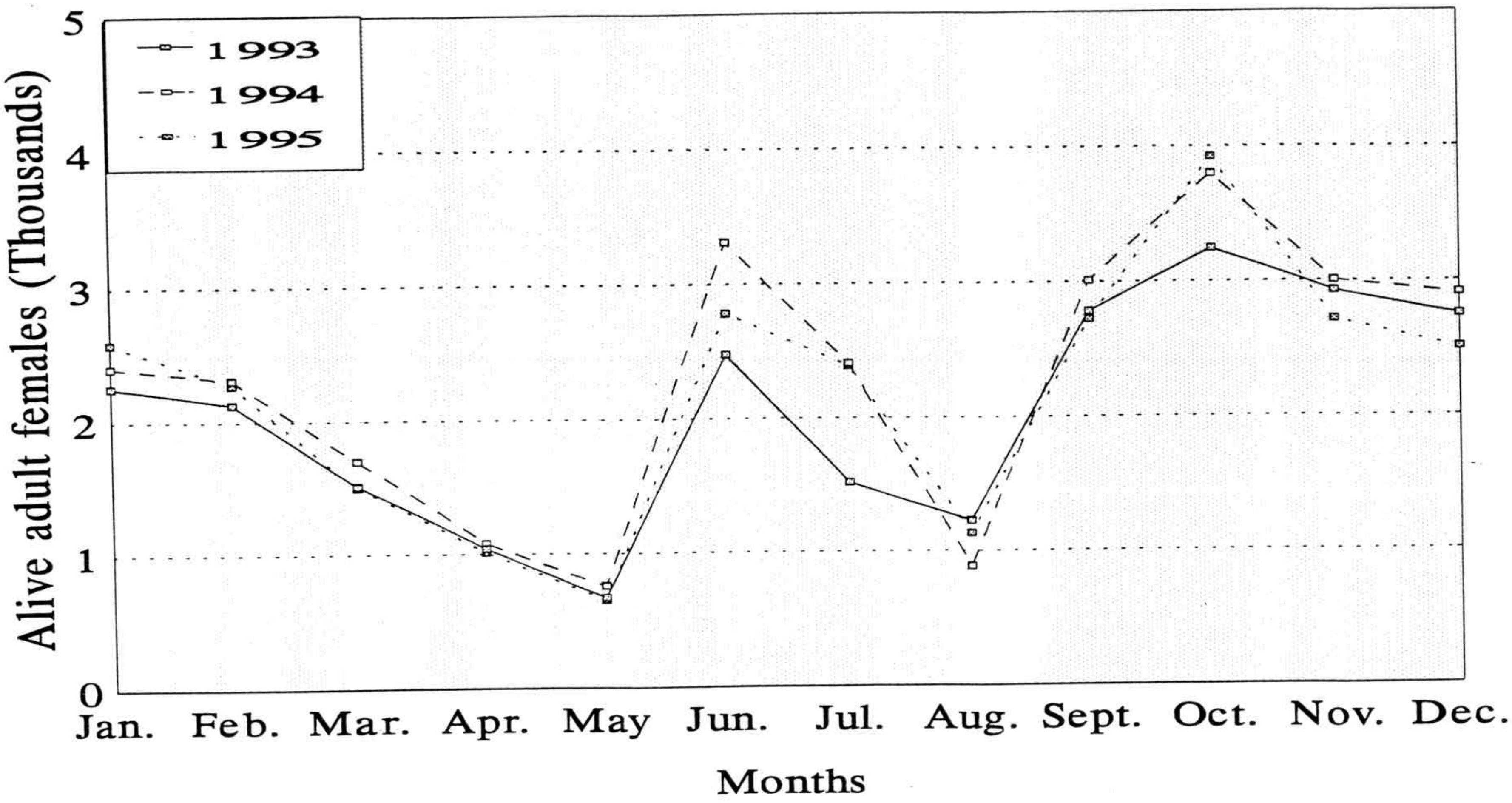


Fig. (22) : Relative abundance of alive adult females of ***P. oleae***, on apple at Nobariya district throughout 1993-1995 years.

Table (23) : Monthly counts of alive ovipositing individuals of *P. oleae* on 30 apple branches, throughout 1993-1995 successive years in Nobariya district (Behera governorate), with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive females on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	-	-	10.85	54	-	-	11.00	56	-	-	10.25	56
Feb.	-	-	13.00	49	69	-	12.10	51	21	-	13.65	50
Mar.	1086	-	15.72	49	972	14.08	16.20	52	1203	57.3	16.4	48
Apr.	1779	1.64	20.50	43	1584	1.63	21.20	47	1881	1.56	20.00	45
May	2478	1.39	25.50	41	2262	1.43	24.30	45	2595	1.38	23.95	44
Jun.	1881	0.52	28.50	36	1467	0.65	27.55	41	1548	0.60	28.00	41
Jul.	1020	0.80	29.55	40	897	0.61	30.50	45	936	0.60	29.55	44
Aug.	816	0.80	28.50	56	1053	1.17	28.45	55	891	0.95	28.10	56
Sept.	1868	2.29	24.80	57	2049	1.95	24.20	58	2103	2.36	24.90	56
Oct.	1308	0.70	22.55	55	1176	0.57	21.25	56	981	0.50	21.95	54
Nov.	408	0.31	17.65	63	339	0.30	17.20	59	375	0.38	18.10	62
Dec.	114	0.28	13.75	61	72	0.21	12.70	60	-	-	13.49	58
Total	12159	-	250.85	604	11940	-	246.65	625	12534	-	248.25	614
Mean	1013.25	-	20.90	50.33	995.00	-	20.55	52.10	1044.50	-	20.69	51.20

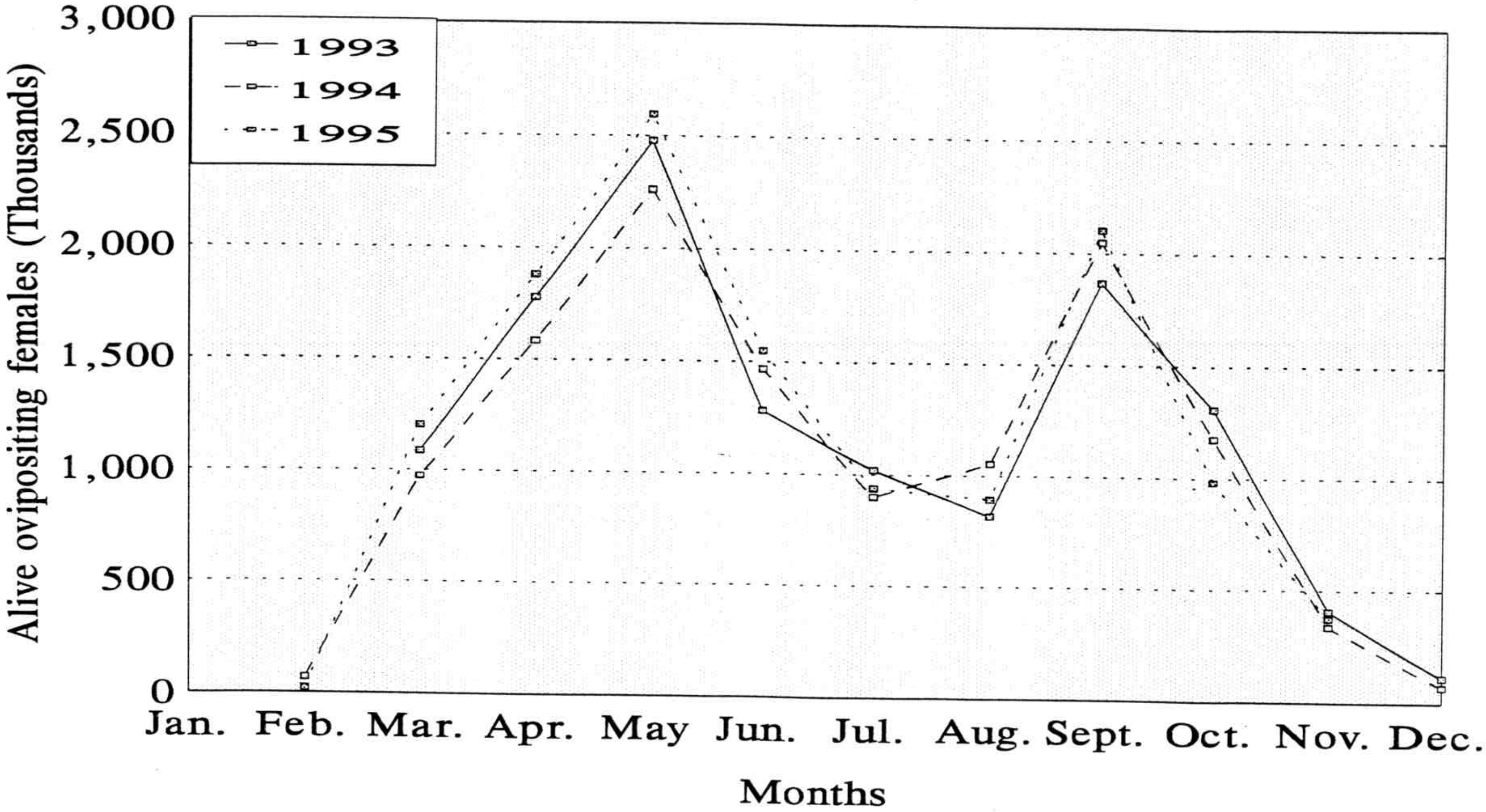


Fig. (23) : Relative abundance of alive ovipositing females of ***P. oleae***, on apple at Nobaryia district throughout 1993-1995 years.

respectively, corresponding to peaks occurred on other host plants, *i.e.* pear and plum at different locations, except plum trees at Menia El-Kamh location, which had three peaks of the ovipositing female individuals' abundance, during April, July and September. The second peak of the ovipositing females abundance observed to occur in September, when 1868, 2049 and 2103 individuals/30 branches, were counted at 24.80, 24.20 & 24.90°C and 57. 58 & 56 % R.H., respectively. On the other hand, the lowest population in the ovipositing female individuals, occurred in December, when 114, 72 and zero individuals/30 branches were counted, at 13.75, 12.70 & 13.49°C and 61. 60 & 58 % R.H. in 1993, 1994 and 1995, respectively.

3- The nymphal stage :

Data in Table (24) and Fig. (24), indicated that comparative to what was observed on the other studied host plants, at different locations, this stage was completely absent during January and oftentimes also during February. On the other hand, corresponding to data recorded on pear and plum trees, at all locations of study, this stage was found to have two main peaks of abundance/year. The first occurred during May, being 8919, 9018 and 9369 nymphs/30 branches of apple, at means of 25.50, 24.30 & 23.95°C and 41, 45 & 44 % R.H., during 1993, 1994 and 1995, respectively. The second peak was observed in September, being 3705, 4200 and 4218 individuals/30 branches, at 24.80, 24.20 & 24.90°C and 57, 58 & 56 % R.H., respectively. The occurrence of the two peaks of the nymphal stage during May and September, simultaneous to those of the other two locations (El-Quanater and Menia El-Kamh locations), could be attributed to the common short incubation period of the insect eggs during these two months, **(Ezzat, 1957)**. Low numbers of this stage were observed in March month of the three years, when 258, 369 and 231 nymphs were counted/30 branches, respectively, correlated with the correspondent means of temperature, % R.H., as shown in Table (23). This low abundance observed

Table (24) : Monthly counts of nymphal stage individuals of *P. oleae* on 30 apple branches, throughout 1993-1995 successive years in Nobariya district (Behera governorate), with the corresponding means of temperature and % R.H.

Year	1993				1994				1995			
Sampling date	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.	Total No. of alive individuals on 30 branches	Rate of change	Mean Temp. °C	Mean % R.H.
Jan.	-	-	10.85	54	-	-	11.00	56	-	-	10.25	56
Feb.	-	-	13.00	49	-	-	12.10	51	-	-	13.65	50
Mar.	258	-	15.72	49	369	-	16.20	52	231	-	16.4	48
Apr.	2568	10.30	20.50	43	2388	6.47	21.20	47	2472	10.70	20.00	45
May	8919	3.36	25.50	41	9018	3.78	24.30	45	9369	3.79	23.95	44
Jun.	5196	0.58	28.50	36	6102	0.68	27.55	41	5901	0.63	28.00	41
Jul.	2721	0.52	29.55	46	2574	0.42	30.50	45	2895	0.49	29.55	44
Aug.	813	0.30	28.50	56	1059	0.41	28.45	55	1128	0.39	28.10	56
Sept.	3705	4.60	24.80	57	4200	4.00	24.20	85	4128	3.66	24.90	56
Oct.	2430	0.66	22.55	55	3069	0.73	21.25	56	2961	0.72	21.95	54
Nov.	702	0.30	17.65	63	927	0.30	17.20	59	828	0.28	18.10	62
Dec.	69	0.10	13.75	61	-	-	12.70	60	-	-	13.49	58
Total	27471	-	250.85	604	29706	-	246.65	625	29913	-	248.25	614
Mean	2289.25	-	20.90	50.33	2475.50	-	20.55	52.10	2492.75	-	20.69	51.20

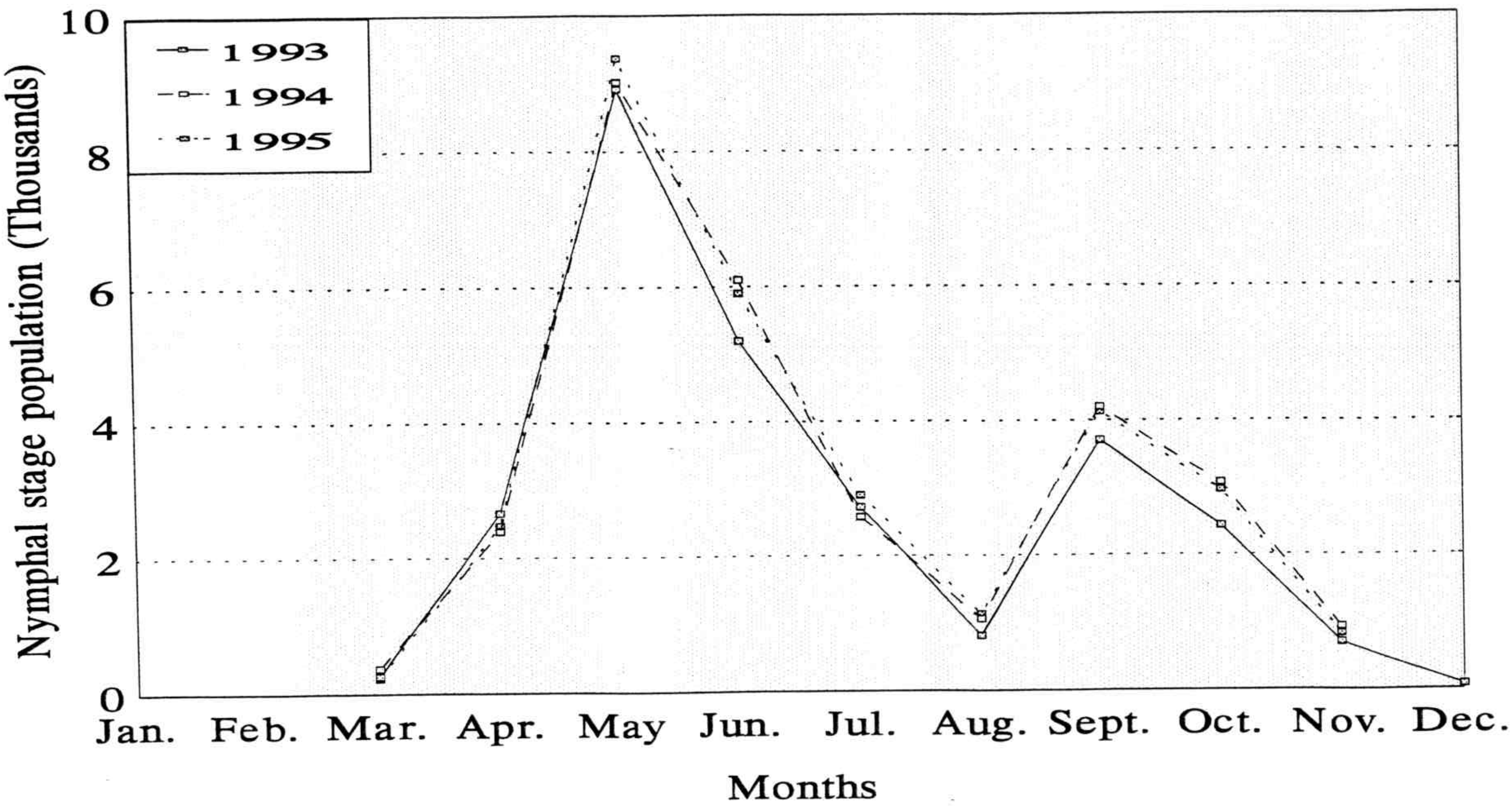


Fig. (24) : Relative abundance of nymphal stage individuals of ***P. oleae***, on apple at Nobariya district throughout 1993-1995 years.

during March, occurred just before the outbreak in eggs-hatching during April and May.

c- The rates of monthly changes in population of different stages of *P. oleae*, on apple trees, at Nobariya location :

As shown in Table (21), the highest two rates of increase in ***P. oleae*** total population were detected during May (2.2, 2.4 and 2.35 in the three studied years, respectively), and September (2.93, 3.1 and 2.84, respectively). These two high rates of increase, came simultaneous to the two high peaks occurred in total population abundance, and could be mainly attributed to the high increases which occurred in the ovipositing and the nymphal stages population during these two months. The severest rate of decrease in the population was recorded in August (0.54, 0.51 and 0.51, respectively) seems to be mainly due to the adverse effect of the high temperature on the nymphal stage, especially the delicate crawlers during late July and August.

In case of the adult female stage, on apple trees, high rates of increase in population were detected during June of the three successive years (3.69, 4.36 and 4.27, respectively), indicating highest rate of increase in June. This high rate of population increase of June was corresponded to that occurred at the remaining locations, and this could be attributed to the rapid development of nymphs which appeared in May to the adult females during June. On the contrary, the severest rate of decrease of the adult females, was discerned in July of the first season, being 0.61, while during the second and third seasons was recorded in August, being 0.40 and 0.47, respectively, (Table 22) .

As for the ovipositing female individuals, the highest rate of increase in the population was observed to occur accidentally in March, being 14.08 and 57.3 in the second and third seasons, while no oviposition started during February of the first season of study, the matter, that caused this rate to be nil during March of the first season, (Table, 23). On the other hand, the comparatively high two rates of increase of the second and especially the third seasons, were resulted due to the low populations of these females during February of the second and third seasons of study. The common high rate of increase in the ovipositing female individuals' population was observed to occur in September, being 2.29, 1.95 and 2.36, resembling that occurred at Menia El-Kamh location. On the other extreme, the severest rate of decrease in the ovipositing female populations, on apple trees occurred in December (0.28, 0.21 and zero, respectively), resembling what occurred at all locations of the study, indicating the highly significant drop in the population of the ovipositing female individuals within that months.

In concern to the nymphal stage, the highest rate of increase was observed to occur in April of the three successive years (10.3, 6.47 and 10.7, respectively, Table 24), following the highest rate of the ovipositing females, which occurred during March. Another two high rates of increase occurred in the population of the nymphal stage, being 3.36, 3.78 and 3.79 in May; and 4.6, 4.0 and 3.66 in September of 1993, 1994 and 1995, respectively (Table, 24).

The obtained results in this concern, indicated that, the nymphs of the plum scale insect, on apple trees, at Nobariya location, has three intervals of fast increase, whose occurred within April, May and September. The severest rate of decrease in nymphal population, was commonly observed during November, being 0.30, 0.30 and 0.28, respectively.

d- Number of generations of *P. oleae* on apple trees, at Nobariya location :

Data in Table (25) and Fig. (25), show the relative abundance of the nymphal stage in relation to the total population on apple trees at Nobariya location, Behera governorate, indicated two peaks of relative abundance throughout the three years of the study. The obtained results referred to two

Table (25) : **Relative abundance of the nymphal stage of *P. oleae* on apple trees at Nobariya district (Behera governorate), indicating number of generations/year.**

Year	1993			1994			1995		
Date of sampling	Total No. of insects	Total No. of nymphs	% of nymphs	Total No. of insects	Total No. of nymphs	% of nymphs	Total No. of insects	Total No. of nymphs	% of nymphs
Jan.	2259	-	0	2406	-	0	2586	-	0
Feb.	2130	-	0	2382	-	0	2295	-	0
Mar.	2853	258	9.04	3042	369	12.13	2931	231	7.88
Apr.	5478	2658	48.52	5052	2388	47.27	5364	2472	46.09
May	12069	8919	*73.90	12039	9018	*74.91	12618	9369	*74.25
Jun.	8955	5196	58.02	10881	6102	56.10	10233	5901	57.67
Jul.	5256	2721	51.77	8577	2574	43.80	6219	2895	46.55
Aug.	2853	813	28.50	2997	1059	35.34	3150	1128	35.8
Sept.	8355	3705	*44.34	9258	4200	*45.37	8955	4128	*46.10
Oct.	6984	2430	34.79	8055	3069	38.10	7866	2961	37.64
Nov.	4029	702	17.42	4272	927	21.70	3921	828	21.12
Dec.	2934	69	2.35	2932	-	0	2505	-	0

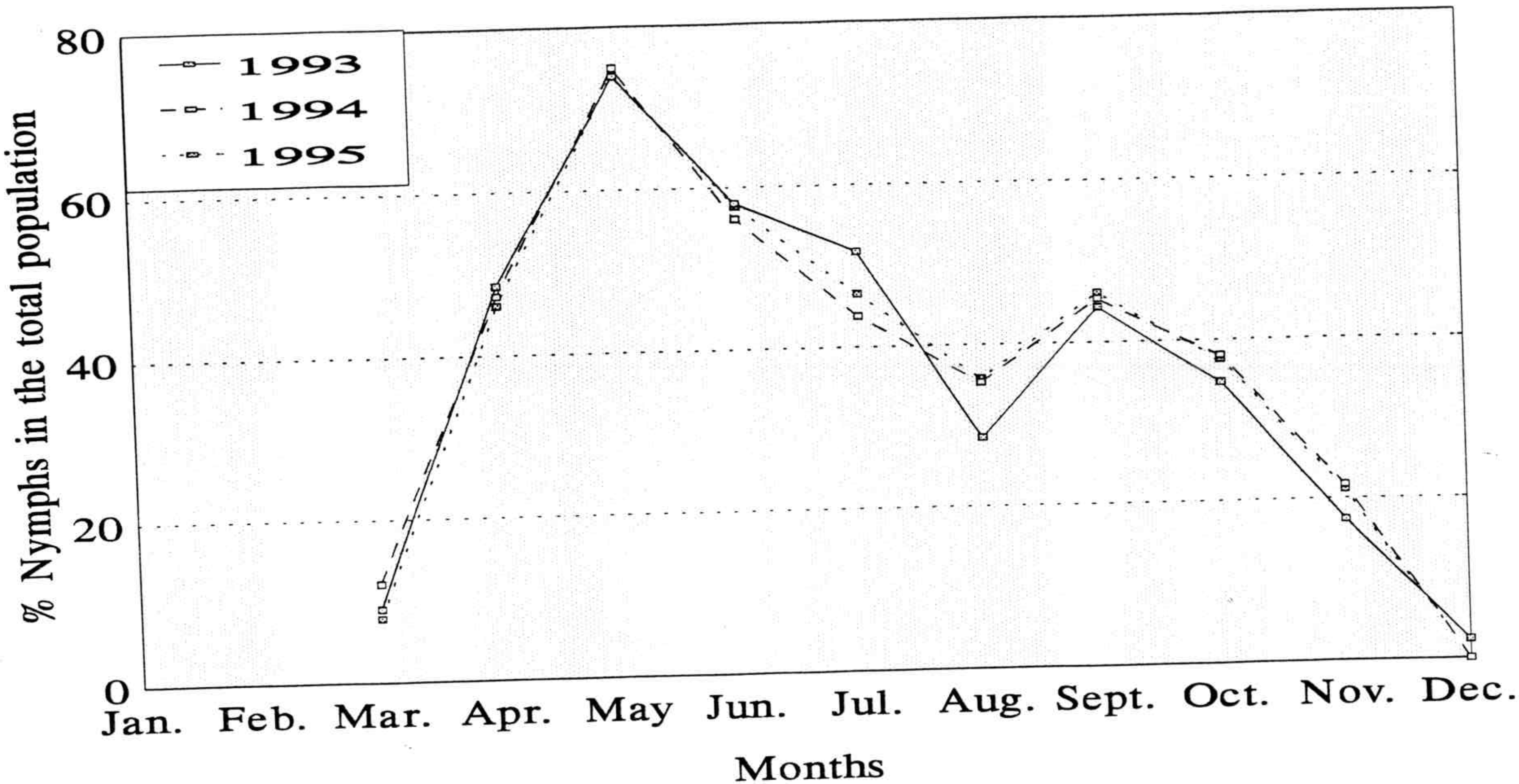


Fig. (25) : Number of generations of ***P. oleae***, on apple at Nobariya district throughout 1993-1995 years.

generations occurred annually for the plum scale insect. The first generation, started during March to reach its maximum abundance in May, where the percentages of the nymphal stages to the total population were 73.90, 74.91 and 74.25 %, during 1993, 1994 and 1995, respectively. The second generation started in August, subsequently reached its maximum abundance within September, where the percentages of the nymphal stages were 44.34, 45.37 and 46.10, respectively.

e- Age-structure of *P. oleae* on apple trees, at Nobariya location :

Data represented in Tables (21, 22, 23 and 24), also in Figs. (21, 22, 23 and 24), indicating the compost-age structure of ***P. oleae*** on apple tress, showed total population of 64155, 69243 and 68643 individuals/30 branches, in 1993, 1994 and 1995, respectively. The adult females represented 38.23, 39.86 and 38.16 %, respectively. The ovipositing female individuals were represented by 18.95, 17.24 and 18.26 % with the same sequence, while the nymphal stage occupied 42.82, 42.90 and 43.58 % of the total population, respectively. These results indicated that, nymphal stage was the most abundant allover the season, followed by the adult females, whereas the ovipositing females were the least abundant individuals at Nobariya location.

In comment on this unique phenomenon of the high abundance of the nymphal stage on apple tress, at Nobariya location, while the adult females were the most abundant allover the other locations and by regarding the higher rate of infestation that was detected on apple trees, at Nobariya to a level that was 2.33 times as what was found on the plum trees, and 1,62 times as observed on pear (calculated on the mean of the total infestation at different locations), the matter that clearly confirmed the importance of the crawlers (first nymphal stage) abundance, and their dangerous role in the dispersion of the infestation with the plum scale insect. From the obtained results, commonly at different location of study, and on different studied host plants, it could be clearly concluded that, the first generation of the plum scale insect, ***P. oleae*** which is known as the spring generation, is the most abundant and consequently the most serious generation. The percentage of the nymphal stage of this generation, which included with the motile crawlers, was comparatively high, reaching about 70 % of the total population, the matter which results in wide dispersal of the insect over large areas, within the time of this generation.

In agreement to our results, **Ezzat (1957)** stated that the crawlers of ***P. oleae*** of the spring brood, started to come out about the end of May, the matter which corresponds to the results obtained in this work, also he stated that the females of ***P. oleae*** occurred in two broods, a spring brood that lasting from July to September, and the fall brood, starting from September to the next February. **Applebaum and Rosen (1964)** in Israel, agreed with the present work when they mentioned that the abundance of the crawlers (first nymphal stage) of the first generation was observed in May, while of the second generation was observed in September. **Habib *et al.*** correspondent to our results, mentioned in **1969,** that the oviposition of the plum scale insect occurred between March and October, and maximum oviposition occurred during June, the fact which correlated to a great extent to the presented findings, which indicated that the highest peak of the ovipositing females almost occurred during this period, depending on the host plant and the location of study. Also, the obtained results, were in almost complete accordance with those of **El-Minshawy *et al.* (1974)**, who recorded that the plum scale insect has two generations ayear, and overwinters from November to next April as fertilized females, also the same authors stated that the oviposition started in April and the crawlers appeared in May-June, while the adult females of the first generation appeared during June, where those of the second generation appeared in mid-August and a few days latter. **Argyrious and Kormadas (1979)**, in Greece, reported results which corroborate with those reported above; they recorded two generations of ***P. oleae*** a year, the spring and the fall generations. In agreement to the present findings, **Huang *et al.* (1989)**, in China, recorded ***P. oleae*** as an important pest on deciduous fruit trees, and they indicated 2-3 generations of this species a year. The same authors stated that the first nymphal instar (crawlers) peaked in May-June, end of August- mid October, and December. Differences in weather and habitats in general, may explain what the others have found and was, to some extent, in some cases different to ours.

4.1.2- Distribution of the plum scale insect, *P. oleae*, on different host plant's heights and directions, and their interaction on pear, plum and apple trees :

4.1.2.1- Effect of different heights of the trees on the distribution of *P. oleae* :

A- On pear trees, at Menia El-Kamh location :

Data recorded in Table (26), clearly showed the different variations occurred in ***P. oleae*** total population on 10 branches of pear trees, at different heights, within the different months of the two studied years (1994 and 1995). Concerning the total number of ***P. oleae*** allover the two years of 1994 and 1995, branches of the first height (lower zone) were observed to be infested with 13594 and 14475 individuals/120 counted branches (10 branches x 12 months) in 1994 and 1995, with means of 1132.83 and 1206.25 individuals/10 branches, in the same two successive years, respectively, indicating the highest insect population on branches of this part of the trees. Middle zone come the next (11907 and 12838 individuals/120 branches, respectively), while the third height (upper zone) was occupied with the lowest population, being 7820 and 8015 individuals/120 branches, allover the two studied years, respectively (calculated as the mean total insect individuals infested 120 branches during the 12 different months of the year). The recorded results of the first year of investigation showed highly significant differences in the insect population on various heights of pear

Table (26) : **Relative population density (number/10 branches) of *P. oleae*, at different heights of pear trees , at Menia El-Kamh location, in 1994 and 1995.**

Levels / Date	1994						1995					
	$Level_1$ *	Rate of change	$Level_2$ *	Rate of change	$Level_3$ *	Rate of change	$Level_1$	Rate of change	$Level_2$	Rate of change	$Level_3$	Rate of change
Jan.	799	-	681	-	525	-	818	-	732	-	561	-
Feb.	666	0.83	539	0.79	419	0.80	675	0.83	602	0.82	405	0.72
Mar.	1413	2.12	993	1.84	792	1.89	1591	2.36	1107	1.84	817	2.02
Apr.	1431	1.01	1099	1.12	886	1.12	1680	1.10	1213	1.10	887	1.09
May	1793	1.25	1397	1.27	1141	1.29	1980	1.18	1495	1.23	1293	1.46
Jun.	1117	0.62	945	0.68	803	0.70	1221	0.62	962	0.64	813	0.63
Jul.	830	0.74	1073	1.14	357	0.44	842	0.69	996	1.03	397	0.49
Aug.	780	0.94	1031	0.96	342	0.96	803	0.95	1025	1.03	346	0.78
Sept.	1522	1.95	1599	1.55	980	2.90	1315	1.64	1497	1.46	864	2.50
Oct.	1287	0.85	935	0.58	596	0.61	1293	0.98	1127	0.75	627	0.73
Nov.	987	0.77	805	0.86	498	0.84	1195	0.92	1069	0.95	519	0.83
Dec.	969	0.98	810	1.00	781	0.97	1062	0.89	1013	0.95	486	0.94
Total	13594		11907		7820		14475		12838		8015	
Overall mean	1132.83 ±70.9		992.25 ±60.85		651.70 ±40.71		1206.25 ±93.52		1069.83 ±86.75		667.92 ±51.43	
"F" value	187.62153						176.51247					
$L.S.D._{0.01}$	29.52223						45.32098					

* Level 1 : 0-1.75 m Level 2 : > 1.75-3 m Level 3 : > 3 m.

trees throughout the total months of the year (individuals/120 branches), and almost in different months (individuals/10 branches). The obtained results in the second year of 1995, showed also highly significant differences between various heights allover the second season of investigation, (Table 26).

Concerning the monthly mean population of ***P. oleae*** at different heights, during the first season of the study, it was clearly observed that the highest insect total population occurred during May and September, being 1793 & 1522 individuals/10 branches of the lowest height, 1397 & 1599 at the middle height and 1141 & 980 individuals/10 branches of the upper height, in 1994, Table (26). While on the other hand, the lowest population/10 branches was estimated in February in cases of the lowest and middle heights (666 and 539 individuals/10 branches, respectively), whereas the lowest population/10 branches of the upper height was observed in August, being 342 individuals. The low insect population of ***P. oleae*** recorded during August on the upper parts of pear trees could be mostly due to the direct effect of high temperature and unfavourite light intensity, which normally occur during this month on insects inhabiting this exposed part of the trees. As shown in Table (26), the highest rates of increase in ***P. oleae*** total population, in the first studied year were recorded at the lower part of pear trees (up to 175 cm from earth) in March and September, being 2.21 and 1.95, respectively, indicating that the local climatic factors at this concerned niche, adopted some favourable conditions during these two months, which probably enhanced the newly emerged crawlers to immigrate and inhabit that lower height of the trees, or enhanced eggs hatching at that niche than occurred at other heights. On the other side, the severest rate of insect population decrease at the lower height of trees, during the first year of study, was detected in June (0.62) and indicating either high percentage of insect mortality, or crawlers migration out of this level due to some unfavourite conditions. In relation to the middle and upper heights of pear trees, the highest rates of insect total population increase, were detected in March (1.84 & 1.89, respectively) and September (1.55 & 2.90, Table 26), while the severest rates of decrease were observed in October for the former height (0.58) and July (0.44) for the latter height generally. From the obtained data concerning the monthly population of ***P. oleae***, at different heights and within different months, in correlation with the insect rates of increase, it was clearly observed during the first studied year of 1994, that the highest rates of increase, at different levels, occurred in March and September, the matter which may be due to the favourable conditions prevailing within these two months, and on the other hand, the severest rate of decrease which was observed in June and July at the lower and upper tree heights seems to be mainly due to the adverse effects of the climatic conditions on insects inhabiting either the lower or the upper unprotected zones, as compared with insects inhabiting the middle zone of trees, which almost protected with the foliage of the other two heights. During the second season (1995), as in the previous season, it was also observed that, in May and September, branches at all heights were occupied with the highest insect population densities, being 1980, 1495 and 1293 individuals/10 branches for May counts and 1315, 1497 and 864 individuals/10 branches for September counts at the lower, middle and upper zones of the trees, respectively. Also, as observed in the first studied season, the lowest insect population at the lower and the middle heights were observed in February, being 675 and 602 individuals/10 branches, respectively, and in August at the upper height (346 individuals/10 branches of pear). As for the monthly rate of change in insect total population, the highest rate of increase, in this year recorded at all heights also in March and September, while the lowest rates were recorded in June, June and July at the lower, middle and upper heights, respectively (Table 26). The obtained results almostly ensure the bad effect of some biotic and/or abiotic factor which prevail during June, July and August, on the total population abundance of the plum scale insect, particularly those inhabiting the upper zone of pear trees, inducing a considerable low rates of increase in the total population. It could be also deduced from the obtained data that, throughout two studied years, the lower zone of pear trees, was occupied by the highest population of ***P. oleae***, followed by the middle zone, whereas the upper zone was occupied by the lowest insect population.

B- On plum trees, at Menia El-Kamh location :

Throughout the two years of study, as shown in Table (27), data indicated that the total population of the plum scale insect, ***P. oleae*** varied significantly at different heights of plum trees during the two years of study. As was observed on pear trees, at the same location of Menia El-Kamh, branches of the lower height were occupied by the highest population of the plum scale insect, calculated as total infestation of different months of the year, being 9576 and 11078 total insect individuals/120 branches allover the two years of 1994 and 1995, respectively, followed by those occupied the middle height of 8539 and 8610 individuals/120 plum branches, while the lowest total population of 6248 and 5635 individuals/120 branches of plum, were inhabiting the upper heights of plum trees. Regarding the monthly records of ***P.oleae*** total populations on plum trees, it was observed in the first studied season of 1994, that the highest population occurred on branches of the lower height in May, being 1152/10 plum branches. Another peak of population size could be discerned at this level in September (1107 individuals/10 branches).On the middle height branches, the highest population size of ***P. oleae*** was observed in September, being 1065 individuals/10 branches of plum, followed in value by that occurred in May (995 individuals/10 branches, Table (27). In case of the upper height, in the same first season, the highest populations were detected, as in case of the lower parts of trees, in May (770 individuals/10 branches), and September (713 individuals/10 branches). The explained results clearly show that the insect population have

Table (27) : Relative population density (number/10 branches) of *P. oleae*, at different heights of plum trees , at Menia El-Kamh location, in 1994 and 1995.

Levels / Date	1994						1995					
	Level$_1$	Rate of change	Level$_2$	Rate of change	Level$_3$	Rate of change	Level$_1$	Rate of change	Level$_2$	Rate of change	Level$_3$	Rate of change
Jan.	443	-	384	-	314	-	532	-	403	-	368	-
Feb.	425	0.96	318	0.91	299	0.95	611	1.14	507	1.26	443	1.20
Mar.	1008	2.40	711	2.24	560	1.87	1106	1.81	809	1.60	601	1.30
Apr.	1018	1.01	851	1.20	653	1.17	1102	1.00	744	0.92	586	0.97
May	1152	1.13	995	1.17	770	1.18	1717	1.60	826	1.11	651	1.10
Jun.	1018	0.88	867	0.87	648	0.84	1306	0.76	731	0.88	423	0.68
Jul.	866	0.85	931	1.10	539	0.83	995	0.76	1093	1.50	312	0.78
Aug.	513	0.59	743	0.80	411	0.76	467	0.45	763	0.70	303	0.97
Sept.	1107	2.16	1065	1.43	713	1.73	1115	2.39	1085	1.42	714	2.36
Oct.	772	0.70	622	0.58	487	0.76	797	0.71	531	0.49	462	0.65
Nov.	687	0.88	621	1.00	472	0.97	703	0.88	601	1.13	410	0.89
Dec.	567	0.93	467	0.75	382	0.81	627	0.89	517	0.86	382	0.93
Total	9576		8539		6248		11078		8610		5635	
Overall mean	798.00 ±50.64		711.58 ±62.76		520.70 ±43.62		923.20 ±72.70		717.5 ±65.83		469.6 ±31.84	
"F" value	183.86243						135.62176					
L.S.D.$_{0.01}$	36.83951						48.60737					

* Level 1 : 0-1.75 m Level 2 : > 1.75-3 m Level 3 : > 3 m.

fluctuated at different heights of the same trees and also from one month to another.

The general trend of these fluctuations appears to be similar to that previously recorded on pear trees, but trees of the fruit crops have varied in the insect population size, which was mostly lower on plum trees. Another difference may be also observed to occur on plum trees, as the lowest insect populations were counted in February in all of the studied heights, being 425, 318 and 299 individuals/10 plum branches, of the first, second and third heights, respectively; where in case of pear, the lowest insect populations were observed in February (at lower and middle heights)and in August (at the upper height), taking into consideration that, also plum branches of the upper height, were occupied by comparatively low insect population during July and August, almost due to the influence of direct exposing to the high temperature and intensity of sun light on different insect stages inhabiting that height. Observations on the different rates of population change throughout the first season of study, at different heights of plum trees, indicated that the highest rates of increase occurred, as on pear trees in March and September, at all of the three studied heights, being 2.40, 2.24 and 1.87 in March and 2.16,1 .43 and 1.73 in September, at the lower, middle and upper heights, respectively (Table 27). The comparatively high population abundance on the lower parts of the trees, which also combined with the highest rates of population increase that occurred in March and September among all the other heights, indicate that, at this height, and also at these two months, ***P. oleae*** find more favourable conditions for reproduction and increase. Concerning the severest rates of insect population decrease, that occurred in several months of the year, the sharpest rates of decrease in the insect population occurred in August at the lower and upper heights, being 0.59 and 0.76, respectively, indicating the bad effect of the climatic conditions which prevail during this month on insects inhabiting the mentioned heights. While the severest rate of decrease in insect population for those inhabiting branches of the middle height occurred in October, being 0.58, this may be due to the normal decreases in the insect population size which almost start with the natural decrease in temperature in October and continues during the subsequent cold winter months. In the subsequent year (1995), branches of the lower height of trees harboured also the highest total population of ***P. oleae*** (average 11078 individuals/120 plum branches), followed by the middle height (8610 individuals/120 branches); while the lowest insect total population was detected on the upper high branches averaging 5635 individuals/120 branches (Table 27).

As for the monthly records of ***P. oleae*** total population, the highest populations occurred on branches of the lower parts of trees during May (1717 individuals/10 branches), followed by those recorded in June and September (1306 & 1115/10 branches, respectively; Table 27). At the middle height, the highest insect population size was observed during July, being 1093 individuals/10 branches, followed by another high population size, almost with the same value in September (1085/10 branches), while on branches of the upper height, the highest insect total population of 714 individuals/10 branches was recorded in September, followed by another peak in May, being 651/10 branches of plum. From the obtained data and results in this concern, it was obviously observed that, within the two years of the study, on pear and plum trees, at Menia El-Kamh location, the over abundance of the plum scale insect, ***P. oleae***, usually occurred at the lower heights of trees, mostly during May and September, and when occurred between times, it could be attributed to the acute deficiency occurred in the concerned parasitoid population during the hot summer months and/or some accidental unfavourable climatic conditions which prevailed during May, for instance, but improved during the subsequent months, *i.e.* June and/or July.

In relation to the recorded low populations of ***P. oleae***, on plum trees, during the second studied season of 1995, the lowest insect population was recorded in August at the lower and upper height of plum trees branches, being 467 and 303 individuals/10 branches, respectively, indicating the intelligible bad effect of August weather conditions on the insect individuals inhabiting these parts of the trees, which normally exposed to either the direct effect of sun light and temperature (at the upper heights of trees) or to the indirect effects of these factors through reflection from earth surface to the lower parts of trees.

The lowest insect population at the middle heights of trees was detected in January (403 individuals/10 branches), following the natural decreases of alive individuals which observed to occur normally in the cold winter months. Observations on the different insect rates of change in the total population, at different heights, indicated mainly two high rates of increase, occurred in March and September at all of the three heights, in addition to a third high rate of insect population increase, have been recorded in July, only at the middle height, almost, following the same sequence of the first year of study. On the other hand, values indicating the rates of population decrease (less than 1), indicated a sharp rates of decrease in August, at the lower height of trees (0.45), and in October, at the middle and upper heights, being 0.49 & 0.65, respectively (Table 27).

C- On apple trees, at Nobariya location :

Data in Table (28) show the total population of the plum scale insect, ***P. oleae***, at different heights of apple tree branches, at Nobariya location, throughout the two years of study. In contrast to what were previously observed on pear and plum trees, the middle height branches harboured the highest insect

Table (28) : Relative population density (number/10 branches) of *P. oleae*, at different heights of apple trees , at El-Nobariya location, in 1994 and 1995.

Levels / Date	1994						1995					
	Level$_1$	Rate of change	Level$_2$	Rate of change	Level$_3$	Rate of change	Level$_1$	Rate of change	Level$_2$	Rate of change	Level$_3$	Rate of change
Jan.	646	-	962	-	795	-	686	-	990	-	869	-
Feb.	671	1.04	908	0.94	778	0.98	690	1.00	837	0.84	763	0.88
Mar.	785	1.17	1293	1.42	780	1.01	781	1.13	1205	1.44	960	1.26
Apr.	1257	1.60	2039	1.58	1762	2.26	1290	1.65	2180	1.81	1870	1.95
May	3581	2.85	4610	2.26	3543	2.03	3780	2.93	4883	2.24	3990	2.13
Jun.	3470	0.96	4437	0.96	2717	0.76	3451	0.91	4472	0.92	2359	0.59
Jul.	1990	0.57	2440	0.55	1410	0.52	2052	0.59	2760	0.62	1493	0.63
Aug.	1008	0.51	1333	0.55	600	0.43	1026	0.50	1454	0.53	672	0.45
Sept.	2683	2.66	3630	2.72	2785	4.64	2576	2.51	3521	2.42	2832	4.21
Oct.	2300	0.86	3073	0.85	2576	0.92	2361	0.92	3005	0.85	2503	0.88
Nov.	1070	0.47	1850	0.60	1293	0.50	997	0.42	1697	0.56	1181	0.47
Dec.	808	0.76	1230	0.66	883	0.68	732	0.73	1074	0.63	703	0.60
Total	20269		27805		19922		20422		28078		20195	
Overall mean	1689.08 ±120.30		2317.08 ±181.73		1660.2 ±142.65		1701.83 ±141.17		2339.83 ±195.63		1682.92 ±147.67	
"F" value	93.7542						81.21742					
L.S.D.$_{0.01}$	15.59469						21.30345					

* Level 1 : 0-1.75 m Level 2 : > 1.75-3 m Level 3 : > 3 m.

population densities amongst all of the other branches of different heights, being 27805 and 28078 total individuals/120 branches of apple (12 months x 10 branches were investigated monthly) in 1994 and 1995, respectively, followed by the lower height branches (20269 & 20422 individuals), whereas the upper height branches were occupied with the lowest insect population, being 19922 and 20195 individuals/120 apple branches, during the two successive studied years, respectively. Statistical analysis of the first year, data indicated highly significant differences between means of insect total populations inhabiting different heights of apple trees. Data obtained throughout the second year of study, indicated highly significant differences between insect population at the middle height of trees and those inhabiting both the lower and the upper heights, while the lower heights of trees was found infested by insignificantly higher insect population than the upper height of apple trees.

Concerning the monthly means of total ***P. oleae*** counts in the first studied year (1994), the highest population of the insect was found inhabiting the branches of the middle height during May, being 4610 individuals/10 apple branches (Table 28). During the same month, the highest population was also counted on branches of the lower and upper parts of apple trees (3581 & 3543 individuals/10 branches, respectively).

In relation to the low insect populations, during the first year, the lowest one was recorded in January on the lower height branches (646 individuals/10 branches), in February, on the middle height branches (908 individuals) and in August,on the upper height branches (600 individuals/10 branches, Table 28). These results confirm that, insects that inhabited the upper height branches were always affected with the direct effect of raised temperature, due to the direct exposure to sun light, while those inhabited the lower and the middle heights, were much more affected by the low temperature degrees during winter months.

Observations on the rates of the population changes, during the first season of study showed highest rates at the middle and lower heights, in May (2.26 and 2.85) and September (2.72 and 2.66), respectively. At the upper height, the highest rates of insect population increase were recorded in April, being 2.26 and in September, being 4.64. The latter value concerning the rate of population increase on the upper height branches of apple, in September, exceeds almost the double value of any other high rate of increase, thus indicating the very low insect population in the preceding month (August), and also that, the insect stages that inhabited this part of apple trees, at Nobariya, were more susceptible to the bad weather factors that normally occurs during that month, than any ***P. oleae*** population, at any other location. This explanation may appear more evident by regarding the means of temperature and R.H. in August, at Nobariya (37°C and 55 % R.H.), compared with those occurred at Menia El-Kamh during the same month (33.6°C and 73 % R.H.). As shown in Table (28), the severest rate of decrease in the total population of ***P. oleae*** (0.43), occurred in August at the upper height during the first season of study. Concerning the lower height, the severest rate of insect population decrease (0.51), was recorded also in August, while at the middle height, that was estimated by 0.55 and occurred successively within both July and August. The obtained results of the first studied year, clearly indicated that, the plum scale insect individuals inhabiting the upper height of trees, were highly affected by the high temperature in August, followed by insects at the lower height, mainly due to the reflection of the solar energy (heat & light) on the ground surface, while those inhabited the middle height of trees, were somewhat, sheltered in this part and were subsequently exposed to less - direct or indirect- high temperature and the other unsuitable conditions.

In relation to the recorded fluctuations in insect population at different heights during the different months of the second studied year, the highest insect population on apple trees branches was found inhabiting those of the middle height of the studied trees, during May month, being 4883 individuals/10 branches. Concerning the lower and upper heights of the same trees, an opposite situation was observed in May compared the preceding year, as the insect population size at the upper parts of trees (3990 individuals/10 branches), have slightly exceeded that of the lower height (3780 individuals/10 branches), all in May 1995.

As for periods of insect low population, data indicated that the lowest population of ***P. oleae*** during the second year, on apple trees branches was found to inhabit branches of the upper height during the hot August month (672/10 apple branches, in 1995), being in complete accordance with that recorded during the preceding studied year. That was followed by what observed on the lower branches in January, when 686 insect individuals were counted on 10 branches, followed by that on the middle height branches during February (837 total individuals/10 branches of apple). These mentioned results of the second season, which were as those of the first season, to a great extent, confirmed that the low temperature of January and February badly affected the insect total population at the lower and middle heights, while the high temperature of July and August (mainly of August at this location) badly affected different stages of ***P.oleae*** inhabiting the upper height of apple trees.

In relation to the different observed rates of change occurred in the insect total population during the second studied year, the highest rate of population increase (4.21) was recorded as in the preceding year on branches of the upper height during September, while another high rate of increase in population occurred in May at the same height, being 2.13. Two high rates of population increase were detected during May and September at the lower and middle heights (2.93 & 2.51 and 2.24 & 2.42, respectively, Table 28. On the other hand, the severest rate of population decrease (0.45) occurred also in August, at the upper height of trees, being similar to that occurred in the first year, while at the lower and middle heights of apple trees, the severest rates of decrease in ***P. oleae*** total population, were recorded in November (0.42 & 0.56, respectively). These comparative severe drops in the insect total population seems to be naturally occurred due to the drop of temperature at the beginning of winter. From the previously explained results, concerning the effect of different heights of the trees on the distribution of the plum scale insect infestation, at Menia El-Kamh (on pear and plum trees) and Nobariya (on apple trees) locations, it could be concluded that, at Menia El-Kamh, on both pear and plum trees, ***P. oleae*** preferred to inhabit the lower heights of trees, followed by the middle heights , and finally the upper heights. As for the population density throughout different months of the year, the highest insect populations were observed during May and September, while the maximum rates of insect increase in population were recorded during March and September, respectively. The lowest insect total populations at this location (Menia El-Kamh), were recorded in August, at the upper height of trees, while the lowest total populations at the lower and middle heights occurred during the winter months (mainly in January & February) . The severest rates of decrease in ***P. oleae*** total population, at Menia El- Kamh, on both pear and plum trees, occurred almost within June-August months at all studied heights of trees.

At the second studied location of Nobariya, on apple trees, with regard to the different heights of apple trees, it was clearly observed a tendency for the highest insect total population to inhabit the branches of the middle height of trees, followed by those of lower height, while the branches of the upper heights of trees, at this location, seemed to be unfavourable to be inhabited by the different insect stages (total individuals). Depending on observations and results, it could be concluded that, the high temperature in August, badly affected the insect total population at the upper and lower heights of trees, mainly due to either the direst effect of the solar radiation (heat & light) on insects inhabiting the upper zone of trees, or the indirect effect on insects inhabiting the lower zone of trees, as a result of reflection on the ground surface, especially on the nymphal stage at both heights. Some other detectable decrease in the insect total population occurred during winter months, resulting severe rates of population decrease, but these decreases could confidently be attributed to the natural drops in the insect total population due to mortality of the old adult females of the preceding brood, also mortality of late nymphs of the fall brood due to low temperature, than to be attributed to the harmful effect of the low temperature on the hibernating adult females of the lately fall brood. Accordingly, the plum scale insect, ***P. oleae***, practices over-abundance in its population during May and September, at a particular height of trees, which was different according to the studied location, the matter that should not be neglected in the control programs of this serious pest.

4.1.2.2- Effect of different directions of trees on the distribution of *P. oleae* :

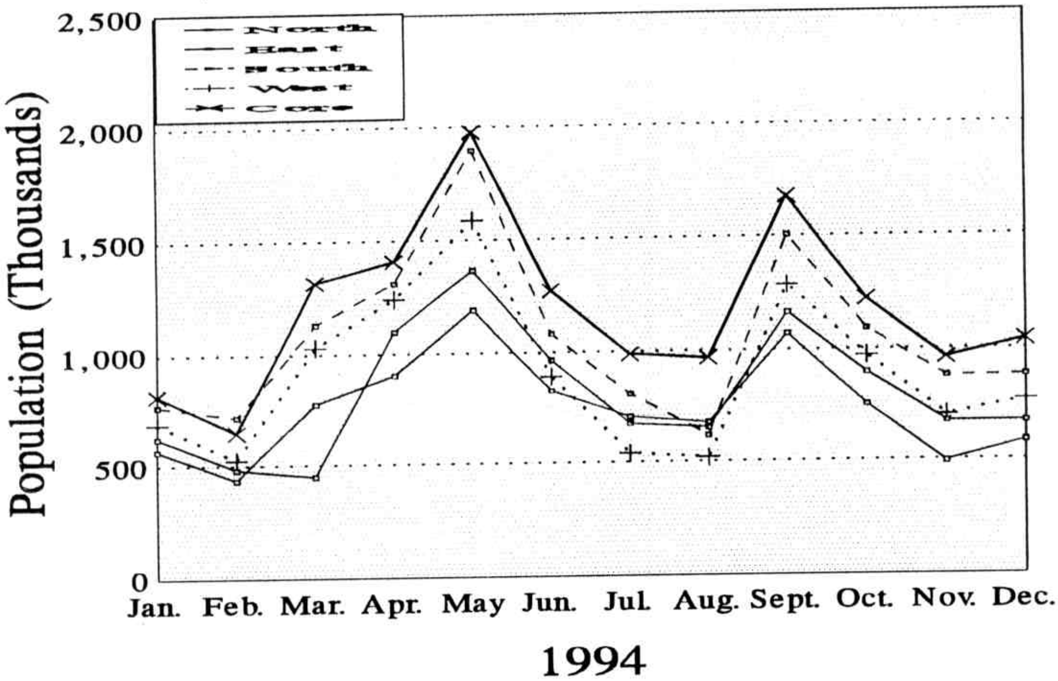
A- On pear trees, at Menia El-Kamh location :

The population densities of ***P. oleae*** were estimated at the main four directions of trees (North, East, South and West), in addition to the central core of trees. As shown in Table (29) and graphically illustrated in Fig. (26), the population of the plum scale insect, on pear tree branches varied significantly at the different cardinal directions and core, within the two studied years of 1994 and 1995. As shown in the concerned table of 1994, the maximum population of the insect allover the year, was found infesting branches of the central core of pear trees, being 14251 individuals/120 branches (12 months x 10 branches were examined monthly), followed by branches of the southern direction, then the western, northern and eastern directions (12658, 10728, 10091 and 8952 individuals/120 branches of pear, respectively). Regarding the fluctuations in total population at the different directions throughout different months of the first season, branches in May, were found to be infested with the highest insect total

Table (29) : Number of *P. oleae* individuals/10 branches of pear trees, at different directions and core, at Menia El-Kamh location, during 1994 and 1995.

	1994										1995									
	North	R	East	R	South	R	West	R	Core	R	North	R	East	R	South	R	West	R	Core	R
Jan.	622	-	564	-	765	-	685	-	813	-	651	-	579	-	743	-	711	-	852	-
Feb.	480	0.77	435	0.77	714	0.93	523	0.76	644	0.79	501	0.77	455	0.79	635	0.85	540	0.76	660	0.77
Mar.	949	1.98	772	1.77	1129	1.58	1031	1.97	1312	2.04	1073	2.14	882	1.94	1253	1.97	1122	2.08	1389	2.10
Apr.	1096	1.15	902	1.17	1306	1.16	1237	1.20	1405	1.07	1183	1.10	1015	1.15	1404	1.12	1326	1.18	1502	1.08
May	1362	1.24	1187	1.32	1892	1.45	1583	1.28	1975	1.41	1420	1.20	1125	1.11	1917	1.37	1612	1.22	2003	1.33
Jun.	964	0.71	825	0.70	1080	0.57	891	0.56	1265	0.64	851	0.60	803	0.71	1069	0.56	905	0.56	1293	0.65
Jul.	670	0.70	701	0.85	805	0.75	538	0.60	986	0.80	702	0.82	713	0.89	825	0.77	536	0.59	1007	0.78
Aug.	650	0.97	673	0.96	615	0.76	518	0.96	965	0.98	636	0.91	666	0.93	752	0.91	520	0.97	973	0.97
Sept.	1162	1.79	1071	1.59	1502	2.44	1281	2.47	1670	1.73	1112	1.75	1017	1.53	1435	1.91	1211	2.33	1614	1.66
Oct.	896	0.77	748	0.70	1090	0.73	973	0.76	1217	0.73	922	0.83	781	0.77	1112	0.77	1023	0.84	1237	0.77
Nov.	671	0.75	492	0.66	879	0.81	700	0.72	960	0.79	792	0.86	583	0.75	991	0.89	897	0.88	1173	0.95
Dec.	669	0.99	583	1.18	881	1.00	768	1.10	1039	1.08	783	0.99	624	1.07	990	1.00	885	0.99	1762	0.99
Total	10091	-	8952	-	12658	-	10728	-	14251	-	10626	-	9243	-	13126	-	11288	-	14865	-
Mean	840.92 ±70.0		746.0 ±62.5		1054.8 ±96.2		894.0 ±61.6		1187.58 ±101.0		885.5 ±73.6		770.25 ±64.3		1093.8 ±98.8		940.67 ±80.0		1238.75 ±105.7	
"F"	81.64250										96.82123									
L.S.D. at 0.01	37.29872										33.06326									

* R : Rate of change (increase or decrease) in population



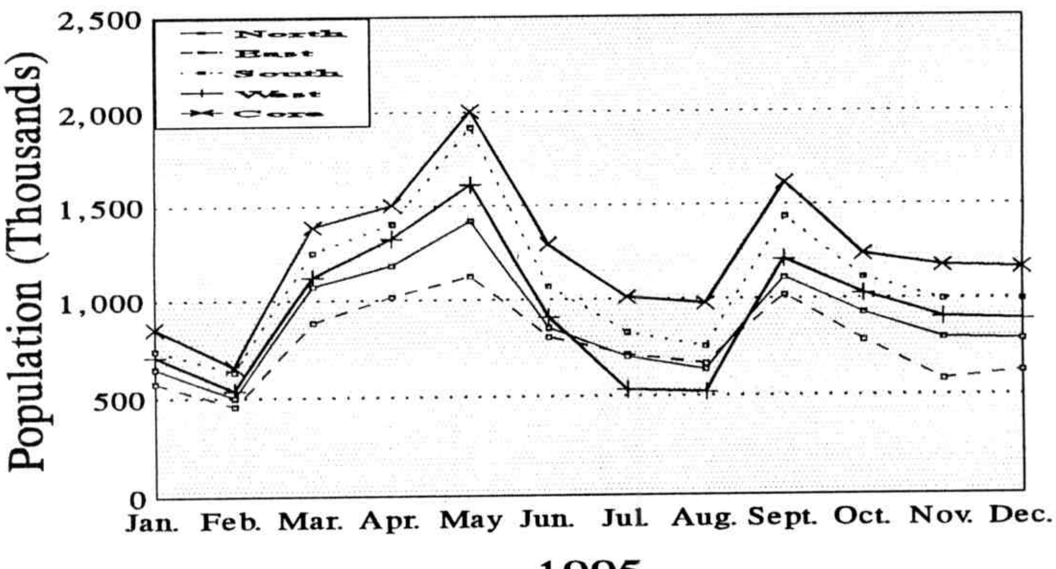


Fig. (26) : Fluctuation of ***P. oleae*** total population at different pear tree directions, at Menia El-Kamh location.

population, being 1975 individuals/10 branches at the central core, 1892 individuals, at the southern branches, 1583 individuals at the western branches, 1362 individuals, at the northern branches and 1187 individuals/10 branches at the eastern direction, in descending order. In September, other peaks in the population abundance could be detected at all tree directions and core, being 1670 individuals/10 branches of the core, 1502 at southern, 1281 at western, 1162 at northern and 1071 individuals/10 branches at the eastern direction, in descending order. In relation to the low insect total populations, infesting different branches of tree directions and core, it was observed that the lowest population at eastern, northern, and core branches occurred in February, being 435, 480 and 644 individuals/10 branches, respectively, while the lowest insect total populations, at the southern and western branches, were recorded during August, being 615 and 518 individuals/10 branches of pear trees, respectively. These data point to the harmful effect of the low temperature in February on the different insect stages inhabiting the northern, eastern and core zonules, also to the bad effect of the high temperature in August on insect individuals inhabiting the southern and western zonules of trees, not denying the effect of the other factors and conditions on insect population wherever it exists. Undoubtedly, the perpendicularity of the incident sun rays, mainly on the southern parts of trees during the hot August, and the long exposure of the western areas of the trees to the comparative high intensive heat and light during August, and other hot summer months, could be the main reasons which badly affected all insect stages especially the delicate crawlers and other nymphal individuals that inhabiting the southern and the western zonules of trees. Observations on different rates of population fluctuations (increase or decrease), at different tree directions and core, during 1994, indicated that, at all directions, the highest rates of population increases occurred in spring (especially in march) and autumn (mainly in September). In concern to the highest rate of population increase of spring season, it occurred at the central core of pear trees, being 2.04 in March, followed by 1.98, 1.97, 1.77, 1.58, also in March at the northern, western, eastern and southern cardinal directions, in respective order. The occurrence of these high increasing rates at different cardinal tree directions in spring (March), with that sequence, indicated also a degree of favourability of this period of the year for ***P. oleae*** individuals inhabiting branches of different directions of trees with the same mentioned sequence (central core, north, west, east and south directions). During the autumn season (in September), the highest rate of increase (2.47) occurred at the western direction, followed by 2.44, 1.79, 1.73, and 1.59 at southern, northern, central core and eastern directions of trees, respectively. Therefore, the cardinal directions and central core of pear trees, at Menia El-Kamh location, could be arranged according to their enhancing the insect population to increase, in autumn (during September), as follows : west : south, north, central core and east directions, in descending order. On the other hand, the severest rates of insect population decrease, were mainly observed to occur in the summer season, at all cardinal directions and core of pear trees. The sharpest decreasing rate (0.56 %) was recorded in June, on the western branches of the trees, indicating that a significant decrease in the insect total population occurred at that site when compared to the insect total population in the preceding month (May), followed by 0.57, 0.64, 0.70 (all in June) and 0.70 (July), at the southern, central core, eastern and northern directions, respectively. When comparing the differences between the highest rate of increase, and the severest rate of decrease in the insect total population, at different directions and core of pear trees, it could be observed that, the western site of trees showed the maximum variation in its insect total population, during different months of the year (2.47- 0.56), followed by the southern site (2.44-0.57), central core (2.04-0.64), northern site (1.96-0.70) and eastern site (1.77-0.66). These results indicated that, the insect population that inhabited the eastern sites of trees, was comparatively stable than those inhabited the remaining directions, while the insect population which inhabited the western sites of trees, was the most dynamically changeful, when compared with the other insect populations occupying the other cardinal directions of pear trees, at Menia El-Kamh location, during the first year of study. Many factors, could cause these variation in the insect population at different directions of trees, *i.e.*, the sun perpendicularity, intensity of the day light, air humidity, wind speed, and others, all or any of them may alter and affect the insect total population at different tree directions, either in negative or positive order. Results of the second year of study, on pear trees, indicated that, as previously occurred in the first year, the maximum insect total population allover the year, was counted on branches of the central core of pear trees, being 14865 individuals/120 branches, calculated as the total number of all insect individuals which were found on all collected branches (120) branches allover the year of 1995, followed by insect populations on southern, western, northern and eastern branches of 13126, 11288, 10626 and 9243 insect total individuals/ 120 branches of pear, respectively (Table 29). In concern to the insect population fluctuations that observed at different cardinal directions and core of pear trees, during the different months of 1995, again, as observed in the previous year, pear branches in May were infested with the highest insect populations of the plum scale insect, being 2003, 1917, 1612, 1420 and 1125 individuals/10 branches of central core, southern, western, northern and eastern tree directions, respectively. In September, other peaks of population abundance of ***P. oleae*** were detected at all of the trees directions, with the same sequence of the first peaks of May, as shown in Table (29). On the other hand, the lowest insect populations at the northern, eastern, central core and southern sites of trees, were recorded in February (at southern and western sites, the lowest insect populations were in August,in the preceding year), being 501, 455, 660, and 635/10 pear branches, where these results are in agreement with what occurred in the preceding year, except for the southern direction branches, which harboured the lowest insect population in August 1994. While at the western direction, the lowest insect population of 520 individuals/10 branches, was observed, as in 1994, in August, the matter that ensures the bad effect of the climatic factors on the insect individuals (different stages), inhabiting that niche during August. In fact, and concerning the lowest abundance on the southern direction either in February, or in August, differences in insect population size between the two months, did not constitute somehow any significant difference between the two populations, (Table 29). The obtained data indicated also, the highest rates of increase in ***P. oleae*** population, were detected in spring (especially in March) and autumn (especially in September). In March, the highest rate of population increase, recorded at the northern sites of trees, being 2.14, followed by 2.10, 2.08, 1.97, and1.94 occurred at central core, western, southern and eastern directions, respectively. While in September, the highest rate of population increase (2.33) was detected at the western tree direction, followed by 1.91, 1.75, 1.66 and 1.53 at southern, northern, central core and eastern directions in respective order, being in the same sequence of the preceding year. In June, the severest rates of decrease in ***P.oleae*** population were detected at all directions, being 0.56 at each of the western and southern directions, followed by 0.60, 0.65 and 0.71, at the northern, central core, and the eastern directions of pear trees, respectively, being in correspondance with the same sequence recorded in June 1994. Regarding the differences between the highest increasing rates, and severest decreasing ones, the maximum difference was also observed as in the first season, at the western direction of the trees (2.33 in September & 0.56 in June), followed by the northern (2.14-0.60), central core (2.10-0.65), southern (1.97- 0.56) and eastern (1.94-0.71) directions. The obtained data confirm the records of the first year, which indicated the comparative stability of insect population at the eastern trees direction, when compared with the more dynamical insect population at the western site of the trees.

B- On plum trees, at Menia El-Kamh location :

Results recorded in Table (30) and Fig. (27) showed that the populations of the plum scale insect, ***P. oleae***, on plum branches, at different cardinal directions and central core of plum trees, varied obviously amongst the two years of the study.

During 1994, the highest insect total population was found at the same location, as that recorded on pear trees, infesting the central core area of trees (total of 10732 individuals/120 branches allover 1994), followed by those infesting branches of the southern, western, northern and eastern directions (9139, 7640, 6887 and 6565 total individuals/120 branches, respectively).

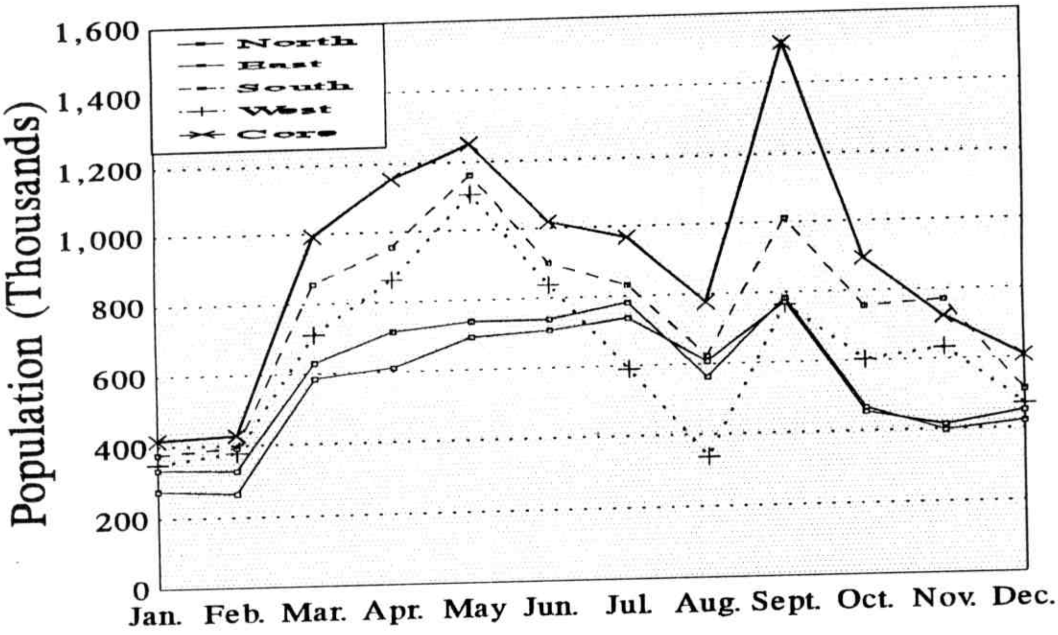
The obtained data, depending on the mean numbers of insect individuals/10 branches indicated insignificant differences, at P = 0.01 between means of insect populations inhabiting the northern and eastern sites of plum trees; while, on the contrary, significant differences at the same level of 0.01 were detected between mean counts/10 branches of the southern, western and the central core, also between their means all, and the means of the northern and eastern direction.

Regarding the fluctuations in ***P. oleae*** total population, at different directions of plum trees throughout the diffrent months of 1994, unlike to that recorded on pear trees (two main peaks of population abundance, in May and September), a common high peak occurred in September, and another almost equivalent peak occurred either in May or July, depending on the different cardinal directions of the trees. The first peak of population abundance was observed in May, at the central core, western and southern branches (1250, 1103 and 1160 individuals/10 branches, respectively, Table 30). This peak was detected in July at the northern and eastern branches, being 780 and 736 individuals/10 branches, respectively. Taking into consideration that the plum

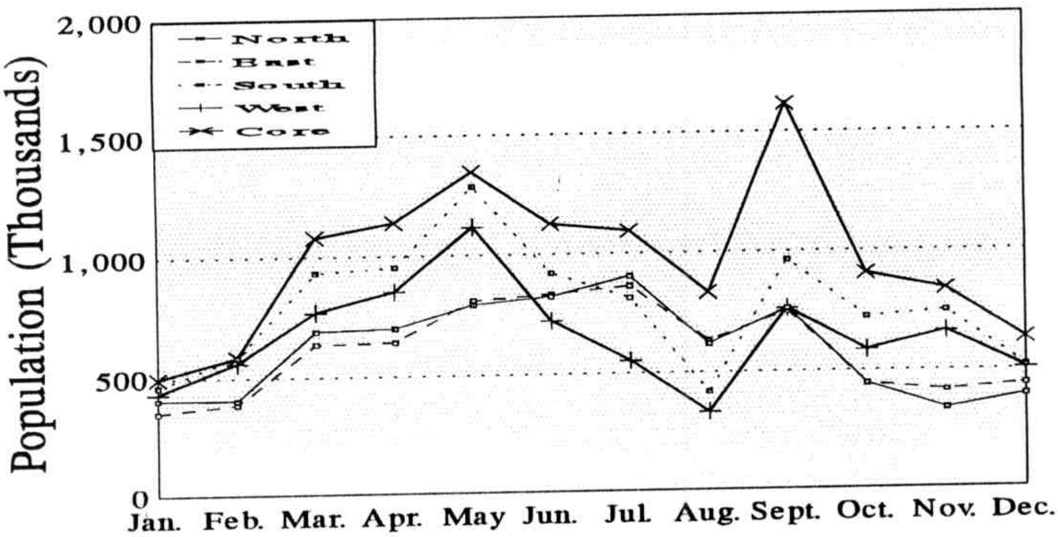
Table (30) : Number of *P. oleae* individuals/10 branches of plum trees, at different directions and core, at Menia El-Kamh location, during 1994 and 1995.

	1994										1995									
	North	R	East	R	South	R	West	R	Core	R	North	R	East	R	South	R	West	R	Core	R
Jan.	334	-	275	-	376	-	350	-	415	-	407	-	352	-	463	-	435	-	496	-
Feb.	328	0.98	265	0.96	392	1.04	379	1.08	427	1.03	403	0.99	385	1.09	583	1.26	558	1.28	582	1.17
Mar.	630	1.92	585	2.21	855	2.18	710	1.87	992	2.32	687	1.70	634	1.56	932	1.60	768	1.38	1081	1.86
Apr.	713	1.13	611	1.04	956	1.12	863	1.22	1153	1.16	797	1.01	639	1.01	952	1.02	851	1.11	1139	1.05
May	737	1.03	692	1.13	1160	1.21	1103	1.28	1250	1.08	793	1.14	810	1.27	1285	1.35	1118	1.31	1343	1.18
Jun.	738	1.00	706	1.02	900	0.78	837	0.76	1017	0.81	822	1.04	831	1.03	920	0.72	721	0.64	1127	0.84
Jul.	780	1.06	736	1.42	830	0.92	590	0.70	968	0.95	903	1.20	862	1.04	813	0.88	549	0.76	1093	0.97
Aug.	563	0.72	607	0.82	623	0.75	337	0.57	776	0.80	614	0.68	628	0.73	415*	0.51	331*	0.61	831	0.76
Sept.	782	1.40	772	1.27	1012	1.62	765	2.27	1513	1.95	760	1.24	749	1.19	962	2.32	761	2.30	1615	1.94
Oct.	465	0.59	453	0.59	755	0.75	603	0.79	893	0.59	444	0.58	446	0.60	723	0.75	583	0.77	903	0.56
Nov.	397	0.85	413	0.91	770	1.02	633	1.05	721	0.81	337	0.76	414	0.93	747	1.03	659	1.13	837	0.93
Dec.	420	1.06	450	1.09	510	0.66	470	0.74	607	0.82	392	1.16	440	1.06	513	0.69	504	0.76	629	0.75
Total	6887	-	6565	-	9139	-	7640	-	10732	-	7259	-	7190	-	9308	-	7838	-	11676	-
Mean	573.91 ±61.3		547.1 ±52.6		761.58 ±61.7		636.66 ±58.8		894.33 ±72.61		604.92 ±59.60		599.17 ±57.91		775.70 ±69.40		653.17 ±62.3		973. ±87.92	
"F"	171.8653										146.2736									
L.S.D. at 0.01	45.67352										39.81764									

* R : Rate of change (increase or decrease) in population



1994



1995

Fig. (27) : Fluctuation of ***P. oleae*** total population at different plum tree directions, at Menia El-Kamh location.

trees are normally different in shape, foliage and structure when compared with pear trees, it is clear from data in table (30), that the insect population rates of increase when grow gradually to reach its first peak of abundance, were -to some extent- affected by the local position of the insect population at different directions of the trees, the matter that may enhance, or suppress these rates according to the different factors acting on either of the five sites of trees. On branches of the southern, western and central core sites, where insect individuals either may be more exposed to sun light and subsequently gained more accumulated degrees of temperature (at the southern and western tree sites), or may be more protected from the acute climatic alternations (at the central core), the insect individuals appeared to develop their own population size faster than those inhabiting the comparatively colder zones of trees (northern and western) within the period extended from January to May; thus, insect rates of increase in population, at these three sites, appeared to be higher than those of the other tree sites, within the same period (from January to May). The second peak of abundance in the plum scale insect population, which was commonly observed in September, at all tree directions and core, the highest one of 1513 individuals/10 branches, was detected at the central core of trees, followed by 1012, 782, 772, 765 individuals/10 branches at the southern, northern, eastern and western directions of trees, respectively. On the other hand, the lowest insect population of 328 and 265 individuals/10 branches, were recorded in February, on the northern and eastern branches, in respective order, while the lowest insect populations at southern and central core zones of trees, were estimated by 376 and 415 individuals/10 branches and occurred in January. On western direction branches, the lowest population abundance of 337 individuals/10 branches, was detected in August. Inspite of the slight differences between data obtained on pear and plum, during the first studied year, the general data on both crops showed that, the insect individuals inhabiting the northern, eastern, and to some extent, the central core branches, were almost affected by the low temperature of winter months, more than they did with the high temperature of summer months. On the other hand, insect individuals inhabiting the western and southern sites of trees, were more affected with the high temperature of summer than they did with the low temperature of winter. From the obtained data, it could be concluded that, the climatic factors varied in their effect on the population abundance of ***P. oleae*** from one site (direction) to another. This, normally depends on the microclimate which could finally reach the insect locations, at the different tree directions, and consequently, the insect population dynamics varied on branches of different sites of the tree throughout the season. In other words, each tree direction has its own population sequence of abundance and depression throughout the season, which almost different those occurred o the other sites. As for the rates of increase or decease in population (rates of change), during the diffrent months of the year, data tabulated in Table (30), showed that, during the first year, the highest rate of insect total population increase occurred at the central core zone of trees, being 2.32, then followed by 2.21, 2.18, 1.92 and 1.87 at the eastern, southern, northern and the western branches of the trees, respectively, during March. This sequence concerning the highest increasing rates of insect total population, at different tree sites of plum branches, completely differed those previously recorded on pear trees during the same year (1994). Thus, confirming the role of the tree structure (external and internal structures) in protecting the insect individuals from, or exposing them to the different surrounding factors which could alter the insect population, consequently, affecting this diffrent rates of increase, at diffrent sites (directions) of the trees. In September, the highest rate of population increase occurred on branches of the western direction (2.27), indicating -again- the unfavourable influence of the solar radiation and the other climatic factors on different insect individuals inhabiting branches of this site of trees during the preceding month

(August). As these severe climatic factors disappeared during September, an improvement in the insect population occurred, causing that high rate of increase to occur. Insect individuals inhabiting branches of the central core of trees during September, showed the second highest rate of increase (1.95) in the insect total population, that was followed by the southern, northern, and eastern directions, as the highest increasing rates were also recorded in September, but estimated by 1.62, 1.40, and 1.27, respectively (Table 30). That was followed by decreasing rate of 0.57 in August, on the western branches and 0.75 in the same month, at the southern branches of trees. The timing of these decreasing rates in the insect total population varied than those previously recorded on pear branches, at the same location (Menia El-Kamh). Results concerning the severest rates of decrease in the total population of ***P.oleae*** on branches of different cardinal directions and central core of plum trees, during the different months of 1994, as in Table (30) confirmed the fact that the insect individuals of different stages infesting the northern, eastern and more or less, the central core branches of plum trees were more affected by the low temperature than those infesting the western and southern branches, which in most cases were more affected with the high temperature during summer. In comparing the differences between the highest rates of insect population increase, and severest rates of decrease, it could be easily observed from Table (30), the greatest difference occurred at the western direction of the trees (2.27-0.57), indicating that branches of this direction harboured the most variable insect population (the same result was previously observed on pear trees), followed by the central core (1.95-0.59), the southern (1.62-0.66), the northern (1.40-0.59), and the eastern direction branches (1.27-0.59). Thus, indicating that, branches of the western direction harboured the most fluctuating insect population, while on the contrary, those inhabiting the eastern direction, were, relatively, of the least fluctuating population.

Results of the second studied year (1995), as shown in Table (30) and Fig. (27), showed the same trend of the first studied year, in concern to the insect population fluctuations, at the four cardinal directions and the central core of trees, within the different months of 1995. The highest insect total population was found infesting branches of the central core of plum trees, as a total of 11676 individuals/120 branches, were counted allover the year of 1995, followed by those infesting branches of the southern (9308), western (7838, northern (7259), and eastern (7190) directions. As shown in Table (30), the difference between means of total ***P. oleae*** individuals/10 branches of plum, at the northern and eastern tree directions was insignificant at 0.01 level, but significant differences appeared between means of insect populations on southern, western and central core branches, and also with any of them and those of the northern and eastern directions. Observations on the insect populations at different trees directions and core zones,throughout different months of 1995, indicated two peaks in the insect population abundance that occurred in different months for the different directions of trees. The first peak occurred between May and July, extending through June, while the second, was a common peak in September.

Regarding the first peak of insect abundance, the highest insect population recorded in May, at the central core of trees (1343 individuals/10 branches), and in the same month, but with fewer counts on the southern and western branches (1285 and 1118 individuals/10 branches, respectively). While on the northern and eastern branches, the first peak of population abundance occurred in July (903 and 862 individuals/10 branches, respectively), although, on branches of these two directions, relatively high population was also detected in June (822 and 831 individuals/10 branches, respectively).

As previously mentioned, the second peak of ***P. oleae*** population abundance, commonly occurred in September, at all directions of plum trees.

During this month, the highest population abundance on different trees directions, could be arranged descendingly as on core zone and the southern, western, northern and eastern branches (1615, 962, 761, 760, and 749 individuals/10 branches, respectively, table 30), following the same sequence of that recorded in 1994.

As for the lowest population abundance of ***P. oleae*** at diffrent directions and core zone of plum trees, that occurred in August on the western and southern branches (331 and 415 individuals/10 branches), in November on the northern branches (337 individuals) and in January on the eastern direction and central core zone branches (352 and 496 individuals/10 branches, respectively;Table 30). Generally, the obtained data of the second year of study, concerning the high and low insect total populations, on different directions of plum trees, throughout different months of the year, indicated similar trend of that previously recorded in the preceding year. Results in Table (30), showed that, in 1995 (second studied year), the highest rates of insect population increase occurred commonly during March on branches of the northern and eastern directions, being 1.70 and 1.56, respectively, and in September on branches of the southern and western directions, also the core zone of trees (2.32, 2.30 & 1.94, in respective order). These results indicated that, in March and September, the insect population showed a considerable outrage on all branches, when compared with populations on branches of different directions during the preceding months (February & August). In relation to the severest rate of decrease in ***P. oleae*** population, on different directions and core zone of plum trees, results in Table (30), indicated their occurrence in October in cases of the core zone, northern and eastern branches (0.56, 0.58 & 0.60, respectively), being in accordance with those previously recorded in the preceding year. The severest rates of population decrease occurred in August on southern and western branches (0.51 and 0.61, respectively), to be synchronized with that recorded in 1994 on the western branches, where varied in case of the southern branches, which showed the severest decreasing rate in December, 1994.

Regarding the differences between the highest increasing and lowest decreasing rates in population abundance, at different tree directions, to deduce the rate of stability of the insect population, results showed that the highest difference occurred at the southern branches of trees (2.32-0.51), to be the most fluctuated population, followed by the western branches (2.30-0.61), the central core (1.94-0.50), the northern branches (1.70-0.58), and finally the branches of the eastern direction (1.27-0.60), which harboured the comparatively most stable insect population.

C- On apple trees, at Nobariya location :

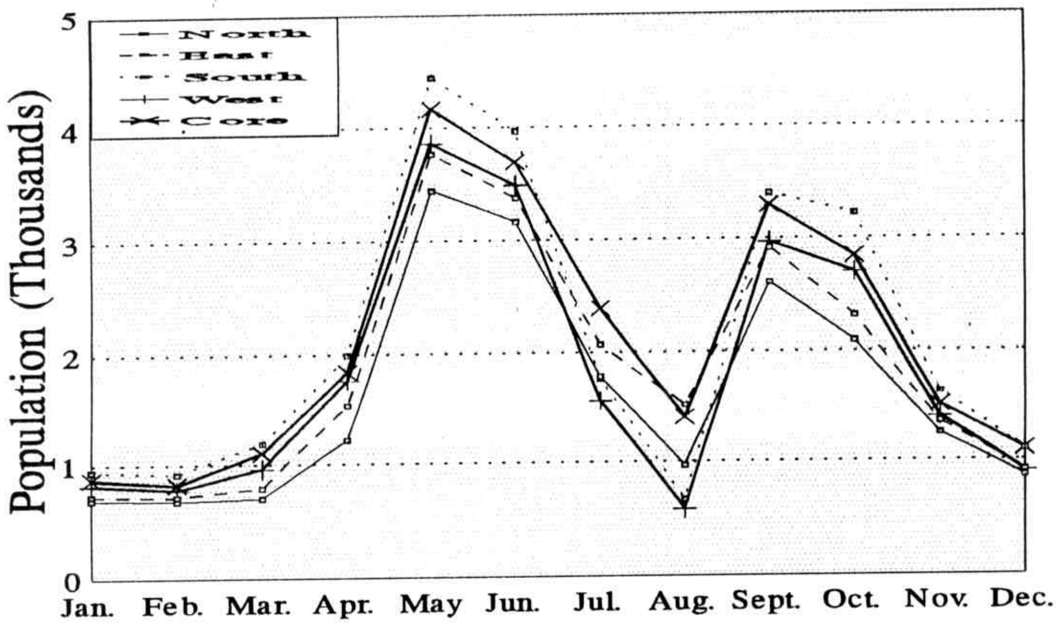
On apple trees it is clear from Table (31) and Fig. (28), that the total population of the plum scale insect varied on branches of the different cardinal directions and core zone.

In the first year of study (1994), the distribution of ***P.oleae*** population on different directions of apple branches at Nobariya varied than those previously recorded on pear and plum branches, at Menia El-Kamh location. The highest total count allover the year occurred on the southern direction branches, being 25196 individuals/120 apple branches, followed by the central core, eastern, western and northern branches (24988, 21963, 21761 and 19430 insect individuals/120 apple branches, respectively, Table 31). The differences in mean total population counts between the eastern and western branches, and also between the southern and central core branches, were statistically insignificant, at 0.01 level. These insignificant differences may be attributed to the heavy abundance and high population densities of the plum scale insect individuals on

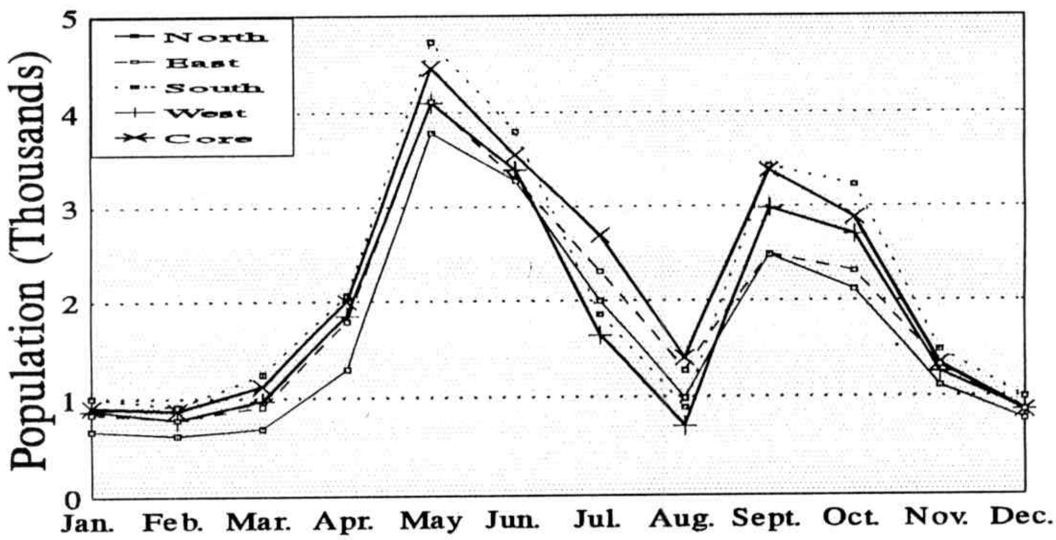
Table (31) : Number of *P. oleae* individuals/10 branches of apple trees, at different directions and core, at El-Nobariya location, during 1994 and 1995.

	1994										1995									
	North	R	East	R	South	R	West	R	Core	R	North	R	East	R	South	R	West	R	Core	R
Jan.	687	-	722	-	940	-	817	-	869	-	671	-	843	-	1006	-	876	-	906	-
Feb.	675	0.98	712	0.99	915	0.97	773	0.95	820	0.94	622	0.93	783	0.93	915	0.91	785	0.90	873	0.96
Mar.	698	1.03	788	1.11	1187	1.30	957	1.24	1096	1.34	690	1.11	912	1.16	1242	1.36	973	1.24	1121	1.28
Apr.	1213	1.74	1531	1.94	1995	1.68	1765	1.84	1841	1.68	1291	1.87	1783	1.96	2060	1.66	1842	1.89	1993	1.78
May	3441	2.84	3770	2.46	4434	2.22	3863	2.19	4160	2.56	3790	2.94	4117	2.31	4732	2.30	4100	2.23	4460	2.24
Jun.	3162	0.92	3372	0.89	3964	0.89	3485	0.90	3693	0.89	3273	0.86	3292	0.80	3802	0.80	3391	0.83	3550	0.80
Jul.	1786	0.56	2067	0.61	1762	0.44	1556	0.45	2381	0.64	1995	0.61	3213	0.70	1850	0.49	1630	0.48	2691	0.76
Aug.	963	0.54	1515	0.73	663	0.38	581	0.37	1402	0.59	985	0.49	1270	0.55	893	0.48	704	0.43	1393	0.52
Sept.	2606	2.71	2913	1.92	3396	5.12	2962	5.10	3290	2.35	2483	2.52	2490	1.96	3430	3.84	2980	4.23	3380	2.43
Oct.	2089	0.80	2309	0.79	3217	0.94	2696	0.91	2836	0.86	2113	0.85	2312	0.93	3225	0.94	2703	0.91	2880	0.85
Nov.	1247	0.60	1352	0.59	1630	0.51	1397	0.52	1503	0.53	1113	0.53	1320	0.57	1472	0.46	1252	0.46	1330	0.46
Dec.	863	0.69	912	0.67	1093	0.67	906	0.65	1097	0.73	768	0.69	862	0.65	988	0.67	863	0.69	855	0.64
Total	19430	-	21963	-	25196	-	21761	-	24988	-	19794	-	22297	-	25615	-	22099	-	25432	-
Mean	1619.17 ±120.7		1830.25 ±162.6		2099.67 ±181.50		1813.42 ±121.2		2082.33 ±183.4		1649.50 ±131.8		1858.0		2134.58 ±161.8		1841.58 ±162.6		2119.33 ±188.03	
"F"	101.2742										98.76537									
L.S.D. at 0.01	51.24823										67.51903									

* R : Rate of change (increase or decrease) in population



1994



1995

Fig. (28) : Fluctuation of ***P. oleae*** total population at different apple tree directions, at Nobariya location.

branches of almost all directions of apple trees, when compared with either pear or plum trees (Table, 31).

Observation on the monthly population counts of ***P.oleae*** individuals on apple branches of the main four directions and central core, showed two common high peaks in the population abundance. The first peak occurred in May, when maxima counts of 4434, 4160, 3863, 3770 and 3441 individuals/10 branches, were counted at the southern, central core, western, eastern and northern branches of apple, respectively, (Table 31). The highest population counts on branches of the southern and the central core branches, at Nobariya, may be due to its characteristic climatic factors, which include the dryness of air, the north-western strong wind and the extremities of air temperature between day and night. In this respect, the southern parts of the trees, may be acted as a shelter against the strong north-western wind, whereas the central core of trees, acted as a private shelter from the alternating high and low temperature, and also to some extent, against air dryness.

The second common peak in the insect population, was observed in September, when means of 3396 individuals were counted/10 southern branches of apple trees, followed by 3290, 2962, 2913, and 2606 individuals/10 branches of the central core, western, eastern, and northern directions of apple trees, respectively.

As for the lowest population abundance of ***P.oleae*** , it occurred either in February (675, 712 and 820 individuals/10 branches of the northern, eastern and central core branches, respectively), or in August (581 and 663 individuals/10 branches of the western and southern directions of trees, respectively, Table 31).

The obtained results concerning the population abundance of ***P. oleae***, on apple tree branches, at different directions,seem to be similar -to great extent- to those previously recorded on either pear or plum trees. Concerning the rates of increase in ***P. oleae*** total population, on branches of apple trees, at different cardinal directions, results indicated that, the population increased giving high rates in May and September. In the former month, the highest rate of population increase (2.84) occurred amongst insects infesting the north direction branches, followed by those on core (2.56), east (2.46), south (2.22) and west (2.19) direction branches. These high increases in ***P. oleae*** population in May, may be referred to the suitability of climatic conditions in this month, which was normally preceded by unsuitable climatic conditions of March and April, which prevail at this semi-desert location, such as the strong wind of Khamaseen, which could be of high bad influence on the freshy hatched crawlers. The worst effect of March and April conditions, could be mainly oriented to the north direction branches of apple trees, causing high mortalities among different ***P. oleae*** stages, and subsequently, the insect population is kept in comparatively low population, but when these climatic conditions are improved during May, the result is normally an increase in population with high rate, and consequently,this may be the reason of obtaining this high rate of increase in population amongst insects infesting this northern site of the trees.

The second high rate of ***P. oleae*** population increase in September, reached a highest value amongst insects infesting the southern and western direction branches (5.12 and 5.10 folds of August populations, respectively), being so high increasing rates than all what previously recorded on different heights and directions of trees. That was followed descendingly by high rates of increase on the northern (2.71), central core (2.35), and eastern (1.92) branches, (Table 31). The two extraordinary high rates of increase, which were observed at the southern and western directions of the trees, indicated that the insect individuals were exposed to strong adverse climatic conditions during the preceding month (August) at these two sites, subsequently followed by an ideal improvement in September, that favoured high increase in population during this month, mainly due to the high percentage of eggs hatching,producing great numbers of crawlers, forming the second high peak of September.

The severest rates of decrease of ***P. oleae*** population recorded either in August or November, at different tree directions. The lowest rates (severest decreases) that occurred in August, were at the western, southern and northern tree branches, being 0.37, 0.38 and 0.54, respectively (Table 31), indicating the bad influence of the high temperature on insects inhabiting these sites of trees, especially the western and southern directions which received the worst conditions, while the lowest rates of November, were on the central core and the eastern branches, being 0.53 and 0.59, respectively. It could be generally, deduced from Table (31) that all of the tree directions of apple trees, had severe decreasing rates in ***P. oleae*** population in August and November (Table 31), due to the bad effect of the high temperature especially on crawlers and nymphs in the former month, and also due to the comparatively unfavourable climatic and other surrounding conditions in November, when compared with those of the preceding month (October), the matter that caused the observed suppressions in the insect population, which normally results in severe rates of decrease in ***P. oleae*** population.

Regarding the differences between the highest rates of increase and the severest rates of population decrease during the first year of study, it was generally observed that these differences were any way higher than those previously recorded of ***P. oleae*** populations infesting pear and plum at Menia El-Kamh, indicating the high fluctuating population size on this host plant at Nobariya, during the different months of the year. These big differences indicate, also, the acute effect of the alternating different factors, especially the climatic factors on the insect population size at that semi-desert areas. The highest difference was recorded at the southern branches (5.12-0.38), followed by those of the western branches (5.10-0.37), northern branches (2.84-0.54), central core branches (2.56-0.53) and eastern branches (2.46-0.59), in descending order, showing that the insect individuals on southern tree branches, have owned the most changeful and dynamical population, whereas the insect individuals inhabiting the eastern branches have owned the minimum fluctuation rates in its community, on apple trees, at Nobariya location.

During the second year of study, on apple trees, at the previously mentioned location, as in the first year, the southern branches harboured the highest total population of ***P. oleae*** individuals allover 1995, being 25615/120 branches, followed by 25432, 22297, 22099 and 19794 total insect individuals on 120 branches of the central core, eastern, western and northern directions of apple trees, respectively (Table 31 and Fig. 28). Regarding the means of total year counts on different directions of apple trees, and the statistical L.S.D. at 0.01 level (Table 31), it is clear that the differences between mean total infestation on the eastern and western branches, and also between those on the southern branches and central core branches of the trees, were insignificant. While the significant differences were detected between the remaining means.

In relation to ***P. oleae*** population fluctuations throughout different months of the year, results obtained and tabulated in Table (31) seemed to be synchronized with those of the preceding year, where the highest peak of population abundance occurred, at all directions in May, when 4732 individuals were counted/10 branches of the southern direction, which harboured the highest insect population, followed by the central core, eastern, western and northern branches which each 10 of them harboured 4460, 4117, 4100 and 3790 individuals, respectively, showing almost the same sequence of the preceding year, with an opposite rank only between the eastern and western tree directions, where the total insect individuals on the eastern branches, slightly exceeded that of the western branches. The second common peak in the insect population, was also observed in September, as 3430 insect individuals were counted/10 southern branches, followed by those on 10 branches of the central core, western, eastern and northern apple tree directions, being 3380, 2980, 2490 and 2483 individuals, respectively, following the same sequence of the preceding year.

In relation to the minimum insect populations, the recorded results indicated that, the lowest populations occurred, either in February or in August. In the former month, the recorded counts on northern, eastern and central core branches, were 622, 783 and 873 individuals/10 apple branches, respectively; while in August, the lowest insect populations were on the western and southern branches, being 704 and 893 individuals/10 branches, in respective order (Table 31). As for the different rates of change in ***P. oleae*** population, throughout different months of the year, data in Table (31), indicated two high common rates of increase occurred annually, in May and September, supporting those observed during the first year of study. In May, the highest rate of increase in the scale insect population was observed on the northern tree branches, being 2.94 folds of that of April population, followed by 2.31, 2.30, 2.24 and 2.23 on the eastern, southern, central core and western branches, in descending order, being slightly different than those of the preceding year. The highest rate of population increase of September, was recorded on the western (4.23) and southern (3.84) tree branches, followed by 2.52, 2.43 and 1.96 folds in the insect populations on the northern, central core, and eastern tree branches, respectively, indicating nearly the preceding sequence of 1994.

In concern to the severest rates of depression in the insect population, at all of the four cardinal directions of apple trees, at Nobariya, those occurred in August. The severest decrease in population abundance was associated with the western branches (0.43 of July population) followed by 0.48, 0.49 and 0.55 on the southern, northern and eastern tree branches, respectively. On the other hand, however, on the central core branches, the severest rate of ***P. oleae*** decrease in population, was estimated by 0.46 and recorded in November, (Table 31).

By regarding the differences between the highest rates of insect population increase and severest rates of decrease, as an indicator for the rate of stability in population, the highest difference was recorded on the western branches (4.23-0.43), to indicate that branches at this direction harbour the most changeful population, followed by the southern branches (3.84- 0.48), northern branches (2.840.49), central core branches (2.43-0.46) and the eastern branches (2.31-0.55), which may be considered as the direction harbouring the relatively most stable population of ***P. oleae***.

The obtained results of the two years of study clearly showed on different host plants (pear, plum and apple) that, the population size of the plum scale insect, ***P. oleae***, was affected to a great extent with different heights and directions of the infested trees and at the two locations of study. It could be also concluded that, in case of pear and plum trees, at Menia El-Kamh location, the lower height of trees (up to 1.75 m.), received the heaviest infestation levels allover the year, followed by the middle height branches (1.75-3 m.), while the third height branches (more than 3 m.) were occupied with the lowest insect population. While in case of the effect of different tree directions and the central core on the rate of infestation by ***P. oleae***, it was observed that the central core zone of trees was occupied with the highest insect population allover the year, on both pear and plum trees. On the other hand, the eastern tree branches, always received the lowest infestation level. Thus, and according to these available data, which were obtained on pear and plum trees, at Menia El-Kamh location, it could be recommended that :

1- The control operations against this insect at that or similar locations, should be applied either in May or September, where the two main peaks of abundance, were recorded, almost at different heights and directions of the trees.

2- The areas of heavy infestation, such as the central core zone and the lower height of trees, should be seriously taken into consideration, when applying either chemical sprays and/or the other agricultural control methods, *i.e.*, pruning method.

3- Areas of comparatively light infestation, *i.e.*, upper height and eastern direction of trees, should not be neglected when applying chemical sprays or pruning , because they could be the main sources of reinfestation to the other parts of trees.

In case of apple trees, at Nobariya semi-desert location, the middle height branches (1.75-3 m.) were found infested with the maximum, insect population, while the third height (more than 3 m.) was occupied with the lowest insect population.

Concerning the effect of different apple tree directions of branches on the distribution of the plum scale insect, the southern branches harboured the highest population, while on the contrary, the northern tree branches seemed to be unfavourable for the plum scale insect, as branches of this direction received the lowest rates of infestation. At all of the heights and direction of apple trees, branches in May and September were loaded with the highest insect population, including all stages of the insect, while in January, February and August, the tree branches were infested with lowest insect populations.

From the obtained data, on apple trees, at Nobariya location and other similar locations, it could be recommended that :

1- As on pear and plum trees, at Menia El-Kamh, also at Nobariya location, the control methods against ***P. oleae*** should be applied either in May or September, due to the presence of two peaks of abundance during these two months annually.

2- Sprays on apple trees (probably other fruit trees), at this location, should be directed intensively to the middle height and southern direction of the trees, the areas which always received highest populations of the plum scale insect, not neglecting the other areas of trees, especially the area of the central core, at the lower height of trees, which followed the previously mentioned area of heavy infestation.

In this respect, **Habib and Khalifa (1957)** studied the effect of tree heights on the distribution of some scale insects, and concluded that the light intensity greatly affects the scale insects distribution on different heights of trees, where on shady trees, the insect population tends to be more concentrated at the upper parts of trees, which were more exposed to the sun light, whereas on sunny trees, all insect items nearly occupied the lower parts of trees. These results are in agreement with the obtained results, where at the upper height of all tested host plants, which always exposed to high intensity of light especially in August, was occupied with the lowest insect populations allover the year, while the lower height (at Menia El- Kamh) and the middle height (at Nobariya), were occupied with the maximum populations of ***P. oleae***. **Hafez and Salama (1965)**, in complete agreement with the previously mentioned results, stated that, generally, the central core of (citrus trees) always harboured the highest populations of many scale insects, while the northern direction harboured the lowest populations, where in this concern, the obtained results indicated that the central core of trees and the southern direction always harboured the maximum insect population, whereas insects inhabiting the northern branches of trees always showed infestation with comparatively low insect population. **Amin (1966)** stated that, the total population of ***P. oleae*** was not significantly affected with regard to the different tree directions, the matter that observed in the obtained result in some cases, *i.e.*, at the northern and eastern branches of plum also at the eastern and western, central core and southern branches of apple trees, during the two studied years, but in complete agreement with the present results, he arranged the gradation of ***P. oleae*** means of infestation on different branches as the central core, southern, western, eastern and the northern directions. With regard to the different heights of trees, the same author found, as the present results have proved, that the highest population of ***P. oleae*** tends to occur at the lower zone of the tree, followed by the middle and upper zones, being in harmony, with the sequence recorded in the present study concerning the infestation level on different heights of trees. **Elwan (1990)** stated that, the scale insects, ***Kilifia acuminaat*** and ***Insulaspis pallidula*** on mango trees, highly infested the lower and middle heights of trees, but slightly observed at the upper height, the matter that in complete accordance with the results of the present study. **Eraki (1991)** found that, the distribution of ***Asterolecanium pustulans***, on fig trees, significantly varied amongst the four cardinal directions being higher at the southern and western sides of fig trees, indicating a high degree of accordance with the present study where the southern branches of apple trees harboured he highest ***P. oleae*** population allover the year, while on pear and plum trees, the southern and western branches were occupied with the second and third ranks of infestation, allover the year. **Kasim (1995)**, postulated that, the maximum counts of ***P. oleae*** on plum trees, were during May, while the minimum were in August, at different heights and directions of plum trees, with complete accordance to the present results.

- Effect of some meteorological factors on the population density of *P. oleae*, on pear and plum trees, at El-Quanater El-Khairiya location :

A- On pear trees :

Data in Tables (32, 33, 34 & 35), show the total numbers of each ***P. oleae*** stages, also the total insect population, infesting 30 branches of pear trees, accompanied by the associated monthly means of the day- maximum temperature (d.mx.t.), night minimum temperature (n.mn.t.) and the daily means of relative humidity (d.m.R.H.).

Figures in Table (36), show the calculated simple correlation (r), simple regression (b), partial regression (P.r.) and the analysis of variance of the insect population density with the associated means of d.mx.t, n.mn.t. and d.m.R.H., during a994 and 1995.

a- Effect of day-maximum temperature (d.mx.t.) :

Throughout 1994, the effect of d.mx.t., showed positive and highly significant correlation with all studied stages, also with the total population of the plum scale insect, where (r) values were 0.73, 0.76, 0.66 and 0.81, for each of nymphs, adult females, ovipositing females and the total insect population, respectively (Tale 36). The partial regression values of all insect stages, in addition to total insect population, showed positive correlation with the d.mx.t., where the calculated value was significant with the female stage, and highly significant in cases of the nymphal stage and the total insect population, but insignificant with the ovipositing adult females. Almost, similar results were obtained in the second studied year of 1995, where the means of the day-maximum temperature (d.mx.t.), showed positive and highly significant correlations with all insect stages and the insect total population, where (r) values were 0.69, 0.78, 0.72 and 0.85, for each of the nymphal stage, the adult females (without laying eggs), ovipositing females and the total insect population, Table (32) : The effect of some meteorological factors on *P. oleae* nymphs on pear trees, at El-Quanater El-Khairiya location, throughout two successive years of 1994 and 1995.

Year / Month	1994					1995				
	No. of nymphs ind./30 branches	Max. temp. °C	Min. Temp. °C	Mean	Mean R.H. %	No. of nymphs ind./30 branches	Max. temp. °C	Min. Temp. °C	Mean	Mean R.H. %
Jan.	-	16.5	7.0	11.8	69.0	-	17.2	8.0	12.6	72.0
Feb.	-	19.6	7.2	13.4	63.0	-	19.8	7.2	13.5	69.0
Mar.	1092	25.2	10.3	17.8	64.0	957	23.0	9.1	16.1	68.0
Apr.	4002	28.4	12.3	20.4	62.0	4200	27.6	11.8	19.7	59.0
May	7422	29.7	14.3	22.0	55.0	7596	29.3	12.5	20.9	60.0
Jun.	2385	33.1	17.0	25.0	64.0	2478	33.3	18.2	25.8	65.0
Jul.	2343	33.9	19.7	26.8	70.0	2463	33.2	20.2	26.7	68.0
Aug.	1134	33.7	20.7	27.2	73.0	984	33.7	20.6	27.2	73.0
Sept.	3987	31.5	17.4	24.5	65.0	4185	30.8	16.4	23.6	69.0
Oct.	3024	29.7	16.0	22.9	62.0	2502	28.3	15.4	21.9	63.0
Nov.	612	25.6	12.4	19.0	66.0	675	25.0	13.8	19.4	66.0
Dec.	120	21.8	8.7	15.3	71.0	270	20.7	8.1	14.4	70.0

Table (33) : The effect of some meteorological factors on *P. oleae* adult females on pear trees, at El-Quanater El-Khairiya location, throughout two successive years of 1994 and 1995.

Year	1994					1995				
Mean	No. of adult females ind./30 branches	Max. temp. C	Min. Temp. C	Mean	Mean R.H. %	No. of adult females ind./30 branches	Max. temp. C	Min. Temp. C	Mean	Mean R.H. %
Jan.	3210	16.5	7.0	11.8	69.0	2859	17.2	8.0	12.6	72.0
Feb.	2487	19.6	7.2	13.4	63.0	2787	19.8	7.2	13.5	69.0
Mar.	2763	25.2	10.3	17.8	64.0	2487	23.0	9.1	16.1	68.0
Apr.	1929	28.4	12.3	20.4	62.0	1893	27.6	11.8	19.7	59.0
May	1113	29.7	14.3	22.0	55.0	1143	29.3	12.5	20.9	60.0
Jun.	3423	33.1	17.0	25.0	64.0	3111	33.3	18.2	25.8	65.0
Jul.	1830	33.9	19.7	26.8	70.0	1563	33.2	20.2	26.7	68.0
Aug.	1836	33.7	20.7	27.2	73.0	1303	33.7	20.6	27.2	73.0
Sept.	2304	31.5	17.4	24.5	65.0	2553	30.8	16.4	23.6	69.0
Oct.	2738	29.7	16.0	22.9	62.0	3996	28.3	15.4	21.9	63.0
Nov.	4551	25.6	12.4	19.0	66.0	4860	25.0	13.8	19.4	66.0
Dec.	4032	21.8	8.7	15.3	71.0	4307	20.7	8.1	14.4	70.0

Table (34) : The effect of some meteorological factors on *P. oleae* ovipositing females on pear trees, at El-Quanater El-Khairiya location, throughout two successive years of 1994 and 1995.

Year / Mean	1994					1995				
	No. of ovipositing females ind./30 branches	Max. temp. C	Min. Temp. C	Mean	Mean R.H. %	No. of ovipositing females ind./30 branches	Max. temp. C	Min. Temp. C	Mean	Mean R.H. %
Jan.	-	16.5	7.0	11.8	69.0	-	17.2	8.0	12.6	72.0
Feb.	210	19.6	7.2	13.4	63.0	60	19.8	7.2	13.5	69.0
Mar.	1671	25.2	10.3	17.8	64.0	1749	23.0	9.1	16.1	68.0
Apr.	1899	28.4	12.3	20.4	62.0	2055	27.6	11.8	19.7	59.0
May	1473	29.7	14.3	22.0	55.0	1404	29.3	12.5	20.9	60.0
Jun.	642	33.1	17.0	25.0	64.0	723	33.3	18.2	25.8	65.0
Jul.	426	33.9	19.7	26.8	70.0	399	33.2	20.2	26.7	68.0
Aug.	1122	33.7	20.7	27.2	73.0	1251	33.7	20.6	27.2	73.0
Sept.	1404	31.5	17.4	24.5	65.0	1869	30.8	16.4	23.6	69.0
Oct.	423	29.7	16.0	22.9	62.0	648	28.3	15.4	21.9	63.0
Nov.	540	25.6	12.4	19.0	66.0	360	25.0	13.8	19.4	66.0
Dec.	-	21.8	8.7	15.3	71.0	24.00	20.7	8.1	14.4	70.0

Table (35) : **The effect of some meteorological factors on *P. oleae* total alive population on pear trees, at El-Quanater El-Khairiya location, throughout two successive years of 1994 and 1995.**

Year	1994					1995				
Mean	No. of alive individuals /30 branches	Max. temp. C	Min. Temp. C	Mean	Mean R.H. %	No. of alive individuals /30 branches	Max. temp. C	Min. Temp. C	Mean	Mean R.H. %
Jan.	3210	16.5	7.0	11.8	69.0	2859	17.2	8.0	12.6	72.0
Feb.	2697	19.6	7.2	13.4	63.0	2847	19.8	7.2	13.5	69.0
Mar.	5526	25.2	10.3	17.8	64.0	5193	23.0	9.1	16.1	68.0
Apr.	7830	28.4	12.3	20.4	62.0	8148	27.6	11.8	19.7	59.0
May	10008	29.7	14.3	22.0	55.0	10143	29.3	12.5	20.9	60.0
Jun.	6450	33.1	17.0	25.0	64.0	6312	33.3	18.2	25.8	65.0
Jul.	4599	33.9	19.7	26.8	70.0	4425	33.2	20.2	26.7	68.0
Aug.	4092	33.7	20.7	27.2	73.0	3540	33.7	20.6	27.2	73.0
Sept.	7695	31.5	17.4	24.5	65.0	8607	30.8	16.4	23.6	69.0
Oct.	7185	29.7	16.0	22.9	62.0	7146	28.3	15.4	21.9	63.0
Nov.	5703	25.6	12.4	19.0	66.0	5895	25.0	13.8	19.4	66.0
Dec.	4152	21.8	8.7	15.3	71.0	4599	20.7	8.1	14.4	70.0

Table (36) : The effect of the main climatic factors on the population density of *P. oleae*, on pear trees during 1994 and 1995, at El-Quanater El-Khairiya location. (Statistical analysis).

Stage	Year	d.mx.t.					d.min.t.					d.m.R.H.					Analysis of variance	
		Simple			Partial		Simple			Partial		Simple			Partial			
		r	b	t	P.r.	t	r	b	t	P.r.	t	r	b	t	P.r.	t	F	E.V. %
Nymphs	1994	+0.73	+0.31	4.52**	+0.32	3.83**	+0.57	+0.21	4.71**	-0.10	0.51	-0.32	-0.15	1.26	-0.06	1.06	8.67**	85.65
	1995	+0.69	+0.29	5.65**	+0.48	4.21**	+0.76	+0.31	6.03**	-0.20	1.08	-0.40	-0.14	1.31	-0.01	0.08	12.52**	81.72
Adult females	1994	+0.76	−0.28	6.53**	+0.38	2.20*	+0.58	+0.28	4.81**	-0.25	1.62	-0.31	-0.14	0.93	+0.06	1.01	14.33**	73.18
	1995	+0.78	−0.22	5.64**	+0.27	4.31**	+0.72	+0.19	3.58**	-0.27	1.71	-0.27	-0.17	0.86	+0.03	1.08	21.85**	77.61
Ovipositing females	1994	+0.66	−0.17	6.33**	+0.21	1.01	+0.64	+0.11	3.29**	-0.17	1.08	-0.22	-0.11	1.02	-0.03	1.03	7.74**	79.82
	1995	+0.72	−0.19	5.33**	+0.22	1.60	+0.73	+0.21	4.08**	-0.06	1.00	-0.28	-0.06	1.62	-0.01	1.21	12.65**	78.46
Total population	1994	+0.81	−0.58	6.23**	+0.63	3.31**	+0.68	+0.43	5.72**	-0.61	1.09	-0.34	-0.27	1.41	-0.06	0.62	17.73**	79.60
	1995	+0.85	−0.63	7.36**	+0.72	5.60**	+0.81	+0.61	4.84**	-0.38	1.60	-0.43	-0.32	1.82	+0.03	0.33	19.51**	79.24

* Significant at 0.05 level

** Highly significant at 0.01 level

(r) : Simple correlation

(b) : Simple regression

(P.reg.) : Partial regression

respectively. partial regression values were positive in all studied cases, and highly significant in cases of nymphs, adult females and the total insect population, while was insignificant in case of the ovipositing females individuals.

From the two years results, the following may be concluded :

1- The mean optimal d.mx.t. for the insect nymphs throughout the two years of study was 29.5°C, where nymphs reached their maxima peaks of 7422 and 7596 individuals/30 branches of pear at 29.7 and 29.3°C,in 1994 and 1995, respectively.

2- The mean of the unfavourite d.mx.t. for the insect nymphal stage throughout the two years, was 21.25°C, where nymphs reached their minima population abundance of 120 and 270 individuals/30 branches, at 21.8 and 20.7°C in the two successive years, respectively.

3- Concerning the adult females (non-ovipositing), the average optimal d.mx.t. of the two studied years was 25.3°C, where this stage reached the maxima peak of abundance of 4551 and 4860 individuals/30 branches of pear, at 25.6 and 25.0°C, during 1994 and 1995, respectively.

4- The mean of unfavourite d.mx.t. for the insect adult females (without laying eggs), was 29.5°C, where this stage reached its minima population of 1113 and 1143 individuals/30 branches of pear, at 29.7°C and 29.3°C, in the two successive studied years of 1994 and 1995 (where in this case, most of adult females started to lay eggs, consequently developed to the next- ovipositing stage, the matter that normally decreased the adult females (females without laying eggs) within the insect total population).

5- The ovipositing females had a mean optimal d.mx.t. of 28.0°C. where they reached the peaks of 1899 and 2055 individuals/30 branches, at 28.4 and 27.6, in 1994 and 1995, respectively.

6- The mean unfavourite d.mx.t. for the ovipositing females, was 19.7°C, where the lowest population of the ovipositing individuals of 210 and 60/30 branches, were recorded at 19.6 and 19.8°C during the two studied years.

7- As for the total insect population of ***P. oleae*** the mean optimal d.mx.t. was 29.5°C, being the same of that of the nymphal stage. At this mean, the bulk of the insect total population (10008 & 10143/30 branches in 1994 & 1995) was observed. On the other hand, the same figures of the unfavourite d.mx.t. (21.25°C), was detected.

From the obtained results, it could be concluded that, the day maximum temperature (d.mx.t.), is undoubtedly one of the most important factors influencing either ***P. oleae*** total population, or any of its stages abundance.

b- Effect of the night-minimum temperature (n.mn.t.) :

In the first year of study, the obtained (r) and (b) values showed positive and highly significant figures for all the studied insect stages and insect total population. Results indicated, on the other hand, insignificant negative partial regression for all studied cases, Table (36). During the second year of study, data of the obtained simple correlation and regression, were almost as of the previous year, where each of the studied factors gave positive and highly significant values for both (r) and b) for all studied insect stages and the total population.

In relation to values of partial regression of the second year, data showed almost same results of the previous studied year,where all values of (pr) were negative and insignificant, with all studied cases.

From the obtained data and results, it could be concluded that :

1- In case of the insect nymphal stage, the mean of optimal n.mn.t. was 13.4°C, where this stage reached its maxima peaks of 7422 and 7596 individuals/30 branches at 14.3°C and 12.5°C, during 1994 and 1995, respectively.

2- The average unfavourite n.mn.t. for the mentioned stage was 8.4°C, where nymphs reached their lowest numbers of 120 and 270 individuals, at 8.7 and 8.1°C, in 1994 and 195, respectively.

3- Regarding adult females, the mean optimal n.mn.t. was 13.1°C, as this stage reached its maxima peaks of 4551 and 4860 individuals/30 branches, at 12.6 and 13.8°C, during 1994 and 1995, respectively.

4- The correspondent mean of lowest population of this stage of 1113 and 1143 individuals/30 branches, was (14.3°C and 12.5°C, in 1994 and 1995, respectively). In this concern, it was observed that, the two means of n.mn.t., which were correspondent to the highest and lowest adult females populations, were almost equal in values (13.1°C and 13.4°C, correspondent to the highest and lowest adult females population, respectively), and this could be explained by regarding the mean of the n.mn.t. of 13.4°C, was not unfavourite mean to adult females, but it could be favorite mean to adult females to develop to the next ovipositing females, subsequently decreasing the numbers of adult non- ovipositing females.

5- The average optimal n.mn.t. for the ovipositing females individuals was 12.05°C, where peaks of population of this stage of 1899 and 2055 individual/30 branches were at 12.3°C and 11.8°C, during 1994 and 1995, respectively.

6- The unfavourite mean of n.mn.t. for the ovipositing females was 7.2°C, at this mean of the night-minimum temperature, the relative population densities of these individuals dropped to 210 and 60 individuals, at 7.2°C during February of the two studied years. In fact, during December, and January, the ovipositing females were almost absent, except of few individuals was accidentally observed, thus data of these two months, were excluded, (Table 34).

7- As for the total population of the plum scale insect, on pear trees, the mean optimal n.mn.t., was 13.4, with the same figures of the nymphal stage (either of the optimal or the unfavourite means), which were previously discussed.

From the obtained results on the effect of d.mn.t. on the plum scale insect, it was clearly concluded, that this factor not to be considered as an important factor affecting the population density of ***P. oleae***, as in all cases, it induced insignificant effects (partial regression in all cases was insignificant).

c- Effect of the daily mean relative humidity (d.m.R.H.) :

As shown in Table (36), the simple correlation coefficient (r), indicated that, this factor had negative insignificant correlations on either insect total population or any of its stages, except with the adult females, where this indicator showed positive, but insignificant correlation in both studied year (1994 & 1995). Also, the partial regression values indicated negative insignificant relations in all studied cases, except with the adult females, in the two studied years, and the total population of the second studied year, where partial regression values, were positive, but also showed insignificant figures.

From the previous data, the following may be concluded :

1- The mean of d.m.R.H. of 57.5 % may be considered as optimum for ***P. oleae*** nymphal stage, as the highest populations of 7422 and 7596 individuals/30 branches of pear were detected, at 55 and 60 % in 1994 and 1995, respectively.
2- The unfavourite mean of d.m.R.H. for the mentioned stage (nymphs), was 70.5 %, where the lowest populations of 120 and 270 individuals/30 branches, were counted at 71 and 70 % R.H., during the two years, respectively.
3- As for the non-ovipositing females individuals, 66 R.H., could be considered as the optimum (peaks of 4551 and 4860 females/30 branches, at 66 % R.H. in both studied years).

4- The lowest females' populations (1113 and 1143 females/30 branches), were detected at 55.0 and 60 % R.H. in the two years, respectively, thus indicating that the unfavourite mean of d.m.R.H., may considered as 57.5 %.

5- In relation to the ovipositing females, the mean optimal d.m.R.H. was 60.5 % (peaks of population density of 1899 individuals/30 branches, at 62.0 % R.H. in 1994 and 2055 individuals/30 branches at 59.0 % R.H., in 1995); Table (34).

6- The unfavourite mean of d.m.R.H., for the ovipositing females was calculated as 66.0 % R.H., where the lowest population of 210 individuals/30 branches was estimated at 63 % R.H. in 1994, and that of 60 individuals/30 branches was counted at 69 % R.H., in the subsequent year.

7- Concerning the insect total population, the mean optimal d.m.R.H. was 57.5 %, where it was 55 % in 1994 (peak of 10008 individuals/30 branches) and 60 % in 1995 (peak of 10143 individuals/30 branches).

8- The mean d.m.R.H. of 66 % was calculated as an unfavourable of total population abundance, where the lowest population were estimated at 63 % R.H. (2697 individuals) and at 69 % (2847 individuals/30 branches) in 1994 and 1995, respectively.

Due to the statistically insignificant differences in populations of ***P. oleae*** in all studied cases, indicating the effect of d.m.R.H., it could be stated that this factor appeared of minor importance than temperature.

d- The combined effect of the three climatic factors on the population density of *P. oleae* infesting pear trees :

The combined effect of the daily means of maximum and minimum temperatures (d.mx.t. and d.mn.t., respectively), and also the means of daily relative humidity (d.m.R.H.) on the insect population density was of high significant effects, in all studied cases, (Table 36).

The obtained results also indicated the high effect of the daily means of the maximum temperature on the activity fluctuations of the plum scale insect. The explained variance (E.V.), of the total effect of studied factors, ranged between 73.18 % (in adult non- ovipositing individuals) and (85.65 %) on the nymphal stage), within the first studied year of 1994, while the E.V. values ranged between 77.61 % (on adult females) and 81.70 % (on nymphal stage) during the second year of study. Generally, depending on the obtained data and results, it was clearly to conclude that the insect nymphal stage was highly affected by the total influence of the three studied climatic factors (81.72-85.65 %), followed by total insect population (79.24-79.60 %), the ovipositing females (78.46-79.82 %), where the adult non-ovipositing females showed to be comparatively of the lowest response to the tested climatic factors, where was affected with from 73.18 to 77.61 %, within the two studied years, respectively.

Also, it could be concluded that, the day-maximum temperature -as a solitary climatic factor- have proved to be the most effective studied factor in influencing the plum scale population density, while the other two studied factors of the night-minimum temperature and the daily mean of relative humidity, almost showed insignificant effects, when each of themwas detected as a climatic factor that may affects the plum scale insect population density.

B- On plum trees :

Data in Tables (37, 38, 39 and 40) showed the total counts of ***P. oleae*** nymphs, adult females, ovipositing females, and also total individuals counted/30 plum branches and their associations with the monthly means of the different studied elements of climate.

Data recorded in Table (41) demonstrated the calculated simple correlation (r) value, simple regression (b), partial regression (pr) and analysis of variance of the population fluctuations of the plum scale insect in relation to the

Table (37) : The effect of some meteorological factors on *P. oleae* nymphs on plum trees, at El-Quanater El-Khairiya location, throughout two successive years of 1994 and 1995.

Year	1994					1995				
Month	No. of nymphs ind./30 branches	Max. temp. °C	Min. Temp. °C	Mean	Mean R.H. %	No. of nymphs ind./30 branches	Max. temp. °C	Min. Temp. °C	Mean	Mean R.H. %
Jan.	-	16.5	7.0	11.8	69.0	-	17.2	8.0	12.6	72.0
Feb.	90	19.6	7.2	13.4	63.0	120	19.8	7.2	13.5	69.0
Mar.	693	25.2	10.3	17.8	64.0	609	23.0	9.1	16.1	68.0
Apr.	1266	28.4	12.3	20.4	62.0	1254	27.6	11.8	19.7	59.0
May	2893	29.7	14.3	22.0	55.0	3048	29.3	12.5	20.9	60.0
Jun.	1581	33.1	17.0	25.0	64.0	1464	33.3	18.2	25.8	65.0
Jul.	864	33.9	19.7	26.8	70.0	780	33.2	20.2	26.7	68.0
Aug.	528	33.7	20.7	27.2	73.0	408	33.7	20.6	27.2	73.0
Sept.	1722	31.5	17.4	24.5	65.0	1989	30.8	16.4	23.6	69.0
Oct.	789	29.7	16.0	22.9	62.0	1251	28.3	15.4	21.9	63.0
Nov.	396	25.6	12.4	19.0	66.0	453	25.0	13.8	19.4	66.0
Dec.	-	21.8	8.7	15.3	71.0	99	20.7	8.1	14.4	70.0

Table (38) : The effect of some meteorological factors on *P. oleae* adult females on plum trees, at El-Quanater El-Khairiya location, throughout two successive years of 1994 and 1995.

Year	1994					1995				
Mean	No. of adult females ind./30 branches	Max. temp. °C	Min. Temp. °C	Mean	Mean R.H. %	No. of adult females ind./30 branches	Max. temp. °C	Min. Temp. °C	Mean	Mean R.H. %
Jan.	1521	16.5	7.0	11.8	69.0	1659	17.2	8.0	12.6	72.0
Feb.	1188	19.6	7.2	13.4	63.0	1299	19.8	7.2	13.5	69.0
Mar.	900	25.2	10.3	17.8	64.0	1026	23.0	9.1	16.1	68.0
Apr.	546	28.4	12.3	20.4	62.0	621	27.9	11.8	19.7	59.0
May	414	29.7	14.3	22.0	55.0	477	29.3	12.5	20.9	60.0
Jun.	1356	33.1	17.0	25.0	64.0	1389	33.3	18.2	25.8	65.0
Jul.	735	33.9	19.7	26.8	70.0	858	33.2	20.2	26.7	68.0
Aug.	729	33.7	20.7	27.2	73.0	561	33.7	20.6	27.2	73.0
Sept.	1218	31.5	17.4	24.5	65.0	1113	30.8	16.4	23.6	69.0
Oct.	1560	29.7	16.0	22.9	62.0	1692	28.3	15.4	21.9	63.0
Nov.	2919	25.6	12.4	19.0	66.0	3186	25.0	13.8	19.4	66.0
Dec.	2112	21.8	8.7	15.3	71.0	2034	20.7	8.1	14.4	70.0

Table (39) : The effect of some meteorological factors on *P. oleae* ovipositing females on plum trees, at El-Quanater El-Khairiya location, throughout two successive years of 1994 and 1995.

Year	1994					1995				
Mean	No. of ovipositing females ind./30 branches	Max. temp. °C	Min. Temp. °C	Mean	Mean R.H. %	No. of ovipositing females ind./30 branches	Max. temp. °C	Min. Temp. °C	Mean	Mean R.H. %
Jan.	-	16.5	7.0	11.8	69.0	-	17.2	8.0	12.6	72.0
Feb.	17	19.6	7.2	13.4	63.0	60	19.8	7.2	13.5	69.0
Mar.	1524	25.2	10.3	17.8	64.0	1428	23.0	9.1	16.1	68.0
Apr.	1551	28.4	12.3	20.4	62.0	1686	27.6	11.8	19.7	59.0
May	660	29.7	14.3	22.0	55.0	741	29.3	12.5	20.9	60.0
Jun.	498	33.1	17.0	25.0	64.0	495	33.3	18.2	25.8	65.0
Jul.	936	33.9	19.7	26.8	70.0	1038	33.2	20.2	26.7	68.0
Aug.	927	33.7	20.7	27.2	73.0	840	33.7	20.6	27.2	73.0
Sept.	1383	31.5	17.4	24.5	65.0	1329	30.8	16.4	23.6	69.0
Oct.	429	29.7	16.0	22.9	62.0	501	28.3	15.4	21.9	63.0
Nov.	210	25.6	12.4	19.0	66.0	-	25.0	13.8	19.4	66.0
Dec.	-	21.8	8.7	15.3	71.0	96	20.7	8.1	14.4	70.0

Table (40) : The effect of some meteorological factors on *P. oleae* total alive population on plum trees, at El-Quanater El-Khairiya location, throughout two successive years of 1994 and 1995.

Year	1994					1995				
Mean	No. of alive individuals /30 branches	Max. temp. °C	Min. Temp. °C	Mean	Mean R.H. %	No. of alive individuals /30 branches	Max. temp. °C	Min. Temp. °C	Mean	Mean R.H. %
Jan.	1521	16.5	7.0	11.8	69.0	1659	17.2	8.0	12.6	72.0
Feb.	1278	19.6	7.2	13.4	63.0	1479	19.8	7.2	13.5	69.0
Mar.	3144	25.2	10.3	17.8	64.0	3063	23.0	9.1	16.1	68.0
Apr.	3336	28.4	12.3	20.4	62.0	3561	27.6	11.8	19.7	59.0
May	3972	29.7	14.3	22.0	55.0	4266	29.3	12.5	20.9	60.0
Jun.	3435	33.1	17.0	25.0	64.0	3348	33.3	18.2	25.8	65.0
Jul.	3535	33.9	19.7	26.8	70.0	2676	33.2	20.2	26.7	68.0
Aug.	2184	33.7	20.7	27.2	73.0	1809	33.7	20.6	27.2	73.0
Sept.	4323	31.5	17.4	24.5	65.0	4431	30.8	16.4	23.6	69.0
Oct.	2778	29.7	16.0	22.9	62.0	3444	28.3	15.4	21.9	63.0
Nov.	3520	25.6	12.4	19.0	66.0	3639	25.0	13.8	19.4	66.0
Dec.	2112	21.8	8.7	15.3	71.0	2229	20.7	8.1	14.4	70.0

Table (41) : The effect of the main climatic factors on the population density of *P. oleae*, on plum trees during 1994 and 1995, at El-Quanater El-Khairiya location.
(Statistical analysis).

Stage	Year	d.mx.t.					n.min.t.					d.m.R.H.					Analysis of variance	
		Simple			Partial		Simple			Partial		Simple			Partial			
		r	b	t	P.r.	t	r	b	t	P.r.	t	r	b	t	P.r.	t	F	E.V. %
Nymphs	1994	+0.83	+0.23	6.32**	+0.41	2.51*	+0.32	+0.30	5.31**	-0.08	0.60	-0.40	-0.21	1.02	-0.03	1.01	8.31**	84.31
	1995	+0.78	+0.31	5.21**	+0.39	2.72*	+0.45	+0.27	5.81**	-1.02	0.92	-0.23	-0.16	0.82	-0.08	0.98	10.20**	83.50
Adult females	1994	+0.75	+0.28	4.57**	+0.38	3.33**	+0.48	+0.33	4.92**	-0.50	1.25	+0.28	+0.22	0.76	+0.10	0.76	12.30**	71.62
	1995	+0.79	+0.32	4.82**	+0.31	4.21**	+0.61	+0.27	4.63**	-1.01	0.81	+0.51	+0.18	0.72	+0.20	1.05	9.62**	73.51
Ovipositing females	1994	+0.46	+0.19	2.76*	+0.42	2.01*	+0.58	+0.18	5.31**	-0.07	4.51**	-0.36	-0.12	1.01	-0.07	1.10	10.82**	79.20
	1995	+0.55	+0.21	2.21*	+0.35	2.81*	+0.66	+0.25	5.72**	-0.09	5.08**	-0.32	-0.20	0.28	-0.09	0.89	13.51**	78.80
Total population	1994	+0.79	+0.49	5.83**	+0.67	3.71**	+0.72	+0.51	6.23**	-0.16	2.4*	-0.44	-0.31	0.07	-0.09	1.09	15.12**	77.37
	1995	0.83	+0.61	4.48**	+0.58	4.87**	+0.79	+0.58	5.85**	-0.21	2.8*	-0.37	-0.34	1.02	-0.08	1.03	13.07**	78.60

* Significant at 0.05 level
** Highly significant at 0.01 level
(r) : Simple correlation
(b) : Simple regression
(P.reg.) : Partial regression

different records of the studied climatic factors, during the two studied years of 1994 and 1995.

a- Effect of the day-maximum temperature (d.mx.t.) :

Almost, the same trend of results previously elucidated on pear trees, was also demonstrated on plum trees. During the first season of study (1994), the influence of this tested factor exhibited positive simple correlations (r) with all studied cases of the insect, indicating the real correlations between this factor and all insect studied stages (including the total number of all individuals). Simple correlation values were highly significant with total population and also with the considered stages, except the ovipositing females which showed positive significant figures. The calculated (r) values were 0.83, 0.75, 0.46 and 0.79, for nymphs, adult females (without eggs), ovipositing females and the total population, respectively. Partial regression values, showed also positive figures with all insect stages and total population, being significant with the nymphal stage and ovipositing female individuals, and highly significant with the adult females and total population of ***P. oleae***.

Statistical analysis of 1995 data showed similar results to those of the previous year. The day maximum temperature showed positive (r) values with all insect stages and total population, being highly significant with the nymphal and adult females, also with the total population, but only significant with the ovipositing female individuals.

Partial regression values of second studied years, showed positive correlation values with all insect stages and total population of ***P. oleae***. Values were highly significant in cases of adult females and total population, where they were only significant with each of the nymphs and ovipositing female individuals.

From the previously explained results, and data in Tables (37, 38, 39, 40 and 41), the following may be concluded :

1- The optimal mean d.mx.t. for ***P. oleae*** nymphal stage is 29.5°C, where this stage reached maxima peak of 2893 and 3048 nymphs/30 branches of plum, at 29.7 and 29.3°C, in 1994 & 1995, respectively, being synchronized with the peaks of the same stages on pear trees, at the same location.

2- The mean unfavourite d.mx.t. for the insect nymphal stage was 21.25°C, as nymphs reached their lowest abundance of zero and 99 individuals/30 branches at 21.8 and 20.7°C, in 1994 & 1995, respectively, being slightly different than those previously mentioned on pear trees.

3- In case of the non-ovipositing adult female individuals, the average of optimal d.mx.t. of the two studied years was 25.3°C, as individuals of these females reached their maximal populations of 2929 females/30 branches, at 25.6°C in 1994 and 3186 females/30 branches, at 25.0°C, in 1995. The mean optimum temperature on plum trees was the same as that previously mentioned on pear trees.

4- The mean unfavourite d.mx.t. for adult females was 29.5°C, as same as on pear trees, with the same figures, where most of adult females have developed to the next ovipositing females.

5- Regarding the ovipositing females, the mean optimal d.mx.t. for abundance of these individuals was 28.0°C, with the same previous figures as on pear trees.

6- The mean d.mx.t. of 21.25°C, was considered unfavourable for the ovipositing abundance. Ovipositing females reached their lowest abundance of zero and 90 individuals/30 branches, at 21.8°C and 20.7°C (in December), during 1994 & 1995, respectively. No ovipositing females observed during January of the two studied seasons.

7- As for the total population of ***P.oleae***, the mean optimal d.mx.t. was 25.3°C, and the unfavourite one was 19.7°C.

The previously explained results concerning the relationship between day-maximum temperature (d.mx.t.) and the different developmental stages of ***P. oleae***, or its total population, clearly indicated that this factor may be fairly considered as of great importance affecting the plum scale insect population fluctuation and activity.

b- Effect of the night-minimum temperature (n.mn.t) :

The obtained results of the first studied year indicated (r) and (b) values of positive and highly significant in either of the studied cases. On the other hand, results indicated negative partial regression values with all of the studied stages, being insignificant in cases of the nymphal and adult female individuals, significant in case of the total insect population, and highly significant in case of the ovipositing female individuals. Similar results were obtained in the subsequent year of 1995, (Table, 41).

From the obtained data and results, it could be concluded that :

1- In relation to the nymphal stage, the mean optimal night-minimum temperature (n.mn.t.), was 13.4°C (14.3 and 12.5°C, in May during 1994 and 1995, respectively); while the mean unfavourite one was 8.4°C (8.7 and 8.1°C in December, 1994 and 1995, respectively). No nymphs absolutely observed during January, but few of them were observed in February & December.

2- In case of adult females, the average optimal n.mn.t. was 13.1°C (12.4 and 13.8°C in November of 1994 and 1995, respectively, whereas the mean n.mn.t. correspondent to the lowest population of this stage, was 13.4°C (14.3 and 12.5°C, in May of 1994 and 1995). Always in case of adult non-ovipositing females, the mean of optimal abundance and the other of the lowest population, were observed to be of slightly different figures, and that observed, was previously explained by showing that the unfavourite mean of adult females, in fact, was favorite in enhancing oviposition, consequently, decreasing the number of adult females, which were developed to the next ovipositing females almost during May of each studied year. On the other hand, however, during November, most immature stages developed to adult non-ovipositing females, before hibernation during winter months, the matter that caused comparatively high abundance of this stage, during November (second peak of the adult females abundance), subsequently, decreasing number of nymphs.

3- Concerning the ovipositing females, the average optimal n.mn.t., was 12.05°C (closely related to the unfavourite average for adult females of 13.4°C), where the highest relative population of ovipositing females was 1551 at n.mn.t. of 12.3°C in 1994 and 1686/30 branches of plum, at 11.8°C in 1995 (both were in April). On the other hand, the lowest abundance of these individuals of 17 and 60 individuals/30 branches of plum, were recorded at n.mn.t. of 7.2°C, during the both studied years of 1994 & 1995, (Table 39).

4- In case of the total insect population, the mean optimal n.mn.t. was 16.9°C, where 4323 total individuals were counted on 30 branches of plum at n.mn.t. of 17.4°C in September 1994, and 4431 individuals/30 branches were recorded at 16.4, during the same month of 1995. On the other hand, the unfavourite mean n.mn.t. was 7.2°C, where 1278 and 1479 total insect individuals/30 branches were counted as the lowest insect total populations, at 7.2°C in February of the two studied years.

From the previously mentioned results, it could be concluded that, the n.mn.t. had more effect on ***P. oleae*** infesting plum trees than those infesting pear trees, due to the presence of highly significant values of partial regression which were calculated in case of the ovipositing females, and the significant values which were recorded in case of the total population, in both studied years, while in case of pear trees, all these values were insignificant.

c- Effect of the daily mean relative humidity (d.m.R.H.) :

As shown in Table (41), results were almost similar to those obtained on pear trees, where the simple correlation coefficient (r), was insignificantly negative on the insect total population, ovipositing females and the nymphal stage, but insignificantly positive in case of the adult females.

From data of Table (41), it could be clearly concluded that :

1- In relation to the insect nymphal stage, on plum trees, the mean optimal d.m.R.H., was 57.5 % (as that calculated on pear trees), whereas the unfavourite mean was 70.5 %.

2- In case of the adult females, the mean optimal d.m.R.H. was 66.0 %, whereas the unfavourite one was 57.5 %.

3- In concern to the ovipositing females, the mean optimal d.m.R.H. was 60.5 %, while the unfavourite one was 66.0 %.

4- Regarding the total population of the plum scale insect, the mean optimal d.m.R.H. was 67 %, whereas the unfavourite one was 66 % (with negative and insignificant partial regression which indicate the lowest effect). Observations on the obtained results of the effect of some meteorological factors on ***P. oleae*** infesting plum trees, indicated that, the daily maximum temperature (d.mx.t.) was the most effective on the insect activity, where almost all data showed either highly or only significant effect due to this factor, followed by the night-minimum temperature (n.mn.t.), which showed in one case (ovipositing females) high significance, and in case of total population, only significant figures, while induced insignificant effects with the remaining two stages (nymphal and adult female stages).

The daily mean R.H. showed negative partial regression values, also negative correlations (r), with the insect total population and all insect stages, except adult female stage, where (r) and (pr) values were positive, but in all cases were of insignificant values and that explain the close values of the gavorite and unfavorite means of this factor. Thus confirming that this factor (R.H.) was of minor importance in its effect on either the studied stages or total population, compared with the remaining studied factors.

d- The combined effect of the three studied factors :

As that previously recorded and explained on pear trees, concerning the simultaneous combined effect of the daily-mean maximum and minimum temperature, and also the means of the daily relative humidity on the activity and abundance of either ***P. oleae*** total population or any of its stages, exhibited highly significant figures. The explained variance (E.V.), ranged between 71.62 % (with the adult females) and 84.31 % (with the nymphal stage) in the first studied year, whereas these percentages of the total effect of the studied factors (E.V.) were 73.51 (with adult females) and 83.50 % (with the nymphal stage) in the second studied year, indicating that, the nymphal stage were of the highest susceptibility to the tested factor, while the adult females were of the lowest one.

From the obtained results on both pear and plum trees, it was clearly indicated that the combined effect of all studied weather elements showed high significancy with either insect total population or any of its stages, where the nymphal stage (crawlers and other immature insect individuals) showed to be comparatively highly affected with these tested weather factors, followed by each of the ovipositing females, total population, and adult females, (depending on E.V. values).

The effect of weather factors on the activity of some scale insect, were studied by **Hall (1924)**, in Egypt; **Bodenheimer (1951)**, in Palestine; **Muma**

(1959), in Florida, and also by **El-Keiy (1964), Hamed (1969), Amin *et al.* (1981), Elwan (1990)** and **Kasim (1995)** in Egypt, who all of them postulated that temperature is the most effective climatic factors on the population abundance of the scale insect, while the other climatic factor, *i.e.* wind velocity, humidity, rain, ... etc., almost induced minor effects, the matter that in complete agreement with the present results.

4.2- Susceptibility of Different Host Plants to Infestation With *P. oleae* :

4.2.1- Susceptibility of pear, plum and apple trees to infestation with *P. oleae* :

The present study is an attempt to evaluate the favourite host plant among the three different hosts, *i.e.*, pear, plum and apple as indicated by rate of infestation of each with ***P. oleae.*** Data in Table (42) show the seasonal average numbers of the plum scale insect per branch on each host plant of pear and plum trees in Qualubiya governorate (El-Quanater El-Khairiya location) and in Sharkiya governorate (Menia El-Kamh location), also on apple trees in Beheira governorate (Nobariya location). In case of pear and plum, the two host plant species were planted concurrently at each of the locations (El-Quanater El-Khairiya and Menia El- Kamh) and were under, more or less the same climatic conditions. Rates of infestation obtained along two years of study (1993-94 & 1994-95), were subjected to statistical analysis to determine the significancy of differences in the rates of infestation. In case of apple, it was planted in Nobariya, as a monoculture without any nearly composting species, and under different climatic conditions. Data obtained from apple; however, was compared statistically with pear and plum, but the above mentioned differences must be always kept in mind.

4.2.1.1- 1993-1994 season :

A- In Sharkiya governorate, at Menia El-kamh location :

Table (42) shows results obtained during the season of 1993-1994 (from December 1993 to November 1994), in Sharkiya governorate, Menia El-Kamh location. When comparing data of pear infestation with that of plum, it was observed that, the rate of pear infestation was significantly higher than that of plum allover the seasons of the two studied years. The average number of all ***P. oleae*** stages per branch allover the year was 93.2 individuals for pears and 62.7

Table (42) : Showing mean number of *P. oleae*/branch on different host plants, in different seasons.

Sampling date		Sharkiya governorate								Qualubiya governorate								Behera governorate			
		1993-1994				1994-1995				1993-1994				1994-1995				Apple			
		Pear		Plum		Pear		Plum		Pear		Plum		Pear		Plum		93-1994		94-1995	
		Means	Total mean	Means	Total mean	Means	Total mean	Means	Total mean	Means	Total mean	Means	Total mean	Means	Total mean	Means	Total mean	Means	Total mean	Means	Total mean
Dec.	Winter	82.9		53.7		79.0		44.9		141.5		69.6		138.4		70.4		97.8		99.4	
Jan.		73.9	70.3	36.7	41.6	71.6	68.7	45.2	47.1	107.0	112.8	50.7	54.3	95.3	109.5	55.3	58.3	80.2	85.8	86.2	87.4
Feb.		54.1		34.5		55.5		51.1		89.9		45.6		94.9		49.3		79.4		76.5	
Mar.	Spring	109.6		71.1		116.8		82.2		184.2		104.8		173.1		102.1		101.4		97.7	
Apr.		114.1	122.5	69.7	78.3	126.1	133.5	73.6	86.6	261.0	259.3	111.2	116.1	271.6	260.9	118.7	121.0	168.4	223.7	178.8	232.4
May		143.9		94.0		157.7		104		333.6		132.4		338.1		142.2		401.3		420.6	
Jun.	Summer	94.5		84.8		98.6		75.1		215.0		114.5		210.4		111.6		362.7		341.1	
Jul.		74.2	79.7	78.1	70.3	66.5	79.3	70.1	63.5	153.3	168.2	84.5	90.6	147.5	158.6	89.2	87.0	195.9	219.5	207.3	217.8
Aug.		70.4		48.0		72.8		45.2		136.4		72.8		118.0		60.3		99.9		105.0	
Sept.	Winter	136.5		95.0		121.6		98.3		256.5		144.1		286.9		147.7		308.6		298.5	
Oct.		93.4	100.2	62.7	72.6	102.4	103.3	57.7	70.4	239.5	228.7	92.5	118.0	238.2	240.5	114.8	127.9	268.5	239.8	262.2	230.5
Nov.		70.8		60.2		86.0		55.3		190.1		117.5		196.5		121.3		142.4		130.7	
General mean		93.2		62.7		96.2		66.9		192.3		94.8		192.4		98.6		192.2		192.00	
"F" value		183.854120				170.64106				126.95283				170.64106				Results compared with data of pear and plum of each season			
L.S.D.0.01		30.62913				22.70193				40.73376				32.70153							

individuals for plum, *i.e.*, 1.5 folds higher on pear than on plum. Analysis of variance (L.S.D., at P = 0.01 = 30.62913) showed the differences in infestation to be highly significant at that level, during the year of the study.

B- In Qualubiya governorate :

At El-Quanater El-Khairiya location, during the same season of 1993-1994, results in Table (42), indicated that pear trees were more susceptible than plum trees to infestation with ***P. oleae*** throughout the first season (1993-1994). The average number of all stages of the plum scale insect per branch allover the year was 2.03 times higher on pear than on plum, where the difference between the means of the insect individuals on pear and on plum, was statistically highly significant.

4.2.1.2- 1994-1995 season "

A- In Sharkiya governorate :

In season of 1994-1995 (second season), data obtained are shown in Table (42). Results indicated a similar trend of susceptibility concerning the two host plant species towards infestation with the plum scale insect, ***P. oleae***, at the two locations of the study. At Menia El- Kamh location, pear trees were found to be more susceptible to infestation than plum trees. Rate of infestation was 1.44 folds higher on pear compared to of plum, the difference was highly significant at P = 0.01.

It is noticeable, however, that the proportional infestation was reasonably close on the two years of study, *i.e.*, 1.5 folds for 1994 and 1.44 folds for 1995.

B- In Qualubiya governorate :

At El-Quanater El-Khairiya location, more or less the same results of 1993-1994 were obtained. The average of infestation on both fruit trees were 192.4 and 98.6 on pear and plum trees, respectively, with a 1.95 higher rate of infestation on pears compared to plums. The difference in rate of infestation was highly significant at P = 0.01, as shown in Table (42).

C- In Beheira governorate, at Nobariya location :

In case of apple trees (Table 42), the mean number of insect population per branch was almostly equal to that of pear, at El-Quanater locations, being 192.2 and 192.0 in 1993-1994 and 1994-1995, respectively, but highly exceeded the means of insect individuals either on pear at Menia El-Kamh or on plums at all locations, (Table, 42). Data obtained indicated, in general, that apple trees received in May and September, the times of the two main peaks of the plum scale insect, the highest rate of infestation with scale insect, than pear and plum did, lighter at El-Quanater El-Khairiya, or at Menia El-Kamh locations, where the average number of the insect individuals on one apple branch was 410.95 in May, *i.e.*, 169 folds higher than the average rate of infestation on pears and 3.48 folds higher than the average rate of infestation on plums. In September, the average number of the insect individuals on apple was 303.55, *i.e.*, 1.52 folds higher on pears, and 2.5 folds higher on plums, estimated as an average per branch, throughout the two seasons of the study. The obtained results, indicated that apple and pear trees (of the same species, and away of other differences in conditions), were more susceptible to infestation with ***P. oleae*** than plum, with the presence of highly significant differences between apple and pear at Menia El-Kamh location and plums at all locations, but not between apple and pear at El-Quanater El-Khairiya location. This observation, however, are in agreement with those of **El-Minshawy *et al.* (1974)**, who arranged the hosts of ***P. oleae***, in Alexandria as apple, plum, olive and peach trees depending on their rate of infestation; also data obtained are in parallel to those obtained by **Gomaa (1978)** in Bulgaria, who found ***P. oleae*** to be a serious pest of apple, pear and fruit trees. Similar results were obtained by **Paloukis *et al.* (1979)**, in Greece, who reported that the plum scale insect, ***P. oleae*** as the most important pest species on peach, apple, pear and olive. The results are also in accordance with those of **Ramaseshiah (1985)** in Afghanistan, who found that, ***P. oleae*** were dominant on almond, apple, apricot, cherry, peach and plum, with the same sequence. From observations and results, among obtained data, it was concluded that, the second season (period) of spring of the study (March, April, and May) is considered the best season in expressing the differences in susceptibility among the three host plant species, where during this period, the host branch -as a unit- in the three host plants, was occupied almost with the greatest possible number of different stages of the plum scale insect, the matter which magnify the expression of susceptibility between the three host plants, as mean number of insects per branch, better than would occur at any other season of the year. During 1993-1994, the average of the greatest insect population per branch of the second season (March, April and May) was 160 as a general mean of infestation throughout all locations of experiment, while it was 171.7 during 1994-1995. The least number of insect population occurred on branch, was the mean number of the first period (December, January and February), which was 73 and 74.2 during the first and second years of the study. Differences in the average of insect population per branch during the different periods, were significant statistically between the first and the second, the first and the third, the first and the fourth, and between the second and the third periods, but was not significant statistically between the second and the fourth periods, which almostly had an adjacent numbers of insects per branch, as shown in Table (43).

The obtained results are in agreement with those of **El-Hakim and Helmy (1983)**, who stated that *P. oleae* has 3 peaks in Fayoum and 2 in Alexandria, also results are in agreement with those of **Moursi and Mesbah (1985)**, who reported that *P. oleae* in Delta has two peaks, the first occurs in March and the second in August-September, also the obtained results are on the same line with those of **Rizk and Mohamed (1985)**, in Iraq, who postulated that the plum scale insect, *P. oleae* has two peaks, the first was observed to start at the end of April, and the second was between August and next April.

almond, apple, apricot, cherry, peach and plum, with the same sequence. From observations and results, among obtained data, it was concluded that, the second season (period) of spring of the study (March, April, and May) is considered the best season in expressing the differences in susceptibility among the three host plant species, where during this period, the host branch -as a unit- in the three host plants, was occupied almost with the greatest possible number of different stages of the plum scale insect, the matter which magnify the expression of susceptibility between the three host plants, as mean number of insects per branch, better than would occur at any other season of the year. During 1993-1994, the average of the greatest insect population per branch of the second season (March, April and May) was 160 as a general mean of infestation throughout all locations of experiment, while it was 171.7 during 1994-1995. The least number of insect population occurred on branch, was the mean number of the first period (December, January and February), which was 73 and 74.2 during the first and second years of the study. Differences in the average of insect population per branch during the different periods, were significant statistically between the first and the second, the first and the third, the first and the fourth, and between the second and the third periods, but was not significant statistically between the second and the fourth periods, which almostly had an adjacent numbers of insects per branch, as shown in Table (43).

The obtained results are in agreement with those of **El-Hakim and Helmy (1983)**, who stated that ***P. oleae*** has 3 peaks in Fayoum and 2 in Alexandria, also results are in agreement with those of **Moursi and Mesbah (1985)**, who reported that ***P. oleae*** in Delta has two peaks, the first occurs in March and the second in August-September, also the obtained results are on the same line with those of **Rizk and Mohamed (1985)**, in Iraq, who postulated that the plum scale insect, ***P. oleae*** has two peaks, the first was observed to start at the end of April, and the second was between August and next April.

Table (43) : Average mean number of insect per branch, on different host plant species, in different seasons, within 2 years.

1993-1994			1994-1995		
Period	Av. no./ branch	L.S.D.	Period	Av. no./ branch	L.S.D.
1*	73.0	12.49437	1*	74.2	24.156484
2*	160.0	at P = 0.05	2*	171.7	at P = 0.05
3*	125.7	F =	3*	121.1	F =
4*	151.9	141.58362	4*	154.5	138.65204

* First period (season) : December, Jan. and Feb., representing winter

Second period (season) : March, Apr. and May, representing spring

Third period (season) : June, July and Aug., representing summer

Fourth period (season) : Sept., Oct. and Nov., reprsenting autumn

4.2.2- Susceptibility of the plum varieties, (Hollywood, Santarosa, and Golden Japanese) to infestation with *P. oleae* :

Data represented in Table (44), showed the seasonal mean numbers of the plum scale insect, ***P. oleae***, including the different stages of the insect per branch, of different plum varieties in Sharkiya and Qualubiya governorates throughout two years of investigations (1994 and 1995).

Results obtained in season (1993-1994), from the two locations of the study indicated that the Hollywood variety of plum was the most susceptible variety to ***P. oleae*** infestation, where the mean number of the different stages of the plum scale insect on Hollywood one branch was 90.2 and 114.0, at Menia El-Kamh and El-Quanater El-Khairiya locations, respectively. Santarosa plum variety came next to Hollywood variety in susceptibility to infestation, where the mean numbers of the different stages of ***P. oleae*** per one Santarosa plum branch were 60.9 and 96.6 at Menia El-Kamh and El- Quanater El-Khairiya locations. The least susceptible variety of plum to ***P. oleae*** was the Golden Japanese variety, where the mean numbers of different stages of the plum scale insect on one branch were 43.9 and 65.2 at Menia El-kamh and El-Quanater El-Khairiya, respectively. Statistical analysis of the obtained data from the two locations of the study, showed a highly significant difference between the three plum varieties at both locations (Table 44).

In the second season of (1994-1995), the results also were parallel to those of the preceding year of the study. Hollywood variety of plum, was found to be the most susceptible plum variety to ***P. oleae*** infestation, where the mean numbers of different insect stages were 91.9 and 116.6 in Sharkiya and Qualubiya, respectively. Santarosa variety of plum came next to Hollywood variety, where the mean numbers of the insect different stages/branch were 65.6 and 98.4 in the same sequence. Golden Japanese plum variety also showed the least degree of susceptibility to ***P. oleae***, when compared with the other two plum

Table (44) : The mean number of *P. oleae* individuals per branch on different plum varieties in Sharkiya and Qualubiya governorates, indicating the suceptibility of plum varities to infestation.

Time of sampling		Sharkiya governorate						Qualubiya governorate					
		1993-1994			1994-1995			1993-1994			1994-1995		
		Hollywood	Santarosa	Golden Japanese	Hollywood	Santarosa	Golden Japanese	Hollywood	Santarosa	Golden Japanese	Hollywood	Santarosa	Golden Japanese
Dec. Jan. Feb.	Winter	58.7	38.2	21.6	69.5	49.6	25.1	74.2	61.3	32.1	78.5	64.6	36.2
Mar. Apr. May.	Spring	109.5	68.3	52.7	115.8	79.7	62.3	139.3	118.7	86.5	146.7	131.5	81.1
Jun. Jul. Aug.	Summer	85.7	65.8	52.6	82.2	63.4	43.6	113.6	93.7	69.2	110.0	88.7	64.3
Sept. Oct. Nov.	Winter	106.9	71.2	48.5	100.2	69.5	47.3	128.9	112.5	73.0	131.2	108.7	69.2
General mean		90.2	60.9	43.9	91.9	65.6	44.6	114.0	96.6	65.2	116.6	98.4	62.7
"F" value		221.63475			385.26666			218.98274			128.686521		
$L.S.D._{0.01}$		9.36974			17.68339			8.41742			22.69812		

varieties. The mean numbers of different ***P. oleae*** sages/Golden Japanese branch were 44.6 and 62.7 in Sharkiya and Qualubiya, in respective order. Statistical analysis of data obtained from the two locations of study, during (1994-1995), showed a significant difference at P = 0.01 between the three plum varieties at Menia El-Kamh location, where the differences of all means exceeded the L.S.D. at 0.01 level but no significant difference between Hollywood and Santarosa plum varieties was observed at P = 0.01, at El-Quanater El-Khairiya location, as shown in Table (44). From the obtained data, it could be concluded that the differences in the plum varieties amongst susceptibility, raised obviously during the second period of the study (March, April and May) in which, branches of different plum varieties were occupied with the highest numbers of the insect population, than occurred in the former or latter other periods, subsequently, the obtained data during this period could be used as an indicator, and/or as an expressive measure amongst differences in susceptibility either between different host plant species or between different varieties of the same plant species, as shown in Tables (43 & 45).

Table (45) : Average total means of insect/branch, on different plum varieties, in different seasons, within 2 years.

1993-1994			1994-1995		
Period	Av. no./ branch	L.S.D. 0.01	Period	Av. no./ branch	L.S.D. 0.01
1	47.7	8.41742	1	53.9	10.48627
2	95.8		2	102.9	
3	80.1	F	3	75.4	F
4	90.2	170.3582	4	154.5	182.37504

These finding obtained, are supported by those of **Hanks and Deno (1993)**, who had shown that the host plant species, phenotype, genotype, and physiological state, may affect the colonization, reproduction and population densities of polyphagous scale insects on the concerned host plant.

4.3- Natural Enemies of the Plum Scale Insect, *P. oleae* :

Insect natural enemies represent an important portion of the world biological resources. The excessive uses of the different pesticides, made Egypt in need of a conservation strategy that embraces preservation, rational utilization and enhancement of the natural biological control agents in the environment. In the present study; however, a survey of the natural enemies associated with the plum scale insect, *P. oleae* (Colveé) infestation, was carried out for 2 successive years (1993 and 1994) at different studied locations in Egypt.

4.3.1- Predators associated with the plum scale insect :

Tables (46, 47, 48, 49 and 50) show the predaceous insects and mites which were observed feeding on, or associated with the plum scale insect at the different studied locations, and on the different studied host plants (pear, plum and apple).

a- *Chilocorus bipustulatus* L. (Coleoptera : Coccinellidae) :

One of the most important predators recorded in pear orchards at Sharkiya (Menia El-Kamh), Beheira (Nobariya) and Qualubiya (El-Quanater El-Khairiya) governorates. It was counted in considerable numbers especially during spring months at Qualubiya on pear and plum trees, also was observed in winter at the same two locations, in addition to Nobariya location, on apple trees, but was not common as on pear and plum trees.

b- *Scymnus bipunctatus* Kug. (Coleoptera : Coccinellidae) :

This species was found in reasonable numbers in summer, on apple trees, at Nobariya location (Beheira), but also observed in small numbers in autumn on pear and plum trees, in Qualubiya and Sharkiya governorates. Its presence was also found to be associated with the infestation of ***P. oleae.***

Table (46) : Syrvey of predators on pear trees, at El-Quanater location during 1993 and 1994.

Season	Predatory insects	Density	Predatory mites	Density
Winter	*Chilocorus bipustulatus* L. (Col., Coccinellidae)	++	*Eupalopsellus olearius* Gomaa (Eupalopsellidae)	+++
	Scymnus bipunctatus Kug. (Col., Coccinellidae)	+	*Agistemus exsertus* Gonzalez (Stigmaeidae)	+
	Haplothrips chahirensis (Thysanoptera)	+	*Saniosulus nudus* Summer	+
Spring	*Chilocorus bipustulatus* L. (Col., Coccinellidae)	++	*Saniosulus nudus* Summer (Eupalopsellidae)	++
	Vedalia cardinales Muls (Col., Coccinellidae)	+	*Eupalopsis aegyptiaca* Zaher (Eupalopsellidae)	++
	Karniothrips flavipes (Thysanoptera)	++		
Summer	*Cybocephalus flaviceps* Reitt. (Col., Nitidulidae)	++	*Saniosulus nudus* Summer (Eupalopsellidae)	++++
	Karniothrips flavipes (Thysanoptera)	++	*A. exsertus* Gonzalez (Stigmaeidae)	+++
	Haplothrips chahirensis (Thysanoptera)	+++		
Autumn	*Scymnus bipunctatus Kug.* (Col., Coccinellidae)	+	*Cheyletia sp.* (Cheyletidae)	++
	Haplothrips chahirensis (Thysanoptera)	+	*A. exsertus* Gonzalez (Stigmaeidae)	++
			Eutogenes punctata Zaher (Cheyletidae)	

+ : 1-3 individuals/10 branch of 15 cm. **+++ : 7-10 individuals/10 branch**

++ : 4-6 individuals/10 branch **++++ : > 10 individuals/10 branch**

Table (47) : Syrvey of predators on pear trees, at Menia El-Kamh location during 1993 and 1994.

Season	Predatory insects	Density	Predatory mites	Density
Winter	*Chilocorus bipustulatus* L. (Col., Coccinellidae)	++	*Agistemus exsertus* Gonzalez (Stigmaeidae)	+
Spring	*Coccinella undecimpunctata* L. (Col., Coccinellidae)	++	*Cheletonominus berlesei* Oud. (Cheyletidae)	+
			Cheyletia sp. (Cheyletidae)	++
	Haplothrips chahirensis (Thysanoptera)	+	*A. exsertus* Gonzalez (Stigmaeidae)	+++
Summer	*Vedalia cardinales* Muls. (Col., Coccinellidae)	++	*Saniosulus nudus* Summer (Eupalopsellidae)	++
	Karniothrips flavipes (Thysanoptera)	++	*Cheletonominus berlesei* Oud. (Cheyletidae)	+
			A. exsertus Gonzalez (Stigmaeidae)	+++
Autumn	*Chilocorus bipustulatus* L. (Col., Coccinellidae)	++	*Eutogenes punctata* Zaher (Cheyletidae)	+++
	Scymnus bipunctatus Kug. (Col., Coccinellidae)	+	*A. exsertus* Gonzalez (Stigmaeidae)	++

+ : 1-3 individuals/10 branch of 15 cm.

++ : 4-6 individuals/10 branch

+++ : 7-10 individuals/10 branch

++++ : > 10 individuals/10 branch

Table (48) : Syrvey of predators on plum trees, at El-Quanater El-Khairiya location during 1993 and 1994.

Season	Predatory insects	Density	Predatory mites	Density
Winter	*Chilocorus bipustulatus* L. (Col., Coccinellidae)	++	*Eupalopsellus olearius* Gomaa (Eupalopsellidae)	+
			Cheyletominus ornatus (C. & F.) (Cheyletidae)	+
Spring	*Chilocorus bipustulatus* L. (Col., Coccinellidae)	++	*Agistemus exsertus* Gonzalez (Stigmaeidae)	+++
	Vedalia cardinales Muls. (Col., Coccinellidae)	++	*Eupalopsellus olearius* Gomaa (Eupalopsellidae)	+
			Eutogenes punctata Zaher (Cheyletidae)	
Summer	*Vedalia cardinales* Muls. (Col., Coccinellidae)	++	*Agistemus exsertus* Gonzalez (Stigmaeidae)	++
			Cheyletia sp. (Cheyletidae)	+
Autumn	*Cybocephalus flaviceps* Reitt. (Col., Nitidulidae)	+	*Eupalopsellus olearius* Gomaa (Eupalopsellidae)	++
	Scymnus bipunctatus Kug. (Col., Coccinellidae)	+	*Cheyletia sp.* (Cheyletidae)	++

+ : 1-3 individuals/10 branch of 15 cm.
++ : 4-6 individuals/10 branch
+++ : 7-10 individuals/10 branch
++++ : > 10 individuals/10 branch

Table (49) : Syrvey of predators on plum trees, at Menia El-Kamh location during 1993 and 1994.

Season	Predatory insects	Density	Predatory mites	Density
Winter	*Coccinella undecimpunctata* L. (Col.,Coccinellidae)	+	*Saniosulus nudus* Summer (Eupalopsellidae)	+
			Cheyletia sp. (Cheyletidae)	
Spring	*Vedalia cardinales* Muls. (Col., Coccinellidae)	++	*Eutogenes punctata* Zaher (Cheyletidae)	+
	C. undecimpunctata L. (Col.,Coccinellidae)	++	*Eupalopsis aegyptiaca* Zaher (Eupalopsellidae)	++
			Agistemus exsertus Gonzalez (Stigmaeidae)	++
Summer	*Vedalia cardinales* Muls. (Col., Coccinellidae)	+++	*Agistemus exsertus* Gonzalez (Stigmaeidae)	++
	Scymnus bipunctatus Kug. (Col., Coccinellidae)	+	*Cheletonominus berlesei* Oud. (Cheyletidae)	+
	C. undecimpunctata L. (Col.,Coccinellidae)	+		
Autumn	*C. undecimpunctata* L. (Col.,Coccinellidae)	++	*Cheyletia sp.* (Cheyletidae)	++
	Vedalia cardinales Muls. (Col., Coccinellidae)	++	*Eutogenes punctata* Zaher (Cheyletidae)	+
			Eupalopsis aegyptiaca Zaher (Eupalopsellidae)	++

+ : 1-3 individuals/10 branch of 15 cm.
++ : 4-6 individuals/10 branch
+++ : 7-10 individuals/10 branch
++++ : > 10 individuals/10 branch

Table (50) : Syrvey of predators on apple trees, at Nobariya location during 1993 and 1994.

Season	Predatory insects	Density	Predatory mites	Density
Winter	*Chilocorus bipustulatus* L. (Col., Coccinellidae)	+	*Agistemus exsertus* Gonzalez (Stigmaeidae)	+
	Coccinella undecimpunctata L. (Col., Coccinellidae)	++	*Eupalopsis aegyptiaca* Zaher (Eupalopsellidae)	++
Spring	*Coccinella undecimpunctata* L. (Col., Coccinellidae)	+	*A. exsertus* Gonzalez (Stigmaeidae)	+
	Vedalia cardinales Muls (Col., Coccinellidae)	++	*Cheyletus sp.* (Cheyletidae)	++
	Karniothrips flavipes (Thysanoptera)	++		
Summer	*Coccinella undecimpunctata* L. (Col., Coccinellidae)	++	*A. exsertus* Gonzalez (Stigmaeidae)	+++
	Scymnus bipunctatus Kug. (Col., Coccinellidae)	++	*Hemicheyletia bakeri* (Cheyletidae)	++
			Eutogenes punctata Zaher (Cheyletidae)	+
Autumn	*Chilocorus bipustulatus* L. (Col., Coccinellidae)	++	*A. exsertus* Gonzalez (Stigmaeidae)	++
	Coccinella undecimpunctata L. (Col., Coccinellidae)	+	*Eutogenes punctata* Zaher (Cheyletidae)	+
	Karniothrips flavipes (Thysanoptera)	+		

+ : 1-3 individuals/10 branch of 15 cm.

++ : 4-6 individuals/10 branch

+++ : 7-10 individuals/10 branch

++++ : > 10 individuals/10 branch

c- *Coccinella undecimpunctata* L. (Coleoptera : Coccinellidae) :

This species was commonly observed and counted, and was found to be associated with the infestation of the plum scale insect in considerable numbers in Sharkiya and Beheira governorates, especially in spring and summer on plum and apple trees. The predator was also found on pear trees in Sharkiya, but was not common in Qualubiya.

d- *Vedalia cardinales* Muls (Coleoptera : Coccinellidae) :

This predaceous species was found to be common on plum trees in Sharkiya and Qualubiya governorates during spring and summer, and was found on apple trees only at Nobariya during spring season.

e- *Cypocephalus flaviceps* Reitt. (Coleoptera : Nitidulidae) :

Uncommon species, was found on plum and pear trees in autumn and summer, associated with the infestation of the plum scale insect.

f- *Haplothrips chahirensis* (Thysanoptera) :

This species was found associated with ***P. oleae***, only on pear trees, in Sharkiya and Qualubiya, whereas it was more common during summer and less common during winter and autumn.

g- *Karnyothrips flavipes* (Thysanoptera) :

This species was found on apple trees during spring and autumn at Nobariya and during spring and summer on pear trees in moderate numbers, whereas it associated with ***P. oleae*** infestation.

h- Predatory mites :

The most common predatory mites observed to be associated with the plum scale insect infestation was ***Saniosulus nudus*** Summer (Eupalopsellidae). This species was found on pear and plum trees in Qualubiya and Sharkiya. It was very common during summer and less common during spring and winter. This species was also found less abundant in Sharkiya during summer seasons, but was not observed at Nobariya all the year round. Another mite species, ***Agistemus exsertus*** Gonzalez (Stigmaeidae), found very common on apple trees at Nobariya in summer, but in few numbers and -in sometimes- may be rare during winter and spring. This species was found to attack the plum scale insect on plum and pear trees during spring and summer, but became almostly very rare in winter. A third species, ***Eutogenes punctata*** Zaher (Cheyletidae), was found to be abundant and effective predator during summer and autumn on pear,plum and apple trees, but became less common in winter and spring. Other predatory mite, *e.g.* ***Cheyletus sp.*** and ***Hemicheyletia bakeri*** (Cheyletidae),a nd ***Eupalopsis aegyptiaca*** Zaher (Eupalopsellidae), were also found associated with/or attacking the plum scale insect as shown in the concerned tables.

4.3.2- Parasitoids of the plum scale insect, *P. oleae* :

Throughout 1993 and 1994 years of survey (before the control experiments), the following parasitoids were recorded at the three studied locations, as shown in Tables (51, 52 and 53).

a- *Aphytis maculicornis* Masi (Hymenoptera : Aphelinidae) :

Avery common primary ectoparasite with very promising rate of parasitism. It was observed allover the three studied location, in Qualubiya, Sharkiya and Beheira. This parasitoid was found to reach its peaks of activity during late winter and spring, also -to some extent- during autumn, but declined drastically in numbers by early summer. The parasitoid populations recovered to a certain extent in the fall, but remained in low numbers in cold winter, until the beginning of spring, where a rapid and effective increase in number took place. In certain favouable locations, *i.e.*, in Qualubiya, the percentage of parasitism reached a high rate up to 77.3 % during 1994.

Table (51) : Survey of parasitoids of *P. oleae* on pear and plum, at El-Quanater El-Khairiya location, during 1993-1994.

Season	*Aphytis maculicornis* Masi			*Aphytis chrysomphali* Mercet			*Aphytis diaspidis* How.		
	Pear	**Plum**	**Apple**	**Pear**	**Plum**	**Apple**	**Pear**	**Plum**	**Apple**
December January, February (Winter)	++	+	--	Rare	Rare	--	Absent	Absent	--
March, April, May (Spring)	++++	+++	--	Absent	Rare	--	+	Absent	--
June, July, August (Summer)	Rare	Very rare or absent	--	Absent	Absent	--	Absent	Absent	--
September, October, November (Autumn)	+++	++	--	Rare	Absent	--	Rare	Absent	--

+ : 5-10 % parasitism　　+++ : 26-50 %　　-- : Unstudied at that location

++ : 11-25 %　　++++ : > 50 %　　Rare : < 5 %

Table (52) : Survey of parasitoids of *P. oleae* on pear and plum, at Menia El-Kamh location, during 1993-1994.

	Aphytis maculicornis Masi			*Aphytis chrysomphali* Mercet			*Aphytis diaspidis* How.		
Season	**Pear**	**Plum**	**Apple**	**Pear**	**Plum**	**Apple**	**Pear**	**Plum**	**Apple**
December January, February (Winter)	++	++	--	Rare	+	--	Absent	Absent	--
March, April, May (Spring)	++++	+++	--	Absent	Absent	--	Absent	Absent	--
June, July, August (Summer)	Absent	Absent	--	Absent	Absent	--	Absent	Absent	--
September, October, November (Autumn)	++	++	--	Rare	+	--	Absent	Absent	--

\+ : 5-10 % parasitism +++ : 26-50 % -- : Unstudied at that location

++ : 11-25 % ++++ : > 50 % Rare : < 5 %

Table (53) : Survey of parasitoids of *P. oleae* on apple trees, at Nobariya location, during 1993-1994.

Season	*Aphytis maculicornis* Masi			*Aphytis chrysomphali* Mercet			*Aphytis diaspidis* How.		
	Pear	**Plum**	**Apple**	**Pear**	**Plum**	**Apple**	**Pear**	**Plum**	**Apple**
December January, February (Winter)	--	--	+	--	--	Absent	--	--	Absent
March, April, May (Spring)	--	--	+++	--	--	Absent	--	--	+
June, July, August (Summer)	--	--	Rare or absent	--	--	Absent	--	--	Absent
September, October, November (Autumn)	--	--	++	--	--	Absent	--	--	Rare

+ : 5-10 % parasitism   +++ : 26-50 %   -- : Unstudied at that location

++ : 11-25 %   ++++ : > 50 %   Rare : < 5 %

b- *Aphytis chrysomphali* Mercet (Hymenoptera : Aphelinidae) :

This parasitoid was observed to attack the plum scale insect during spring and autumn. The percentage of parasitism was found very low (1.5-5 %) parasitism. It was observed in Qualubiya and Sharkiya, but not in Beheira governorates.

c- *Aphytis diaspidis* How. (Hymenoptera : Aphelinidae) :

This parasitoid was uncommon on the plum scale insect ***P. oleae***. Parasitism with ***A. diaspidis*** was observed on the plum scale insect that infested pear and apple trees in very rare percentage, but not on those infested plum trees. Its activity extended throughout the spring season and decreased sharply in cold winter and hot summer.

Tables (51, 52, and 53) show the three parasitoid species that were detected on the plum scale insect at the different localities of the study.

- seasonal activity of *Aphytis maculicornis* (Masi) in the control of the plum scale insect, *P. oleae* :

A- On pear trees, at Qualubiya :

Tables (54 and 55), show the numbers of the parasitized and unparasitized insects and consequently the percentages of parasitism on ***P. oleae*** infesting 10 pear branches during 1994 and 1995.

During 1994, counts of the immature stages of the parasitoid (eggs, larvae and pupae), indicated that, the parasitoid has two periods of maximum seasonal activity per year. The first period of activity during 1994 started in mid-February (22.8 % parasitism) when means of temperature and R.H. were 13.4°C (7.2-19.6)°C and 63 % R.H., respectively. During this period of the parasitoid activity, the maximum efficacy of the parasitoid was detected in April at 20.4°C (12.3-28.4)°C and 62 % R.H. Afterwards, the parasitoid activity declined

Table (54) : Number of *P. oleae* on 10 branches of pear trees, and the percentages of parasitism by *A. maculicornis* in Qualubiya governorate, during 1994 season.

Month	Total examined females*	Unparasitized females	Parasitized females with :			Total parasitized females	% Parasitism
			Eggs	Larvae	Pupae		
Jan.	953	857	26	50	20	96	10.0
Feb.	931	718	60	63	90	213	22.8
Mar.	1412	780	159	123	350	632	44.7
Apr.	1316	298	165	345	508	1012	77.3
May	849	495	62	82	210	354	41.7
Jun.	1278	1181	-	27	70	97	7.6
Jul.	654	648	-	-	6	6	0.9
Aug.	852	852	-	-	-	-	0
Sept.	1204	1032	89	37	46	172	14.3
Oct.	1548	950	182	202	214	598	38.6
Nov.	1740	905	272	313	250	835	47.9
Dec.	1443	1215	40	135	53	228	15.8

* Examined females : Females, with or without eggs.

successively, until August when no parasitized insects were detected at mean temperature of 27.2°C (20.7-33.7)°C and 73 % R.H. Throughout the same season, the second period of parasitoid activity started in mid-September (14.3 % parasitism), at mean temperature of 24.5°C (17.4-31.5)°C and 65 % R.H. The maximum activity of the parasitoid during the second period, occurred in mid-November (47.9 % parasitism), at mean temperature of 19.0°C (12.4-25.6)°C and 66 % R.H. The percentage of parasitism declined after this peak until reached 15.8 %, at the end of December, at mean temperature of 15.3°C (8.7-21.8)°C and 71 % R.H. (Table 54)

During 1995, counts of ***A. maculicornis*** immature stages showed also a pattern of fluctuation with two periods of activity. The first started in February (19.5 % parasitism) at mean temperature of 13.5°C (7.2- 19.8)°C and 69 % R.H. During this first period of parasitoid activity, the maximum efficacy (74.8 % parasitism) occurred in April, at mean temperature of 19.7°C (11.8-27.6)°C and R.H. of 59 %, then the parasitoid activity declined until reached zero % during August 1995, at mean temperature of 27.2°C (20.6-33.7)°C and 73 % R.H. The second period of the parasitoid activity in 1995, started in September (11.6 % parasitism), at mean temperature of 23.6°C (16.4- 30.8)°C and 69 % R.H. Maximum activity of the parasitoid, during this period, was detected in November (54.3 % parasitism), at mean temperature of 19.4 % (13.8-25)°C and 66 % R.H. The percentage of parasitism decreased gradually within December, at mean temperature of 14.4°C (8.1-20.7)°C and 70 % R.H., to still almostly steady during winter months, reaching about 10-18 % parasitism (Table 55).

The obtained data, generally, showed higher parasitoid activity throughout the first period than the second, also the peak of activity in the first period reached 77.3 % and 74.8 % in 1994 and 1995, respectively, in April, being higher than that detected in November, in the second period (47.9 and 54.3 % in 1994 and 1995, respectively). The interval between the two periods of activity, in June, July and August was characterized with a very low percentages of parasitism, so that, all of the scale insect individuals inspected in August were found free from any parasitism.

B- On plum trees, at Qualubiya :

Data in Table (56) show numbers of scale insect females (adult and ovipositing), also the percentages of parasitism on ***P. oleae*** individuals infesting 10 branches of plum trees during 1994 season. The immature stages of the parasitoid indicated during that first studied year, that the parasitoid also had two periods of annual activity corresponded with those recorded on pear trees, at the same studied location of El-Quanater El-Khairiya. The first period of the parasitoid activity started in mid-February and extended to the beginning of May. The peak of parasitism activity was estimated by 56.3 % and occurred in April. After this peak, the percentage of parasitism declined sharply to reach zero % during mid-August. The second period of the parasitoid activity observed to start in mid-September, and gradually increased until reached its highest peak in November when the percentage of parasitism reached 36.2 %, subsequently declined sharply during the cold winter months to reach 6.3-6.7 % (in December and next January) and remained almostly steady until the beginning of the next first period of activity in February of the next year.

In the second studied year of 1995, as shown in Table (57), the percentages of the parasitized plum scale insect, showed almostly similar trend as did in the previous studied year of 1994. The highest peak of the first period of the parasitoid activity of 61.8 % parasitism occurred in April, and of the second period of 38.6 % parasitism also was detected during the first half of November. The same observation of higher activity of the parasitoid during the first period than the second period on pear trees, was also noticed on plum trees.

Table (56) : Number of *P. oleae* on 10 branches of plum trees, and the percentages of parasitism by *A. maculicornis* in Qualubiya governorate, during 1994 season.

Month	Total examined females*	Unparasitized females	Parasitized females with :			Total parasitized females	% Parasitism
			Eggs	Larvae	Pupae		
Jan.	462	433	9	14	6	29	6.7
Feb.	408	357	8	16	27	51	12.5
Mar.	622	413	41	62	106	209	33.6
Apr.	728	318	80	115	215	410	56.3
May	441	302	33	43	63	139	31.5
Jun.	563	536	3	9	15	27	4.8
Jul.	583	580	-	3	-	3	0.5
Aug.	463	463	-	-	-	-	0
Sept.	838	771	35	17	15	67	8.0
Oct.	708	500	73	58	77	208	29.4
Nov.	937	598	114	124	101	339	36.2
Dec.	627	585	10	21	8	39	6.3

* Examined females : Females, with or without eggs.

Table (57) : Number of *P. oleae* on 10 branches of plum trees, and the percentages of parasitism by *A. maculicornis* in Qualubiya governorate, during 1995 season.

Month	Total examined females*	Unparasitized females	Parasitized females with :			Total parasitized females	% Parasitism
			Eggs	Larvae	Pupae		
Jan.	553	523	7	16	7	30	5.4
Feb.	453	386	21	10	36	67	14.8
Mar.	818	525	67	88	138	293	35.8
Apr.	769	294	82	154	239	475	61.8
May	406	271	30	38	67	135	33.3
Jun.	628	593	-	14	21	35	5.6
Jul.	632	624	-	2	6	8	1.3
Aug.	467	467	-	-	-	-	0
Sept.	814	738	40	17	19	76	9.3
Oct.	731	533	71	53	74	198	27.1
Nov.	1062	652	137	146	127	410	38.6
Dec.	710	654	15	28	13	56	7.9

* Examined females : Females, with or without eggs.

The interval between the two periods of *A. maculicornis* activity, similarly as on pear trees and was characterized with very low percentages of parasitism, where it reached zero % in mid-August.

C- On apple trees, at Beheira (Nobariya location) :

With reference to data in Table (58), the parasitoid ***A. maculicornis*** had two periods of parasitism activity on the plum scale insect, ***P. oleae*** during 1994. The first period started within the first half of February (11.7 % parasitism), at mean temperature of 12.1°C (3.9-20.3)°C and 51 % R.H. The highest percentage of parasitism of 61 % occurred in April, at mean temperature of 21.2°C (12.6-29.8)°C and 47 % R.H., then the percentage of parasitism started to decline sharply during the hot summer months to reach the lowest level of 0.6 % parasitism in August, at mean temperature of 28.5°C (18.4-38.5)°C, and 55 % R.H.

The second period of activity recorded to start in September by 7.4 % parasitism, at mean temperature of 24.2°C (17.3-31.1)°C, combined with 58 % R.H. During this period, the peak of activity occurred in November (36.2 % parasitism), at mean temperature of 17.2°C (8.8-25.6)°C, with R.H. % of 59. In December, the rate of parasitism drastically declined to reach 2.8 %, when mean temperature was 12.7°C (5.6- 19.8)°C combined with 60 % R.H. This low rate of parasitism remained almostly stable up to next January, then, reincreased in February of the subsequent year, to start a new period of activity.

The same trend of parasitoid activity was noticed throughout 1995, (Table 59). The parasitoid activity started also in February, at mean temperature of 13.7°C (3.6-23.7)°C and 50 % R.H., subsequently extended up to mid-May, at mean temperature of 23.9°C (16.1-31.8)°C and 44 % R.H. During this period, the parasitoid peak of abundance of 54.3 % parasitism occurred in April, at mean temperature of 20.0°C (11.6- 28.4)°C and 45 % R.H. Afterwards, the percentage

Table (58) : Number of *P. oleae* on 10 branches of apple trees, and the percentages of parasitism by *A. maculicornis* at Nobariya location, during 1994 season.

Month	Total examined females*	Unparasitized females	Parasitized females with :			Total parasitized femaes	% Parasitism
			Eggs	Larvae	Pupae		
Jan.	862	838	10	9	5	24	2.8
Feb.	762	675	30	24	36	90	11.7
Mar.	900	605	90	70	135	295	32.7
Apr.	964	376	153	160	140	588	61.0
May	1083	793	75	75	5	290	26.8
Jun.	1444	1403	25	11	5	41	2.8
Jul.	1108	1100	-	3	4	8	0.7
Aug.	674	670	-	-	21	4	0.6
Sept.	1609	1490	61	37	149	119	7.4
Oct.	1635	1184	128	174	105	451	27.6
Nov.	1031	658	127	141	10	373	36.2
Dec.	970	943	6	11	10	27	2.8

* Examined females : Females, with or without eggs.

of parasitism declined sharply during host summer, to reach zero % in August, at mean temperature of 28.1°C (19.2-37.0)°C combined with 56 % R.H.

The second period of the parasitoid activity during 1995, started in mid-September (9.2 % parasitism), at mean temperature of 24.9°C (16.7- 33.1)°C, with percentage of relative humidity of 56 %. During this period, the highest parasitoid activity of 32.0 % parasitism, occurred in November, at mean temperature of 18.1°C (11.3-24.9)°C, and 62 % R.H. In December, the rate of parasitism dropped sharply to reach 3.2 %, and remained at this low rate during December and up to next January, reincrease again in February of the next year, when a new first period of activity continued up to May. It could be, in general, observed that at Nobariya, as well as at El-Quanater El-Khairiya locations, the second period of the parasitoid activity on the plum scale insect, infesting pear, plum, or apple trees, was generally lower than that recorded throughout the first period of parasitoid activity, it could be also noticed that the peaks of ***A. maculicornis*** activity, were observed during spring and autumn months, while the lowest levels of the parasitoid activities were observed and recorded during summer months, especially in August when the rate of parasitism almostly reached zero at all studied locations. In winter months (in December, January and beginning of February), parasitism was detected amongst the collected samples, but percentages of parasitism were generally low, although these percentages were certainly higher than those recorded during hot summer months (in June, July and especially August).

These findings, clearly showed that ***A. maculicornis*** was adversely affected by high temperature when combined with dryness than by either any of the two factors alone, or by low temperature, irrespective of the air humidity level. The obtained results are, in general, supported by those of **Priesner and Hosny (1940)**, who stated that ***A. maculicornis*** was highly abundant during winter and spring, in Egypt, also the obtained data are on the same line with the

Table (59) : Number of *P. oleae* on 10 branches of apple trees, and the percentages of parasitism by *A. maculicornis* at Nobariya location, during 1995 season.

Month	Total examined females*	Unparasitized females	Parasitized females with :			Total parasitized females	% Parasitism
			Eggs	Larvae	Pupae		
Jan.	753	736	8	7	2	17	2.3
Feb.	710	630	25	22	33	80	12.6
Mar.	865	596	80	56	133	269	31.0
Apr.	940	427	89	164	260	513	54.3
May	1050	750	79	87	134	300	28.6
Jun.	1253	1200	-	15	38	53	4.4
Jul.	845	842	3	-	-	3	0.3
Aug.	680	680	-	-	-	-	0
Sept.	1550	1408	70	43	29	142	9.2
Oct.	1518	1142	132	138	106	376	24.8
Nov.	1109	754	121	102	132	355	32.0
Dec.	955	924	20	9	2	31	3.2

* Examined females : Females, with or without eggs.

conclusion of **Hafez and Doutt (1954)**, who postulated that, the parasitoid, *A. maculicornis* is highly abundant during spring and sharply decreased in number during summer. **Huffaker *et al.* (1962)** concluded that the activity of *A. maculicornis* is highly abundant in spring and that was correlated with the levels of the scale insect activity in spring, and that conclusion is also parallel with data obtained in this study. In Greece, the results of **Argyrious and Kourmadas (1979)** confirm results of the present study. They recorded that the ectoparasitoid, *A. maculicornis* gave over 50 % parasitism in spring, then subsequently, decreased in number allover the rest of the year. On the contrary to the present results, -to some extent- **Cohen (1993)** in Golden heights in Israel, found that *A. maculicornis* was dominant and highly effective on ***P. oleae*** infesting apple trees during all winter season.

4.3.4- Comparative seasonal activity of *A. maculicornis* on different host plants :

Data concerning the rate of parasitism by ***A. maculicornis*** indicated that the parasitoid has two periods of activity per year. It was also observed that these periods were almostly similar in time of occurrence, but were not equal in their potencies. Table (60) shows differences in the percentages of parasitism induced by *A. maculicornis* to the plum scale insect infesting different host plants (pear,plum and apple).

From data in Table (60), it was observed that there were differences in the peaks of the two periods of parasitoid activity at the two studied locations, and on different host plants. On pear trees, peak of percentage of parasitism during the first period of the parasitoid activity (in April), was estimated by 77.3 % and 74.8 % in 1994 and 1995, respectively, with mean of 76.1 % within the two studied years. In relation to the plum trees, during the same first period of the parasitoid activity, the highest peak of parasitism was estimated by 56.3 %

Table (60) : Comparative seasonal activities of *A. maculicornis* on different host plants in two locations expressed as percentages of parasitism, during 1994 and 1995.

Month	Pear (Qualubiya)			Plum (Qualubiya)			Apple (Nobariya location)		
	1993	1994	Mean % parasitims	1993	1994	Mean % parasitims	1994	1995	Mean % parasitims
Jan.	10%	8.2%	9.1%	6.7%	5.4%	6.1%	2.8%	2.3%	2.6%
Feb.	22.8	19.5	21.2	12.5	14.8	13.7	11.7	12.6	12.2
Mar.	44.7	52.5	48.6	33.6	35.8	34.7	32.7	31.0	31.9
Apr.	77.3	74.8	76.1	56.3	61.8	59.1	61.0	54.3	57.7
May	41.7	41.7	41.7	31.5	33.3	32.4	26.8	28.6	27.7
Jun.	7.6	5.6	6.6	4.8	5.6	5.2	2.8	4.4	3.6
Jul.	0.9	0.7	0.8	0.5	1.3	0.9	0.7	0.3	0.5
Aug.	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.3
Sept.	14.3	11.6	13.0	8.0	9.3	8.7	7.4	9.2	8.3
Oct.	38.6	41.6	40.1	29.4	27.1	28.3	27.6	24.7	26.2
Nov.	47.9	54.3	51.1	36.2	38.6	37.4	36.2	32.0	34.1
Dec.	15.8	11.4	13.6	6.3	7.9	7.1	2.8	3.2	3.0
Total means of the two seasons			26.8%			19.5%			17.3%

and 61.8 % in 1994 and 1995, in respective order (59.1 %, as a whole mean of the two studied years). In apple orchard, at Nobariya, the peak of parasitoid abundance in the two studied years reached 61.0 % and 54.3 %, respectively, with a mean of 57.7 %.

In concern to the second period of the parasitoid activity (in November), data obtained of this investigation, showed almostly a similar trend of ***A. maculicornis*** activity on the plum scale insect infesting pear, plum, or apple trees. On pear trees, during this second period, throughout the two studied years (1994 and 1995). The highest peak was estimated as 47.9 % and 54.3 % in respective order, with mean of 51.1 % within the two studied years. On the plum trees, the highest peak reached 36.2 % and 38.6 %, respectively (37.4 % as a whole mean of the two years). As reported during the first period of activity, apple orchard trees, showed the least percentage of parasitism during the two studied years. The highest peak of parasitism in the second period of activity on apple trees was 36.2 % and 32.0 % within 1994 and 1995, respectively, with a general mean of 34.1 %. According to these data, the three deciduous plant tree species could be arranged in descending order concerning the role played by ***A. maculicornis*** against ***P. oleae***, as pear, on which the highest percentages of parasitism occurred (26.8 % as an overall average of parasitism allover the two studied years), followed by plum (19.5 % mean percentage of parasitism), while the least attractant host plant for the parasitoid was apple, on which the overall mean percentage of parasitism during the two studied years, was 17.3 %. It could be also deduced from the obtained results that the overall mean percentage of parasitism on pear trees was 1.37 and 1.55 folds that on plum and apple trees, respectively, and that on plum trees was 1.13 folds that on apple trees.

4.4- Some Factors Affecting the rate of Parasitism :

Data in Tables (61, 62 and 63) indicated that, on pear, plum and apple trees, two main periods of the parasitoid annual activity, could be detected. The first period started in late February and extended to reach its maximum peak during April, while the second period of activity started in September, and reaching its maximum peak during November, within all of the two years of study, and at all location of experiment, but with different rates of parasitism, depending on the host plants, location and different years of study. Statistical analysis of data was carried out to determine the effect of each tested factor, and also the combined effects of different factors on the rate of parasitism by ***A. maculicornis*** on its host, ***P. oleae***, infesting pear, plum and apple trees.

4.4.1- On pear trees, at El-Quanater El-Khairiya location :

A- During the first period of the parasitoid activity (February-May) :

During the first year, as shown in Table (64), values of the calculated simple correlation (r) were positive with all studied cases, except with the factor (density of infestation), where it showed negative values in relation to the rate of parasitism. partial regression (pr) values were positive and significant in cases of the day maximum temperature, and night minimum temperature, but were negative and insignificant with each of the wind velocity, the daily mean % R.H., and the density of insect infestation, indicating that temperature (minimum and maximum °C), is the main factor affecting the rate of parasitism, whereas the other studied factors, showed insignificant effects. The combined effect of all of these factors induced significant effect on the rate of parasitism, affecting the activity of the parasitoid by 53.7 % (Table, 64). During the second year of study, almost the same results were obtained, where all values of simple correlation (r) were positive with the rate of parasitism, except the density of insect infestation, which alone sowed negative simple correlation, with the rate of parasitism.

Table (61) : Factors affecting the rate of *A. maculicornis* parasitism on *P. oleae* infesting pear trees, Qualubiya governorate.

	1993						1994					
	Mean temp.		Wind	R.H.	Infestation	%	Mean temp.		Wind	R.H.	Infestation	%
Month	Min.	Max.	velocity	%	density	Parasitism	Min.	Max.	velocity	%	density	Parasitism
Jan.	6.5	16.3	2.9	75	8.6/cm	10	7.0	16.5	3.1	69	7.6/cm	8.2
Feb.	6.2	17.5	2.8	66	7.19	22.8	7.2	19.6	2.7	63	7.2	19.5
Mar.	9.5	24.4	2.9	67	11.8	44.7	10.3	25.2	2.9	64	11.3	52.5
Apr.	13.4	27.0	2.4	62	10.21	77.3	12.3	28.4	2.6	62	10.5	74.8
May	13.6	29.5	1.7	58	8.9	41.7	14.3	29.7	1.6	55	8.8	41.7
Jun.	17.2	32.0	1.9	62	10.8	7.6	17.0	33.1	2.1	64	10.22	5.6
Jul.	19.2	33.8	1.3	62	6.0	0.9	19.7	33.9	1.4	70	5.2	0.7
Aug.	19.6	34.5	1.2	75	7.9	-	20.7	33.7	1.1	73	6.8	-
Sept.	18.7	31.4	2.8	63	9.9	14.3	17.4	31.5	3.1	65	11.8	11.6
Oct.	16.6	28.0	1.3	66	11.1	38.6	16.0	29.7	1.5	62	12.4	14.6
Nov.	13.6	26.8	1.2	64	13.6	47.9	12.4	25.6	1.5	66	13.9	54.3
Dec.	9.3	21.5	1.8	68	10.8	15.8	8.7	21.8	2.1	71	11.5	11.4

Table (62) : Factors affecting the rate of *A. maculicornis* parasitism on *P. oleae* infesting plum trees, Qualubiya governorate.

Month	1993						1994					
	Mean temp.		Wind velocity	R.H. %	Infestation density	% Parasitism	Mean temp.		Wind velocity	R.H. %	Infestation density	% Parasitism
	Min.	Max.					Min.	Max.				
Jan.	6.5	16.3	2.9	75	4.1/cm	6.7	7.0	16.5	3.1	69	4.4/cm	5.4
Feb.	6.2	17.5	2.8	66	3.2	12.5	7.2	19.6	2.7	63	3.6	14.8
Mar.	9.5	24.4	2.9	67	6.5	33.6	10.3	25.2	2.9	64	6.5	35.8
Apr.	13.4	27.0	2.4	62	6.6	56.3	12.3	28.4	2.6	62	6.2	61.8
May	13.6	29.5	1.7	58	8.9	31.5	14.3	29.7	1.6	55	7.7	33.3
Jun.	17.2	32.0	1.9	62	5.9	4.8	17.0	33.1	2.1	64	5.0	5.6
Jul.	19.2	33.8	1.3	62	4.5	0.5	19.7	33.9	1.4	70	5.1	1.3
Aug.	19.6	34.5	1.2	75	4.4	-	20.7	33.7	1.1	73	3.7	-
Sept.	18.7	31.4	2.8	63	6.9	8	17.4	31.5	3.1	65	6.5	9.3
Oct.	16.6	28.0	1.3	66	5.3	29.4	16.0	29.7	1.5	62	5.8	27.1
Nov.	13.6	26.8	1.2	64	8.3	36.2	12.4	25.6	1.5	66	8.5	38.6
Dec.	9.3	21.5	1.8	68	5.6	6.3	8.7	21.8	2.1	71	5.7	7.9

Table (63) : Factors affecting the rate of *A. maculicornis* parasitism on *P. oleae* infesting apple trees, Nobariya location.

	1993						1994					
	Mean temp.		Wind	R.H.	Infestation	%	Mean temp.		Wind	R.H.	Infestation	%
Month	Min.	Max.	velocity	%	density	Parasitism	Min.	Max.	velocity	%	density	Parasitism
Jan.	2.4	19.3	4.3	54	6.4/cm	2.8	3.7	18.3	3.9	56	6.8	2.3
Feb.	4.0	22.0	3.9	49	6.6	11.7	3.9	20.3	3.8	51	6.1	12.6
Mar.	6.9	24.6	4.0	49	7.1	32.7	7.0	25.4	4.3	52	7.2	31.0
Apr.	11.8	29.2	3.7	43	7.3	61.0	12.6	29.8	3.5	47	7.7	54.3
May	17.2	33.8	2.8	41	8.1	26.8	16.0	32.6	3.0	45	8.7	28.6
Jun.	20.5	36.5	3.2	36	12.7	2.8	19.3	35.8	3.6	41	11.6	4.4
Jul.	21.6	37.5	2.8	40	8.8	0.7	23.3	37.8	3.1	45	8.9	0.3
Aug.	19.6	37.4	4.1	56	5.2	-	18.4	38.5	4.0	55	5.4	-
Sept.	17.2	32.4	3.1	57	13.5	7.4	17.3	31.1	2.8	58	12.9	9.2
Oct.	14.2	30.9	2.9	55	12.2	27.6	13.1	29.4	3.2	56	13.8	24.7
Nov.	10.3	25.0	4.1	63	8.9	36.2	8.8	25.6	4.1	59	8.2	32.0
Dec.	5.2	22.3	3.6	61	8.0	2.8	5.6	19.8	3.8	60	6.7	3.2

Table (64) : Simple correlation (r) and partial regression (P. reg.) of the main factors affecting percentage of parasitism by *A. maculicornis* on *P. oleae* infesting pear trees, at Qualyubiya governorate.

Period	Factors	1993						1994					
		Simple corr.	Partial			Analysis of variance		Simple corr.	Partial			Analysis of variance	
		r	Pr	S.E.	t	F	E.V. %	r	Pr	S.E.	t	F	E.V. %
First period of parasitoid activity Feb. - Apr.	Day max. temp.	+0.85	+6.15	± 2.32	2.25*			+0.68	+9.12	±3.70	2.61*		
	Day min. temp.	+0.76	+6.03	± 1.44	2.16*	8.46*	53.7%	+0.63	+8.17	±2.15	1.12		
	Wind velocity	+0.67	-9.07	± 3.62	1.62			+0.57	-8.63	±2.27	2.16*	10.33*	65.85
	Daily mean R.H.	+0.58	-8.50	± 6.54	-1.21			+0.48	-6.42	±4.12	0.29		
	Infestation density	-0.36	-4.37	± 1.25	0.82			-0.33	+5.11	±2.16	1.15		
Second period of parasitoid activity Sept. - Nov.	Day max. temp.	+0.58	-8.12	±15.30	1.23			+0.78	-7.19	±6.12	2.19*		
	Day min. temp.	+0.64	-10.15	±20.18	1.11			+0.56	-8.16	±5.17	1.20		
	Wind velocity	+0.52	-20.80	±27.12	0.83	4.26	45.7%	+0.47	-2.13	±3.60	0.96	12.18*	57.2
	Daily mean R.H.	-0.60	+12.15	±6.26	0.74			-0.52	+6.22	±4.18	0.58		
	Infestation density	-0.66	-6.62	±7.14	0.86			-0.42	-5.11	±6.14	0.73		

* Significant at 0.05 level

** Highly significant at 0.01 level

partial regression values of the second seasons, showed positive significant relation with the day-maximum temperature, positive insignificant relation with each of the night-minimum temperature and density of insect infestation, but showed negative and significant relation with the wind velocity, and negative insignificant relation with the daily mean % R.H.

The combined effect of all of the tested factors induced significant effect on the rate of parasitism, by ***A. maculicornis***, affecting the parasitoid activity by 65 % (Table, 64).

From the obtained results, it could be concluded that :

a- During the first period of the parasitoid activity, the day-maximum temperature and the night minimum temperature, were the most important studied factors in affecting the rate of parasitism by ***A. maculicornis***.

b- The daily mean % R.H. and the density of insect infestation had almost no effect on the parasitoid activity, as all their results were of insignificant values.

c- The wind velocity rates, showed negative significant effect only during this first period, of the second year of study, the matter which indicated that it could be an important factor, under particular circumstances.

d- The optimal means of the studied factors in affecting the rate of parasitism, during the first period of the parasitoid activity (February-May), were 12.85 & 27.70°C, 2.5 m/sec., 62 % R.H.,a nd 10.35 insects/cm, for each of the night-minimum temperature, the day-maximum temperature, wind velocity, relative humidity and density of insect infestation (mean number of insect females on one cm. of branches), respectively. These optimal means were during April, where the highest mean of the percentage of parasitism of the two studied years (77.05 %) was recorded.

e- The lowest rates of parasitism were recorded during January, June, July, August and December, being 10.0, 7.6, 0., zero and 15.8 %, respectively, with the means of studied factors, as shown in Table (61) and consequently, were excluded from the two studied periods of the parasitoid activity.

B- During the second period of the parasitoid activity (September-November) :

During the first year of study, the obtained records showed positive simple correlation (r), with each factor of means of day temperature, night temperature and wind velocity, but was negative with each of the daily mean of % R.H. and the density of insect infestation. Partial regression (pr) with all of the tested factors were negative and insignificant, except with the daily mean % R.H., it was positive and also insignificant.

The combined effect of all these factors on the rate of parasitism,, during the second period of the parasitoid activity, showed insignificant effect, constituting 45.7 % of the total factors (studied or not), which could affect the rate of parasitism, *i.e.*, the host plant, other natural enemies of both insect and parasitoid, accidental weather factors, ... etc. During the second studied year, data of the second period of the parasitoid activity (September-November), almost showed similar results to those of the first studied year, where the means of daily-maximum temperature, night minimum temperature, and wind velocity, gave positive simple correlations (r) with the rate of parasitism, but negative simple correlations in cases with the daily mean % R.H. and the density of infestation. Partial regression showed negative significant value with the daily means of maximum temperature, also showed negative, but insignificant values with each of the means of night- minimum temperature, wind velocity and density of infestation, and showed positive insignificant value with the daily mean of % R.H. The combined effect of all tested factors, during the second period of the parasitoid activity, showed significant effect on the rate of parasitism, constituting 57.2 % of the total factors, which could affect this rate

(Table 64). From the obtained results, during the second period of the parasitoid activity, on pear trees, at El-Quanater El- Khairiya location, it could be concluded that :

a- The means of maximum-day temperature and minimum- night temperature, had less importance, and negative partial regression values in relation to the rate of parasitism when compared with those of the first period of the parasitoid activity, where each of the two factors, during the second period of the two studied years, gave insignificant values, except the negative significant partial regression of the mean of maximum day-temperature of the second year.

b- Most of the tested factors during this period had either positive, or negative partial regression on the rate of parasitism, but of insignificant values.

c- The recorded partial regression for the effect of most of the studied factors on *A. maculicornis* activity throughout the first period of activity, showed different relations to those obtained throughout the second period of activity, indicating varying effect of these factors on the rate of parasitism depending on the period of parasitoid activity.

d- The more effects of the tested factors on *A. maculicornis* activity, generally, occurred during the first period of the parasitoid activity (February-May) when compared with those occurred during the second period (September-November).

e- The optimal mean of the day-maximum temperature on the rate of parasitism was 26.2°C, while the corresponding unfavorite mean was 31.45°C, during this second period of the parasitoid activity, on pear trees.

f- The optimal mean of the night-minimum temperature on the rate of parasitism during this period was 13.0°C, while the corresponding unfavorite mean was 18.0°C, indicating to the enhancement which occurred to this rate under comparatively high difference between the day maximum and the night minimum temperature degrees.

g- The optimal mean of the wind velocity during the same second period of activity was 1.32 m/sec., while the correspondent unfavorite mean was 2.95 m/sec.

h- In relation to the effect of the daily mean of % R.H., during the same second period of the parasitoid activity, which almost showed insignificant effect, no great difference observed between the favourite and the unfavorite means, where they were 65 and 64 %, respectively.

i- The optimal mean of the density of infestation was 13.75 insects/cm, while the unfavorite mean was 10.85 insects/cm.; however, this factor induced insignificant effect on the rate of parasitism.

General observations on factors affecting the rate of parasitism by the parasitoid, *A. **maculicornis***, on the plum scale insect, ***P. oleae*** infesting pear trees, at El-Quanater El-Khairiya location, during the two periods of the parasitoid activity, indicated that, the studied factors in most cases had different correlation values with the rate of parasitism, depending on the period of the parasitoid activity. More effects were generally detected during the first period, while lower effects occurred during the second period of activity. During the first period, the day-maximum temperature and night minimum temperature, had positive partial regression values, indicating parallel correlation with the rate of parasitism, almost with significant values, while during the second period of *A. **maculicornis*** activity, these two factors showed negative partial regression values, indicating an opposite correlations with the rate of parasitism, but with insignificant data. The obtained results concerning the effect of temperature on this rate; however, indicated a positive response of the parasitoid population size to any increase in temperature during the first period and vice versa, during the second period of the parasitoid activity. Values obtained in case of the remaining factors were insignificant, except with the wind velocity rates during the first period of the second studied year, whereas the combined effect of all these tested factors were always significant except during the second period of the parasitoid activity in the first studied year.

4.4.2- On plum trees, at El-Quanater El-Khairiya location :

A- During the first period of the parasitoid activity (February-May) :

As shown in Table (65), positive simple correlation values were obtained with all of the tested factors in first year, except in case of the effect of the insect density on the rate of parasitism, where it showed negative simple correlation. Partial regression values were positive in cases of studying the effect of day-maximum and night-minimum temperature, but was highly significant with the first factor, and only significant with the second. These values were insignificantly negative in cases of wind velocity, daily mean of % R.H., and density of insect infestation.

During the first period of the parasitoid activity, in the first studied year, the combined effect of all tested factors on the parasitoid activity was significant by 48.16 % (accordingly, it was expected that the unstudied factors, *i.e.*, host plant, natural enemies of ***A. maculicornis***, some accidental factors, ... etc., expected to affect the rate of parasitism by 51.84 %).

In the second year of study (1994), almost the same results were obtained, where positive simple correlations were detected with the tested factors, but this correlation was negative in case of analysing the effect of the insect density on the parasitoid activity. The partial regression values were positive and highly significant with each of the day-maximum and the night minimum temperatures, but showed negative regression with each of wind velocity, mean % R.H. and density of infestation, with significancy in case of the first factor (wind velocity) and insignificancy in cases of the remaining two factors. The combined effect of the tested factors altogether was significant, and comprised 52.17 % of the whole effect caused by all of the total affecting factors. From the obtained results, it could be concluded that :

a- During the first period of the parasitoid activity, on plum trees, as was observed on pear trees, the day- maximum temperature and night-minimum temperature, were the most important factors that affected the rate of parasitism during this study, where all obtained data showed highly significant, or significant positive partial regression values.

b- Data of the second year, during the first period of the parasitoid activity, showed negative significant effect with wind velocity.

c- Results of the daily mean of % R.H. and density of infestation, seemed to have lower importance in affecting the rate of parasitism, during the first period of the parasitoid activity, where all of the obtained results, were insignificant.

d- The optimal means of the affecting climatic factors on the rate of parasitism were in April, during the first period of *A. maculicornis* activity, while the unfavorite means were in January, June, July and August, with the same means of climatic factors were discussed former on pear trees of the same location of El-Quanater El-Khairiya.

B- During the second period of the parasitoid activity (September-November) :

Data of the first studied year, showed positive simple correlations (r) with each of the day-maximum temperature, the night-minumum temperature and wind velocity, but showed negative correlation with the daily means of % R.H. and density of infestation. Partial regression (pr) showed negative and significant correlation with the day-maximum temperature, and insignificant negative-correlations with each of the night-minimum temperature and wind velocity, whereas it showed positive-insignificant correlations with each of the daily means of % R.H. and density of infestation, with the same results obtained on pear trees, with one exception, of the density of infestation, that showed negative value of the partial regression on pear trees, although it was insignificant in both cases.

Table (65) : Simple correlation (r) and partial regression (P. reg.) of the main factors affecting percentage of parasitism by *A. maculicornis* on *P. oleae* infesting plum trees, at Qualyubiya governorate.

Period	Factors	1993						1994					
		Simple corr.	Partial			Analysis of variance		Simple corr.	Partial			Analysis of variance	
		r	Pr	S.E.	t	F	E.V. %	r	Pr	S.E.	t	F	E.V. %
First period of parasitoid activity Feb. - Apr.	Day max. temp.	+0.92	+7.18	±4.6	4.18**			+0.83	+8.17	±3.52	5.16**		
	Day min. temp.	+0.73	+5.16	±2.15	2.20*			+0.72	+12.15	±4.18	4.24**		
	Wind velocity	+0.54	-10.18	±2.18	1.18	10.15*	48.16	+0.68	-9.11	±6.12	2.14*	12.64*	52.17
	Daily mean R.H.	+0.48	-9.12	±7.12	0.82			+0.52	-8.10	±4.32	1.04		
	Infestation density	-0.42	-6.14	±2.16	0.73			-0.28	-6.17	±5.17	0.85		
Second period of parasitoid activity Sept. - Nov.	Day max. temp.	+0.62	-6.15	±3.6	2.08*			+0.77	-7.23	±2.17	2.21*		
	Day min. temp.	+0.58	-4.12	±2.18	1.62			+0.68	-5.72	±3.17	1.71		
	Wind velocity	+0.47	-8.11	±6.15	0.74	6.18	42.6	+0.62	-9.13	±5.12	-0.73	5.72	47.6
	Daily mean R.H.	-0.63	+7.20	±5.14	0.65			-0.56	+6.18	±4.48	0.52		
	Infestation density	-0.71	+10.8	±6.12	0.58			-0.47	+11.70	±5.37	0.86		

* Significant at 0.05 level

** Highly significant at 0.01 level

The combined effect of all tested factors on the rate of parasitism, on plum trees, during the second period of the parasitoid activity in the first studied year, was insignificant and caused 42.6 % (Table 65) of the total effect of all factors.

In the second studied year, similar results were obtained, where all of the day-maximum temperature, the night minimum temperature and the wind velocity, gave positive simple correlations with the rate of parasitism, while the daily means of % R.H. and density of infestation showed negative simple correlations. Partial regression values showed to be significant and negative with day-maximum temperature factor and negative insignificant with each of the night-minimum temperature and wind velocity factors, while it showed to be insignificantly positive with the daily means % R.H. and density of infestation factors.

The combined effect of all tested factors on the rate of parasitism, on plum trees, during the second period of the parasitoid activity, in the second studied year, was insignificant, affected the rate of parasitism by 47.6 %. From the obtained results, it could be concluded that :

a- As previously observed on pear trees, during the second period of the parasitoid activity, the daily maximum and the night-minimum temperatures had lower negative effects on the rate of parasitism, when compared with those of the first period of the parasitoid activity, which showed highly significant- positive values.

b- The factors of wind velocity, % R.H. and density of infestation seemed to have no real effects on the rate of parasitism, especially during the second period of parasitoid activity, where almost all of the obtained results were insignificant.

c- The combined effect of th tested factors, altogether, was almostly clear and significant during the first period of parasitoid activity, contrary to what observed during the second period of parasitoid activity, where the combined effect of the tested factors was insignificant.

d- The optical means of the studied factors during this second period of the parasitoid activity (in November) also the unfavorite means (in September), were the same means were recorded on pear trees, during the same period and at the same location.

4.4.3- On apple trees, at Nobariya location :

A- During the first period of the parasitoids activity (February-May) :

In case of the first year, all of the tested factors showed positive simple correlations (r) with rate of parasitism, being partially different from that obtained on pear and plum trees, where density of infestation was always observed to show negative correlation with this rate. Partial regression values of the day-maximum temperature and the night-minimum temperature were positive and highly significant (for the first time), positive-insignificant with the density of infestation, but negative and significant with each of the wind velocity and daily mean % R.H. The combined effect of all of the tested factors altogether on the rate of parasitism by *A. maculicornis* was highly significant and caused 73.8 % of the total effect of all factors, (Table 66).

Data of the second year (1994), showed almost similar trend as those of the previous year. All of the studied factors showed positive simple correlations (r) with the rate of parasitism. Partial regression showed -more or less- similar results to those of 1993, where the values were positive highly significant with each of the daily means of the maximum-day and minimum-night temperatures, and insignificantly positive with the insect density of infestation, whereas it showed negative and significant values with each of the daily means of % R.H,. and wind velocity. The combined effect of the tested factors altogether, showed highly significant effect which comprised 69.8 % of the total effect on the parasitoid (Table 66).

From the obtained results, it could be concluded that :

a- At Nobariya location, on apple trees, during the first period of parasitoid activity, the day-maximum and night minimum temperatures, were the most effective factors on the rate of *A. maculicornis* parasitism on ***P. oleae***.

b- The daily means of % R.H. showed more effect on the parasitoid activity, at Nobariya location, on apple trees, than those recorded at El-Quanater El-Khairiya location on either pear or plum trees.

c- The wind velocity rates showed negative significant effect on the rate of parasitism at this location and during the first period of the parasitoid activity, whereas it showed insignificant values at El-Quanater El-Khairiya location.

d- The effect of the insect infestation density was generally insignificant, and seemed to be of less importance in affecting the rate of parasitism.

e- The optimal mean of the day-maximum temperature during the first period of the parasitoid activity on apple trees was 29.5°C (during April), while the unfavorite mean was 21.45°C (during February).

f- The optimal mean of the night-minimum temperature was 12.2°C, while the unfavorite mean was 3.95°C.

g- The optimal means of the other tested factors with the corresponding unfavorite means, are shown in Table (63).

B- During the second period of the parasitoid activity (September-November) :

In the first studied year (1993), all the tested factors showed positive simple correlations with the rate of parasitism by ***A. maculicornis***, except the factor of insect density which showed negative simple correlation with this rate (Table 66). Partial regression values were negative-insignificant with each of the means of the day-maximum temperature, night- minimum temperature, and insect

Table (66) : Simple correlation (r) and partial regression (P. reg.) of the main factors affecting percentage of parasitism by *A. maculicornis* on *P. oleae* infesting apple trees, at Nobariya location.

Period	Factors	1993						1994					
		Simple corr.	Partial			Analysis of variance		Simple corr.	Partial			Analysis of variance	
		r	Pr	S.E.	t	F	E.V. %	r	Pr	S.E.	t	F	E.V. %
First period of parasitoid activity Feb. - Apr.	Day max. temp.	+0.38	+18.60	±3.62	6.8**			+0.29	+13.60	±0.86	5.25**		
	Day min. temp.	+0.42	+9.15	±5.43	6.21**			+0.52	+12.31	±3.12	6.31**		
	Wind velocity	+0.28	-22.8	±8.12	3.22*	14.25	73.8	+0.31	-20.70	±5.17	3.08*	12.28**	69.8
	Daily mean R.H.	+0.33	-17.13	±6.18	3.06*			+0.28	-12.42	±2.16	2.27*		
	Infestation density	+0.22	+8.52	±4.60	0.83			+0.09	+6.17	±1.18	0.69		
Second period of parasitoid activity Sept. - Nov.	Day max. temp.	+0.68	-8.61	±6.18	1.29			+0.58	-9.18	±7.11	1.08		
	Day min. temp.	+0.72	-5.62	±5.20	1.81			+0.63	-6.12	p6.18	1.63		
	Wind velocity	+0.54	+12.70	±4.11	0.93	3.74	33.4	+0.72	+10.15	±6.11	1.02	4.84	42.6
	Daily mean R.H.	+0.38	+10.5	±2.16	0.15			-0.32	+12.80	±5.16	0.37		
	Infestation density	-0.28	-3.16	±4.18	0.82			-0.41	-4.17	±6.20	0.62		

* Significant at 0.05 level

** Highly significant at 0.01 level

infestation density, whereas it showed positive-insignificant values with wind velocity rates and % R.H. The combined effect of the tested factors altogether, at Nobariya location, on apple trees showed insignificant effect on the rate of parasitism of ***A. maculicornis*** activity, where the whole effect was estimated by 33.4 % of the total affecting factors.

Data of the second studied year (1994), as shown in Table (66), indicated positive simple correlations (r) of the means of maximum day temperature, minimum night temperature and wind velocity. The effect of mean % R.H. and insect infestation density showed negative simple correlations. Partial regression showed almost the same results of those of 1993, where it showed negative-insignificant values with each of the means of maximum day temperature, the minimum night temperature and the density of infestation with ***P. oleae***, whereas it showed positive-insignificant relations with the mean values of the wind velocity and R.H. The combined effect of these factors altogether on the rate of parasitism was insignificant during the second period of the parasitoid activity, on apple trees, at Nobariya location, in the second year of study. The total effect was estimated by 42.6 % of the total studied and unstudied factors.

4.4.4- General observation on factors affecting the rate of parasitism :

Data obtained from the two studied locations of pear and plum trees at Qualubiya and apple trees, at Beheira, throughout two years, indicated that, the studied factors. *i.e.*, the means of daily maximum temperature, night minimum temperature, wind velocity, R.H., and the insect infestation density, showed higher effect on the rate of parasitism with ***A. maculicornis*** parasitizing the plum scale insect, ***P. oleae***, during the first period of the parasitoid activity, which extended from February to May, than their effect during the second period of activity which occurred from September to November. During the first period of parasitoid activity, the combined effect of all of the tested factors, exhibited either highly significant effect (*i.e.*, at Nobariya, on apple trees) or significant effect (*i.e.*, at El-Quanater El-Khairiya, on pear and plum trees) on the activity of the parasitoid, ***A. maculicornis***, consequently, affected the rate of parasitism. During this period, the means of either day-maximum temperature or the night-minimum temperature, proved to be the most important factors in affecting the rate of parasitism, where in most cases, they gave positive and either highly significant (*i.e.* apple trees) effect on the activity of the parasitoid or significant effect (*i.e.* pear trees). The optimal mean of the day-maximum temperature ranged between 27.7°C (on pear and plum trees) and 29.50°C (on apple trees), while the unfavorite mean ranged between 18.55°C and 21.15°C, in the same sequence, the matter that indicated positive partial regression values of this factor with the rate of parasitism, during the first period of the parasitoid activity, at both locations. In concern to the effect of the means of the night minimum temperature, the optimal values of this factor, ranged between 12.2°C (on apple trees) and 12.85°C (on pear and plum trees), while the unfavorite values ranged between 3.95°C and 6.70°C, in th same respective order.

The other important factor in affecting the rate of parasitism during the first period of the parasitoid activity, was the rate of wind velocity, especially on apple trees, at Nobariya location, where it showed significant-negative partial regression throughout the two successive years. The comparative importance of this factor, could be arised from either its ability of dispersing the delicate crawlers of the plum scale insect, consequently, causing high dispersal to the insect infestation, which, subsequently affects the rate of parasitism, or from its ability of transferring the adult stage of the parasitoid from particular place to another, depending on the wind direction and the wind speed, the matter that could alter the rate of parasitism in a particular area from time to another. The factor of wind velocity was only important at Nobariya location, where in some cases, *i.e.*, in late March, it recorded 4.3 m/sec., but at El-Quanater location where this factor showed almost insignificant effect, anyway it did not exceed 3.1 m/sec., the matter that indicated that factor could be important, and may be considered as a limiting factor when reaches a particular speed. The remaining two tested factors of the daily means of R.H. and the density of insect infestation, which had either negative or positive partial regression values with the rate of parasitism, almost induced insignificant effect on that rate.

During the second period of the parasitoid activity (September-November), most of the tested factors showed insignificancy with the rate of parasitism, at the two studied locations (El-Quanater and Nobariya). Only means of maximum day temperature during the two studied years, on plum trees, and only during the second studied year, on pear trees, this factor showed significant values with the rate of parasitism, where the other tested factors, exhibited either positive or negative, but insignificant values. Also in relation to the tested factors altogether, the combined effect of these factors on the rate of parasitism was insignificant, except on pear trees, in the second year of study. The comparative lower effect of the tested separate factors, or almost their combined effect during the second period of the parasitoid activity, when compared with their comparatively higher effect during the first period, may be attributed to the interaction of some other factors, which prevailed during any of the two periods of the parasitoid activity, *i.e.*, the population size of both insect and parasitoid, different rates of increase occurred in their own populations, the natural enemies of each of them and the different host plant conditions either in spring or in autumn and any other unstudied environmental factors, which may interact with the studied factors, or with the parasitoid itself. In agreement with the obtained results, **Huffaker *et al.* (1962),** stated that, the parasitoid, *A. maculicornis*, was highly abundant in spring season, during the abundance of the plum scale insect, *P. oleae*. Also the obtained data are on the same line with **Broodryk and Dutt (1966)** who concluded that the development of *A. maculicornis* was accelerated at comparatively high temperature, and slowed at low temperature, the matter that observed in our study, especially during the first period of the parasitoid activity, where temperature showed positive partial regression in most studied cases, also they recorded a sharp decimation in the parasitoid numbers occurred beginning from June and extended to August or September, in complete agreement with the obtained results. With similar results to the present, **Kennett *et al.* (1966)** recorded that the parasitoid, ***A. maculicornis*** showed high susceptibility to the hot and dry conditions, the matter that noticed at Nobariya location, where the percentage of parasitism showed almost lower values than it did at El-Quanater location. **Argyrious and Kourmadas (1979)** in correspondent to the obtained results, mentioned that, the parasitoid, ***A. maculicornis***, induced high rate of parasitism during spring, but declined in number during the summer season. Recently, **Miller and Haro (1994)**, recorded other factor affecting the rate of ***Aphytis melinus*** parasitism, where they mentioned that the parasitoid uses a kind of kairomones from the scale of its host, ***Aonidiella aurantii*** as an oviposition stimulant, the matter which explains the observed insignificancy of the effect of the tested factors altogether, especially during the second period of the parasitoid activity, on the rate of parasitism, where other unstudied factors, *i.e.*, kairomones, could be responsible in affecting this rate.

5- Chemical Control Studies :

5.1- Effect of the tested insecticides on *P.oleae*, infesting pear trees, at El-Quanater El-Khairiya location :

5.1.1- Effect of spring sprays :

Spring sprays were applied mainly to control the insect nymphal stage, especially crawlers which are not protected, or completely covered with the thick scales like adults, and which were observed to prevail during May month, constituting more than 99 % of the total insect population **(Amin *et al.*, 1970)**. The efficiency of the tested insecticides against either the total population of ***P. oleae***, or any of its stages, are shown in concerned tables.

A- Season 1994 :

a- Effect on the total population :

As shown in Table (67) data obtained showed that, Sumi-oil (fenitrothion 6 % and 80 % mineral oil) 1.25 % was the most effective insecticide used against ***P. oleae*** total population in May, followed by Cidial K oil (phenthoate 5 % and 80 % mineral oil) 1.25 %, phenthoate (Cidial) 0.125 %, diazinon (Basudin) 0.125 %, fenitrothion (Sumithion) 0.125 %, the pyrethroid compound fenvalerate (Sumicidin) 0.125, KZ oil 1.5 % and Misrona oil (4) 1.5, where the percentages of the total insect reduction were; 83.9, 82.7, 81.2, 80.5, 79.5, 73.3, 72.8 and 71.9, respectively, calculated as means of % total insect stages reduction throughout 180 days of the experiment.

Analysis of variance of the tested insecticides, as represented in Table (67), showed insignificant differences mainly between the members of each insecticidal group (*i.e.* organophosphorus, fortified oils, mineral oils groups), but significancy appeared between the means of reduction of the separate groups, the matter which indicated the unique effect of members of each group, which was - more or less- similar in its efficacy with minor differences between compounds.

Table (67) : Effect of different insecticides on *P. oleae* in May (spring spray) at El-Quanater location, on pear trees calculated as % of insect stages reduction, in 1994.

Insecticides groups	Organophosphorus compounds												Pyrethroid compound				Fortified oils								Mineral oils							
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate				Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	90.2	90.9	97.6	92.9	88.2	89.3	95.4	91.0	89.3	91.2	96.1	92.2	94.7	96.2	98.2	96.5	83.3	83.8	91.5	86.2	82.6	83.5	90.1	85.4	75.0	75.3	88.2	79.5	72.1	73.6	88.6	78.1
30	90.0	91.3	96.3	92.5	88.0	88.7	95.2	90.6	90.2	90.5	96.0	92.2	94.5	96.2	97.7	96.1	88.5	89.3	94.6	90.8	88.0	88.6	93.7	90.1	77.0	79.7	89.6	82.2	76.1	78.7	90.2	81.7
45	89.6	91.5	95.4	92.2	88.0	87.2	95.0	90.1	88.5	90.9	95.2	91.5	91.3	93.6	94.3	93.1	90.2	90.8	94.7	91.9	90.3	91.2	93.3	91.6	80.9	82.5	90.6	84.7	81.2	82.0	90.1	84.4
60	86.8	88.5	91.6	88.9	85.8	87.2	90.1	87.7	86.2	87.7	90.8	88.2	81.1	84.3	86.2	83.9	91.5	93.7	96.2	93.8	90.0	91.8	95.2	92.3	81.2	81.8	88.7	83.9	79.7	80.3	86.2	82.1
75	82.7	84.5	88.3	85.2	81.4	83.6	85.3	83.4	81.7	84.0	87.2	84.3	63.8	63.9	72.5	66.7	87.4	89.6	91.2	89.4	86.5	87.1	89.9	87.8	70.3	71.8	81.5	74.5	68.6	71.2	80.7	73.5
90	75.6	76.2	81.5	77.8	74.6	75.4	80.3	76.8	75.2	76.3	80.4	77.3	51.7	53.2	61.4	55.4	81.1	83.5	88.3	84.3	80.2	81.6	85.4	82.4	58.1	61.7	69.3	63.0	59.1	60.3	67.3	62.2
180	36.2	37.5	42.6	38.8	34.1	35.3	40.8	36.7	32.8	37.1	42.3	37.4	18.8	21.3	23.6	21.2	48.6	51.3	53.7	51.2	46.6	50.2	51.7	49.5	39.2	42.3	45.1	42.2	40.2	41.9	42.7	41.6
Means of reduction	78.7	80.1	84.8	-	77.2	78.1	83.2	-	77.7	79.7	84.0	-	70.8	72.7	76.3	-	81.5	83.1	87.2	-	80.6	82.0	85.6	-	68.8	70.7	79.0	-	68.1	69.7	78.0	-
Total reduction	81.2				79.5				80.5				73.3				83.9				82.7				72.8				71.9			

	L.S.D. at 0.01	F
Treatments	2.29894	17.63425
Stages	1.02538	27.25874
Intervals	8.72481	59.38292

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

The comparable effect of the fortified mineral oils to the organic phosphates may be attributable to the presence of OP compounds in its formulations. It is worth attention that Sumi oil gave significant results to the members of OP compounds, where Cidial K (fortified mineral oil) showed insignificancy with each of diazinon and phenthoate. The highest difference was observed between Sumi-oil, which gave the highest percentage of insect total population reduction (83.9 %) and Misrona oil (4), which gave the least reduction (71.4 %). This result may be taken as an indication of the importance of the presence of an acute toxicant in oil formulation.

b- Susceptibility of different *P. oleae* stages to the tested insecticides :

b.1- The nymphal stage :

Results in Table (67) indicated that, the nymphal stage of the plum scale insect, was more susceptible to the insecticides used, than any other insect stages, followed by the ovipositing female individuals and mature adult females in descending order. The differences between stages, were statistically highly significant at P = 0.01 (Table, 67). Susceptibility of the nymphal stage among all tested insecticides, probably attributed to either the absence of the protective scales in case of crawlers, or to the thin waxy layers which cover the other settled nymphal individuals, and were not enough to provide protection against the penetration of toxicants, also may be due to the comparative active motion of crawlers which enable the small insecticidal droplets to contact than, when compared with the settled and covered adult females. When comparing different effects of the tested insecticides on the insect nymphs, as shown in Table (67), it was clearly observed that Sumi oil, the fortified mineral oil had the highest effect on nymphs, where it induced 87.2 % reduction, followed by each Cidial K (85.6 %), phenthoate (84.8 %), diazinon (84 %), fenitrothion (83.2 %), KZ oil (79 %), Misrona (4) oil (78 %) and the pyrethroid compound fenvalerate, which induced the lowest effect on the insect nymphs, being 76.3 %, all induced within the total time of experiment of 180 days. From the obtained results, also it could be concluded that always the % reduction of the nymphal stage was higher than that of the total population, indicating the comparatively high susceptibility of nymphs to all tested insecticides as compared to the other insect stages.

b.2- The ovipositing female individuals :

Ovipositing females of ***P. oleae*** observed to follow the nymphs in susceptibility to the tested insecticides, Table (67). Sumi-oil induced the highest percent of reduction to the ovipositing females, being 83.1 %, followed by each of Cidial K (82.0 %), phenthoate (80.1 %), diazinon (79.7 %), fenitrothion (78.1 %), fenvalerate (72.7 %), KZ oil (70.7 %) and Misrona (4) oil (69.7 %), in descending order. The intermediate susceptibility of these individuals, however, could be attributed to the comparatively high consumption of the main essential nutrients when producing eggs, the matter that caused low tolerance to the tested insecticides.

b.3- the adult -non ovipositing-females :

The comparative high tolerance of these individuals to the tested compounds, seemed to arise from the coverage with thick scale, also could be due to their immobility, the matter that caused less contacts with the tested insecticides. On these individuals, Sumi-oil induced the highest % of reduction, being 81.5, then followed by Cidial K, phenthoate, diazinon, fenitrothion, fenvalerate, KZ oil and Misrona oil, inducing 80.6, 78.7. 77.7, 77.2, 70.8, 68.8 and 68.1 % reduction, in respective order.

C- Persistence of bioactivity of insecticides used :

Data obtained, as in Table (67), showed that, in cases of the OP compounds and the pyrethroid compound (fenvalerate), the first, second and the third post counts (after 15, 30 and 45 days of application, respectively), showed the highest percentages of insect reduction, being 91.7 and 95.2 %, calculated as an average of % insect reduction within the three post counts of OP compounds and the pyrethroid one, respectively. Subsequently, the toxicity of the OP compounds gradually degenerated within the next post counts data, to give an average of 37.6 % insect reduction after 180 days of application. The pyrethroid compound (fenvalerate), retained stable toxicity on ***P. oleae*** for 60 days, then degenerated sharply to give 21.2 % insect reduction, after 180 days of insecticidal treatment.

In case of the fortified mineral oils (Sumi oil and Cidial K oil), their fatal effect gradually increased during the first, second and the third post counts, to reach their maximum effect within the fourth interval (average of 93.8 and 92.3 % for Sumi-oil and Cidial K, respectively), then gradually degenerated to induce a common average of 50.4 % insect reduction, after the total time of experiment (180 days).

Concerning the single mineral oils (KZ and Misrona oils), the maximum peaks of their lethal action were recorded within the third interval (45 days after spraying), giving an average of 84.6 % insect reduction, after that period, their toxic effect on the total population of the plum scale insect decreased gradually to cause an average of 41.9 % insect reduction, after 180 days of application. The obtained data also demonstrated that, fortified mineral oils, had the longest bioactivity on ***P. oleae***, when compared with the other tested insecticidal groups and compounds, whereby, they gave means of 51.2 and 49.5 % insect reduction after 180 days of application, for Sumi-oil and Cidial K oil, respectively, followed by single mineral oils (average of 41.9 % reduction), the OP compound (average of 37.6 %) and the pyrethroid compound (fenvalerate, which only caused 21.2 % reduction) after 180 days of applications. The obtained results also proved the fast action of the pyrethroid compound, where fenvalerate caused

96.5 % insect reduction during the first post count (15 days after application), also data proved the delayed effect of both fortified mineral oils and single minerals oils, where they reached their maximum lethal action in no less than 45-60 days of application.

The recorded results on pear trees, during the first season of study, after spring sprays in may 1994, indicated that the most effective scalicide on ***P. oleae***, was Sumi-oil, followed by Cidial K oil (both are fortified mineral oils with OP compounds), phenthoate (OP compound), diazinon (OP compound), fenitrothion (OP compound), fenvalerate (pyrethroid compound), KZ oil and misrona (4) oil (both are single mineral oils). Also, observations on the residual bioactivity of the tested insecticides, showed that fortified mineral oils were found to have the longest residual effect on ***P oleae***, while the pyrethroid compound (fenvalerate), showed the shortest residual effect after 180 days of application.

B- season 1995 :

The obtained data of the second season of study, which showed the effect of the different insecticides on ***P. oleae*** when sprayed in spring, were to great extent, similar to those obtained during the preceding season of 1994. Table (68) exhibit the effects of the tested insecticides on different stages and on the total population of the plum scale insect, ***P. oleae.***

a- Effect on total population :

Data indicated that the fortified mineral oil, Sumi-oil still having the superior toxic effect on the total population (as mean of all stages reduction) on ***P. oleae***, where it caused 83.5 % reduction to the insect total population, as a mean of reduction within the 180 days of experiment. Cidial K (fortified mineral oil), phenthoate, diazinon, fenitrothion (all are OP compounds), KZ oil, Misrona (4) oil (both are single mineral oils) and fenvalerate (pyrethroid compound),

Table (68) : Effect of different insecticides on *P. oleae* in May (spring spray) at El-Quanater location, on pear trees calculated as % of insect stages reduction, in 1995.

Insecticides groups	Organophosphorus compounds												Pyrethroid compound				Fortified oils								Mineral oils							
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate				Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	89.8	90.3	96.5	92.2	87.1	89.2	93.6	89.9	89.3	90.0	95.2	90.5	94.2	96.3	100	96.8	82.8	82.8	92.3	85.9	82.0	82.7	91.5	85.4	75.8	76.8	89.6	80.5	74.8	76.0	86.9	79.2
30	90.2	90.9	96.8	92.6	87.3	89.4	94.1	90.3	89.0	90.5	95.5	91.6	95.1	95.8	98.2	96.4	86.8	87.2	95.6	89.9	86.1	86.5	94.1	88.9	78.2	81.5	91.2	83.6	78.2	80.3	90.6	83.0
45	89.2	90.8	96.1	92.0	87.3	88.5	93.9	89.9	88.4	90.0	95.2	91.2	91.6	93.5	95.2	93.4	89.6	90.7	94.8	91.7	88.9	90.3	93.9	91.0	83.6	85.2	93.3	87.4	83.0	84.7	92.7	86.8
60	78.1	88.7	92.3	89.4	84.2	85.6	91.0	89.9	86.3	86.8	91.6	88.2	81.4	85.0	87.2	84.5	90.9	92.5	96.8	93.4	89.7	92.6	95.8	92.7	83.2	84.2	91.5	86.3	82.1	83.8	91.0	85.6
75	83.2	83.9	87.8	84.9	82.3	84.1	86.0	84.1	83.0	83.6	86.9	84.5	62.2	64.3	71.6	66.0	88.1	88.9	92.5	89.8	87.3	88.0	91.8	89.0	72.6	76.1	81.8	76.8	71.8	74.6	80.7	75.7
90	76.1	75.6	80.8	77.5	73.8	75.1	80.8	76.6	74.9	75.3	81.6	77.3	52.3	53.1	64.2	56.5	81.9	82.8	89.5	84.7	81.1	82.3	86.5	83.3	60.6	63.5	71.3	65.0	59.1	62.2	68.1	63.1
180	38.2	37.1	44.3	39.9	34.7	36.2	43.5	38.1	36.5	38.5	43.2	39.4	16.5	18.6	25.2	20.1	45.6	48.9	51.7	48.7	44.3	46.2	50.4	46.9	36.1	40.2	46.3	40.9	35.2	40.5	47.3	41.0
Means of reduction	79.1	79.6	85.0	-	76.7	78.3	83.3	-	78.2	79.2	84.2	-	70.5	72.4	77.4	-	80.8	82.0	87.6	-	79.9	81.2	86.3	-	70.0	72.4	80.7	-	69.1	71.7	79.6	-
Total reduction	81.2				79.4				80.5				73.4				83.5				82.5				74.4				73.5			

	L.S.D. at 0.01	F
Treatments	2.35963	14.54196
Stages	1.08468	20.76731
Intervals	8.13213	70.34423

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

Table (68) : Effect of different insecticides on *P. oleae* in May (spring spray) at El-Quanater location, on pear trees calculated as % of insect stages reduction, in 1995.

Insecticides groups	Organophosphorus compounds												Pyrethroid compound				Fortified oils								Mineral oils							
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate				Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	89.8	90.3	96.5	92.2	87.1	89.2	93.6	89.9	89.3	90.0	95.2	90.5	94.2	96.3	100	96.8	82.8	82.8	92.3	85.9	82.0	82.7	91.5	85.4	75.8	76.8	89.6	80.5	74.8	76.0	86.9	79.2
30	90.2	90.9	96.8	92.6	87.3	89.4	94.1	90.3	89.0	90.5	95.5	91.6	95.1	95.8	98.2	96.4	86.8	87.2	95.6	89.9	86.1	86.5	94.1	88.9	78.2	81.5	91.2	83.6	78.2	80.3	90.6	83.0
45	89.2	90.8	96.1	92.0	87.3	88.5	93.9	89.9	88.4	90.0	95.2	91.2	91.6	93.5	95.2	93.4	89.6	90.7	94.8	91.7	88.9	90.3	93.9	91.0	83.6	85.2	93.3	87.4	83.0	84.7	92.7	86.8
60	78.1	88.7	92.3	89.4	84.2	85.6	91.0	89.9	86.3	86.8	91.6	88.2	81.4	85.0	87.2	84.5	90.9	92.5	96.8	93.4	89.7	92.6	95.8	92.7	83.2	84.2	91.5	86.3	82.1	83.8	91.0	85.6
75	83.2	83.9	87.8	84.9	82.3	84.1	86.0	84.1	83.0	83.6	86.9	84.5	62.2	64.3	71.6	66.0	88.1	88.9	92.5	89.8	87.3	88.0	91.8	89.0	72.6	76.1	81.8	76.8	71.8	74.6	80.7	75.7
90	76.1	75.6	80.8	77.5	73.8	75.1	80.8	76.6	74.9	75.3	81.6	77.3	52.3	53.1	64.2	56.5	81.9	82.8	89.5	84.7	81.1	82.3	86.5	83.3	60.6	63.5	71.3	65.0	59.1	62.2	68.1	63.1
180	38.2	37.1	44.3	39.9	34.7	36.2	43.5	38.1	36.5	38.5	43.2	39.4	16.5	18.6	25.2	20.1	45.6	48.9	51.7	48.7	44.3	46.2	50.4	46.9	36.1	40.2	46.3	40.9	35.2	40.5	47.3	41.0
Means of reduction	79.1	79.6	85.0	-	76.7	78.3	83.3	-	78.2	79.2	84.2	-	70.5	72.4	77.4	-	80.8	82.0	87.6	-	79.9	81.2	86.3	-	70.0	72.4	80.7	-	69.1	71.7	79.6	-
Total reduction	81.2				79.4				80.5				73.4				83.5				82.5				74.4				73.5			

	L.S.D. at 0.01	F
Treatments	2.35963	14.54196
Stages	1.08468	20.76731
Intervals	8.13213	70.34423

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

followed and caused 82.5, 81.2, 80.5, 79.4, 74.4, 73.5 and 73.4 % reduction to the insect total population, respectively. Analysis of variance of the tested insecticides showed insignificant differences between compounds belonging to the same group in their reductive effect on the total population of ***P. oleae***, where L.S.D. at P = 0.01 between treatments was 2.35963, higher than any difference between compounds of the same group. Differences were highly significant between Sumi oil and all of the tested insecticides, except Cidial K oil (belonging to the same group of Sumi-oil) and phenthoate (Op group), on the other hand, the toxic effect of the mineral oils (KZ and Misrona (4) oils) were significantly lower than all of the tested compounds, except fenvalerate. An examination of the obtained results showed that KZ oil and misrona (4) oil have exceeded fenvalerate in their effect on the total population of the plum scale insect, when compared with their effect during the previous year, of 1994. In fact, the observed differences between these compounds were not real, due to the insignificant values of L.S.D., at P = 0.01, neither in 1994 nor in 1995, and the observed reverse effect, could be due to some accidental climatic conditions, which may enhanced -to some extent- the degeneration of the pyrethroid compound, but had no, effect on stability of the comparatively non-chemically active mineral oils.

b- Susceptibility of different *P. oleae* stages to the tested insecticides :

b.1- The nymphal stage :

Examination of the susceptibility of the different stages of ***P. oleae***, as shown in Table (68), clearly indicated that the nymphal stage (crawlers and immature individuals) were the most susceptible to the tested compounds, where the % nymphal reductions were 87.6, 86.3, 85.0, 84.2, 83.3, 80.7, 79.6 and 77.4, caused by sumi- oil, cidial K, phenthoate, diazinon, fenitrothion, KZ oil, Misrona (4) oil, and fenvalerate, in descending respective order, as mean reductions within 180 days after applications.

b.2- The ovipositing female individuals :

The ovipositing females susceptibility, observed to come next to nymphs to the tested insecticides, where they showed 82.0, 81.2, 79.6, 79.2, 78.3, (72.4) and 71.7 % reductions with for each of Sumi oil, Cidial K, phenthoate, diazinon, fenitrothion, (fenvalerate & KZ oil), and Misrona (4) oil, in respective descending order, as means of reductions, during 180 days.

b.3- The adult -non ovipositing-females :

These individuals showed less susceptibility to the tested insecticides, than did any other insect individuals. The percentage of reductions were 80.8, 79.9, 79.1, 78.2, 76.7, 70.5, 70.0 and 69.1, caused by Sumi-oil, Cidial K, phenthoate, diazinon, fenitrothion, fenvalerate, KZ oil and Misrona (4) oil, respectively. From the obtained data, it could be concluded that, the effect of the different tested insecticides, were more or less similar in their descending effects on either the total insect population, or other insect stages, where each of any insecticide tested occupied the same position (more or less), in its reductive potency on the different insect stages, *i.e.* Sumi oil and Cidial oil, always had the superior effects on all insect stages, whereby, single mineral oils, *i.e.*, KZ & Misrona oils, and fenvalerate, always induced the lowest reductive effects on either total population, or the different stages of ***P. oleae***. On the other hand, phenthoate, diazinon and fenitrothion occupied the third, fourth and the fifth effective position, along the two years of study.

c- Persistence of bioactivity of insecticides used :

Data obtained in Table (68) showed that, in case of the OP compounds and the pyrethroid compound, the highest insect % reductions were obtained during the first, second and the third post counts (15, 30 and 45 days after spraying), resembling the results of the preceding year of 1994, with insignificant differences at P = 0.01 between different compounds within the first three counts post-treatment, where for OP compounds the mean percentage of reductions were 90.9, 91.5 and 91.0 in the three successive counts. Although fenvalerate showed comparatively high % insect reduction throughout the first three post counts, but differences between means of % reduction (96.8, 96.4, 93.4 in respective order), were insignificant during the first three post counts. Starting from the fourth post-treatment count, data of the OP compounds showed gradual decrease in % total insect reduction, to give 39.9, 38.1 and 39.4 % for each of phenthoate, fenitrothion and diazinon, respectively, after 180 days of application, while data of the pyrethroid compound (fenvalerate) showed a sharp fall, starting from the fifth post count (75 days after application), to give only 20.1 % insect population reduction, at the end of experiment (after 180 days of application). In case of the fortified mineral oils, their toxicity to the plum scale insect did not start high, as in OP and pyrethroid compounds, but gradually, increased to reach their maximum efficacy in reducing the insect total population after 60 days of application (represented in data of the fourth post treatment count), being 93.4 and 92.7 % for each of Sumi-oil and Cidial K, respectively, then each of them decreased gradually to give 48.7 and 46.9 % reduction after 180 days, in respective order.

Observations on data of the single mineral oils (KZ and Misrona-4 oils), also as observed with the fortified oils, did not show high lethal effect at the beginning, but their potency increased in a gradual rate to give the highest lethal effect on ***P. oleae*** after 45 days of application, being 87.4 and 86.8 % total reduction for KZ and Misrona (4) single oils, respectively. General decreases were observed in their efficacy to give 40.9 and 41.0 % reductions in insect total population, after 180 days of application for KZ and Misrona, respectively. When comparing the residual bioeffect of the different insecticides used, data in Table (68) showed that the fortified mineral oils gave the best results, supported with the results of the preceding year, causing 48.7 and 46.9 % insect population reduction by Sumi oil and Cidial K, followed with Misrona (4), kz oil, phenthoate, diazinon, fenitrothion and fenvalerate, causing 41.0, 40.9, 39.9, 39.4, 38.1 and 20.1 % insect population reduction, respectively, after 180 days of the experiment, almost the same results of the spring season of the preceding year.

5.1.2- Effect of the autumn sprays :

Autumn sprays were chosen for the control of insect population constituting the second high peak of abundance of ***P. oleae***, also the nymphal stage, especially crawlers of the fall brood, and also to control the other insect individuals (adult and ovipositing females) which resulted and developed from the spring brood of the same year, and where the fruit deciduous trees, *i.e.*, pear, plum, and apple, are free from fruits and began to undergo defoliation, the matter which enable the tested insecticides to contact directly with the insect individuals on bared branches.

A- Season 1994 :

a- Effect on the total population :

Data given in Table (69) indicated that, as was observed in spring sprays, the fortified mineral oils occupied the highest category in their lethal effect on the plum scale insect, ***P. oleae*** where caused the highest % reduction to its total population, combined with the longest bio-residual effect after 180 days of spraying amongst all tested insecticides. The different percentages of total insect reduction were 81.3, 79.2, 75.2, 73.3, 71.8, 71.6, 69.2 and 69.1, caused by Sumi-oil, Cidial K, phenthoate, KZ single oil, Misrona 4 single oil, diazinon, fenitrothion and fenvalerate, respectively. Analysis of variance showed significant differences at P = 0.01 between the two members of the fortified mineral oils' group and all of the rest of tested compounds, but not between them.

Table (69) : **Effect of different insecticides on *P. oleae* in Sep. (autumn spray) at El-Quanater location, on pear trees calculated as % of insect stages reduction, in 1994.**

Insecticides groups	Organophosphorus compounds												Pyrethroid compound				Fortified oils								Mineral oils							
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate				Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	98.6	91.2	96.3	92.4	84.3	86.2	92.7	87.7	86.3	89.6	93.2	89.7	95.8	96.2	99.6	97.2	81.7	84.3	89.5	85.2	80.6	82.2	87.3	83.4	74.6	76.2	86.8	79.2	72.3	75.2	88.2	78.6
30	86.3	91.0	93.2	90.2	81.6	82.4	87.0	83.7	83.4	84.7	89.9	86.0	92.6	93.2	96.4	94.1	87.4	89.6	92.5	89.8	83.5	86.4	90.7	86.9	76.2	80.5	87.3	81.3	74.7	80.0	86.4	80.4
45	82.7	86.4	88.6	85.9	79.3	82.5	88.0	83.2	81.6	86.3	88.0	85.3	87.2	89.7	91.6	89.5	89.5	91.2	94.6	91.8	89.6	89.8	92.3	90.6	81.5	83.7	86.2	83.8	78.7	83.2	85.0	82.3
60	78.4	81.6	83.2	81.1	71.2	74.6	79.3	75.0	73.5	78.7	81.2	77.8	68.2	71.6	81.4	73.7	92.3	94.6	95.2	94.0	90.6	92.7	91.2	91.5	82.3	83.6	88.5	84.8	80.9	82.6	86.4	83.3
75	71.3	81.6	83.2	74.7	64.6	69.0	73.5	69.0	69.0	70.7	76.4	72.0	56.3	58.2	61.7	58.7	84.3	84.6	86.7	85.2	84.7	82.2	84.8	83.9	68.5	73.0	82.6	74.7	62.8	71.6	82.0	72.1
90	64.6	-	-	64.6	58.4	-	-	58.4	61.8	-	-	61.8	42.9	-	-	42.0	76.5	-	-	76.5	71.3	-	-	71.3	61.3	-	-	61.3	60.6	-	-	60.6
180	21.8	21.6	24.7	22.7	16.7	18.2	20.4	18.4	18.6	20.3	22.5	20.5	6.9	7.3	11.2	8.5	41.6	42.0	44.0	42.5	38.6	41.2	43.4	41.1	34.7	39.5	41.2	38.5	31.9	36.5	38.8	35.7
Means of reduction	72.0	75.6	78.2	-	65.2	68.8	73.5	-	67.7	71.7	75.2	-	64.3	69.4	73.7	-	79.0	81.1	83.8	-	77.0	79.1	81.6	-	68.4	72.8	78.8	-	66.0	71.5	77.8	-
Total reduction	75.2				69.2				71.6				69.1				81.3				79.2				73.3				71.8			

	L.S.D. at 0.01	F
Treatments	2.30824	23.61931
Stages	1.35284	13.27752
Intervals	8.62533	58.38624

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

Significancy also appeared between phenthoate (as the lowest effective one) and all of others, except KZ single mineral oil, which showed insignificancy with phenthoate in the long run. Significant differences were observed between diazinon and each of fenitrothion (same OP group), and fenvalerate (pyrethroid group), but not between diazinon and each of any single mineral oil.

Observation on the autumn sprays indicated that the fortified mineral oils have proved to be the most effective insecticides used to control the plum scale insect, either in spring or autumn seasons. From the obtained results of the autumn sprays, it could be concluded that, the significant differences appeared between the members of OP group, showing that phenthoate was the most effective OP compound and diazinon was the least one, this may be due to differences in the OP compounds stabilities under different climatic conditions (of spring and autumn), also data indicated that the mineral oils, when used or mixed with other compounds, *i.e.* the fortified mineral oils, seemed to enhance and prolong the toxicity of these other compounds and/or encourage its entry from beneath scales, causing more contacts with th insect body, subsequently, causing higher percentages of reduction to the target. In other words, mineral oils, when mixed with the OP compounds acted as shield, keeping the OP compound from rapid degeneration, and increasing their rate of penetration, whereas mineral oils alone gave comparatively low % insect reduction, and acted mainly through their physical properties.

b- Susceptibility of different *P. oleae* stages to the tested insecticides :

b.1- The nymphal stage :

Data recorded in Table (69), showed high comparative nymphal susceptibility to all tested insecticides, when compared with the other insect stages. Sumi-oil caused the highest % reduction to these nymphs (crawlers and immature individuals) of 83.8 % throughout the 180 days of the experiment, followed with 81.6, 78.8, 78.2, 77.8, 75.2, 73.7 and 73.5 %, caused by Cidial K fortified oil, KZ single oil, phenthoate, Misrona-4 single oil, diazinon, fenvalerate and fenitrothion, respectively. After autumn sprays, it was observed that, the fortified mineral oils, have kept their advantages in reducing the nymphal stage, having the highest % reduction amongst the rest of the tested insecticides, but on the other hand, it was observed that the single mineral oils (KZ and Misrona oils), after autumn sprays, had the preceding on each of diazinon and fenitrothion (OP compounds), when compared with the sequence of the insecticidal effects were observed after the spring sprays, which calculated as means of % nymphal reduction within 180 days. The obtained results, again referred to the different climatic conditions, also to the acquired stability of the OP compounds when mixed with mineral oils, which showed almost constant stability under different climatic conditions.

b.2- The ovipositing females :

Data in Table (69), showed that, the ovipositing female individuals of ***P. oleae***, as after the spring sprayers, also after the autumn sprays, followed the nymphal stage in their susceptibility to the tested insecticides. Percentages of reductions of 81.1, 79.1, 75.6, 72.8, 71.7, 71.5, 69.4 and 68.8 % were caused by Sumi oil, Cidial K, phenthoate, KZ oil, diazinon, Misrona (4) oil, fenvalerate and fenitrothion, respectively. From the obtained data, it was observed that, mineral oils, after autumn sprays, on the ovipositing females and nymphs, showed more reductive influence than that occurred after the spring sprays. On the other hand, fenitrothion showed to be less effective on both nymphs and ovipositing females when sprayed in autumn than it did in the spring sprays.

b.3- The adult -non ovipositing- females :

As shown in Table (69), adult females showed their usual low susceptibility also after the autumn sprays. Sumi oil was observed to be the most effective tested insecticide on adult females of ***P. oleae***, where it induced the highest percentage of reduction to adult females population within 180 days of the experiment, being 79.0 %, followed with Cidial K, phenthoate (OP compound), KZ oil (single mineral oil), diazinon (OP compound), Misrona (4) (single mineral oil), fenitrothion (OP compound) and fenvalerate (pyrethroid compound), where each of them caused 77.0, 72.0, 68.4, 67.7, 66.0, 65.2 and 64.3 % adult females reduction, respectively.

c- Persistence of bioactivity of insecticides used :

Data in Table (69) showed that, the highest % insect population reduction, was observed and recorded in each of the first, second and the third post- treatment counts, for the OP and pyrethroid compounds, where the means of % insect population reduction, were 89.9, 86.6 and 84.8 % in the first, second and the third OP post counts, while they were 97.2, 94.1 and 89.1 % for fenvalerate, in the three successive post counts, respectively, without significant differences between these means of the three post counts, where L.S.D. at P = 0.01 was 8.62533 between different intervals (post counts).

Beginning from the fourth treatment counts, degenerations appeared to occur in the efficacies of the OP and pyrethroid compounds, where the OP compounds gradually degenerated, giving 22.7, 18.4 and 20.5 % insect population reduction after 180 days of application, for each of phenthoate, fenitrothion and diazinon, respectively, while the pyrethroid compound "fenvalerate" showed high rate of degeneration, subsequently gave 8.5 % total insect population reduction, after the total time of the experiment (180 days after application). Data of the fortified mineral oils and single mineral oils showed a gradual increases in their reductive efficacies on ***P. oleae*** total population throughout the first four post-treatment counts, to reach their maximum reductive effects within the fourth period of post-treatment counts, being 94.0, 91.5 % reduction for each of the Sumi-oil and Cidial K and 84.8 & 83.3 % for KZ oil and Misrona-4 oils, respectively. Gradually, and moderately, their toxicities decreased to give 42.5, 41.1, 38.5 and 35.7 % insect reduction for each of Sumi oil, Cidial K, KZ oil and Misrona-4 oils, respectively, after 180 days of applications.

Observations on the obtained results, indicated also in autumn sprays, that the fortified mineral oils, still having the superiority in their long-lived toxic action on the plum scale insect, whereby their % of total insect population reductions, were the highest percentages, being 42.5 and 41.1 for Sumi-oil and Cidial K, followed by KZ oil, Misrona-4 oil, phenthoate, diazinon, fenitrothion and fenvalerate, causing 38.5, 35.7, 22.7, 20.5, 18.4 and 8.5 % reductions, respectively, in the total population of ***P. oleae*** after 180 days of application, more or less, following the same sequence of the insecticidal residual bioactivity observed in spring sprays, but causing in often times lower % insect reductions than those of spring sprays.

B- Season 1995 :

a- Effect on the total population :

Data given in Table (70) indicated that the fortified mineral oils, Sumi oil and Cidial K oil, were the most effective two insecticides used in suppressing the total population of ***P. oleae*** after autumn sprays, in the second studied season of 1995. Sumi oil caused an average of 79.5 % reduction in the insect total population, throughout 180 days, followed with Cidial K, phenthoate, diazinon, KZ oil, fenitrothion, Misrona oil (4), and fenvalerate. Each of Misrona (4) oil and fenvalerate, almost caused the same % of reduction, where percentages of

Table (70) : Effect of different insecticides on *P. oleae* in Sep. (autumn spray) at El-Quanater location, on pear trees calculated as % of insect stages reduction, in 1995.

Insecticides groups	Organophosphorus compounds												Pyrethroid compound				Fortified oils								Mineral oils							
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate				Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	90.3	90.6	98.2	93.5	85.2	86.3	92.9	88.1	87.3	89.2	96.5	91.0	94.2	95.6	98.4	96.1	79.2	80.6	88.2	82.7	77.3	79.2	86.2	80.9	70.6	72.2	83.6	75.5	68.5	72.0	81.3	73.9
30	85.8	89.7	95.6	90.4	81.2	85.0	90.3	85.5	83.6	87.2	93.7	88.2	92.8	94.2	97.0	94.7	84.3	86.6	90.7	87.2	82.0	84.6	88.3	84.9	74.1	78.3	84.5	79.0	72.5	76.6	81.6	76.9
45	82.3	85.4	86.8	84.8	78.4	81.6	84.0	81.3	80.3	83.6	84.2	82.7	85.1	88.3	93.6	89.0	85.0	87.6	91.2	87.9	83.3	84.5	90.7	86.2	76.4	81.7	83.6	80.6	73.6	81.0	81.2	78.6
60	75.8	82.2	86.3	81.4	69.9	76.6	80.7	75.7	72.6	78.5	84.2	78.4	70.3	70.6	97.7	73.5	89.3	91.2	93.6	91.4	86.1	88.4	92.1	88.9	78.5	82.2	84.0	81.6	77.6	79.8	82.1	79.8
75	70.4	72.1	81.6	74.7	66.3	67.5	80.2	71.3	70.0	70.8	83.2	74.7	58.2	58.9	63.0	60.0	85.2	86.0	88.6	86.6	82.3	87.3	88.2	85.9	71.5	76.3	79.4	75.7	69.6	74.2	75.3	73.0
90	62.8	-	-	62.8	58.2	-	-	58.2	61.7	-	-	61.7	40.6	-	-	40.6	74.3	-	-	74.3	71.6	-	-	71.6	61.6	-	-	61.6	61.2	-	-	61.2
180	22.9	24.7	25.0	24.2	20.2	20.6	22.0	20.9	20.8	22.5	23.8	22.4	7.7	8.2	10.6	8.8	38.6	41.7	45.3	41.9	36.2	41.8	43.1	40.4	30.6	32.3	39.2	34.0	28.7	31.2	40.6	33.5
Means of reduction	70.0	74.1	78.9	-	65.6	69.6	75.0	-	68.0	72.0	77.6	-	64.1	69.3	73.7	-	76.6	79.0	82.9	-	74.1	77.6	81.4	-	66.2	70.5	75.7	-	64.5	69.1	73.7	-
Total reduction	74.4				70.1				72.5				69.0				79.5				77.7				80.7				69.1			

	L.S.D. at 0.01	F
Treatments	2.43366	20.97589
Stages	1.08468	14.20908
Intervals	10.07324	56.69449

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

reduction in the total population of ***P.oleae*** were 77.7, 74.4, 72.5, 70.8, 70.1, 69.1 and 69.0, respectively. Analysis of variance as shown in Table (70), during the second year of study, showed highly significant differences between the % of total insect reduction induced by the two fortified mineral oils both, and the rest of the other tested insecticides, but not between them. Significancy also appeared between phenthoate and all of the others except diazinon (same OP group), also significant differences were recorded between Misrona (4) mineral oil and diazinon, but not between diazinon and KZ oil.

In general, the fortified mineral oils, were observed to induce the highest percentage of insect reduction, and had the longest-lived toxic actions amongst the other tested insecticides, either in spring, or in autumn sprays, also possessing the highest stability, the matter which enabled them to have a high population reducing action on the plum scale insect.

b- Susceptibility of different *P. oleae* stages to the tested insecticides :

b.1- The nymphal stage :

As shown in Table (70), the nymphal stage were observed, as commonly observed before, to be the highest susceptible stage to the tested insecticides, when compared with the other insect individuals, *i.e.*, adult and ovipositing females. Sumi oil showed to be the most effective tested compound on the nymphal stage of ***P. oleae***, where it induced 82.9 % reduction in the concerned population, calculated as mean of reduction within the total time of the experiment (180 days). Following Sumi oil, Cidial K, phenthoate, diazinon, KZ oil, fenitrothion, (fenvalerate and Misrona-4 oil), came to cause 81.4, 78.9, 77.6, 75.7, 75.0 and (73.7) % nymphal reduction during the same total period of experiment, showing -to same extent- different arrangement to that of the preceding year. During the recent year of 1995, each of Sumi oil and Cidial K oil, have kept their first and second ranks of efficacy on the plum scale nymphal stage, where each of phenthoate and diazinon have preceded KZ oil, and fenitrothion preceded each of fenvalerate and Misrona (4) single oil. To explain what was occurred, it could be suggested that susceptibility of nymphal stage may be affected to the tested insecticides when used twice, for two successive years, on same trees, or that occurred, could be attributed to some -unstudied- accidental climatic conditions, which were enable to enhance or depress the comparative toxicity of each tested insecticide.

b.2- Susceptibility of the ovipositing females :

As recorded in Table (70), the oviposition females as always did, followed the nymphs in susceptibility to the tested insecticides within the two studied years. The percentage of reductions occurred in the population of the ovipositing females of 79.0, 77.6, 74.1, 72.0, 70.5, 69.6, 69.3 and 69.1, were caused by Sumi oil, Cidial K (fortified mineral oil), phenthoate, diazinon, KZ single oil, fenitrothion, fenvalerate and Misrona (4) oil, respectively, as an average of % reduction, within the experiment total time of 180 days, with a different sequence to that observed during the preceding year of 1994, with the same probable suggested reasons mentioned former.

b.3- Susceptibility of the adult females :

Adult females, as previously shown in Table (70), still the least susceptible stage to the tested insecticides, as was always observed. The % of adult females reductions of 76.6, 74.1, 70.0, 68.0, 66.2, 65.6, 64.5 and 64.1 were caused by each of Sumi-oil, Cidial K, phenthoate, diazinon, KZ oil, fenitrothion, Misrona (4) oil, and finally, fenvalerate, in respective order, with the highest efficacy of Sumi-oil and lowest to fenvalerate, as was previously observed in the preceding year of 1994.

c- Persistence of bioactivity :

As previously mentioned about data of 1994, also in 1995, as shown in Table (70), the first, second and the third post-treatment counts (15, 30, and 45 days after insecticidal applications), were recorded to be the most effective three periods in reducing ***P. oleae*** total population for the OP and the pyrethroid compounds, without significant differences between each of any, in causing % insect total population reduction, where % of reductions were 90.8, 88.0, and 82.9, for the means of the first three periods of the OP compounds and 96.1, 94.7 and 89.0 for the pyrethroid compound "fenvalerate". Significant differences between data taken in the first post count (and oftentimes in the second post count too), and beginning of those of the fourth post count, for each of the OP and pyrethroid compounds. In case of the fortified mineral oils, the two tested compounds (Sumi oil and Cidial K), reached their maximum toxic effects gradually after 60 days of application, where the percentage of ***P. oleae*** reductions were 91.4 and 88.9, induced by Sumi oil and Cidial K, respectively, the matter that indicated the slow -but prolonged toxic action of these compounds on the different individuals of ***P. oleae***, also this delayed effect of the fortified mineral oils, may cause a bad interaction with the oviposition operation, subsequently and -to some extent- lately, caused high percentage of reduction to the insect total population, which as observed appeared lately after 60 days of application, the particular point in worth of further detailed investigation. The two single mineral oils (KZ and Misrona-4 oils), also reached their maximum effect on ***P. oleae*** after 60 days of application, being 81.6 and 79.8 % total reductions to the insect, for each of KZ and Misrona-4 mineral oils, respectively, following the same manner of fortified mineral oils and indicating that the delayed effect of each (fortified and single mineral oils), was mainly attributed to the chemical and physical properties of the mineral oil, not only to the mode of OP group action, when added to the mineral oils.

Observations on the residual bioactivity of the tested insecticides, showed that Sumi-oil had the longest observed efficacy on ***P. oleae*** where it caused 41.9 % reduction to the total population, after 180 days of application, followed by Cidial K oil, KZ mineral oil, Misrona (4) mineral oil, phenthoate, diazinon, fenitrothion and fenvalerate, causing 40.4, 34.0, 33.5, 24.2, 22.4, 20.9 and 8.8 % reduction to the total population of the plum scale insect, ***P. oleae***.

5.1.3- Effect of winter sprays (only on pear trees) :

Winter spraying were applied and tested, due to their common uses on deciduous trees, *i.e.* pear,plum and apple trees, in Egypt, without any regards to their highly reductive influence on the comparatively low population of beneficial parasitoid, ***A. maculicornis***, the main parasitoid of the plum scale insect, and which were observed to start its activity against the insect in late winter (late February, just after the time of winter spraying), the matter which always causes a considerable reduction in its insect-controlling efficacy during this critical period (February), during which the scale insect was in winter hibernation (and was more tolerant to the used insecticides), where the parasitoid was found in a considerably few individuals, which were highly affected with any insecticide used during this period, causing a considerable reduction to its efficacy allover the rest of the year.

A- Season 1994 :

a- Effect on the total population :

Data in Table (71) clearly show, that fortified mineral oils proved accurately to be the most effective tested insecticides on the plum scale insect, ***P. oleae*** after the spring, autumn and winter sprays (not with ignoring their harmful effect on the parasitoid, as will be discussed later). Sumi oil showed the highest efficacy amongst the other tested compounds, where it caused 76.5 % reduction

Table (71) : Effect of different insecticides on *P. oleae* in Jan. (winter spray) at El-Quanater location, on near trees calculated as % of insect stages reduction, in 1994.

Insecticides groups	Organophosphorus compounds												Pyrethroid compound			
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	84.2	-	-	84.2	81.3	-	-	81.3	82.6	-	-	85.6	88.3	-	-	88.3
30	81.6	-	-	81.6	79.5	-	-	79.5	80.2	-	-	80.2	83.1	-	-	83.1
45	80.5	90.6	96.0	89.1	76.3	89.8	93.5	86.5	79.3	88.2	95.2	87.6	82.3	89.6	95.4	89.1
60	73.9	89.5	92.3	85.2	70.7	85.5	90.2	82.1	71.5	87.2	90.3	83.0	63.5	79.6	84.3	75.8
75	70.2	78.7	89.0	79.3	69.3	75.8	89.5	78.2	70.3	77.9	89.9	79.4	51.1	62.3	68.7	60.7
90	61.3	67.2	80.5	70.0	59.6	68.2	77.9	68.6	60.6	67.3	79.3	69.1	41.2	51.6	53.8	48.9
180	20.8	29.7	31.7	27.4	20.0	27.8	30.7	26.2	20.3	27.9	35.3	27.2	8.9	16.5	18.3	14.6
Means of reduction	67.5	71.1	77.9	-	65.2	69.4	76.4	-	66.4	69.7	78.0	-	59.8	59.9	64.1	-
Total reduction	72.2				70.3				71.4				61.3			

Insecticides groups	Fortified oils								Mineral oils							
Insecticides	Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	73.5	-	-	73.5	71.4	-	-	71.4	67.2	-	-	67.2	65.7	-	-	65.7
30	79.5	-	-	79.5	78.3	-	-	78.3	72.5	-	-	72.5	73.2	-	-	73.2
45	83.2	85.7	89.4	86.1	81.7	84.2	88.6	84.8	80.3	81.6	82.5	81.5	80.7	82.3	84.6	82.5
60	88.5	89.7	91.2	89.8	86.5	88.1	91.3	88.6	83.3	84.6	84.8	84.2	82.1	82.7	85.2	83.7
75	84.3	86.2	88.4	86.3	82.6	85.2	87.7	85.2	79.1	79.8	81.3	80.1	76.2	77.4	79.5	77.7
90	75.3	77.1	79.3	77.2	76.2	77.3	78.5	77.3	60.3	63.1	85.2	62.9	58.1	58.7	60.3	59.0
180	35.3	44.1	46.2	41.9	35.3	41.6	44.7	40.5	31.7	30.5	32.3	31.5	29.2	30.1	31.0	30.1
Means of reduction	74.2	76.6	78.9	-	73.1	75.3	78.2	-	67.8	67.9	69.2	-	66.5	66.4	68.1	-
Total reduction	76.5				75.5				68.3				67.0			

	L.S.D. at 0.01	F
Treatments	2.53704	17.62351
Stages	1.13893	22.87563
Intervals	9.02537	67.26518

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

to the total population of ***P. oleae*** throughout 180 days (as an average reduction of different post-counts), followed by each of Cidial K, phenthoate, diazinon, fenitrothion, KZ oil, Misrona (4) single oil, and fenvalerate, causing 75.5, 72.2, 71.4, 70.3, 68.3, 67.0 and 61.3, in respective order to the previously mentioned insecticides. No significant differences at 0.01 level (P = 0.01), appeared between the reductive influence within the members of each insecticidal group, but appeared between (Sumi oil and Cidial K), and all of the other groups, also between fenvalerate (the lowest effective one) and all of tested insecticides. Highly significant differences appeared between the means of insect reduction of the different groups, where they calculated as 76.0, 71.3, 67.7 and 61.3 % for each of the fortified mineral oils, OP compounds, single mineral oils and pyrethroid groups, respectively, indicating the highest effect of fortified oils and the lowest effect of the pyrethroid compound within an interval of 180 days. From obtained results, it was clearly to conclude that Sumi-oil (fortified mineral oils in general), was the most effective-tested compound, and phenthoate (Cidial) was the most powerful OP compound, whereas KZ single mineral oil was the most effective mineral oil, all in reducing the total population of ***P. oleae***. On the other hand, fenvalerate was the lowest effective compound used in this concern.

b- Effect on different stages :

b.1- The nymphal stage :

After winter sprays, in general, nymphal stage -as shown in Table (71), showed to be the most susceptible insect stage to all tested insecticides. The means of nymphal reductions within the 180 days of experiment were 78.9, 78.2, 78.0, 77.9, 76.4, 69.2, 68.1 and 64.1 for Sumi-oil, Cidial K, diazinon, phenthoate, fenitrothion, KZ oil, Misrona (4) oil and fenvalerate, respectively, supporting the adverse effect of the fortified oil group particularly on these delicate stage.

b.2- the ovipositing female individuals :

After winter sprays, and as usually observed, these individuals came next in susceptibility to the tested compound to the nymphal stages. Sumi-oil and Cidial K, were the most effective two insecticides in reducing the ovipositing females population of ***P. oleae***, as their means of reductions of different post-treatment counts, within 180 days of experiment were 76.6 and 75.3 %. Phenthoate, diazinon, fenitrothion, KZ oil, Misrona-4 oil,a nd fenvalerate, came next inducing % reduction of 71.1, 69.7, 69.4, 67.9, 66.4 and 59.5, respectively, more or less, the same results of the spring sprays of 1995.

b.3- The adult females :

This stage proved to be the lowest susceptible stage to the tasted insecticides, after all sprays, where % reductions of this stage of 74.2, 73.1, 67.8, 67.5, 66.5, 66.4, 65.2 and 59.8 were induced by each of Sumi oil, Cidial K, KZ single oil, phenthoate, Misrona- 4 oil, diazinon, fenitrothion and fenvalerate, in respective order. Significant figures appeared between the susceptibility records of nymphs and the other stage (ovipositing and adult females); however, significancy did not appear between the two latter stages.

c- Persistence of bioactivity :

As clearly shown in Table (71), the first three post-treatment counts of the OP and pyrethroid compounds, recorded the highest percentages of insect total population reduction, allover the experiment, but the absence of the susceptible nymphs and the ovipositing females during the first and second periods of post counts (in January and February, where only the hibernating adult females were counted and recorded), and their beginning of appearance within the third post count period, caused the highest insect reduction %, not to appear within the first post-treatment count period, where only the less susceptible stage of adult females were exist, but to appear within the third period of post counts (beginning of March), where the ovipositing females, consequently the nymphs (mainly crawlers) started to appear in comparatively low numbers, the matter that induced high percentages of mortality between these individuals, arising the % reduction in the total insect population within the records of the third post count. Thus, in cases of the OP compounds, significant figures started to appear between the first and sixth post counts data, but not between the first and the fifth post counts, as were observed in spring and autumn sprays. In case of fenvalerate, the pyrethroid, significancy started to appear between first and fourth post counts data, mainly due to the expected short persistence of pyrethroids in general, when compared with the other comparatively stable compounds. The highest percentages of insect total population reduction in concern to the OP and pyrethriod compounds, observed in records of the third post- treatment counts, after winter sprays, and were (89.1), 87.6, 86.5, for each of (phenthoate and fenvalerate), diazinon, and fenitrothion, respectively. In relation to the fortified mineral oils and the single mineral oils, the most effective period on the insect, was the fourth post-count period, after treatment (60 days after spraying), when applied in January as winter sprays, where the percentages of the total reductions in the insect total population were, 89.8, 88.6, 84.2 and 83.7, for each of Sumi-oil, Cidial K, KZ and Misrona-4 oils, respectively. In cases of the fortified oils, significant figures began to appear between the fourth post count records and starting from th sixth ones,indicating the delayed and long lived actions of both compounds. When comparing the residual effects of different tested insecticides, Sumi oil showed the highest residual efficacy, inducing 41.9 % insect population reduction, after 180 days of application, followed with Cidial K, KZ and Misrona (4) single oils, phenthoate, diazinon, fenitrothion and fenvalerate, causing 40.5, 31.5, 30.1, 27.4, 27.2, 26.2 and 14.6 %, in respective order.

B- Season 1995 :

The obtained data in Table (72) showed to a great extent, similar results to that of the preceding year, where Sumi oil was the most effective and tested insecticide in inducing the highest percentage of ***P. oleae*** total population reduction, within the experimental period (180 days), being 77.0 % followed by those of Cidial K, phenthoate, diazinon, fenitrothion, KZ oil, Misrona (4) oil and fenvalerate being 76.1, 73.0, 72.2, 70.1, 69.6, 68.4 and 61.8, respectively.

Significant figures appeared between the fortified oils and all the other tested insecticides, also between fenvalerate (which induced the lowest percentage of reduction within the period of experiment), and all the rest of the tested compounds. Concerning the OP group, significancy appeared between fenitrothion which had the lowest effect and the other two members of the OP group (phenthoate and diazinon); however, no significant figures were recorded between fenitrothion and each of the two mineral oils (KZ and Misrona oils), within the experimental period, when calculated as means of insect population reduction. As was observed in the previous year of 1994, in case of the OP and pyrethroid compounds, the first three post count records included with the highest percentages of insect population reduction, with referring to the third post counts to be included with the highest comparable percentage of insect population reduction for the OP group and the pyrethroid compound. In both of the fortified mineral oils and single mineral oils, the fourth post count records, found to have the highest records in expressing the percentage of insect population reduction, in a complete correlation with the insecticidal serial effects of the preceding year.

Residual effect studies showed that, Sumi-oil and Cidial K, had the longest toxic influence on the plum scale insect, where they caused 42.9 and 40.8 % insect population reductions, after 180 days of application followed by each of KZ oil, Misrona (4) oil, phenthoate, diazinon, fenitrothion and at least

Table (72) : Effect of different insecticides on *P. oleae* in Jan. (winter spray) at El-Quanater location, on pear trees calculated as % of insect stages reduction, in 1995.

Insecticides groups	Organophosphorus compounds												Pyrethroid compound				Fortified oils								Mineral oils							
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate				Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	85.3	-	-	85.3	83.6	-	-	83.6	84.1	-	-	84.1	90.5	-	-	90.5	72.3	-	-	72.3	72.0	-	-	72.0	66.5	-	-	66.5	65.8	-	-	65.8
30	82.6	-	-	82.6	80.3	-	-	80.3	81.7	-	-	81.7	84.2	-	-	84.2	78.5	-	-	78.5	76.3	-	-	76.3	72.8	-	-	72.8	71.5	-	-	71.5
45	79.8	91.2	96.0	89.0	78.5	89.2	79.1	82.3	80.2	90.1	95.8	88.7	81.7	90.2	96.3	89.4	83.6	85.8	90.3	86.6	83.5	86.2	91.7	87.1	82.6	83.1	85.2	83.6	81.3	83.6	86.2	83.7
60	75.1	90.3	92.7	86.0	72.7	88.1	90.3	83.7	73.0	89.7	91.2	84.6	65.2	80.1	83.3	76.2	87.7	89.2	92.5	89.8	86.1	88.3	93.6	89.3	83.6	85.1	86.3	85.0	83.0	84.2	85.1	84.1
75	71.8	77.5	88.6	79.3	70.0	75.5	87.1	77.5	70.9	76.5	88.2	78.5	50.3	64.2	68.6	61.0	83.2	84.7	89.3	85.7	82.2	85.1	87.1	84.8	78.3	78.9	82.7	80.0	77.1	79.3	81.2	79.2
90	63.2	70.2	81.7	71.7	61.5	67.3	79.3	69.4	62.5	69.1	80.3	70.6	42.1	52.7	54.7	49.8	77.5	79.3	80.6	79.1	76.3	78.0	79.3	77.9	63.1	65.2	67.2	65.2	60.2	63.1	66.3	63.2
180	22.1	30.3	33.2	28.5	20.8	29.1	32.5	27.5	21.3	30.0	33.1	28.1	7.6	17.2	19.1	14.6	36.2	46.1	46.3	42.9	34.1	43.3	45.0	40.8	32.5	33.3	34.6	33.5	28.1	31.0	32.6	30.6
Means of reduction	68.6	71.9	78.4	-	66.8	69.8	73.7	-	67.7	71.1	77.7	-	60.2	60.9	64.4	-	74.1	77.0	79.8	-	72.9	76.2	79.3	-	68.5	69.1	71.2	-	66.7	68.2	70.3	-
Total reduction	73.0				70.1				72.2				61.8				77.0				76.1				69.6				68.4			

	L.S.D. at 0.01	F
Treatments	2.10395	20.58364
Stages	1.03829	23.87531
Intervals	8.10235	58.1365

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

Table (73) : The comparative percentages of the average total reduction induced by the tested insecticides to *P. oleae* infesting pear trees, at different seasons of the two studied years.

Compounds	Organophosphorus compounds									Pyrethroid compound			Fortified oils						Mineral oils					
	Phenthoate			Fenitrothion			Diazinon			Fenvalerate			*Sumi-oil*			Cidial K			KZ oil			Masrona oil		
Stages	Ad.	Ov.	Nym.	Ad.	Ov.	Nym.	Ad.	Ov.	Nym.	Ad.	Ov.	Nym.	Ad.	Ov.	Nym.	Ad.	Ov.	Nym.	Ad.	Ov.	Nym.	Ad.	Ov.	Nym.
Spring sprays	78.9	79.9	84.9	7.70	78.2	83.3	78.0	79.5	84.1	70.7	72.6	76.9	81.2	82.6	87.4	80.3	81.6	86.0	69.4	71.6	79.9	68.6	70.7	78.8
Mean	81.2			79.5			80.5			73.4			*83.7*			82.6			73.6			72.7		
Autumn sprays	71.0	74.9	78.6	65.4	69.2	74.3	67.9	71.9	76.4	64.2	69.4	73.7	77.8	80.1	83.4	75.6	78.4	81.5	67.3	71.7	77.3	65.3	70.3	75.8
Mean	74.8			69.6			72.1			69.1			*80.4*			78.5			72.1			70.5		
Winter sprays	68.1	71.5	78.2	66.0	69.6	75.1	67.1	70.4	77.9	60.0	60.4	64.3	74.2	76.8	79.4	73.0	75.8	78.8	68.2	68.5	70.2	67.1	67.3	69.2
Mean	72.6			70.2			71.8			61.6			*76.8*			75.9			69.0			67.9		
General mean	76.2			73.1			74.8			68.0			80.3			79.0			71.6			70.4		

Means were calculated as mean of the two years

* Ad. : Adult females, Ov. : Ovipositing females, Nym. : Nymphal stages.

i.e., by using mineral oils, which showed less toxicity on the parasitoid, or delaying the spring sprays to late May, to give enough chance to this parasitoid to control the plum scale insect, with maximum gain.

Concerning the winter sprays, as shown in Table (73), they were found to be the lowest effective sprays in reducing ***P.oleae*** population, mainly due to the abundance of the hibernating adult females, which showed less susceptibility and comparatively high tolerance to the tested insecticides. The winter sprays were observed to be commonly applied on most of the deciduous trees in Egypt to control the plum scales, and other related scale insects due to the presence of the trees free of any foliage and fruits, the matter which easily enables the used insecticide to contact with scales on branches and twigs, without any barrier, subsequently reducing the amount of the insecticide used. On the other hand, in winter, almostly in mid and late February, the parasitoid ***A. maculicornis***, was observed in a few scattered individuals, of low parasitic activity, was badly affected with the residues of the long-lived insecticides, *i.e.*, Sumi-oil and Cidial K, which were applied in winter sprays (December-January), the matter that subsequently caused high percentage of reduction to this parasitoid, consequently, reducing its expected activity allover the rest of the year, than any other sprays did.

In concern to the autumn sprays, it almost showed an intermediate reductive effects to ***P. oleae***, when compared with spring or winter sprays, where they gave percentages of reduction lower than those of spring, and almost higher than those of winter sprays. These sprays could be considered the best tested sprays, where they induced a satisfactory reductions in ***P. oleae*** population; moreover, they were applied away of the main period of the parasitoid activity, of spring season. Generally, the insecticides which were sprayed to control ***P. oleae*** infesting pear trees, at El-Quanater location, could be arranged according to their average percentage of ***P. oleae*** reduction, throughout the three sprays, as follows : Sumi-oil, Cidial K, phenthoate, diazinon, fenitrothion, KZ oil, Misrona (4) and finally, fenvalerate, where each of them induced an average % reduction of three sprays (spring, autumn and winter sprays) in the plum scale insect total population of 80.3, 79.0, 76.2, 74.8, 73.1, 71.6, 70.4 and 68.0 %, respectively, allover the total time of the control experiment.

5.2- Effect of the tested insecticides on *P. oleae*, infesting plum trees, at El-Quanater El-Khairiya location :

5.2.1- Effect of spring sprays :

A- Season 1994 :

a- Effect on the total population :

Data expressed in Table (74) showed to some extent, on plum trees, different results to those obtained on pear trees, during the same year and at the same location. In case of the fortified mineral oils, their precedence in reducing *P. oleae* total population was similar to that observed on pear trees amongst the other tested insecticides, also the average effect of phenthoate (Cidial), which observed often to occupy the third rank of efficaciy on ***P. oleae*** on pear trees, also occupied the same rank of efficacy on plum trees. Similarity with pear trees appeared in the comparative longevities of different tested insecticides, where the fortified oil group exhibited also the longest persistence of bioactivity, while fenvalerate (pyrethroid), showed the shortest one. Data were different on plum trees when compared with those of pear trees, when Cidial K during the first studied season, have preceded Sumi oil (each belongs to fortified mineral oil group), but in insignificant figures, in reducing ***P. oleae*** total population, inducing 86.6 % reduction, as mean of total reductions within 180 days, followed

Table (74) : **Effect of different insecticides on *P. oleae* in May (spring spray) at El-Quanater location, on plum trees calculated as % of insect stages reduction, in 1994.**

Insecticides groups	Organophosphorus compounds												Pyrethroid compound				Fortified oils								Mineral oils							
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate				Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	94.2	95.4	100	96.5	94.3	95.0	100	96.4	93.4	94.3	100	95.9	95.7	95.9	100	97.2	87.9	88.3	91.9	89.4	88.2	88.9	92.2	89.8	76.9	77.2	80.3	78.1	75.2	77.3	88.0	77.5
30	95.3	97.9	100	97.7	94.9	96.7	100	97.2	94.2	95.8	100	96.7	96.7	96.9	100	97.9	89.6	90.3	95.4	91.8	90.2	91.6	94.9	92.2	79.2	79.9	88.7	82.6	78.2	78.8	87.3	78.4
45	93.6	97.2	100	96.9	93.5	96.3	98.2	96.0	93.2	95.2	96.9	95.1	95.2	95.8	98.0	96.3	93.1	93.9	96.8	94.6	93.7	93.8	97.1	94.9	87.7	88.2	93.6	89.8	85.8	86.3	91.5	87.9
60	91.6	91.9	96.8	93.4	91.1	82.0	95.2	92.8	90.5	91.3	95.0	92.3	86.2	83.2	88.4	85.9	94.8	95.3	96.8	95.6	95.2	95.8	97.0	96.0	86.8	87.9	91.7	88.8	85.2	86.0	90.6	87.3
75	88.7	89.2	93.1	90.3	87.1	88.4	92.3	89.3	87.0	86.2	91.6	88.3	74.6	76.7	83.4	78.2	92.4	93.1	94.8	93.4	93.2	93.9	95.0	94.0	83.6	85.1	86.4	85.0	81.9	83.8	87.2	84.3
90	81.5	83.6	90.7	85.3	80.2	82.5	89.7	84.1	81.1	82.0	87.6	83.6	63.1	63.9	80.2	69.1	88.8	89.5	92.3	90.2	87.2	90.6	93.2	90.3	74.9	76.3	83.5	78.2	73.6	74.8	81.0	76.5
180	37.2	39.5	44.3	40.3	36.7	38.8	42.6	39.7	35.2	36.9	42.3	38.1	23.8	26.7	36.2	28.9	45.2	4.57	52.8	47.9	46.3	46.7	53.6	48.9	40.5	42.8	46.5	43.2	40.2	40.8	47.6	42.9
Means of reduction	83.2	85.0	89.3	-	82.5	84.2	88.3	-	82.1	83.1	87.6	-	76.5	77.0	83.7	-	84.5	85.2	88.7	-	84.9	85.9	89.0	-	75.7	76.8	81.5	-	74.3	75.4	80.7	-
Total reduction	85.8				85.1				84.3				79.1				86.1				86.6				78.0				76.4			

	L.S.D. at 0.01	F
Treatments	1.90465	18.58781
Stages	2.9020	189.028475
Intervals	7.42130	87.44626

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

by Sumi oil, phenthoate, fenitrothion, diazinon, fenvalerate, Kz oil and Misrona (4) oil, inducing average reactions of 86.1, 85.8, 85.1, 84.3, 79.1, 78.0 and 76.4 % in the total population of ***P. oleae***, within the same period, respectively, nearly each of them have caused significantly higher influence on plum trees than it did on pears.

No significant differences at P = 0.01 were observed between compounds of each tested group, also between Sumi oil and all members of the OP group, but appeared between Cidial K fortified oil and diazinon. Significancy recorded between fenvalerate (lower efficacy) and all of the other tested compounds (higher efficacy), except KZ single oil. Differences between the effect of OP compounds (as a group) and the fortified oil group was insignificant, but significant figures recorded between each of the other groups.

b- Susceptibility of different stages to the tested insecticides :

b.1- The nymphal stage :

This stage, proved on plum trees, as previously proved on pear trees to be the most susceptible stage to the tested compounds, where phenthoate, induced the highest percent of reduction to this stage, being 89.3, then followed with each of Cidial K, which gave an emulated percentage of reduction to nymphs of 89 %, Sumi oil, fenitrothion, diazinon, fenvalerate, KZ single oil and Misrona (4) single oil, which gave 88.7, 88.3, 87.6, 83.7, 81.5 and 80.7 % reduction to this stage, as an average reduction along 180 days, respectively (Table 74). Observations on nymphal reduction percentages induced by the tested compounds on plum trees, seemed to be higher -in general- than those caused by the same insecticides on pear, indicating to some extent that the host plant could play a partial role in the insect tolerance to different insecticides.

b.2- The ovipositing females :

The ovipositing individuals usually follows the nymphal stage in susceptibility to insecticides, as previously observed on pear trees, and recently on plum trees, but with different response to the tested insecticides, where on plum, Cidial K preceded all the others, including 85.9 % average reduction to this individuals, along 180 days of the experiment, followed with Sumi oil, phenthoate, fenitrothion, diazinon, fenvalerate, KZ oil and Misrona (4) oil, in respective order which induced 85.2, 85.0, 84.2, 83.1, 77.0, 76.8 and 75.4 % reduction, respectively. Observations on data indicated the higher efficacies of the tested insecticides, when compared with those recorded on pear trees, (Table 74).

b.3- The adult females (non-ovipositing) :

These individuals as always observed, were the most tolerant individuals to the tested insecticides. Cidial K gave the highest percentage of the adult females reduction, on plum trees, throughout 180 days of following data up, where it induced 84.9 % reduction in the adult females population, followed by Sumi-oil, phenthoate, fenitrothion, diazinon, fenvalerate, KZ oil and Misrona (4) oil, following the same insecticidal efficacies observed on both total population and ovipositing females, where each of them reduced the adult females population with 84.5, 83.2, 82.5, 82.1, 76.5, 75.7 and 74.3, respectively, during the same period of 180 days, Table (74).

c- Persistence of bioactivity :

The obtained data, as shown in Table (74), indicated that the first three post treatment counts of the OP compounds and fenvalerate (pyrethroid), were included with the highest percentages of reduction in the total population of ***P. oleae***, being 96.3, 97.2 and 96.0, as means for the first three counts of OP compounds and 97.2, 97.9 and 96.3, for the first three counts of the pyrethroid compound "fenvalerate", indicating that, the second post-treatment count records showed the highest percentages of insect reduction after each of these compounds application, without significant figures with the means of the first and the third post count records.

In case of the fortified mineral oils, the toxic effect gradually increased, to induce their maximum reductive potencies within the fourth post count period (60 days after application), resembling the gradually increased influence of the single mineral oils, which reached their highest efficacy after 45 days of application. Concerning the residual bioactivity of each tested insecticides, data indicated that Cidial K was the most effective compound after 180 days of application, where it caused 48.9 % insect reduction, followed with Sumi-oil, KZ oil, Misrona (4) oil, phenthoate, fenitrothion, diazinon and fenvalerate, inducing 47.9, 43.2, 42.9, 40.3, 39.7, 38.1 and 28.9, in descending respective order.

B- Season 1995 :

a- Effect on the total population :

Data recorded in Table (75) nearly showed related results to those of 1994 on the influences of the different tested insecticides in inducing different percentages of reduction in the total population of ***P. oleae***. The obtained data of the second year, of spring sprays, showed that Cidial K induced the superior lethal influence on the plum scale insect infesting plum trees when compared to the other tested compounds. From Table (75), it was clearly observed that Cidial K induced 87.2 % total insect population reduction, as means of reduction occurred throughout 6 months after application, followed with each of Sumi- oil, phenthoate, fenitrothion, diazinon, fenvalerate, KZ oil and Misrona (4) oil, where they caused 86.4, 85.0, 83.7, 82.5, 78.7, 77.0 and 75.7 % reduction in the total population of ***P. oleae***, respectively. Significant figures at P = 0.01 appeared between the means of reduction of the different groups, also between phenthoate

Table (75) : Effect of different insecticides on *P. oleae* in May (spring spray) at El-Quanater location, on plum trees calculated as % of insect stages reduction, in 1995.

Insecticides groups	Organophosphorus compounds												Pyrethroid compound			
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	93.8	96.5	100	96.8	93.1	94.3	100	95.8	92.3	93.2	100	95.2	94.8	96.9	100	97.2
30	94.9	97.0	100	97.3	94.2	96.3	100	96.8	93.0	94.2	100	95.7	95.5	95.8	100	97.1
45	92.8	96.2	100	96.3	91.7	95.9	96.5	94.7	91.2	93.6	95.3	93.4	95.2	94.6	98.4	96.1
60	90.1	92.5	97.3	93.3	89.3	91.6	95.2	92.0	87.7	90.7	92.6	90.3	93.2	84.7	89.3	85.7
75	86.8	87.3	91.6	88.6	84.3	86.1	89.5	86.6	83.5	84.8	88.2	85.5	93.3	75.5	81.3	76.7
90	81.2	83.3	87.1	83.9	80.8	82.6	87.2	83.5	80.3	81.5	86.2	82.7	61.6	65.4	79.2	68.7
180	35.5	38.2	43.6	38.1	33.6	35.5	40.6	36.6	31.5	33.2	39.1	34.6	25.3	27.9	33.3	28.8
Means of reduction	82.2	84.4	88.5	-	81.0	83.2	87.0	-	79.9	81.6	85.9	-	75.6	77.3	83.1	-
Total reduction	85.0				83.7				82.5				78.7			

Insecticides groups	Fortified oils								Mineral oils							
Insecticides	Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	88.3	88.9	92.7	89.9	88.7	89.1	93.4	90.4	75.0	75.9	78.2	76.2	74.7	75.2	76.1	75.3
30	89.2	89.8	96.3	91.8	89.8	89.8	97.3	92.3	78.8	79.3	89.6	82.6	78.0	78.5	88.3	81.[illegible]
45	92.6	93.7	79.2	94.5	93.3	93.8	97.9	95.0	86.6	87.2	92.5	88.8	84.3	86.5	91.7	87.[illegible]
60	95.2	95.8	9.77	96.2	96.1	96.7	97.6	96.8	87.2	87.9	90.4	88.5	86.3	87.1	89.6	87.4
75	93.3	93.7	95.2	94.1	94.0	94.8	96.2	95.0	80.3	84.1	85.2	83.2	81.6	83.2	84.3	83.1
90	89.2	89.9	91.6	90.2	90.3	91.6	93.2	91.7	73.4	77.5	81.7	77.5	71.7	75.6	79.2	75.5
180	43.8	46.5	53.1	47.8	44.8	47.2	55.3	49.1	39.5	41.2	45.1	41.9	36.2	38.5	41.7	38.4
Means of reduction	84.5	85.5	89.1	-	85.3	86.1	90.1	-	74.4	76.2	80.4	-	73.3	75.0	78.7	-
Total reduction	86.4				87.2				77.0				75.7			

	L.S.D. at 0.01	F
Treatments	1.88153	21.57444
Stages	3.61562	1.18839
Intervals	7.89826	80.84146

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

and fenvalerate (pyrethroid), Cidial K (fortified mineral oil), and with each of the two single mineral oils (KZ and Misrona-4). Significant differences highly appeared between Misrona (4) oil (of lower efficacy) and all of the tested insecticides (of higher efficacies) except KZ oil of the same group.

b- Effect on different stages :

Observation on susceptibility of the different ***P. oleae*** stages to the tested insecticides, showed comparatively high susceptibility of the nymphal stage and the differences were statistically highly significant compared to adults and in some cases when compared to those of the ovipositing females.

The same descending efficacies of Cidial K, Sumi- oil, phenthoate, fenitrothion, diazinon, fenvalerate, KZ and Misrona-4 oils, were recorded on the nymphal stage as well as the ovipositing females and adult females, with the percentages of reduction recorded in Table (75).

c- Persistence of bioactivity :

As shown in Table (75), in cases of the OP and the pyrethroid compounds, the first, second and the third post-treatment count records, have registered the highest means of reduction in ***P. oleae*** total population being an average of 95.9, 96,6 & 94.8 % for the three OP successive post counts, and 97.2, 97.1 and 96.1 % for those of the pyrethroid compound, indicating that the second post count of the OP compounds loaded with the highest % of insect reduction, where in case of the pyrethroid compound, each of the first and second post counts, were almost equal; however, no significant differences were observed between different records of the three successive post counts of both OP and the pyrethroid compounds. In relation to the fortified mineral oils, records of the fourth post counts were observed to include the highest percentages of reduction in the total population, being 96.2 and 96.7 %, for each of Cidial K and Sumi-oil, respectively. Almost, the same results were obtained with the single mineral oils, where the third post count of KZ oil, and the fourth post count of Misrona (4) oil, were included with the highest percentages of insect reduction, when compared with the other post counts.

5.2.2- Effect of autumn sprays :

A- Season 1994 :

a- Effect on total population :

As were previously observed on data of pear, the tested insecticides had lower efficacies when sprayed in autumn than when sprayed in spring to control ***P. oleae*** on both pear and plum trees. Table (76) showed the comparative influence of each tested insecticide in inducing different percentages of reduction either in ***P. oleae*** total population, or in any of its other stages.

From Table (76), Cidial K, appeared to have the most effective influence in reducing the total population of ***P. oleae***, when compared with the other tested insecticides. Cidial K, which reduced 85.8 % of the insect total population, was followed with each of Sumi-oil, phenthoate, fenitrothion, diazinon, KZ oil, Misrona oil and fenvalerate, more or less, the same sequence of insecticidal efficacies obtained in spring of 1994. The sequential compounds induced 84.7, 80.7, 79.2, 77.1, 75.2, 73.6 and 73.5, respectively. Significancy at $P = 0.01$ appeared between means of reduction of different tested groups, but not between the means of each fenvalerate "pyrethroid" and the mineral oils group or any of its members, *i.e.*, KZ or Misrona (4) single oils. Significant differences were observed also between each member of the fortified mineral oils and any of the other tested compounds. Efficacy of each of the single mineral oils, were observed to be significantly lower than any of the tested insecticides, except fenvalerate, also the effect of phenthoate was significantly higher than diazinon.

Table (76) : Effect of different insecticides on *P. oleae* in Sep. (autumn spray) at El-Quanater location, on plum trees calculated as % of insect stages reduction, in 1994.

Insecticides groups	Organophosphorus compounds												Pyrethroid compound				Fortified oils								Mineral oils							
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate				Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	94.6	96.3	100	96.9	92.6	95.1	100	95.9	88.8	94.2	100	94.3	95.6	97.0	100	97.6	85.3	86.2	93.7	88.4	86.3	87.7	94.2	98.4	74.3	76.1	77.8	76.1	72.6	75.1	78.3	75.3
30	43.7	97.2	100	96.9	92.2	96.3	100	96.2	86.7	91.5	100	92.7	96.8	98.2	100	98.3	88.5	89.4	95.7	91.2	89.5	91.4	95.0	91.9	78.5	80.6	88.6	82.6	76.8	79.5	85.7	80.7
45	88.2	93.4	100	93.9	85.7	89.3	96.5	90.5	83.9	87.7	94.6	88.7	93.1	95.3	96.2	94.9	93.6	93.9	96.8	94.8	94.7	95.2	97.3	95.7	82.7	86.2	93.6	87.5	81.2	83.6	91.6	85.5
60	82.7	86.5	92.2	87.1	82.8	85.1	90.8	86.2	80.0	83.8	89.7	84.5	79.6	81.2	90.8	83.9	94.0	95.2	96.9	95.4	95.5	95.8	97.0	96.1	85.0	87.3	89.3	87.2	82.9	85.1	86.3	84.8
75	78.5	81.3	85.2	81.7	77.0	81.6	82.3	80.3	74.1	76.6	83.5	78.1	60.6	60.8	71.2	64.2	90.3	91.7	93.8	91.9	92.3	93.6	95.4	93.8	76.4	81.2	83.6	80.4	73.4	82.5	80.9	78.9
90	69.1	-	-	69.1	66.4	-	-	66.4	66.5	-	-	66.5	38.8	-	-	38.8	79.3	-	-	79.3	83.2	-	-	83.2	66.8	-	-	66.8	64.2	-	-	64.2
180	25.4	28.6	36.3	30.1	24.7	26.9	33.8	28.5	22.6	22.9	32.8	26.1	8.7	11.2	14.6	11.5	45.5	45.8	51.2	47.5	44.2	47.1	53.3	48.5	36.3	38.6	42.5	39.1	35.4	39.3	39.9	38.2
Means of reduction	76.0	80.6	85.6	-	74.5	79.1	83.9	-	71.8	76.1	83.4	-	67.6	74.0	78.8	-	82.4	83.7	88.0	-	88.7	85.1	88.7	-	71.4	75.0	79.2	-	69.5	74.2	77.1	-
Total reduction	80.7				79.2				77.1				73.5				84.7				85.8				75.2				73.6			

	L.S.D. at 0.01	F
Treatments	2.37762	25.91329
Stages	5.11326	9.48833
Intervals	10.98376	49.59234

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

Table (76) : Effect of different insecticides on *P. oleae* in Sep. (autumn spray) at El-Quanater location, on plum trees calculated as % of insect stages reduction, in 1994.

Insecticides groups	Organophosphorus compounds												Pyrethroid compound				Fortified oils								Mineral oils							
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate				Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym	Mean	Ad.	Ov.	Nym	Mean	Ad.	Ov.	Nym	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym	Mean	Ad.	Ov.	Nym	Mean	Ad.	Ov.	Nym	Mean	Ad.	Ov.	Nym	Mean
15	94.6	96.3	100	96.9	92.6	95.1	100	95.9	88.8	94.2	100	94.3	95.6	97.0	100	97.6	85.3	86.2	93.7	88.4	86.3	87.7	94.2	98.4	74.3	76.1	77.8	76.1	72.6	75.1	78.3	75.3
30	43.7	97.2	100	96.9	92.2	96.3	100	96.2	86.7	91.5	100	92.7	96.8	98.2	100	98.3	88.5	89.4	95.7	91.2	89.5	91.4	95.0	91.9	78.5	80.6	88.6	82.6	76.8	79.5	85.7	80.7
45	83.2	93.4	100	93.9	85.7	89.3	96.5	90.5	83.9	87.7	94.6	88.7	93.1	95.3	96.2	94.9	93.6	93.9	96.8	94.8	94.7	95.2	97.3	95.7	82.7	86.2	93.6	87.5	81.2	83.6	91.6	85.5
60	82.7	86.5	92.2	87.1	82.8	85.1	90.8	86.2	80.0	83.8	89.7	84.5	79.6	81.2	90.8	83.9	94.0	95.2	96.9	95.4	95.5	95.8	97.0	96.1	85.0	87.3	89.3	87.2	82.9	85.1	86.3	84.8
75	78.5	81.3	85.2	81.7	77.0	81.6	82.3	80.3	74.1	76.6	83.5	78.1	60.6	60.8	71.2	64.2	90.3	91.7	93.8	91.9	92.3	93.6	95.4	93.8	76.4	81.2	83.6	80.4	73.4	82.5	80.9	78.9
90	69.1	-	-	69.1	66.4	-	-	66.4	66.5	-	-	66.5	38.8	-	-	38.8	79.3	-	-	79.3	83.2	-	-	83.2	66.8	-	-	66.8	64.2	-	-	64.2
180	25.4	28.6	36.3	30.1	24.7	26.9	33.8	28.5	22.6	22.9	32.8	26.1	8.7	11.2	14.6	11.5	45.5	45.8	51.2	47.5	44.2	47.1	53.3	48.5	36.3	38.6	42.5	39.1	35.4	39.3	39.9	38.2
Means of reduction	76.0	80.6	85.6	-	74.5	79.1	83.9	-	71.8	76.1	83.4	-	67.6	74.0	78.8	-	82.4	83.7	88.0	-	88.7	85.1	88.7	-	71.4	75.0	79.2	-	69.5	74.2	77.1	-
Total reduction	80.7				79.2				77.1				73.5				84.7				85.8				75.2				73.6			

	L.S.D. at 0.01	F
Treatments	2.37762	25.91329
Stages	5.11326	9.48833
Intervals	10.98376	49.59234

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

b- Effect on different stages :

b.1- The nymphal stage :

The obtained data indicated that, the nymphs were the most susceptible stage to the tested insecticides, (Table 76), whereas Cidial K caused 88.7 % reduction in their population, as mean of reductions occurred throughout the total time of the experiment (180 days), followed with each of Sumi oil, phenthoate, fenitrothion, diazinon, KZ oil, fenvalerate and Misrona (4) oil, which induced 88.0, 85.6, 83.9, 83.4, 79.2, 78.8 and 77.1 % nymphal reduction, in respective order.

b.2- The ovipositing females :

These individuals which usually were observed to follow the nymphal stage on susceptibility, suffered 85.1, 83.7, 80.6, 79.1, 76.1, 75.0, 74.2 and 74.0 % reductions, when exposed to each of Cidial K, Sumi oil, phenthoate, fenitrothion, diazinon, KZ single oil, Misrona (4) single oil and fenvalerate, respectively, Table (76).

b.3- The adult (non-ovipositing) females :

In all studied cases, these individuals were the most tolerant, amongst the other insect stages, when exposed to the tested compounds (Table 76). During the autumn experiment, in the first studied year of 1994, these individuals followed the same sequence of the insecticidal influence on nymphs, which induced 83.7, 82.4, 76.0, 74.5, 71.8, 71.4, 69.5 and 67.6 % adult females reductions for each of Cidial K, Sumi oil, phenthoate, fenitrothion, diazinon, KZ and Misrona (4) oils and fenvalerate, respectively. Significant differences appeared between the susceptibilities of the nymphal stage (the highest susceptible stage) and that of adult females (the least susceptible stage), but in some cases also between the nymphal stage and the ovipositing females, *i.e.*, in case of diazinon, and between the adult females and the ovipositing females, *i.e.*, in case of fenvalerate.

c- Persistence of bioactivity :

When efficacy of each insecticidal group, after the different successive post-treatment counts was considered, it was obvious that, the fist three post count records of OP and pyrethroid compounds, exhibited the highest percentages of insect total population reduction, being of an average of 95.7, 95.3 and 91.0 % for those of OP compounds and 97.6, 98.3 and 94.9 % for the three post counts after fenvalerate treatment, without significant differences between data of the three post counts of the compounds investigated, indicating the instant influences of both OP and pyrethroid tested compound on the plum scale insect, which observed to reach their maximum toxicities within about 30 days of application, subsequently, degradation started gradually in the OP compounds to give significant differences starting from the lower records of the fifth post count, while in case of the pyrethroid compound, it gave significantly lower records, starting from the fourth post count, indicating the comparatively rapid degeneration of the compound.

In case of the fortified mineral oils, their latent effects -as observed on pear trees- also recorded on plum trees which appeared within the fourth post count records, being 96.1 and 95.4 % reduction in the insect total population for each of Cidial K and Sumi oil respectively, where significancy appeared after 90 days of application (in records of the sixth post counts), indicating the comparative stabilities of these formulations.

Concerning the two single mineral oils (KZ and Misrona), they gave their maximum influence after 45 days of application (in records of the third post count), indicating to some extent their delayed and latent effect in inducing considerable percentage of reduction in ***P. oleae*** total population.

B- season 1995 :

a- Effect on the total population :

Data obtained and shown in Table (77), clearly showed almost similar results to those of the preceding year, with one exception of fenvalerate, which exceeded the influence of Misrona (4) oil in its reducing efficacity to the total population of ***P. oleae***. Data showed Cidial K fortified mineral oil to be the most effective tested insecticide in inducing reduction in the insect total population, where it caused 85,6 % within the experiment of 180 days, followed with Sumi oil, phenthoate, fenitrothion, diazinon, KZ oil, fenvalerate and Misrona (4) oil, each of them caused 84.2, 79.8, 77.3, 76.7, 75.3, 73.4 and 73.1, respectively. Significant figures appeared between the separate groups, but not between the single mineral oils group and the pyrethroid compound "fenvalerate". Within the members of each group, significancy arised between phenthoate (of higher efficacy) and each of fenitrothion and diazinon (of lower efficacies), but not between fenitrothion nd diazinon, also no significant differences occurred between the members of fortified mineral oils group, also not between KZ and Misrona single mineral oils. High significant differences were observed between each of "Cidial K and Sumi oil" and all of the tested groups.

b- Effect on the different stages :

b.1- The nymphal stage :

Observations on the susceptibility of the different stages of ***P. oleae*** to the tested insecticides, on plum trees, in the second studied year, showed as shown in Table (77), the comparatively higher susceptibility of nymphs as compared with those of the other insect stages to the applied insecticides. Cidial K fortified oil, was the most effective formulation on the nymphal stage, since it caused 89.4 % reduction within the time of the experiment, then followed with each of Sumi oil, fenitrothion, phenthoate, diazinon, KZ oil and (Misrona and

Table (77) : Effect of different insecticides on *P. oleae* in Sep. (autumn spray) at El-Quanater location, on plum trees calculated as % of insect stages reduction, in 1995.

Insecticides groups	Organophosphorus compounds												Pyrethroid compound				Fortified oils								Mineral oils							
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate				Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	93.2	94.7	100	96.0	90.7	92.5	100	94.4	88.6	90.3	98.6	92.5	97.6	97.9	100	98.5	86.3	87.6	92.5	88.8	87.2	87.9	96.6	90.6	75.2	78.3	79.6	77.7	72.6	74.8	81.3	76.2
30	93.0	95.6	100	96.2	88.5	91.7	100	93.4	86.5	89.2	98.0	91.2	97.8	98.0	100	98.6	89.2	90.6	96.2	92.0	90.5	92.3	98.5	93.8	78.2	82.3	90.2	83.6	75.1	80.8	88.4	81.4
45	86.3	91.4	96.8	91.5	86.0	90.2	100	92.1	85.3	88.7	92.6	88.9	91.3	93.7	98.2	94.4	92.4	92.8	96.7	93.7	92.6	94.8	100	95.8	82.6	84.2	92.0	86.3	79.5	83.7	90.6	84.6
60	81.6	87.2	89.3	86.0	82.3	85.6	93.6	87.2	81.0	82.4	88.7	84.0	78.5	78.8	92.3	83.2	93.5	94.5	97.3	95.1	94.2	94.8	98.2	95.7	83.1	85.3	88.7	85.7	80.9	82.5	87.2	83.5
75	76.4	79.5	81.3	79.1	74.7	76.2	87.3	79.4	75.2	73.3	84.7	77.7	61.9	63.3	67.2	64.1	88.3	88.7	91.5	89.5	90.1	90.6	92.8	91.2	72.7	79.4	85.6	79.2	69.8	77.4	83.7	76.9
90	68.6	-	-	68.6	64.0	-	-	64.0	62.9	-	-	62.9	44.6	-	-	44.6	80.3	-	-	80.3	81.2	-	-	81.2	64.6	-	-	64.6	61.6	-	-	61.6
180	27.6	33.4	35.2	32.1	27.2	32.6	31.4	30.4	25.8	28.7	32.6	29.0	7.9	8.3	13.4	9.9	44.2	46.3	48.6	46.4	45.7	45.3	50.4	47.1	38.2	41.8	43.6	41.2	34.2	38.5	39.9	37.5
Means of reduction	75.2	80.3	83.8	-	73.3	78.1	85.4	-	72.2	75.4	82.5	-	68.5	73.3	78.5	-	82.0	83.4	87.1	-	83.1	84.3	89.4	-	70.7	75.2	80.0	-	67.7	73.0	78.5	-
Total reduction	79.8				77.3				76.7				73.4				84.2				85.6				75.3				73.1			

	L.S.D. at 0.01	F
Treatments	2.44532	22.87248
Stages	0.77388	43.14515
Intervals	10.56918	50.67568

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

fenvalerate), which caused 87.1, 85.4, 83.8, 82.5, 80.0 and (78.5) %, respectively.

b.2- The ovipositing female individuals :

The ovipositing females, observed to follow the insect nymphal stage in susceptibility to the tested insecticides, where Cidial K was observed to be the most potent tested one on that stage, it caused 84.3 % reduction, followed with Sumi oil, phenthoate, fenitrothion, diazinon, KZ oil, fenvalerate and Misrona mineral oil (4), which caused 83.4, 80.3, 78.1, 75.4, 75.2, 73.3 and 73.0, respectively.

b.3- The adult (non-ovipositing) females :

The same sequence of insecticidal potencies on the ovipositing females, was also recorded on the adult non-ovipositing females, the least susceptible insect stage observed during the total time of this experiment, where they with same previous arrangement caused 83.1, 82.0, 75.2, 73.3, 72.2, 70.7, 68.5 and 67.7 % reduction, throughout the total period of experiment. Significant figures appeared between susceptibility of different stages, where the L.S.D. at P = 0.01 was very small)0.77388), as previously shown in Table (77).

c- Persistence of bioactivity :

Data of different post count records of the tested insecticides showed, as shown in Table (77), significant variation in percentage of reduction within each period of the different post count records. In concern to the OP and pyrethroid compounds, the first three post count records were found to include the highest % of reduction (as always did), with referring to the first and second post count records to be occupied with highest values induced by these two groups, whereas in case of the fortified mineral oils, the third post count data of Cidial K and the fourth of Sumi oil, showed the highest percentages of insect reduction, throughout all of the experimental period. In relation to the single mineral oils, third post count data observed to give the highest records of insect population reduction compared with any other records.

5-2-3- Comparative studies on the effect of different sprays on the plum scale insect infesting plum trees :

Data in Table (78), showed the different percentages of insect reduction which caused by the different tested insecticides on ***P. oleae***, after spring and autumn sprays, also the general means of reduction after the two sprays. From data, it could be concluded that the spring sprays on plum, as were on pear, were more effective than the autumn sprays for each of the tested insecticides, where all percentages of insect reduction after the spring sprays, were higher than those obtained after the autumn sprays, as shown in Table (78).

Comparative data of general reduction, which were calculated as means of spring and autumn sprays, indicated that Cidial K caused the highest percentage of insect total population reduction, being 86.3, followed by sumi oil, phenthoate, fenitrothion, diazinon, KZ oil, fenvalerate and Misrona (4) oil, where each caused 85.4, 82.9, 81.8, 80.3, 76.4, 76.2 and 74.8 %, total insect reduction, in respective order.

5-3- Effect of the tested insecticides on *P. oleae*, infesting apple trees, at Nobariya location :

5.3.1- Effect of spring sprays :

A- Season 1994 :

a- Effect on total population :

Data in Table (79) summarize the obtained results on apple trees, at Nobariya location. Obtained results were almost similar to those obtained from

Table (78) : The comparative percentages of the insect reduction, induced by the tested insecticides to *P. oleae* infesting plum trees after spring and autumn sprays.

Group	Organophosphorus compounds									Pyrethroid			Fortified oils						Mineral oils					
Compound	Phenthoate			Fenitrothion			Diazinon			Fenvalerate			Sumi oil			Cidial K			KZ oil			Misrona oil		
Stage	ad.	ov.	nym.	ad.	ov.	nym.	ad.	ov.	nym.	ad.	ov.	nym.	ad.	ov.	nym.	ad.	ov.	nym.	ad.	ov.	nym.	ad.	ov.	nym.
Spring sprays	82.7	84.7	88.9	81.8	83.7	87.7	81.0	82.4	86.8	76.1	77.2	83.4	84.5	85.4	88.9	85.1	86.0	89.6	75.1	76.5	81.0	73.8	75.2	79.7
Means	85.4			84.4			83.4			78.9			86.3			86.9			77.5			76.2		
Autumn sprays	75.6	80.5	84.7	73.9	78.6	84.7	72.0	75.8	83.5	68.1	73.7	78.7	82.2	83.6	87.6	83.4	84.7	89.1	71.1	75.1	79.6	68.6	73.6	77.8
Means	80.3			79.1			77.1			73.5			84.5			85.7			75.3			73.3		
General mean	82.9			81.8			80.3			76.2			85.4			86.3			76.4			74.8		

- Means were calculated as mean of the two years.

ad. : adult females, ov. : ovipositing females, nym. : nymphs

Table (79) : Effect of different insecticides on *P. oleae* in May (spring spray) at El-Nobaryia location, on apple trees calculated as % of insect stages reduction, in 1994.

Insecticides groups	Organophosphorus compounds												Pyrethroid compound			
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	87.6	88.0	93.0	89.5	88.1	88.9	93.5	90.2	88.6	89.3	94.3	90.7	93.5	93.8	100	95.8
30	87.0	87.8	94.2	89.7	88.2	88.5	94.6	90.4	88.7	89.9	95.3	91.3	92.3	93.4	100	95.2
45	85.8	86.6	94.8	89.1	87.1	88.3	95.7	90.3	87.9	88.2	96.3	90.8	89.5	89.9	100	93.1
60	84.6	85.2	94.2	88.0	85.1	86.2	95.0	88.8	85.3	86.7	95.1	89.0	75.2	76.2	81.3	77.6
75	78.5	79.6	90.1	82.7	79.9	81.3	91.3	84.1	80.3	81.7	93.2	85.1	62.3	65.7	72.6	66.9
90	71.6	73.2	85.3	76.7	73.2	74.6	87.3	76.4	75.1	75.8	88.8	79.9	53.1	53.6	58.2	55.0
180	32.1	32.6	34.7	33.1	32.7	33.4	34.6	33.6	33.3	34.7	35.1	34.4	24.3	25.6	27.4	25.8
Means of reduction	75.3	75.1	83.8	-	76.3	77.3	84.6	-	77.0	78.0	85.4	-	70.1	71.2	77.1	-
Total reduction	78.4				79.4				80.1				72.8			

Insecticides groups	Fortified oils								Mineral oils							
Insecticides	Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	82.7	83.1	86.2	84.0	82.0	82.6	87.1	83.9	71.6	72.3	86.5	75.8	70.6	70.0	82.7	75.1
30	85.8	87.1	89.6	87.5	84.7	86.3	88.7	86.6	75.6	75.7	88.1	79.8	74.8	75.2	87.7	79.2
45	89.6	90.5	93.6	91.2	88.2	91.2	92.5	90.6	82.0	82.5	89.3	84.6	80.8	81.9	88.3	83.7
60	93.6	94.2	95.6	94.5	93.0	94.1	95.1	94.1	81.6	82.0	88.3	83.9	80.8	81.3	87.4	83.2
75	89.0	89.6	91.3	89.9	88.3	89.2	90.7	89.4	76.9	77.2	83.5	79.2	76.2	77.2	82.7	78.7
90	83.4	83.7	88.5	85.2	82.6	83.2	88.2	84.7	71.4	72.6	78.3	74.1	70.8	71.8	76.2	72.9
180	46.3	48.3	52.2	48.9	44.2	45.1	50.6	46.6	40.3	42.7	47.8	43.6	40.0	40.5	46.9	42.2
Means of reduction	81.5	82.4	85.3	-	80.4	81.7	84.7	-	71.3	72.1	79.8	-	70.6	71.1	78.8	-
Total reduction	83.0				82.3				74.4				73.5			

	L.S.D. at 0.01	F
Treatments	2.519426	9.60649
Stages	5.11326	1.65388
Intervals	7.057208	89.35714

Ad : Adult females
Ov : Ovipositing females
Nym. : Nympahl stage

experiments of pear and plum orchards, where the fortified mineral oils showed the highest influences on the plum scale, while the pyrethroid compound and the single mineral oils exhibited the least effects.

As previously shown in Table (79), Sumi oil was found to be the most efficient of all of the tested insecticides, where it induced 83.0 % total population reduction to the scale insect, as mean of different reductions throughout the total time of the experiment (more or less the same results on pear trees, after spring sprays), followed by each of Cidial K, diazinon, fenitrothion, phenthoate, KZ oil, Misrona (4) oil and fenvalerate, where each caused 82.3, 80.1, 79.4, 78.4, 74.4, 73.5 and 72.8 % reductions, respectively, with some different insecticidal sequences to those of pear and plum. Statistical significancy did not recorded between any two members of the same insecticidal group, but significant differences appeared between the means of insect reduction of each group and those of the other groups, except between fenvalerate and the single mineral oils group, which showed insignificant difference, along to the total time of experiment.

b- Susceptibility of different *P. oleae* stages to the tested insecticides :

b.1- the nymphal stage :

Observations on obtained data, as shown in Table (79), demonstrated the high susceptibility of the nymphal stage (especially crawlers) to all tested insecticides. Diazinon when applied on apple trees, gave the highest percentage of reduction to the nymphal population, being 85.4, followed by each of sumi oil, Cidial K, fenitrothion, phenthoate, KZ oil, Misrona (4) oil and fenvalerate, causing 85.3, 84.7, 84.6, 83.8, 79.8, 78.8 and 77.1 % reduction to the nymphs, respectively (as mean of different percentages of reductions throughout different post counts after applications). Observations on the previously mentioned results, indicated at Nobariya location, on apple trees, that diazinon for the first time have preceded each of the two fortified mineral oils in controlling ***P. oleae*** nymphs, but without significant differences between means of reduction. This phenomenon could be explained by comparing data of nymphal reduction on pear trees (at El-Quanater location), with the correspondent data of apple trees (at Nobariya location), starting from the records of the fourth post counts, which showed the beginning of the OP compounds degeneration. In concern to data of pear trees, the records of the fourth, fifth and sixth post counts were 90.8, 87.2 & 80.4 %, respectively, where data of the nymphal reductions on apple trees, of the same three successive post counts were 95.1, 93.2 & 88.8 %, indicating comparatively higher percentages of reduction on apple trees. From the previously mentioned, it could be concluded that the dry climate of Nobariya, also the different host plant type (apple), could be factors contributing to the higher stability of diazinon and/or the low tolerance of ***P. oleae*** nymphal stage at Nobariya location, when compared with those of El-Quanater El-Khairiya location.

b.2- The ovipositing female individuals :

The ovipositing females as previously observed on pear and plum, on apple trees, also observed to come following the nymphal stage in susceptibility among the tested insecticides, Table (79). All tested compounds induced significant differences among the nymphal stage and ovipositing female populations, except the fortified mineral oils, which showed comparatively high, but insignificant influence on them both, at P = 0.01, the matter that could be attributed to the high toxicity of the fortified mineral oils to both stages, consequently, any differences in % reduction, were statistically canceled. Sumi oil, was the most effective tested insecticide on the ovipositing females of ***P. oleae***, it caused 82.4 % reduction throughout all the experiment period (180 days), followed with Cidial K, diazinon, fenitrothion, phenthoate, KZ oil, fenvalerate and misrona (4) oil, where each induced 81.7, 78.0, 77.3, 75.1, 72.1, 71.2 and 71.1 % reduction, respectively.

b.3- The adult non-ovipositing females stage :

These individuals showed the lowest susceptibility and the highest tolerance among the tested compounds, as shown in Table (79), where the fortified mineral oils induced the highest toxic influence. Sumi oil and Cidial K caused 81.5 and 80.4 % reduction during the time of the experiment, followed with diazinon, fenitrothion, phenthoate, KZ & Misrona (4) single oils and fenvalerate, which induced 77.0, 76.3, 75.3, 71.3, 70.6 and 70.1 %, respectively with the same sequence of the ovipositing females. No significant figures recorded among the tested insecticides on the ovipositing and adult females, after different applications with all tested insecticides.

c- Persistence of bioactivity :

Observations on the different intervals after sprayings in relation to the tested insecticides efficacies on ***P. oleae*** demonstrated that the OP and pyrethroid compounds showed their highest influences during the periods of the first three successive post counts, where the OP compounds recorded 90.1, 90.5 and 90.1 %, calculated as means of reductions of the first, second and the third post treatment counts of all tested OP insecticides, whereas the pyrethroid compound (fenvalerate), induced 95.8, 95.2 and 93.1 % general insect reduction, in concern to the previously mentioned post counts, respectively.

In relation to the OP compounds, they started to lose their efficacies beginning from the fifth or the sixth post counts, where significant differences in their efficacies on ***P. oleae*** started to appear, when compared with those of the first three ones, while in case of the pyrethroid insecticide, significancy started to appear beginning from the fourth post count data, indicating fast degeneration in its efficacy after nearly less than 60 days of application. In case of the fortified mineral oils, and single mineral oils, the highest efficacies appeared throughout the fourth and the third pot counts records, respectively in a similar way to what observed on pear and plum trees. A gradual degeneration for them both occurred to show significantly low toxic influences starting from the sixth post count data, as shown in Table (79).

As previously observed on both pear and plum trees, the fortified mineral oils showed, on apple trees, to be the highest persistent compounds, where their mean of insect reduction was 47.8 % (48.9 for Sumi oil and 46.6 % for Cidial K), after 180 days of applications indicating and supporting their long-lived action wherever they used and on different host plants (*i.e.*, pear, plum, or apple). The single mineral oils (KZ and Misrona), followed the fortified mineral oils in persistence, where they caused a mean of 42.9 % insect reduction (43.6 and 42.2 % for each of KZ and Misrona oils, respectively), followed with the OP compounds and the pyrethroid, causing means of insect reduction of 33.7 and 25.8 %, respectively, after 180 days of application (records of the seventh post count).

B- season 1995 :

a- Effect on the total population :

Results recorded in the second studied year, were to a great extent similar to those of the previous year, at the same location and after the spring insecticidal applications, as shown in Table (80). Obtained data clearly showed that Sumi oil (fortified mineral oil) was the most reducing agent to ***P. oleae*** total population throughout a particular time, whereby it induced 82.6 % insect reduction, as a mean of different reductions occurred within 180 days of the control experiment. That formulation was followed in potency with each of Cidial K, diazinon, fenitrothion, phenthoate, KZ oil, Misrona (4) oil, and

Table (80) : Effect of different insecticides on *P. oleae* in May (spring spray) at El-Nobaryia location, on apple trees calculated as % of insect stages reduction, in 1995.

Insecticides groups	Organophosphorus compounds												Pyrethroid compound			
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	84.8	85.7	93.2	87.9	85.0	86.7	94.8	88.8	86.3	88.2	95.1	89.9	92.9	94.3	100	95.7
30	84.2	85.3	94.7	88.1	84.8	85.9	95.2	88.6	87.2	88.7	95.7	90.5	91.7	92.6	100	94.8
45	83.0	84.6	95.3	87.6	83.7	84.9	96.0	88.2	86.2	86.8	97.3	90.1	88.2	89.6	96.5	91.4
60	81.2	82.5	93.6	85.8	81.7	83.2	94.2	86.4	84.2	84.8	95.3	88.1	74.3	76.2	80.5	77.0
75	76.8	80.3	88.2	82.4	77.2	80.6	89.5	82.4	79.9	82.5	91.3	84.6	63.1	66.2	71.7	67.0
90	70.5	71.3	85.6	75.8	70.8	71.3	86.6	76.2	73.5	74.2	88.7	78.8	52.8	53.6	58.1	54.8
180	30.0	31.7	33.2	31.6	30.7	32.6	34.5	32.6	33.0	35.6	38.6	35.7	23.6	25.6	28.9	26.0
Means of reduction	72.9	74.5	83.4	-	73.4	75.0	84.4	-	75.8	77.3	86.0	-	69.5	71.2	76.5	-
Total reduction	77.0				77.6				79.7				72.4			

Insecticides groups	Fortified oils								Mineral oils							
Insecticides	Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	81.3	82.5	87.3	83.7	80.8	81.7	87.0	83.2	73.0	73.2	84.1	76.8	72.1	72.5	82.6	[illegible]
30	85.7	86.4	89.8	87.3	85.2	85.6	88.3	86.4	76.2	76.5	87.2	80.0	75.0	75.9	86.2	[illegible]
45	90.0	91.6	99.2	91.9	89.1	90.3	94.0	91.1	82.5	83.1	88.6	84.7	82.2	83.0	86.5	[illegible]
60	93.5	93.9	95.8	94.4	92.6	93.5	94.2	93.4	82.0	82.6	88.2	84.3	81.6	81.5	86.3	[illegible]
75	88.2	88.7	89.6	88.8	86.2	87.9	89.3	87.8	77.8	78.3	88.5	79.5	76.3	77.1	81.1	[illegible]
90	80.3	80.9	87.1	82.8	80.0	80.2	85.3	81.8	71.7	71.6	78.3	73.9	68.5	69.3	76.8	[illegible]
180	48.6	49.2	51.3	49.7	45.6	46.3	49.2	47.0	39.2	41.3	46.2	42.2	38.6	42.3	44.2	[illegible]
Means of reduction	81.1	81.9	85.0	-	79.9	80.8	83.9	-	71.8	72.4	79.3	-	70.6	71.7	77.7	-
Total reduction	82.6				81.5				74.5				73.3			

	L.S.D. at 0.01	F
Treatments	2.72311	8.070465
Stages	9.56604	3.55606
Intervals	6.991404	89.112230

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

fenvalerate, each caused 81.5, 79.7, 77.6, 77.0, 74.5, 73.3 and 72.4 % reduction, respectively. When compared statistically as groups, no significant differences were observed between the single mineral oils and the pyrethroid compound, while these differences were significant between all of the other tested groups. When compared as compounds, Sumi oil and Cidial K were found to be significantly more effective at P = 0.01 compared to all other tested compounds, also diazinon showed high potency when recorded significant differences with compounds belonging to other groups, but not with its relatives of the OP group. No significancy was recorded between any compound and other members of its group (Table 80).

b- Susceptibility of different stages :

b.1- Susceptibility of the nymphal stage :

According to data recorded in Table (80), diazinon was the most effective insecticide on the nymphal stage, where it induced the highest % of reduction amongst other tested insecticides, being 86.0 % along the total time of experiment, followed with each of Sumi oil, fenitrothion, Cidial K, phenthoate, KZ oil, Misrona (4) oil and fenvalerate, nearly the same insecticidal sequence of the previous year, with one exception of fenitrothion, which preceded Cidial K in 1995.

b.2- Susceptibility of the ovipositing females :

Data of the second year of spring sprays, on apple, also demonstrated that, the ovipositing females followed the nymphal stage in susceptibility to the tested isecticides, (Table 80), where Sumi-oil caused 81.9 % reduction to these individuals during the whole time of experiment, subsequently, followed with Cidial K, diazinon, fenitrothion, phenthoate, KZ oil, Misrona (4) oil and fenvalerate, causing 80.8, 77.3, 75.0, 74.5, 72.4, 71.7 and 71.2 % reduction, within the same period, respectively, almost following the same sequence of efficacies of the previous year.

fenvalerate, each caused 81.5, 79.7, 77.6, 77.0, 74.5, 73.3 and 72.4 % reduction, respectively. When compared statistically as groups, no significant differences were observed between the single mineral oils and the pyrethroid compound, while these differences were significant between all of the other tested groups. When compared as compounds, Sumi oil and Cidial K were found to be significantly more effective at P = 0.01 compared to all other tested compounds, also diazinon showed high potency when recorded significant differences with compounds belonging to other groups, but not with its relatives of the OP group. No significancy was recorded between any compound and other members of its group (Table 80).

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b.3- Susceptibility of adult (non-ovipositing) females :

These individual which always showed the lowest susceptibility amongst the other insect stages to the different tested compounds, also followed in spring sprays of 1995 the same order of the lowest susceptibility and were reduced by 81.1 % with Sumi oil followed by Cidial K, diazinon, fenitrothion, phenthoate, KZ oil, misrona (4) oil and fenvalerate, each of them caused 79.9, 75.8, 73.4, 72.9, 71.8, 70.6 and 69.5 % reduction, respectively, during the same studied period.

c- Persistence of bioactivity :

Results in Table (80), indicated that, in case of the OP and pyrethroid compounds, the first three post count records have owned the highest percentages of insect total population reduction, especially with the pyrethroid compound, where with the OP compounds, the fourth post count could be added, but in case of the fortified mineral oils and single mineral oils, the highest percentages of reduction were observed in the third and fourth post counts, and could be extended up to the fifth post treatment count records, especially with the fortified mineral oils, before significant differences between the subsequent counts appeared in the sixth post treatment count, indicating significant degradations of bioactivity. These results were identical with results of 1994.

5.3.2- Effect of the autumn sprays :

A- Season 1994 :

a- Effect on total population :

Data of the first season of the autumn sprayings, on apple trees, at Nobariya location, indicated as shown in Table (81) that, Sumi oil, not diazinon as was in spring sprays, was the most potent-tested insecticide in inducing the highest % reduction in ***P oleae*** total population throughout the total time of the

Table (81) : Effect of different insecticides on *P. oleae* in Sep. (autumn spray) at El-Nobaryia location, on apple trees calculated as % of insect stages reduction, in 1994.

Insecticides groups	Organophosphorus compounds												Pyrethroid compound			
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	84.6	86.2	93.5	88.1	85.1	87.3	92.6	88.3	86.7	88.2	96.3	90.4	93.1	95.0	96.7	94.9
30	84.2	85.6	94.7	88.2	83.2	86.1	94.0	87.8	87.5	87.8	96.9	90.7	90.8	90.8	95.6	92.4
45	81.7	82.3	91.2	85.1	80.7	81.6	91.0	84.3	83.6	85.2	93.1	87.3	83.5	86.3	92.4	87.4
60	74.5	76.3	86.2	79.0	76.3	76.8	88.4	80.5	78.4	76.9	90.2	81.8	72.5	72.8	83.0	76.1
75	69.6	70.8	76.5	72.3	70.3	71.2	75.3	72.3	73.2	70.5	81.8	75.2	52.6	54.4	83.2	56.7
90	61.6	-	-	61.6	61.0	-	-	61.0	64.1	-	-	64.1	38.3	-	-	38.3
180	20.2	22.4	25.6	22.7	23.1	24.9	27.2	25.1	24.0	24.6	26.3	25.0	10.6	10.8	13.0	11.5
Means of reduction	68.1	70.6	77.9	-	68.5	71.3	78.1	-	71.1	72.2	80.8	-	63.1	68.4	74.0	-
Total reduction	72.2				72.6				74.7				68.5			

Insecticides groups	Fortified oils								Mineral oils							
Insecticides	Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	83.1	86.5	83.0	77.5	82.8	85.1	81.8	83.2	71.2	72.5	81.8	75.2	71.8	70.3	79.9	74.0
30	86.2	90.8	87.1	84.8	85.7	91.7	87.4	86.4	77.4	78.1	86.2	80.6	78.0	78.6	84.8	80.5
45	93.2	96.3	93.1	88.2	91.7	95.6	91.8	91.1	82.0	82.6	87.6	84.1	81.1	82.3	85.9	83.1
60	90.9	92.6	91.4	90.8	91.7	92.0	91.5	93.4	82.1	82.5	87.2	83.9	80.0	81.1	86.7	82.6
75	82.7	84.3	82.8	80.3	81.4	83.6	81.8	87.8	70.1	71.2	80.0	73.8	70.0	72.2	79.5	73.9
90	-	-	72.3	70.6	-	-	70.6	81.8	59.3	-	-	59.3	56.2	-	-	56.2
180	43.8	45.2	44.2	41.1	42.6	44.0	42.6	47.0	32.8	33.2	38.5	34.8	31.6	32.6	36.5	33.6
Means of reduction	80.0	82.6	-	76.2	79.3	82.0	-	-	67.8	70.0	76.9	-	67.0	69.5	75.6	-
Total reduction	80.0				79.2				71.6				70.7			

	L.S.D. at 0.01	F
Treatments	2.44202	17.99761
Stages	0.5414	891.76307
Intervals	9.36280	66.03752

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

experiment, where it reduced the insect population by 80 %. Cidial K came next, to reduce 79.2 % ***P. oleae*** total population within the same period, then, successively came each of diazinon, fenitrothion, phenthoate, KZ oil, Misrona (4) oil and fenvalerate, where they caused 74.7, 72.6, 72.2, 71.6, 70.7 and 68.5 %, successively. The insecticidal sequence was similar to that of spring sprays, with one exception of Sumi- oil, which have preceded diazinon, after autumn sprays. No significant figures recorded between toxicities of members of same group, but recorded between the means of reduction of the different groups, except between the single mineral oils group and the OP group, which after autumn sprays showed comparatively lower toxic effect than it did after spring application. Significancy between the individual compounds recorded high significant values between each of (Sumi oil and Cidial K) and the other tested compounds, also fenvalerate was significantly lower than all tested insecticides, except Misrona single mineral oil, all at P = 0.01.

b- Susceptibility of different stages :

Observation on susceptibility of different insect stage to the tested insecticides, clearly showed highly significant differences between the different stages to the tested compounds, where L.S.D. at P = 0.01 was 0.5417 and F value was 891.76307 (Table 81).

b.1- Susceptibility of the nymphal stage :

The nymphal stage showed to be the highest susceptible stages to the different sprays, where Sumi- oil reduced 82.6 % of its population throughout the total time of experiment followed with each of Cidial K, diazinon, fenitrothion, phenthoate, KZ oil, Misrona (4) oil and fenvalerate, which each of them reduced the nymphal stage of ***P. oleae*** by 82.0, 80.8, 78.1, 77.9, 76.9, 75.6 and 74.0 %, respectively, resembling the sequential insecticidal influence on the total population.

b.2- Susceptibility of the ovipositing females :

The ovipositing females, as shown in Table (81), followed the nymphal stage in susceptibility and were reduced in population by 80.0, 79.3, 72.2, 71.3, 70.6, 70.0, 69.5 and 68.4 %, when treated with Sumi oil, Cidial K, diazinon, fenitrothion, phenthoate, KZ oil, Misrona (4) oil and fenvalerate, respectively.

b.3- Susceptibility of the adult (non-ovipositing) females :

This stage which always showed the least susceptibility, as shown in Table (81), suffered 77.4, 76.2, 71.1, 68.5, 68.1, 67.8, 67.0 and 63.1 in the same general insecticidal sequence, which was observed amongst all insect stages, after the first season autumn sprays, on apple trees.

c- Persistence and bioactivity :

According to the highest records obtained on the percentages of insect reduction throughout the different post counts, records of the three post counts of the OP and pyrethroid compounds have owned the highest values in this concern, giving an average of 88.9, 88.9, 85.6 % for the first three post counts of the OP compounds, and 94.9, 92.4, 87.4 % for the pyrethroid one, indicating the fast toxic action of their effects. The OP compound showed a moderate degeneration, when compared with pyrethroid insecticide, whereby the counts of the fifth post treatment, were significantly lower than the preceding counts, while in case of fenvalerate (pyrethroid compound), the fourth post treatment counts was significantly lower than the third. In concern to the fortified mineral oils and single mineral oils, each of them recorded the highest values of toxicity throughout the third and the fourth post counts being 92.5 and 91.5 %, respectively for the fortified oil, and 83.6 & 83.3 % for the mineral oils, calculated as an average reduction % of each group, within the two successive periods, the matter that indicated the delayed effect of those tested compounds, also data demonstrated their slow loss of bioactivity, whereby significantly lower counts appeared in the sixth post count, for the fortified mineral oils, and appeared in the fifth post count records of the tested mineral oils.

Concerning the longevities of the tested insecticides, Sumi oil was the longest-lived one, where it gave 44.2 % insect total reduction, after 180 days of application (within the seventh post count records), followed with each of Cidial K, KZ oil, Misrona (4) oil, fenitrothion, diazinon, phenthoate and fenvalerate, where each of them caused 42.6, 34.8, 33.6, 25.1, 25.0, 22.7 and only 11.5 % insect population reduction, respectively, after 180 days of application.

B- Season 1995 :

a- Effect on total population :

Data in Table (82), clearly showed similar results to those obtained in the preceding year, in which, Sumi oil gave the highest percentage to the total population of ***P. oleae***, being 79.3 %, followed with Cidial K (78.3), diazinon (75.0), fenitrothion (72.5), phenthoate (72.3), KZ oil (71.6), Misrona oil (70.8) and fenvalerate (69.5). Significant differences appeared between the fortified mineral oils group (of the highest toxic effect), and all of the other tested groups, also between the OP group (higher) and the pyrethroid compound (lower), but not between the single mineral oils group and each of the pyrethroid compound and the OP compounds as a group. Differences between compounds of the same group showed insignificant figures, on the other hand, significant differences recorded between each of (Sumi oil and Cidial K) and all other tested insecticides, also between diazinon and the rest of the tested insecticides, where it induced significantly lower percentage of reduction than the fortified mineral oils and significantly higher one than the others.

Table (82) : Effect of different insecticides on *P. oleae* in Sep. (autumn spray) at El-Nobaryia location, on apple trees calculated as % of insect stages reduction, in 1995.

Insecticides groups	Organophosphorus compounds												Pyrethroid compound				Fortified oils								Mineral oils							
Insecticides	Phenthoate				Fenitrothion				Diazinon				Fenvalerate				Sumi oil				Cidial K				Kz oil				Misrona oil			
Days after application	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean	Ad.	Ov.	Nym.	Mean
15	82.7	85.3	92.6	86.9	82.9	84.8	94.2	87.3	85.0	87.3	100	90.8	94.4	95.2	100	96.5	77.2	79.5	85.2	80.6	78.1	78.5	84.2	80.2	70.0	70.9	79.6	73.5	70.2	70.2	77.3	72.6
30	84.8	86.2	95.3	88.8	82.0	83.6	92.5	86.0	85.8	86.3	100	90.7	91.3	91.8	100	94.4	83.1	84.7	89.2	85.7	81.3	82.3	88.6	84.1	75.8	76.6	86.6	79.7	74.2	74.8	88.1	79.0
45	82.3	83.4	92.6	86.1	83.1	83.8	91.6	86.2	82.8	84.2	95.2	87.4	85.2	85.9	96.3	89.1	89.0	89.8	94.6	91.1	86.6	87.9	92.6	89.0	82.6	83.1	86.9	84.2	82.0	82.8	88.5	84.4
60	74.8	75.2	87.3	79.1	76.0	75.6	88.2	79.9	77.1	77.6	91.0	81.9	73.5	74.1	81.5	76.4	91.3	92.9	93.8	92.7	71.4	91.9	94.2	92.5	83.2	83.5	86.0	84.2	82.0	83.4	85.4	83.6
75	70.4	71.2	75.1	72.2	71.1	71.3	78.7	73.7	74.2	74.5	80.3	76.3	51.4	53.3	71.6	58.8	82.2	82.5	85.1	83.3	81.1	82.6	85.2	82.9	72.8	73.5	81.7	76.0	71.9	72.4	80.7	75.0
90	60.2	-	-	60.2	60.7	-	-	60.7	62.6	-	-	62.6	35.2	-	-	35.2	75.3	-	-	75.3	73.1	-	-	73.1	61.2	-	-	61.2	61.1	-	-	61.1
180	21.3	21.9	26.1	23.1	22.1	22.8	27.4	24.1	23.6	24.8	27.4	25.3	9.6	10.8	12.6	11.0	41.6	41.8	46.2	43.2	39.6	41.6	44.2	41.8	31.0	31.6	39.2	33.9	30.1	32.2	34.2	32.2
Means of reduction	68.1	70.5	78.2	-	68.3	70.3	78.7	-	70.2	72.5	82.3	-	62.9	68.5	77.0	-	77.1	78.5	82.4	-	75.9	77.5	81.5	-	68.1	69.9	76.7	-	67.4	69.3	75.7	-
Total reduction	72.3				72.5				75.0				69.5				79.3				78.3				71.6				70.8			

	L.S.D. at 0.01	F
Treatments	2.817164	14.87599
Stages	6.24217	91.83562
Intervals	9.81983	60.76319

Ad : Adult females

Ov : Ovipositing females

Nym. : Nympahl stage

b- Susceptibility of different stages :

b.1- The nymphal stage :

Studies of the response of the different insect stages to the tested insecticides, showed the comparative high susceptibility of the nymphal stage, to all tested compounds, being 82.4, 82.3, 81.5, 78.7. 78.2, 77.0, 76.7 and 75.7 % reduction, as means of different reduction recorded in the different post counts after the spraying of Sumi oil, diazinon, Cidial K, fenitrothion, phenthoate, fenvalerate, KZ oil and Misrona (4) oil, respectively. Observation on the nymphal susceptibility, in the second year, after autumn sprays, indicated that diazinon have preceded Cidial K, whereas fenvalerate did the same with the two single mineral oils in efficacy, when data compared with those of the previous year. The obtained results, could be attributed to either some accidental climatic factors which may had some effects on the tested insecticides, or to the repeated use of the insecticides which could have introduced some degree of selection towards tolerance of ***P. oleae*** to some of the tested insecticides. In case of the pyrethroid compound, fenvalerate, its comparatively higher toxicity of the second year, could be attributed to its high efficacy on nymphs during the first and second post count periods, where it caused 100 % nymphal reduction, subsequently highly raised the nymphal population general mean of reduction.

b.2- The ovipositing females :

The ovipositing females population in all studied cases, was found to be more susceptible than the adult- nonovipositing females, and less susceptible than the nymphal stage, to all tested insecticides, but significancy in some cases, *i.e.*, Sumi oil, Cidial K, KZ oil and Misrona (4) oil did not observed between the ovipositing females and the nymphal stage; however, the insignificancy of these cases, could be attributed either to the high or low insecticidal reduction similarity in magnitude of toxic effect, *i.e.*, Sumi oil and Cidial K, are both highly active on the nymphal stage and ovipositing females, while in KZ and Misrona (4) oils, their bioactivity were comparatively low to the concerned stages; hence, no significant figures between their means of reduction were recorded. Sumi oil was observed to be the most effective compound on the ovipositing females, followed with each of Cidial K, diazinon, phenthoate, fenitrothion, KZ oil, Misrona (4) oil and fenvalerate, inducing 78.5, 77.5, 72.5, 70.5, 70.3, 69.9, 69.3 and 68.5 % reduction, respectively, (Table 82).

b.3- The adult non-ovipositing females :

Concerning the susceptibility of these individuals, it showed similar sequence as of the total population and the ovipositing females, to the tested insecticides but with lower percentages of reduction, where Sumi oil induced 77.1 % reduction, followed by Cidial K (75.9 %), diazinon (70.2 %), fenitrothion (68.3 %), phenthoate and KZ oil (68.1 %), Misrona (4) oil (67.4 %) and fenvalerate (62.9 %), throughout the total time of experiment, Table (82). In general, susceptibility between stages, was less than that observed in the previous year.

c- Persistence of bioactivity :

When comparing records of the different post treatment counts, the first three post counts of the OP and pyrethroid compounds showed, as previously always did, the highest percentages of insect total population reduction, where in cases of the fortified mineral oils and the single mineral oils, almost the third and fourth post count data showed the highest ones. In concern to the residual bioactivity of the tested insecticides, the fortified mineral oils possessed the longest-lived action on ***P. oleae***, where they caused the highest percentages of reduction in the total population of the insect (43.2 % for Sumi oil and 41.8 % for Cidial K) within the seventh post count records (180 days after application), followed by KZ oil (33.9 %), Misrona (4) oil (32.2 %), diazinon (25.3 %), fenitrothion (24.1 %), phenthoate (23.1 %) and fenvalerate (11.0 %), each after the same period of 180 days.

5.3.3- Comparative studies on the effect of different sprays on *P. oleae* infesting apple trees, at Nobariya location :

Data of Table (83), showed the different mean percentages of insect reduction which were induced by the different tested insecticides on the plum scale insect, ***P. oleae***, after the spring and autumn sprays, on apple trees, at Nobariya location during 1994 and 1995. From these data, it could be concluded that the spring sprays were more effective in controlling ***P. oleae*** than autumn sprays. In concern to the spring sprays, according to the comparative potencies on the insect, the tested compounds could be arranged in descending order as : Sumi oil, Cidial K, diazinon, fenitrothion, phenthoate, KZ & Misrona (4) single mineral oils, and fenvalerate, where each of them induced % reduction of 82.9, 81.9, 79.9, 78.5, 77.7, 74.5, 73.4 and 72.6, respectively, along the time of experiment. In concern to the autumn sprays, they showed the same sequential order of insecticides of the spring sprays, but with different lower percentages of reduction, where each of them caused 79.9, 78.8, 74.9, 72.5, 72.2, 71.6, 70.8 and 69.0 % insect total population reduction, as an average reductions of those recorded within the different post- treatment counts.

Depending on the general means of insect reductions (of the spring and autumn sprays), the tested insecticides could be arranged according to their potencies in controlling ***P. oleae***, as : Sumi oil (81.4 %), Cidial K (80.4 %), diazinon (77.4 %), fenitrothion (75.5 %), phenthoate (74.9 %), KZ oil (73.1 %), Misrona (4) oil (72.1 %) and fenvalerate (70.8 %), as an average reduction of the spring and autumn sprays of the two studied years.

5.3.4- General observations on the control experiments :

1- The tested insecticides :

From the obtained and discussed data and results, it was clearly obvious that the fortified mineral oils (mineral oils with OP compounds), have proved the

Table (83) : The comparative percentages of the insect reduction, induced by the tested insecticides to *P. oleae* infesting apple trees after spring and autumn sprays.

Group	Organophosphorus compounds									Pyrethroid			Fortified oils						Mineral oils					
Compound	Phenthoate			Fenitrothion			Diazinon			Fenvalerate			Sumi oil			Cidial K			KZ oil			Misrona oil		
Stage	ad.	ov.	nym.	ad.	ov.	nym.	ad.	ov.	nym.	ad.	ov.	nym.	ad.	ov.	nym.	ad.	ov.	nym.	ad.	ov.	nym.	ad.	ov.	nym.
Spring sprays	74.1	75.3	83.6	74.9	76.2	84.5	76.4	77.7	85.7	69.8	71.2	76.8	81.3	82.2	85.2	80.2	81.3	84.3	71.6	72.4	79.6	70.6	71.4	78.3
Means	77.7			78.5			79.9			72.6			82.9			81.9			74.5			73.4		
Autumn sprays	68.1	70.5	78.1	68.4	70.8	78.4	70.7	72.4	81.6	63.0	68.5	75.5	77.3	79.3	83.0	76.1	78.4	81.8	68.0	70.0	76.8	67.2	69.4	75.7
Means	72.2			72.5			74.9			69.0			79.9			78.8			71.6			70.8		
General mean	74.9			75.5			77.4			70.8			81.4			80.4			73.1			72.1		

- Means were calculated as mean of the two years.

ad. : adult females, ov. : ovipositing females, nym. : nymphs superior effects in reducing either ***P. oleae***, total population, or any of its stages after 180 days of being applied, with significant-higher differences amongst all other tested insecticides. On the other hand, fortified mineral oils, *i.e.*, Cidial K and Sumi oil, showed comparative delayed effect on the plum scale insect, whereby, they almost showed their maximum toxic actions in no less than 45-60 days of application. According to these characters, they may be applied in definite times, *i.e.*, after collecting fruits to avoid their latent toxic effect on the consumer, and/or in early winter (if necessary), to allow enough time to induce their effects on the hibernating insect females and before the beginning of fruits emergence, also in cases of the chronic and heavy infestation with the plum scale insect, due to their high percentages of insect reduction among the other tested compounds, however, these compounds should not be recommended in areas of high parasitoids activity on ***P. oleae*** (or other scale insects), due to the highly observed toxicity induced by them to these natural enemies. In relation to the OP tested group, they showed to follow the fortified mineral oils in potency; however, they induced fast toxic actions on ***P. oleae***, where their highest efficacies appeared in the first three post treatment counts (15-45 days after application), subsequently degenerated moderately throughout the following next post counts records. These observed characters of the OP compounds recommended them to be perfectly used in cases of moderate infestation with the plum scale insect, and at least 20-30 days of expected insect abundance, *i.e.* in April, before the first insect abundance of May, and/or in August, before the insect second peak of abundance of September, also in cases of low parasitoids activity, due to their comparatively high toxic influence on the parasitoids and other natural enemies.

Concerning the pyrethroid compound, fenvalerate, it showed very fast high toxic influence on the plum scale insect, where its maximum efficacy was observed in the records of the first or second post-treatment counts (15-30 days, after application), followed with a moderate degenerations, after comparatively short period of inducing its maximum influence, subsequently, followed by sharp degenerations starting from 60-75 days of application (fourth and fifth post counts records) to induce about 10-25 % reduction at the end of experiment (180 days). These characters recommended the pyrethroid compound "fenvalerate" to be used in the emergence cases, *i.e.*, short periods before collecting fruits and/or when trees had an accidental infestation, to prevent the insect disperse or the insect establishment after any accidental infestation; however, it should not be recommended during periods of parasitoids activity, due to its high toxic influence on parasitoids.

In relation to the single mineral oils (KZ and Misrona-4 oils), they showed delayed effects (as did the fortified mineral oils), and comparatively lower toxicity to both insect and parasitoids amongst the other tested insecticides. In most studied cases, their effects in inducing reduction to ***P. oleae*** along the total time of the experiment, were to a great extent similar or close to those induced by the pyrethroid compound, fenvalerate; however, all of them were different in time of inducing maximum efficacy, as previously mentioned before. These characters of the single mineral oils, recommended them to be used at any time and where insect infestation is not very heavy, also where parasitoids induce comparatively high percentages of parasitism.

2- The host plants :

Concerning the different studied host plants, almost all tested insecticides induced higher influence on ***P. oleae*** infesting plum trees in all studied cases, than they did on ***P. oleae*** infesting any other host plant, *i.e.*, pear and apple trees, the matter that indicated the effect ofthe host plant characters, *i.e.*, morphology, internal structure, chemical constitutional and other plant characters on tolerance of the plum scale insect to the tested insecticides. On the other hand, the control experiments showed almost similar results on both pear and apple, which belonging to the same plant genus (***Pyrus***), whereas showed different results on plum of different genus (***Prunus***).

3- Time of insecticidal application :

In this concern, the spring sprays were always observed to induced higher percentages of reduction than either autumn sprays or (winter sprays on pear only), almost amongst all tested compounds. That was observed, could be explained by the presence of huge numbers of nymphs (mainly the crawlers) in spring season (almost in late April and May), the insect stage which showed the highest susceptibility to the tested insecticides among all other insect stages, subsequently, induced high percentages of insect reduction, after the spring sprays when compared with either the autumn sprays where the percentage of the nymphal stage lower than those of spring or with the winter sprays (on pear), where the hibernating females showed more tolerance to the tested insecticides.

4- Location of experiment :

Different control experiments, were applied at two locations, at El-Quanater El-Khairiya and Nobariya locations. From the obtained data, it was clearly observed that, in some cases, the same insecticide used in a particular location, gave different results, when applied at the other location, for instance, when the OP compound diazinon was applied on ***P. oleae*** infesting apple trees, at Nobariya, it induced higher influence than it did at the other location of El-Quanater, on pear and plum trees. This result, could be attributed to the characteristic climatic conditions at each location, where at Nobariya, dryness of air and the low humidity percentages, alternately high and low temperature, and intensity of sun light, .. etc., and all of the other unstudied climatic factors at that location, could either affect the insect tolerance to the tested insecticides, by affecting the insect or any of its stages, or by affecting the degree of stability of particular tested insecticide, to give different results, under different circumstances.

5- Susceptibility of different insect stages :

As previously shown and discussed, without any exception, the nymphal stage of ***P. oleae*** (crawlers and other immature individuals) have shown the highest susceptibility to the tested insecticides, amongst the other studied stages, after different sprays and at all locations, followed by the ovipositing females and the non-ovipositing adult females, always with the same sequence, in all studied cases. The obtained results of different insecticides sprays, are on the same line with those of **Herrera (1964)**, who stated that, the insecticides applications on scale insect should be applied only between late spring and mid-autumn to avoid disturbing the general insect fauna, also, he supported the usage of the mineral oils in the scale insect control. Also, the obtained data are in agreement with those calculated by **Hendi *et al.* (1964)**, who reported that the mineral oils and also their mixtures with malathion (OP compound), were highly effective against the diaspidid scale insects. **Rashad (1969)**, in Egypt, supported the present results when demonstrated that combinations of mineral oils with phosphorus compounds were used with a great success against the scale insects, and the aim of mixing oils with phosphorus compounds is to use the mineral oils in lower concentrations with good results, and also to avoid the deleterious effects on trees by using high concentrations of mineral oils. **Hafez and Salama (1968)**, also **Soliman (1970)**, recommended the usage of the mineral oils when mixed with phosphorus compounds, *i.e.*, dimethoate, parathion, .. etc., to control the scale insect, which always give satisfactory results, the matter that shown in the present study. In concern of the selected spraying time of spring (May), **Argyrious and Kourmadas (1981)**, in Greece, determined exactly the time of ***P. oleae*** treatment with insecticides to be in May or early June, where that time, were also suitable for the treatment against borers, with a good control results, with a second treatment at the beginning of September, to control the late infestation of the scale insect. On the same trend, **Helmy *et al.* (1982)**, concluded that 1 % sun oil was effective on different sale insects, six months after summer application. In 1983, **Ehler and Endicott**, in complete agreement with the present results, recorded that, the nymphal stage of ***P. oleae***, especially the crawlers, were highly susceptible to malathion than any other stages of the insect. **Mako *et al.* (1988)**, found -in not complete agreement with the present results- that the pyrethroid compounds were highly effective in controlling the plum scale insect, *P. oleae*, and application in late April to beginning of June (spring sprays), was preferable. In accordant to the obtained results, **Helmy *et al.* (1991)**, postulated that ***P. oleae*** was less sensitive to some scalicides, and the nymphal stage was the most susceptible stage, followed with adult females (ovipositing and non- ovipositing adult females), and according to potencies, they arranged the tested insecticides as : Basudin (diazinon), Reldan, Sumithion (fenitrothion), Sumi oil, Oleoekalux and KZ oil. Recently, **Grafton (1995)**, postulated that, the resistance of scale insects were closely related to the extend use of some insecticides, the matter that appeared in the obtained results when some insecticidal potencies were altered after the second application, in the second season of study, at different locations.

5.4- The effects of Tested Insecticides on the Parasitoid, *Aphytis maculicornis* (Masi), the main Parasitoid of the Plum Scale Insect, *Parlatoria oleae* (Colveé) :

5.4.1- On pear trees, at El-Quanater El-Khairiya location :

5.4.1.1- Effect of spring sprayings :

A- Season 1994 :

a- Effect on the parasitoid total population :

As shown in Table (84), almost all of the tested compounds caused high percentages of reduction on ***A. maculicornis*** when spayed during the spring season (the time of parasitoid main activity); however, the group of the single mineral oils (KZ and Misrona-4 oils) caused the lowest reduction in the incidence of parasitism. The tested insecticides showed comparatively higher percentages of reduction to the parasitoid than the effect they excreted on ***P. oleae***. Nearly, all the tested compounds induced unexpected high percentages of parasitoid reduction, without correlation to those of ***P. oleae***, except in cases of fenvalerate (pyrethroid compound), which induced more or less the same percentages of reduction to both ***P. oleae*** and ***A. maculicornis***, and the single mineral oils, which induced lower percentages of reduction to the parasitoid than they did to the insect pest.

As shown in Table (84), the OP compound fenitrothion induced the highest effect on the different counted parasitoid stages (larval and pupal stages) being 86.3 % reduction calculated as mean reduction of both stages, throughout the total experimental time (in case of the spring sprays, data of parasitoid percentages of reductions, were not available in records of the fifth and sixth post counts, where he parasitoid was rarely observed during late July and all August), followed by phenthaote, Sumi-oil, Cidial K, diazinon, fenvalerate, KZ oil and Misrona (4) oil, which caused 85.5, 85.3, 84.5, 84.1, 74.9, 45.5 and 44.1 % parasitoid mean reductions, respectively, throughout the total time of experiment.

Table (84) : Effect of different insecticidal groups and compunds on the parasitoid *A. maculicornis* after spring spray (May) , at El-Quanater location , on pear trees in 1994 .

	Organophorus compounds									Pyrethroid			Fortified oils						Mineral oils					
compounds	Phenthoate			Fenitrothion			Diazinon			Fenvalerate			Sumi oil			Cidial K			KZ - oil			Misrona oil		
Days after application	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M
15	95.3	93.1	94.2	97.2	94.1	95.7	96.2	93.4	94.8	98.6	95.7	97.2	87.3	81.6	84.5	85.1	81.3	83.2	56.3	52.4	54.4	54.2	51.6	52.9
30	95.0	93.3	94.1	95.8	93.2	94.5	94.0	92.1	93.0	96.2	94.3	95.3	95.2	94.9	95.1	95.7	93.2	94.5	58.3	54.2	56.3	55.1	53.2	54.2
45	94.9	90.1	92.5	95.8	91.7	93.8	93.7	89.9	91.8	95.3	92.7	94.0	96.7	95.9	96.3	95.9	95.3	95.6	50.1	45.7	47.9	50.6	45.0	47.8
60	94.6	90.0	92.3	95.1	91.0	93.0	92.0	88.5	90.3	91.6	53.3	57.3	96.8	94.3	95.6	96.2	95.8	96.0	46.2	43.1	44.7	43.2	41.6	42.4
75	Parsitoid was not available during this time																							
90	Parsitoid was not available during this time																							
180	57.2	51.1	54.2	58.2	50.3	54.5	52.6	48.2	50.5	31.7	30.2	30.9	56.6	53.8	55.2	54.6	52.3	53.5	28.1	20.3	24.2	25.4	20.5	22.9
Mean	87.4	83.5	–	88.5	84.1	–	85.7	82.4	–	76.6	73.2	–	86.5	84.1	–	85.5	83.9	–	47.8	43.1	–	45.7	42.4	–
General mean of reducation	85.5			86.3			84.1			74.9			85.3			84.5			45.5			44.1		

	L.S.D. at 0.01	F
Between treatments (compounds)	3.20767	131.35424
Between intervals (post counts)	22.50127	19.58613
Between stages	3.21073	128.18577

L. : Larvae of parasitoid , % reduction .
P. : Pupae , % reduction .
M. : Mean of larvae and Pupae , % reduction .

No statistically significant differences appeared between the OP compounds as a group and the two fortified mineral oils in their efficacies of reducing the parasitoid total population, also the differences between the members of the same group were insignificant. Significancies highly appeared between fenvalerate and mineral oils, and all of the other tested compounds, also between them both. From the obtained data, it could be concluded that, the OP and fortified mineral oils groups were highly effective as suppressive groups to ***A. maculicornis***, whereas fenvalerate induced significantly lower percentage of reduction, and the single mineral oils, which caused comparatively the lower percentages of reduction amongst all tested compounds.

b- Susceptibility of different stages :

In relation to the susceptibility of the larval and pupal stages of the parasitoid to the tested insecticides, larval stage showed to be more susceptible than the pupal stage. Fenitrothion (Sumithion) appeared to be the most effective tested compound on the larval stage of the parasitoid ***A. maculicornis***, where it caused 88.5 % reduction, as mean different reductions in different post counts, followed by phenthoate, Sumi oil, diazinon, Cidial K, fenvalerate, KZ oil and Misrona (4) oil, which each of them caused 87.4, 86.5, 85.7, 85.5, 76.6, 47.8 and 45.7, respectively, without significant differences between the OP and fortified mineral oils compounds, but the differences between them and each of the pyrethroid compound and the two single mineral oils were significant at P = 0.01. The pupal stage of the parasitoid was less susceptible to the tested insecticides, where each of Sumi oil and fenitrothion induced an equal percentages of reduction being 84.1 %, followed by Cidial K, phenthoate, daizinon, fenvalerate, KZ and Misrona (4) single mineral oils, which in respective order caused 83.9, 83.5, 82.4, 73.2, 43.1 and 42.4 % pupal reduction, throughout 180 days, after application, without significant figures between the OP compounds and fortified mineral oils, while the differences between them and each of fenvalerate and the two single mineral oils were significant at P = 0.01.

c- Persistence of bioactivity :

When data of the different post counts of each tested group were compared, parallel results to those of their influence on the pest were obvious. While each of the OP group and the pyrethroid compound induced their maximum efficacies directly after application, thus, data of the first three post count records showed the highest percentages of parasitoid reduction, being 94.9, 93.9 and 92.7 % as means of the first, second and third records of the OP compounds, and 97.2, 95.3 and 94.0 % for the same post count records of fenvalerate. On the other hand, in case of the fortified mineral oils, the second, third and fourth post count records, showed the maximum efficacies on the parasitoid, being as means; 94.8, 96.0 and 95.8 % reduction, respectively. In case of the single mineral oils, they showed their maximal reductive influence on ***A. maculicornis*** in the records of the second post count of either KZ oil or Misrona (4) oil. These obtained data are parallel to some extent to those of the tested insecticides on ***P. oleae*** in the timing of their maximum effect. No significant differences were recorded between data of the first four post counts, but significant figures occurred between data of the seventh post count (180 days after application) and data of the other post counts for all tested compounds.

With respect to the insecticides different persistence, Sumi oil showed the longest lethal action on ***A. maculicornis*** where it caused 55.2 % reduction after 180 days of application, followed by fenitrothion, phenthoate, Cidial K, Diazinon, fenvalerate, KZ oil and Misrona oil, where each of them caused 54.5, 54.2, 53.5, 50.5, 30.9, 24.2 and 22.9 % reduction to the parasitoid, respectively. The observed long-lived actions of the fortified mineral oils, could be attributed to their comparatively high stabilities, but in case of the OP compounds, their long-lived action on the parasitoid, could be due to their high and quick reductive efficacies which appeared soon after application, within data of the first three post counts, the matter that reduced the parasitoid population to the lowest size, which subsequently exposed to the adverse weather conditions of July and August (which were synchronized with the fifth and sixth post counts of spring sprays, and which showed very rare-uncounted numbers of the parasitoid), the matter that enhanced the deleterious effects of the OP compounds on the population, and extended it to 180 days after application. The single mineral oils and pyrethroid compound showed moderate to low persistence of action on *A. **maculicornis.***

B- Season 1995 :

a- Effect on the parasitoid total population :

As shown in Table (85), the effect of the tested insecticides on the total percentage of parasitoid reduction, were almost similar to those detected in the preceding season, with an exception of Sumi oil which have preceded phenthoate (OP compound) in non- significant figures. According to different potencies of the tested compounds, they could be arranged in descending order as : fenitrothion, Sumi-oil, phenthoate, Cidial K, diazinon, fenvalerate, KZ oil and Misrona-4 oil single mineral oils, each of them induced 86.0, 85.5, 85.3, 84.9, 83.4, 75.1, 46.0 and 44.8 % reduction to the total population of *A. **maculicornis***, in respective order. Highly significant differences appeared between the two single mineral oils and all of the other tested compounds, also between fenvalerate and the rest of the others. No significant differences were recorded between members of each group, also between the means of the OP and fortified oils groups. Data of the second year also showed the comparatively higher potencies of both, OP group (especially fenitrothion), and fortified mineral oils (especially Sumi oil) in reducing the parasitoid total population, when sprayed at that time of May (about mid-May).

Table (85) : Effect of different insecticidal groups and compunds on the parasitoid *A. maculicornis* after spring spray (May) , at El-Quanater location , on pear trees in 1995 .

	Organophorus compounds									Pyrethroid			Fortified oils						Mineral oils					
compounds	Phenthoate			Fenitrothion			Diazinon			Fenvalerate			Sumi oil			Cidial K			KZ - oil			Misrona oil		
Days after application	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M
15	95.6	92.3	94.0	98.1	93.7	95.9	95.2	92.7	94.0	97.3	94.8	96.0	86.5	94.2	85.4	85.3	84.1	84.7	56.6	54.3	55.5	55.1	53.2	54.2
30	95.2	92.9	94.0	96.2	93.5	94.9	94.1	91.8	93.0	95.3	93.2	94.3	94.2	93.9	94.1	93.6	92.9	93.3	58.7	55.2	57.0	58.3	54.6	56.5
45	93.7	91.2	92.5	95.1	90.6	92.9	92.9	88.3	90.6	93.3	91.6	92.5	96.8	95.3	96.1	95.8	94.3	95.1	53.2	47.3	50.3	54.1	44.2	49.2
60	94.0	91.0	92.5	92.2	91.5	91.9	91.6	86.7	89.2	62.8	60.3	61.6	96.7	94.8	95.8	96.6	94.5	95.6	45.1	42.3	43.7	43.6	40.3	42.0
75	Parsitoid was not available during this time																							
90	Parsitoid was not available during this time																							
180	56.8	50.7	54.3	56.7	52.7	54.7	51.8	49.2	50.5	32.0	30.5	31.3	57.1	55.8	56.5	56.6	54.8	55.7	26.3	21.2	23.8	24.8	20.7	22.8
Mean	87.1	83.6	–	87.7	84.4	–	85.1	81.7	–	76.1	74.1	–	86.3	84.8	–	85.6	84.1	–	48.0	44.1	–	47.2	42.4	–
General mean of reducation	85.3			86.0			83.4			75.1			85.5			84.9			46.0			44.88		

	L.S.D. at 0.01	F
Between treatments (compounds)	2.95421	124.76191
Between intervals (post counts)	27.76853	9.07094
Between stages	2.03596	103.72154

L. : Larvae of parasitoid , % reduction .
P. : Pupae , % reduction .
M. : Mean of larvae and Pupae , % reduction .

b- Susceptibility of different stages :

From obtained data, results showed the comparative high susceptibility of the parasitoid larval stage when compared to that of pupal stage. To a great extent, percentages of larave reduction were similar to those of the preceding year, being 87.7, 87.1, 86.3, 85.6, 85.1, 76.1, 48.0, 47.2 % induced by fenitrothion, phenthoate, Sumi oil, Cidial K, daizinon, fenvalerate, KZ oil and Misrona (4) oil, respectively, as means of reductions of different post count records, with the same sequence of the preceding year, with one exception of Cidial K, which preceded diazinon in the present season. In relation to the parasitoid pupae susceptibility, almost the same results of the previous year were obtained, where Sumi oil insecticide induced the highest percentage of reduction to the parasitoid pupal stages of 84.8 % (as mean of different reductions during the total experimental time), followed by fenitrothion, Cidial K, phenthoate, diazinon, fenvalerate, KZ oil and Misrona (4) oil, causing 84.4, 84.1, 83.6, 81.7, 74.1, 44.1 and 42.4 % reduction, respectively, with significant differences between each of the pyrethroid compound and the two single mineral oils together, and the rest of the tested compounds, at $P = 0.01$.

c- Persistence of bioactivity :

Observations on records of different post counts indicated that, all records of the four OP post counts showed highest adverse effects on the parasitoid, where that effect extended only to the third post count records of the pyrethroid compound (fenvalerate) the matter that indicated the comparative higher stability of the OP group members, compared to fenvalerate. In case of the fortified mineral oils, they showed delayed -but extended- effects on the parasitoid, where their maximal reductions occurred after 45 to 60 days of application, subsequently extended to be of high effective influence after 180 days of application. The two single oils (KZ and Misrona), showed comparatively alike, but not equal behaviour to the fortified mineral oils, where they induced their maximal reductions after 30 days of application, but their delayed reductive effects were too much lower, when compared to the fortified mineral oils, Table (85).

5.4.1.2- Effect of autumn sprays :

A- Season 1994 :

Data in Table (86) showed the effects of the tested insecticides on the parasitoid, *A. maculicornis* when sprayed in autumn of 1994.

a- Effect on the parasitoid total population :

The obtained results, indicated -in general- lower effects of the pyrethroid compound and the two single mineral oils, and on the other hand, the higher effects of the OP and fortified mineral oils compounds, when compared with those recorded after spring sprays on the concerned parasitoid. In case of the OP compounds and the fortified mineral oils, the increases observed in their reductive records, after autumn sprays, when compared to those of spring, could be attributed to the lower parasitoid population which deduced at that time, compared with those of spring, the matter that indicated mathematically higher comparative rates of parasitoid reduction, also it could be due to the comparative long-lived actions of each of OP and fortified mineral oils, which when sprayed in September (as autumn sprays), their lethal actions easily extended to February and March (where they caused an average of 55.7 and 62 % reduction for each of OP and fortified mineral oils after 180 days of application), the matter that highly affected the parasitoid population during the beginning of its first peak of abundance, causing comparative high total percentages of reduction as counted and calculated at the end of the experimental time. On the other hand, the lower effects of each of fenvalerate (pyrethroid compound), and the two single

Table (86) : Effect of different insecticidal groups and compunds on the parasitoid *A. maculicornis* after autumm spray (September) , at El-Quanater location , on pear trees in 1994 .

	Organophorus compounds									Pyrethroid			Fortified oils						Mineral oils					
compounds	Phenthoate			Fenitrothion			Diazinon			Fenvalerate			Sumi oil			Cidial K			KZ - oil			Misrona oil		
Days after application	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M
15	96.2	94.3	95.3	98.6	95.2	96.9	99.3	96.2	97.8	99.5	98.6+	99.0	89.6	85.3	87.5	89.2	85.7	87.5	57.2	52.6	54.9	54.2	53.6	53.9
30	96.0	93.6	94.8	97.1	93.1	95.1	97.3	95.6	96.5	97.3	94.5	95.9	92.7	91.9	92.3	92.5	90.7	91.6	57.9	53.1	55.5	58.1	55.2	56.6
45	95.1	92.6	94.4	96.6	92.3	94.5	96.1	94.3	95.2	96.2	93.1	94.7	95.8	93.9	94.9	85.2	93.2	94.2	50.6	44.2	47.4	49.3	45.1	47.2
60	94.8	91.3	93.0	94.8	91.3	93.0	93.6	89.3	91.5	96.5	67.3	68.4	96.8	95.1	96.0	97.3	95.2	96.3	45.1	42.4	43.8	43.3	40.2	41.8
75	90.8	89.2	90.0	92.5	91.0	91.8	89.0	86.2	87.6	62.6	61.2	61.9	92.7	90.9	91.8	92.3	90.1	91.2	42.3	35.1	38.7	40.6	35.2	37.9
90	89.3	87.1	88.2	90.9	89.2	90.0	87.1	85.8	86.2	58.3	56.7	57.5	86.6	85.6	86.1	85.4	84.3	84.9	30.6	27.0	28.8	30.8	25.3	28.1
180	59.6	53.7	56.2	61.7	54.3	58.1	54.6	51.2	52.9	32.7	31.6	32.2	62.7	62.6	62.7	61.6	60.8	61.2	22.3	18.5	20.4	20.7	16.9	18.8
Mean	88.8	86.0	-	90.3	86.6	-	88.1	85.4	-	73.7	71.9	-	88.1	86.5	-	87.6	85.7	-	43.7	39.0	-	42.4	38.8	-
General mean of reducation	87.4			88.5			86.8			72.8			87.3			86.7			41.4			40.6		

	L.S.D. at 0.01	F
Between treatments (compounds)	4.28237	51.34423
Between intervals (post counts)	21.17303	10.53124
Between stages	3.62518	98.62153

L. : Larvae of parasitoid , % reduction .
P. : Pupae , % reduction .
M. : Mean of larvae and Pupae , % reduction .

mineral oils, which each of them showed lower efficacies on ***A. maculicornis*** after autumn sprays, compared to those of spring, it could be explained by their comparative lower effect on the parasitoid host (***P. oleae***) after autumn sprays in relation to spring sprays, consequently caused lower effects on its parasitoid, also on the contrary to the OP compounds and fortified oils, fenvalerate showed the lowest residual bioactivity on ***P. oleae*** when compared to the other tested compounds (caused an average of 8.7 % ***P. oleae*** reduction after 180 days of application, in autumn, on pears), the matter that preserved the plum scale insect in considerable numbers, consequently saved enough host individuals for the parasitoid to complete its life cycle, allowing it to increase in numbers, subsequently showed less percentages of reduction at the end of the total time of experiment. Table (86), showed -as was observed after spring sprays- that fenitrothion was the most effective insecticides used in reducing the parasitoid total population, where it induced 88.5 % reduction -as mean of different reductions throughout 180 days-, followed by phenthoate, Sumi oil, daizinon, Cidial K, fenvalerate, KZ oil and Misrona (4) oil, causing 87.4, 87.3, 86.8, 86.7, 72.8, 41.3 & 40.6 %, respectively, more or less with results parallel to those of spring sprays, except daizinon which preceded Cidial K in efficacy. No significant differences were observed between members of any group, also not between the OP and fortified mineral oils either as compounds, or as two different groups. The differences between reductions induced by fenvalerate and the two mineral oils were significant at P - 0.01, also between each of them and the rest of the tested compounds.

In case of the OP compounds, no significant differences appeared in the first six post counts, but appeared between data of the seventh (180 days after application) and those of previous post counts. In relation to the pyrethroid compound, the first three post counts data showed the highest percentages of ***Aphytis*** reductions, whereas significancy appeared starting from data of the fourth post count, and data of the previous post counts indicating the comparative lower stability of this compound. Observations on fortified mineral oil, showed the delayed effects of these compounds, where their maximal efficacies on the parasitoid obtained from records of the fourth post counts, without any significant differences between data of the first six post counts, but between them all and those of the seventh post count. The two single mineral oils showed their maximal influence on the parasitoid within the records of the second post count, indicating, to some extent, the delayed effect of these compounds, where significant differences started to appear between records of the second post count and those of the sixth post count, at P = 0.01.

b- Susceptibility of different stags :

The same trend of spring sprays, was observed after autumn sprays, in concern to the susceptibility of the parasitoid different stages to the tested insecticides. The larval stage showed higher susceptibility than the parasitoid pupal stage. The same sequence of the tested insecticides potencies on total parasitoid population was also attained on the larval stages, where fenitrothion induced 90.3 % reduction to the parasitoid larave (as mean of different reductions throughout 180 days), followed by (diazinon & Sumi oil), Cidial K, fenvalerate, KZ oil and Misrona (4) oil, where each of them induced 88.8, (88.1), 87.6, 73.7, 43.7 and 42.4 %, without significancy between the OP and fortified mineral oils groups, but between them and each of fenvalerate and the two single mineral oils.

In relation to the parasitoid pupal susceptibility to the tested insecticides, as on the larval stage, fenitrothion showed the highest efficacy on the pupal stage, causing 86.6 % mean reduction, followed by Sumi oil, phenthoate, Cidial K, diazinon, fenvalerate, KZ and Misrona (4) mineral oils, inducing 86.5, 86.0, 85.7, 85.4, 71.9, 39.0 and 38.8 %, with the same trend of significancy obtained on the larval stage.

c- Persistence of bioactivity :

Observations on the persistence of the tested insecticides, indicated the long-lived efficacies of the fortified mineral oils, where Sumi oil caused 62.7 % parasitoid reduction in data of 180 days after application, followed by Cidial K (61.2 %), fenitrothion (58.0 %), phenthoate (56.2 %), diazinon (52.9 %), fenvalerate (32.2 %), KZ oil (20.4 %) and Misrona (4) oil (18.8 %).

B- Season 1995 :

a- Effect on the parasitoid total population :

As shown in Table (87), similar results to those of the preceding year of 1994, were obtained, where most of the tested insecticides induced similar trend of efficacies on the total population of ***A. maculicornis***. Fenitrothion was the most potent insecticide used in reducing total ***Aphytis*** population, followed by each of Sumi oil, phenthoate, Cidial K, diazinon, fenvalerate, KZ oil and Misrona (4) mineral oil, each of them induced 89.1, 87.5, 87.4, 87.2, 86.7, 73.7, 41.4 and 40.4 %, as means of reduction throughout 180 days of experiment, respectively. No significant differences were found between means of the OP reductions and those of the fortified mineral oils, but significant differences recorded between them and each of the pyrethroid compound and the single mineral oils, also between them both. Significant differences did not appear between the internal compounds of each group.

b- Susceptibility of different stages :

Observations revealed that the larval stage of the parasitoid showed to be the most susceptible stage to the tested compounds, where fenitrothion induced 90.5 % reduction -as mean of different reductions recorded during the total experimental time, followed by phenthoate, diazinon, Sumi oil, Cidial K, fenvalerate, KZ oil and Misrona oil, causing 88.4, 88.3, 88.2, 87.5, 74.9, 43.3, and 42.1 %, respectively, without significant differences between means of the OP compounds and fortified mineral oils, but between them and each of the pyrethroid compound and the two single mineral oils, also between them both.

The parasitoid pupal stage did not differ significantly from the larval stage, although they showed less susceptibility to the tested insecticides, where fenitrothion induced 87.6 % reduction throughout the time of experiment, followed by (Sumi oil and Cidial K), phenthoate, diazinon, fenvalerate, KZ oil and Misrona (4) oil, each of them induced (86.8), 86.4, 85.1, 72.6, 39.4 and 38.7 %, respectively, indicating in general, the same results of the preceding year.

c- Persistence of bioactivity :

In relation to the OP compounds, no significant differences appeared between data of the first six post counts, where the first post count records showed the highest percentages of the parasitoid reduction, whereas significant differences at $P = 0.01$ appeared between the first and seventh post count records. The same trend observed in case of the pyrethroid compound, but significant difference at $P = 0.01$ started to appear between records of the first and fourth post counts. In relation to the fortified mineral oils, they almost showed nearly the same results of the previous year, where highest influences were attained from data of the fourth post count, without significant differences between data of the first four post counts, but between any of them, and data of the seventh. In case of mineral oils, highest influence appeared in data of the same second post count, without significant differences at $P = 0.01$ between the first five post count records, but between the second and starting from the sixth. In almost similar way, the fortified mineral oils during the second year, showed the highest residual efficacies on *A. maculicornis*, where induced mean of 62.4 % reduction to the *Aphytis* total population, followed by the OP group, which induced a man of 56.9 %, the pyrethroid compound (33.3 %) and the two single mineral oils, which caused a mean of 19 % reduction in the records of the seventh post count.

5.4.1.3- Effect of winter sprays :

The winter sprays were conducted, as they being considered the recommended timing of sprays on deciduous trees,since at that time, trees are in dormancy, without any foliage, the matter that lessen the amount of insecticide used to control the plum scale insect, also without causing any harms or pollution due to the absence of fruits at that time, but on the other hand, *P. oleae* at that time (December-February), are usually in winter hibernation as adult gravid females, the insect stage which was found to be more tolerant to the insecticides used, and where its natural parasitoid, *A. maculicornis*, still in comparatively low numbers than what expected to be found after few weeks latter, in March and April, the matter that induced very bad influence on the low numbers of the parasitoid, subsequently preventing it from reaching the first peak of abundance, which expected to occur during late March or April.

A- Season 1994 :

a- Effect on the parasitoid total population :

Data in Table (88), showed the effects of different tested insecticides when sprayed in winter, on the parasitoid, *A. maculicornis*, on pear trees.

The obtained results, generally indicated the comparatively higher effect of the organophosphorus group (especially fenitrothion) and the fortified mineral oils group (almost its two members induced nearly the same effect), on the parasitoid *Aphytis*, when compared for instance, with the single mineral oils, *i.e.*, Table (88) : **Effect of different insecticidal groups and compounds on the parasitoid *A. maculicornis* after winter spray (January) , at El-Quanater location, on pear trees in 1994.**

	Organophosphorus compounds									Pyrethroid			Fortified oils						Mineral oils					
Compounds	**Phenthoate**			**Fenitrothion**			**Diazinon**			**Fenvalerate**			**Sumi oil**			**Cidial K**			**KZ-oil**			**Misrona oil**		
Days after application	**L**	**P**	**M**	**L**	**P**	**M**	**L**	**P**	**M**	**L**	**P**	**M**	**L**	**P**	**M**	**L**	**P**	**M**	**L**	**P**	**M**	**L**	**P**	**M**
15	100.0	98.6	99.3	100.0	99.3	99.7	100.0	97.2	98.6	100.0	100.0	100.0	98.5	97.3	97.9	99.6	99.0	99.3	62.6	61.2	61.9	66.1	58.3	59.2
30	98.5	98.2	98.4	99.5	98.7	99.1	97.1	96.3	96.7	99.0	100.0	99.5	100.0	100.0	100.0	100.0	100.0	100.0	64.5	61.3	62.9	63.2	60.3	61.8
45	96.6	96.2	96.4	97.2	97.0	97.1	95.6	94.6	95.1	98.0	96.7	97.4	100.0	100.0	100.0	100.0	100.0	100.0	57.2	53.6	55.4	55.1	54.6	55.0
60	95.3	94.2	94.8	96.3	95.1	95.7	95.2	93.6	94.4	72.3	71.6	72.0	96.2	96.2	96.2	89.2	95.6	96.9	53.7	51.3	52.5	52.6	52.0	52.3
75	93.6	90.4	92.0	94.1	91.3	92.7	92.7	90.8	91.8	63.5	61.9	62.7	84.3	80.7	82.5	85.1	81.3	83.2	48.6	32.3	40.5	49.7	36.2	43.0
90	90.6	88.1	89.4	90.6	89.2	89.9	90.0	86.5	88.3	57.1	55.3	56.2	83.3	81.6	82.5	80.8	79.6	80.2	31.7	28.5	30.1	30.1	26.3	28.2
180	Parasitoid was not available to be detected during this time																							
Mean	95.8	94.3	-	96.3	95.1	-	95.1	93.2	-	81.7	80.9	-	93.7	92.6	-	94.0	92.6	-	53.1	48.0	-	51.8	48.0	-
General mean of reduction	95.0			95.7			94.1			81.3			93.2			93.3			50.5			49.9		

	L.S.D. at 0.01	F
Between treatments (compounds)	4.26387	68.035216
Between intervals (post counts)	12.30862	22.12578
Between stages		2.62352

L. : Larvae of parasitoid, % reduction

P. : Pupae, % reduction

M. : Mean of larvae and pupae, % reduction

KZ and Misrona, which induced the lowest reduction percentages to the parasitoid population. In case of OP group, fenitrothion showed the highest reduction percentages on the parasitoid total population, where it induced 95.7 % reduction throughout the total time of experiment of 90 days duration (in winter sprays,the half monthly post counts were detected on the parasitoid only for 90 days, because the seventh post count, which have been taken usually after 180 days of insecticides applications, would be in the winter sprays within mid July to August, the time where the parasitoid was recorded in very numbers; thus, that seventh post count data, were excluded), followed by, phenthoate, diazinon, Cidial K, Sumi oil, fenvalerate, KZ oil and Misrona (4) oil, inducing 95.0, 94.1, 93.3, 93.2, 81.3, 50.5 and 49.9, ***Aphytis*** population reduction, respectively. No significant differences were observed between members of each group, also between the OP and fortified mineral oils groups, but appeared between each of the pyrethroid compound and the two single mineral oils, and the other two groups, also between them both. The observed increases in reduction percentages, of all tested insecticides on the parasitoid were expected, due to the comparative rarity of its abundance at that time of spraying (January), when compared -for instance- with its high abundance during spring season.

b- Susceptibility of different stages :

As shown in Table (88), after winter sprays, all tested insecticides almost showed the same trend of spring and autumn sprays (but with higher values), where larval stage was more susceptible to all tested compounds than showed the pupae, but without significant differences between the two parasitoid stages at P = 0.01, probably due to the comparatively high influences occurred to them both. Fenitrothion have recorded to be the most effective tested insecticide on the parasitoid larvae, causing 96.3 % reduction within 90 days, followed by phenthoate, daizinon, Cidial K, Sumi oil, fenvalerate, KZ oil and Misrona (4) oil, which caused 95.8, 95.1, 94.0, 93.7, 81.7, 53.1 and 51.8 percentages of reduction, respectively.

In relation to the susceptibility of the parasitoid pupal stage to the tested insecticides, almost the same sequence of the insecticides potencies were obtained, where fenitrothion came first, followed by each of phenthoate, diazinon, (Sumi oil & Cidial K), fenvalerate and (KZ & Misrona-4 oils), which caused 95.1, 94.3, 93.2, (92.6), 80.9 and (48.0) % reduction, respectively.

c- Persistence of bioactivity :

Data of different post counts, indicated in case of the OP compounds, no significant differences between all records of % reduction of the six studied post counts were recorded, taking into consideration that first post count data were occupied with the highest percentages of reduction, the matter that enable to conclude the fast and adverse effects of the OP compounds on the low population of ***A. maculicornis***, when sprayed in winter. In relation to the pyrethroid compound, fenvalerate, data of the first post count showed 100 % reduction to ***Aphytis*** total population, indicating the fast and high lethal effect of this compound on the concerned parasitoid, but a significant drop in percent reduction appeared between data of the fourth post count and the preceding three ones, which indicated also the comparative fast degeneration of the pyrethroid compound. In concern to the fortified mineral oils, they induced their highest efficacies within records of the second and third post counts, where the % reduction of ***Aphytis*** reached 100 %. Observations indicated that the percentages of reduction of the fortified mineral oils dropped significantly between data of the fifth post count and the preceding four counts, but not between data of the fifth and sixth post counts, all at P = 0.01. In case of the single mineral oils, their maximal influence appeared in data of the second post count, where significancy in their reductional efficacies started to appear between records of the sixth post count and the rest of other post counts, also between those of the fifth and of the second post counts.

Due to the absence of data of the seventh post counts (180 days after application, almost in July of winter sprays), the fortified mineral oils did not gain a chance to induce their long-lived lethal influence on the parasitoid, where the OP compounds have preceded them causing an average of 89.2 % reduction after 90 days of application, followed by the fortified mineral oils (81.4 %), the pyrethroid "fenvalerate" (56.2 %) and the single mineral oils, which induced an average of 29.2 % reduction after the same period of application.

B- Season 1995 :

a- Effect on the parasitoid total population :

Almost, the same results of the preceding year were obtained, Table (89). the highest percentage of reduction to the total population of the parasitoid was induced by fenitrothion, being 96.1 %, induced within 90 days of the winter experiment, followed by phenthoate, daizinon, (Sumi oil & Cidial K), fenvalerate, KZ oil and Misrona (4) mineral oils, which induced 95.1, 93.8, (93.5), 81.3, 49.8 and 49.5, respectively. Significant differences at P = 0.01, appeared between fenvalerate and the single mineral oils, and between each of them and the rest of tested compounds. No significant differences were observed between the different compounds of each group.

b- Susceptibility of different stages :

Data,a s in Table (89), showed that the larval stage of *A. maculicornis*, was less tolerant -insignificantly- than the pupal stage, where to the larval stage, fenitrothion induced 97.0 % reduction throughout 90 days, followed by phenthoate, diazinon, Sumi oil, Cidial K, fenvalerate, KZ and Misrona mineral oils, inducing 96.1, 95.1, 93.7, 93.4, 81.8, 52.3 and 51.7 % reduction,

Table (89) : Effect of different insecticidal groups and compounds on the parasitoid *A. maculicornis* after winter spray (January) , at El-Quanater location, on pear trees in 1995.

Compounds	Organophosphorus compounds									Pyrethroid			Fortified oils						Mineral oils					
	Phenthoate			Fenitrothion			Diazinon			Fenvalerate			Sumi oil			Cidial K			KZ-oil			Misrona oil		
Days after application	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M
15	100.0	99.2	99.6	100.0	99.5	99.8	100.0	97.5	98.8	100.0	100.0	100.0	96.7	96.2	96.5	95.6	95.3	95.5	61.3	60.0	60.7	61.2	60.7	61.0
30	98.9	97.3	98.1	99.6	98.2	98.9	97.3	96.2	96.8	99.5	99.2	99.4	100.0	100.0	100.0	100.0	100.0	100.0	63.1	61.2	62.2	63.2	62.6	62.9
45	97.5	96.4	97.0	98.6	97.7	98.2	95.4	93.6	94.5	97.2	97.0	97.1	100.0	100.0	100.0	100.0	100.0	100.0	56.4	52.6	54.5	55.1	53.2	54.2
60	96.1	93.2	94.7	97.5	95.3	96.4	95.0	91.6	93.3	73.5	71.6	72.6	97.3	97.3	97.3	97.5	100.0	98.8	53.1	50.7	51.9	52.3	49.6	51.0
75	93.7	91.1	92.4	95.0	92.2	93.6	93.1	89.7	91.4	65.1	64.2	64.7	85.6	84.3	85.3	86.3	86.0	86.2	47.2	33.5	40.4	46.1	32.6	39.4
90	90.2	87.4	88.8	91.1	88.3	89.7	98.5	86.3	87.9	55.2	52.6	53.9	82.6	82.2	82.4	81.2	80.5	80.8	32.6	26.3	29.5	32.5	25.3	28.9
180	Parasitoid was not available to be detected during this time																							
Mean	96.1	94.1	-	97.0	95.2	-	95.1	92.5	-	81.8	80.8	-	93.7	93.3	-	93.4	93.6	-	52.3	47.4	-	51.7	47.3	-
General mean of reduction	95.1			96.1			93.8			81.3			93.5			93.5			49.8			49.5		

	L.S.D. at 0.01	F
Between treatments (compounds)	5.63274	83.57207
Between intervals (post counts)	11.30751	32.82725
Between stages	-------	4.03512 (insignificant)

L. : Larvae of parasitoid, % reduction

P. : Pupae, % reduction

M. : Mean of larvae and pupae, % reduction

respectively, almost with the same sequence of the preceding year. In concern to the pupal stage of *A. maculicornis* responds to the tested compounds, fenitrothion showed to be the most effective one used, where it induced 95.2 % reduction within 90 days, followed by phenthoate (94.1 %), Cidial K (93.6 %), Sumi oil (93.3 %), daizinon (92.5 %), fenvalerate (80.8 %), KZ oil (47.4 %) and Misrona (4) oil (47.3 %), all induced within 90 days followed applications.

c- Persistence of bioactivity :

No significant differences were recorded between data of all OP post counts (6 post counts), indicating the higher influence of those compounds on the parasitoid throughout the total time of experiment (90 days), with referring to data of the first post counts to show the highest percentages of the parasitoid reduction. In case of the pyrethroid compound (fenvalerate), data of the first post count (15 days after application), showed the highest percentage of reduction (100 %), but significancy at 0.01 appeared between data of the fourth, and those of the preceding post counts, also between data of the fourth and data of the sixth post count. In relation to the fortified mineral oils, *i.e.*, Sumi oil & Cidial K, the second and third post counts data showed the highest percentages of ***Aphytis*** reduction, being 100 %, but significancy appeared between those of the fifth and sixth post counts and data of the preceding ones as previously observed in the preceding year. The single mineral oils showed the same trend of the previous year; thus, their maximal reductive potencies appeared in data of the second post counts, with significant difference between those and data starting from the fourth post count for Misrona (4) oil, and starting from the fifth one for KZ oil. As previously observed in the preceding year, the long-lived action of the different groups, were different when compared to those of spring and autumn sprays, mainly due to the incomplete time of the winter experiment, where the OP group showed the longest bioactivity on ***A. maculicornis*** giving an average of

88.8 % reduction after 90 days of application (fenitrothion induced 89.7, phenthaote 88.8, and diazinon 87.9 % reduction), followed by the fortified mineral oils, which gave an average of 81.6 % (82.1 for Sumi oil and 80.8 % for Cidial K), fenvalerate (53.9 %) and the single mineral oils, which gave an average of 29.2 % (29.5 % induced by KZ oil & 28.9 % induced by Misrona-4).

5.4.2- On plum trees, at El-Quanater El-Khairiya location :

5.4.2.1- Effect of spring sprays :

A- Season 1994 :

a- Effect on the parasitoid total population :

Data in Table (90) indicated that, as observed on pear trees, the OP compounds, induced the highest percentages of the parasitoid reduction on plum trees, after the spring spays. The OP compound, phenthoate, which was previously observed to occupy the second rank of efficacy on pear trees, after the spring sprays, showed to be the most potent compound used on *A. maculicornis* total population, when sprayed on plum trees during the same period (spring), giving an average percentage of reduction of 88.1, throughout the first year of study. Diazinon, on plum trees, showed comparative higher potency than it did on pear trees, where it induced 87.7 % reduction to the parasitoid, and followed phenthoate in efficacy. Fenitrothion, Sumi oil, Cidial K, fenvalerate, KZ oil and Misrona (4) oil, came next, inducing 87.5, 87.0, 86.8, 75.8, 45.9 and 45.7 % *Aphytis* reduction, respectively. Results on plum trees, indicated higher percentages of the parasitoid reduction than those recorded on pear trees, *i.e.*, fenitrothion, which was the most potent insecticide on ***Aphytis***, on pear trees, only induced 86.3 % reduction, but on plum trees, inspite of it caused 87.5 % ***Aphytis*** reduction, it only occupied the third rank of efficacy. Undoubtedly, the host plant morphology, physiology, nutritive constituents, and many other factors, *i.e.*, irrigation system, fertilizers, .. etc., where all or any of them, are

Table (90) : Effect of different insecticidal groups and compounds on the parasitoid *A. maculicornis* after spring spray (May) , at El-Quanater location, on plum trees in 1994.

	Organophosphorus compounds									Pyrethroid			Fortified oils						Mineraloils					
Compounds	Phenthoate			Fenitrothion			Diazinon			Fenvalerate			Sumi oil			Cidial K			KZ-oil			Misrona oil		
Days after application	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M
15	99.2	97.5	98.4	98.5	97.2	97.9	98.7	98.2	98.5	99.7	99.2	99.5	88.2	83.6	85.9	88.3	82.6	85.5	57.2	54.3	55.8	55.8	55.6	55.7
30	98.6	95.7	97.2	97.3	94.6	96.0	98.3	96.5	97.4	91.6	90.0	90.8	95.8	95.2	95.5	96.2	96.0	96.1	57.7	55.6	56.7	58.2	56.7	57.5
45	94.7	91.3	93.0	95.2	92.1	93.7	95.3	90.7	93.0	87.3	81.5	84.4	96.7	95.7	96.2	96.8	95.6	96.2	51.8	43.2	47.5	50.9	46.7	48.8
60	92.3	91.5	91.9	94.8	91.3	93.1	93.6	90.0	91.8	78.6	66.2	72.4	97.0	96.3	96.7	96.7	95.9	96.3	45.8	44.3	45.0	44.3	42.7	43.5
75	Parasitoid was not available to be detected during this time																							
90	Parasitoid was not available to be detected during this time																							
180	61.3	58.5	59.9	60.2	53.7	57.0	58.6	56.7	57.7	32.6	30.8	31.7	61.5	60.1	60.8	62.0	58.3	60.2	27.5	21.1	24.3	25.8	19.9	22.9
Mean	89.2	86.9	-	89.2	85.8	-	88.9	86.4	-	78.0	73.5	-	87.8	86.2	-	88.0	85.7	-	48.0	43.7	-	47.0	44.3	-
General mean of reduction	88.1			87.5			87.7			75.8			87.0			86.8			45.9			45.7		

	L.S.D. at 0.01	F
Between treatments (compounds)	3.17849	114.42486
Between intervals (post counts)	23.46033	7.78386
Between stages	3.35955	18.032963

L. : Larvae of parasitoid, % reduction

P. : Pupae, % reduction

M : Mean of larvae and pupae, % reduction important factors in affecting the insect pest, subsequently affecting its parasitoid and its tolerance to the tested insecticides. No significant difference were observed neither between the internal compounds of each group, nor between the OP and fortified mineral oil groups, but arised between each of the pyrethroid compound "fenvalerate" and the two mineral oils and the rest of the tested compounds, also between fenvalerate and the two single mineral oils (KZ and Misrona), all at 0.01 level.

b- Susceptibility of different stages :

As shown in Table (90), and previously observed o pear trees, parasitoid larval stage on plum trees showed higher susceptibility to the tested insecticides, than showed the pupal stage. The OP compounds were highly effective on the larval stage of ***A. maculicornis***, where fenitrothion and phenthoate induced 89.2 % average reduction within the total time of the experiment (180 days), followed by diazinon, Cidial K, Sumi oil, fenvalerate, KZ and Misrona (4) mineral oils, inducing 88.9, 88.0, 87.8, 78.0, 48.0 and 47.0 % ***Aphytis*** larval reduction, respectively.

In relation to the pupae susceptibility to the tested compounds, phenthoate induced the highest % reduction, being 86.9, as an average percent of different reductions, induced to the pupae population, within the total time of experiment, followed by diazinon, Sumi oil, fenitrothion, Cidial K, fenvalerate, Misrona (4) and KZ mineral oils, induced 86.4, 86.2, 85.8, 85.7, 73.5, 44.3 and 43.7 %, respectively. Significant differences appeared between larvae and pupae with each of fenitrothion, fenvalerate and KZ oil, but not with the other tested compounds.

c- Persistence of bioactivity :

Concerning data of different post counts, in case of the OP compounds, no significant differences were recorded throughout all first four post counts, but started to appear between each of them, and those of the seventh one (180 days after application), with referring to the percentages of reduction of the first post counts to show the highest ones. In relation to the pyrethroid compound "fenvalerate", no significant differences appeared between % reductions of the first three post counts, but it occurred between data of the first and those of the fourth post counts and up, also between data of the seventh, and those of all previous post counts, all at P = 0.01. In case of the fortified mineral oils, significant differences were not observed except between data taken after 180 days and all of the preceding ones, with the same results for the single mineral oils. Data of the fifth and sixth post counts were absent, due to the normal rarity of the parasitoid during July and August months.

According to the comparative persistence of each of the tested insecticides, the fortified mineral oils, when were given enough time (180 days after application), induced the highest residual bioactivity, where Sumi oil and Cidial K, caused 60.8 and 60.2 % reduction, within records of reduction percentages of the seventh post count (180 days after spraying), followed by phenthoate (59.9 %), diazinon (57.7 %), fenitrothion (57.0 %), fenvalerate (31.7 %), KZ oil (24.3 %) and Misrona (22.9 %), which showed the shortest residual bioactivity amongst the tested compounds, on the parasitoid, ***A. maculicornis.***

B- Season 1995 :

a- Effect on the parasitoid total population :

As shown in Table (91), almost the same results of the previous year were obtained, with two exceptions, where the two single mineral oils (KZ and Misrona) gave the same percentage of reduction, and diazinon which showed the

Table (91) : Effect of different insecticidal groups and compounds on the parasitoid *A. maculicornis* after spring spray (May) , at El-Quanater location, on plum trees in 1995.

Compounds	Organophosphorus compounds									Pyrethroid			Fortified oils						Mineral oils					
	Phenthoate			Fenitrothion			Diazinon			Fenvalerate			Sumi oil			Cidial K			KZ-oil			Misrona oil		
Days after application	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M
15	98.8	97.3	98.1	99.2	98.0	98.6	99.6	97.7	98.6	99.2	98.5	98.9	86.7	94.2	85.5	86.5	85.2	85.9	86.3	53.3	54.8	56.8	83.7	55.3
30	96.1	95.9	96.0	95.5	95.3	95.4	96.5	96.2	96.4	93.4	92.6	93.0	96.3	95.8	96.1	95.3	95.0	95.2	58.2	55.2	56.7	59.6	56.3	58.0
45	94.5	93.6	94.1	94.6	91.9	93.1	95.1	93.3	94.2	85.3	82.3	83.8	97.1	96.1	96.6	96.2	95.7	96.0	51.3	46.2	48.8	53.5	51.2	52.4
60	92.2	91.4	91.8	91.7	91.0	91.4	92.1	90.6	91.4	76.3	68.2	72.3	97.3	96.8	97.1	96.9	95.7	96.3	44.6	42.8	43.7	42.7	40.8	41.8
75	Parasitoid was not available to be detected during this time																							
90	Parasitoid was not available to be detected during this time																							
180	59.8	58.3	59.1	60.6	56.6	58.6	60.0	53.8	56.9	31.6	30.1	30.9	62.2	62.0	62.1	61.7	59.3	60.5	25.8	20.7	23.3	22.8	16.5	19.7
Mean	88.3	87.3	-	88.3	86.6	-	88.7	86.3	-	77.2	74.3	-	88.0	87.0	-	87.3	86.2	-	47.2	43.6	-	47.1	43.7	-
General mean of reduction	87.8			87.4			87.5			75.8			87.5			86.8			45.4			45.4		

	L.S.D. at 0.01	F
Between treatments (compounds)	3.29468	102.69290
Between intervals (post counts)	22.03757	71.23572
Between stages	--------	0.21356 (insignificant)

L. : Larvae of parasitoid, % reduction

P. : Pupae, % reduction

M. : Mean of larvae and pupae, % reduction

same average of the parasitoid reduction of Sumi oil. In this concern, phenthoate, the OP compound, for the second year of usage on plum trees, after spring sprays, showed to be the most effective tested insecticide on ***A. maculicornis***, followed by (Diazinon & Sumi oil), fenitrothion, Cidial K, fenvalerate, and (KZ & Misrona mineral oils), where each of them induced 87.8, (87.5), 87.4, 86.8, 75.8 and (45.4) % reduction, respectively, within the total experimental time. Significant difference did not appear between any two members of the same group, also not between the OP and fortified mineral oil groups, but appeared between each of the pyrethroid compound and mineral oils and the other two groups, also between them both (the pyrethroid compound and the two single mineral oils), giving almost similar results to those of the previous year.

b- Susceptibility of different stages :

When comparing the susceptibility of the different parasitoid stages to the tested insecticides, larval stage showed higher susceptibility than showed the pupal stages,but without significant differences between them both, at 0.01 level, as shown in Table (91).

c- Persistence of bioactivity :

Data of different successive post counts, were identical to those of 1994, where in case of the OP compounds, no significant differences were recorded throughout the first four post counts, but existed between their data and those of the seventh one. In relation to the pyrethroid fenvalerate, significantly was observed between data of the first post count and data of only fourth one, indicating less persistence of fenvalerate when compared to the OP compounds. In concern to the fortified mineral oils, they showed almost the same behaviour of the OP compounds, where no significant differences occurred between data of the first four post counts, but recorded between any of them and those recorded after the seventh post count, with referring to the first post count data of the OP group, to be loaded with the highest percentages of the parasitoid reduction, and almost the third one of the fortified mineral oils to be with the same order. The two single mineral oils, again, expressed their maximal potencies in data of the second post count, without significant differences between records of the first four post counts, but between any of them and those of the seventh.

In relation to the extended efficacies of the tested compounds, Sumi oil showed the highest residual bioactivity, after 180 days, followed by each of Cidial K, phenthoate, fenitrothion, diazinon, fenvalerate, KZ oil, and Misrona (4) oil, respectively, in descending order, Table (91).

5.4.2.2- Effect of autumn sprays :

A- Season 1994 :

a- Effect on the parasitoid total population :

Data in Table (92), which showed the different percentages of *A. maculicornis* total population reduction, after autumn sprays, on plum, indicated the same phenomenon of the increased potencies of the OP and fortified mineral oils compounds, and the lower potencies of the pyrethroid compound and mineral oils when sprayed in autumn, than they did after spring applications, and which was also observed on pear trees, at the same location, where the average percentages of the parasitoid reduction induced by the OP and fortified mineral oils compounds, were higher than those induced by the same compounds after the spring sprayings; on the other hand, records of the pyrethroid compound and the two single mineral oils, were comparatively lower than those induced after spring sprayings, with the same probable explanation suggested on pear trees. After autumn applications, on plum trees fenitrothion induced the highest percentage of reduction to the concerned parasitoid, where it caused 89.1 % reduction of the total population of ***Aphytis***, as an average of % reduction throughout the total

Table (92) : Effect of different insecticidal groups and compounds on the parasitoid *A. maculicornis* after autumn spray (September), at El-Quanater location, on plum trees in 1994.

	Organophosphorus compounds									Pyrethroid			Fortified oils						Mineral oils					
Compounds	**Phenthoate**			**Fenitrothion**			**Diazinon**			**Fenvalerate**			**Sumi oil**			**Cidial K**			**KZ-oil**			**Misrona oil**		
Days after application	**L**	**P**	**M**	**L**	**P**	**M**	**L**	**P**	**M**	**L**	**P**	**M**	**L**	**P**	**M**	**L**	**P**	**M**	**L**	**P**	**M**	**L**	**P**	**M**
15	98.7	97.3	98.0	99.3	98.5	98.9	99.7	98.2	98.9	100.0	98.3	99.2	90.2	89.5	89.9	89.3	88.5	88.9	56.3	53.2	54.8	57.2	55.4	56.3
30	97.2	96.4	96.8	98.2	95.2	96.7	98.9	96.3	97.6	94.5	92.7	93.6	92.3	91.6	92.0	92.6	92.2	92.4	58.7	56.3	57.5	59.3	57.6	58.5
45	94.7	92.8	93.8	96.4	93.2	94.8	95.1	93.1	94.1	87.8	82.3	85.1	96.8	96.2	96.5	95.4	95.0	95.2	50.8	46.1	48.5	51.2	44.8	48.0
60	93.2	90.7	92.0	95.1	92.3	93.7	93.6	91.8	92.7	77.5	68.2	72.9	97.3	96.5	96.9	96.8	95.9	96.4	44.3	42.8	43.6	42.7	40.6	41.7
75	90.9	88.5	89.7	93.1	90.6	91.9	92.7	89.5	91.1	62.3	61.7	62.0	95.2	95.2	95.2	94.7	93.8	94.3	43.1	36.6	39.9	40.0	35.1	37.6
90	89.6	85.4	87.5	90.0	87.4	88.7	90.2	86.1	88.2	53.3	51.2	52.3	86.3	84.1	85.2	85.2	83.7	84.5	34.3	31.6	33.0	34.1	29.8	32.0
180	6.3	55.6	58.0	62.5	56.2	59.4	61.3	55.2	85.3	34.6	31.2	32.9	62.5	61.7	62.1	61.7	61.6	61.7	26.8	22.4	24.6	26.3	21.5	23.9
Mean	89.2	86.7	-	90.7	87.6	-	90.2	87.2	-	72.9	69.4	-	88.7	87.8	-	88.0	87.2	-	44.9	41.3	-	44.4	40.7	-
General mean of reduction	88.0			89.1			88.7			71.1			88.2			87.6			43.1			42.5		

	L.S.D. at 0.01	F
Between treatments (compounds)	3.424545	86.90650
Between intervals (post counts)	22.02835	10.53504
Between stages	3.67169	12.79744

L. : Larvae of parasitoid, % reduction

P. : Pupae, % reduction

M. : Mean of larvae and pupae, % reduction

time of experiment, followed by diazinon, Sumi oil, Cidial K, phenthoate, fenvalerate, KZ oil and misrona (4) oil, inducing 88.7, 88.2, 87.6, 88.0, 71.1, 43.1 and 42.5 %, in respective order. In spite of the absence of significant differences between data of the internal compounds of each group, the arrangement of the insecticide potencies on the parasitoid, after the autumn sprays on plum trees, observed to be in different sequence either after the spring sprays on plum trees, or generally on pear trees, the matter that indicated the effect of either the host plant, and/or the weather factors on the insecticide efficacy, also on the insect (pest or parasitoid) tolerance to the applied chemicals.

Significantly lower reduction percentages in the parasitoid population were found between those induced by the pyrethroid compound and all of the tested compounds, also between the mineral oils and the rest of the different used insecticides. No significant differences were detected between any of the OP and the fortified mineral oils, when compared as either groups or separate compounds.

b- Susceptibility of different stages :

In this concern, and as shown in Table (92), the larval stage of the parasitoid showed higher susceptibility to all tested insecticides than showed the pupae, although the differences between stages were statistically insignificant in all cases, with exception of the pyrethroid compound and the two mineral oils.

c- Persistence of bioactivity :

Observations on data of the different subsequent post counts indicated that, the OP compounds showed no significancy between records of the first six post counts, but significant differences were recorded between data of the seventh post count, and all of the preceding ones, with referring to the first post count data to show the highest percentages of parasitoid reduction. In case of the pyrethroid compound, "fenvalerate", significant differences started to be observed between the first post count data, which contained the highest percentages of ***Aphytis*** reduction, and those of the fourth post count. The fortified mineral oils, almost showed the same trend of the OP compounds, where no significant differences appeared within data of the first six post counts, but existed between those of the seventh and all of the preceding ones, with referring to the fourth post count to be occupied with the highest percentages of the parasitoid reduction. The second post count data of the single mineral oils showed the highest values of reducing the parasitoid numbers, with significancy at 0.01 level between data of the seventh post count and those of the first three post counts.

The influence of the fortified mineral oils residues, showed the highest efficacies when compared with those of the other tested compounds, where Sumi oil residues after 180 days of application induced 62.1 % reduction to the parasitoid total population, followed by each of Cidial K, fenitrothion, diazinon,phenthoate, fenvalerate, KZ oil and Misrona (4) oil, each caused 61.7, 59.4, 58.3, 58.0, 32.9, 24.6 and 23.9 % reduction, respectively.

B- Season 1995 :

a- Effect on the parasitoid total population :

As recorded in Table (93), related results to those of the previous year (1994), were observed, with exception of phenthoate, which have preceded the two fortified mineral oils in efficacy on the parasitoid total population during 1995. The comparative reduction percentages induced to the parasitoid, when exposed to the different tested insecticides, indicated that fenitrothion, have owned the maximum reductive potency on the parasitoid, when sprayed in autumn (September) on plum trees, resembling what occurred in the previous year. Fenitrothion induced an average reduction to the parasitoid calculated as

Table (93) : Effect of different insecticidal groups and compounds on the parasitoid *A. maculicornis* after autumn spray (September) , at El-Quanater location, on plum trees in 1995.

	Organophosphorus compounds									Pyrethroid			Fortified oils						Mineral oils					
Compounds	Phenthoate			Fenitrothion			Diazinon			Fenvalerate			Sumi oil			Cidial K			KZ-oil			Misrona oil		
Days after application	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M
15	98.9	97.6	98.2	98.8	97.3	98.0	100.0	98.2	99.1	100.0	97.6	98.8	89.3	89.0	89.2	90.2	90.0	90.1	55.3	52.6	54.0	56.2	53.7	55.0
30	98.1	96.8	97.5	98.0	96.5	97.3	99.5	97.4	98.5	96.2	93.6	94.9	93.8	92.7	93.3	92.5	91.6	92.1	59.1	54.3	56.7	59.6	55.2	57.4
45	95.2	91.3	93.3	96.1	94.2	95.2	94.2	92.3	93.3	86.1	81.5	83.8	95.1	94.3	94.7	94.8	93.9	94.4	51.4	4.1	49.8	50.6	46.7	48.7
60	93.7	89.6	91.7	94.8	93.1	93.9	93.2	90.8	92.0	76.2	70.1	73.2	97.2	96.4	96.8	96.6	95.2	95.6	43.8	41.6	42.7	43.2	40.5	41.8
75	91.2	87.5	89.3	92.9	90.6	91.8	91.6	88.8	90.2	67.3	63.2	65.3	94.3	93.6	94.0	94.0	93.2	93.6	42.2	40.7	41.5	42.8	39.1	41.0
90	88.9	86.1	87.5	89.5	88.3	88.9	89.1	85.4	87.2	52.1	52.0	52.0	84.1	83.3	83.7	83.5	83.5	83.5	35.2	30.6	32.9	33.1	28.7	30.9
180	60.0	54.6	57.3	63.0	58.3	60.7	62.3	56.4	59.4	31.6	29.7	30.7	62.1	59.2	60.7	61.7	60.3	61.0	25.3	20.8	23.1	25.0	19.7	22.4
Mean	89.4	86.2	-	90.4	88.3	-	90.0	87.0	-	72.8	69.7	-	88.0	86.9	-	87.6	86.8	-	44.6	41.2	-	44.4	40.5	-
General mean of reduction	87.8			89.4			88.5			71.2			87.5			87.2			42.9			42.4		

	L.S.D. at 0.01	F
Between treatments (compounds)	3.450802	88.172797
Between intervals (post counts)	22.35838	9.618663
Between stages	-------	1.07792 (insignificant)

L. : Larvae of parasitoid, % reduction

P. : Pupae, % reduction

M. : Mean of larvae and pupae, % reduction

89.4 % throughout the total time of experiment, followed by diazinon, phenthoate, Sumi oil, Cidial K, fenvalerate, KZ oil and Misrona oil, producing 88.5, 87.8, 87.5, 87.2, 71.2, 42.9 & 42.4 % average reduction to the total population of the parasitoid, in respective order. No significant differences at P = 0.01 were found between compounds under the same group, also between the OP compounds and each of the two fortified mineral oils. Highly significant differences occurred between each of fenvalerate and mineral oils together and the rest of the tested compounds.

b- Susceptibility of different stages :

In this concern, the larval stage of the parasitoid showed comparative higher susceptibility than showed the pupal stage, also with the same response to the tested insecticides of the previous year, where fenitrothion induced an average reduction of 90.4 % throughout the total time of the experiment, followed by each of diazinon (90.0 %), phenthoate (89.2 %), Sumi oil (88.0 %), Cidial K (87.6 %), fenvalerate (72.8 %), KZ oil (44.6 %) and Misrona (4) oil, which induced 44.4 %.

During the same year of 1995, after autumn sprays, on plum trees, the responds of the pupal ***Aphytis*** stage slightly differed than those observed in the previous year, where fenitrothion induced the highest average percentage of the parasitoid pupae reduction, caused 88.3 %, followed by diazinon, Sumi oil, Cidial K, phenthoate, fenvalerate, KZ oil and Misrona (4) oil, producing 87.0, 86.9, 86.8, 86.2, 69.7, 41.2 and 40.5 % reduction, respectively. The slight differences in the insecticide potencies on the total population or any of stages of the parasitoid, when compared with those of the previous year, could be however, due to the repetitive usage of the tested compounds at the same location of the experiment, the matter that could alter the parasitoid response to the different tested insecticides, as commonly observed, after the repetitive uses of the insecticides at all locations of the experiment.

c- Persistence of bioactivity :

In case of the OP compounds, no significant differences were recorded between data of reduction of the first six post counts, but occurred between the seventh post count data and all of the preceding data of different post counts. Almost the same results were obtained with the fortified mineral oils, where no significant differences were observed between all first six post count data, but between those of the seventh and all the others. In relation to the pyrethroid compound, significant differences appeared between data of the first four post count and those of the seventh, but not between the first three ones. In relation to the two single mineral oils, no significant differences were recorded between data of the first five post counts, but between those of the first three ones, and data of the sixth and seventh post counts.

After the second autumn sprays (during the second year of study), Cidial K, showed the longest lived lethal action on ***A. maculicornis*** population, producing 61.0 % reduction, after 180 days of usage, followed by (Sumi oil & fenitrothion), diazinon, phenthoate, fenvalerate, KZ oil and Misrona (4) oil, inducing (60.7), 59.4, 57.3, 30.7, 23.1 and 22.4 % reduction, in the records of the seventh post counts, respectively.

5.4.3- On apple trees, at Nobariya location :

5.4.3.1- Effect of the spring sprays :

A- Season 1994 :

a- Effect on the parasitoid total population :

More or less, the same results of the tested insecticides on pear and plum trees, were obtained on apple trees, as shown in Table (94), where the OP compounds and the fortified mineral oils induced the highest percentages of reduction to the concerned parasitoid, whereas the pyrethroid compound and the single mineral oils induced the lowest ones, with slight differences in the

Table (94) : Effect of different insecticidal groups and compounds on the parasitoid *A. maculicornis* after spring spray (May) , at El-Nobariya location, on apple trees in 1994.

	Organophosphorus compounds									Pyrethroid			Fortified oils						Mineral oils					
Compounds	Phenthoate			Fenitrothion			Diazinon			Fenvalerate			Sumi oil			Cidial K			KZ-oil			Misrona oil		
Days after application	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M
15	100.0	99.3	99.6	100.0	98.6	99.3	99.5	97.2	98.4	100.0	97.5	98.8	91.5	87.2	89.4	90.8	87.5	89.2	56.3	55.1	55.7	55.2	53.7	54.4
30	98.8	97.5	98.1	98.2	96.5	97.3	97.3	95.3	96.3	97.2	96.3	96.8	93.6	92.8	93.2	93.5	91.7	92.6	58.6	56.2	57.4	58.1	57.2	57.6
45	97.8	95.3	96.6	96.3	94.2	95.3	95.1	92.7	93.9	96.5	91.7	94.1	95.7	93.9	94.8	96.2	93.3	94.8	56.9	53.3	55.1	55.8	52.1	53.9
60	95.0	93.7	94.4	95.1	93.3	94.2	94.1	92.0	93.0	71.3	67.5	69.4	97.2	96.8	97.0	96.5	95.1	95.8	52.8	51.3	52.1	51.6	50.6	51.1
75	Parasitoid was not available to be detected during this time																							
90	Parasitoid was not available to be detected during this time																							
180	66.2	62.8	64.5	65.2	60.6	62.9	61.7	58.6	60.2	33.6	31.7	32.7	62.3	61.2	61.8	61.6	61.0	-	25.3	20.2	22.7	23.7	18.5	21.1
Mean	91.6	89.7	-	90.7	88.6	-	89.5	87.2	-	79.7	77.0	-	88.1	86.4	-	87.7	85.7	-	50.0	47.2	-	48.9	46.4	-
General mean of reduction	90.6			89.8			88.4			78.3			87.3			86.7			48.6			47.7		

	L.S.D. at 0.01	F
Between treatments (compounds)	4.02628	66.44675
Between intervals (post counts)	22.6416	9.20832
Between stages	--------	6.44485 (insignificant)

L. : Larvae of parasitoid, % reduction

P. : Pupae, % reduction

M. : Mean of larvae and pupae, % reduction

arrangement of the insecticides sequence of potencies within each tested group. On apple trees, after spring sprays, phenthoate (OP compound), showed the highest average of % reduction to the parasitoid being 90.6, throughout the total time of experiment (in case of spring sprays, only five post counts were attained due to the absent data of the fifth & sixth post counts, as previously explained in cases of pear and plum spring sprays), followed by fenitrothion, diazinon, Sumi oil, Cidial K, fenvalerate, KZ oil and Misrona (4) oil, producing 89.8, 88.4, 87.3, 86.7, 78.3, 48.6 and 47.7 %, respectively. No significant differences at 0.01 level were recorded between the OP group and the fortified mineral oils group, also not between the compounds of the same group, but significant differences observed between the pyrethroid compound and the two single mineral oils, also between them together and the others.

b- Susceptibility of different stages :

As shown in Table (94), also as observed in the previous cases, the larvae of the parasitoid showed more susceptibility to all tested insecticides than showed the pupae, but without significant differences between them both at P = 0.01, amongst all tested compounds.

c- Persistence of bioactivity :

In case of the OP compounds, the first post count data showed the highest percentages of the parasitoid reduction, without significant differences between data of the first four post counts, but with any of each and those of the seventh one. In relation to the pyrethroid compounds, it also showed its maximal potency in data of the first post count, and without significant differences appeared within the first three post counts data, whereas it appeared between any of each and starting from data of the fourth post count. The fortified mineral oils expressed their maximal potencies against the parasitoid within the records of the fourth post count data, without significant differences between the first four post counts data, but between each of any and the seventh one. Data of the two single mineral oils, resembled those of the fortified mineral oils, except that their maximal potencies appeared in the records of the second post count (30 days after application).

In general, the OP compounds and the fortified mineral oils showed the longest-lived lethal actions on the concerned parasitoid, where they induced the highest percentages of reduction amongst all tested compounds in the records of the seventh post count (180 days after application), whereas the pyrethroid compound and the two single mineral oils showed the shortest ones, thus they induced the lowest percentages of ***Aphytis*** reduction, in data of the concerned post count.

B- Season 1995 :

a- Effect on the parasitoid total population :

As shown in Table (95), the same sequence of the insecticides reductive potencies on ***A. maculicornis*** of the previous year, was also attained in the present year of 1995, where phenthoate was the most effective insecticide on the parasitoid, produced mean reduction of 90 % throughout the total time of experiment, subsequently, followed by each of fenitrothion, diazinon, Sumi oil, Cidial K, fenvalerate, Misrona (4) oil and KZ oil, where each induced 89.3, 87.9, 87.0, 86.1, 78.3, 47.8 and 47.7 % reduction, respectively, within the same period. No significant differences were recorded amongst data of the compounds under the same group, or between the OP group and the fortified mineral oils, except between phenthoate and Cidial K. Significant differences were recorded between fenvalerate and the two mineral oils, as well as between the single mineral oils, and all tested compounds, all at P = 0.01. In all cases of the OP compounds, differences in reduction percentages of the first four post counts were

Table (95) : Effect of different insecticidal groups and compounds on the parasitoid *A. maculicornis* after spring spray (May) , at El-Nobariya location, on apple trees in 1995.

Compounds	Organophosphorus compounds									Pyrethroid			Fortified oils						Mineral oils					
	Phenthoate			Fenitrothion			Diazinon			Fenvalerate			Sumi oil			Cidial K			KZ-oil			Misrona oil		
Days after application	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M
15	98.6	98.2	98.4	100.0	98.5	99.3	100.0	99.6	99.9	100.0	98.2	99.1	90.3	88.1	89.2	88.5	86.2	87.4	55.8	53.2	54.5	56.2	55.7	55.9
30	98.3	97.5	97.9	97.3	97.3	97.3	97.8	96.3	97.1	96.2	94.3	95.3	92.6	91.2	91.9	92.2	90.8	91.5	57.6	55.1	56.4	59.1	58.3	58.7
45	97.3	96.1	96.7	96.6	95.2	95.9	95.1	93.3	94.2	95.1	92.3	93.7	95.3	95.1	95.2	94.6	93.8	94.2	56.1	52.7	54.4	55.7	51.6	53.7
60	95.2	92.1	93.6	94.7	91.6	63.2	93.7	87.2	90.5	72.5	70.3	71.4	97.2	95.6	96.4	97.1	95.3	96.2	51.3	50.8	51.1	51.2	49.3	50.3
75	Parasitoid was not available to be detected during this time																							
90	Parasitoid was not available to be detected during this time																							
180	65.1	61.7	63.4	63.1	58.7	60.9	60.0	56.4	58.2	32.5	31.6	32.1	63.1	61.6	62.4	62.0	60.5	61.3	23.8	20.5	22.2	22.6	18.5	20.6
Mean	90.9	89.1	-	90.3	88.3	-	89.3	86.6	-	79.3	77.3	-	87.7	86.3	-	86.9	85.3	-	48.9	46.5	-	49.0	46.7	-
General mean of reduction	90.0			89.3			87.9			78.3			87.0			86.1			47.7			47.8		

	L.S.D. at 0.01	F
Between treatments (compounds)	3.49400	89.80331
Between intervals (post counts)	22.84663	8.50387
Between stages	2.03568	24.85344

L. : Larvae of parasitoid, % reduction

P. : Pupae, % reduction

M. : Mean of larvae and pupae, % reduction

insignificant, but the differences between any of them and those of the seventh post count were significant. The same results were found with the pyrethroid compound, but these reduction percentages of the first two post counts and the fourth post count were significantly different, also between the records of the third and these of the seventh post counts. The fortified mineral oils, showed the same trend of the OP compound, where no significant differences occurred between data of the first four post counts, but appeared between each of any and those recorded in the seventh, with the same trend in concern to the single mineral oils.

b- Susceptibility of different stages :

As recorded in Table (95), a similar trend of the previous concerned results was obtained. The larval stage of the parasitoid showed less tolerance to the tested compounds than showed the pupal stage, where phenthoate induced 90.9 % reduction to the parasitoid larvae, throughout the total time of experiment, followed by fenitrothion (90.3 %), diazinon (89.3 %), Sumi oil (87.7 %), Cidial K (86.9 %), fenvalerate (79.3 %), Misrona-4 oil (49.0 %), and KZ oil (48.9 %). The same sequence of insecticides potencies was also observed on the parasitoid pupae, where phenthoate induced the highest average of reduction to this stage, being 89.1 %, followed by fenitrothion (88.3 %), diazinon (86.6 %), Sumi oil (86.3 %), Cidial K (85.3 %), Misrona (4) oil (46.7 %) and KZ oil (46.5 %),all after the total time of experiment.

c- Persistence of bioactivity :

The longest-lived lethal effect on the parasitoid was induced -as previously reported- by phenthoate, which recorded the highest percentage of the parasitoid reduction within the records of the seventh post count, being 63.4 %, followed by Sumi oil (62.4 %), Cidial K (61.3 %), fenitrothion (60.9 %), diazinon (58.2 %), fenvalerate (32.1 %), KZ oil (22.2 %) and Misrona oil (20.6 %).

5.4.3.2- Effect of autumn sprays :

A- Season 1994 :

a- Effect on the parasitoid total population :

After autumn sprays, and as shown in Table (96), the OP compound, fenitrothion, induced the highest average percent of reduction, to the total population of *A. maculicornis*, after the total time of 180 days of the experiment, after which it caused 90.5 % reduction, followed by each of phenthoate, diazinon, Sumi oil, Cidial K, fenvalerate, KZ and Misrona oil, inducing 89.2, 88.3, 88.0, 87.7, 71.9, 44.5 and 42.6 % reduction, respectively. Reduction percentages were observed at Nobariya, after autumn sprays, however, were not higher than those of spring sprays, as was noticed on pear and plum at El-Quanater location in cases of the OP compounds and the fortified mineral oils. In the same time, fenvalerate and the two single mineral oils gave lower reduction percentages as they previously did, after autumn sprays on pear and plum trees, at El-Quanater El-Khairiya location. No significant differences were recorded between any two compounds of the same group, also not between any of the OP compounds and each of the two fortified mineral oils. Reduction caused by fenvalerate and the two mineral oils were significant, also between any of them and the rest of the tested compounds.

b- Susceptibility of different stages :

The influences of all tested insecticides, were more on the parasitoid larval stage than on pupal stage, although the differences were statistically insignificant. Amongst the larval stage, as on the total population of the concerned parasitoid, fenitrothion showed the maximum average percentage of reduction, being 91.4, as mean of different percentages of reduction in data of the seven post counts, followed by phenthoate, diazinon, Sumi oil, Cidial K, fenvalerate, KZ and Misrona oil, inducing 90.1, 89.2, 88.6, 88.2, 72.6, 45.9 and

Table (96) : Effect of different insecticidal groups and compounds on the parasitoid *A. maculicornis* after autumn spray (September), at El-Nobariya location, on apple trees in 1994.

Compounds	Organophosphorus compounds									Pyrethroid			Fortified oils						Mineral oils					
	Phenthoate			Fenitrothion			Diazinon			Fenvalerate			Sumi oil			Cidial K			KZ-oil			Misrona oil		
Days after application	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M
15	100.0	98.5	99.25	100.0	99.3	99.7	100.0	99.2	99.6	100.0	98.6	99.3	93.6	92.5	93.1	93.7	93.0	93.4	56.8	53.7	55.3	56.9	55.2	56.1
30	98.2	97.6	97.9	98.6	98.2	98.4	97.1	96.6	96.9	97.2	95.6	96.4	94.2	93.7	94.0	94.2	93.8	94.0	85.2	56.3	57.3	58.7	57.9	58.3
45	96.1	95.6	95.9	97.2	96.5	96.8	95.3	93.6	94.5	93.1	90.7	91.9	95.8	95.2	95.5	95.3	94.9	95.1	54.2	52.6	53.4	52.3	50.4	51.4
60	94.3	92.8	93.6	95.1	96.2	94.5	93.8	90.7	92.3	72.3	71.6	72.0	97.2	96.1	96.7	96.9	95.8	96.4	48.7	46.3	47.5	46.1	43.8	44.0
75	90.6	87.1	88.9	92.8	90.7	91.8	89.6	86.8	88.2	61.2	59.7	60.5	95.2	94.6	94.9	94.7	94.2	94.5	43.7	41.2	42.5	41.1	37.2	39.2
90	88.2	86.3	87.3	90.6	87.1	88.9	87.3	86.1	86.7	52.1	50.8	51.5	85.1	83.8	84.5	84.4	82.6	83.4	37.5	32.6	35.1	33.1	29.3	31.2
180	63.1	60.6	61.9	65.6	62.4	64.0	61.1	59.4	60.3	32.6	31.4	32.0	58.7	56.4	57.6	58.3	55.8	57.1	22.1	19.6	20.9	18.4	15.8	17.1
Mean	90.1	88.4	-	91.4	89.6	-	89.2	87.5	-	72.6	71.2	-	88.6	87.5	-	88.2	87.2	-	45.9	43.2	-	43.8	41.4	-
General mean of reduction	89.2			90.5			88.3			71.9			88.0			87.7			44.5			42.6		

	L.S.D. at 0.01	F
Between treatments (compounds)	3.00592	126.46627
Between intervals (post counts)	23.32478	8.20587
Between stages	------	0.43583 (insignificant)

L. : Larvae of parasitoid, % reduction

P. : Pupae, % reduction

M. : Mean of larvae and pupae, % reduction

43.8 %, respectively. In concern to the parasitoid pupal stage, which always showed less susceptibility to the tested insecticides, fenitrothion, also induced the highest influence amongst the other compounds, producing 89.6 %, followed by phenthoate, (diazinon and Sumi oil), Cidial K, fenvalerate, KZ and Misrona oils, which caused 88.0, (87.5), 87.2, 71.2, 43.2 and 41.4 %, during the total time of 180 days of the experiment.

c- Persistence of bioactivity :

Records of the first post counts of each of the OP compounds and the pyrethroid compound "fenvalerate", showed the maximum percentages of the parasitoid reduction, whereas this phenomenon was observed in the records of the fourth post count data of the fortified mineral oils, and in the second post count data of the mineral oils. In case of the OP compounds, no significant differences were recorded within data of the first six post counts, but observed between those of the seventh and the rest of the preceding post counts, with similar trend for the fortified mineral oils. In case of fenvalerate, significant drop in percent reduction of the parasitoid was found between the seventh post count data and those of the first five post counts, also between data of the fifth & sixth post counts and data of the first three post counts, and between the fourth post count data and those of each of the first and second post count records, but not recorded between any of the first three post counts. In relation to the single mineral oils, no significant differences at $P = 0.01$ were recorded between figures of the first four post counts, but between those of the sixth, and records of the first two post counts, also between data of the seventh, and the rest of data of the preceding post counts.

At this location (Nobariya), after autumn sprays, the OP and fortified mineral oils compounds induced the highest long-lived lethal influence on the parasitoid, where fenitrothion induced 64.0 % parasitoid reduction in the records of the seventh post count, followed by phenthoate (61.9 %), diazinon (60.3 %), Sumi oil (57.6 %), Cidial K (57.1 %), fenvalerate (32.0 %), KZ oil (20.9 %) and Misrona (4) oil, which showed the shortest-lived lethal influence on the parasitoid, of only 17.1 %.

B- Season 1995 :

a- Effect on the parasitoid total population :

More or less, the same results of the previous year, were also obtained in the present year (1995) of study, as shown in Table (97). Fenitrothion, the OP compound, which proved its highest efficacy amongst all tested insecticides on all of the parasitoid stages and total population, when sprayed in autumn, at all studied locations, induced an average reduction of 90.2 % to the parasitoid total population, throughout the total time of the experiment, followed by phenthoate, Sumi oil, Cidial K, diazinon, fenvalerate, KZ oil and Misrona (4) oil, each of them induced 89.2, 88.3, 87.9, 87.7, 72.1, 44.2 and 42.8 %, in respective descending order. No significant differences observed between compounds of the same group, also not between the OP group and any of the two fortified mineral oils, but were recorded between fenvalerate and each of the two mineral oils, and between them both, and the rest of the other tested two groups.

b- Susceptibility of different stages :

Without significant differences, and as usually observed, on apple trees, the parasitoid larval stage showed comparatively higher susceptibility to the tested insecticides than showed the parasitoid pupae. To the parasitoid larval stage, fenitrothion induced the highest average reduction percentage of 91.5 % within the total time of experiment, followed by phenthoate, Sumi oil, diazinon, Cidial K, fenvalerate, KZ oil and Misrona (4) oil, in which each of them induced 90.4, 89.9, 88.8, 88.3, 73.1, 45.2 and 44.0 % reduction, respectively. In regards

Table (97) : Effect of different insecticidal groups and compounds on the parasitoid *A. maculicornis* after autumn spray (September) , at El-Nobariya location, on apple trees in 1995.

	Organophosphorus compounds									Pyrethroid			Fortified oils						Mineral oils					
Compounds	Phenthoate			Fenitrothion			Diazinon			Fenvalerate			Sumi oil			Cidial K			KZ-oil			Misrona oil		
Days after application	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M	L	P	M
15	100.0	99.6	99.8	100.0	98.5	99.3	98.6	97.1	97.9	100.0	99.2	99.6	95.2	93.7	94.5	94.6	94.2	94.4	58.2	56.6	57.4	57.3	54.2	55.8
30	96.5	96.0	96.3	97.3	97.1	97.2	96.2	95.3	95.8	96.5	94.3	95.4	95.8	94.3	95.1	95.2	94.6	94.9	60.2	58.7	59.5	58.1	56.3	57.2
45	95.1	93.3	94.2	96.5	95.2	95.9	94.2	91.6	92.9	92.6	88.5	90.6	96.6	95.3	96.0	95.7	95.0	95.4	60.0	57.3	58.6	57.2	55.4	56.3
60	94.6	93.2	93.9	95.2	92.8	94.0	92.0	91.5	91.8	73.5	71.2	72.4	97.1	95.8	96.5	96.3	95.7	96.0	42.4	40.5	41.5	42.0	41.6	41.8
75	92.2	88.6	90.4	93.7	90.2	92.0	90.7	87.1	88.9	62.6	61.0	61.8	95.1	93.2	94.1	95.0	94.2	94.6	40.1	37.2	38.7	40.8	36.5	38.7
90	90.4	85.4	87.9	91.6	86.3	89.0	88.3	84.7	86.5	51.3	50.2	50.8	83.2	81.7	82.5	82.6	80.8	81.7	34.3	32.6	33.5	32.7	30.0	31.4
180	63.9	60.1	62.0	66.3	62.7	64.5	61.6	58.3	59.9	35.2	32.7	34.0	60.3	58.8	59.6	58.7	57.3	58.0	21.5	18.6	20.0	19.6	17.4	18.5
Mean	90.4	88.0	-	91.5	89.0	-	88.8	86.5	-	73.1	71.0	-	89.0	87.5	-	88.3	87.4	-	45.2	43.1	-	44.0	41.6	-
General mean of reduction	89.2			90.2			87.7			72.1			88.3			87.9			44.2			42.8		

L.S.D. at 0.01		F	
Between treatments (compounds)	4.15225	57.98300	
Between intervals (post counts)	21.81659	11.60967	
Between stages	------	0.112655	(insignificant)

L. : Larvae of parasitoid, % reduction

P. : Pupae, % reduction

M. : Mean of larvae and pupae, % reduction

to the parasitoid pupal stage, fenitrothion showed the highest percentage of reduction, being 89.0 %, subsequently followed by phenthoate (88.0 %), Sumi oil (87.5 %), Cidial K (87.4 %), diazinon (86.5 %), fenvalerate (71.0 %), KZ oil (43.1 %) and Misrona (4) oil, which caused 41.6 %, as mean of different reductions of the pupal stage which recorded within the total time of experiment.

c- Persistence of bioactivity :

In relation to the OP compounds, no significant differences were detected between data of the first six post counts, but were found between those of the seventh and data of the other preceding post counts, with presence of the highest percentages of the parasitoid reduction in data of the first post count, with similar results in concern to the fortified mineral oils, with one exception in data of the third and fourth post count which possessed the highest percentages of the parasitoid reduction.

In case of the pyrethroid compound "fenvalerate", the maximum percentage of ***Aphytis*** total population reduction, appeared in the first post count data, without significant differences between data of the first three post counts, also between those of the sixth and seventh, fifth and sixth and fourth and fifth post counts. In case of the mineral oils, the second post count data showed the highest reduction percentages amongst all of the other data of the former or latter post counts, without significancy between data of the first five post counts, also between those of the last three post counts, but between any of the first three post counts, and those of the sixth and the seventh post counts. Fenitrothion, as observed in the previous year, showed the longest bioactivity on the total population of the parasitoid, where it induced 64.5 % reduction in the records of the seventh post count (180 days after application), followed by phenthoate (62.0 %), diazinon (59.9 %), Sumi oil (59.6 %), Cidial K (58.0 %), fenvalerate (34.0 %), KZ oil (20.0 %) and Misrona (4) oil, which induced 18.5 % parasitoid reduction, after the same concerned period.

5.4.3.3- General observations on the effect of the tested insecticides, on the parasitoid *A. maculicornis* :

Results recorded above and obtained after different sprayings, *i.e.*, spring, autumn and in one case (pear at El-Quanater), winter sprayings, indicated that all of the tested insecticides induced considerable damage to the main parasitoid of the plum scale insect, after each sprayings in all cases examined.

In relation to the tested insecticides, which belonged to different groups, the organophosphorus compounds and the fortified mineral oils, caused the highest percentages of the parasitoid reduction amongst all tested insecticides, on different host plants and at different locations. The immediate effect of the tested OP compounds, combined with their comparative high residual efficacies, also the delayed effects of the fortified mineral oils, combined with their comparative extended lethal action, made them both of highly effective influence on either the plum scale insect and/or its parasitoid, ***A. maculicornis***. All of the tested OP compounds and the two fortified mineral oils induced higher percentages of reduction to the parasitoid, than they did to the plum scale insect itself, where, for instance, the OP compound fenitrothion induced 79.5 % average reduction to ***P. oleae***, while it caused 86.3 % average reduction to the parasitoid, and for Sumi oil, the fortified oil, only induced 83.9 % average reduction to the insect pest, but caused 85.3 % reduction to the parasitoid, all after spring sprays in 1994. In relation to the pyrethroid compound "fenvalerate", it was observed to induce comparatively moderate effect, on both, the pest and parasitoid, but slightly higher on the parasitoid than on the pest, for instance, it induced 73.3 % average reduction to ***P. oleae*** on pear trees, after spring sprays of 1994, and 74.9 % to the parasitoid, under the same circumstances. On the other hand, with completely different results, the mineral oils, *i.e.*, KZ and Misrona oils, were found to induce the lowest percentages of reduction to the parasitoid, combined with moderate reduction percentages to ***P. oleae***, where, for instance, KZ oil induced 72.8 %

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average reduction to the pest, while caused only 47.8 % to the parasitoid, all after the spring sprays of 1994. To explain what was observed with the mineral oils, it should be taken in consideration that the life cycle of the parasitoid is completed in considerably shorter time than that of its host (average of 20 days), the matter that allowed the parasitoid to complete its life cycle and escape from underneath scales through the exit holes, before any of the tested mineral oils kills the insect pest by means of suffocation, (or by any other means) whereas in case of the OP compounds and the fortified mineral oils, either their fast lethal action (OP compounds), or their comparatively extended bioactivity, (OP and fortified oils) enable any of them to cause high percentages of reduction to both of insect and parasitoid, especially to the unprotected adults of the parasitoid, subsequently causing higher percentages of reduction to its different stages.

In relation to the time of spraying, it was observed generally that, the autumn sprayings induced higher percentages of reduction to the parasitoid, when the OP compounds and the fortified mineral oils were sprayed, while the pyrethroid compound and the two mineral oils induced lower percentages of reduction to the parasitoid after the same autumn sprayings, when compared with those induced after the spring sprayings. On the other hand, however, the plum scale insect, always showed lower responds to the autumn sprayings, than did with the spring sprayings. This opposite relation between the insect and its parasitoid with most of the tested insecticides, after autumn sprayings, throws doubt on the advisability of autumn sprays, except with pyrethroids or mineral oils. In regards to the winter sprayings that only tested on pear trees, the obtained results indicated the comparatively lower percentages of insect reduction after these sprayings, when compared with the results of the autumn and spring sprays. These low percentages of insect reduction, after winter sprayings, mainly attributed to the abundance of the more tolerant hibernating insect adult females, to all tested insecticides. On the other hand, winter sprayings induced the highest percentages of reduction to the parasitoid, the case which could be due to the comparative rarity of the parasitoid individuals during the cold winter, when compared with its high abundance mainly in spring and also in autumn, the matter that make winter sprayings very dangerous to the parasitoid and comparatively with lower control to the pest, the matter that should be taken into consideration to reduce the common uses of winter sprays on these deciduous trees, especially the OP compounds and the fortified mineral oils in controlling ***P. oleae***, and if necessary to spray in winter, mineral oils, unfortified should be used.

The obtained data and results are in agreement with those of **Martino (1982)**, who stated in Italy that controlling the scale insects with mineral oils, were able to recolonize the treated areas with natural enemies of the scale insects such as ***Aphytis spp.*** than areas treated with organophosphorus or carbamate insecticides. Data obtained here, are in agreement with those obtained by **Argyrious and Kormadas (1983)**, in Greece, who postulated that the control of the plum scale insect, ***P. oleae***, with their natural enemies taken into consideration, should be applied in late May or early June, and the second application -if needed, could be at the end of August or at the beginning of September, against the late generation of the plum scale insect. The obtained results by **Ehler and Endicott (1983)**, were parallel to the present results, where they indicated that Malathion bait sprays against ***Ceratitis capitata***, was followed by increase of ***P oleae*** population, due to the decrease of its natural enemies, where Malathion showed high lethal effect on the parasitoids, and was less toxic to the insect pest. In correspondence to the obtained results, **Phillips *et al.* (1983)**, in California, found that preparations of acephate, or dimethoate applied in sprays to control scale insects, induced high percentages of reduction to ***Aphytis melinus***, which remained in low numbers for 10 weeks after applications. **Bellows *et al.* (1985)** reported that each of acephate, dimethoate, formetonate hydrochloride and Sabadella, had the longest residual effects on the natural enemies of scale insects, including ***Aphytis spp.***, also mentioned that acephate showed the longest-lived lethal influence on ***Aphytis***, amongst the other tested insecticides, which support the present results. **Clement (1988)**, postulated, with complete accordance to the present results that winter sprays on deciduous trees, to control the plum scale insect, were injurious to ***Aphytis*** parasitoids, as biocontrol agent on this pest. **Helmy *et al.* (1991)** mentioned that, the parasitoid ***A. maculicornis***, and the other scale insect parasitoids, were highly affected by all insecticides used, with the exception of the mineral oils, which induced the least influence to both insects and parasitoids, which completely support the present findings.