RESULTS AND DISCUSSION

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1. Survey of host plants, distribution and natural enemies of the Mediterranean black scale, *Saissetia oleae.*

1.1. Survey of host plants of the Mediterranean black scale, *Saissetia oleae* and their distribution in Egypt:

In the present study *S. oleae* was collected from 27 host plant species belonging to 22 families from 35 localities in 18 governorates (Table 5 and 6). These means that *S. oleae* is distributed in most localities in various governorates of Egypt attacking large number of host plants.

1.2. Survey of the Mediterranean black scale, *Saissetia oleae* parasitoids and predators:

Survey of *S. oleae* parasitoids and predators were conducted in differnt locations representing different Egyptian governorates. That was carried by random collections of leaf and twig samples infested with *S. oleae* from different plants that were brought to the laboartory for examination. Parasitoids, hyperparasitoids and predators were isolated and identified.

1.2.1. Survey of parasitoids:

The collected parasitoids and hyperparasitoids were identified as follows, (Table, 7).

Table (5): Host plants of the Mediterranean black scale, *Saissetia oleae* in Egypt:

Family	Species	Common name	Density of *S. oleae*
Agavaceae	*Agava americana*	-	+
Anacaxdiaceae	*Pistacia vera*	-	+
	Schiruls molle	-	+
Apocyanaceae	*Nerium oleander*	Oleander	++
	Plumeria acutifolia	Frangi pani	+
Arliaceae	*Aralia* sp.	-	+
	Panax sp.	-	+
Begoniacae	*Begonia* sp.	-	+
Caprifoliaceae	*Lonicera japonica*	Gold and silver flowers	+
Caryophyllaceae	*Dionthus caryophyllus*	Carnation	+
Combretaceae	*Terminalia catappa*	-	+
Compositae	*Artemisia absinthius*	-	++
Curciferae	*Brassica oleraceae* var *capitata*	Cabbage	+

Table (5): Cont'd.

Family	Species	Common name	Density of *S. oleae*
Ebenaceae	*Diospyros kaki*	Japanese date plum kaki	+
Ericaceae	*Erica arborea*	Brior root	+
	E. scoparia	Small heath	+
Geraniaceae	*Pelargonium zonale*	Horse shoe	+
Gramineae	*Arundo donax*	Giant red, Bamboo	+
Lauraceae	*Persea americana*	Alligator pear	+
Leguminosae	*Acacia* sp.	Acacia	++
	Gercia siliquastrum	Judastr tree red bud	+
Liliaceae	*Ruscus aculeatus*	Batcher`s broom or box holly	+
Moraceae	*Ficus benghalensis*	Bengal fig	++
Myrtaceae	*Psidium guajava*	Guava	+++
Oleaceae	*Oleae* sp.	Olive	+++
Rutaceae	*Citrus* sp.	Citrus	+
Scrophulariaceae	*Pentstemon speciosus*	Bread tongue	++

Table (6): **Distribution of the Mediterranean black scale, *Saissetia oleae* in Egypt:**

Governorate	Locality	Recording Date
Lower Egypt:		
Alexandria	El-Amiriya	15, August, 1998
	El-Agamiy	17, August, 1998
	El-Mamura	20, August, 1998
Beheira	Idku	7, Sept. 1998
	Kafr El-Dauwar	7, Sept. 1998
	Rashid	18, Sept. 1999
Cairo	Helwan	15, June, 1998
	Maadi	15, June, 1999
	El-Basatin	23, June, 2000
Daqahliya	Mit-Ghamr	20, Sept. 1998
	Talkha	25, Sept. 1999
Gharbyia	Basyun	11, Nov. 1998
	Kafr El-Zayat	13, Nov. 1999
	Samannud	25, Nov. 2000
Matruh		20, Oct. 1998
		25, Oct. 1999
		30, Oct. 2000
Minufiya	Birket El-Sab	11, Nov. 1998
	Shbin El-Kom	25, Nov. 2000

Table (6): Cont'd.

Governorate	Locality	Recording Date
Northern Coast		21, Oct. 1998
		26, Oct. 1999
		29, Oct. 2000
North Sinai	El-Arish	25, Aug. 1998
		5, Aug. 2000
Qalyubiya	Benha	26, July, 1998
	Kafr Shokr	5, July, 1999
	Qalyub	23, July, 2000
Sharqiya	Abu-Hammad	25, June, 1998
	Bilbeis	2, June, 1999
	Inshas	2, June, 1999
South Sinai	El-Tour	2, Sept. 1998
		15, Sept. 2000
		15, Sept. 2000
Suez		13, May, 1998
		24, May, 1998
		27, May, 2000
Upper Egypt:		
Assiut	Assiut	3, May, 1999
	Manfalout	11,May, 2000
Aswan	El-efantin Island	16, March, 1999

Table (6): Cont'd.

Governorate	Locality	Recording Date
	Edfu	17, March,1999
	Kom Ombo	30, March, 2000
Beni-Suef	Beni-Adi	11, Oct. 1998
	El-Fashn	11, Oct. 1998
	Berba	19, Oct. 2000
El-Minya	Abu-Qurqus	3, June, 1998
		21, June, 1999
		9, July, 2000
		9, July, 2000
Giza	Dokki	15, July, 1998
	El-Saf	20, July, 1999

Table (7): Survey of parasitoids attacking the Mediterranean black scale, *Saissetia oleae* in Egypt:

Family	Species	Type of parasite
Aphelinidae	*Coccphagus lycimnia* (Walker)	Primary parasite
	Marietta leopardina Mot.	Hyperparasite
Encyrtidae	*Baeoanusia* sp.	Primary parasite
	Diversinervus elegans Silvestri	Primary parasite
	Metaphycus bartletti (Annecke & Mynhardt)	
	M. flavus (Howard)	Primary parasite
	M. helvolus (Compere)	Primary parasite
	M. zebratus (Mercet)	Primary parasite
	Microterys flavus (Howard)	Primary parasite
	Paracerapterocerus africanus Girault	Primary parasite
Mymaridae	*Alaptus* sp.	Primary parasite
Pteromalidae	*Scutellista cyaneae* (Mot.)	Primary parasite

1.2.2. Survey of predators:

The collected predaceous species were identified as follows, (Table, 8).

As shown in Table (5) it can be concluded that *S. oleae* attacks 27 plant species. Twenty two of them as a new record for the first time in Egypt. Whereas El-Minshawy and Saad, 1977 and Mohammed and Nada, 1991 recorded only, 5 host plant species (i.e. *Antigonon* sp., *Capsicum annum, Citrus limon, Nerium oleander* and *Psidium guajava*).

Concerning of the natural enemies of *S. oleae*, it was observed that very little was known on the natural enemies of *S. oleae* in Egypt prior to the studies of Priesner and Hosny (1940). They recorded three parasitoids and one predator. Also, Abd-Rabou (1998) recorded three parasitoids attacking *S. oleae* [i.e. *Metaphycus flavus* Howard, *M. lounsburyi* (Howard) and *M. zebratus* (Mercet)].

While, In the present work, 12 parasitoids were recorded on *S. oleae*. One of them as a new record, *Mi. flavus* for the first time in Egypt. The others are *C. lycimnia, M. helvolus, M. flavus, P. africanus* and *Alaptus* sp. and the hyperparasitoid, *M. leopardina* (Table, 7) . On the other hand, nineteen predators of S. oleae recorded here for the first time in Egypt (Table, 8).

Table (8): Survey of predators attacking the Mediterranean black scale, *Saissetia oleae* in Egypt:

Order	Family	Species
Coleoptera	Coccinellidae	*Chilocorus bipustulatus* L.
		Clitostethus arcuatus Rossi
		Coccinella undecimpunctata L.
		Cryptolaemus montrouzieri Mulsant
		Exochomus flavipes Thrum.
		Rhizobius littura Fab.
		Rodalia cardinalis Muls.
		Scymnus interruptus Goiz
		S. syriacus Mars.
		Scymnus sp.
		Selethorus sp.
Diptera	Syrphidae	*Syrphus corollae* Fab.
		Syrphus sp.
		Xanthogramma aegyptium Wied

Table (8): Cont'd.

Order	Family	Species
Hemiptera	Anthocoridae	*Orius laevigatus* Fieb
		Orius sp.
Neuroptera	Chrysopidae	*Chrysoperla carneae* (Stephens)
		Chrysopa septempunctata Wesm.
	Staphylinidae	*Paederus alffierii* Koch.
Thysanoptera	Phloeothripidae	*Haplothrips andresi* Priesner

2. Population dynamics of *Saissetia oleae* and its natural enemies:

2.1. Population dynamics of the Mediterranean black scale, *Saissetia oleae* and the number of generations in correlation to the surrounding environmental factors:

The population dynamics of *S. oleae* were studied for two successive years extending from April, 1998 to March, 2000 on olive trees cultivated in Northern Coast. (150 Km. west of Alexandria).

The data obtained during the first year (1998-1999) which are reported in Table (9) and Figs (3 and 4) showed that *S. oleae* has two peaks of population in late April, 1998 and late August 1998 [(2447 and 1841 individuals/30 leaves and 15 twigs (20 cm long)], respectively. On the other hand, the lowest densities of the insect were recorded during late-Dec. 1998 [(397 individuals/ 30 leaves and 15 twigs (20 cm long)].

Data of the second year (1999-2000) which are presented in Table (10) and graphically illustrated in Figs (5 and 6) revealed that *S. oleae* had two annual peaks of population on olive trees in the beginning of April 1999 and half Aug. 1999.

The total counts of these peaks were 2207 and 953 individuals/30 leaves and 15 twigs, respectively.

It could be concluded that the highest population of *S. oleae* on olive trees during the two successive years occurred on early spring and late summer (in April and August) in the both years (1998-1999 and 1999-2000).

Table (9): Mean number of *Saissetia oleae* (Oliver) on 30 leaves and 15 twigs (20 cm long) of olive trees at Northern Coast during (April 1998-March 1999).

Sampling date	Number of *S. oleae* /sample								Q	Mean daily weather factors				
	E	1st	2nd	3rd	T	NO	O	Total		M°C	Mn°C	RH%	W mm	Wi m/s
1 April, 98	968	567	298	207	1072	223	88	2351	-	22.1	11.6	66	12.6	9.2
15	1086	594	277	197	1068	198	95	2447	1.04	24.0	16.7	65	15.3	8.6
1 May	1002	545	288	186	1019	207	93	2321	0.95	26.2	17.3	62	16.2	8.6
15	915	506	190	172	868	188	114	2085	0.89	27.0	20.4	63	18.0	9.9
1 June	753	333	187	139	659	133	88	1633	0.78	27.6	21.7	70	21.5	11.3
15	687	334	156	119	609	97	70	1463	0.89	28.7	22.7	66	21.5	11.7
1 July	588	301	176	80	557	106	74	1325	0.90	28.9	23.1	72	24.5	8.6
15	519	240	109	78	427	80	57	1083	0.81	30.0	23.3	69	24.4	9.4
1 Aug.	617	236	110	84	530	86	63	1196	1.10	30.3	24.2	69	25.2	8.9
15	743	350	208	158	716	156	70	1841	1.53	31.0	23.9	64	23.6	9.4
1 Sept.	593	330	188	141	659	146	80	1478	0.80	30.1	22.4	67	23.0	8.3
15	502	281	171	111	563	135	69	1112	0.75	29.1	22.5	71	23.9	8.2
1 Oct.	454	238	172	110	520	112	63	1149	1.03	28.7	20.3	68	21.5	6.9
15	375	216	118	88	422	111	62	970	0.84	27.0	18.9	69	19.7	7.4
1 Nov.	322	161	72	47	280	55	46	703	0.72	24.8	15.8	65	15.6	6.9
15	206	123	71	37	231	46	37	620	0.88	24.5	15.9	58	13.4	9.4
1 Dec.	167	93	70	43	206	45	28	446	0.71	21.2	12.3	66	12.8	7.1
15	159	86	56	33	175	38	25	397	0.89	21.0	8.0	70	11.5	6.3
1 Jan. 1999	229	141	72	50	263	61	33	586	1.47	16.7	10.0	73	11.3	8.6
15	315	133	77	48	258	52	43	668	1.13	16.8	7.4	68	9.8	8.4
1 Feb.	330	169	72	55	296	55	37	718	1.07	17.5	8.3	73	11.2	5.7
15	399	192	105	91	388	94	41	922	1.28	17.5	9.1	63	9.7	8.2
1 March	475	226	119	95	440	101	51	1267	1.15	19.2	9.1	70	11.8	6.6
15	507	266	158	96	520	131	58	2016	1.13	20.9	10.6	67	11.8	8.4

E = Egg, 1st = 1st nymphal instar, 2nd = 2nd nymphal instar, 3rd = 3rd nymphal instar, T =Total of nymphal instars, NO= Non-ovipositing females and O= Ovipositing females, Q = Quotient of increase, M = Maximum temperature, Mn = Minimum temperature, RH = Relative humidity, W = Water vapour and Wi = Wind speed.

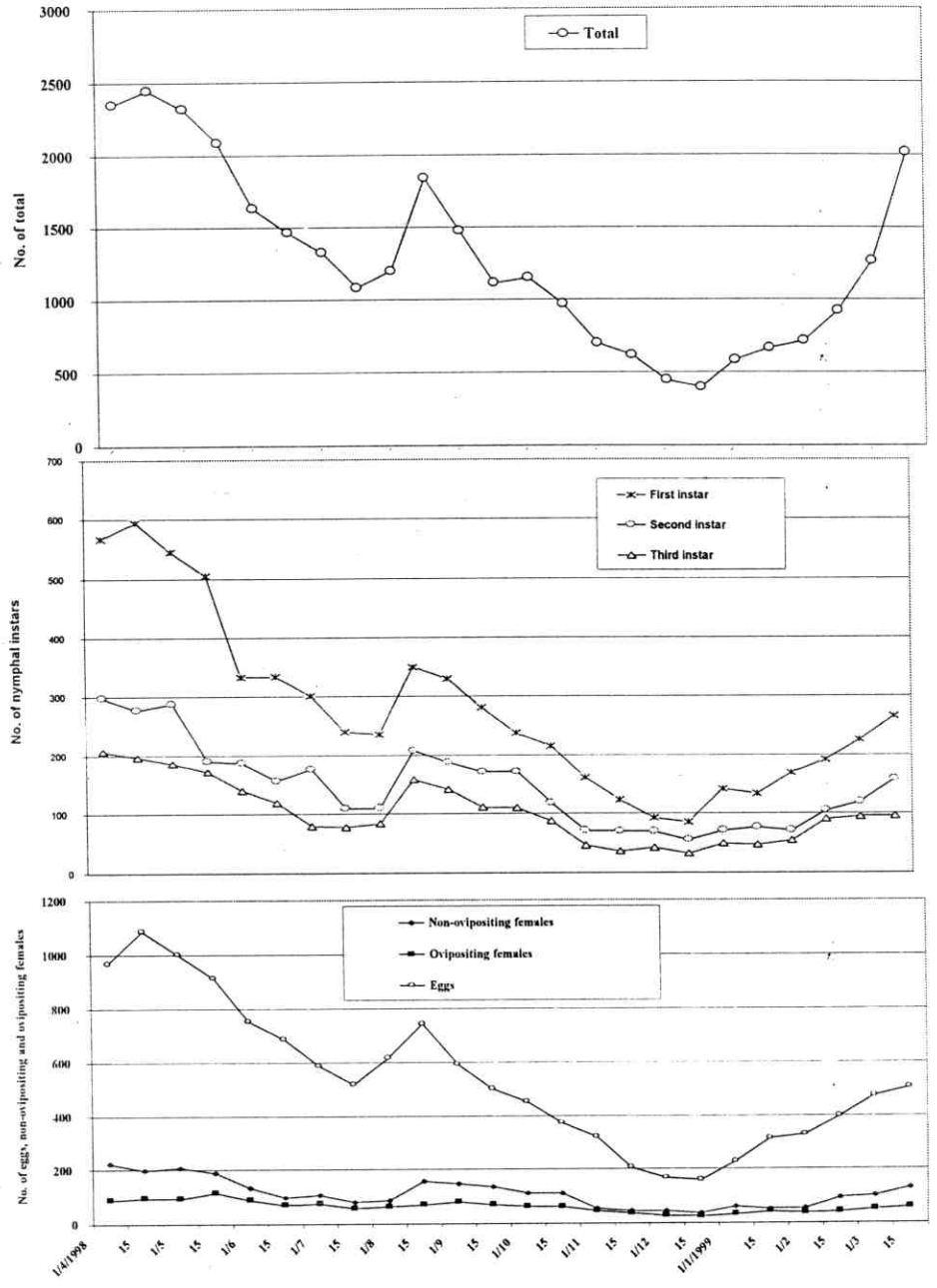

Fig. (3): Numbers of eggs, nymphal instars and non-ovipositing & Ovipositing females of *Saissetia oleae* on olive trees in Northern Coast during (1998-1999).

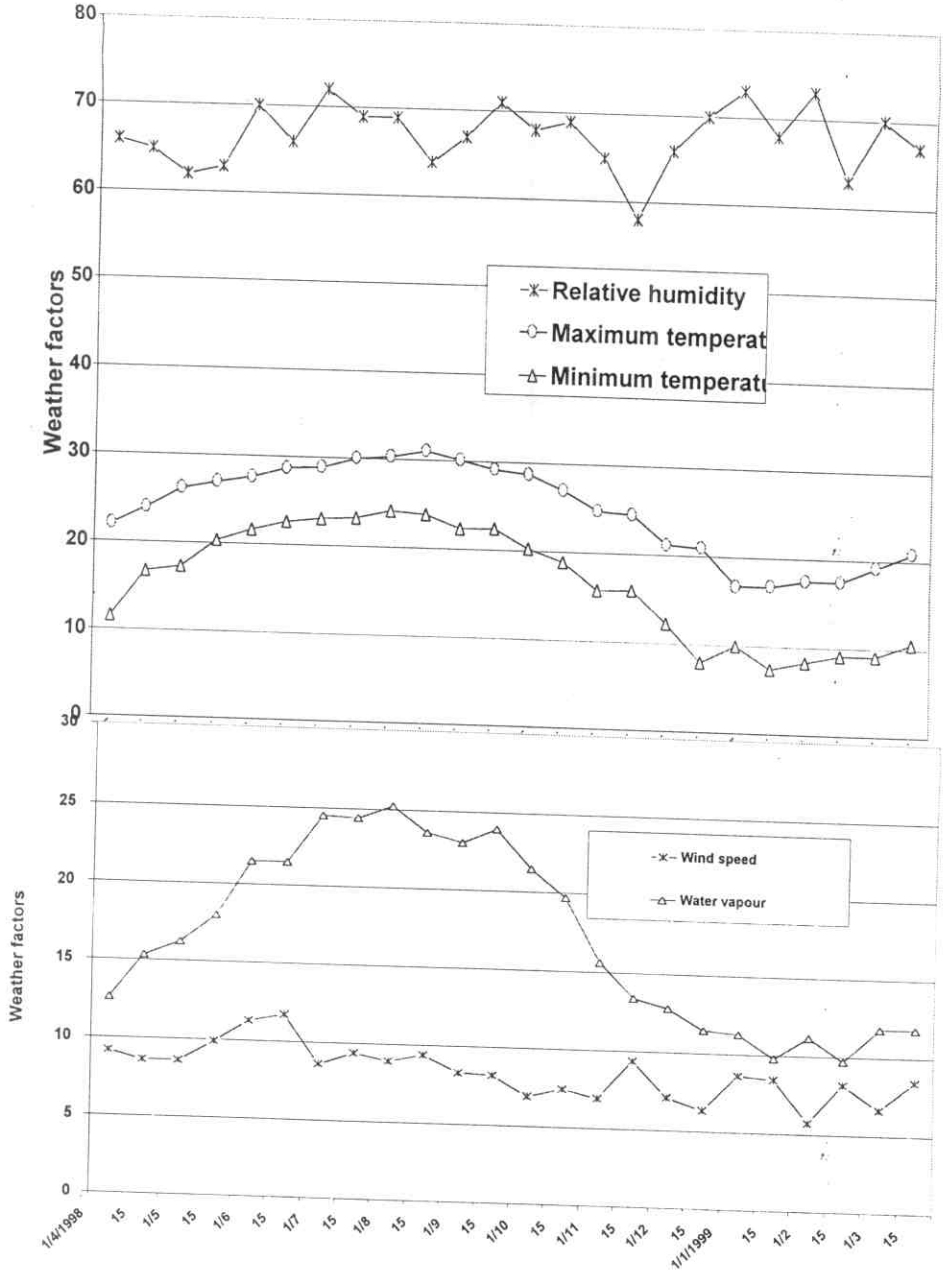

Fig. (4): Mean daily of maximum, minimum temperatures, relative humidity, wind speed and water vapour in Northern Coast during (1998-1999).

Table (10): Means in number of *Saissetia oleae* (Oliver) on 30 leaves and 15 twigs (20 cm long) of olive trees at Northern Coast during (April 1999-March 2000).

Sampling date	Number of *S. oleae* /sample								Q	Mean daily weather factors				
	E	1st	2nd	3rd	T	NO	O	Total		M°C	Mn°C	RH%	W mm	Wi m/s
1 April, 99	841	524	323	277	1124	148	94	2207	-	24.1	14.3	66	14.2	8.7
15	787	456	318	268	1142	157	85	2071	0.94	23.0	19.6	71	13.0	7.0
1 May	776	421	239	222	882	169	85	1912	0.92	26.4	17.6	68	17.7	2.7
15	677	370	233	210	813	131	97	1718	0.89	27.4	17.2	65	17.0	8.9
1 June	565	347	211	183	741	110	67	1483	0.86	28.6	22.3	69	22.2	10.7
15	410	196	138	115	449	77	55	991	0.66	27.3	19.6	73	20.9	7.8
1 July	202	200	125	105	430	77	39	748	0.75	31.1	23.2	74	26.6	8.8
15	268	148	96	100	344	70	41	723	0.96	30.5	22.4	68	23.4	8.5
1 Aug.	331	189	104	91	384	66	58	839	1.16	31.4	25.5	71	26.8	9.3
15	417	218	105	89	412	70	54	953	1.13	32.1	26.1	77	30.4	9.7
1 Sept.	322	138	128	114	380	75	57	874	0.87	29.3	20.5	59	19.3	8.4
15	233	168	113	74	355	54	47	689	0.82	32.7	24.6	66	24.6	9.3
1 Oct.	184	133	77	63	273	52	40	549	0.79	26.7	16.9	66	17.0	6.8
15	146	147	104	69	320	51	43	560	1.02	29.7	19.9	66	21.1	8.2
1 Nov.	101	71	40	68	179	39	36	355	0.63	23.8	13.4	71	15.5	6.2
15	88	52	25	18	95	40	33	256	0.72	25.4	15.3	73	17.4	5.7
1 Dec.	66	42	20	19	81	12	36	195	0.76	22.5	13.6	69	16.1	6.2
15	68	38	21	16	75	10	9	162	0.83	18.8	9.8	73	11.7	8.6
1 Jan. 2000	96	59	33	18	110	13	9	228	1.40	19.4	9.1	78	11.7	8.3
15	126	78	42	35	155	22	11	314	1.37	19.6	7.1	70	10.7	6.7
1 Feb.	144	86	54	44	184	26	15	369	1.17	18.6	8.2	72	11.1	7.6
15	182	128	56	43	227	27	18	453	1.28	19.6	9.5	67	10.7	8.3
1 March	231	156	70	64	290	42	23	586	1.29	20.8	12.5	67	12.7	8.2
15	323	120	113	88	321	69	28	741	1.26	22.1	11.6	65	12.1	8.8

E = Egg, 1st = 1st nymphal instar, 2nd = 2nd nymphal instar, 3rd = 3rd nymphal instar, T =Total of nymphal instars, NO= Non-ovipositing females and O= Ovipositing females, Q = Quotient of increase, M = Maximum temperature, Mn = Minimum temperature, RH = Relative humidity, W = Water vapour and Wi = Wind speed.

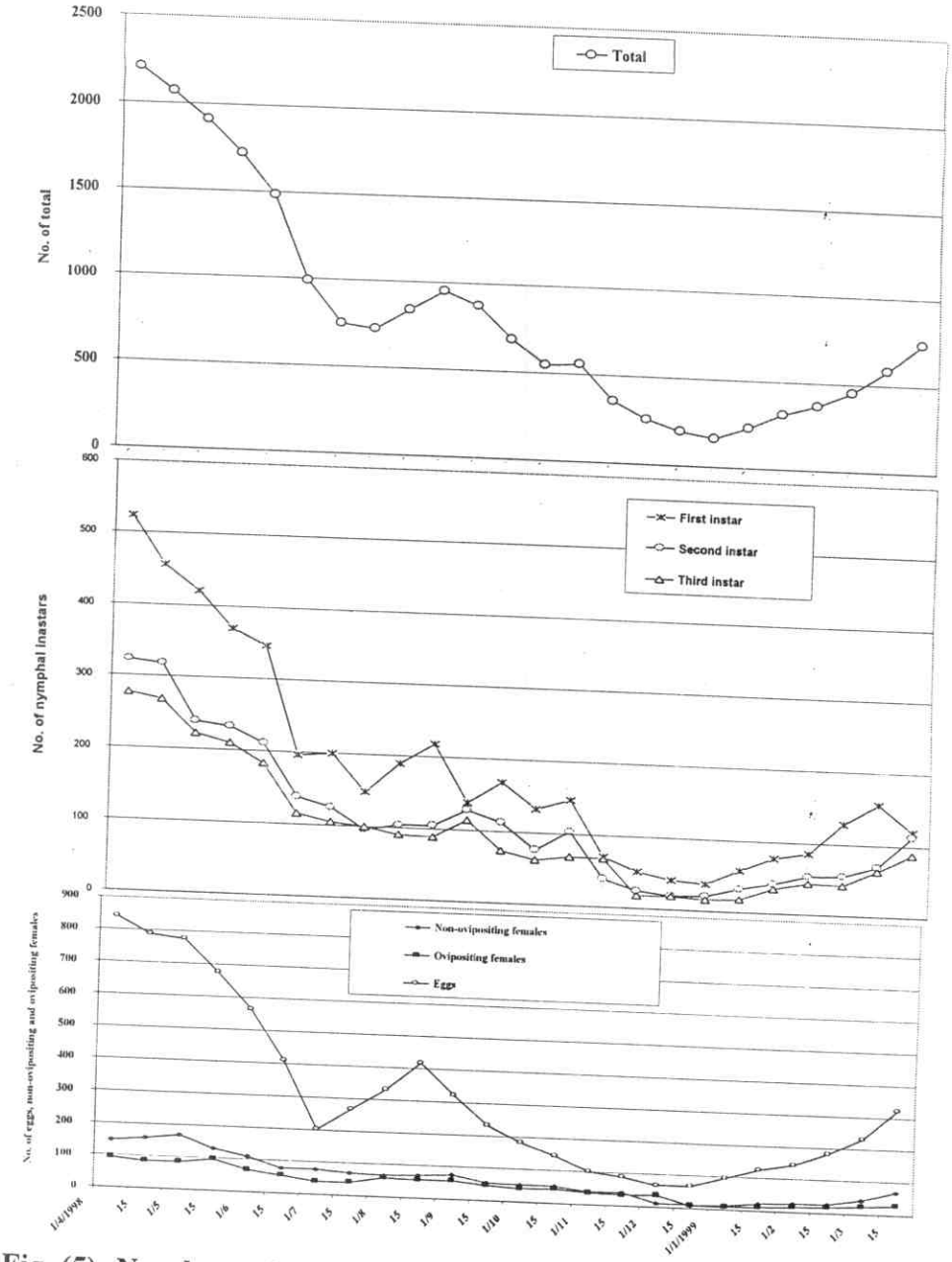

Fig. (5): Numbers of eggs, first, nymphal instars and non-ovipositing & ovipositing females of Saissetia oleae on olive trees in Northern Coast during (1999-2000).

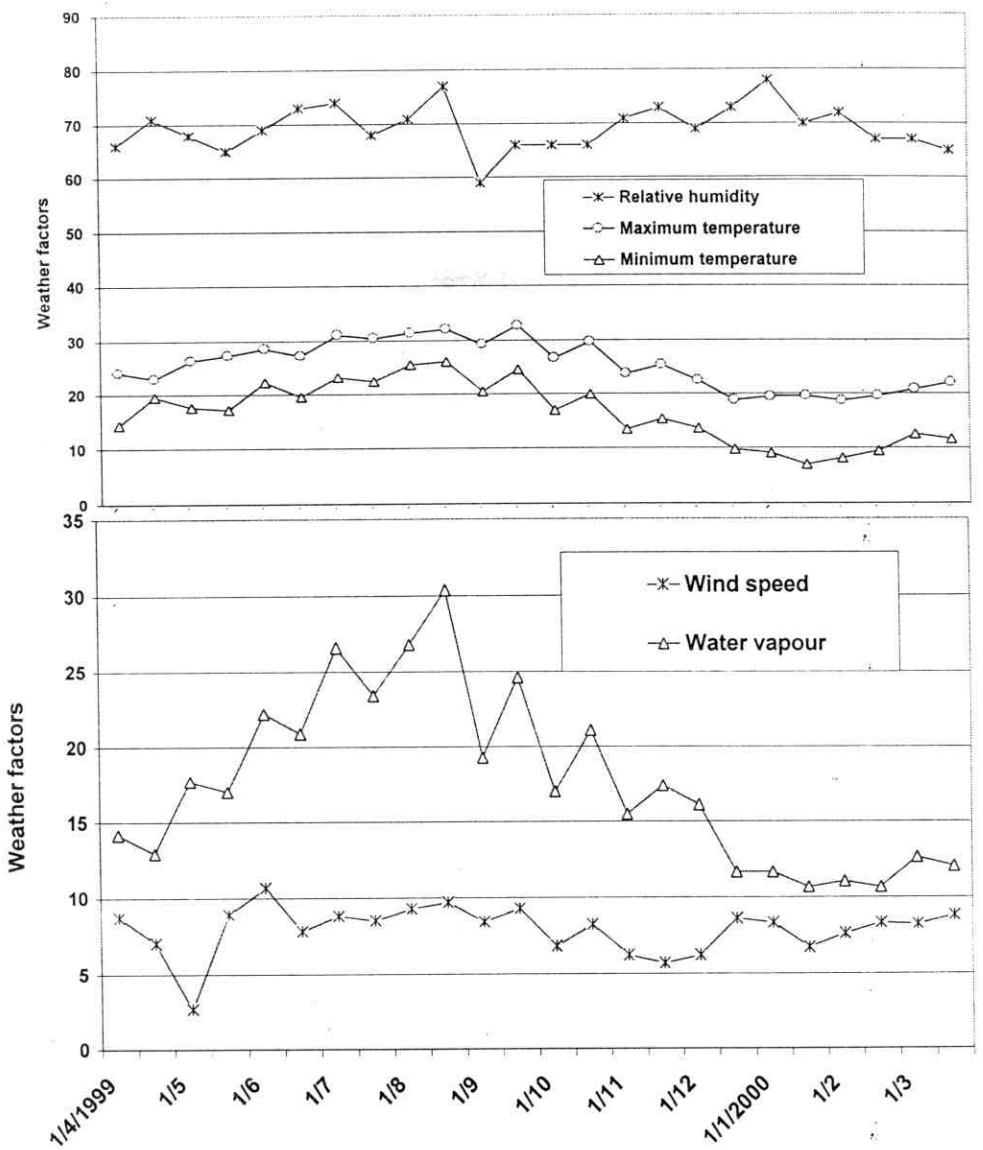

Fig. (6): Mean daily of maximum, minimum temperatures, relative humidity, wind speed and water vapour in Northern Coast during (1999-2000).

Tancyurek-Soydanbay and Yalcin (1979) recorded that *S. oleae* had one peak in Turky in the beginning of July. While, Briales and Campos (1986) recorded it's peak in Spain in June.

Concerning the quotient of increase of the total population density of *S. oleae* throughout the two studied years (Tables 9 and 10) data revealed that the first year had two increase periods, the first occurred in summer with 1.53 at late Aug. and the second in early-winter with 1.47 in 1st Jan. On the other hand, two depression periods occurred in early June (0.78) and early Dec. (0.71) in 1998-1999 (1st Year).In the second year the two highest increases of *S. oleae* total population were recorded in early Aug. (1.16) in summer season and (1.40) in early Jan. in winter season and two depression periods occurred in late June (0.66) and early Nov. (0.63).

2.1.1. Number and duration of generation:

Data in Tables (9 and 10) show the number and duration of *S. oleae* generation throughout the two years of study 1998-1999 and 1999-2000. These results indicated that, *S. oleae* may had 2 generations per year. The 1st generation extended from the 1st April to 1st Sept. 1998 and from the 1st of April, 1999 until the 1st Oct. 1999 through the first and second years of infestation, respectively. The nymphs reached their maximum percentage on mid Sept. 1998 with 50.6% where, the accompanied max., min. temperature and relative humidity, water vapour and wind speed were 29.1, 22.5, 71%, 23.9 and 8.2, respectively.

The second generation of *S. oleae* infesting olive trees started from 1st Sept. 1998 to 1st Feb., 1999 and from 1st Oct. 1999 to 1st Feb. 2000 in the first and second years, respectively. However, the maximum percentage of pre adult occurred on the 1st Jul. 1999 with 57.5% where, the accompanied max., min., RH, water vapour and wind speed were 31.1, 23.1, 74%, 26.6 and 8.8, respectively. These results agree with data obtained by Rosen *et al.* (1971) who recorded two generations of *S. oleae* per year on olive in Israel. Contradicting results were obtained by Homriti and Laraichi (1981), Briales and Campos (1986), Orphanides (1990) who recorded one generation of *S. oleae* on olive trees in Morocco, Spain and Greece, respectively.

2.1.2. Effect of climatic factors on the population of different stages of *Saissetia oleae*:

The effectiveness of climatic factors on different stages of *S. oleae* was studied during the two years (1998-1999 and 1999-2000) at the Northern Coast in Egypt.

Figs (4 and 6) show the daily maximum and minimum temperatures, daily mean relative humidity, daily mean water vapour and daily wind speed.

Statistical analysis of the relation between main climate factors and the population of *S. oleae* (Table, 11) during the first year 1998-1999 revealed that the effect of max. temp. factor was highly significant ($R^2 = 0.3509$, $P < 0.01$). Other factors were insignificant. The combination effect of max. temp., RH, water

Table (11): Relation between weather factors and population dynamics of *Saissetia oleae* during the two years of investigation (1998-1999 and 1999-2000).

Factors	1998-1999				1999-2000			
	a	b	R^2	T	a	b	R^2	T
Max. Temp.	119.116700	14.977165	0.1564	0.0558	51.677187	10.115438	0.1294	0.0842
Max. Sqr. Of Max. Temp.	152.725681	*12.470137 *0.199223	0.3500	*0.3081 *0.4349	2262.171344	3.542904 189.998767	0.3509	0.0141 0.0103
Min. Temp.	43.133263	12.527206	0.1721	0.04349	92.291858	6.995861	0.1012	0.1298
RH	1041.827530	11.780764	0.0571	0.2608	536.460900	4.767891	0.0242	0.4677
Water vapour	80.503509	9.906309	0.0894	0.1559	80.503509	9.906309	0.0894	0.1559
Wind speed	412.071564	78.611019	0.3914	0.0011	412.071564	78.611019	0.3914	0.0011

vapour, wind speed was highly significant with ($R^2 = 0.7819$ and $P < 0.01$).

During the second year 1999-2000 statistical analysis indicated that wind speed factor had highly significant effect with $R^2 = 0.3914$ and $P < 0.01$, but the other factors were insignificant, while the combination effect of observed max. and min. temp. was highly significant ($R^2 = 0.6346$, $P < 0.01$).

2.1.3. Effect of different olive tree levels and directions on the distribution of *Saissetia oleae.*

The total population of *S. oleae* on the upper, medium and lower levels of the tree during the two years of investigation are given in Tables (12 and 13) and graphically illustrated in Figs (7-12).

The effects of the cardinal directions, (north, south, east, west and core) on the distribution of this pest during the two successive years of studying (1998-1999 and 1999-2000) are also, represented in Tables (15 and 16) and illustrated in Figs (13-22).

2.1.3.1. Effect of different levels of the olive trees on the distribution of *Saissetia oleae* population.

Data presented in Tables (12 & 13), showed the variations in the total population of *S. oleae* on olive, at the three levels during the two years (1998-1999 and 1999-2000) (Figs 7-12).

Table (12): Half-monthly counts of *Saissetia oleae* in relation to different olive tree levels in Northern Coast during 1998/1999.

Sampling date	No. of individuals of *S. oleae*																				
	Lower							Medium							Upper						
	E	1st	2nd	3rd	NO	O	T	E	1st	2nd	3rd	NO	O	T	E	1st	2nd	3rd	NO	O	T
1 April, 98	338	161	89	63	48	24	723	130	63	39	35	30	23	320	126	60	28	22	14	10	260
15	373	194	100	83	58	28	836	130	155	33	32	34	22	406	160	68	31	25	19	12	315
1 May	372	273	97	93	69	38	942	115	63	33	32	31	23	297	134	81	38	29	24	12	318
15	283	293	182	92	97	46	993	89	54	30	31	30	21	255	92	66	38	35	27	15	273
1 June	197	204	181	124	80	57	843	74	42	25	27	28	20	216	78	47	31	37	32	23	248
15	104	96	69	122	113	69	573	65	35	20	23	27	16	186	46	39	23	24	31	23	186
1 July	79	80	71	91	134	69	524	54	30	17	15	22	16	154	53	34	20	22	26	26	181
15	91	55	43	65	84	65	403	53	27	14	15	17	11	137	83	27	17	18	19	19	183
1 Aug.	98	66	36	37	61	34	332	70	27	13	12	14	8	144	119	39	15	15	15	12	215
15	193	85	41	29	32	29	409	85	35	13	11	10	6	160	101	54	20	13	12	9	209
1 Sept.	229	102	48	37	26	20	462	79	41	18	11	10	4	163	88	48	29	14	9	7	195
15	216	98	50	46	33	15	458	74	39	21	16	9	4	163	59	44	24	26	14	6	173
1 Oct.	88	80	55	46	41	19	329	61	36	19	20	13	3	152	48	31	22	21	25	10	157
15	67	65	40	43	42	24	281	52	30	17	17	19	5	140	38	24	16	17	19	16	130
1 Nov.	25	53	32	31	24	20	185	38	22	14	14	13	8	109	29	20	13	14	14	11	101
15	53	39	23	25	26	15	181	34	19	13	12	13	5	96	20	15	9	11	11	7	73
1 Dec.	63	39	17	16	18	11	164	27	16	10	11	3	5	72	31	12	7	7	9	6	72
15	68	42	18	14	15	8	165	24	13	8	7	3	3	58	45	15	6	5	6	4	81
1 Jan. 99	89	47	20	14	10	6	186	35	15	6	6	5	4	71	52	23	7	4	3	2	91
15	137	63	28	16	12	3	259	29	20	8	5	4	1	67	78	27	12	5	2	0	124
1 Feb.	182	81	35	25	12	7	342	57	26	11	6	3	1	104	99	41	17	9	4	0	170
15	190	115	55	31	18	11	420	73	33	15	8	5	0	134	103	54	25	14	7	1	204
1 March	235	131	33	47	23	11	480	89	44	19	12	7	1	172	114	60	29	23	11	4	241
15	251	163	46	31	39	15	545	113	58	25	16	10	2	224	142	66	38	29	18	8	301
Total	4021	2625	1409	1221	1115	644	11035	1650	943	441	394	360	212	4000	1938	995	515	439	371	243	4501

E = Egg, 1st = 1st nymphal instar, 2nd = 2nd nymphal instar, 3rd = 3rd nymphal instar, NO= Non-ovipositing females and O= Ovipositing females and T =Total of population

Table (13): Half-monthly counts of *Saissetia oleae* in relation to different olive tree levels in Northern Coast during 1999/2000.

Sampling date	No. of individuals of *S. oleae*																							
	Lower							Medium							Upper									
	E	1st	2nd	3rd	NO	O	T	E	1st	2nd	3rd	NO	O	T	E	1st	2nd	3rd	NO	O	T			
1 April, 99	573	446	233	210	169	127	1758	155	73	35	24	15	7	309	171	79	30	27	22	11	340			
15	605	457	343	247	185	152	1989	165	79	37	27	23	9	340	196	88	39	30	26	14	393			
1 May	550	482	369	331	234	157	2123	129	87	40	31	23	13	323	214	101	44	37	27	16	439			
15	345	441	376	332	310	204	2008	103	66	43	39	29	14	294	184	113	50	40	36	18	441			
1 June	253	260	299	369	342	287	1810	80	51	33	41	34	17	256	163	96	53	48	37	23	420			
15	137	176	186	291	334	306	1430	63	42	28	31	36	19	219	123	84	49	49	46	25	376			
1 July	87	81	89	178	282	276	993	55	32	22	27	30	20	186	99	72	40	35	46	29	321			
15	77	46	44	87	175	264	693	44	28	17	22	18	15	144	85	47	30	37	42	32	273			
1 Aug.	89	42	25	42	81	133	412	65	24	15	15	17	9	145	102	43	24	35	35	27	266			
15	110	46	22	21	31	55	285	80	34	12	13	14	8	161	123	49	21	23	25	20	261			
1 Sept.	137	52	27	22	21	27	286	79	44	17	11	12	8	171	134	61	25	19	21	10	270			
15	125	73	28	25	19	15	285	73	40	23	16	8	6	166	135	68	31	25	19	10	288			
1 Oct.	103	65	37	26	21	11	263	68	36	19	22	14	3	162	117	77	36	28	21	8	287			
15	103	57	29	33	22	15	259	55	32	19	18	19	7	150	95	57	36	33	27	10	258			
1 Nov.	81	44	26	24	31	18	224	43	26	17	16	16	11	129	80	50	29	34	32	13	238			
15	68	40	21	24	23	23	199	38	21	13	15	13	10	110	67	89	23	26	32	16	253			
1 Dec.	56	35	25	18	20	17	171	30	22	11	13	13	7	96	51	33	20	22	23	18	167			
15	47	28	18	16	17	12	138	33	15	10	10	10	6	84	44	27	17	17	20	13	138			
1 Jan. 2000	67	22	14	13	13	7	136	42	15	8	9	8	5	87	47	20	15	14	15	11	122			
15	95	34	12	11	10	8	170	56	26	8	7	7	3	107	61	23	12	14	12	5	127			
1 Feb.	148	49	20	9	9	6	241	66	30	9	7	5	2	119	84	28	12	9	12	5	150			
15	199	76	29	15	8	4	331	81	34	16	9	5	1	146	99	41	13	11	8	4	176			
1 March	244	98	43	24	10	3	422	97	43	19	14	7	1	181	117	46	22	12	9	2	208			
15	325	148	58	34	19	3	587	107	54	7	16	10	3	197	138	70	28	20	10	3	269			
Total	4624	3298	2373	2402	2386	2130	17213	1807	954	478	453	386	204	4282	2729	1462	699	645	603	343	6481			

E = Egg, 1st = 1st nymphal instar, 2nd = 2nd nymphal instar, 3rd = 3rd nymphal instar, NO= Non-ovipositing females and O= Ovipositing females and T =Total of population

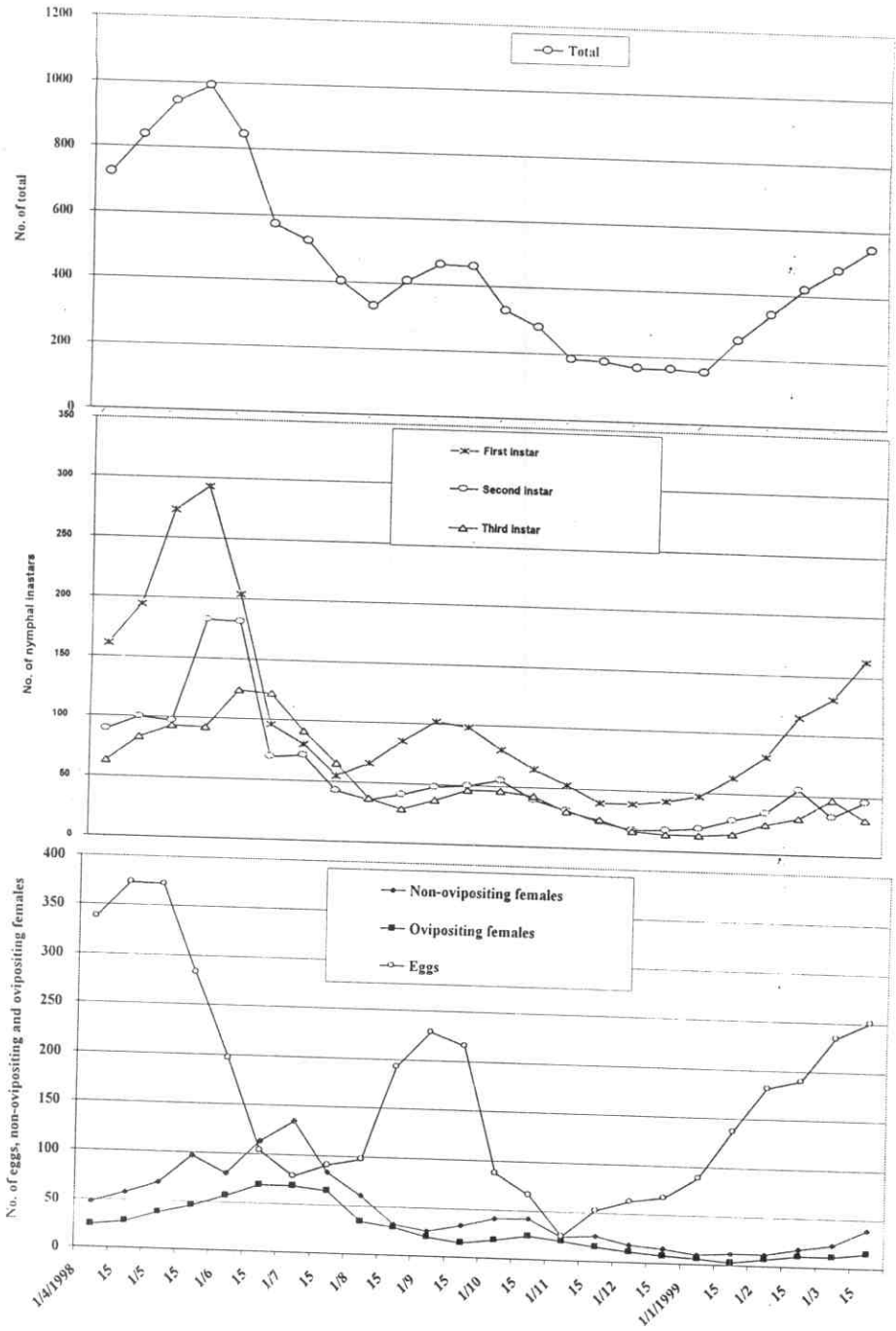

Fig. (7): Half-monthly counts of *Saissetia oleae* in relation to lower level of the olive tree in Northern Coast during (1998-1999).

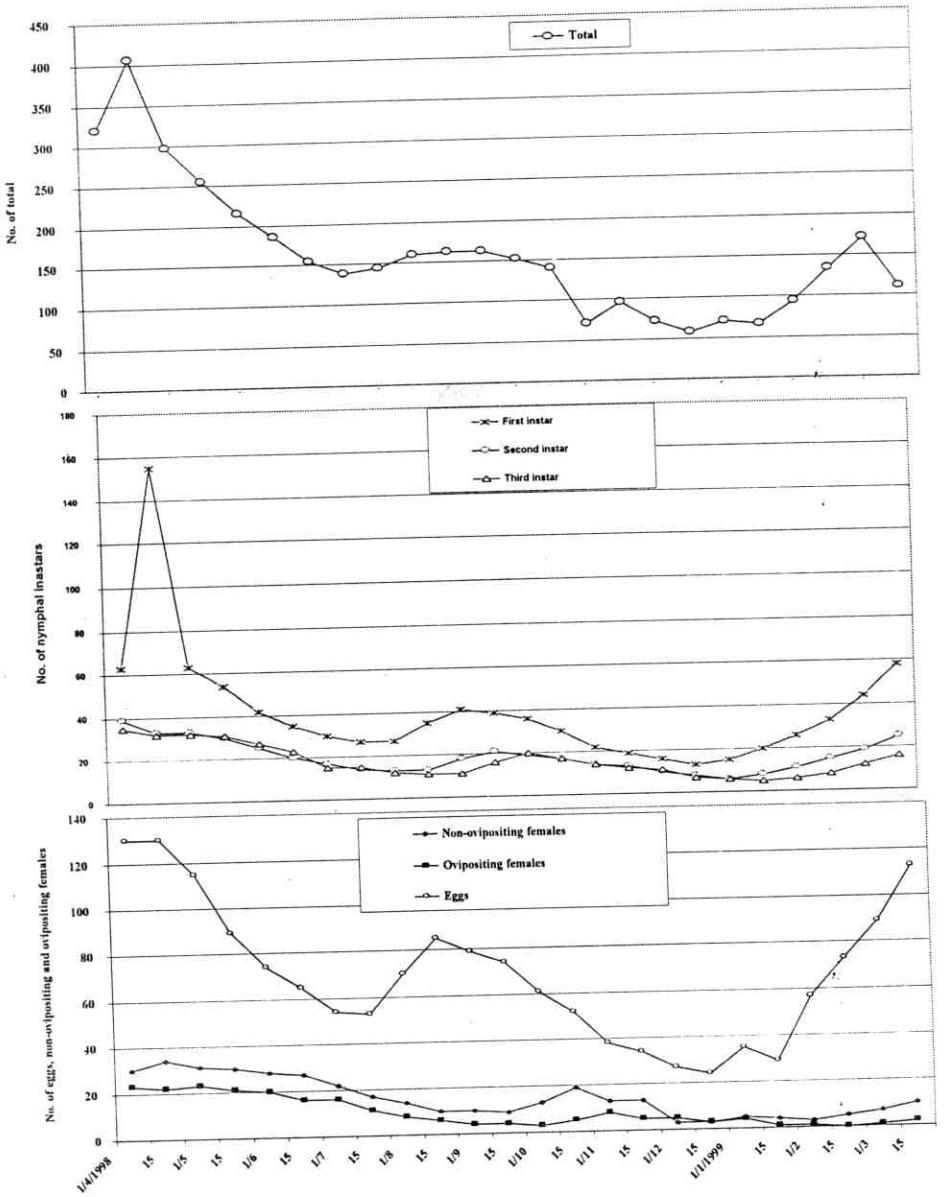

Fig. (8): Half-monthly counts of *Saissetia oleae* in relation to medium level of the olive tree in Northern Coast during (1998-1999).

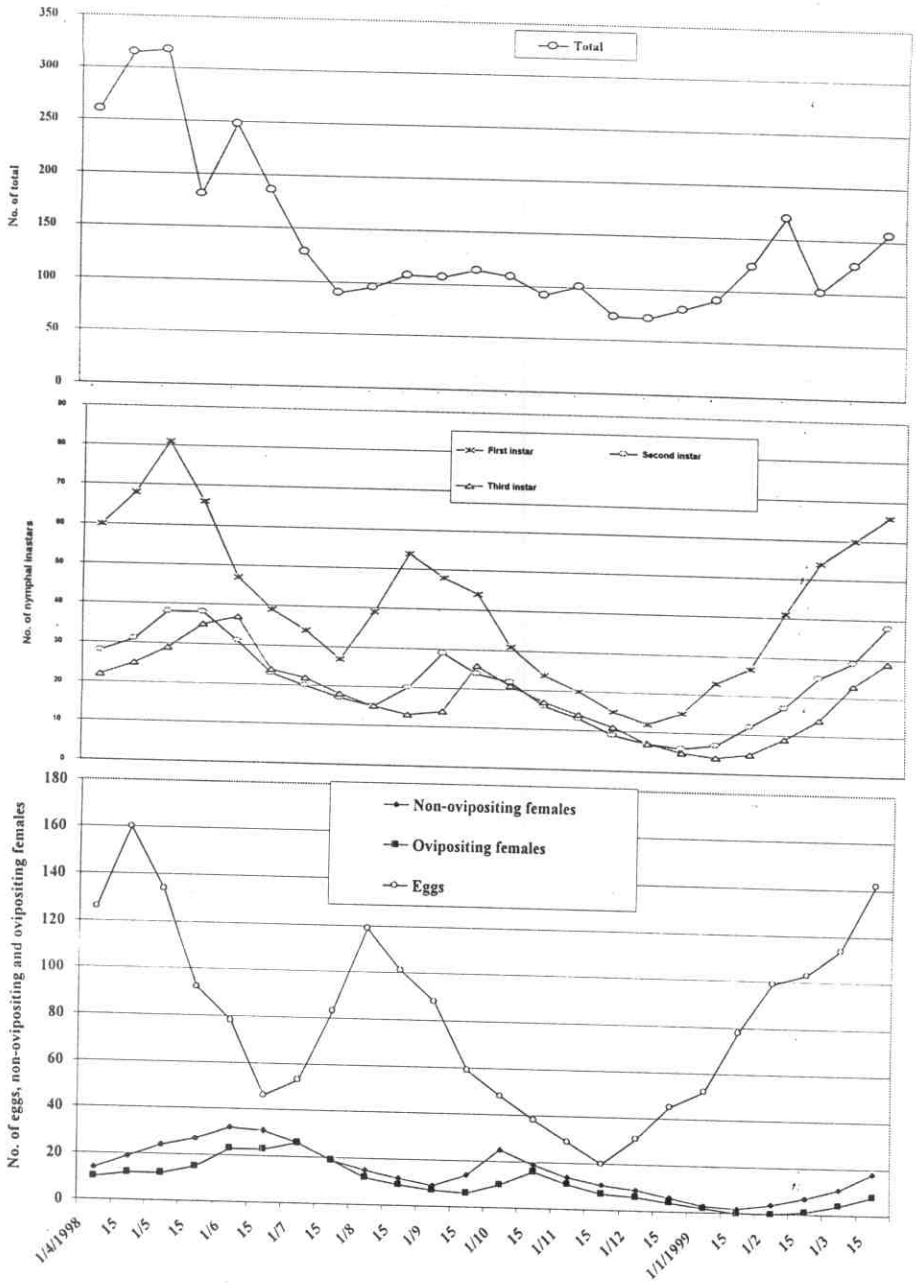

Fig. (9): Half-monthly counts of *Saissetia oleae* in relation to upper level of the olive tree in Northern Coast during (1998-1999).

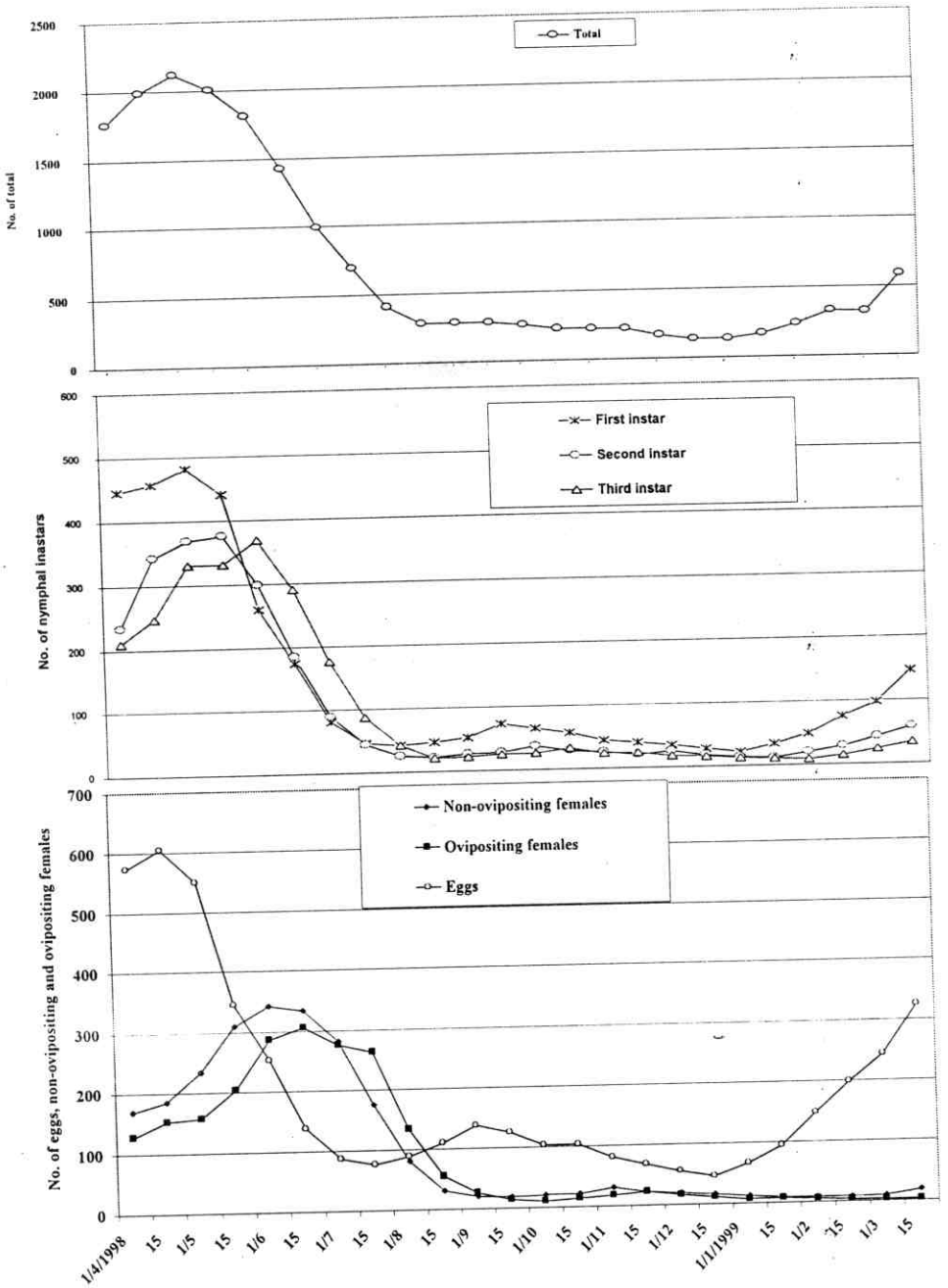

Fig. (10): Half-monthly counts of *Saissetia oleae* in relation to lower level of the olive tree in Northern Coast during (1999-2000).

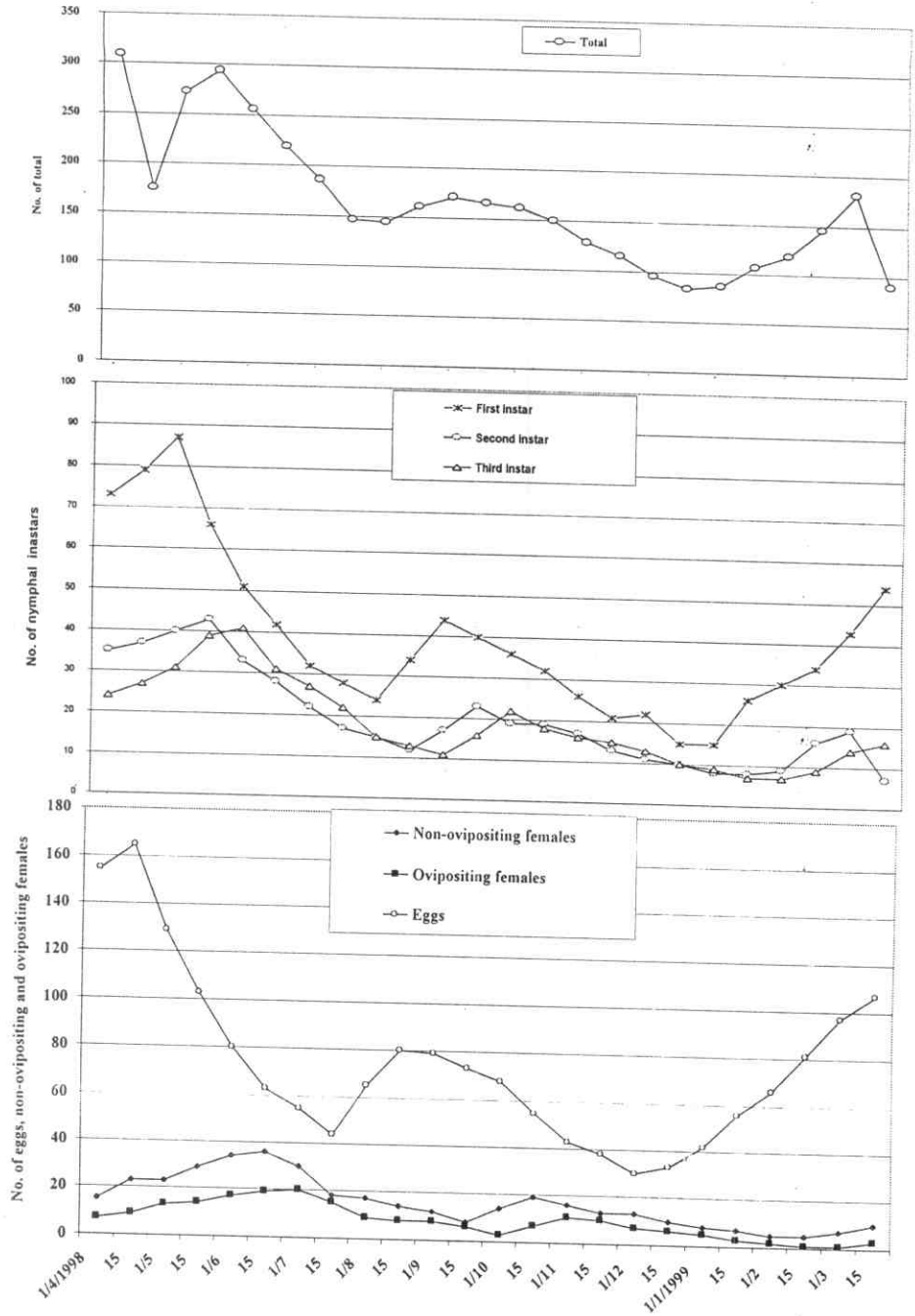

Fig. (11): Half-monthly counts of *Saissetia oleae* in relation to medium level of the olive tree in Northern Coast during (1999-2000).

Table (14): **Statistical analysis of the effect of different levels of the olive trees on *Saissetia oleae* population during the two years (1998-1999 and 1999-2000).**

Seasons / Level	1998-1999	1999-2000
	Mean	Mean
Lower	296.22 a	526.44 a
Middle	157.57 b	155.56 b
Upper	107.21 c	103.57 b
F value	79.69	45.70
P value	0.001	0.0001

Table (15): Half-monthly counts of *Saissetia oleae* on olive trees in relation to cardinal direction and tree centre in Northern Coast during 1998/1999.

Sampling date	East							South							North							West							Central core						
	E	1st	2nd	3rd	NO	O	T	E	1st	2nd	3rd	NO	O	T	E	1st	2nd	3rd	NO	O	T	E	1st	2nd	3rd	NO	O	T	E	1st	2nd	3rd	NO	O	T
1 April, 98	270	136	66	62	55	31	620	214	110	56	53	39	36	508	591	305	143	129	118	68	1354	518	305	143	132	149	173	1420	140	90	58	53	27	15	383
15	288	144	73	66	60	30	661	215	111	59	54	47	23	509	672	322	166	140	123	80	1503	511	279	156	141	124	63	1274	138	87	54	47	31	16	373
1 May	255	159	81	70	64	40	669	197	126	61	56	51	20	511	652	330	177	159	135	86	1539	415	279	158	153	138	69	1212	102	61	39	35	25	13	275
15	192	137	83	77	67	45	601	53	102	69	57	53	29	363	405	276	180	173	146	95	1275	401	269	165	155	149	81	1220	81	49	30	25	21	11	217
1 June	132	92	70	79	74	48	495	110	81	57	66	52	30	396	295	197	126	173	164	97	1052	368	227	151	164	150	85	1145	71	46	28	23	19	9	196
15	100	70	52	68	76	53	419	74	64	42	53	61	21	315	157	156	108	118	164	112	815	303	192	122	148	159	85	1009	57	34	22	17	13	8	151
1 July	74	57	38	49	65	50	333	69	41	36	38	52	28	264	98	78	96	103	111	106	592	222	167	107	120	138	91	845	49	33	21	18	15	5	141
15	61	42	30	39	46	43	261	50	37	22	31	33	22	195	80	46	45	92	102	69	434	157	133	90	102	115	69	666	39	27	16	12	9	5	108
1 Aug.	84	50	23	28	36	28	249	71	29	19	20	25	18	182	111	45	28	41	86	68	379	193	90	74	86	69	58	570	43	26	15	11	8	5	108
15	117	42	19	21	27	21	247	93	37	16	18	18	10	192	126	62	28	26	39	50	331	259	106	61	72	80	51	629	79	35	14	11	6	2	147
1 Sept.	94	58	23	17	19	16	227	86	53	21	14	14	8	196	113	64	30	24	24	24	279	195	156	68	58	69	41	587	74	46	20	14	8	2	164
15	87	49	31	21	16	11	215	76	42	31	19	13	7	188	98	53	29	29	23	12	244	138	90	88	65	59	36	476	66	45	29	21	12	3	176
1 Oct.	76	44	24	30	19	9	202	60	38	21	29	18	5	171	89	49	27	32	27	10	234	112	79	66	52	59	26	394	45	30	19	19	9	6	128
15	69	35	22	21	28	10	185	47	29	18	19	28	8	149	72	46	26	24	27	11	206	91	65	52	64	80	30	382	41	22	14	12	7	2	98
1 Nov.	57	35	18	20	24	17	171	37	25	15	16	17	10	120	58	35	23	23	24	13	176	82	58	43	50	61	40	334	30	17	9	9	5	3	73
15	48	32	16	16	18	9	139	31	21	13	13	15	7	100	48	31	19	21	22	11	152	69	53	36	41	44	30	273	30	17	10	7	6	2	72
1 Dec.	45	24	15	16	14	9	123	24	16	11	12	12	6	81	38	25	15	18	20	8	124	68	42	34	34	36	19	233	21	9	6	5	3	1	45
15	35	21	13	12	11	6	98	16	14	12	10	10	4	66	31	19	15	15	16	8	104	53	40	29	31	31	17	201	18	10	5	3	2	0	38
1 Jan. 99	52	18	11	12	11	4	108	28	11	7	7	8	3	64	41	21	11	13	14	6	106	65	32	24	25	28	12	186	34	14	7	4	2	1	62
15	69	31	9	10	9	3	131	46	17	6	6	7	2	84	56	27	12	10	11	4	120	71	40	17	23	21	10	182	40	18	6	4	3	0	71
1 Feb.	87	34	15	8	7	2	153	68	26	10	4	5	1	114	98	38	18	11	8	3	176	95	43	23	15	18	8	202	55	26	11	4	1	0	97
15	111	47	18	13	6	1	196	87	37	16	9	4	1	154	127	53	22	16	10	3	231	107	51	30	23	14	8	233	55	29	12	5	1	0	102
1 March	131	57	23	17	12	0	240	116	52	21	14	7	0	210	156	79	27	21	15	2	300	136	69	37	28	16	6	292	85	30	16	6	2	0	139
15	147	66	32	22	16	5	288	161	67	30	20	13	2	293	203	90	40	29	20	5	387	133	86	46	34	22	8	329	60	43	20	7	4	0	134
Total	2681	1480	805	794	780	491	7031	2029	1186	669	638	602	301	5425	4415	2447	1411	1440	1449	951	12113	4762	2951	1820	1816	1829	1116	14294	1453	844	481	372	239	109	3498

E = Egg, 1st = 1st nymphal instar, 2nd = 2nd nymphal instar, 3rd = 3rd nymphal instar, NO= Non-ovipositing females and O= Ovipositing females and T =Total of population

Table (16): Half-monthly counts of *Saissetia oleae* on olive trees in relation to cardinal direction and tree centre in Northern Coast during 1999/2000.

Sampling date	East							South							North							West							Central core						
	E	1st	2nd	3rd	NO	O	T	E	1st	2nd	3rd	NO	O	T	E	1st	2nd	3rd	NO	O	T	E	1st	2nd	3rd	NO	O	T	E	1st	2nd	3rd	NO	O	T
1 April, 99	369	179	100	89	81	40	858	420	208	107	59	85	36	915	383	178	91	91	83	50	876	420	216	121	105	90	49	1001	122	68	35	24	17	8	274
15	384	191	107	98	86	45	911	391	210	121	92	69	42	925	382	184	91	88	88	52	885	436	232	133	119	104	54	1078	144	36	33	24	16	7	260
1 May	399	204	123	100	96	50	972	268	190	117	103	89	47	814	313	189	91	87	83	46	809	398	257	150	121	116	60	1102	119	57	30	18	11	8	243
15	279	184	135	127	102	53	880	218	112	97	97	100	51	675	207	148	94	87	84	46	666	329	215	175	147	127	68	1061	93	44	24	16	11	6	194
1 June	182	162	105	132	115	54	750	164	105	67	79	95	57	567	150	101	78	89	82	43	543	290	193	138	171	145	72	1009	81	25	20	10	6	6	148
15	101	101	97	114	129	60	602	134	83	56	62	77	58	470	82	91	54	75	85	42	429	186	168	121	136	167	80	858	68	38	21	12	5	3	147
1 July	86	66	64	90	112	64	482	96	69	44	53	61	40	363	63	47	53	50	68	44	325	126	120	115	116	134	83	694	54	20	17	9	10	2	112
15	73	54	48	60	87	55	377	122	52	35	41	49	31	330	78	34	24	48	64	35	283	95	80	85	103	115	74	552	44	20	14	9	6	5	98
1 Aug.	112	48	35	46	57	44	342	135	55	25	32	39	25	311	106	40	17	22	64	24	273	130	64	59	82	100	66	501	77	36	21	6	4	3	147
15	134	61	31	32	42	32	332	131	68	29	24	31	17	300	140	54	21	15	21	30	281	145	84	64	56	99	68	516	99	53	22	12	6	1	193
1 Sept.	99	81	39	29	30	23	301	104	65	36	26	22	14	267	105	69	28	19	13	9	243	116	92	59	46	55	45	413	78	49	26	13	9	3	178
15	87	66	53	38	27	15	286	89	47	35	34	23	10	238	48	51	41	27	15	5	187	92	71	74	57	50	31	375	75	41	27	14	8	4	169
1 Oct.	37	95	54	25	36	13	260	79	45	23	34	30	11	222	69	42	26	38	21	6	202	74	58	50	71	54	23	330	65	36	24	13	8	3	149
15	62	47	30	49	50	17	255	66	41	21	22	30	16	196	58	34	21	24	22	9	168	58	51	43	48	69	25	294	56	29	18	14	6	2	125
1 Nov.	56	42	33	36	40	27	234	35	34	20	19	18	12	138	41	30	18	19	23	14	145	49	39	35	42	47	35	247	49	24	16	10	7	2	108
15	49	37	28	32	35	22	203	43	30	18	18	16	8	133	32	21	15	16	16	11	111	41	32	23	33	40	27	196	37	21	14	8	6	2	88
1 Dec.	39	33	23	25	30	18	168	48	17	12	13	14	5	109	27	16	11	13	14	6	87	34	22	23	27	37	20	163	36	12	14	8	4	3	77
15	36	28	23	21	23	14	145	34	24	15	16	15	6	110	21	15	9	10	11	6	72	38	21	16	21	24	16	136	27	15	13	8	3	1	67
1 Jan. 00	56	24	21	19	20	11	151	69	23	9	11	12	5	129	40	10	9	7	9	3	78	64	29	13	14	20	12	152	41	17	14	6	5	1	84
15	70	38	17	19	20	10	174	95	36	12	8	10	3	164	62	25	5	7	6	2	107	83	46	15	11	12	9	176	47	22	14	8	3	3	97
1 Feb.	39	44	29	16	17	9	154	80	51	19	10	7	2	169	83	30	13	4	6	2	138	94	56	33	14	9	5	211	54	24	10	9	4	1	102
15	115	64	39	27	41	7	293	155	66	28	17	9	1	276	103	39	15	8	4	1	170	115	71	41	26	12	5	270	80	29	15	8	4	2	138
1 March	129	71	48	63	24	6	341	202	84	35	26	15	3	365	160	60	25	17	10	2	274	154	79	51	39	24	4	351	93	36	21	14	4	2	170
15	144	105	63	43	33	8	396	194	75	34	22	12	3	340	168	99	72	47	35	10	431	111	50	24	17	9	5	216							
Total	3137	2025	1345	1330	1333	697	9867	3546	1908	1079	974	980	534	9021	2947	1583	884	883	904	491	7692	3735	2395	1709	1652	1685	941	12117	1750	802	487	290	172	83	3584

E = Egg, 1st = 1st nymphal instar, 2nd = 2nd nymphal instar, 3rd = 3rd nymphal instar, NO= Non-ovipositing females and O= Ovipositing females and T =Total of population.

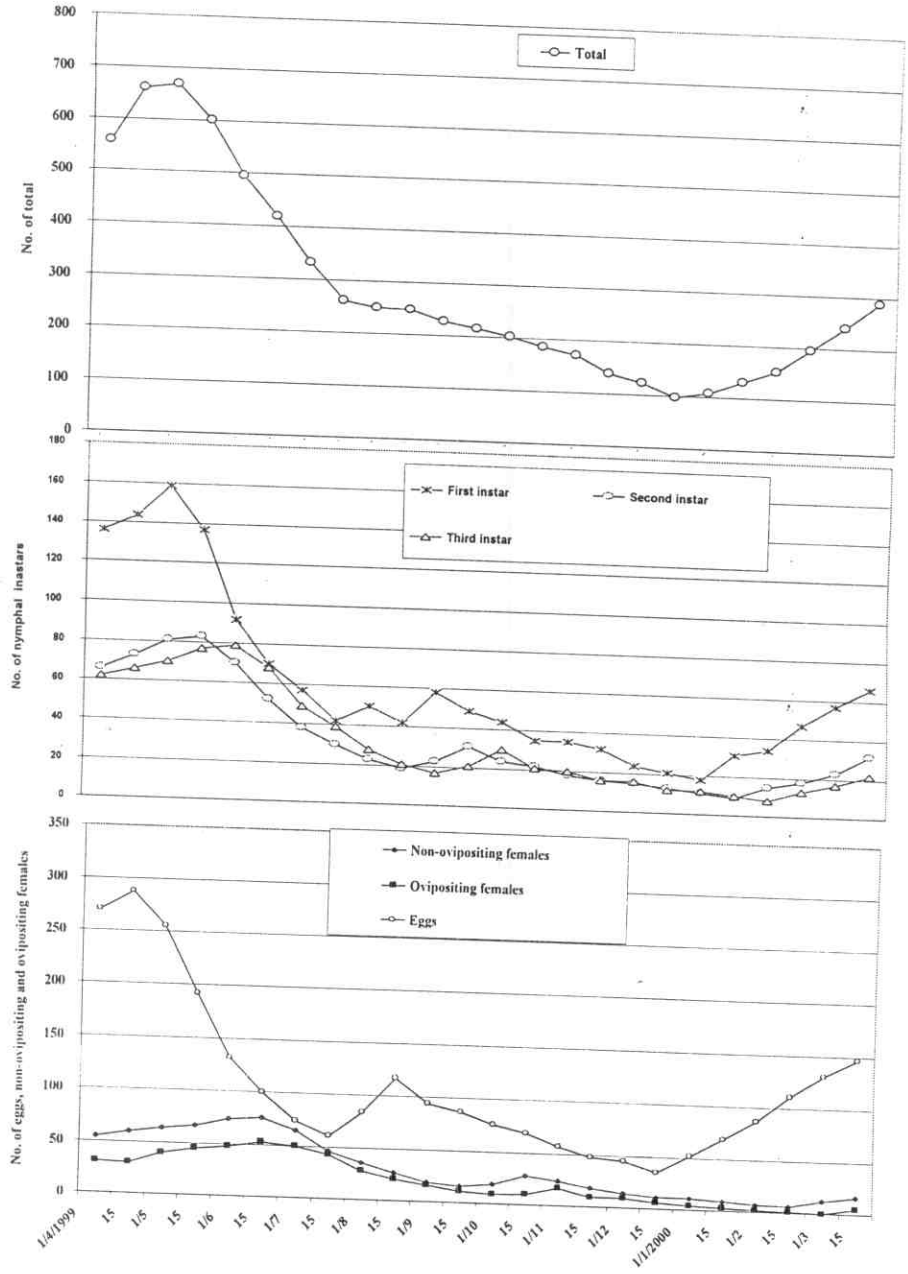

Fig. (13): Half-monthly counts of *Saissetia oleae* in relation to east direction of the olive tree in Northern Coast during (1998-1999).

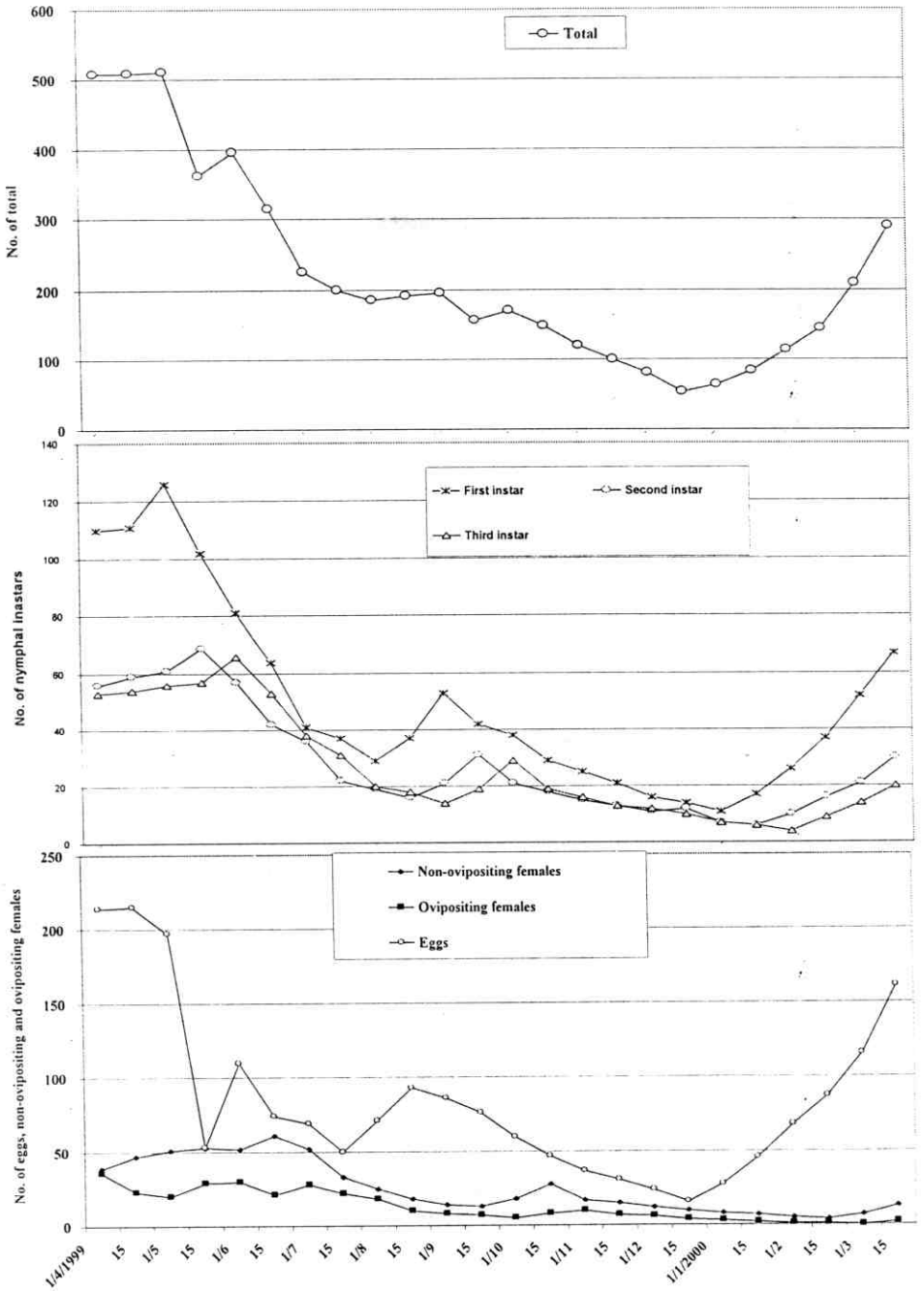

Fig. (14): Half-monthly counts of *Saissetia oleae* in relation to south direction of the olive tree in Northern Coast during (1998-1999).

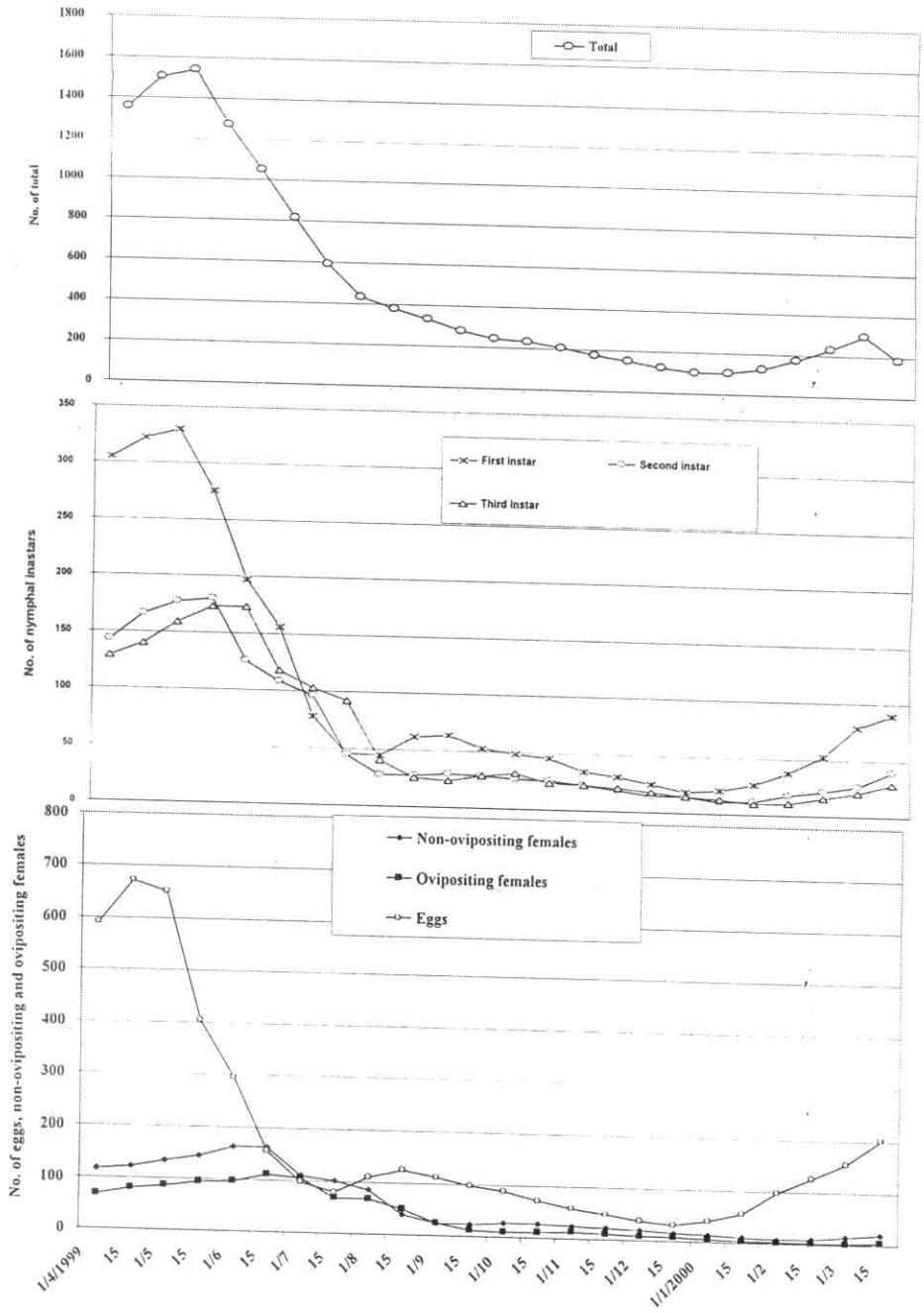

Fig. (15): Half-monthly counts of *Saissetia oleae* in relation to north direction of the olive tree in Northern Coast during (1998-1999).

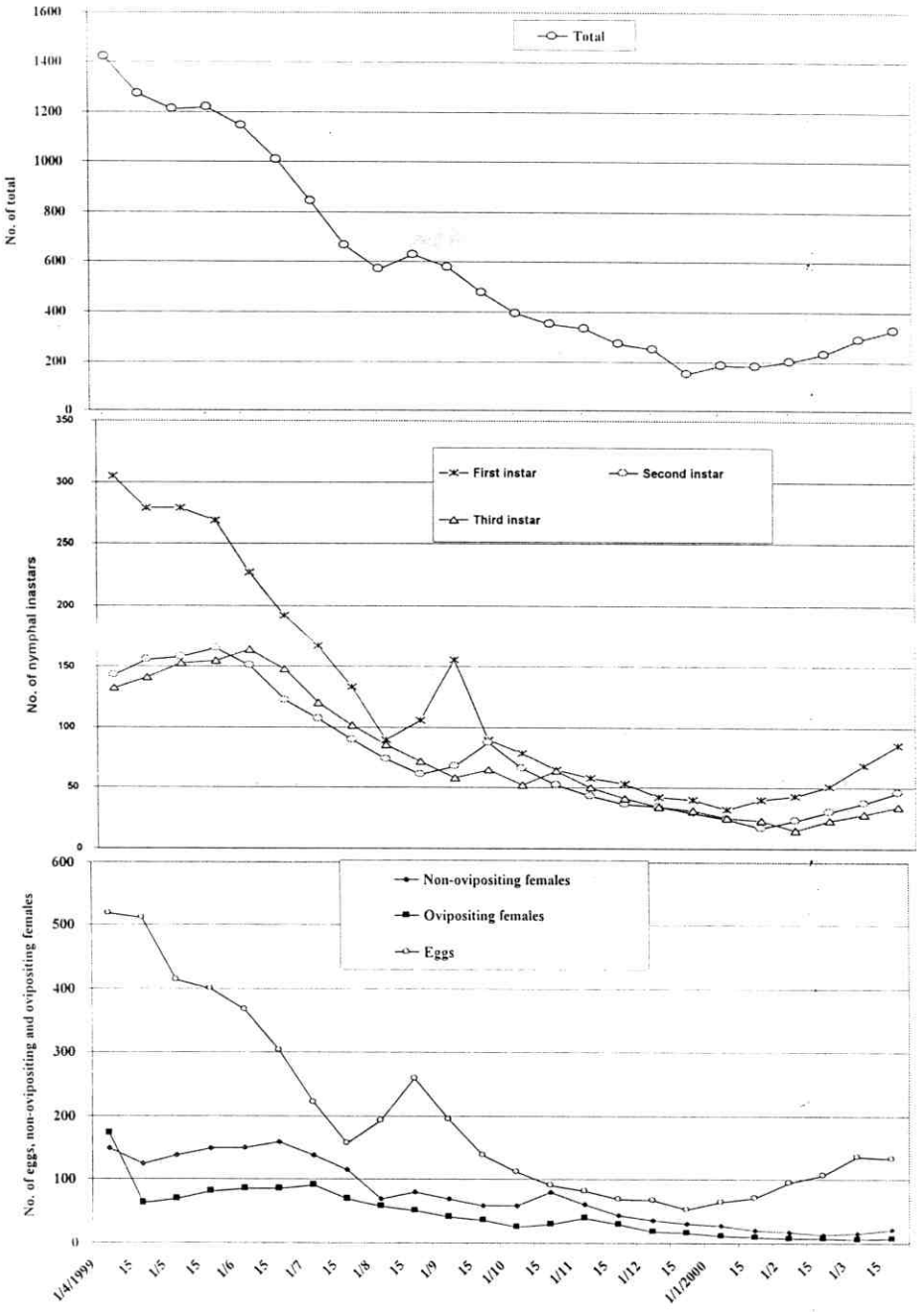

Fig. (16): Half-monthly counts of *Saissetia oleae* in relation to west direction of the olive tree in Northern Coast during (1998-1999).

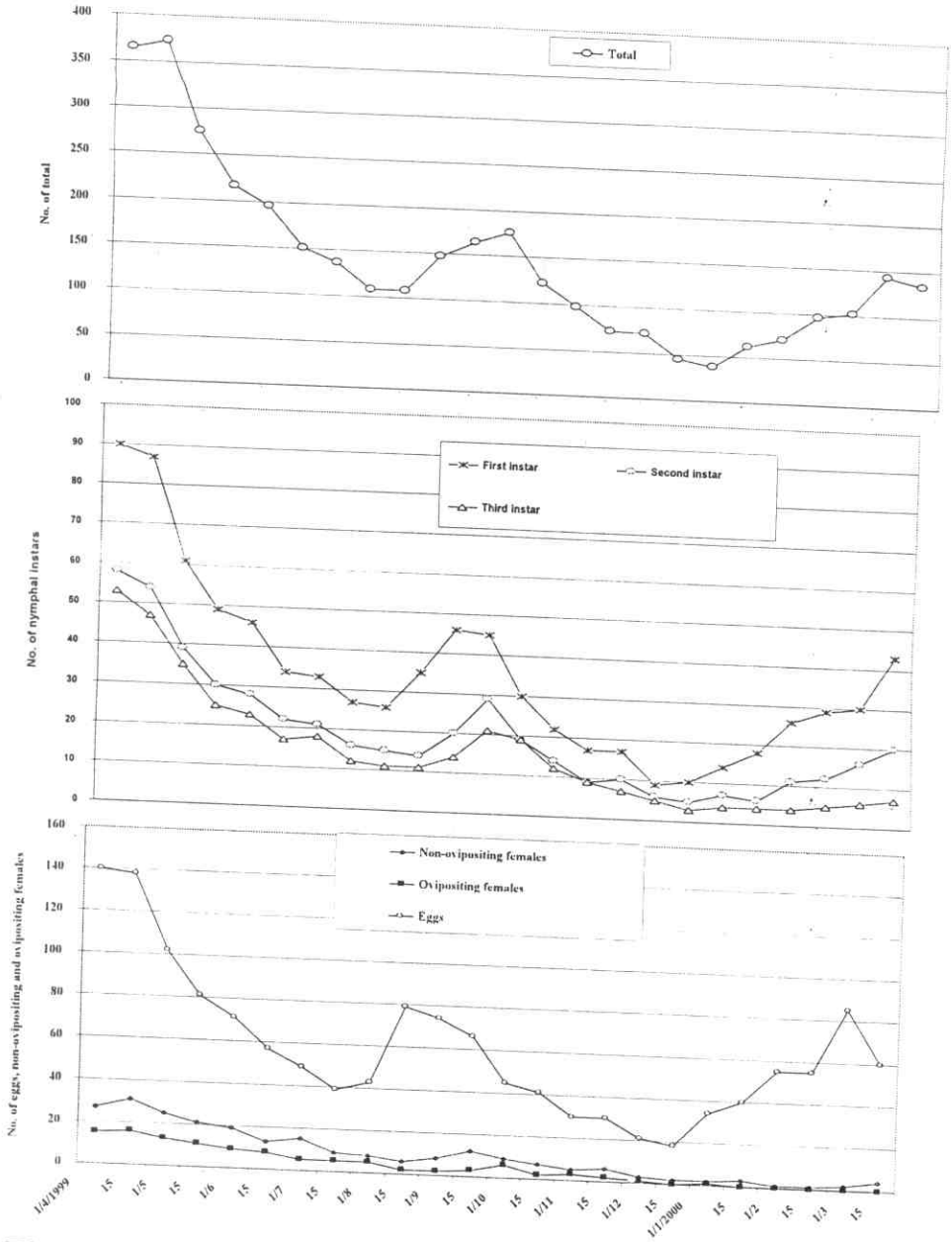

Fig. (17): Half-monthly counts of *Saissetia oleae* in relation to central core direction of the olive tree in Northern Coast during (1998-1999).

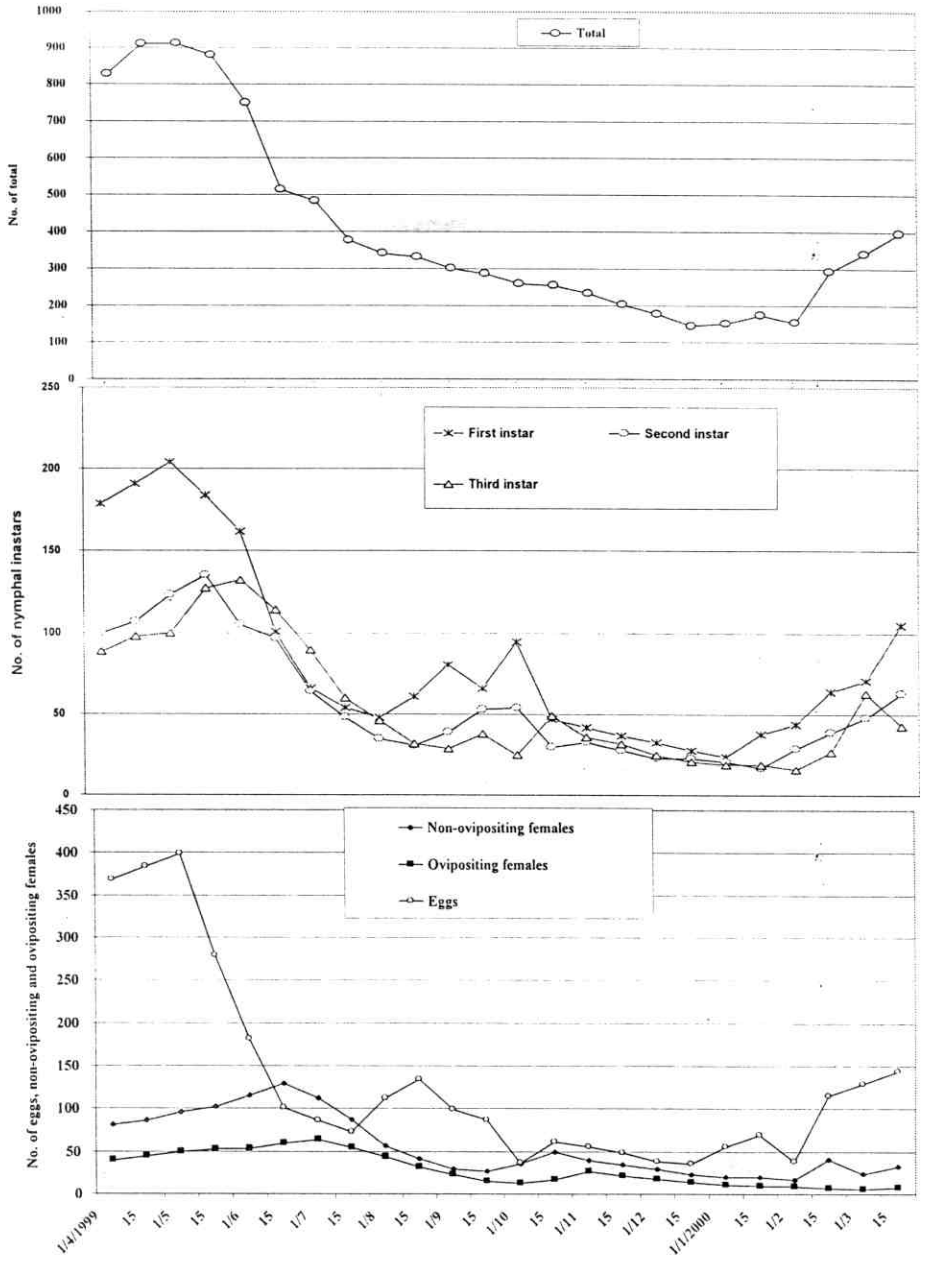

Fig. (18): Half-monthly counts of *Saissetia oleae* in relation to east direction of the olive tree in Northern Coast during (1999-2000).

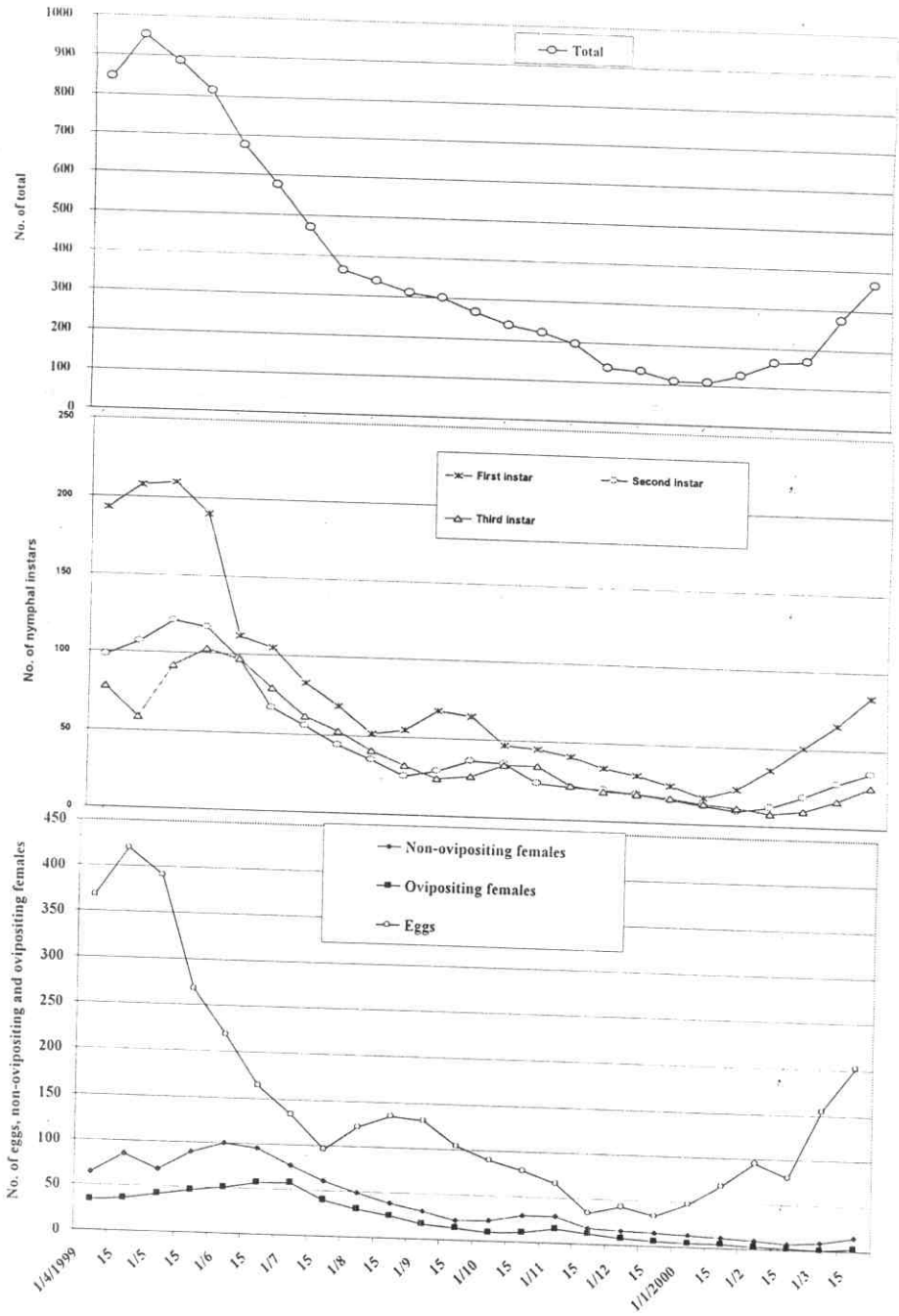

Fig. (19): Half-monthly counts of *Saissetia oleae* in relation to south direction of the olive tree in Northern Coast during (1999- 2000).

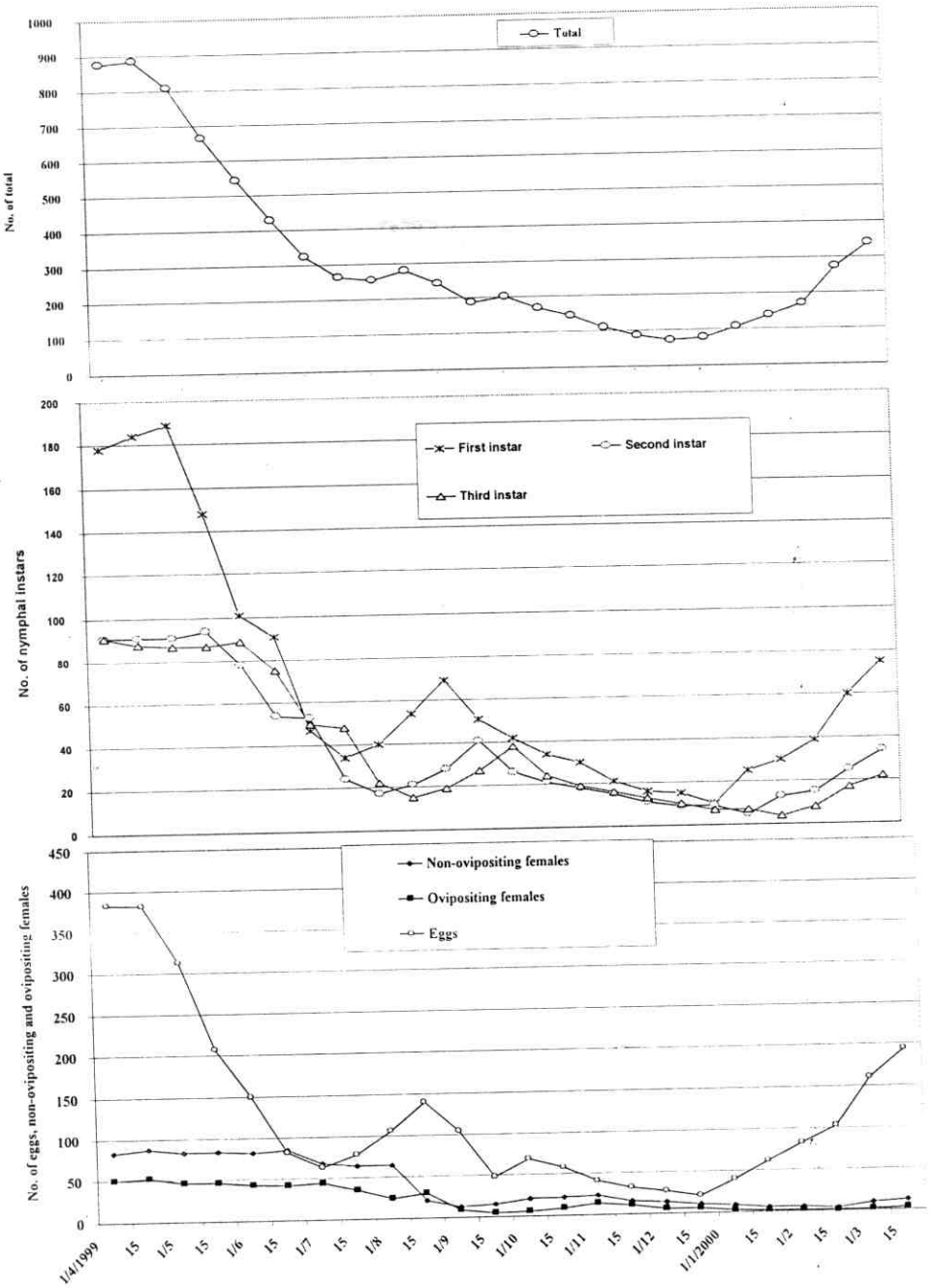

Fig. (20): Half-monthly counts of *Saissetia oleae* in relation to north direction of the olive tree in Northern Coast during (1999-2000).

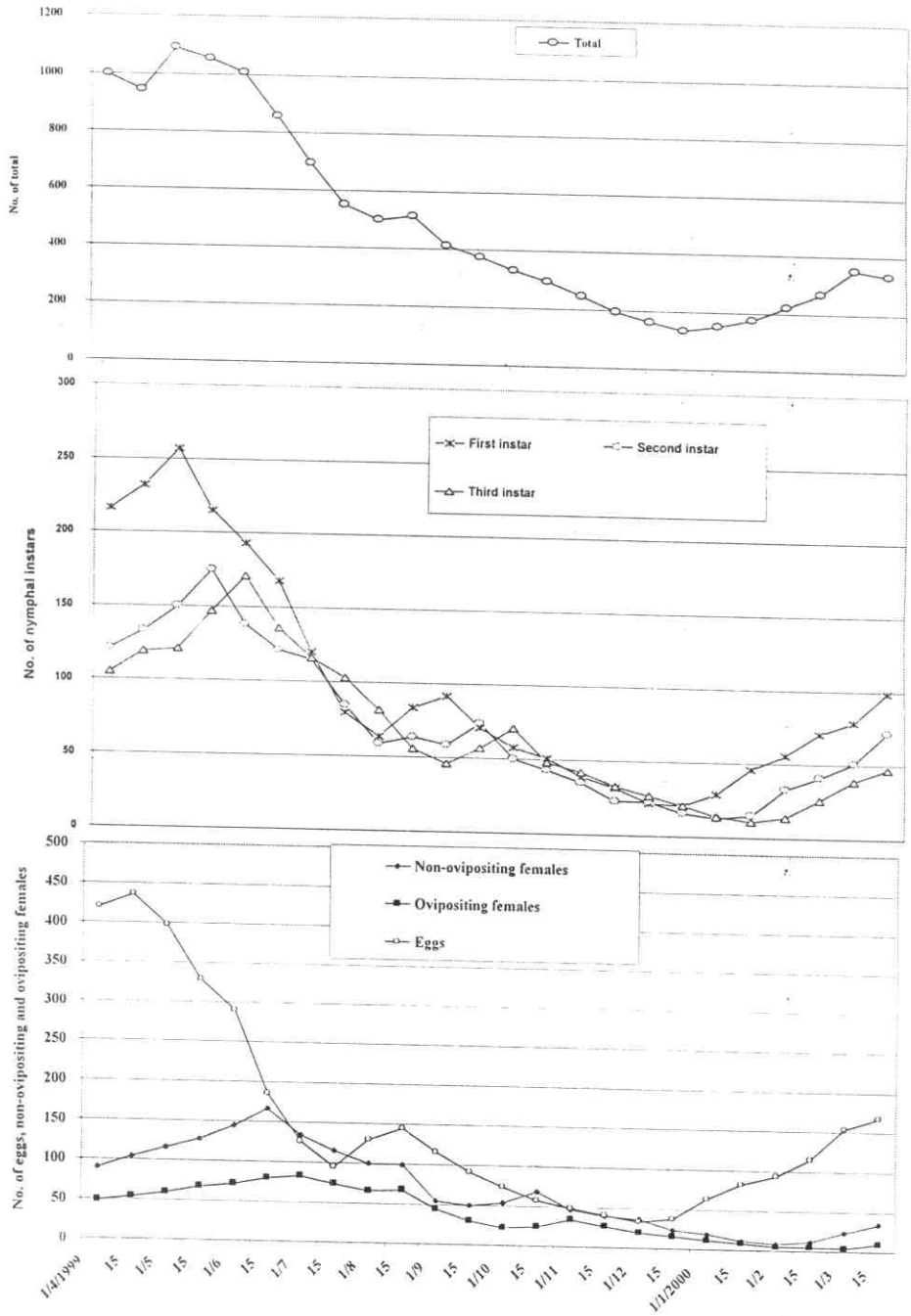

Fig. (21): Half-monthly counts of *Saissetia oleae* in relation to west direction of the olive tree in Northern Coast during (1999-2000).

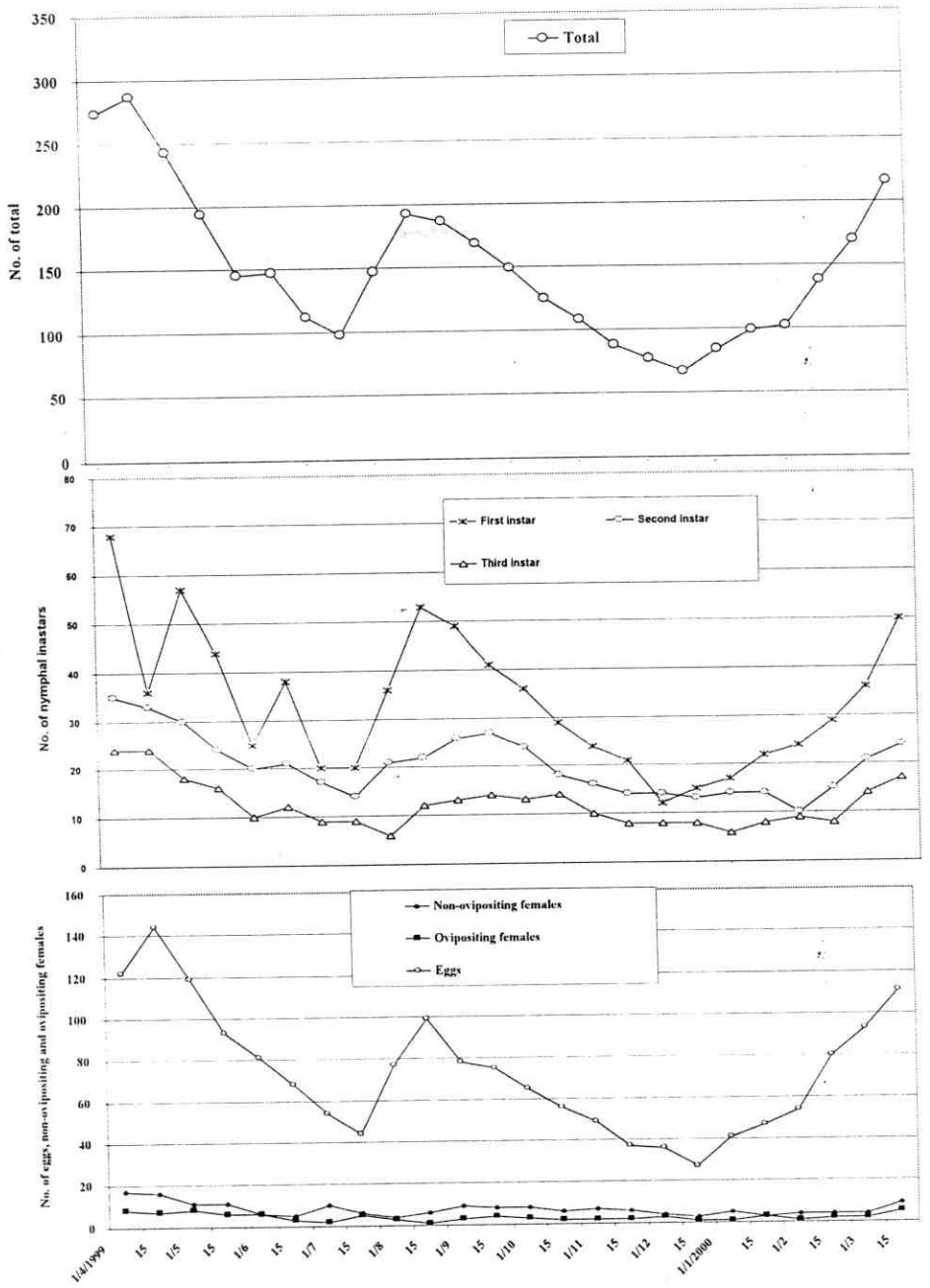

Fig. (22): Half-monthly counts of *Saissetia oleae* in relation to central Core direction of the olive tree in Northern Coast during (1999-2000).

Statistical analysis of the data (Table, 17) throughout the two years showed highly significant differences between the Cardinal directions of olive trees (F = 80.44 and 111.86 in the first and second years, respectively).

The results showed that the west is the preferable direction for this pest.

2.2. Population dynamics of the natural enemies of the Mediterranean black scale, *Saissetia oleae* and the relationship between the population and weather factors:

One location was chosen for this study, Northern Coast. Relative population densities of parasitoids and predators were estimated throughout the period which extended from 1 April 1998 to 15 March 2000. Half-monthly counts were made on 150 leaves and 75 twigs obtained at random from nine olive trees.

2.2.1. Population dynamics of parasitoids:

2.2.1.1. *Metaphycus bartletti* Annecke & Mynhardt:

This species was previously recorded by Abd-Rabou (2001) associated with *S. oleae* in Egypt. Rate of parasitism by this species at Northern Coast on *Oleae europaea* averaged 11.3 and 11.1% during the two years 1998-1999 and 1999-2000, respectively (Tables, 18 and 19, Figs 23 and 24).

Table (17): **Statistical analysis for the effect of different directions of olive trees on *S. oleae* population through the two years of study (1998-1999 and 1999-2000).**

Seasons / Direction	1998-1999	1999-2000
	Mean	Mean
North	320 a	230 c
South	180 b	278 b
East	141 c	196 d
West	347 a	394 a
Middle	78 d	85
F value	80.44	111.86
P value	0.0001	0.0001

Table (18): Numbers of inspected *Saissetia oleae* individuals and associated with parasitoids, predators and percent of parasitism on olive trees during 1998-1999.

Date	No.	Parasitoids												Predators						
		Mb		*Mf*		*Mif*		*De*		*Ss*		Total		No. of predators						
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	*Cc*	*Cb*	*O*	*Ss*	*Ef*	*Cu*	Total
April, 98	1750	318	18.1	119	6.8	42	2.4	0	0.0	14	0.8	493	28.1	14	19	4	7	3	8	55
15	1919	254	13.2	100	5.2	7	0.3	0	0.0	28	1.4	389	20.2	21	18	4	5	3	7	58
May	2355	344	14.6	74	3.1	0	0.0	0	0.0	60	2.5	478	20.2	18	23	3	7	2	14	67
15	2746	329	11.9	76	2.7	0	0.0	11	0.4	95	3.4	511	18.6	16	23	3	3	4	18	67
June	4033	320	7.9	48	1.1	0	0.0	38	0.9	236	5.8	642	15.9	26	26	6	9	5	19	91
15	3739	250	6.6	62	1.6	0	0.0	192	5.1	207	5.5	711	19.0	31	31	9	5	3	18	97
Jul.	3300	144	4.3	108	3.2	0	0.0	205	6.2	162	4.9	619	15.4	20	20	4	3	3	16	66
15	2843	123	4.3	90	3.1	0	0.0	59	2.0	153	5.3	425	11.7	15	18	9	3	3	10	58
Aug.	2242	201	8.9	188	8.3	0	0.0	17	0.7	105	4.6	511	22.7	14	15	4	3	2	7	45
15	1824	285	15.6	226	12.3	7	0.3	0	0.0	63	3.4	581	31.8	11	13	3	3	2	7	39
Sept.	1672	360	21.5	158	9.4	46	2.7	0	0.0	26	1.5	590	32.4	7	12	3	3	3	5	33
15	1378	313	22.7	158	11.4	19	1.3	0	0.0	13	0.9	503	36.5	6	9	3	3	3	3	27
Oct.	1080	197	18.2	76	7.0	7	0.6	0	0.0	0	0.0	280	25.9	5	6	3	3	2	3	22
15	891	162	18.1	40	4.4	28	3.1	0	0.0	0	0.0	230	25.8	3	6	3	2	2	2	18
Nov.	545	102	18.7	34	6.2	44	8.0	0	0.0	3	0.5	183	33.5	3	5	3	2	2	3	18
15	668	55	8.2	16	2.3	23	3.4	19	2.8	2	0.2	115	17.2	3	4	2	2	3	3	17
Dec.	564	18	3.1	6	1.0	4	0.7	16	2.8	0	0.0	44	8.6	2	3	3	3	2	3	16
15	505	21	4.1	3	0.5	4	0.7	16	3.1	0	0.0	44	8.7	2	3	4	3	2	4	18
Jan. 99	573	21	3.6	0	0.0	9	1.5	17	2.9	0	0.0	47	8.2	2	2	3	3	2	5	17
15	666	30	4.5	0	0.0	6	0.9	8	1.2	0	0.0	44	6.6	3	4	2	2	3	8	22
Feb.	334	58	17.3	4	1.1	3	0.8	3	0.8	0	0.0	68	18.8	4	7	2	1	2	8	24
15	1263	146	11.5	10	0.7	3	0.2	0	0.0	19	1.5	178	14.0	4	13	2	2	3	7	31
Mar.	1693	179	10.5	27	1.5	2	0.1	0	0.0	43	2.5	251	14.8	8	18	3	2	3	9	43
15	2074	94	4.5	51	2.4	14	0.6	0	0.0	80	3.8	239	16.6	7	21	3	3	3	12	49
Overall	40657	4324	271.2	1674	96.0	268	26.4	601	28.8	1309	48.0	8176	470.4	245	319	88	82	65	199	998
Average	1694.0	180.1	11.3	69.7	4.0	11.1	1.1	25.0	1.2	54.5	2.0	340.6	19.6	10.2	13.2	3.6	3.4	2.7	8.2	41.6

Mb = Metaphycus barteltti , Mf = Metaphycus flavus, Mif = Microterys flavus, De =Diversinervus elegans, Sc =Scutellista cyaneae, Cc =Chrysoperla carneae, Cb = Chilocorus bipustulatus, O = Orius sp., *Ss = Scymnus syriacus, Ef = Exochomus flavipes, Cu = Coccinella undecimpunctata*

Table (19): Numbers of inspected *Saissetia oleae* individuals and associated with parasitoids, predators and percent of parasitism on olive trees during 1999-2000.

Date	No.	Parasitoids												Predators						
		Mb		*Mf*		*Mif*		*De*		*Sc*		Total		No. of predators						
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	*Cc*	*Cb*	*O*	*Ss*	*Ef*	*Cu*	Total
April, 99	3658	452	12.3	211	5.7	87	2.3	74	2.0	121	3.3	945	25.8	27	20	6	3	4	14	74
15	3834	373	9.7	129	3.3	91	2.3	68	1.7	243	6.3	904	23.5	22	18	7	3	3	21	74
May	4165	335	8.0	96	2.3	54	1.2	44	1.0	320	7.6	849	20.3	36	15	8	4	3	23	89
15	4571	212	4.6	75	1.6	105	2.2	64	1.4	440	9.6	896	19.6	40	20	7	8	3	29	107
June	4997	182	3.6	102	2.0	48	0.9	73	1.4	557	11.1	962	19.2	47	28	10	10	1	23	119
15	5664	165	2.9	181	3.1	36	0.6	201	3.5	613	10.8	1196	21.1	53	36	5	9	3	20	126
Jul.	5426	204	3.7	308	5.6	57	1.0	253	4.6	416	7.6	1238	22.8	40	32	9	6	4	22	113
15	5069	173	3.4	268	5.2	67	1.3	422	8.3	186	3.6	1116	22.0	31	26	13	3	2	18	93
Aug.	4393	390	8.8	442	10.0	71	1.6	276	6.2	87	1.9	1266	28.8	18	18	11	3	2	16	68
15	4055	526	12.9	397	9.7	69	1.7	135	3.3	95	2.3	1222	30.1	16	13	6	3	2	15	55
Sept.	3395	687	20.2	507	14.9	51	1.5	76	2.2	64	1.8	1385	40.7	17	10	5	3	2	12	49
15	2935	603	20.5	404	13.7	53	1.8	63	2.1	43	1.4	1166	39.7	15	9	5	3	1	12	45
Oct.	2586	635	24.5	287	11.0	67	2.5	49	1.8	48	1.8	1086	41.9	14	9	4	2	2	8	39
15	2164	457	21.1	119	5.4	125	5.7	30	1.3	16	0.7	747	34.5	15	6	3	2	2	8	36
Nov.	1903	233	12.2	86	4.5	145	7.6	30	1.5	22	1.1	516	27.1	7	5	3	2	2	8	27
15	1575	199	12.6	39	2.4	72	4.5	34	2.1	23	1.4	367	23.3	6	3	1	1	3	7	21
Dec.	1347	128	9.5	33	2.4	47	3.4	59	4.3	16	1.1	283	21.0	5	3	1	2	3	5	19
15	1085	80	7.3	23	2.1	31	2.8	65	5.9	12	1.1	211	19.4	9	7	2	2	2	4	26
Jan. 2000	853	51	5.9	20	2.3	20	2.3	37	4.3	5	0.5	133	15.5	10	3	2	3	2	3	23
15	1152	70	6.0	43	3.7	25	2.1	23	1.9	16	1.3	177	15.3	11	4	3	0	2	3	23
Feb.	1422	129	9.0	69	4.8	13	0.9	12	0.8	13	0.9	236	16.5	14	2	3	2	2	5	28
15	1804	247	13.6	127	7.0	28	1.5	27	1.4	14	0.7	443	24.5	15	8	6	4	3	7	43
Mar.	1961	313	15.9	169	8.6	49	1.2	25	1.2	36	1.8	592	30.1	15	11	7	4	2	11	50
15	2682	443	16.5	196	7.3	49	1.5	42	1.5	66	2.4	796	29.6	19	15	5	9	3	9	60
Overall	72696	7287	266.4	4331	136.8	1460	52.8	2182	64.8	3472	76.8	18732	612.0	502.0	321.0	132.0	91.0	58.0	303.0	1407
Average	3029	303.6	11.1	180.4	5.7	60.8	2.2	90.9	2.7	144.6	3.2	780.5	25.5	20.9	13.3	5.5	3.7	2.4	12.6	58.6

Mb = Metaphycus barteltti , Mf = Metaphycus flavus, Mif = Microterys flavus, De =Diversinervus elegans, Sc =Scutellista cyaneae,
Cc =Chrysoperla carneae, Cb = Chilocorus bipustulatus, O = Orius sp., *Ss = Scymnus syriacus, Ef = Exochomus flavipes, Cu = Coccinella undecimpunctata*

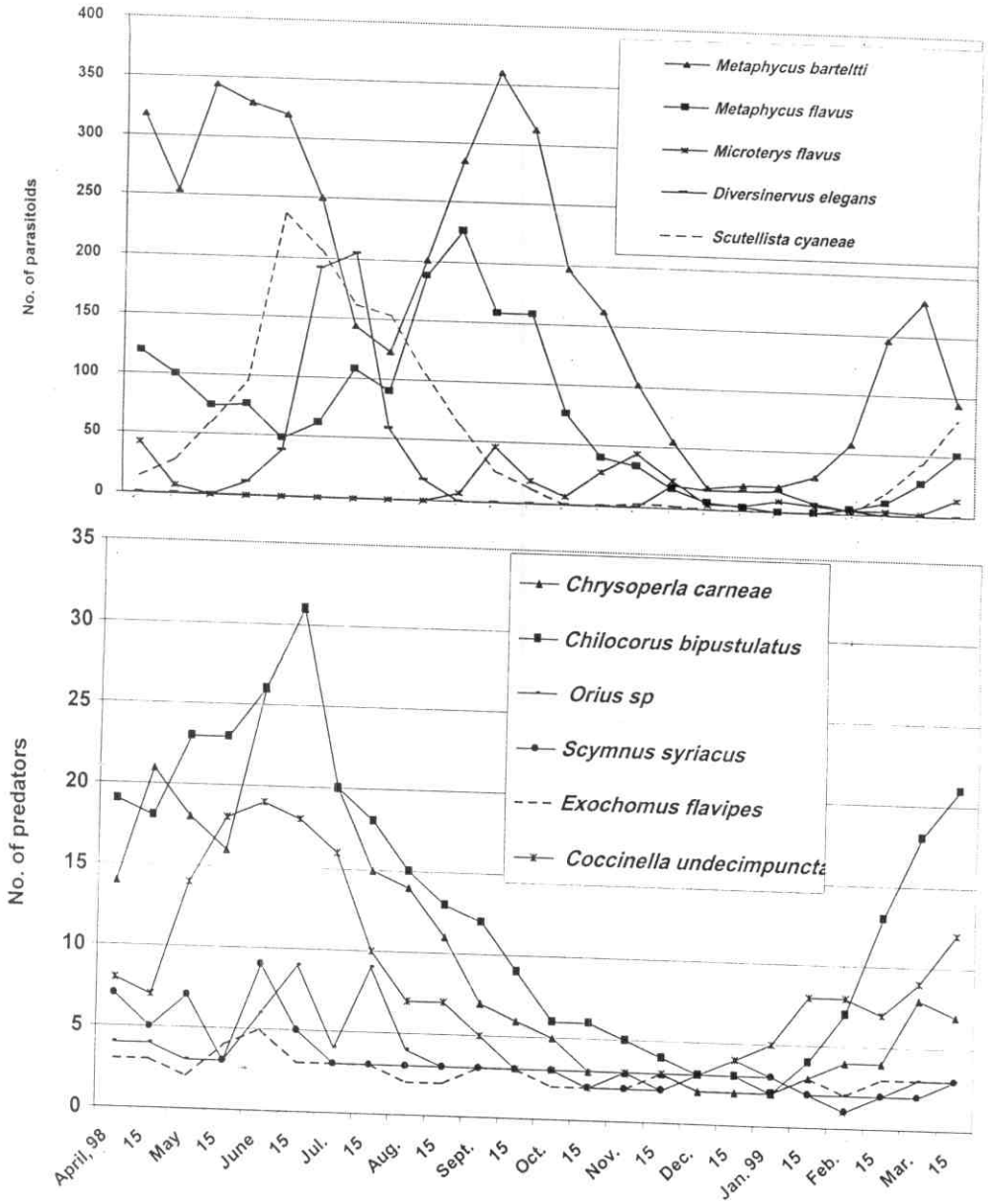

Fig. (23): Half-monthly counts of different parasitoids and predators of *Saissetia oleae* on olive trees during 1998-1999.

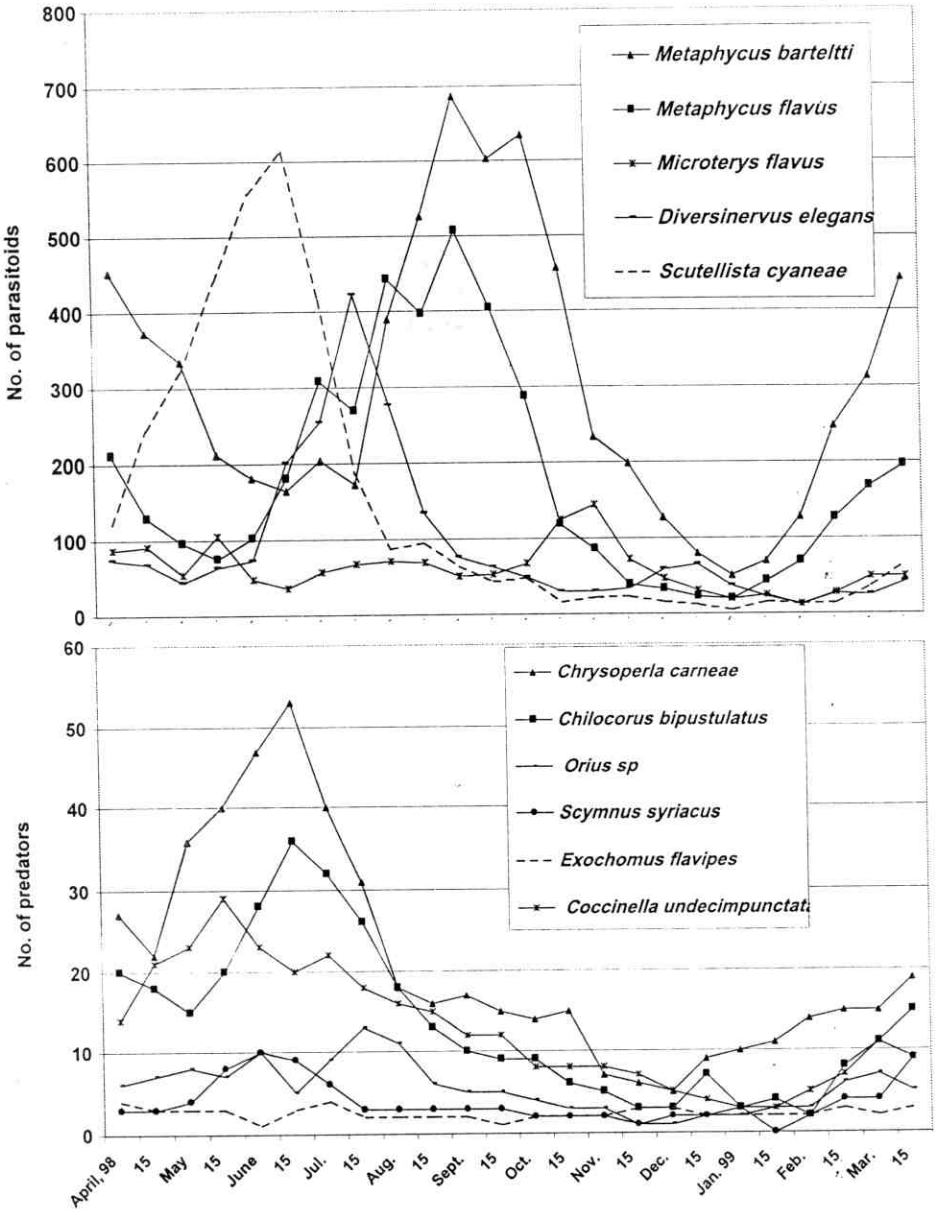

Fig. (24): Half-monthly counts of different parasitoids and predators of *Saissetia oleae* on olive trees during 1999-2000.

2.2.1.2. *Metaphycus flavus* Howard:

This species was recorded by Priesner & Hosny (1940) associated with *Coccus hesperidum* L. on *Citrus* sp.; with *Pulvinaria floccifera* (Westwood) on guava, *Psidium guajava* and with *S. oleae* on *Cycas revoluta* in Delta and Upper Egypt. On the other hand, recorded data in the present study indicated that the percentages of parasitism by this species at Northern Coast on *Oleae* sp. averaged 4.0 and 5.7% during the two years of investigation 1998-1999, 1999-2000, respectively. Maximum rates of parasitism reached 12.3 and 14.9% during mid of August, 1998 and early of September, 1999 (Tables, 18 and 19, Figs 23 and 24).

2.2.1.3. *Microterys flavus* (Howard):

This species is recorded here in Egypt for the first time associated with *S. oleae*. Parasitism rates by this species in Northern Coast, on olive trees averaged 1.1 and 2.2% during the two years 1998-1999 and 1999-2000, respectively (Tables, 18 and 19). Maximum rates of parasitism reached 3.4 and 7.6% during mid Nov. 1998 and early of Nov., 1999 respectively. *Mi. flavus* is a widely distributed parasitoid on various soft scale insects. It has been recorded in North America, North and South Africa, the far east, Australia, New Zeland, Europe and around the Mediterranean Basin (Annecke, 1964; Rosen, 1967a and Saakjan-Baranova, 1968).

2.2.1.4. *Diversinervus elegans* (Silvestri):

This species was recorded by Priesner & Hosny (1940) associated with *S. oleae, P. floccifera* and *C. hesperidum* in Egypt. Data tabulated in Tables (18 and 19) showed that rates of parasitism by this species in Northern Coast on *S. oleae* on olive averaged 1.2 and 2.7% during the two years 1998-1999 and 1999-2000, respectively (Tables, 18 and 19). Maximum parasitism rates were attained during early July, 1998 and mid of July, 1999 which represented by 6.2 and 8.3%, respectively. This primary parasitoid was first recorded from Eritrea (Silvestri, 1915). It is also known from Australlia (Compere, 1931, Wilson, 1960). In Southern Africa, Annecke (1964) recorded it. It was found to be a common parasitoid of the Mediterranean black scale, *S. oleae* and a rare parasitoid of the hemispherical scale, *S. coffeae* (Walker) on olive (Rosen *et al.,* 1971).

2.2.1.5. *Scutellista cyaneae* (Mots.):

Also, this parasitoid was, recorded in Egypt by Priesner and Hosny (1940) associated with *Ceroplastes africans* on *Acacia nilotica*, *Albizzia lebbek* & *Ficus carica*; *Parasaissetia nigra* on *Ficus sycamorus* and *S. coffeae* on olive in Lower and Upper Egypt. Recorded parasitism rates (Tables, 18 and 19) by this species in Northern Coast on *S. oleae* on olive averaged 2.0 and 3.2% during the two years, respectively. Maximum rates of parasitism were estimated during 1st June, 1998 and early of June 1999; being 5.8 and 11.1%, respectively. This species is a cosmopolitan egg predator and facultative ectoparasitoid of various soft scale insects, probably of African or for Eastern

origin (Rubstov, 1954). Bodenheimer (1951) listed it as an important natural enemy of several soft sacle insects. Rosen (1967a) found it often to be the dominant parasitoid of the Florida wax scale, *Ceroplastes floridensis* Comstock, an abundant parasitoid of the Mediterranean black scale, *S. oleae* and a very rare parasitoid of the fig wax scale *Ceroplastes rusci* (L.) on citrus.

It can be concluded that the present work indicated that *M. bartletti* was the most effective parasitoid on *S. oleae* on olive trees with maximum parasitism rates 22.7 on mid-September, 1998 and 24.5% on October, 1st 1999 (Tables, 18 and 19 and Figs 22 and 23). Also, statistical analysis of data, throughout the two years, showed highly significant differences between the different parasitoids in their effectiveness on *S. oleae* ($F= 0.51.10$ and $P < 0.01$). Consequently, it can be stated that, the parasitoid *M. bartletti* is the best parasitoid in controlling *S. oleae* on olive trees in Northern Coast.

The effects of the main climatic factors on the population of *M. bartletti* revealed that during the first year 1998-1999, the effect of R.H.% was highly significant with $R^2 = 0.3011$ and $P< 0.01$ but the other factors were insignificant. While, during the second year 1999-2000, the effect of wind speed factor was significant ($R^2= 0.1682$ and $P <0.05$) but other factors were insignificant.

The effect of the main climatic factors showed that through the first year 1998-1999 max. temperature and water vapour are highly significant on *M. flavus* population, with $R^2=$

0.1682 and P < 0.01 ; R^2 = 0.3573 and P < 0.01, respectively. Other factors were insignificant. While, during the second year 1999-2000, the effect of min. temperature and water vapour factors, were significant R^2= 0.4156 and P < 0.05. Other factors were insignificant.

The effect of the main climatic factors on the population of *Mi. flavus* were insignificant.

The statistical analysis of the effect of climatic factors on the population of *D. elegans* indicated that RH. factor was significant with R^2= 0.2799 and P <0.01 and R^2= 0.1754 and P< 0.05 during the first and second years, respectively.

Data revealed that during the first year 1998-1999 max., min. temperatures and water vapour had significant effect on the population of *S. cyaneae*. with R^2 = 0.2158 and P<0.05; R^2= 0.2732 and P<0.01, R^2= 0.2322 and P<0.01, respectively. But the other factors were insignificant. While, during the second year, 1999-2000, the effect of max., min temperatures, water vapour and wind speed were significant (R^2 = 0.2158 and P<0.05, R^2= 0.2704 and P<0.01, R^2= 0.2195 and P<0.01 and R^2= 0.4417 and P<0.01, respectively).

2.2.2. Population dynamics of Predators:

Data presented in Tables (18 and 19) and illustrated in Figs (23 and 24) show the population fluctuation, of predators belonging to, Hemiptera, Coleoptera and Neuroptera.

2.2.2.1. *Chilocorus bipustulatus* L.

Two peaks per year were recorded annually for *C. bipustulatus* (Tables, 18 and 19) and (Figs 23 and 24) In the first year, the 1st peak (31 individuals) was recorded on June 15th and the second peak (21 individuals) on March 15th. While, in the second year, this predator was common from April to June and from Jan. to March. Abd-Allah (1988) and Metwally (1993) mentioned that numbers of *C. bipustulatus* were generally low during winter and summer months. Rosen (1967b) reported that the predator, *C. bipustulatus* plays a decisive role in preventing massive build up of the scale insects. The current results agree with those of Bodenheimer (1951), Metwally (1993) who reported two peaks per year for this predator.

2.2.2.2. *Chrysoperla carneae* (Stephens):

Tables (18 and 19) and Figs (23 and 24) show the abundance of this chrysopid species during the two successive years, 1998-1999 and 1999-2000. One peak per year of *C. carneae* was recorded in mid of June represented by 31 and 53 individuals in the first and second year, respectively. (Abd-Rabou, 1996 b) reported the important role of *C. carneae* in controlling some of homopterous insects.

2.2.2.3. *Coccinella undecimpunctate* (L.)

The abundance of this species recorded in Tables (18 and 19) and Figs (23 and 24) during the two successive years clearly showed that this predator had two peaks represented by 19 (1st

June) and 12 (15th March) individuals for the first year and 29 (15th May) and 11 (1st March) for the second years. This predator is assumed as basis for supporting biological control of different insects (Abd-Rabou, 1999b).

2.2.2.4 *Exochomus flavipes* Thrum.

The coccinellid predator, *E. flavipes* recorded a low population throughout the two considered years. However, the number was almost similar allover the two years. Priesner (1931), Brettll (1964) and Argyriou and Katsoyannos (1977) recorded this predator as a normal enemy of scale insects in different localities of the world.

2.2.2.5. *Orius* spp.

Total numbers of these species recorded during the two years were 88 individuals in first year and 132 individuals in the second year.

2.2.2.6. *Scymnus syriacus* Mars.

The data of the dynamics of this species shown in Tables (18 and 19) and Figs (23 and 24) indicated that this coccinellid predator had one peak per year. Total numbers of this species were 82 individuals in first year and 91 individuals in the second year. In this respect Abd-Allah (1988) and Metwally (1993) recorded two peaks of *S. syriacus* . Tawfik *et al.* (1970), Lal & Naji (1980) and El-Agamy *et al.* (1994) reported that *S. syriacus* was found feeding on scale insects.

Statistical analysis indicated that the effect of max. & min. temperatures, water vapour and wind speed on *C. bipustulatus* were highly significant with $P<0.01$ during the second year (1999-2000) and not significant during the first year (1998-1999).

The effect of climatic factors on *C. carneae* during the first year (1998-1999) indicated that max. & min. temperatures and water vapour were highly significant with $P<0.01$ and during the second year max. & min. temperatures, water vapour and wind speed were highly significant with $P<0.01$.

The effect of climatic factors during the second year on *C. undecimpunctate* observed max. & min. temperatures, water vapour and wind speed were highly significant with $P<0.01$ and during the first year, the factors were insignificant.

The wind speed had highly significant effect on *E. flavipes* during the second year (1999-2000) with $P<0.01$, while the other factors were insignificant during the first and second years.

The effect of climatic factors on *Orius* sp. observed max. and min. temperatures were highly significant during the first year $P<0.01$. While, during the second year water vapour and wind speed were highly significant with $P<0.01$.

The effect of main climatic factors on *S. syriacus* revealed that max. and max. square temperatures had highly significant effect with $P<0.01$ during the first year. But during

the second year (1999-2000), wind speed was highly significant with $P<0.01$.

3. Efficacy of some natural compounds and an IGR on the Mediterranean black scale, *Saissetia oleae* and its natural enemies:

3.1. On *Saissetia oleae:*

Data obtained during the two seasons of study concerning the efficacy of five natural compound and an IGR i.e. M-pede, Neemazal, Jojoba, Biofly, KZ oil and Buprofezin on eggs, preadults and adults of *S. oleae* infesting olive trees are given in Tables (20,21,22 and 23).

3.1.1. Effect of different preparations on egg stage:

Eggs population showed less susceptibility to the tested compounds, than any other stage. The mean percentage of reductions were 42.3, 29.4, 29.2, 23.7, 18.3 & 11.2 and 34.06, 26.0, 25.4, 17.06, 12.8 & 8.2 caused by Buprofezin, Biofly and KZ oil, Neemazal, Jojoba and M-pede, during, the first and the second seasons (i.e. 1998 and 1999, respectively) (Tables 21 and 23). The differences between these responses to the compounds proved highly significant after 45 days from spraying. ($F= 619.20$, $P<0.01$, for 1998 and $F= 222.19$, $P<0.01$, for 1999).

Statistical analysis of the data, showed high significance between the effect of assayed compounds on eggs population after 21 days from application, Buprofezin was the most

Table (20): Numbers of alive individuals (eggs, preadults and adults) of *Saissetia oleae* pre and post spraying olive trees with certain compounds and an IGR during 1998.

Treatment	Conc.	Pre-treatment counts			Post-treatment counts											
					21 days after application			45 days after application			90 days after application			Mean		
		E	P	A	E	P	A	E	P	A	E	P	A	E	P	A
Buprofezin	1 ml/l.	684	380	275	479	68	152	445	41	138	433	28	123	452.3	45.8	137.7
Biofly	1.5 ml/l.	678	378	311	584	195	246	533	152	211	522	115	189	546.3	154.0	215.3
KZ oil	15 ml/l.	692	358	302	524	133	227	512	107	191	664	177	268	566.7	139.0	228.7
Neemazal	3 ml/l.	686	364	320	582	179	285	564	153	240	671	276	296	605.7	202.7	273.7
Jojoba	15 ml/l.	687	352	316	621	243	277	612	195	229	708	274	218	647.0	237.3	241.3
M-pede	2.5 ml/l.	697	372	305	692	292	287	688	267	249	756	397	297	712.0	318.7	277.7
Control	-	688	399	361	720	462	425	791	522	496	852	608	525	706.3	530.7	473.0

E = Eggs P = Preadults A = Adults

Table (21): Reduction percentages in infestation with *Saissetia oleae* at different intervals after spraying during 1998.

Treatment	Conc.	% reduction in infestation at different intervals											
		21 days after application			45 days after application			90 days after application			Average		
		E	P	A	E	P	A	E	P	A	E	P	A
Buprofezin	1 ml/l.	33.3	85.3	53.3	44.0	92.0	62.0	49.6	95.6	69.6	42.3	91.0	61.6
Biofly	1.5 ml/l.	18.0	56.0	33.3	32.3	70.0	48.0	38.0	80.3	59.0	29.4	68.8	46.8
KZ oil	15 ml/l.	28.3	68.3	37.0	36.3	78.0	51.6	23.0	68.0	39.3	29.2	71.4	42.6
Neemazal	3 ml/l.	20.3	58.3	25.0	29.3	68.6	42.6	21.6	51.0	37.0	23.7	59.3	34.9
Jojoba	15 ml/l.	14.3	40.6	26.0	23.0	58.0	45.0	17.6	49.3	53.0	18.3	49.3	41.3
M-pede	2.5 ml/l.	5.6	32.3	20.3	15.0	45.3	37.6	13.0	30.3	33.6	11.2	36.0	30.5

E = Eggs P = Preadults A = Adults

Table (22): Numbers of alive individuals (eggs, preadults and adults) of *Saissetia oleae* pre and post spraying olive trees with certain compounds and an IGR during 1999.

Treatment	Conc.	Pre-treatment			Post-treatment counts											
					21 days after application			45 days after application			90 days after application			Mean		
		E	P	A	E	P	A	E	P	A	E	P	A	E	P	A
Buprofezin	1 ml/l.	886	591	394	600	133	178	573	89	159	725	84	141	632.7	102.0	159.3
Biofly	1.5 ml/l.	894	577	384	789	309	267	712	263	257	636	204	217	712.3	258.7	247.0
KZ oil	15 ml/l.	886	587	377	690	243	243	647	202	228	804	265	339	713.7	236.7	270.0
Neemazal	3 ml/l.	867	514	394	743	251	306	740	231	266	840	435	305	774.3	306.0	292.3
Jiojopa	15 ml/l.	814	508	385	734	253	295	720	305	283	838	483	358	764.0	347.0	312.0
M-pede	2.5 ml/l.	879	507	396	868	417	349	841	389	341	897	596	358	869.0	467.3	349.3
Control	-	897	617	389	922	699	388	957	820	440	1002	990	491	960.3	836.3	439.7

E = Eggs P = Preadults A = Adults

Table (23): Reduction percentages in infestation with *Saissetia oleae* at different intervals after spraying during 1999.

Treatment	Conc.	% reduction in infestation at different intervals											
		21 days after application			45 days after application			90 days after application			Average		
		E	P	A	E	P	A	E	P	A	E	P	A
Buprofezin	1 ml/l.	34.6	80.6	55.0	40.3	89.6	64.6	27.3	91.6	72.6	34.1	87.3	64.1
Biofly	1.5 ml/l.	15.0	53.3	30.6	26.0	66.0	41.3	37.0	78.6	55.0	26.0	66.0	42.3
KZ oil	15 ml/l.	25.0	64.0	35.6	32.0	74.6	47.0	19.3	72.3	29.0	25.4	70.3	37.2
Neemazal	3 ml/l.	17.3	57.0	21.0	20.3	67.0	39.4	13.6	47.6	39.3	17.1	57.2	29.9
Jojoba	15 ml/l.	12.6	38.3	25.0	17.6	55.0	36.3	8.3	41.0	47.6	12.8	44.7	36.3
M-bed	2.5 ml/l.	4.3	28.0	12.3	11.0	42.6	24.3	9.3	27.0	28.6	8.2	32.5	21.7

E = Eggs P = Preadults A = Adults

effective compound used against eggs of *S. oleae* followed by KZ oil, Neemazal, Biofly, Jojoba and M-pede during the two seasons. In case of 45 days after spraying Buprofezin was most effective compound followed by KZ oil, Biofly, Neemazal, Jojoba and M-pede. On the other hand, found Buprofezin was the most effective compound after 90 days of spraying, followed by Biofly, KZ oil, Neemazal, Jojoba and M-pede during the first season, 1998. During the season of 1999, Biofly was the most effective compound followed by Buprofezin, KZ oil, Neemazal, M-pede and Jojoba after 90 days.

3.1.2. Effect of different chemical compounds on preadult stage:

Results in Tables (21 and 23) indicated that the pre-adult stages of *S. oleae* were more susceptible to the chemical compounds used, than any other insect stage. The mean percentage of reductions were 90.9, 71.4, 68.7, 59.3, 49.3, 35.9 and 87.2, 70.3, 65.9, 57.2, 44.6, 32.5 caused by Buprofezin, KZ oil, Biofly, Neemazal, Jojoba and M-pede, respectively. Comparison between the periods after the application, showed significant differences on preadult stages (Tables 21 and 23).

In the present work, the mean reduction percentages of IGR and KZ oil treatment were 87.2-90.9% and 70.3-71.4%, respectively. These results comes in agreement with that of Briales & Campos (1983) and Nucifora *et al.*, (1979). They found that the percentages of reduction efficacy of IGR and KZ oil were 91-99 and 68-78%, respectively.

Statistical analysis of the data, showed highly significant differences between the effect of tested chemical compounds on pre-adult stage. Buprofezin was the most effective compound on preadult of *S. oleae* and M-pede was the least effective one after 21, 45 and 90 days, during the two years, 1998 and 1999.

3.1.3. Effect of different chemical compounds on adult stage:

As shown in Tables (21 and 23) data obtained showed that the mean reduction percentages were 61.6, 46.8, 42.6, 41.3, 34.8, 30.5 and 64.06, 42.3, 37.2, 36.3, 29.8, 21.7 caused by Buprofezin, Biofly, KZ oil, Jojoba, Neemazal and M-pede, respectively.

Lampson and Morse (1992) tested the IGR (Fenoxycarb). They reported significant reduced in population of *S. oleae*, including adult stage.

The result indicated that, there was a significant different between the periods after application and the highest percentage of reduction was recorded after 45 days ($F= 455.7, 650.9$ for the two seasons, $P<0.01$)

Statistical analysis of the data showed highly significant differences between the effect of chemical compounds on adult stage. As common Buprofezin is the most effective compound on adult stage after 21, 45 and 90 days from application, during 1998 and 1999 years.

3.2. On natural enemies:

3.2.1. Effect of chemical compounds on *Saissetia oleae* parasitoids:

Data in Tables (24, 25, 26 and 27) showed the effect of different natural compounds and an IGR (buprofezien) against the parasitoids of *S. oleae* on olive trees.

Spraying were carried out in the first June 1998 and repeated at the same time in the second year (1999) in the same farm located in Northern Coast.

The average maximum and minimum temperatures in the field were (21.7 and 27.6°C) and (22.3 and 28.6 °C) and relative humidities were 70 and 69 % in the two years, respectively (Figs 4 and 6).

In the two trials, of applications of different parasitoids (*M. barteltti, M. flavus, Mi. flavus, D. elegans* and *S. cyaneae*) of *S. oleae* on olive trees in Northern Coast were sprayed as a whole tree spray.

The *Metaphycus* spp. are the dominant parasitoids of *S. oleae* on olive trees.

The maximum and minimum pre-spraying numbers of the parasitoids, *Metaphycus* spp., *Mi. flavus, D. elegans* and *S. cyaneae* were (416-246), (136-61), (87-11) and (48-12) in 1998 trail for M-pede, Neemazal, Jojoba oil, Biofly, KZ oil and Buprofezin in Table (24), respectively. While, in the 1999 trail were (304-193), (114-86), (72-53) and (29-17) for the forementioned parasitoids, respectively (Table, 26).

Table (24): Numbers of alive individuals of different parasitoids of *Saissetia oleae* on olive trees treated with certain natural compounds and an IGR during 1998.

Treatment	Conc.	Pre-treatment counts				Post-treatment counts												Mean			
						One month				Two months				Three months							
		Mit	*Mif*	*De*	*Sc*	*Mit*	*Mif*	*De*	*Sc*	*Mit*	*Mif*	*De*	*Sc*	*Mit*	*Mif*	*De*	*Sc*	*Mit*	*Mif*	*De*	*Sc*
Buprofezin	1 ml/l.	293	64	11	48	18	12	0	1	17	3	0	4	21	3	0	2	18.7	6.0	0.0	2.3
Biofly	1.5 ml/l.	416	136	55	12	123	48	20	5	164	46	21	20	47	16	6	0.3	111.3	36.7	15.7	8.4
KZ oil	15 ml/l.	353	61	23	20	44	6	2	2	37	5	1	1	42	5	0	0	41.0	5.3	1.0	1.0
Neemazal	3 ml/l.	246	132	87	33	80	57	38	15	104	66	46	9	102	82	48	20	95.3	68.3	44.0	15.3
Jojoba	15 ml/l.	303	72	63	26	23	24	19	7	26	18	11	5	22	14	3	6	23.7	18.7	11.0	6.0
M-pede	2.5 ml/l.	269	124	27	16	89	47	11	6	90	49	11	6	88	51	4	8	89.0	49.0	8.7	6.7
Control	-	397	101	50	17	301	95	45	15	275	88	39	13	255	91	42	16	277.0	91.3	42.0	14.7

***Mit* = (*M. bartletti* and *M. flavus*), *Mif* = *Mi. flavus*, *De* =*D. elegans*, *Sc* =*S. cyaneae*,**

Table (25): Percent reduction in the numbers of the parasitoids of *Saissetia oleae* on olive trees treated with some natural compounds and an IGR during 1998 season.

Treatment	Conc.	% reduction of the parasitoids of *S. oleae* at different intervals												Average			
		One month				Two months				Three months							
		Mit	*Mif*	*De*	*Sc*	*Mit*	*Mif*	*De*	*Sc*	*Mit*	*Mif*	*De*	*Sc*	*Mit*	*Mif*	*De*	*Sc*
Buprofezin	1 ml/l.	97.9	99.8	100	97.6	91.6	94.6	100	96.1	88.8	94.8	100	95.6	92.8	96.4	100	96.4
Biofly	1.5 ml/l.	61.0	62.5	59.6	52.8	43.1	50.1	48.6	46.8	45.0	48.7	37.5	38.0	49.7	53.8	48.6	45.9
KZ oil	15 ml/l.	93.6	89.5	90.3	88.6	94.9	90.1	94.4	93.5	81.5	90.9	100	100	96.2	94.6	94.9	94.0
Neemazal	3 ml/l.	57.1	54.1	51.5	48.5	39.0	42.6	32.2	35.7	35.4	31.1	34.3	35.6	43.8	42.6	39.3	39.9
Jojoba	15 ml/l.	76.9	64.6	71.5	69.5	87.6	71.3	77.6	74.9	88.7	78.4	75.4	83.7	84.4	71.4	74.8	76.0
M-pede	2.5 ml/l.	56.3	59.7	54.7	57.5	51.7	54.6	47.8	50.9	49.1	54.4	38.3	46.9	53.4	56.2	46.9	51.8

Mit = (M. bartletti and *M. flavus), Mif = Mi. flavus, De =D. elegans, Sc =S. cyaneae,*

Table (26): Numbers of alive individuals of different parasitoids of *Saissetia oleae* on olive trees treated with certain natural compounds and an IGR during 1999.

Treatment	Conc.	Pre-treatment counts				Post-treatment counts												Mean			
						One month				Two months				Three months							
		Mit	*Mif*	*De*	*Sc*	*Mit*	*Mif*	*De*	*Sc*	*Mit*	*Mif*	*De*	*Sc*	*Mit*	*Mif*	*De*	*Sc*	*Mit*	*Mif*	*De*	*Sc*
Buprofezin	1 ml/l.	212	96	53	21	14	7	3	1	14	7	4	1	16	8	4	2	14.7	7.3	3.7	1.3
Biofly	1.5 ml/l.	217	88	63	29	58	29	18	9	60	29	20	9	66	33	24	21	61.3	30.3	20.7	13.3
KZ oil	15 ml/l.	242	86	55	17	8	4	3	1	12	2	2	1	11	4	3	1	10.3	3.3	2.7	1.0
Neemazal	3 ml/l.	193	110	72	19	76	41	24	11	75	45	28	8	88	48	33	8	79.7	44.7	28.3	9.0
Jojoba	15 ml/l.	304	91	57	21	54	16	9	4	48	19	9	2	49	19	10	4	50.3	18.0	9.3	3.3
M-pede	2.5 ml/l.	288	114	58	22	112	47	21	8	110	50	25	9	115	53	28	9	112.3	50.0	24.7	8.7
Control	-	252	107	70	22	211	91	61	18	191	81	52	16	177	70	42	13	193.0	80.7	51.7	15.7

Mit = (M. bartletti and *M. flavus), Mif = Mi. flavus, De =D. elegans, Sc =S. cyaneae,*

Table (27): Percent reduction in numbers of the parasitoids of *Saissetia oleae* on olive trees treated with some natural compounds and an IGR during 1999 season.

Treatment	Conc.	% Reduction of the parasitoids of *S. oleae* at different intervals												Average			
		One month				Two months				Three months							
		Mit	*Mif*	*De*	*Sc*	*Mit*	*Mif*	*De*	*Sc*	*Mit*	*Mif*	*De*	*Sc*	*Mit*	*Mif*	*De*	*Sc*
Buprofezin	1 ml/l.	92.1	91.4	93.5	94.2	91.3	90.4	90.0	93.5	90.0	89.0	89.8	86.9	91.1	90.3	91.1	91.5
Biofly	1.5 ml/l.	68.1	61.3	67.2	62.1	63.5	56.5	57.3	57.3	59.9	50.5	48.7	47.8	63.7	56.1	57.7	55.7
KZ oil	15 ml/l.	96.1	94.5	93.7	92.8	93.5	93.9	95.1	91.9	94.0	93.9	92.7	91.9	94.5	94.1	93.8	92.2
Neemazal	3 ml/l.	52.9	56.2	61.7	54.9	48.7	46.0	47.7	42.1	39.8	42.2	38.3	42.1	47.1	48.1	49.2	46.4
Jojoba	15 ml/l.	78.8	79.3	81.9	76.7	79.2	72.4	78.7	80.4	78.7	72.4	76.4	73.8	78.9	74.4	79.0	77.0
M-pede	2.5 ml/l.	53.6	51.5	58.5	55.6	49.6	42.1	42.0	43.8	47.3	38.6	35.0	43.8	50.2	44.1	45.2	47.7

Mit = (M. bartelttti and *M. flavus), Mif = Mi. flavus, De =D. elegans, Sc =S. cyaneae,*

It is known that the exoskeleton (cuticle) of insects consists of protein and chitin. During the processes of ecdysis, the old cuticle of an insect is shed and a new one is grown. The IGR's (antimoulting) are chemicals which interfere with the development of insects. Buprofezin belongs to the chemical group thiadiazines, which interfere with the development of the insects exoskeleton (CSI-chitin synthesis inhibitor). It is selective being non-toxic or low toxic to parasitoids (Hammock, 1990).

In Tables (25 and 27) Buprofezin gave toxic effect against all *S. oleae* parasitoids (over 90.3% average reduction) in the olive farm in the two trials of application during 1998 and 1999 seasons. Also, results indicated that the parasitoids are very sensitive to residues of IGR.

John (1993) stated that, the time of application is more important for IGRs. He found the time of application early in population development was critical for optimal control and saving against parasitoids.

Schuster (1989) found that the buprofezin sterilize eggs of parasitoids and prevents successful moulting at all nymphal stages while only prevents adult emergence following the last nymphal stage. Adults of parasitoids observed in more response to contact with residues of the IGR. In addition, buprofezin was to impact the egg laying of adult exposed to fresh residues (Harshman 1996).

The data in Tables (25 and 27) show that KZ oil gave over than 92.2% average reduction against all parasitoids of *S. oleae* in the olive farm in two trials 1998 and 1999. On the other

hand Jojoba oil gave more than 71.4% average reduction against all parasitoids of *S. oleae* in the olive farm in two trials 1998 and 1999. This may be due to the Jojoba oil is a natural oil (plant extraction).

The other three tested compounds (M-pede, Neemazal and Biofly) gave moderate toxic effect against the parasitoids. Biofly gave less than 53.8% average percent reduction against all *S. oleae* parasitoids in the first year (1998) (Table, 25), while gave less than 63.7% average reduction in the second year (1999) (Table, 27).

M-pede gave less than 56.2% average percent reduction against all *S. oleae* parasitoids in the first year (1998) (Table, 25) while gave less than 50.2% average reduction in the second year (1999) (Table, 27).

Neemazal gave less than 43.8% average percent reduction against all *S. oleae* parasitoids in the first year (1998) (Table, 25) while gave less than 49.2% average reduction in the second year (1999) (Table, 27).

The differences between these responses to the compounds proved higher significant effects after 45 days from spraying. ($F= 619.20$, $P<0.01$, for 1998 and $F= 222.19$, $P<0.01$, for 1999).

These results are concordat with those obtained by Mangoud (1994 and 2000) who found that oil + sulfur, light oil alone and oil + malathion gave over than 99% average reduction against parasitoids of some scale insects.

3.2.2. Effect of chemical compounds on *Saissetia oleae* predators :

Data in Tables (28, 29, 30 and 31) show the effect of different natural compounds and an IGR (buprofezin) against the predators attacking *S. oleae* on olive trees.

Spraying was carried out in two successive years in 1st June 1998 and in 1st June 1999 in the same farm located in Northern Coast.

The average maximum and minimum temperatures in the field were (21.7 and 27.6°C) and (22.3 and 28.6°C) and relative humidities were 65 and 68 % in the two years, respectively (Figs 4 and 6).

In the two trials of applications of different predators (*C. carneae, C. bipustulatus, Orius* spp., *S. syriacus*, *E. flavipes*, *C. undecimpunctata*) of *S. oleae* on olive trees in Northern Coast were sprayed as a whole tree spray.

The maximum and minimum of pre-spraying numbers of the predators were (41-45), (17-27), (21-27), (7-10), (9-12) and (1-4) for six predators in the first trail (1998) in Table (28), respectively while, the average pre-spraying numbers in the second trail (1999) were (82-98), (52-81), (46-56), (32-43), (25-36) and (21-24) for six predators, respectively (Table 30).

Data in Tables (29 & 31) revealed that Buprofezin gave toxic effect against all *S. oleae* predators (over 90.8% average reduction) and on the other hand KZ oil gave over than 86.3% average reduction in the olive farm in the first trail (1998), while

Table (28): Numbers of alive individuals of different predators of *Saissetia oleae* on the olive trees treated with certain natural compounds and an IGR during 1998.

Insecticides	Conc.	Pre-treatment counts						Post-treatment counts																					
								One month						Two months						Three months						Mean					
		Cc	Cb	O	Ss	Ef	Cu	Cc	Cb	O	Ss	Ef	Cu	Cc	Cb	O	Ss	Ef	Cu	Cc	Cb	O	Ss	Ef	Cu	Cc	Cb	O	Ss	Ef	Cu
Buprofezin	1 ml/L	42	25	25	10	11	4	2	2	1	1	1	0	4	3	2	0	0	0	5	3	2	0	0	0	3.7	0.7	1.7	0.3	0.3	0
Biofly	1.5 ml/L	41	22	24	8	12	1	10	7	6	2	4	0	15	10	8	3	4	0	16	9	10	2	3	0	13.7	8.7	8.0	2.3	3.7	0
KZ oil	15 ml/L	45	18	25	8	12	2	5	2	2	1	2	0	8	3	1	1	2	0	8	3	2	1	1	0	7.0	3.0	1.7	1.0	1.7	0
Neemazal	3 ml/L	43	17	22	7	10	3	17	8	9	3	5	0	18	9	10	3	5	0	18	7	10	2	18	0	17.7	8.0	9.7	2.7	9.3	0
Jojoba	15 ml/L	42	20	21	10	12	4	12	7	6	3	4	0	15	8	6	5	5	0	16	10	7	3	4	0	14.3	6.7	6.3	2.7	4.3	0
M-pede	2.5 ml/L	42	27	27	9	9	2	20	16	12	4	5	0	21	15	12	4	5	0	25	15	13	3	3	0	22.0	15.3	24.3	3.7	4.3	0
Control	-	59	42	35	28	20	15	71	59	45	38	29	24	69	51	40	35	29	18	63	42	35	18	14	11	67.7	50.7	40.0	30.3	24.0	17.7

Cc =C. carneae, Cb = C. bipustulatus, O = Orius sp., Ss = S. syriacus, Ef = E. flavipes, Cu = C. undecimpunctata.

Table (29): **Percent reduction in number of the predators of *Saissetia oleae* on olive trees treated with some natural compounds and an IGR during 1998.**

Treatment	Conc.	% Reduction of the predators of *S. oleae* at different intervals																		Average					
		One month						Two months						Three months											
		Cc	Cb	O	Ss	Ef	Cu	Cc	Cb	O	Ss	Ef	Cu	Cc	Cb	O	Ss	Ef	Cu	Cc	Cb	O	Ss	Ef	Cu
Buprofezin	1 ml/l.	96.0	94.3	96.9	92.6	93.7	100	91.9	90.1	100	100	100	100	88.9	88.0	100	100	100	100	92.3	90.8	99.0	97.5	97.9	100
Biofly	1.5 ml/l.	79.7	77.3	80.6	81.6	77.0	100	68.7	62.6	70.8	70.0	69.7	100	63.5	59.1	58.3	61.1	64.3	100	70.6	66.3	69.9	70.9	70.3	100
KZ oil	15 ml/l.	90.8	92.1	93.8	90.8	88.5	100	84.8	86.3	76.5	90.0	84.8	100	83.4	83.3	92.0	80.5	88.1	100	86.3	87.2	87.4	87.1	87.1	100
Neemazal	3 ml/l.	67.1	66.5	68.2	68.4	65.5	100	64.2	56.4	60.2	65.7	54.6	100	60.8	50.0	54.5	53.6	42.8	100	64.3	57.6	61.0	62.6	56.8	100
Jojoba	15 ml/l.	76.3	75.1	77.8	77.9	77.0	100	69.5	67.1	75.0	60.0	62.1	100	64.3	50.0	66.7	53.3	52.4	100	70.0	64.1	73.2	63.7	63.8	100
M-pede	2.5 ml/l.	60.4	57.8	65.4	67.3	61.7	100	57.2	54.2	61.1	64.4	49.5	100	44.3	44.4	51.9	48.1	52.4	100	54.0	52.1	59.5	59.9	54.5	100

Cc =C. carneae, Cb = C. bipustulatus, O = Orius sp., *Ss = S. syriacus, Ef = E. flavipes, Cu = C. undecimpunctata.*

Table (30): Numbers of alive individuals of different predators of *Saissetia oleae* on olive trees treated with certain natural compounds and an IGR during 1999.

Treatment	Conc.	Pre-treatment counts						Post-treatment counts																Mean					
								One month						Two months						Three months											
		Cc	Cb	O	Ss	Ef	Cu	Cc	Cb	O	Ss	Ef	Cu	Cc	Cb	O	Ss	Ef	Cu	Cc	Cb	O	Ss	Ef	Cu	Cc	Cb	O	Ss	Ef	Cu
Buprofezin	1 ml/l.	98	52	46	43	26	21	4	3	3	2	1	0	6	5	5	3	2	0	8	6	8	4	3	0	6.0	4.7	5.3	3.0	2.0	0
Biofly	1.5 ml/l.	89	81	56	33	25	21	16	12	10	5	4	0	19	13	4	5	4	0	19	14	15	5	4	0	18.0	13.0	9.7	5.0	4.0	0
KZ oil	15 ml/l.	82	63	46	42	26	22	6	4	2	3	2	0	7	4	3	4	2	0	8	4	5	5	2	0	7.0	4.0	3.3	4.0	2.0	0
Neemazal	3 ml/l.	84	63	50	32	36	24	23	17	13	8	10	0	27	20	15	8	9	0	30	18	16	7	16	0	26.7	18.3	14.7	18.3	11.7	0
Jojoba	15 ml/l.	90	66	50	36	32	23	17	14	10	7	7	0	22	17	12	6	6	0	21	15	15	5	6	0	20.0	15.3	12.3	6.0	6.3	0
M-pede	2.5 ml/l.	83	63	55	34	35	22	25	18	15	9	10	0	30	20	15	8	8	0	33	22	15	9	7	0	29.3	20.0	15.0	8.7	8.3	0
Control	-	99	65	55	37	30	25	81	55	45	29	25	20	77	45	39	21	18	15	68	39	31	17	15	12	75.3	46.3	38.3	22.3	19.3	15.7

Cc =C. carneae, Cb = C. bipustulatus, O = Orius sp., *Ss = S. syriacus, Ef = E. flavipes, Cu = C. undecimpunctata.*

Table (31): Percent reduction in numbers of the predators of *S. oleae* on olive trees treated with some natural compounds and an IGR during 1999.

Treatment	Conc.	% Reduction of the predators of *S. oleae* at different intervals																		Average					
		One month						Two months						three months											
		Cc	Cb	O	Ss	Ef	Cu	Cc	Cb	O	Ss	Ef	Cu	Cc	Cb	O	Ss	Ef	Cu	Cc	Cb	O	Ss	Ef	Cu
Buprofezin	1 ml/l.	95.0	93.2	92.0	94.1	95.4	100	92.1	86.1	84.7	87.7	87.2	100	88.1	80.8	78.7	79.8	76.9	100	91.7	91.0	85.1	87.2	86.5	100
Biofly	1.5 ml/l.	78.0	80.0	78.2	80.7	80.8	100	72.6	73.6	72.3	73.3	73.3	100	68.9	67.1	67.3	67.0	68.0	100	73.2	73.6	72.6	73.7	74.0	100
KZ oil	15 ml/l.	91.1	92.8	94.7	90.9	90.8	100	89.0	90.8	90.8	83.2	87.2	100	85.8	89.4	86.7	74.1	84.6	100	88.6	86.7	90.7	82.7	87.5	100
Neemazal	3 ml/l.	66.5	68.1	68.2	68.1	66.7	100	58.7	54.1	57.7	60.0	58.3	100	48.0	52.4	43.2	52.4	44.4	100	57.7	58.2	56.4	60.2	56.5	100
Jojoba	15 ml/l.	76.9	74.9	75.6	75.2	73.8	100	68.6	62.8	66.2	70.6	68.8	100	66.0	62.1	63.3	69.8	62.5	100	70.5	66.6	68.4	71.9	68.4	100
M-pede	2.5 ml/l.	63.2	66.2	66.7	66.2	65.7	100	53.5	54.1	61.5	58.5	61.9	100	42.1	41.8	51.6	42.4	60.0	100	52.9	54.0	59.9	55.7	62.5	100

Cc =C. carneae, Cb = C. bipustulatus, O = Orius sp., Ss = S. syriacus, Ef = E. flavipes, Cu = C. undecimpunctata.

in the second trial (1999) the two compounds gave over than 82.7% average reduction. The results indicated that the predators are sensitive to residues of IGR and KZ oil.

The data in Table (29 and 31) show that the other four compounds gave medium effect against the predators attacking *S. oleae* in the olive farm in two trials 1998 and 1999 years. Jojoba oil, Neemazal and M-pede and Biofly gave around 70% average reduction against all predators in the two trials 1998 and 1999. This is mostly, due to that the four compounds are natural. The present work agree with the finding of El-Khouly (2001). Who stated that insect growth regulator, Iufenuron and neem tree extract (Azadiractin) caused very toxic effect on the predators *C. undecimpunctata, C. carneae* and *P. alfiereii*.