EXPERIMENTAL RESULTS

EXPERIMENTAL RESULTS

CHAPTER (I)

EFFECT OF INSECTICIDES ON SOIL BACTERIA

In this experiment, the number of total bacteria, azotobacters and denitirifying bacteria were counted in both glucose amended or unamended soil. To the soil samples, either the recommended field dose or 10-fold the field dose of one the following insecticides: Sevin (Carbaryl) ,Larvin (Thiodicarb) and Lannate (Methomyl) over a period of 45 days was added.

(a) Total Bacteria :

The results in Table (2) and Fig (1) show a significant increase during the first five days followed by a decrease in the total bacterial counts in both the insecticide treated and untreated and in glucose amended and unamended soils. The presence of glucose in soil resulted in a significant increase in the total bacterial count. However, the highest bacterial count was recorded after 5 days of incubation in all experimental treatments. Also, the results reveal that, the bacterial counts in insecticides treated soils were higher compared with the control only in glucose amended soil. On the other hand, the total counts were higher in soil samples amended with 10-fold of the recommended dose . The stimulation effect is clear in soil treated with Lannate followed by Sevin and finally by Larvin. However, the population increased several times using the tested doses of the experimental insecticides

Table (2) Total counts of bacteria as influenced by various doses of the three insecticides in soil amended or non-amended with glucose

Time in days	counts /g. dry soil (X 10^6)													
	Soil		Doses of Sevin				Doses of Larvin				Doses of Lannate			
	without G	with G	1		10		1		10		1		10	
			1	1+G	10	10+G	1	1+G	10	10+G	1	1+G	10	10+G
1	49.30	357.00	52.96	113.45	51.60	196.90	87.81	110.76	30.01	169.45	70.30	178.25	98.51	207.95
5	307.40	558.45	252.45	1184.05	314.50	1399.95	111.35	297.50	300.05	1320.05	267.55	1189.05	317.15	1421.55
10	49.65	103.45	27.80	76.25	107.95	202.90	13.37	50.41	162.95	183.60	96.90	117.05	112.69	217.35
15	68.85	109.40	43.95	96.31	136.85	234.86	30.01	73.10	185.65	205.96	113.90	145.10	129.16	215.65
30	19.55	25.76	23.56	12.55	26.35	37.40	17.14	14.45	28.31	20.82	32.30	40.80	41.65	30.86
45	41.06	78.20	28.65	113.90	20.68	33.15	22.78	50.41	84.41	23.63	33.75	15.56	22.04	31.45

G = Glucose

The results were statisitically analysed using "F" test.

Significant different at < (0.005)

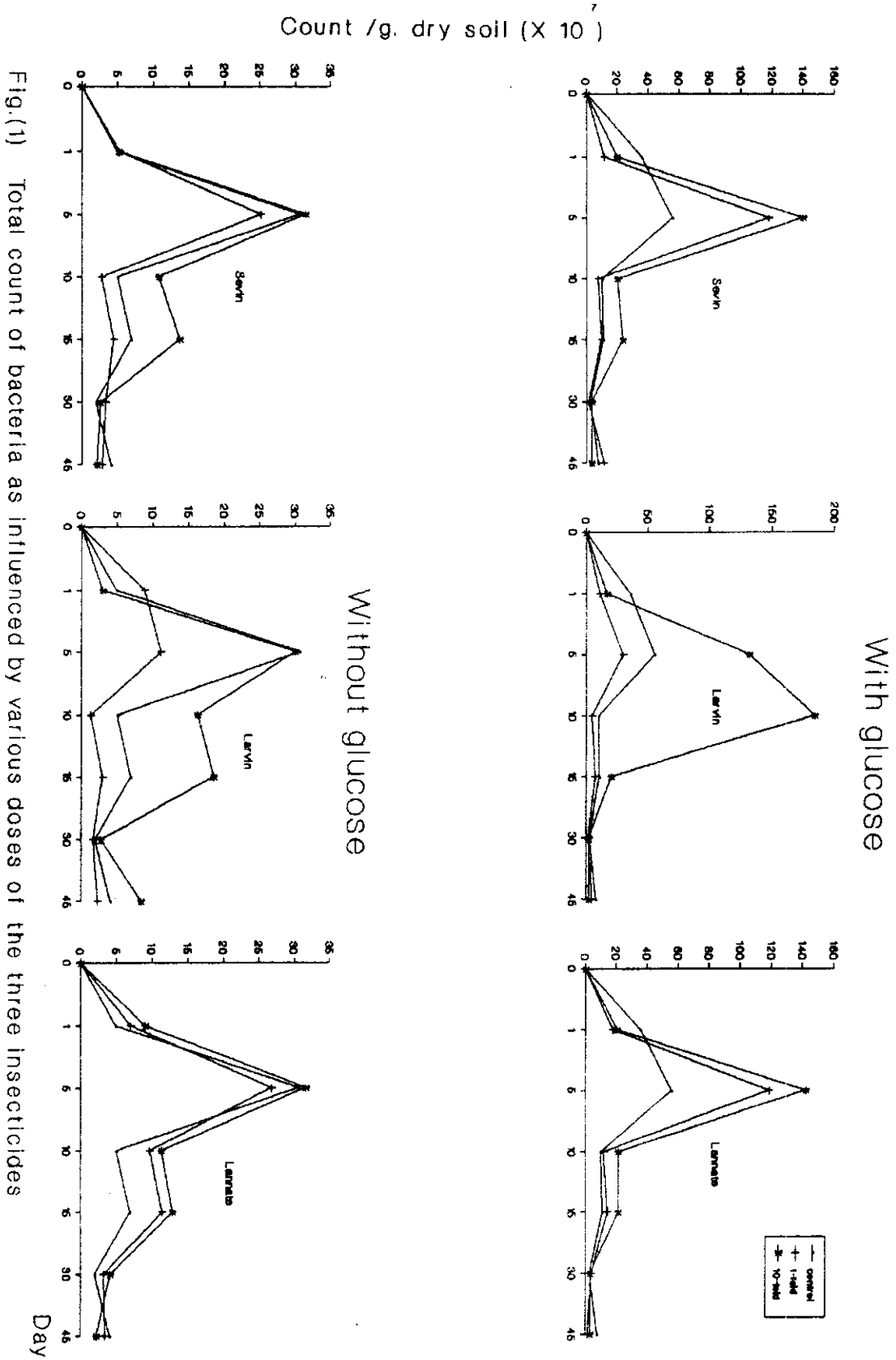


Fig.(1) Total count of bacteria as influenced by various doses of the three insecticides

(b) Azotobacters :

The results presented in Table (3) and Fig. (2) show that the counts of azotobacter were increased by time of treatment until reached its maximum on the 5th day using all doses of the used insecticides (1,10) in both amended and namended soil with slightly increase in amended soil, and then decreased. The results reveal also that stimulatory or inhibitory effects of the experimental insecticides on the total count of azotobacter differed according to type of the insecticide; its dose, the supplementation of glucose and the time of treatment. Also, the results indicate that by using Sevin and Lannate (10-fold of the recommended dose) in the amended soil, the azotobacter counts were increased 3- and 4-fold respectively, after 5 days of treatment.

Table (3) Counts of aerobic nitrogen fixers bacteria as influenced by various doses of carbamate insecticides in glucose amended and non-amended soil.

Time in days	counts /g. dry soil (X 10^3)													
	Soil		Doses of Sevin				Doses of Larvin				Doses of Lannate			
	without G	with G	1		10		1		10		1		10	
			1	1+G	10	10+G	1	1+G	10	10+G	1	1+G	10	10+G
1	61.20	119.00	50.15	110.50	68.85	102.00	20.40	41.65	61.20	68.85	80.75	119.00	93.50	153.00
5	476.00	501.50	153.00	493.00	212.50	714.00	67.15	119.00	93.50	127.50	170.00	714.00	238.00	935.00
10	17.85	20.40	14.45	19.55	34.00	110.50	5.78	34.00	11.90	20.40	17.85	38.25	32.30	39.95
15	11.90	68.85	5.19	34.00	14.45	34.00	7.91	11.90	9.35	14.45	17.00	29.75	18.70	20.85
30	12.30	28.05	11.05	12.55	34.00	44.20	8.08	12.75	11.90	14.45	14.45	22.95	16.15	21.25
45	1.70	14.45	1.53	113.90	1.53	22.25	6.29	33.15	1.70	28.05	28.05	14.45	7.91	34.00

G = Glucose

The results were statisitically analysed using "F" test.

Significant different at < (0.005)

CHAPTER (II)

EFFECT OF INSECTICI DES ON SOME SOIL PORPERTIES

To study the effect of carbamate insecticides (Sevin, Larvin & Lannate) on the chemical properties of soil inoculated with microbs, glucose ammended and unamended soil samples, and treated and untreated with different doses of the tested insecticides were chemically analyzed at different time intervals during the experimental period (45 day), as previously described in material and methods.

1- Organic Carbon:

The data presented in Table (5) and Fig (4) show that no significant effect of all insecticides used at different doses along the experimental conditions used, on organic carbon contents of soil compared to control. This is because no considerable differance between the organic carbon contents of control and those of insecticide treated soils.

Table (5) Determination of organic carbon in soil in the presence of Sevin, Larvin and Lannate

Time in days	Organic carbon oxidation g/100 g dry soil													
	Soil		Doses of Sevin				Doses of Larvin				Doses of Lannate			
	without G	with G	1		10		1		10		1		10	
			1	1+G	10	10+G	1	1+G	10	10+G	1	1+G	10	10+G
1	0.918	1.209	0.912	1.209	0.918	1.209	0.918	1.209	0.924	1.203	0.924	1.209	0.918	1.203
5	0.930	1.218	0.927	1.227	0.930	1.215	0.921	1.224	0.930	1.213	0.933	1.221	0.927	1.212
10	0.942	1.227	0.936	1.233	0.945	1.236	0.933	1.230	0.942	1.233	0.939	1.245	0.954	1.259
15	0.930	1.209	0.930	1.224	0.930	1.221	0.942	1.230	0.936	1.230	0.933	1.233	0.948	1.224
30	0.930	1.215	0.927	1.215	0.933	1.215	0.930	1.218	0.930	1.212	0.927	1.221	0.924	1.215
45	0.930	1.218	0.930	1.218	0.927	1.221	0.924	1.221	0.930	1.221	0.933	1.221	0.924	1.224

G = Glucose

The results were statisitically analysed using "F" test.

Significant different at < (0.005)

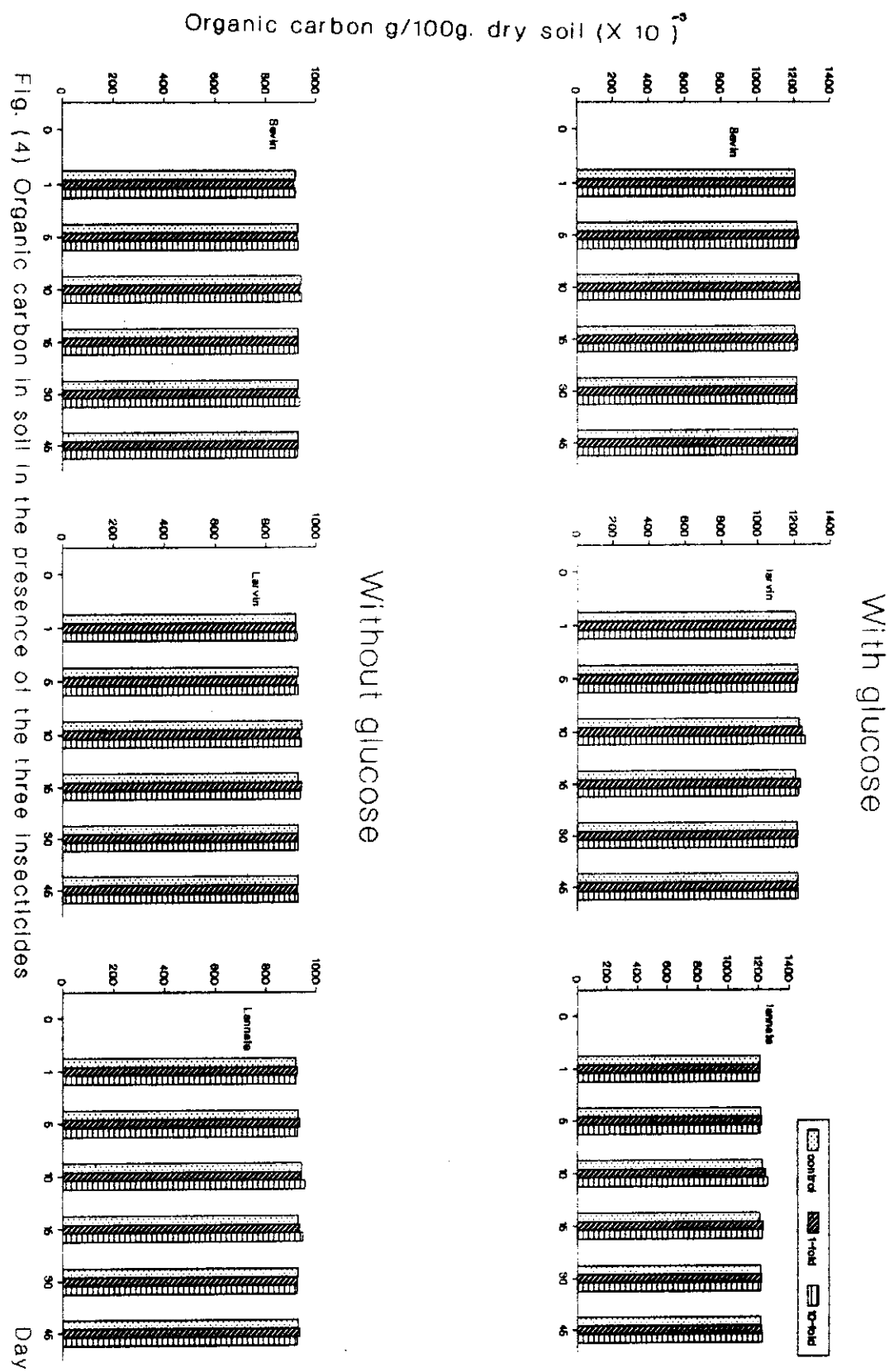


Fig. (4) Organic carbon in soil in the presence of the three insecticides

2- Calcium Carbonate:

As illustrated in Table (6) and Fig (5) the calcium carbonate contents, in control samples as well as in the amended insecticide-treated soil samples inoculated with microbs, recorded the highest values after the shortest incubation period (one day). But in unamended insecticide treated soil samples, the highest values of calcum carbonate were recorded after 10 days of incubation. In general, the decrease of calcium carbonate contents after incubation time more than one day in control and amended insecticide treated soil sampls and after more 10 days in glucose unamended insecticide treated soil samples, may be due to the consumption of calcium carbonate by the organisms inoculated in thess samples. In general, an irregular effect of carbamate insecticides (Sevin, Larvin & Lannate) varying from decrease to increase was noticed along the experimental period compared to control.

Table (6) Determination of Calcium carbonate in soil in the presence of Sevin, Larvin and Lannate

Time in days	Organic carbon oxidation g/100 g dry soil													
	Soil		Doses of Sevin				Doses of Larvin				Doses of Lannate			
	without G	with G	1		10		1		10		1		10	
			1	1+G	10	10+G	1	1+G	10	10+G	1	1+G	10	10+G
1	3.10	3.20	2.00	3.00	2.20	3.10	0.26	2.50	0.29	2.70	2.50	3.10	2.40	3.30
5	1.90	2.00	1.80	2.30	1.80	1.40	0.10	2.10	0.25	2.60	2.40	2.35	1.90	2.00
10	2.10	2.30	2.90	2.30	2.00	2.40	0.10	2.10	0.28	2.30	2.55	2.50	2.60	2.00
15	0.60	0.70	1.15	1.95	1.95	2.00	0.10	0.35	0.23	0.60	1.30	0.25	0.20	0.15
30	1.50	1.60	0.70	0.45	0.60	0.60	0.06	0.35	0.16	1.60	1.30	0.10	1.00	0.80
45	0.80	0.70	0.60	0.40	0.80	0.50	0.10	0.90	0.05	0.60	0.80	0.90	0.50	0.30

G = Glucose

The results were statisitically analysed using "F" test.

Significant different at < (0.005)

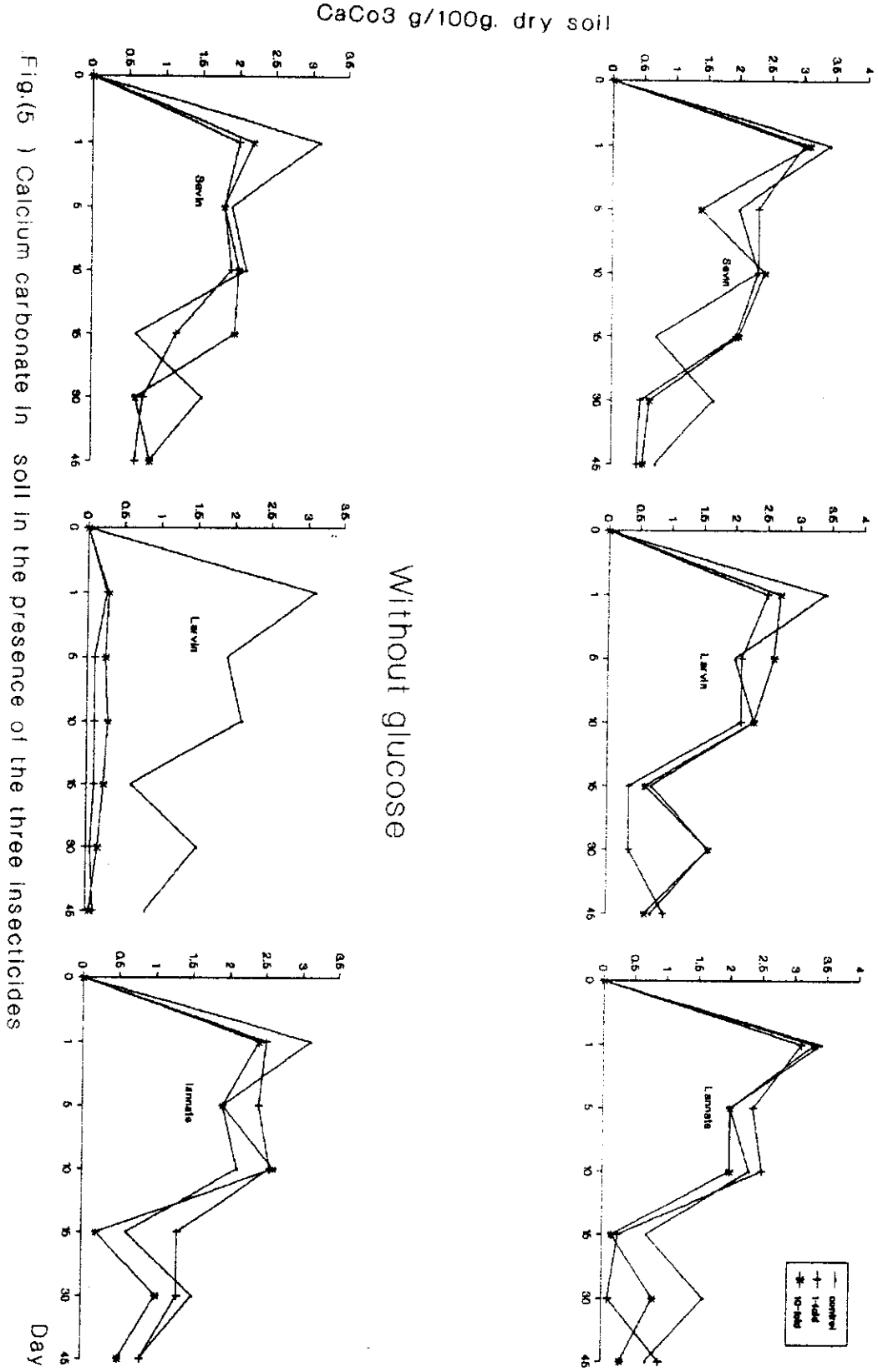


Fig.(5) Calcium carbonate in soil in the presence of the three insecticides

3- Carbonate Contents:

From the data presented in Table (7) and Fig (6), it can be noticed that after the first time interval (one day) highest values of carbonate contents were recorded in both control and insecticide treated as well as glucose amended and unamended soils. After incubation time more than one day and by using the all doses (the recommended dose & 10-fold) of tested insecticides (Sevin, Larvin & Lannate), the carbonate contents were decreased in both glucose amended and unamended soils. This may indicate that the carbonate contents could be utilized by the microorganisms in soil. Also, the results show that the insecticides (Sevin, Larvin & Lannate) had no significant effect on the carbonate contents and the highest values were found in glucose amended soils,

Table (7) Determination of carbonate in soil in the presence of Sevin, Larvin and Lannate

Time in days	CO_3^{++} mg/100 g dry soil													
	Soil		Doses of Sevin				Doses of Larvin				Doses of Lannate			
	without G	with G	1		10		1		10		1		10	
			1	1+G	10	10+G	1	1+G	10	10+G	1	1+G	10	10+G
1	0.0154	0.0173	0.0134	0.0211	0.0115	0.0215	0.0115	0.0192	0.0115	0.0173	0.0115	0.0112	0.0115	0.0230
5	0.0086	0.0125	0.0077	0.0096	0.0019	0.0115	0.0011	0.0096	0.0077	0.0106	0.0085	0.0077	0.0058	0.0077
10	0.0048	0.0058	0.0029	0.0058	0.0010	0.0038	0.0029	0.0077	0.0038	0.0048	0.0085	0.0038	0.0019	0.0038
15	0.0029	0.0816	0.0096	0.0029	0.0567	0.0048	0.0019	0.0067	0.0029	0.0072	0.0053	0.0058	0.0007	0.0538
30	0.0196	0.0086	0.0072	0.0110	0.0077	0.0067	0.0106	0.0001	0.0001	0.0091	0.0001	0.0144	0.0106	0.0086
45	0.0038	0.0058	0.0077	0.0154	0.0048	0.0029	0.0067	0.0019	0.0038	0.0038	0.0038	0.0067	0.0067	0.0067

G = Glucose

The results were statisitically analysed using "F" test.

Significant different at < (0.005)

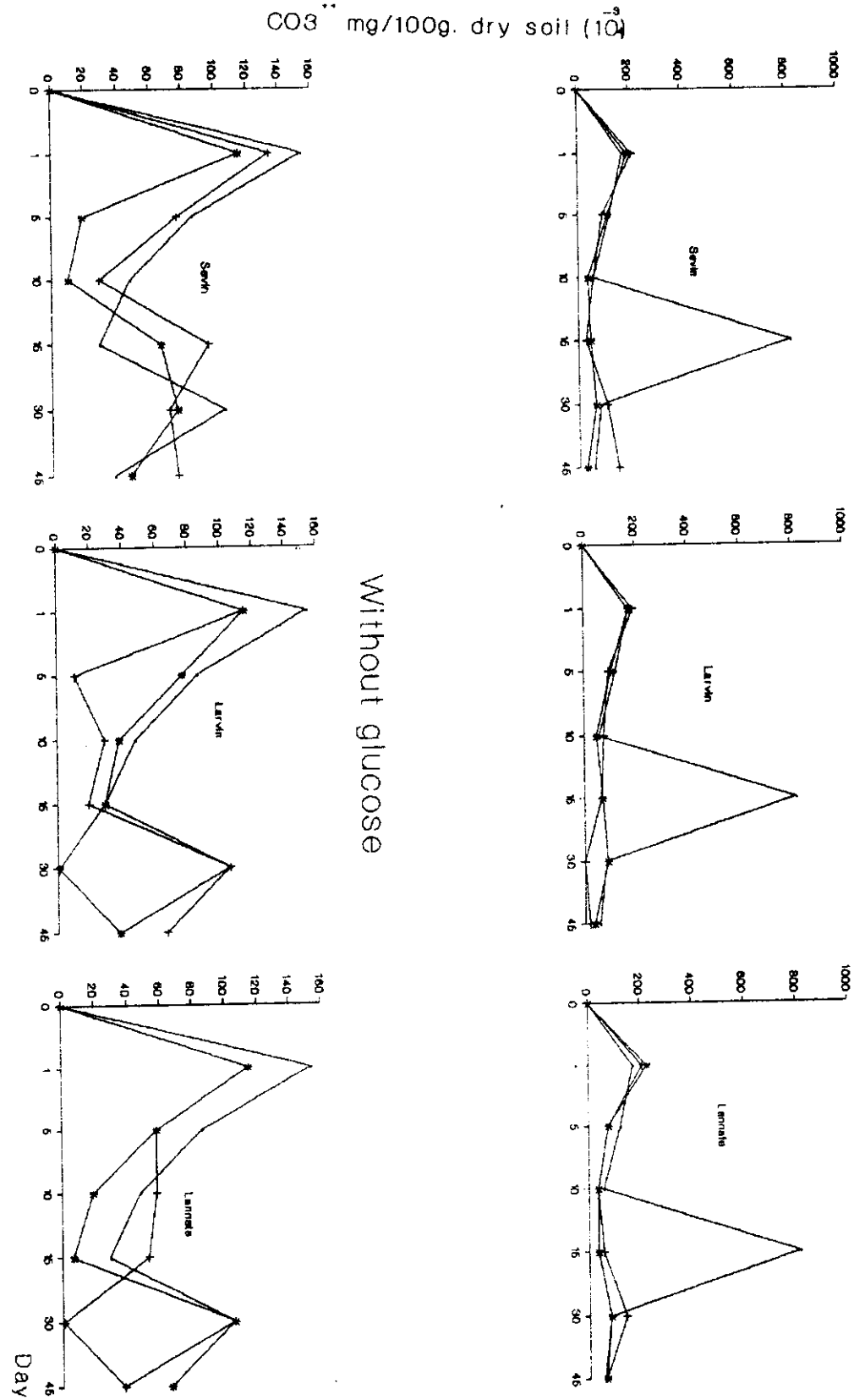


Fig.(6) Carbonate in the soil in the presence of the three insecticides

4- Bicarbonate Contents:

As shown in Table (8) and Fig (7), regardless of presence or absence of insecticides, the bicarbonate contents were only high in glucose amended soil compared to those unamended soil. As in carbonate contents experiment, also the bicarbonate contents recorded the highest values after the shorter incubation time interval (one day) and then decrease along the experimental period in glucose amended and unamendod and insecticide treated and untreated soils. By using Sevin (the recommended dose and 10-fold) lower levels of bicarbonate contents were recorded compared to those produced in the presence of Larvin and Lannate the recommended dose and 10-fold), only in glucose amended soil.

Table (8) Determination of bicarbonate in soil in the presence of Sevin, Larvin and Lannate

Time in days	HCO_3^- mg/100 g dry soil													
	Soil		Doses of Sevin				Doses of Larvin				Doses of Lannate			
	without G	with G	1		10		1		10		1		10	
			1	1+G	10	10+G	1	1+G	10	10+G	1	1+G	10	10+G
1	0.2050	0.6223	0.1981	0.4174	0.1708	0.2944	0.1366	0.2460	0.1708	0.2801	0.1571	0.5813	0.1640	0.5403
5	0.1161	0.1435	0.0956	0.1571	0.1366	0.2118	0.0888	0.1435	0.1025	0.1574	0.0888	0.1435	0.1298	0.1366
10	0.1273	0.1435	0.1128	0.1230	0.1059	0.1161	0.1264	0.1332	0.1537	0.1537	0.0683	0.1401	0.1196	0.1332
15	0.0956	0.1025	0.1059	0.1059	0.1366	0.1674	0.1059	0.1435	0.1127	0.1708	0.1161	0.1537	0.1230	0.1708
30	0.1366	0.1640	0.1196	0.1264	0.1196	0.1674	0.1303	0.1197	0.1401	0.1503	0.1537	0.1640	0.1127	0.1537
45	0.1127	0.0888	0.1537	0.1059	0.1161	0.1537	0.1093	0.0786	0.0752	0.1264	0.0922	0.0922	0.1127	0.1537

G = Glucose

The results were statisitically analysed using "F" test.

Significant different at < (0.005)

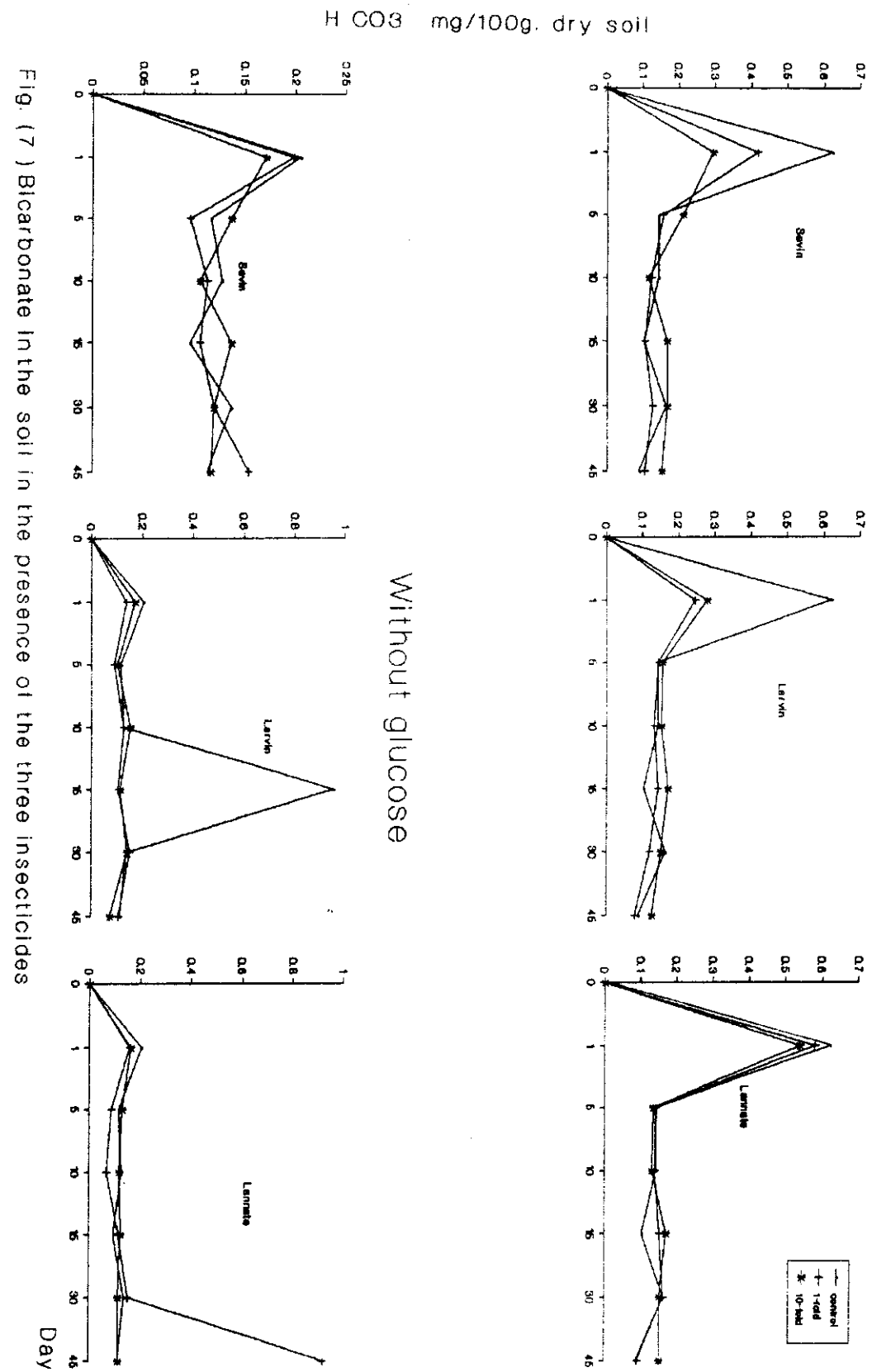


Fig. (7) Bicarbonate in the soil in the presence of the three insecticides

5- The Effect on Total Soluble Salts

The effect of carbamate insecticides (Sevin, Larvin & Lannate) on the content of soluble salts of the inoculated soil, was also investigated. It is noticed form Table (9) and Fig. (8) that only in glucose amended control samples as well as glucose amended insecticide treated soil samples, the contents of soluble salts were recorded the highest values after one day of incubation and then decrease along the experimental period. No clear relationship between the used dose and the evaluated contents of soluble salts of the inoculated soil samples. Generally, under the experimental conditions tested (different incubation periods and various doses of (Sevin, Larvin & Lannate) , an irregular influence was showen.

Table (9) Determination of total soluble salts in soil in the presence of Sevin, Larvin and Lannate

Time in days	Total soluble salts g/100 g dry soil													
	Soil		Doses of Sevin				Doses of Larvin				Doses of Lannate			
	without G	with G	1		10		1		10		1		10	
			1	1+G	10	10+G	1	1+G	10	10+G	1	1+G	10	10+G
1	0.0864	0.4776	0.1912	0.3888	0.0952	0.4062	0.4216	0.4416	0.1336	0.3456	0.1528	0.2176	0.2984	0.4744
5	0.1856	0.1696	0.2032	0.1448	0.1296	0.1576	0.2056	0.5404	0.2288	0.1744	0.2128	0.1240	0.1856	0.2452
10	0.2296	0.1880	0.2664	0.2536	0.2608	0.3216	0.1640	0.6388	0.7712	0.1912	0.1872	0.1672	0.2504	0.2584
15	0.2088	0.1328	0.2160	0.1808	0.2744	0.2064	0.1656	0.1952	0.2504	0.1326	0.2512	0.1960	0.2752	0.1856
30	0.1852	0.1280	0.3712	0.1024	0.2808	0.2304	0.1568	0.1320	0.1976	0.1208	0.3176	0.1988	0.1648	0.2744
45	0.1288	0.0888	0.1928	0.0912	0.2056	0.2264	0.1528	0.1248	0.1912	0.0776	0.2096	0.1388	0.1488	0.1757

G = Glucose

The results were statisitically analysed using "F" test.

Significant different at < (0.005)

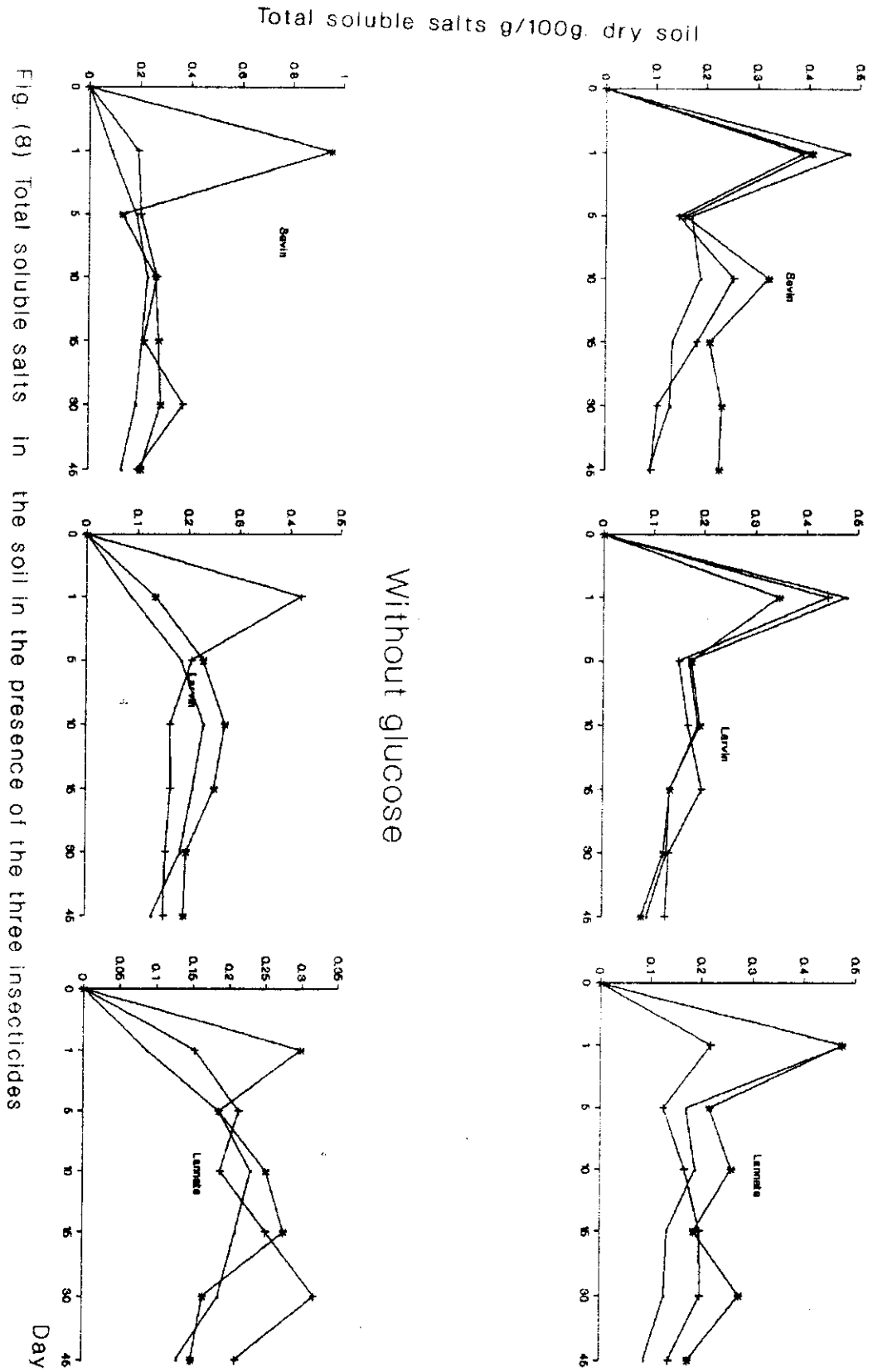


Fig. (8) Total soluble salts in the soil in the presence of the three insecticides

CHAPTER (III)

ISOLATION AND CHARACTERIZATION OF THE TEST BACTERIA

A- Isolation and Identification :

a) Isolation

The target of the present experiment was to isolate and identify certain bacterial species from fertile clay loam soil free from pesticides. The soil samples were collected from different localites from 0-30 cm depth, transferred to the laboratory then dried and ground. After sieving throug 2.0 mm sieve, the soil samples were distributed in plastic pots in 200g quantities and then amended with glucose and treated with the insecticides and the experiment was conducted as previously mentioned in material and methods.

The bacterial colonies appears on the nitrogen free plates were subcultured several times to purify desired bacteria from other contaminants. To make sure that these organisms are completely pure, they were plated on nutrient agar plates. The poor growth or the complete inhibition of growth indicated that these bacteria were completely pure. Using this method 41 different pure isolates were obtained and listed in Table (10 a & b) .

b) The principal characteristics of the isolated strains :

The bacteria isolated in the previous experiment (41 pure organisms) were denoted as free-living aerobic nitrogen fixers as then grow on specifically on nitrogen-free (Ashbey's medium) the morphological and physiological characteristics are shown Table (10 a & b). Two bacterial strains numbered 4 and 15 were selected for urther studies in the current work. The selected strains exhibited the highest values rowth

Table (10.a) The description of the locality isolated nitrogen fixing organisms

No. of organisms	Shape of cell	Elevation	Margin	Optcal Feature	Motility	Growth on starch	Form on streak	Consistency	Surface	Pigments	
										sol.	insoluble
1	Round	Convex	Entire	Trans.	+	+	Fili.	Watery	Smooth	-	Pale brown
2	Round	Flat	Entire	Trans.	+	+	Spreed.	Membr.	Smooth	-	Beige
3	Round	Raised	Entire	Opaque	+	+	Spreed.	Membr.	Rough	-	Pale brown
4	Round	Flat	Entire	Opaque	+	+	Spreed.	Viscid	Rough	-	Beige
5	Round	Raised	Entire	Opaque	+	+	Fili.	Viscid	Smooth	-	Beige-brown
6	Irregular	Raised	Undulate	Opaque	+	+	Echinu.	Viscid	Rough	-	Beige
7	Round	Flat	Entire	Opaque	+	+	Beaded	Membr.	Rough	-	Beige
8	Round	Convex	Entire	Opaque	+	+	Spreed.	Viscid	Rough	-	Beige
9	Spindle	Convex	Entire	Opaque	+	+	Spreed.	Viscid	Smooth	-	Pale brown
10	Round	Convex	Entire	Trans.	+	+	Beaded	Watery	Smooth	-	Red-beige
11	Round	Convex	Entire	Opaque	+	+	Fili.	Watery	Smooth	-	Beige
12	Round	Flat	Erose	Opaque	+	+	Echinu.	Viscid	Rough	-	Brown-orange
13	Round	Raised	Entire	Opaque	+	+	Fili.	Viscid	Smooth	-	Brown
14	Round	Raised	Entire	Opaque	+	+	Spreed.	Viscid	Smooth	-	Brown
15	Irregular	Raised	Entire	Opaque	+	+	Echinu.	Viscid	Rough	-	Orange-brown
16	Irregular	Flat	Entire	Opaque	+	+	Echinu.	Membr.	Rough	-	Beige-brown
17	Irregular	Raised	Undulate	Trans.	+	+	Echinu.	Viscid	Rough	-	Red-beige
18	Round	Flat	Entire	Trans.	+	+	Fili.	Viscid	Smooth	-	Brown
19	Round	Convex	Entire	Trans.	+	+	Spreed.	Viscid	Smooth	-	Beige
20	Irregular	Convex	Undulate	Opaque	+	+	Echinu.	Membr.	Rough	-	Brown
21	Round	Convex	Entire	Trans.	+	+	Spreed.	Watery	Smooth	-	Orange-brown
22	Round	Convex	Entire	Trans.	+	+	Fili.	Watery	Smooth	-	Pale-beige
23	Round	Convex	Entire	Trans.	+	+	Fili.	Watery	Smooth	-	Brown
24	Irregular	Flat	Entire	Opaque	+	+	Echinu.	Viscid	Rough	-	Beige
25	Round	Flat	Undulate	Trans.	+	+	Spreed.	Viscid	Smooth	-	Deep-brown
26	Round	Convex	Entire	Trans.	+	+	Fili.	Watery	Smooth	-	Red-brown
27	Round	Convex	Entire	Trans.	+	+	Spreed.	Watery	Smooth	-	Beige-brown
28	Irregular	Raised	Undulate	Trans.	+	+	Echinu.	Membr.	Rough	-	Yellow-beige
29	Round	Convex	Entire	Trans.	+	+	Spreed.	Viscid	Smooth	-	Beige
30	Round	Convex	Entire	Trans.	+	+	Spreed.	Viscid	Smooth	-	Beige-brown
31	Round	Convex	Entire	Trans.	+	+	Echinu.	Watery	Smooth	-	Pale-brown
32	Round	Convex	Entire	Trans.	+	+	Fili.	Watery	Smooth	-	Orange-beige

Table (10.b)

33	Irregular	Raised	Undulate	Opaque	+	+	Echinu.	Viscid	Rough	-	Red-brown
34	Round	Convex	Entire	Trans.	+	+	Fili.	Watery	Smooth	-	Deep-beige
35	Round	Convex	Entire	Trans.	+	+	Spreed.	Watery	Smooth	-	Beige-brown
36	Round	Raised	Entire	Trans.	+	+	Fili.	Watery	Smooth	-	Beige
37	Spindle	Convex	Entire	Trans.	+	+	Fili.	Watery	Smooth	-	Beige-brown
38	Round	Convex	Entire	Trans.	+	+	Fili.	Watery	Smooth	-	Beige
39	Round	Convex	Entire	Trans.	+	+	Echinu.	Watery	Smooth	-	Beige-red
40	Round	Convex	Entire	Trans.	+	+	Spreed.	Watery	Smooth	-	Beige-brown
41	Round	Convex	Entire	Trans.	+	+	Fili.	Watery	Smooth	-	Beige-red

Trans. = Translucent
Spreed.= Spreeding
Fili. = Filiform
Echinu.= Echinulate

and nitrogen fixing capacity. Strains 4 & 15 were found to form non-diffusible to grown pigment, motile and were able to utilize starch as the carbon source. These characters are applied to the species *Az chroococcum* .

CHAPTER (V)

EFFECT OF SOME INSECTICIDES ON THE BIOLOGICAL ACTIVITY OF AZOTOBACTER

The Effect on Growth

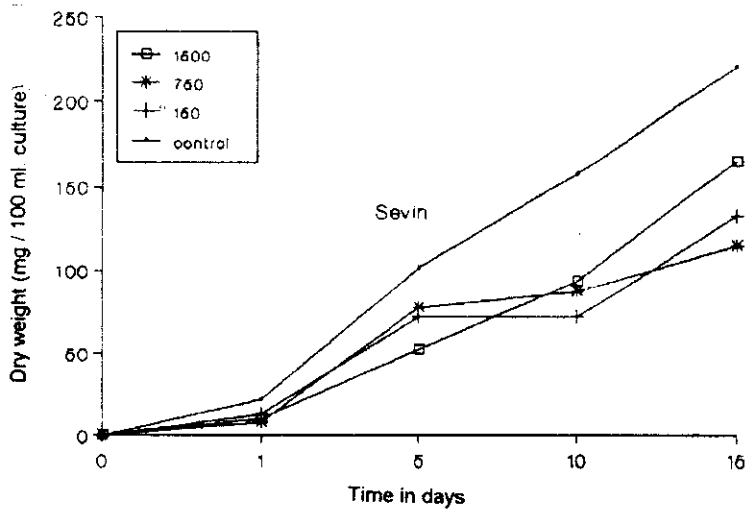
The effect of the insecticides (Sevin, Larvin & Lannate) on the growth of the two isolates (4,15) of *Azotobacter chroococcum* strains was studied.

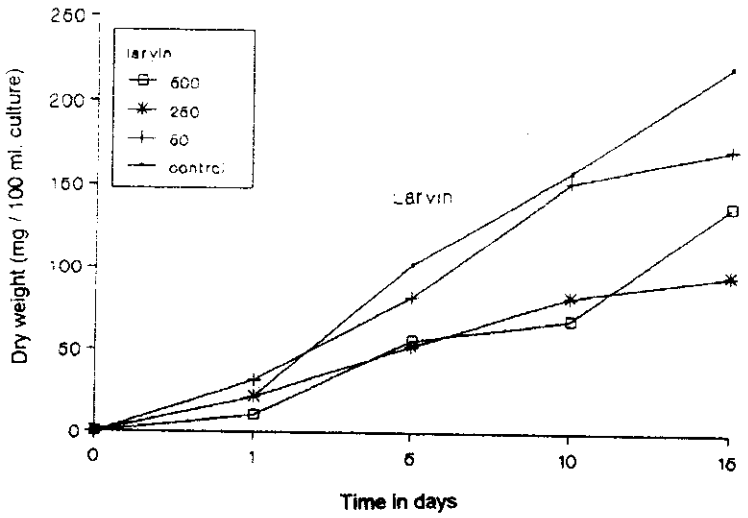
(I) Isolate No. 4:

The results presented in Table (11) and Fig (9) show that the bacterial growth (expressed as dry weight) of the isolate No.4 which was (refferred to *Az. chroococcum.* A_4) clearly affected by the presence of carbamate insecticides (Sevin, Larvin & Lannate) in the culture medium used. In control cultures, the rate of growth increased with time along the experimental period (15 days). On the other hand, both Sevin and Larvin at the different three doses had negative effect on *Az.chroococcum* No.$_4$ growth at the all time intervals investigated, compared to control. But the highest growth was recorded after one day incubation time in the presence of Lannate (150 ug/100 ml) culture, while high growth was obtained at dose of (300 ug/ 100 ml) culture after incubation time of 15 days. At doses other than the previous two doses and at the other incubation time intervals tested, the insecticide lannate had a negative effect on *Azotobacter chroococcum* A_4 growth.

Table (11) Effect of carbamate insecticides on the dry weight of *Az chroococcum* A_4

Time in days	Dry weight (mg/100 ml culture)									
	Sevin (ug)				Larvin (ug)			Lannate (ug)		
	Con.	150	750	1500	50	250	500	30	150	300
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	22.0	13.0	8.0	10.0	32.0	22.0	11.0	20.0	33.0	11.0
5	102.0	72.0	78.0	52.0	82.0	52.0	56.0	92.0	103.0	50.0
10	158.0	72.0	88.0	94.0	152.0	82.0	68.0	74.0	88.0	94.0
15	221.0	133.0	115.0	166.0	172.0	96.0	138.0	117.0	113.0	277.0





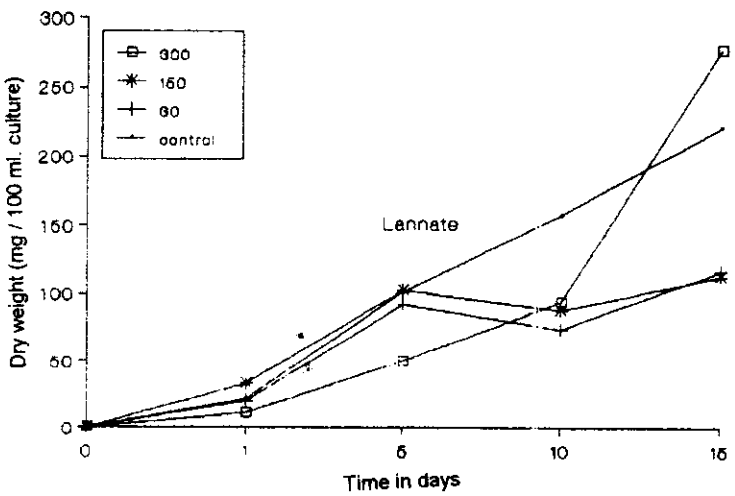


Fig (9) Effect of carbamate insecticides on the dry weight of *Az.chroococcum* A_4

(II) Isolate No. 15 :

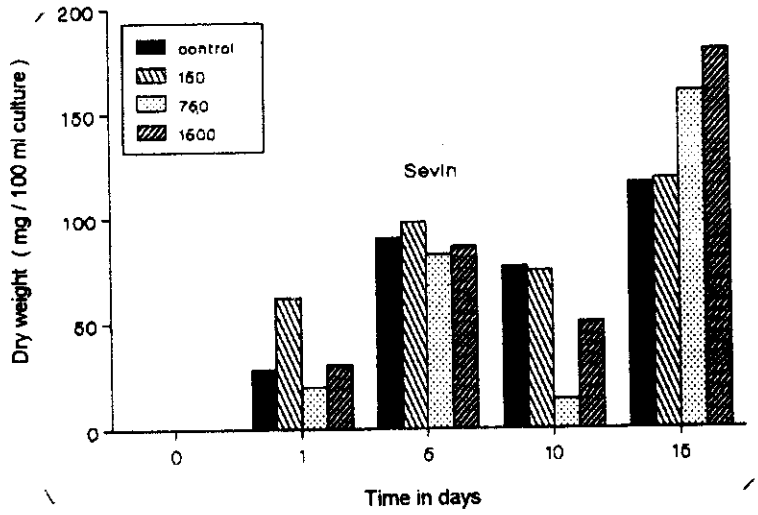
The isolate No. 15 was refferred to *Az. chroococcum* A_{15} as in isolate 4, the effect of Sevin, Larvin and Lannate on *Az. chroococcum* No. 15 growth at different time intervals of 1,5,10 and 15 days, was investigated.

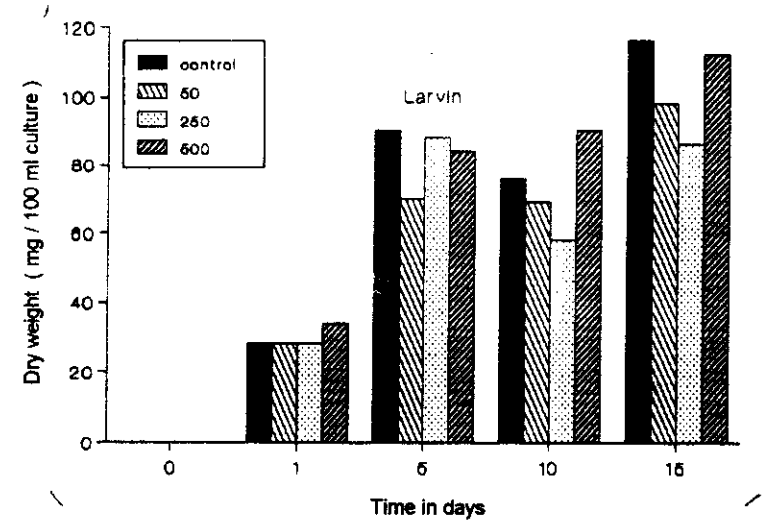
As shown in Table (12) and Fig (10) , the insecticide Sevin stimulate the growth of this isolate, recording 102, 138 and 155% of the control at Sevin doses of 150, 750 and 1500 ug/100 ml culture respectively after 15 days of incubation. Also high growth of 221 and 108% of control occured at Sevin dose of 150 ug/ after incubation periods of 1 and 5 days, respectively.

At doses of Sevin and after incubation periods other than, mentioned above, Sevin had a negative effect on *Az chroococcum.* A_{15} growth compared to control. Also, by using different doses of the insecticide Larvin, and at different incubation periods, the growth rates of *Az. chroococcum* A_{15} were decreased except at dose 500 ug/100 ml culture at incubation periods of 1 and 10 days, recording 121 and 118% of control, respectively. The insecticide Lannate had a stimlatory effect on the *Az. chroococcum.* A_{15} growth using 30,150 and 300 ug/100 ml culture medium after incubation periods of 10 and 15 days. Also high growth was recorded at Lannate doses of 30 and 150 ug/100 ml culture medium 1 and 5 days, respectively compared to control. At doses and incubation periods other than mentioned above, Lannate depressed the growth of this organism.

Table (12) Effect of carbamat insecticides on the dry weight of *Az chroococcum* A_{15}

Time in days	Dry weight (mg/100 ml culture)									
	Sevin (ug)				Larvin (Ug)			Lannate (ug)		
	Con.	150	750	1500	50	250	500	30	150	300
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	28.0	62.0	20.0	30.0	28.0	28.0	34.0	59.0	14.0	12.0
5	90.0	98.0	82.0	86.0	70.0	88.0	84.0	60.0	102.0	46.0
10	76.0	74.0	14.0	50.0	69.0	58.0	90.0	95.0	80.0	106.0
15	116.0	118.0	160.0	180.0	98.0	68.0	112.0	152.0	130.0	194.0





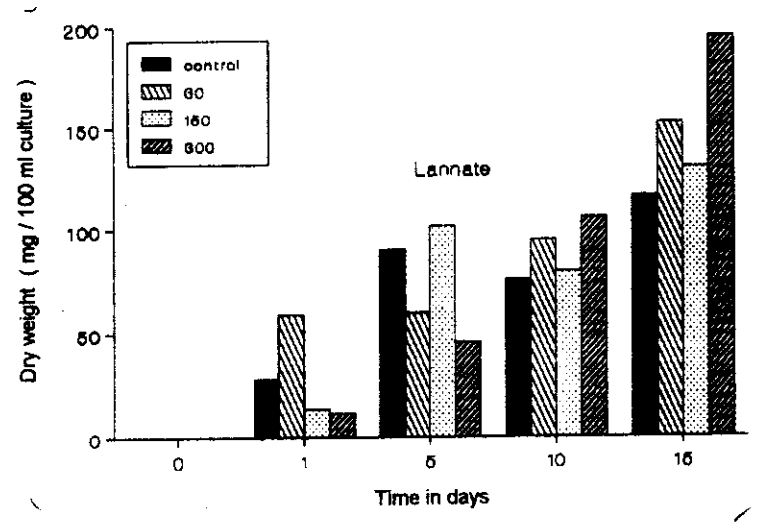


Fig. (10) Effect of carbamate insecticides on the dry weight of *Az. chroococcum* A_{15}

The Effect on the Total Fixed Nitrogen :

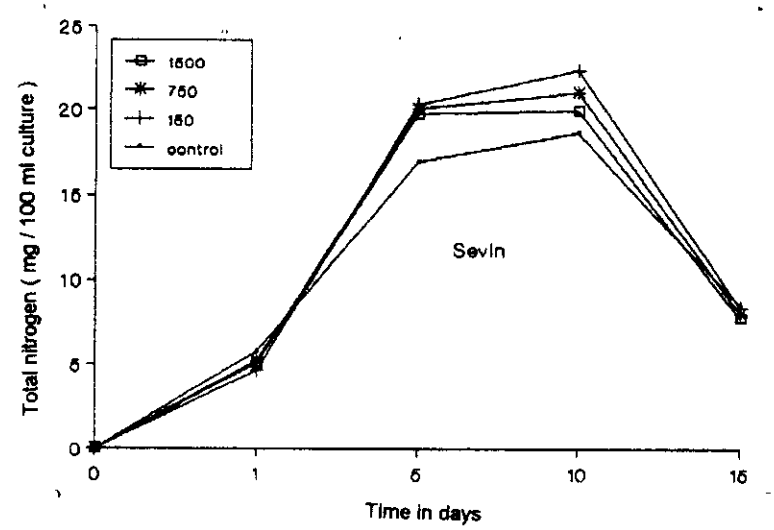
With the aim of studying the effect of insecticides on nitrogen fixation by *Az. chroococcum* A_4 and A_{15} different doses of (the recommended dose, 5-fold and 10-fold) were used in Ashbey's medium.

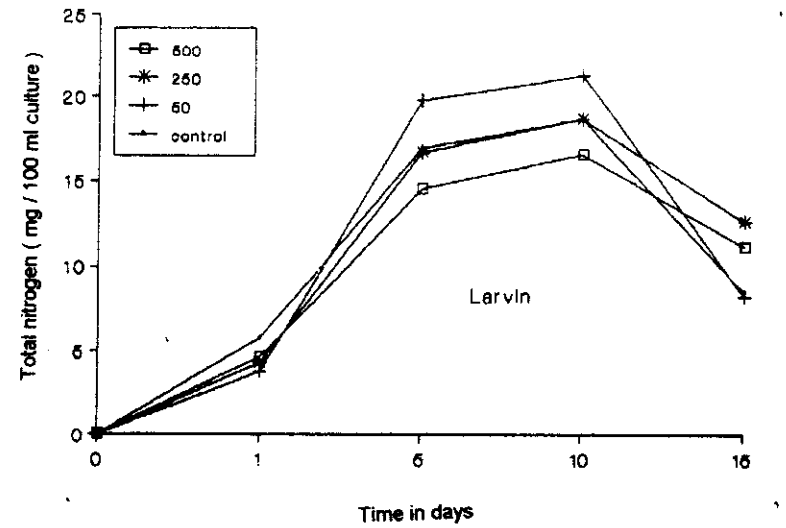
(I) *Azotobacter Chroococcum* A_4 :

As presented in Table (13) and Fig (11) paralle to the control cultures, doses the nitrogen fixed by *Az. chroococcum* . A_4 in the presence of different doses (the recommended dose, 5-fold & 10-fold) of Sevin, Larvin and L annate was increased by time untile 10 days at which the highest amounts were recorded,and then decreased after 15 days incubation time. Compared to control, and in the presence of Sevin higher amounts of the fixed nitrogen were obtained after 5 and 10 days incubation times at the all doses used. However , at incubation time other than mentioned above,Sevin had a depressing effect on the nitrogen fixation by *Azotobacter chroococcum* A_4. Using Larvin, the fixed nitrogen recorded higher values at the lowest dose only (the recommended dose) after 5 and 10 days incubation, giving 116 and 114% of control, respectively. At doses higher than the recommended dose, Larvin had a negative effect on the nitrogen fixation along the experimental period. At the recommended dose of Lannate, the highest amounts of fixed nitrogen was obtained after 10 days incubation time. In general, by using the three insecticides (Sevin, Larvin & Lannate), as the tested dose increased, the amount of fixed nitrogen by *Az chroococcum* A_4 decreased.

Table (13): Effect of carbamate insecticides on the total nitrogen fixing efficiency of *Az chroococcum* A_4

Time in days	Total nitrogen (mg/100ml culture)									
	Sevin (ug)				Larvin (ug)			Lannate (ug)		
	Con.	150	750	1500	50	250	500	30	150	300
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	5.78	4.67	5.22	5.04	3.73	4.29	4.67	6.34	4.48	4.48
5	16.98	20.34	20.06	19.78	19.78	16.73	14.55	18.29	18.10	14.55
10	18.66	22.39	21.09	19.97	21.27	18.65	16.61	28.93	21.83	21.09
15	8.58	8.50	8.10	7.84	8.33	12.69	11.20	8.57	10.26	10.26





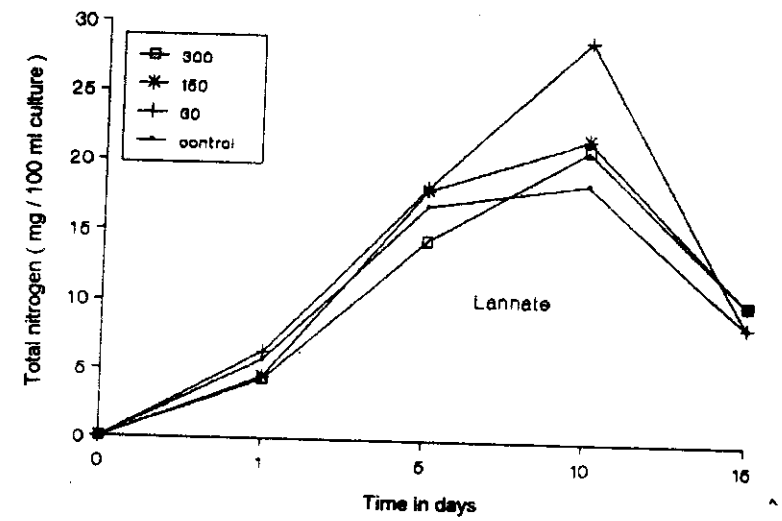


Fig. (11) Effect of carbamate insecticides on the total nitrogen fixing efficiency of *Az. chroococcum* A_4

(II) *Azotobacter chroococcum* A_{15} :

The results given in Table (14) and Fig (12) show that, using sevin at the recommended dose, 5-fold and 10-fold and also in control cultures, the highest values of the fixed nitrogen were obtained after 5 days incubation, by *Az. chroococcum* A_{15}. Compared to control, at the recommended dose of Sevin higher amounts of the fixed nitrogen were recorded at the different time intervals tested. Gererally, the insecticide Sevin stimulate the nitrogen fixation by the tested bacterium, but the amount of fixed nitrogen decreased as the dose increased. On the other hand, by using Larvin at different doses and at the different incubation periods, the nitrogen fixed was depressed to lower values compared to control. The third insecticide Lannate stimulate the nitrogen fixation by *Az. chroococcum* A_{15} at the recommended dose and 5-fold after 5 days incubation. The amounts of fixed nitrogen differ widely with the type and dose of insecticides as well as the incubation period.

Table (14): Effect of carbamate insecticides on the total nitrogen fixing efficiency of *Az chroococcum* A_{15}

Time in days	Total nitrogen (mg/100 ml culture)									
	Sevin (ug)				Larvin (ug)			Lannate (ug)		
	Con.	150	750	1500	50	250	500	30	150	300
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	4.71	6.35	5.82	5.60	3.08	5.32	4.29	3.55	4.11	6.34
5	19.79	21.65	20.16	18.11	18.11	17.92	17.92	24.26	20.16	19.41
10	18.29	21.09	18.95	17.55	16.99	17.55	17.36	17.92	19.60	18.67
15	7.47	8.21	8.97	8.21	5.04	7.09	5.60	7.09	8.21	6.34

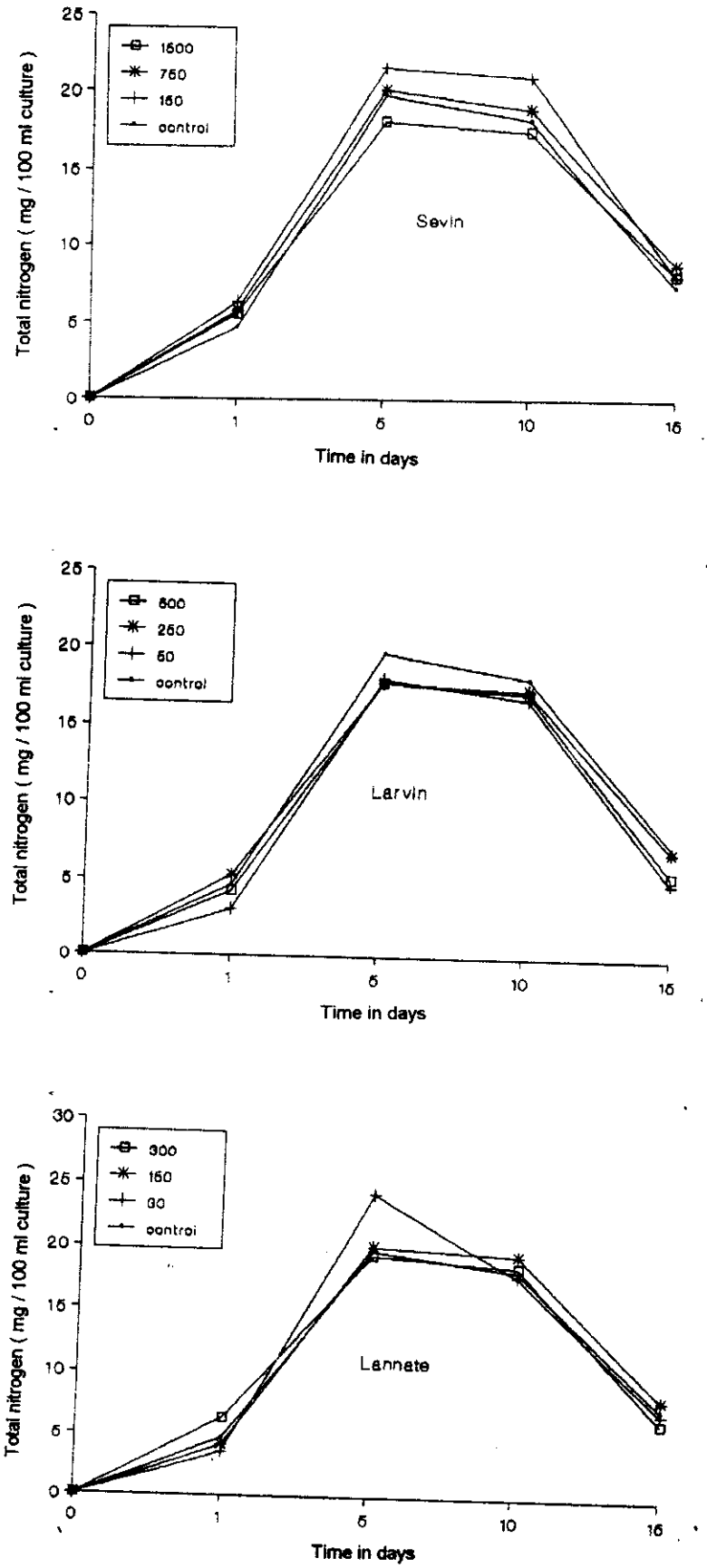


Fig. (12) Effect of carbamate insecticides on the total nitrogen fixing efficiency of *Az. chroococcum* A_{15}

The Effect on Ammoniacal Nitrogen Content :

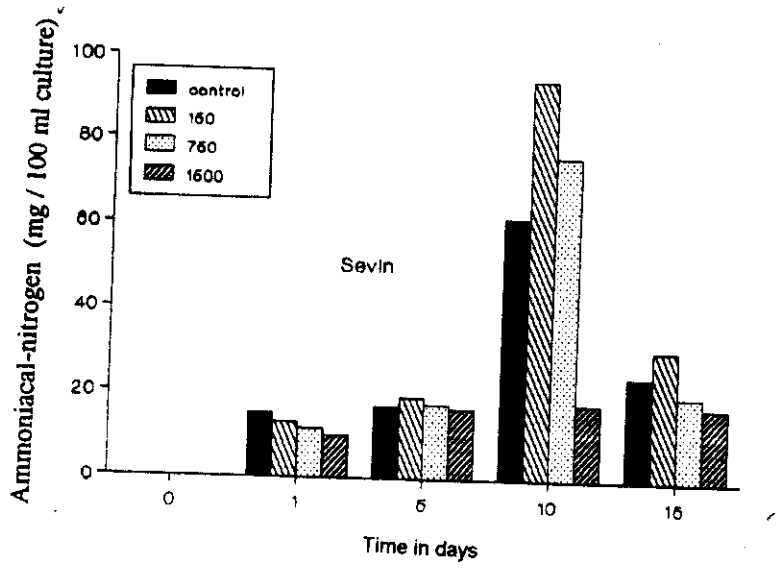
The purpose of the present experiment was to study the effect of certain carbamate insecticides on the ammoniacal nitrogen produced by *Az .chroococcum* A_4 and A_{15}. Different doses (the recommended dose, 5-fold & 10-fold) of Sevin, Larvin and Lannate were added to Ashbey's medium and the experiment was conducted as described in material and methods .

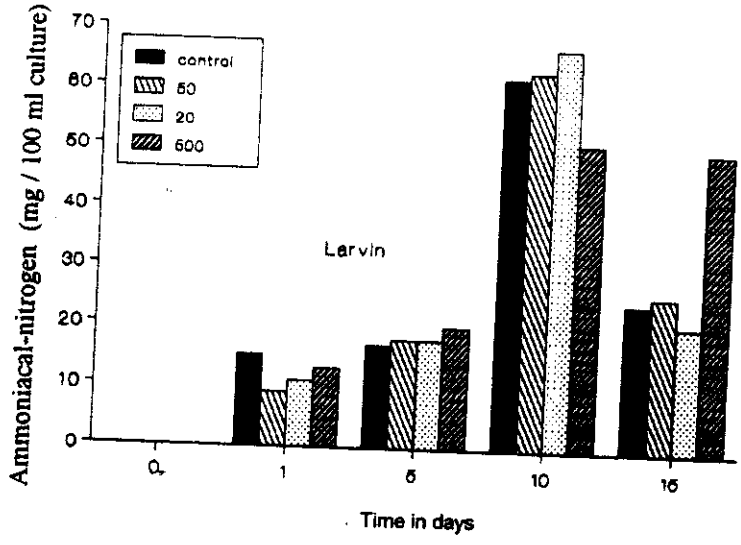
(I) *Azotobacter chroococcum* A_4 :

As shown in Table (15) and Fig (13), generally, the production of the ammoniacal nitrogen in the insecticide treated cultures, followed the same pattern as in control culture. Using Sevin, the highest value of ammoniacal nitrogen was recorded after 10 days of incubation at the recommended dose. Also high amounts of ammoniacal nitrogen were obtained at 5-fold the recommended field dose after the same incubation period. Ammonical nitrogen production behaved the same trend using Larvin and Lannate as Sevin, where the highest values were obtained at the recommended dose after 10 days of incubation by *Az chroococcum* A_4. An irregular effect of both Larvin and Lannate, ranging from stimulation to depression of ammoniacal nitrogen production was noticed at different doses after various incubation periods.

Table (15): Effect of carbamate insecticides on ammoniacal-nitrogen formation of *Az. chroococcum* A_4

Time in days	Ammoniacal-nitrogen (mg/100 ml culture)									
	Sevin (ug)				Larvin (Ug)			Lannate (ug)		
	Con.	150	750	1500	50	250	500	30	150	300
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	15.0	13.0	11.5	10.0	9.0	11.0	13.0	10.0	10.0	11.0
5	17.0	19.0	17.5	16.4	18.0	18.0	20.0	17.0	13.0	18.5
10	62.0	95.0	76.5	18.0	63.0	67.0	51.0	72.0	38.0	32.0
15	24.5	31.0	20.0	17.5	26.0	21.0	50.0	31.0	28.0	27.0





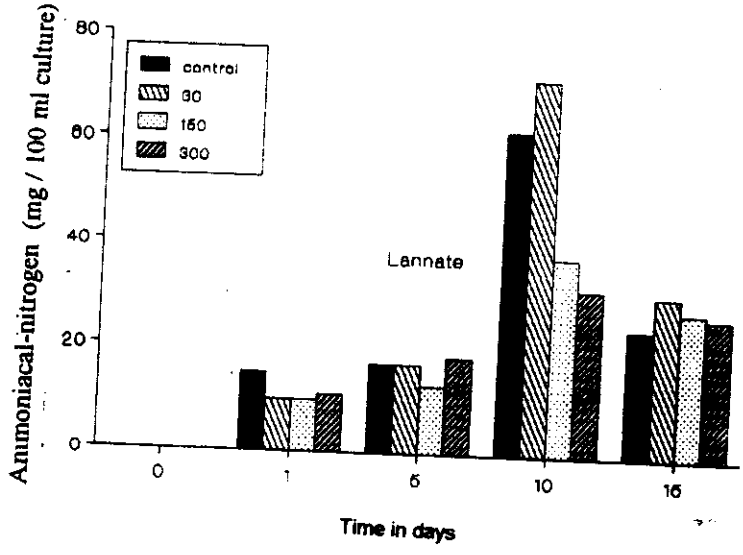


Fig. (13) Effect of carbamate insecticides on the ammoniacal nitrogen formation by *Az. chroococcum* A_4

(II) *Azotobacter chroococcum* A_{15}

The production of ammoniacal nitrogen by *Az chroococcum* A_{15} widely affected by the insecticides, Sevin, Larvin and Lannate after different time intervals. It can be noticed from the results presented in Table (16) and Fig (14) that, the highest ammoniacal nitrogen production was obtained at the recommended dose of Sevin, Larvin and Lannate after incubation period of 10 days by *Az chroococcum* A_{15}. Unsteady effect of Sevin, Larvin and Lannate was noticed at the various doses tested along the experimental period.

Table (16): Effect of carbamate insecticides on ammoniacal-nitrogen formation of *Az. chroococcum* A_{15}

Time in days	Ammoniacal-nitrogen (mg/100 ml culture)									
	Sevin (ug)				Larvin (ug)			Lannate (ug)		
	Con.	150	750	1500	50	250	500	30	150	300
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	11.5	21.0	13.0	15.0	30.0	16.0	15.5	13.5	21.0	15.0
5	20.0	38.0	16.0	27.5	20.0	18.5	22.0	18.5	23.0	19.0
10	53.0	82.0	38.0	31.0	74.0	36.0	25.0	61.0	27.0	15.0
15	11.0	35.0	18.0	15.5	21.0	13.0	13.0	6.0	8.5	8.5

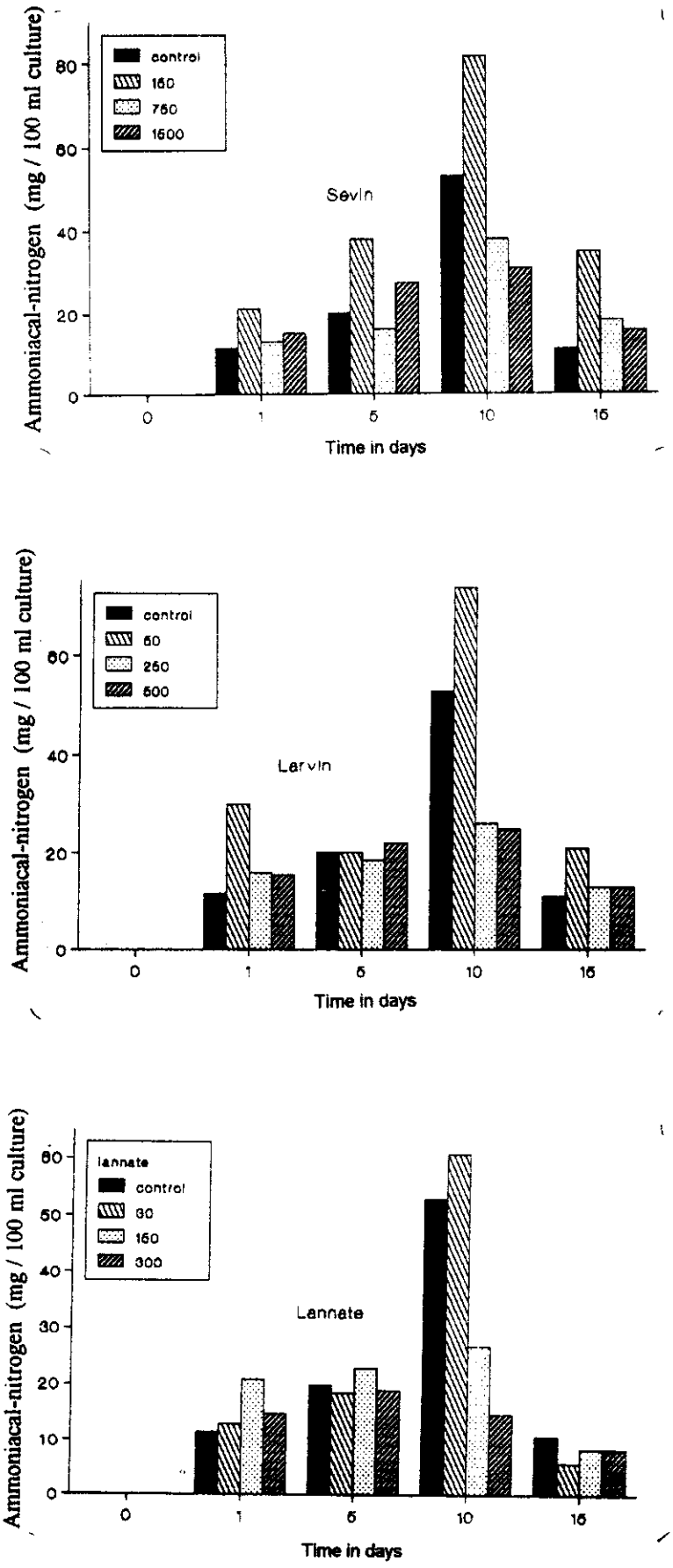


Fig. (14) Effect of carbamate insecticides on the ammoniacal nitrogen formation by *Az. chroococcum* A_{15}

The Effect on Amino-Nitrogen Content:

As in total and ammoniacal-nitrogen contents, the aim of this experiment was to study the effect of carbamate insecticides (Sevin, Larvin & Lannate) on the production of amino-nitrogen by *Az. chroococcum* A_4 and A_{15} in Ashbey's medium.

(I) *Azotobacter chroococcum* A4

The results given in Table (17) and Fig (15) show that as in control cultures, the amounts of amino nitrogen produced by *Az. chroococcum* A_4 using different doses (the recommended dose, 5-fold & 10 fold) of Sevin, Larvin and Lannate increased with time until 5 days at which the highest values were recorded, and then decreased after 10 days and again increased after 15 days of incubation. Compared to control cultures, high production of amino nitrogen was obtained using the insecticide, Sevin at the recommended dose and 5-fold after 5 days of incubation and after 15 days of incubation at 5-and 10-fold the recommended dose by *Az. chroococcum* A_4. Using the three insecticides at the various doses used, after one day of incubation, the amounts of amino nitrogen produced by this organism were low compared to those of control cultures. The insecticide Larvin stimulate the production of amino nitrogen by the tested bacterium only after 5 and 15 days of incubation at various tested doses. On the other hand, the insecticide Lannate depressed the amino nitrogen production under all experimental conditions tested except after 5 days at 1- and 5-fold the recommended dose, where high production was obtained compared to control.

Table (17): Effect of carbamate insecticides on amino-nitrogen formation of *Az. chroococcum* A_4

Time in days	Amino-nitrogen (mg/L culture)									
	Sevin (ug)				Larvin (ug)			Lannate (ug)		
	Con.	150	750	1500	50	250	500	30	150	300
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	37.8	22.4	32.9	33.8	32.9	32.9	22.4	28.0	33.6	21.7
5	38.4	44.1	47.6	37.8	36.4	47.6	36.8	42.0	43.4	30.6
10	24.5	5.6	12.6	43.4	7.7	24.0	23.1	36.3	19.6	20.3
15	32.9	28.0	36.4	42.0	44.8	46.6	43.4	16.8	16.8	16.8

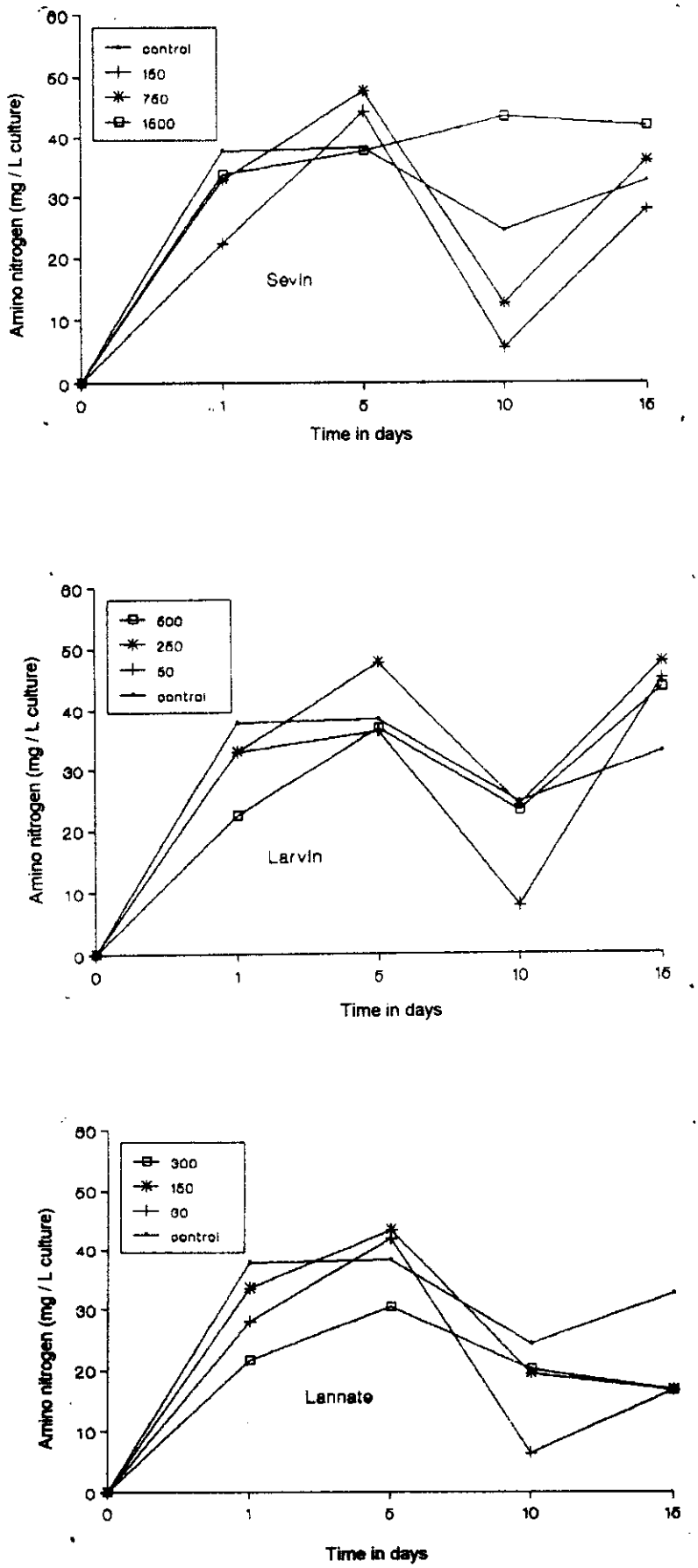


Fig. (15) Effect of carbamate insecticides on the amino nitrogen formation by *Az. chroococcum* A_4

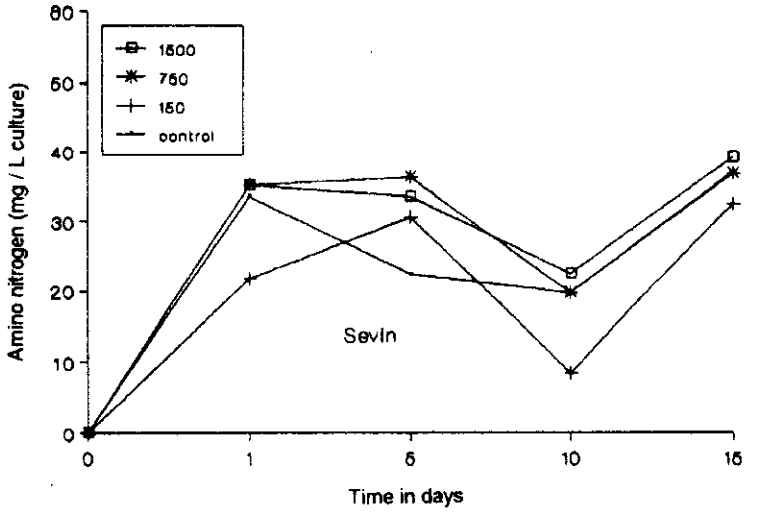
(II) *Azotobacter chroococcum* A_{15} :

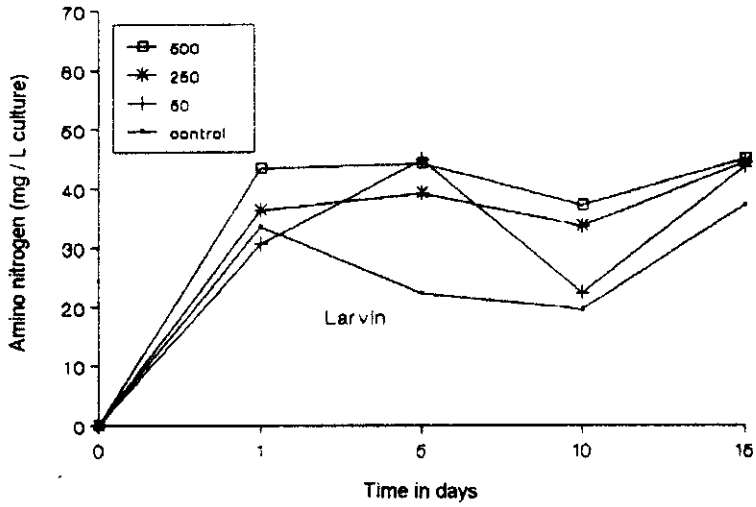
The influence of carbamate insecticides (Sevin, Larvin & Lannate) on the amount of amino Nitorgen produced by Az. chroococcum A15 was also investigated in Ashbey's medium.

It is noticed from Table (18) and Fig (16) that in control cultures, high value of amino nitrogen was recorded after one day of incubation then decreased by time until 15 days at which the highest amount was recorded. Using both Sevin and Larvin at 5-and 10-fold the recommended dose, the amino nitrogen production was stimulated to levels higher than control at the different time intervals tested. On the other hand, the insecticide Lannate had a depressing on the amino-nitrogen production by Az. chroococcum A_{15} under experimental conditions used,compared to control, except at 5-and 10-fold the recommended dose after incubation periods of 5 and 15 days where the highest values were obtained.

Table (18): Effect of carbamate insecticides on amino-nitrogen formation of *Az. chroococcum* A_{15}

Time in days	Amino-nitrogen (mg/L culture)									
	Con.	Sevin (ug)			Larvin (ug)			Lannate (ug)		
		150	750	1500	50	250	500	30	150	300
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	33.6	21.7	35.2	35.2	30.6	36.4	43.4	22.4	28.0	22.4
5	22.4	30.6	36.4	33.6	44.8	39.2	44.1	20.3	37.8	33.6
10	19.6	8.4	19.6	22.4	22.4	33.6	37.1	10.5	19.6	13.3
15	37.1	32.4	36.8	39.2	43.4	44.1	44.8	12.6	21.7	22.4





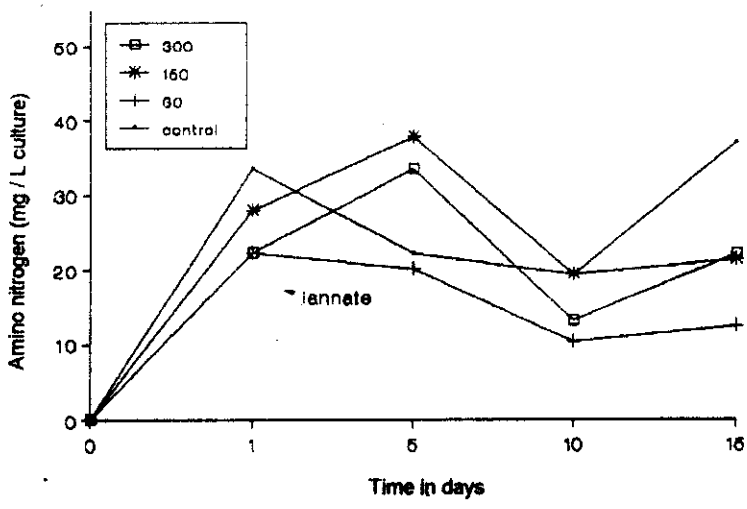


Fig. (16) Effect of carbamate insecticides on the amino nitrogen formation by *Az. chroococcum* A_{15}

The Effect on Ascorbic Acid Production:

To study the effect of insecticides on ascorbic acid production by *Az. chroococcum* 4,15, the organisms were grown in the presence of different doses of Sevin, Larvin and Lannate, and the produced ascorbic acid was determined at different time intervals of 1,5,10 and 15 days as previously described.

(I) *Azotobacter chroococcum* A_4:

As shown in Table (19) and Fig (17), the production of ascorbic acid in control cultures (without insecticide) decreased with time. However, using Sevin at the recommended dose, 5-fold and 10-fold, high levels of ascorbic acid were produced, recording 141, 149 and 348% control, respectively after 15 days incubation. Also, high production of as ascorbic acid was obtained by using 10-fold the recommended dose after 1 and 5 days incubation, giving 118 and 126% of control, respectively. At doses of Sevin after incubation periods other than the mentioned above, Sevin had a negative effect on ascorbic acid production by *Az. chroococcum.* A_4. By using Larvin at different doses and after different incubation periods, lower levels of ascorbic acid were produced compared to those of control, except at the dose of 500 ug/100 ml culture after 15 days incubation where high proudction was obtained (311% of control). Also, Lannate had a depressing effect on ascorbic acid production by this organism, except at doses of 30 and 300 ug/100 ml culture after 1 and 5 days incubation, repectively, where high production was obtained (161 and 454% of control respectively).

Table (19): Effect of carbamate insecticides on ascorbic acid production by *Az chroococcum* A_4

Time in days	Ascorbic acid (mg/L culture)									
	Sevin (ug)				Larvin (Ug)			Lannate (ug)		
	Con.	150	750	1500	50	250	500	30	150	300
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	0.621	0.308	0.554	0.732	0.397	0.447	0.320	1.000	0.509	0.263
5	0.509	0.208	0.487	0.643	0.364	0.375	0.376	0.333	0.372	0.532
10	0.152	0.063	0.063	0.096	0.063	0.063	0.067	0.045	0.031	0.074
15	0.063	0.089	0.094	0.219	0.018	0.045	0.196	0.040	0.052	0.286

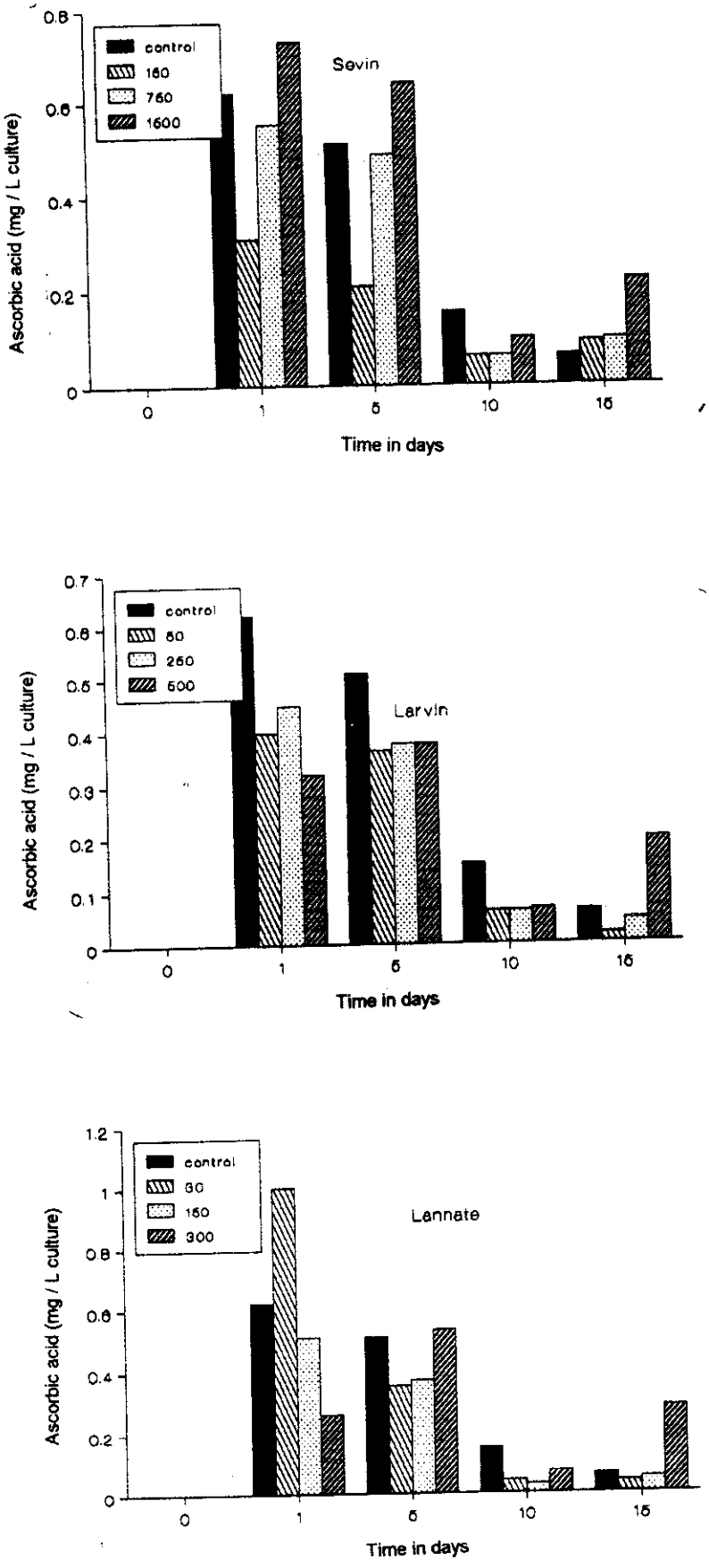


Fig. (17) Effect of carbamate insecticides on the ascorbic acid production by *Az. chroococcum* A_4

(II) *Azotobacter chroococcum* A_{15} :

As in *Az. Chroococcum* A_4, the amounts of ascorbic acid produced by control cultures decreased with time Table (20) and Fig(18) .However, in the presence of Sevin (the recommended dose, 5-fold and 10-fold), higher amounts of ascorbic acid were produced by this bacterium, recording the highest production after 5 days at 10-fold the recommended dose . By using Larvin after 5 days incubation at doses of 50, 250 and 500 ug/ 100 ml culture and after 15 days at doses of 250 and 500 ug/ 100 ml culture higer levels of ascorbic acid were produced by this organism, compared to control. Under conditions other than mentioned above, Larvin had a depressing effect on ascrobic acid production by *Az. chroococcum* A_{15}. The ascorbic acid production was increased compared to control by Lannate but only after one day at dose of 30 ug/100 ml culture, after 5 days at doses of 150 and 300 ug/100 ml culture. In general, under the other experimental conditions used, Lannate depressed the production of ascorbic acid by *Az. chroococcum.* A_{15}.

Table (20): Effect of carbamate insecticides on ascorbic acid production by *Az chroococcum* A_{15}

Time in days	Ascorbic acid (mg/L culture)									
	Sevin (ug)				Larvin (ug)			Lannate (ug)		
	Con.	150	750	1500	50	250	500	30	150	300
0	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1	0.464	0.375	0.487	0.532	0.375	0.421	0.263	0.989	0.294	0.286
5	0.263	0.330	0.453	0.688	0.342	0.272	0.319	0.196	0.375	0.587
10	0.078	0.006	0.051	0.152	0.026	0.029	0.022	0.049	0.054	0.063
15	0.051	0.089	0.107	0.172	0.013	0.067	0.069	0.040	0.047	0.075

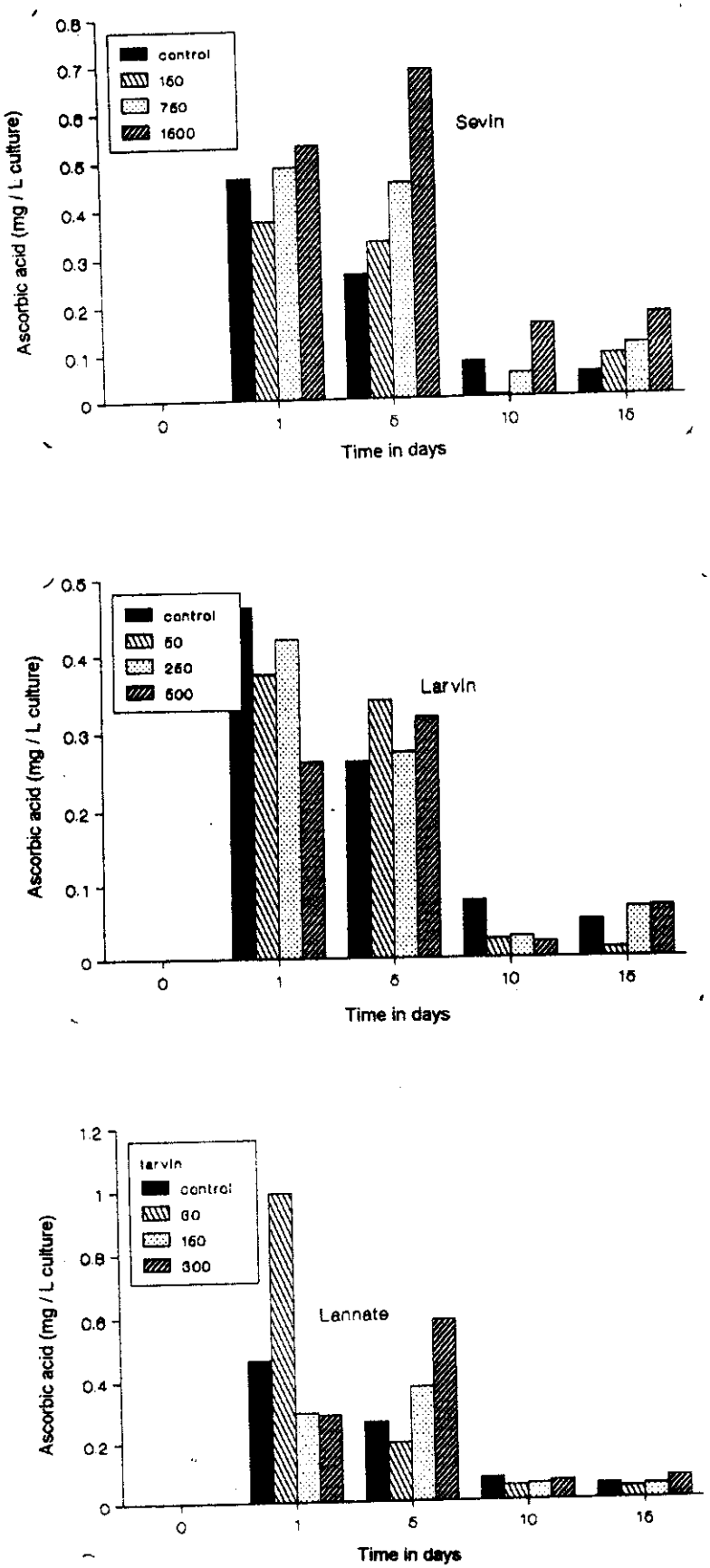


Fig. (18) Effect of carbamate insecticides on the ascorbic acid production by *Az. chroococcum* A_{15}

The Effect on the Biosynthesis of Indole-3-acetic acid (IAA):

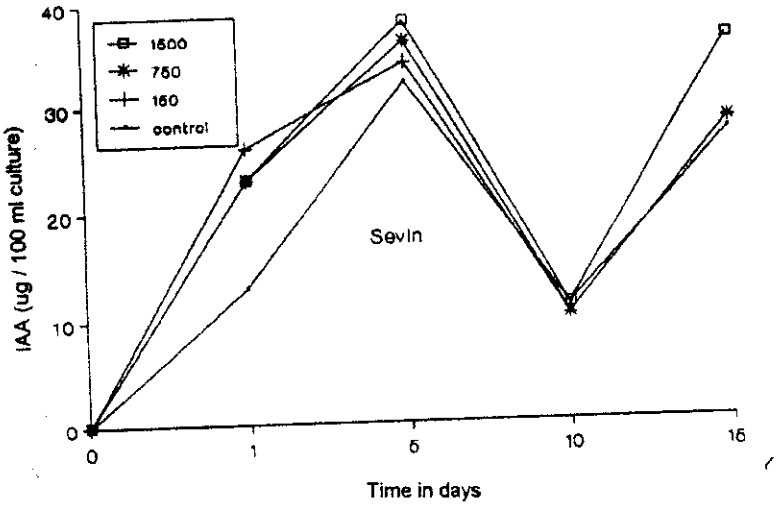
In the present experiment, the effect of different concentrations of carbamate insecticides (Sevin, Larvin & Lannate) on the production of IAA by *Az. chroococcum* A_4 & A_{15} was investigated. The organisms were grown in Ashbey's medium containing 1, 5 and 10-fold the recommended dose of insecticide and the amounts of IAA produced were determined after different incubation periods of 1,5,10 & 15 days, as previously mentioned in materials and methods

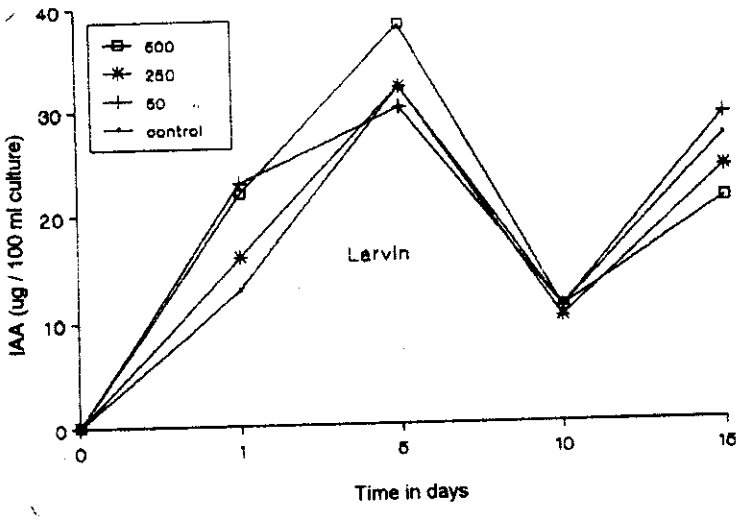
(I) *Azotobacter Chroococcum A_4* :

It can be noticed clearly from the results given in Table (21) and Fig (19) that both the control cultures and the insecticide treated cultures followed the same pattern in respect to IAA. production, where its produced amounts increased with time until 5 days of incubation and then decreased after 10 days and increased again after 15 days of incubation. Compared to control using Sevin, Larvin and lannate at the various tested doses, the highest amounts of IAA. were produced by *Az. chroococcum* A_4 after one day of incubation, followed by those produced after 5 days and the lowest amouts were produced at 10 days of incubation. In general, the presence of Sevin, Larvin and Lannate at their tested doses stimulated the production of IAA by *Az. chroococcum* A_4 especially Lannate which was the most effective followed by Sevin, after one day of incubation.

Table (21) : Effect of carbamate insecticides on indole-3-acetic acid production by of *Az. chroococcum* A_4

Time in days	IAA.(mg/100 ml culture)									
	Sevin (ug)				Larvin (ug)			Lannate (ug)		
	Con.	150	750	1500	50	250	500	30	150	300
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	13.0	26.0	23.0	23.0	23.0	16.0	22.0	28.0	24.0	36.0
5	32.0	34.0	36.0	38.0	30.0	32.0	38.0	40.0	35.0	34.0
10	11.0	10.0	10.0	11.0	11.0	10.0	11.0	11.0	11.0	10.0
15	27.0	28.0	38.0	36.0	29.0	24.0	21.0	35.0	27.0	23.0





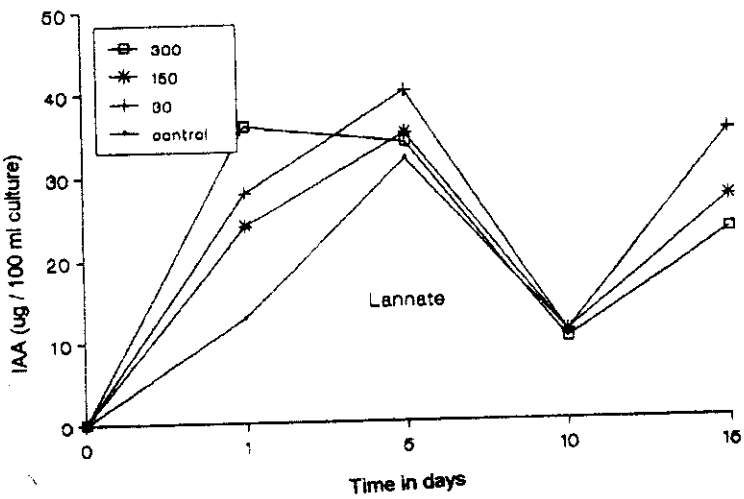


Fig. (19) Effect of carbamate insecticides on indole-3-acetic acid production by *Az. chroococcum* A_4

(II) *Azotobacter chroococcum* A_{15} :

The results represented in Table (22) and Fig (20) show that as in *Az. chroococcum* A_4, the production of IAA. by *Az. chroococcum* A_{15} in insecticide treated cultures followed the same trend like in control cultures. Also here, the tested insecticides (Sevin, Larvin & Lannate) stimulated the production of IAA by *Az. chroococcum* A_{15} especially after 1 and 5 days of incubation.

Table (22):Effect of carbamate insecticides on indole-3-acetic acid production by of *Az. chroococcum* A_{15}

Time in days	IAA (mg/100 ml culture)									
	Sevin (ug)				Larvin (ug)			Lannate (ug)		
	Com	150	750	1500	50	250	500	30	150	300
0	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00
1	9.0	15.0	12.0	16.0	12.0	15.0	14.0	14.0	13.0	17.0
5	31.0	32.0	36.0	31.0	29.0	31.0	31.0	37.0	34.0	32.0
10	10.0	10.0	10.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
15	21.0	22.0	26.0	21.0	23.0	23.0	31.0	24.0	21.0	19.0

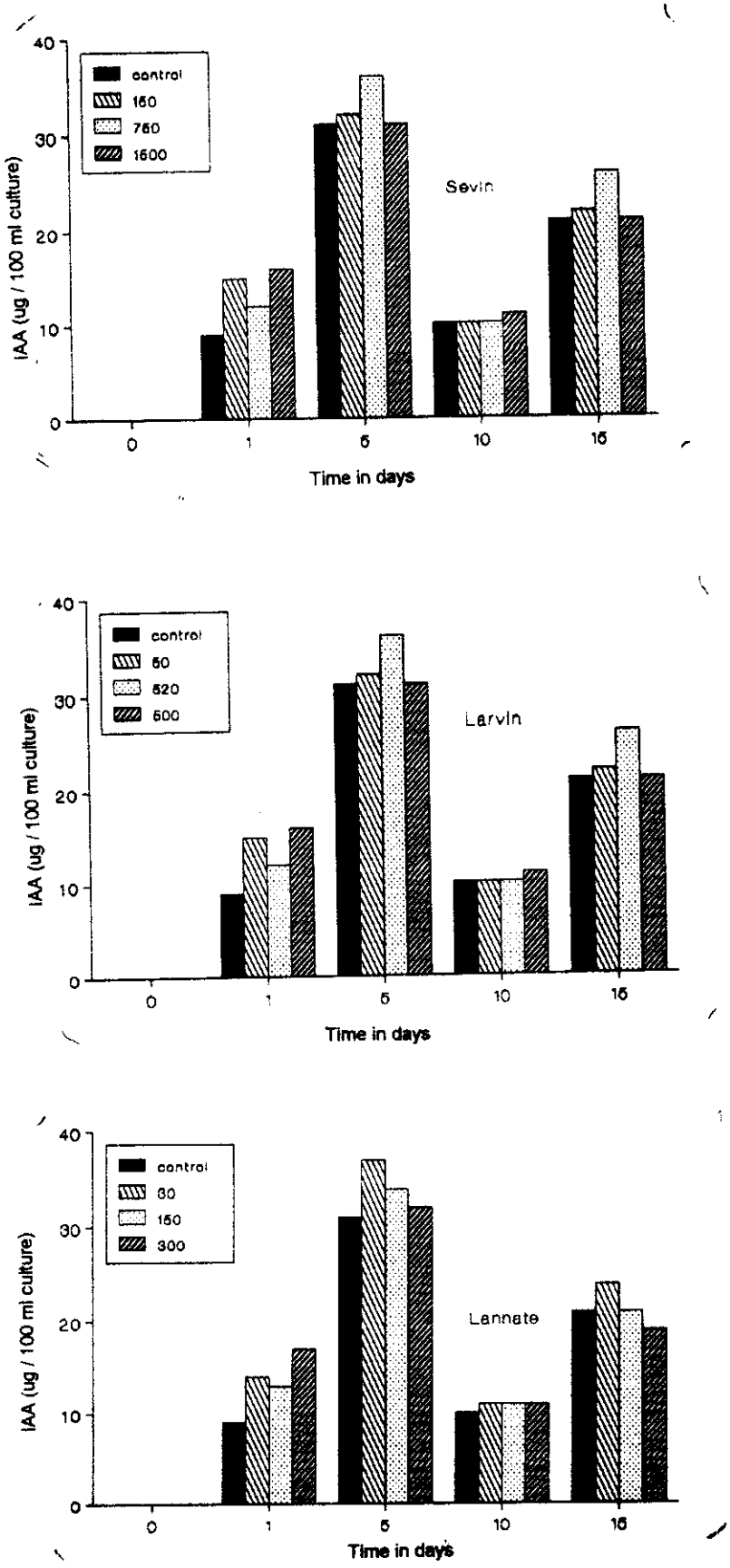


Fig. (20) Effect of carbamate insecticides on indole-3-acetic acid production by *Az. chroococcum* A_{15}

THE PEESISTENCE OF INSECTICIDES

The persistency of the carbamate insecticides tested in this work (Sevin, Larvin & Lannate) and their resistance to degradation in cultures, soil samples and cell-free extract of *Az. chroococcum* A_4 & A_{15}, were investigated. The persistence of insecticide was determined as the nitrogen content of the residual insecticide used under the experimental conditions, as described before .

(a) Persistence of Insecticides in Cultures of *Az. chroococcum* :

As shown in Table (23 a,b&c and 24 a,b&c) and Figs (21 and 22), the amounts of Sevin, Larvin and Lannate added to cultures of *Azotobacter chroococcum* A_4 and A15 decreased with time and the lowest amount of the insecticides were recorded at the end of the experimental incubation period (0-24 days). This means that the persistence of the tested insecticides in both *Azotobacter chroococcum* A_4 and A_{15} decreased with time. In respect to Lannate, it had a lower persistance compared to those of Sevin and Larvin where, low values of Lannate residues were recorded, in comparison with control of each insecticide. On the other hand, the persistence of the tested insecticides (Sevin, Larvin & Lannate) in *Az. chroococcum* A_4 culutres, was lower than in Az. chroococcum A_{15} cultures in which higher values of insecticide residues were determined.

Table (23 a) Persistancy of Sevin in *Az chroococcum* A_4 culture.

Time in hours	N_2 of larvin at different ug/100 ml culture			% recovery			Amounts of larvin residues culture ug/100 ml culture		
	150	750	1500	150	750	1500	150	750	1500
0	2.072	10.360	20.720	100.00	100.00	100.00	100.00	100.00	100.00
3	0.868	5.376	13.132	41.89	51.89	63.38	62.84	389.18	950.70
6	0.672	4.284	9.912	32.43	41.35	47.84	48.65	310.13	717.60
12	0.448	2.772	6.104	21.62	26.76	29.46	32.43	200.70	441.90
24	0.308	1.904	4.200	14.86	18.38	20.27	22.29	137.85	304.05

Table (23 b) Persistancy of Larvin in *Az chroococcum* A_4 culture.

Time in hours	N_2 of larvin at different ug/100 ml culture			% recovery			Amounts of larvin residues culture ug/100 ml culture		
	50	250	500	50	250	500	50	250	500
0	1.680	8.400	16.800	100.00	100.00	100.00	100.00	100.00	100.00
3	1.008	6.020	13.580	60.00	71.67	80.83	30.00	179.18	404.15
6	0.532	2.968	7.168	31.67	35.33	42.67	15.84	88.30	213.35
12	0.364	2.744	5.740	21.67	32.67	34.17	10.84	88.33	170.85
24	0.280	1.736	3.976	16.67	20.67	23.67	8.34	51.68	118.35

Table (23.c) Persistancy of Lannate in *Az chroococcum* A_4 culture.

Time in hours	N_2 of larvin at different ug/100 ml culture			% recovery			Amounts of larvin residues culture ug/100 ml culture		
	30	150	300	30	150	300	30	150	300
0	1.176	5.880	11.760	100.00	100.00	100.00	100.00	100.00	100.00
3	0.252	1.456	3.080	21.43	24.76	26.19	6.43	37.14	78.57
6	0.112	0.672	1.764	9.52	11.43	15.00	2.86	17.15	45.00
12	0.028	0.252	0.728	2.38	4.29	6.19	0.71	6.44	18.57
24	0.000	0.000	0.000	00.00	00.00	00.00	00.00	0.00	00.00

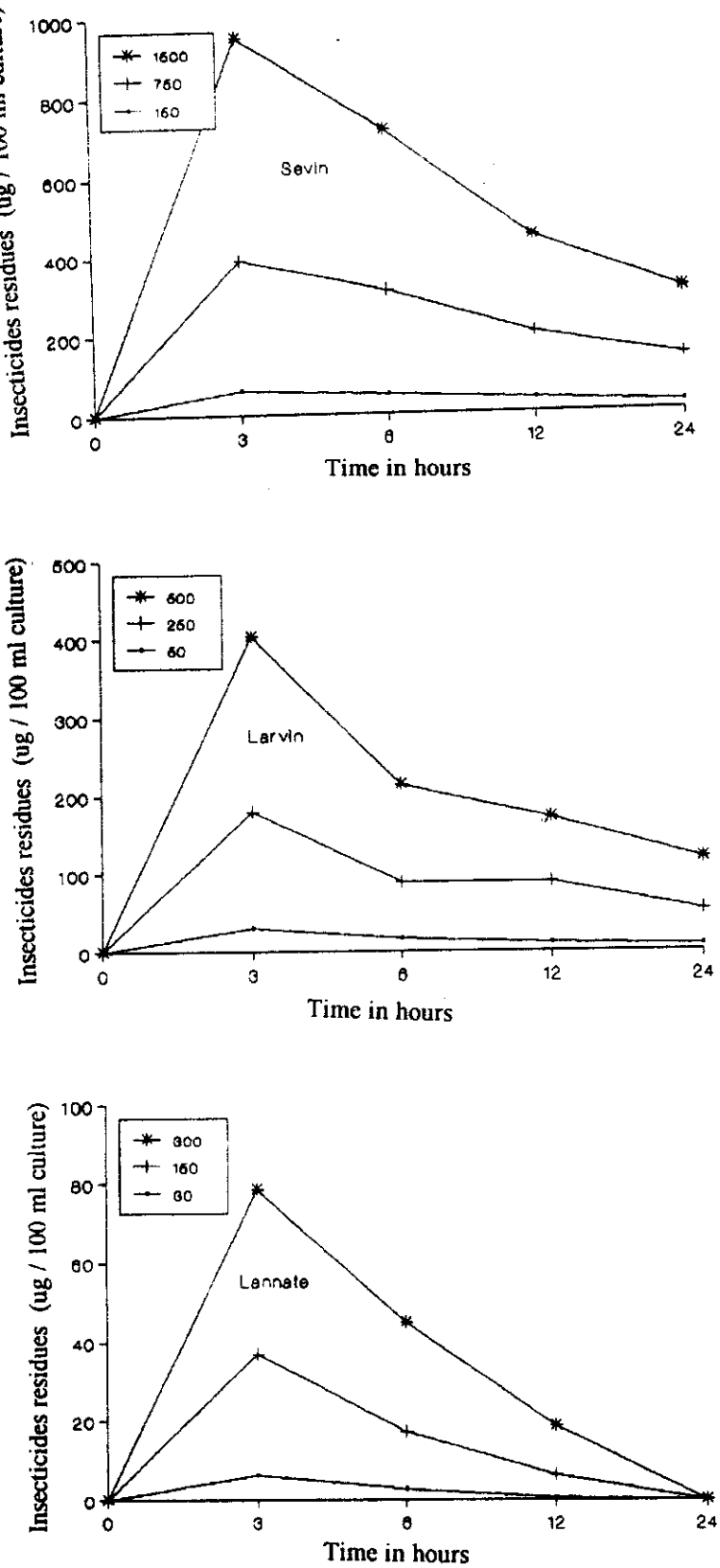


Fig. (21) Persistancy of the carbamate insecticides in *Az. chroococcum* A_4 culture

Table (24 a) Persistancy of Sevin in *Az chroococcum* A_{15} culture.

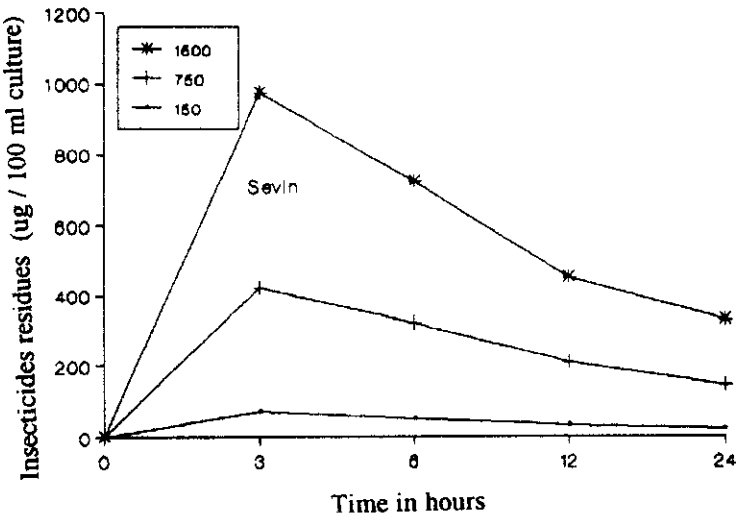
Time in hours	N_2 of larvin at different ug/100 ml culture			% recovery			Amounts of larvin residues culture ug/100 ml culture		
	150	750	1500	150	750	1500	150	750	1500
0	2.072	10.360	20.720	100.00	100.00	100.00	100.00	100.00	100.00
3	0.980	5.824	13.468	47.30	56.22	65.00	70.95	421.65	975.00
6	0.728	4.452	9.996	35.14	42.99	48.24	52.71	322.28	723.60
12	0.476	2.912	6.244	22.97	28.11	30.14	34.46	210.83	452.10
24	0.336	2.016	4.564	16.22	19.46	22.03	24.33	145.95	330.45

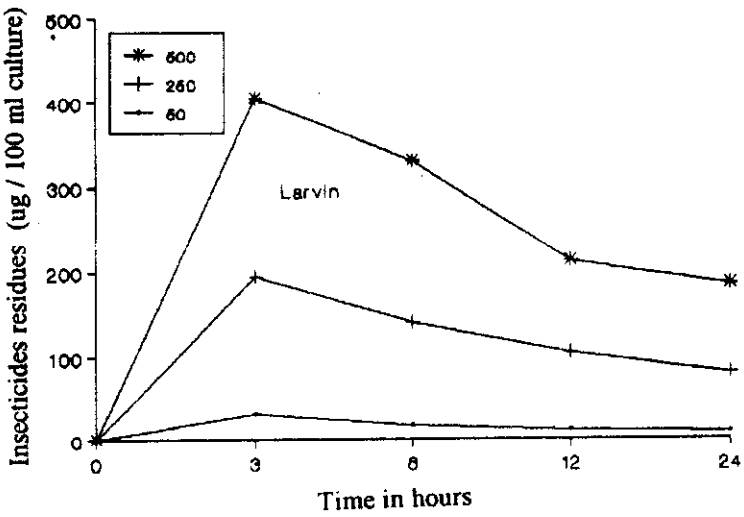
Table (24 b) Persistancy of Larvin in *Az chroococcum* A_{15} culture.

Time in hours	N_2 of larvin at different ug/100 ml culture			% recovery			Amounts of larvin residues culture ug/100 ml culture		
	50	250	500	50	250	500	50	250	500
0	1.680	8.400	16.800	100.00	100.00	100.00	100.00	100.00	100.00
3	1.092	6.552	13.608	65.00	78.00	81.00	32.50	195.00	405.00
6	0.588	4.704	11.144	35.00	56.00	66.33	17.50	140.00	331.55
12	0.420	3.500	7.140	25.00	41.67	42.50	12.50	104.18	212.50
24	0.336	2.688	6.216	20.00	32.00	37.00	10.00	80.00	185.00

Table (24.c) Persistancy of Lannate in *Az chroococcum* A_{15} culture.

Time in hours	N_2 of larvin at different ug/100 ml culture			% recovery			Amounts of larvin residues culture ug/100 ml culture		
	30	150	300	30	150	300	30	150	300
0	1.176	5.880	11.760	100.00	100.00	100.00	100.00	100.00	100.00
3	0.280	2.100	4.564	23.81	35.71	38.80	7.14	53.57	116.40
6	0.224	1.316	3.052	19.05	22.38	25.95	5.72	33.57	77.85
12	0.168	0.896	2.156	14.29	15.24	18.33	4.29	22.86	54.99
24	0.000	0.000	0.308	00.00	00.00	02.62	0.00	00.00	7.86





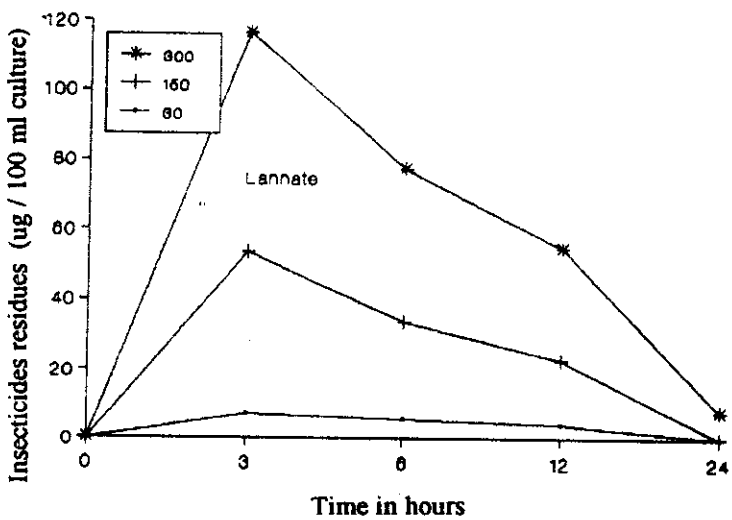


Fig. (22) Persistancy of the carbamate insecticides in *Az. chroococcum* A_{15} culture

(b) Persistence of Insecticides in cell-free Extracts of *Az. chroococcum* :

The effect of cell-free extracts of *Az. chroococcum* A_4 & A_{15} on the persistence of the insecticides Sevin, Larvin and Lannate was studied and is illustrated in Tables (25 & 26) and Figs. (23 & 24). As in complete cultures, but here rapidly, the degradation of the tested insecticides incresased with time (0-60 second) using the cell-free extracts of *Az. chroococcum* A_4 and A_{15}. On the other hand, the persistancies of Sevin, Larvin and Lannate in cell-free extract of *Az. chroococcum* A_4 were lower than those of *Az. chroococcum.* A_{15} . Also where, higher amounts of insecticide residues were determined in *Az. chroococcum* A_{15} cell-free extract. Compared to each other, using the two cell-free extracts, the insecticide Larvin was more stable than Sevin, and Lannate was the most labile one. In this experiment, very short time intervals (10, 20, 30, 40, 50 & 60 seconds) were applied, which indicates that the cell-free extract containing the bacterial enzymes, was more effective in the insecticides biodegradation process.

Table (25) Persistancy of Carbamate insecticides in soil samples inoculated with *Az chroococcum* A_4

Time in days	N_2 of larvin at different ug/100 gm soil			% recovery			Amounts of larvin residues culture ug/100 gm soil		
	Sevin	Larvin	Lannate	Sevin	Larvin	Lannate	Sevin	Larvin	Lannate
	150	50	30	150	50	30	150	50	30
0	2.072	1.680	1.176	100.00	100.00	100.00	100.00	100.00	100.00
1	0.462	0.560	0.168	22.30	33.33	14.29	33.45	16.67	4.29
5	0.216	0.322	0.098	10.42	19.17	8.33	15.63	9.59	2.50
10	0.126	0.182	0.042	6.08	10.83	3.57	9.12	5.42	1.07
15	0.070	0.098	0.014	3.38	5.83	1.19	5.07	2.92	0.36

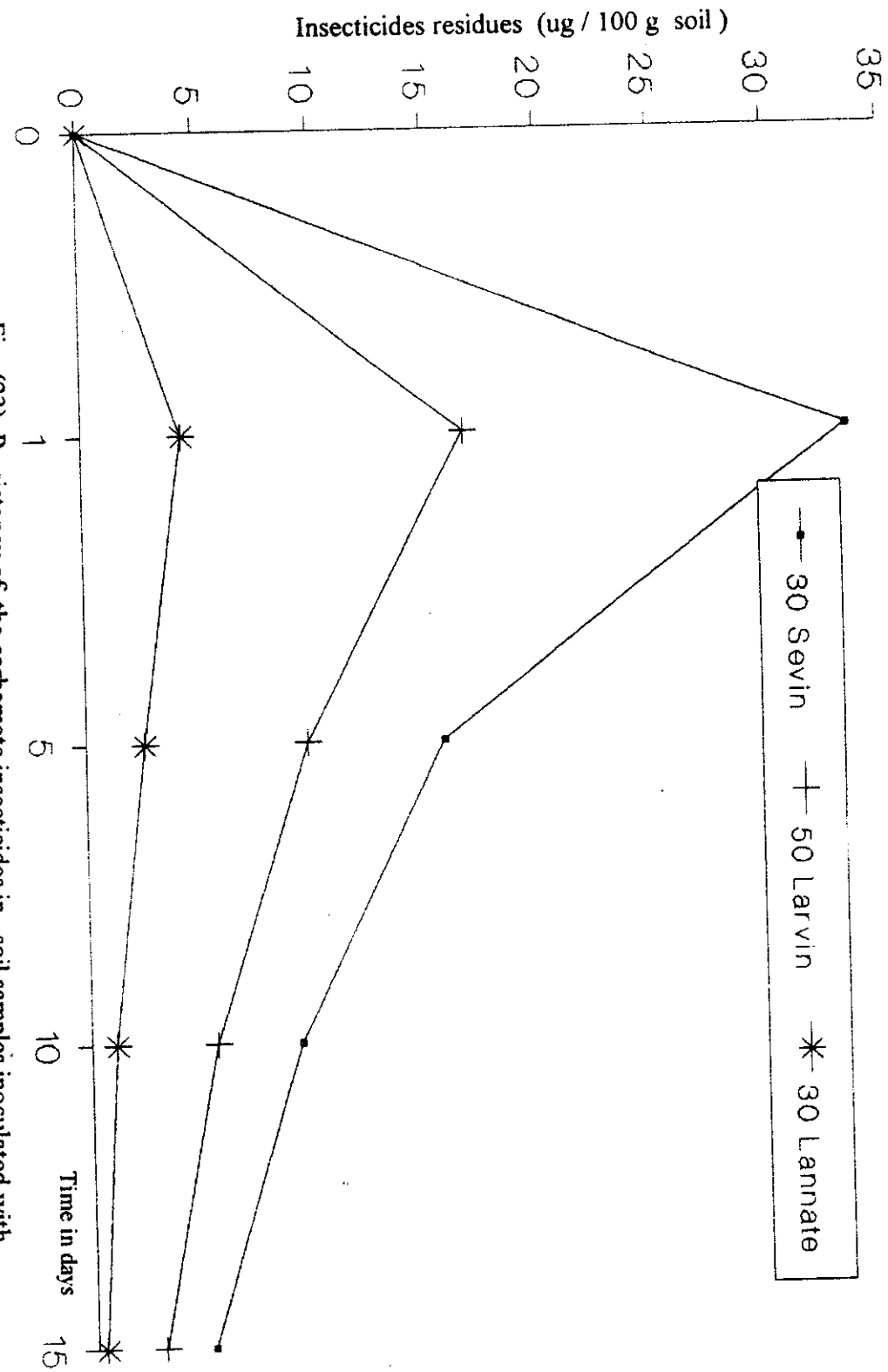


Fig. (23) Persistancy of the carbamate insecticides in soil samples inoculated with *Az. chroococcum* A_4

Table (26) Persistancy of Carbamate insecticides in soil samples inoculated with *Az chroococcum* A_{15}

Time in days	N_2 of larvin at different ug/100 gm soil			% recovery			Amounts of larvin residues culture ug/100 gm soil		
	Sevin	Larvin	Lannate	Sevin	Larvin	Lannate	Sevin	Larvin	Lannate
	150	50	30	150	50	30	150	50	30
0	2.072	1.680	1.176	100.00	100.00	100.00	100.00	100.00	100.00
1	0.546	0.588	0.210	26.35	35.00	17.86	39.53	17.50	5.36
5	0.546	0.378	0.126	12.16	22.50	10.71	18.24	11.25	3.21
10	0.168	0.252	0.070	8.11	15.00	5.95	12.16	7.50	1.79
15	0.084	0.126	0.028	4.05	7.50	2.38	6.08	3.75	0.71

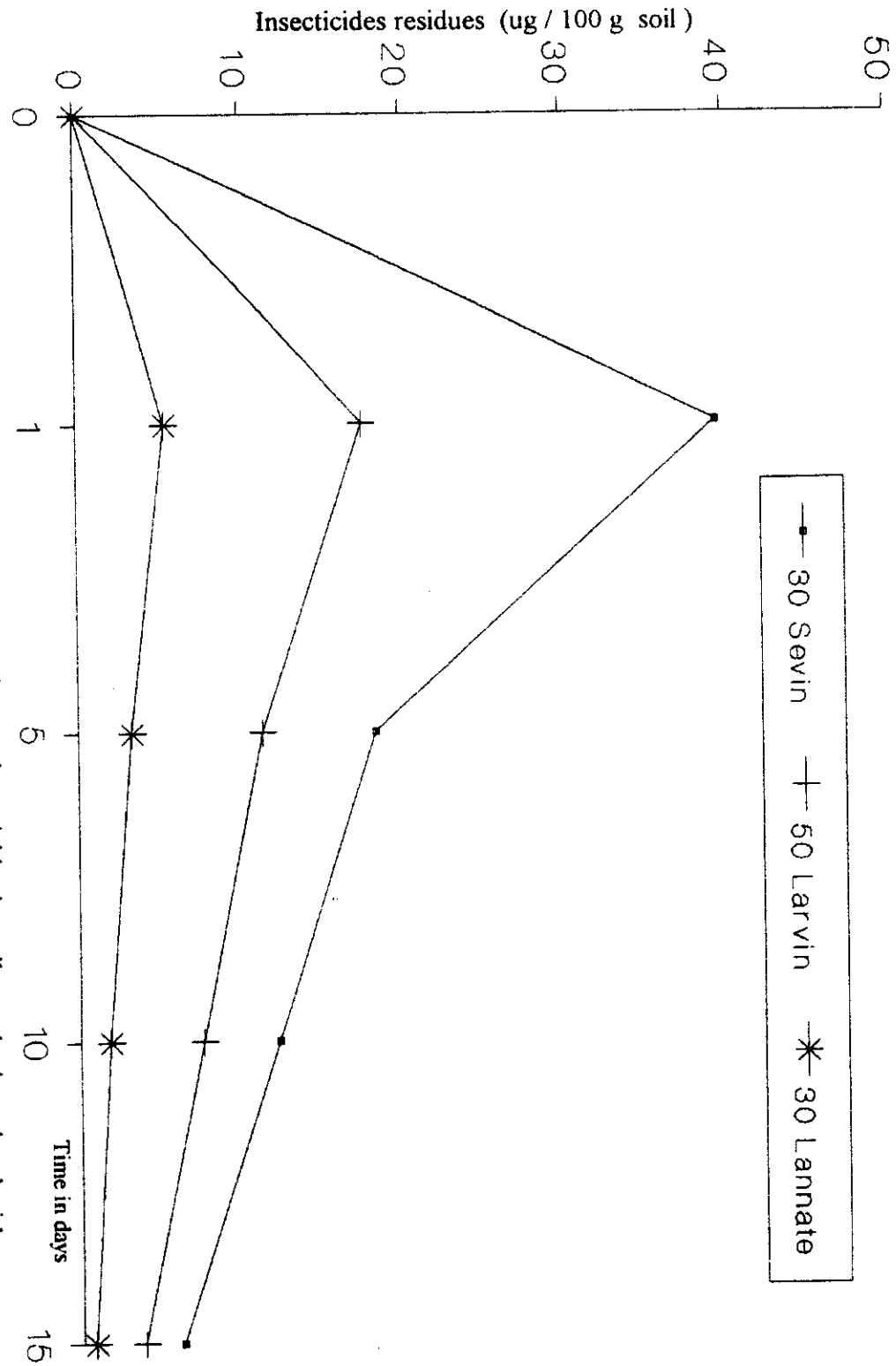


Fig. (24) Persistancy of the carbamate insecticides in soil samples inoculated with *Az. chroococcum* A_{15}

(c) Persistence of Insecticides in Inoculated Soil samples:

The persistency of carbamate insecticides in soil samples inoculated with *Az. chroococcum* A_4 and A_{15} was also investigated. It can be noticed from Tables (27 & 28) and Figs. (25 & 26) that by using the two strains of *Az. chroococcum,* the persistence of the tested insecticides (Sevin, Larvin & Lannate) decreased with time. But Lannate was the most labile insecticide followed by Sevin and Larvin which was the most stable one, compared to each other. On the other hand the biodegradation of Sevin, Larvin and Lannate in soil samples inoculated by the *Az. chroococcum.* A4 was more than that in those inoculated by the other strain where, higher insecticide residues were determined.

Table (27) Persistancy of Carbamate insecticides in cell free extract of with *Az chroococcum* A_4

Time in Seconds	N_2 of larvin at different ug/100 ml culture			% recovery			Amounts of larvin residues culture ug/100 ml culture		
	Sevin	Larvin	Lannate	Sevin	Larvin	Lannate	Sevin	Larvin	Lannate
	150	50	30	150	50	30	150	50	30
0	2.072	1.680	1.176	100.00	100.00	100.00	100.00	100.00	100.00
10	0.644	0.672	0.168	30.08	40.00	14.29	45.12	20.00	4.29
20	0.532	0.560	0.112	25.68	33.33	9.52	38.52	16.67	2.86
30	0.392	0.448	0.084	18.92	26.63	7.14	28.38	13.32	0.14
40	0.336	0.336	0.028	16.22	20.00	2.38	24.33	10.00	0.71
50	0.280	0.252	0.000	13.51	15.00	0.00	20.27	7.50	0.00
60	0.196	0.196	0.000	9.46	11.67	0.00	14.19	5.84	0.00

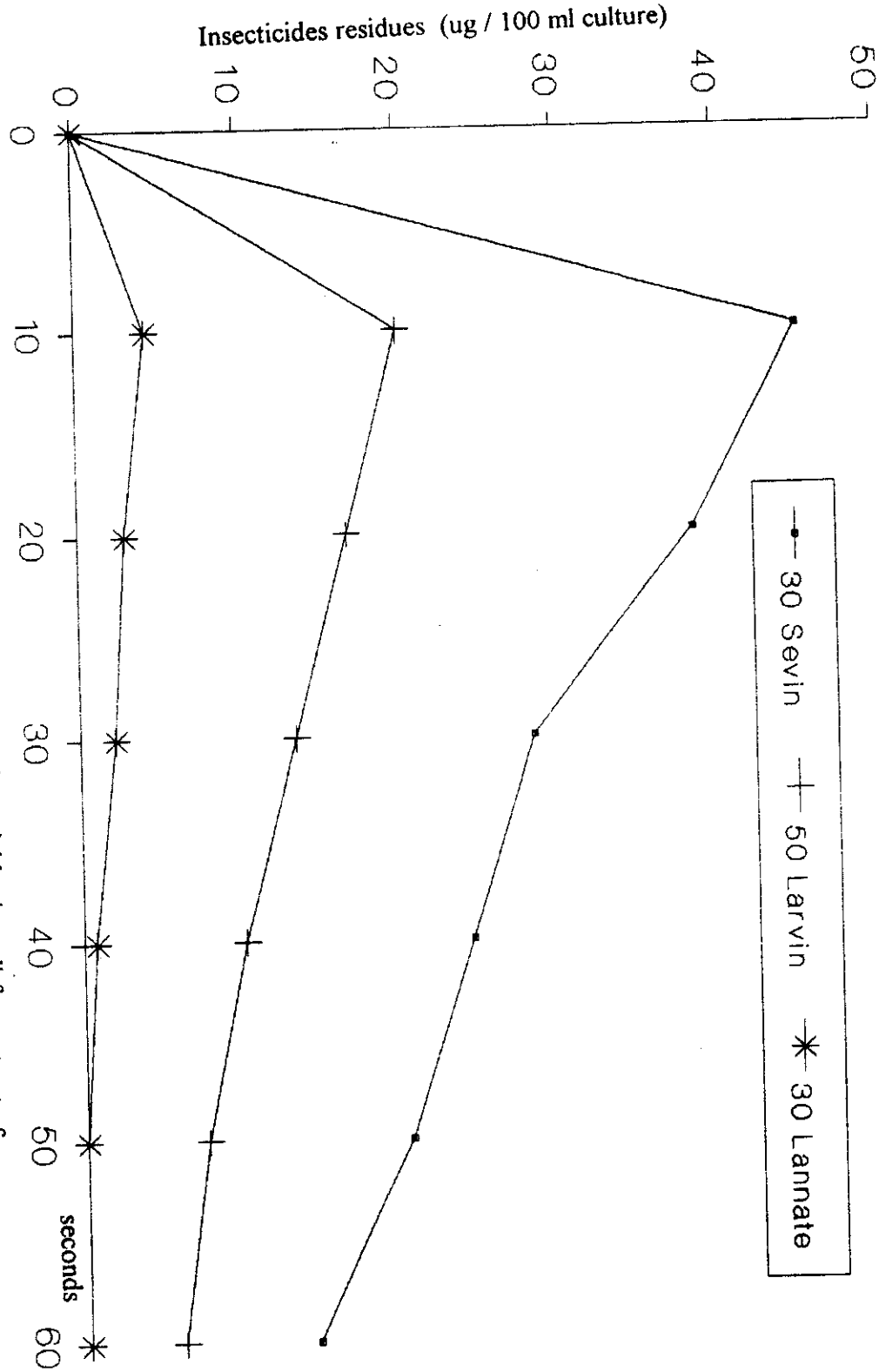


Fig. (25) Persistancy of the carbamate insecticides in cell-free extract of *Az. chroococcum* A_4

Table (28) Persistancy of Carbamate insecticides in cell free extract of with *Az chroococcum* A_{15}

Time in Seconds	N_2 of larvin at different ug/100 ml culture			% recovery			Amounts of larvin residues culture ug/100 ml culture		
	Sevin	Larvin	Lannate	Sevin	Larvin	Lannate	Sevin	Larvin	Lannate
	150	50	30	150	50	30	150	50	30
0	2.072	1.680	1.176	100.00	100.00	100.00	100.00	100.00	100.00
10	0.756	0.924	0.252	36.40	55.00	21.43	54.60	27.50	6.43
20	0.644	0.700	0.168	31.08	41.67	14.29	46.62	20.84	4.29
30	0.476	0.504	0.140	22.97	30.00	11.90	34.46	15.00	3.57
40	0.396	0.420	0.112	18.92	25.00	9.52	28.38	12.50	2.86
50	0.336	0.308	0.056	16.22	18.33	4.79	24.33	9.17	1.43
60	0.252	0.258	0.000	12.16	15.00	0.00	18.24	7.50	0.00

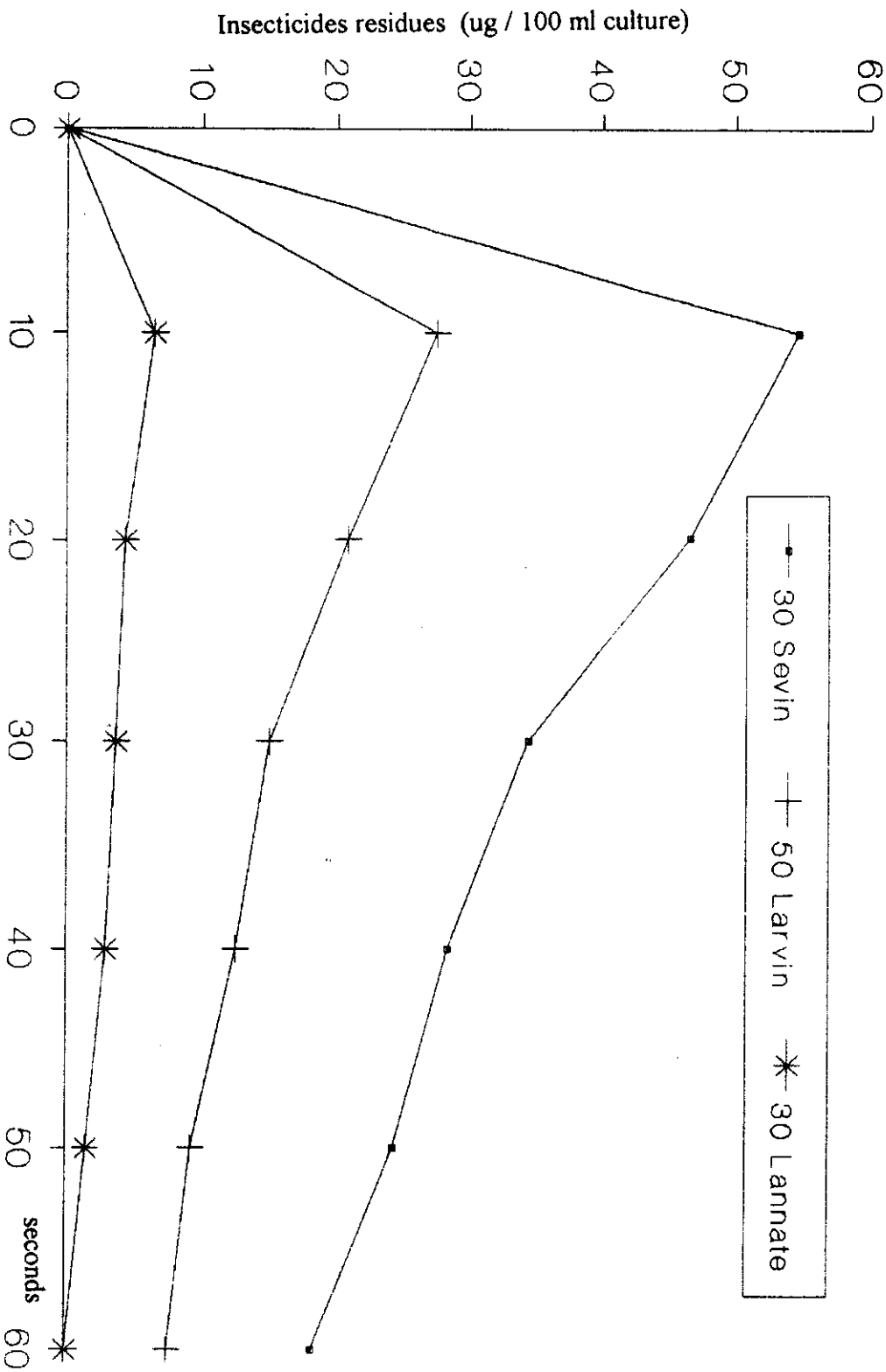


Fig. (26) Persistancy of the carbamate insecticides in cell-free extract of *Az. chroococcum* A_{15}