Table 1 :

Relative Toxicity of some Insecticide to the Cotton Aphids

Aphis gossypii (Glover)

Insecticides	LC 5o ppm	LC 5o Upper limit	LC 5o Lower limit	Slope	Chi Square x^2	LC 16	LC 84
Monocrotophos	2.747	3.363	2.243	1.62	7.81	o.66	11.426
Pirimicarb	5.428	6.455	4.564	1.16	5.o3	o.744	39.6o4
Cypermethrin	8.89	11.957	6.616	o.74	3.21	o.5o8	196.4o2
Malathion	13.3o	15.94	11.1oo	1.38	2.19	2.52	7o.17

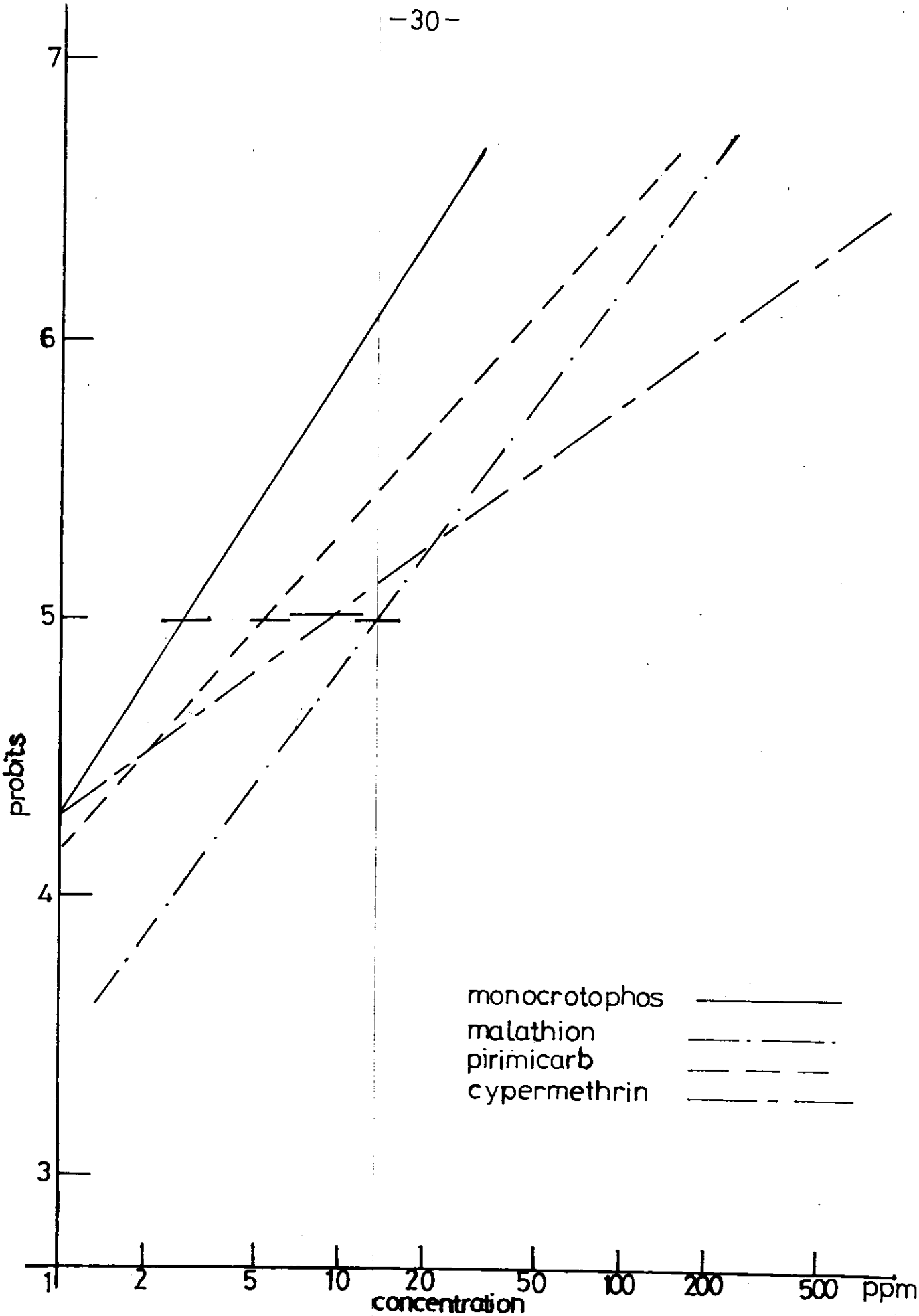

Fig. 1 : Relative potency of some insecticides on Aphis gossypii (Glover) .

either in low or high doses. Pirimicarb comes next in potency in intermediate and high doses, while the second best in low doses was cypermethrin, Malathion was the least effective of the insecticides investigated, but owing to the rather flat Ld-P line of cypermethrin, it was found more toxic than the later in high doses (LC_{84}).

The above results agree with many field observations, Zeid and Herkly (1971) reported malathion to be the least effective, while Khalil and Rizk (1972) found monocrotophos to be the most effective foliar spray among different organophosphous compounds. This report was further supported by the findings of Shoeib et al, (1973) in experiments conducted at sids experimental fields. Ullah, (1977) found in laboratory experiments and field tests carried out in Romania, that monocrotophos gave a good Kill up to 21 days in comparison with other organophosphorus compounds. Larsson (1978) and Nichols (1978) found that synthetic pyrethroids such as cypermethrin, fenvalerate and permethrin could reduce the population of aphids. Sidhu and Dhawan (1979) stated, that monocrotophos was very effective against aphids. Melia and Blasco (1980) reported that pirimicarb gave a good results against Aphis gossypii.,

Halawa et al, (1981) found that monocrotophos and pirimicarb were the most effective products against Cotton aphids Aphis gossypii.

BABU and Azam (1982) found that monocrotophos was the most effective insecticide against Aphis gossypii followed by Cypermethrin.

Relative toxicity of some insecticides to aphid lion chrysopa Carnea (Stephens) :-

- LC_{50}'s Values of tested insecticides to aphid lion :

The maximum toxicity expressed as LC_{50} value in table No. 2 and Fig. 2 to third instar larvae of the aphid lion (Chrysopa Carnea), was obtained when monocrotophos was used. Next in toxicity was malathion, where the LC_{50} was 3.37 times higher than that of monocrotophos.

Larvae of the aphid lion showed considerable tolerance towards the other two insecticides investigated, i.e., Pirimicarb and cypermethin as far as LC_{50} value. Pirimicarb had LC_{50} value 14.65 times higher than that of the most toxic insecticide tested; Monocrotophos, and 4.34 times higher than that of malathion. Cypermethrin was more or less similar in its potencey towards this predator to pirimicarb, its LC_{50} was 1.03 times that of Pirimicarb, 4.49 times higher than that of malathion and 15.14 times higher than monocrotophos.

- Slope :

It was noticeable that experiments with larvae of Chrysopa Carnea produced low slopes, (Fig. 2), indicating

Table 2 :

Relative toxicity of some insecticides to the third instar larvae of Aphid lion Chrysopa Carnea (Stephens)

Insecticides	LC 5o ppm	LC 5o Upper limit	LC 5o Lower limit	Slope	Chi Square x^2	LC 16	LC 84
Monocrotophos	34.25	6o.95	19.24	o.77	1.1o	1.71	684.26
Malathion	115.56	196.35	68.o1	o.97	1.32	1o.81	1235.55
Pirimicarb	5o1.73	1455.66	172.93	o.94	o.97	43.3o	5813.16
Cypermethrin	518.56	1116.29	24o.89	1.28	o.68	85.91	313o.12

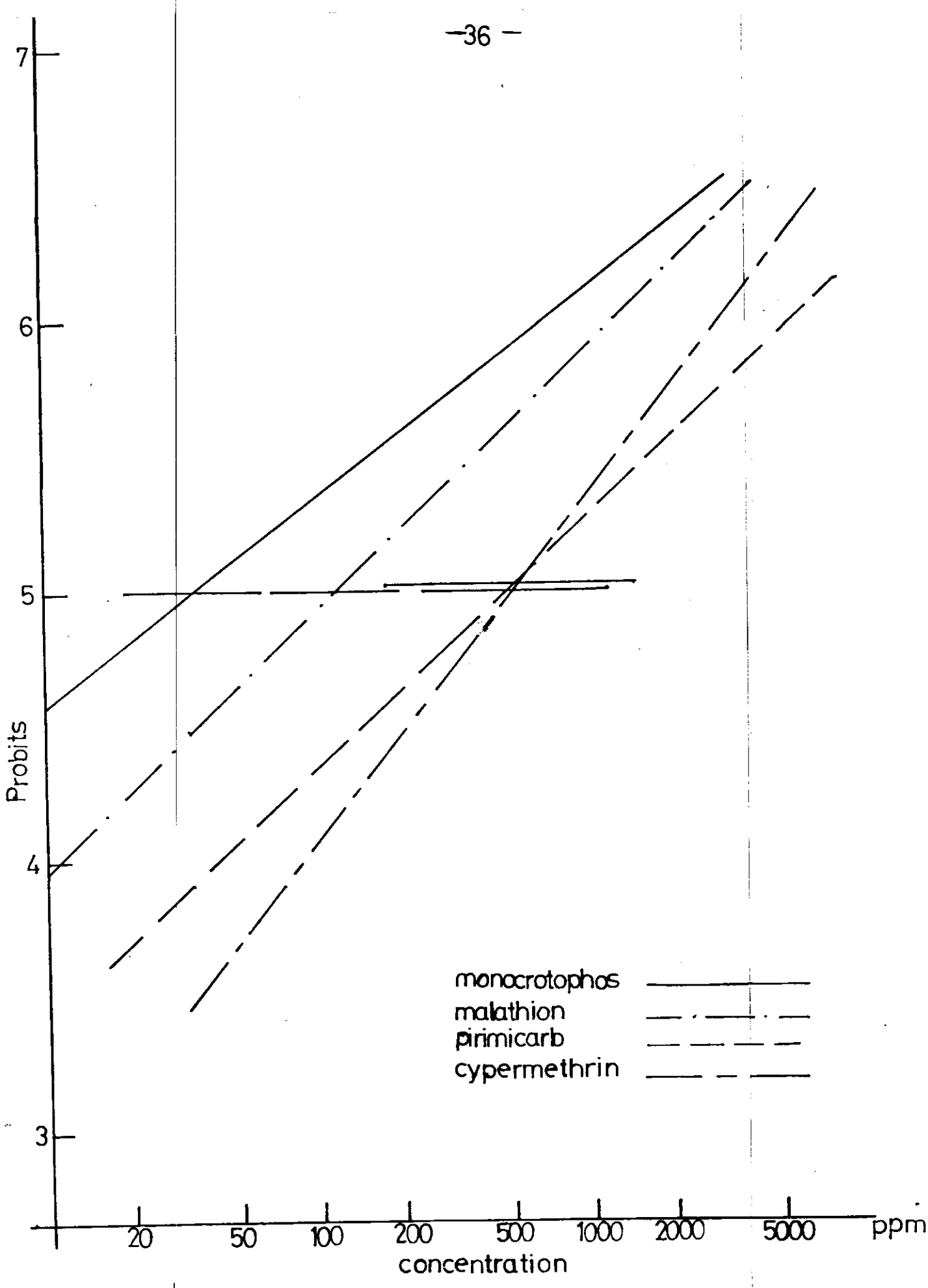

Fig. 2 : Relative potency of some insecticides on Chrysopa carnea (Steph.) larvae .

the need for substantial increases in dosage to obtain increases in mortalities, and indicating also a greater variance in the experiments conducted (Fig. 2). Table 2 shows that the slopes for this insect did not exceed the value of 1.0, except in experiments with cypermethrin where it reached 1.28.

- LC_{16} and LC_{84} of tested insecticides to chrysopa:

In low dosages (i.e. LC_{16}) the same arrangement of toxicity found in comparisons of LC_{50}'s was maintained. It was, in a descending order of the efficiency, monocrotophos, malathion, Pirimicarb and cypermethrin respectively.

The LC_{16} for malathion was 6.32 times higher than that of monocrotophos while the same value for pirimicarb was 25.32 times and Cypermethrin 50.24 times higher than the same value far monocrotophos.

When the LC_{84} values were taken into concèderation, two obsewations emerged, the first is that the differances in LC_{84} values between the different toxicants and monocrotophos were smaller than that observed in the comparison between the LC_{16} values of the tested compounds. It was found that malathion had an LC_{84} value 1.81 times higher than that of monocrotophos, Pirimicarb 8.5 times higher,

and cypermethrin had LC_{84} 4.57 times higher than that of monocrotophos. The second observation was that at such a high dosage cypermethrin was more toxic than pirimicarb.

This leads to the conclusion that the safety margin of all the toxicants investigated was larger at lower concentration (LC_{16} values).

The above findings agree with many lab. and field observations. Helgesen and Tauber (1974) Grapel (1981) and Hellpap (1982) indicated that pirimicarb had no significant impact on the population of Chrysopa Carnea. While wilkison et al, (1975) stated that C. Carnea was a tolerant species to insecticides and the larvae were more tolerant than the adults, this report was further supported by KHALIL and Rizk (1972)b and Khalil et al, (1976) who report that foliar sprays adversely affected the population of beneficial species, but Chrysopa Carnea larvae were propably the most tolerant, plapp and Bull (1978) found that the larvae of green lacewing were tolerant to several insecticides including natural pyrethrins, fenvalerate, permethrin and NRDC 161. BABRIKOVA (1979) stated that the eggs, larvae and pupae were more tolerant than the adults of Chrysopa Carnea,

while pirimor, garadona, phosalone and dicafol were the least toxic compounds to the larvae.

Kismir and Sengonca (1980) found that monocrotophos caused heavy larval mortality in comparison with Cypermethrin. Roach and Hopkins (1981) stated that monocrotophos can essentially elimenate the green lacewings at the recommended field rates.

Franz et al, (1980) found that pirimicarb gave less favourable results against chrysopa Carnea if compared with Dipel. Niemczyk et al, (1979) indicated that cypemethrin was found not very toxic to larvae of Chrysopa Carnea.

Relative toxicity of different insecticides to the larvae of lady bird Coccinella Undecimpunctata L. :-

- LC_{50} values of tested insecticide to the lady bird larvae :

Table No.(3) and Fig.(3), show the results obtained by exposure of third instar larvae of lady bird Coccinella Undecimpunctata to different concentrations of four different insecticides.

When LC_{50}'s values of the different compounds were compared, the maximum toxicity was obtained with monocrotophos, having the smallest LC_{50} value (13.21 ppm), followed by pirimcarb with an LC_{50} value 1.54 fold higher than the LC_{50} of monocrotophos. The next in effectiveness on lady bird's larvae was malathion, it had an LC_{50} value 2.11 times higher than that of monocrotophos and 1.37 times higher than pirimicarb.

The third instar larvae of lady bird showed Considerable tolerance towards Cypermethrin, as far as LC_{50} value, it was 20.45 times higher than that of monocrotophos, 13.26 folds higher than Pirimicarb and 9.69 times higher than the LC_{50} value of malathion.

Table 3 ;

Relative toxicity of some insecticides to the third instar larvae of lady bird (Coccinella undecimpuntata)

Insecticide	LC 5o ppm	LC 5o Upper limit	LC 5o Lower limit	Slope	Chi Square x^2	LC16	LC 84
Monocrotophos	13.21o	17.33	1o.o6	1.16	4.23	1.82	95.88
Pirimicarb	2o.37	29.38	14.13	o.79	1.86	1.11	374.o6
Malathion	27.89	35.37	21.99	1.51	1.76	6.o6	128.27
Cypermethrin	27o.18	431.o3	169.36	1.28	o.4o	44.71	1632.88

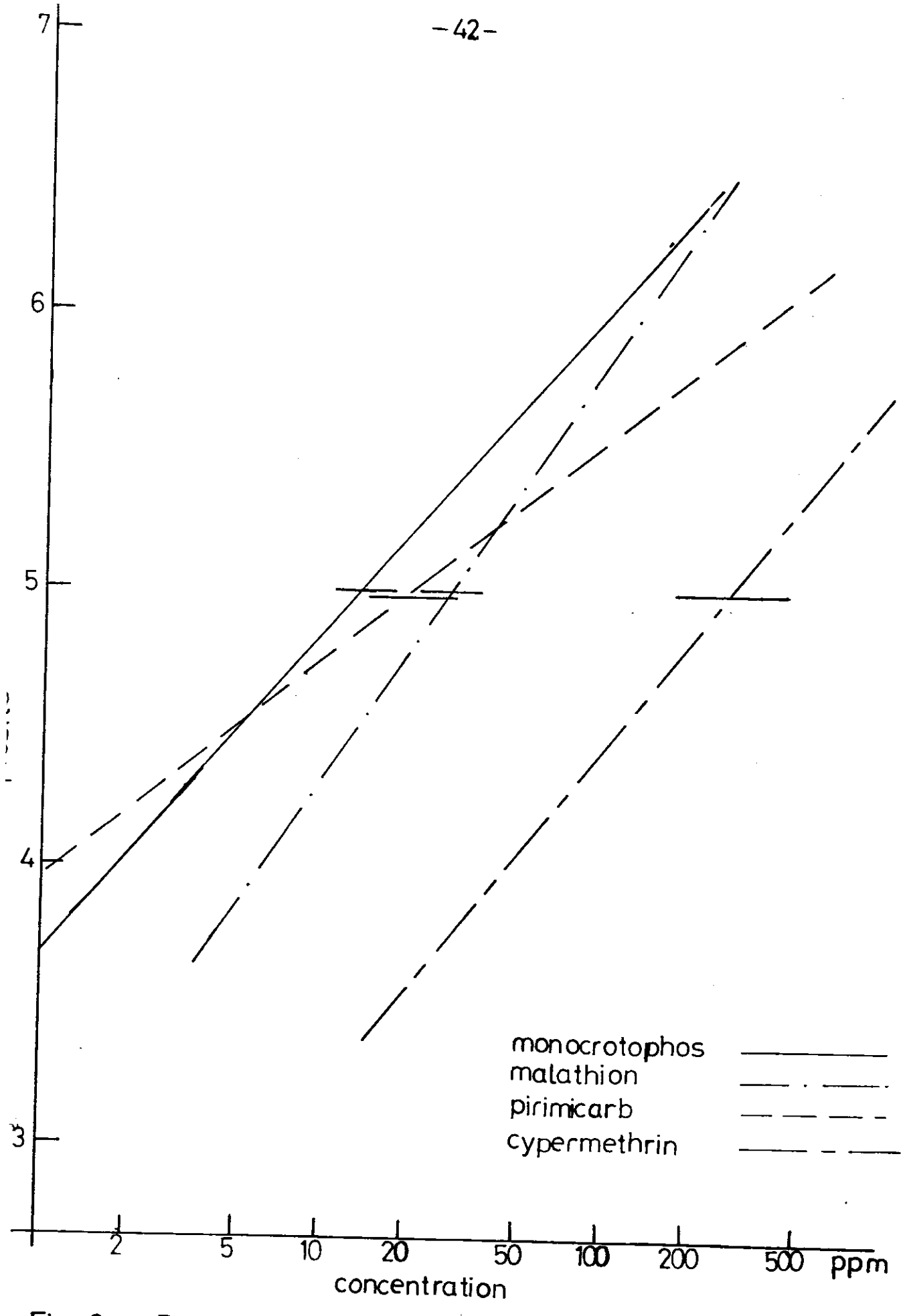

Fig. 3 : Relative potency of some insecticides on Coccinella undecimpunctata (L.) larvae.

- Slope :

The descending order of slopes of the tested compounds used on larvae of Coccinella Undecimpunctata was malathion,cypermethrin, monocrotophos and pirimicarb respectively.

It was noticeable that there was a Considerable defferance between the highest slope of malethion and the lowest slope of pirimcarb. On the other hand, the slopes for monocrotophos and cypermethrin were more or less equal (Fig. 3).

- LC_{16} and LC_{84} of some insecticides to lady bird's larvae :

As a consequence of the differances in the slopes of the tested compounds, it was expected that the arrangement of their effecacy would differ if it was compared at higher or lower doses than the LC_{50}.

When the LC_{16} was considered for the four different insecticides, it was found that the descending order of potency was pirimicarb, monocrotophos, malathion and cypermethrin respectively. The LC_{16} value for monocrotophos was 1.64 times higher than that of pirimicarb, while the same value far malathian was 5.46 folds higher

than pirimicarb and 3.33 times higher than that of monocrotophos, and the LC_{16} value for cypermethrin was 40.28, 24.57 and 7.38 folds higher than that of pirimicarb, monocrotophos and malathion respectively.

If the LC_{84} values were taken into consideration the arrangement of effeciency will be monocrotophos, malathion, Pirimicarb and cypermethrin respectively. The LC_{84} value, of malathion was 1.34 times higher than that of monocrotophos. The LC_{84} value of Pirimicarb was 3.90 folds higher than monocrotophos and 2.92 folds higher than malathion. The LC_{84} for cypermethrin was 17.03, 12.73 and 4.37 times than that of monocrotophos, malathion and pirimicarb respectively.

The above results indicated that monocrotophos was the most toxic compounds among the tested insecticides specially in the intermediate and high concentrations. While cypermethrin was the least effective compound of the insecticide investigated either at high or low dasage rates.

The above results coincide with the findings of Ullah (1977) who emphasised the high toxicity of monocrotophos to C. septempunctata.

There is, however, a descripancy between the above results and those reported by Georgis and Taha (1977) who stated that malathion was more toxic than pirimicarb to larvae of C. Undecimpunctata, this differance in results may be due to differances in technique, since they used direct spraying with a hand sprayer on the test insects, while in the present work insects were exposed to pretreated surfaces, it is noticeable, however, that the differance in LC_{50} for the two toxicants in the present work is not significant, while, in higher doses (LC_{84}) malathion was considerably more toxic than pirimicarb.

Relative toxicity of some insecticides to the adults of lady bird Coccinella Undecimpunetate L. :-

- LC_{50} Values of some insecticides to the lady birds :

Table No.(4) and Fig. (4) demonestrate the results obtained by the exposure of Coccinella Undecimpunctata adults to treated surfaces with different concentrations of four different insecticides.

When the LC_{50} values were compared the maximum toxicity was noticed with monocrotophos, having the smallest value of LC_{50}; (7.646 ppm). Next in toxicity was malathion, it had LC_{50} value 2.49 times higher than that of monocrotophos.

The lady bird adults showed considerable tolerance towards the other two compounds investigated, i.e., cypermethrin and pirimicarb. Cypermethrin had an LC_{50} value 11.88 times higher than the most toxic compound tested, i.e. monocrotophos and 4.77 folds higher than the LC_{50} value of malathion.

Pirimicarb was more or less similar in its effect toward the adults of the lady bird to cypermethrin, it had LC_{50} value 1.01 times higher than that

Table 4 :

Relative toxicity of some insecticides on adults of lady bird (Coccinella undecimpunctata L.)

Insecticide	LC 5o ppm	LC 5o Upper Limit	LC 5o Lower Limit	Slope	Chi Square x^2	LC 16	LC 84
Monocrotophos	7.646	7.779	7.513	2.427	1.14	2.961	19.745
Malathion	19.o6	33.88	1o.715	1.1243	o.2772	2.46	147.78
Cypermethrin	9o.825	136.882	6o.256	1.651	2.295	22.517	366.354
Pirimicarb	91.76	124.39	67.66	1.997	o.9647	28.966	29o.666

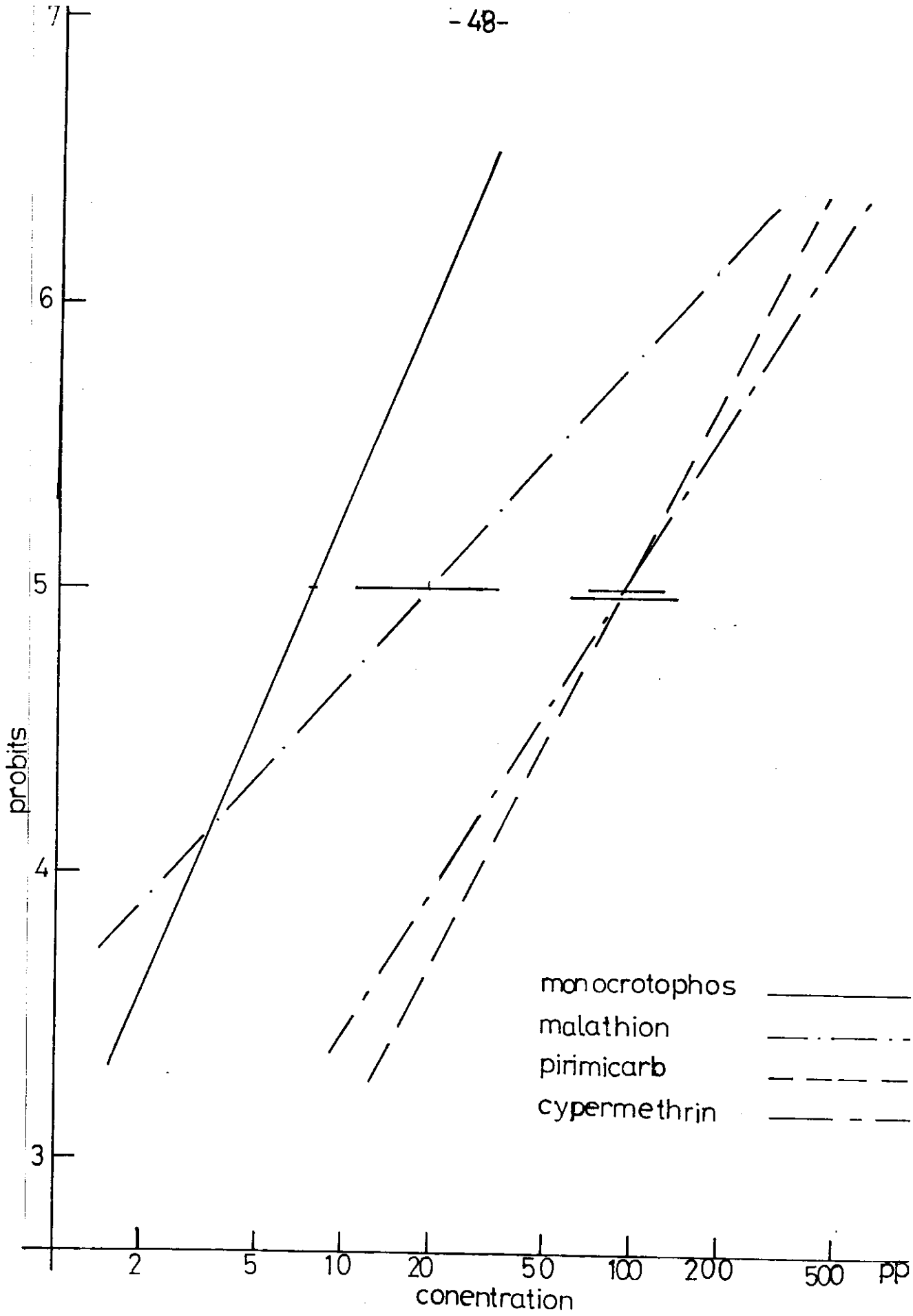

Fig. 4 : Relative potency of some insecticides on Coccinella undecimpunctata (L.) adults .

Georgis and Taha (1977) who concluded that malathion, actelic (pirimiphos - methyl) and supracide (methedathion) were more toxic than pirimicarb to the adults of C. septempunctata.

They also agree with the results reported by ABOL-El-AAL et al, (1979) who demonstrated that the safest compounds for coccinella adults were cyperenethrin, sumicidine (fenvalerate) and chlorpyrifas.

The relative susceptibility of Aphids and its predators to Monocrotophos :-

Table 5 and Fig. (5) demonstrate the Comparative effect of monocrotophos on Aphis gossypii and two of its predators; The larvae of chrysopa Carnea, larvae and adults of Coccinella Undecimpunctata.

- LC_{50} Values of moncrotophos :

A comparison of the LC_{50} values for aphids and its predators reveal that aphids were considerably more susceptible to the toxicant than its predators. The differance was most obvious in the larvae of chrysopa carnea where its LC_{50} value was 9.1 times higher than that of aphids. Next in taleration to this toxicant was the larval stage of Coccinella Undecimpunctata where its LC_{50} was 4.8 folds higher than that of aphids. The most susceptible of the predators under investigation to monocrotophos was the adults of Coccinella Undecimpunctata. its LC_{50} value was only 2.78 folds higher than that of Aphis gossypii.

-LC_{16} and LC_{84} of monocrotophos :

Considering the value of the LC_{16} as an indicator of the effect of low dosage, the aphids were more susceptible than the other species. The larvae of Chrysopa

The relative susceptibility of Aphis gossypii and its predators to malathion :

Table No. (7) and Fig. No. (6), show the effect of malathion on Aphis gossypii and its predators, i.e., third instar larvae of chrysopa Carnea and third instar larvae and the adults of Coccinella Undecimpunctata.

- LC_{50} values of malathion :

A comparison of the LC_{50} values for aphids and its two predators showed that, the aphids were more susceptible to malathion than the other species under investigation. The larvae of Chrysopa Carnea had the highest LC_{50} value which means that this predator was the least susceptible of the tested species, its median lethal concentiation was 8.69 folds higher than that of the aphids. Next in toleration of this toxicant was the larval stage of the lady bird beetle having LC_{50} value 2.1 times higher than that of the Aphids. Adult stage of C. Undecimpeunctata was the most susceptible of the predator tested species, its LC_{50} was only 1.43 folds higher than that of Aphis gossypii.

- LC_{16} and LC_{84} values of malathion :

When the low dosages (i.e. LC_{16}) were taken into

Table 7

Relative susceptibility of Aphis gossypii and its predators to malathion

Insect	LC 5o ppm	LC 5o Upper limit	LC 5o Lower limit	LC 16 ppm	LC 84 ppm	Slope	Chi Square x^2
Aphis gossypii	13.3o	15.94	11.1oo	2.52	7o.17	1.38	2.19
Chrysopa carnea	115.56	196.35	68.o1	1o.81	1235.55	o.97	1.32
Coccinella undecimpunctata larvae	27.89	35.37	21.99	6.o6	128.27	1.51	1.76
C. undecimpunctata Adult	19.o6	33.88	1o.715	2.46	147.78	1.124	o.277

Table 8

Comparative response of Aphis gossypii and its predators to malathion

Insect	LC 50 ppm	Log LC 50	Variance	t 0.05
Aphis gossypii	13.30	1.1239	0.0016	-
Chrysopa carnea	115.56	2.0628	0.0139	7.544**
C. undecimpunctata larvae	27.89	1.4454	0.0028	4.858**
C. undecimpunctata Adult	19.06	1.2802	0.0163	1.168

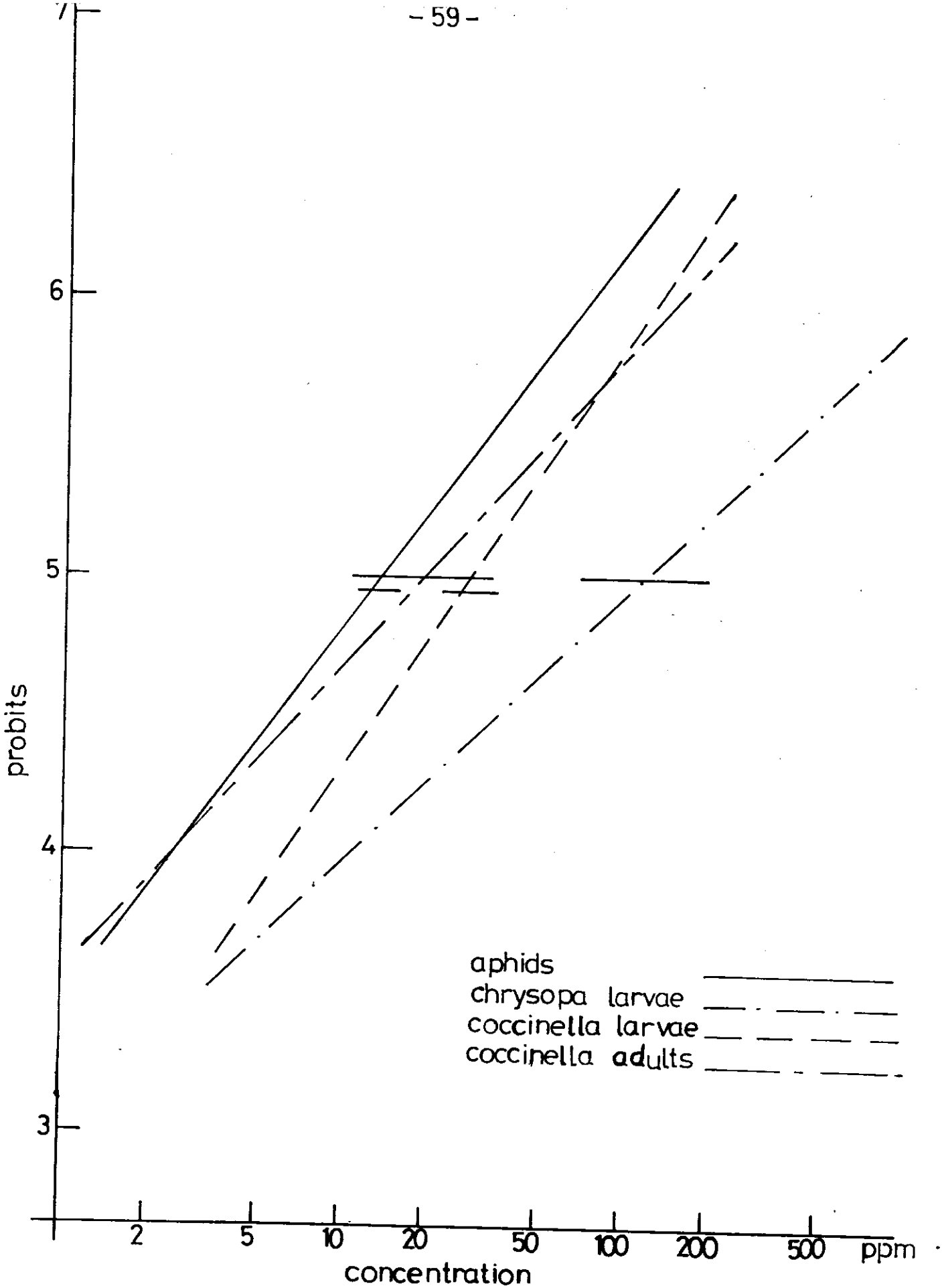

Fig. 6 : Effect of malathion on Aphis gossypij and its predators Chrysopa carnea larvae and Coccinella undecimpunctata larvae and adults.

consederation, it was noticeable that the adults of C. undecimpunctata were more susceptible than the larval stages of the same species. Chrysopa Carnea showed the least susecptible among the insects investigated, its LC_{16} value was 4.39 folds higher than that of C. undecimpunctata adults. Next in taleration was the larval stage of C. undecimpunctata, its LC_{16} was 2.46 folds higher than that of its adults. While the LC_{16} value of Aphis gossypii was simillar to that of the adults of lady bird, its LC_{16} was 1.02 times higher than that of its predator adult stage of C. undecimpunctata.

In the higher dosage rates (i.e. LC_{84}), the most susceptible of the species tested was Aphis gossypii, followed by the larvae of coccinella undecimpunctata, where its LC_{84} value was 1.83 times higher than that of the aphids. Next in susceptibility was the adult stage of lady bird with LC_{84} value 2.11 folds higher than that of the aphids and with the difference of 1.15 folds higher than that of the larval stage of the same species. The least susceptible of insect species tested was chrysopa carnea larvae where its LC_{84} value was 17.61 folds higher than Aphis gossypii.

- Slopes :

The lowest slope among the species investigated was that of the larvae of chrysopa carnea, this is together with the high value of LC_{50} (Fig. 7) suggested a sort of tolerance born out of selection, this point is supported by the fact that malathion has been used against aphids for a long time. This phenomenon would deserve further investigations in order to confirm or refute the above suggestion. The highest slope value was that of the adults of the lady bird beetle , followed by the aphids while the slope of C. undecimpunctata. Occupied an intermediate position.

Table No. (8) shows the variances of the Ld-P line of the aphids and its three predators. The smallest variance was that of aphids, followed by larvae of C. undecimpunctata. The largest variance was that of the adults of lady bird. This large variance could not be explained on the basis of a high slope (Fig. 7), but it would mean a large difference between m and $\bar{x}$, which would suggest in turn a conspicuous variation in homogenity of tested insects. Another large variance was that of the larvae of C. Carnea but it would be readily explainable on the basis of a small slope.

When t value was calculated for the differences between predators and pest (Table 8), it was found that the differences between LC_{50} for aphids and both C. Carnea larvae and C. undecimpunctata larvae were significant, while the adults of C. undecimpuncata were not significautly less susceptible to malathion in comparison with aphids.

The relative susceptibility of aphids and its predators to pirimicarb :-

Table No. (9) and Fig. No. (7) show the comparative effect of pirimicarb on Aphis gossypii and its predators; the larvae of chrysopa carnea and larval and adult stages of Coccinella Undecimpunctata.

- LC_{50} values of Pirimicarb :

It is noticeable, in table 9, that Aphis gossypii was the most susceptible of the insect species exposed to the toxicant. A considerable differance was obvious in the larvae of chrysopa carnea where its LC_{50} value was 92.43 folds higher than the LC_{50} value of Aphis gossypii. Next in toleration of this toxicant was the Adult stage of the lady bird where its LC_{50} value was 16.9 times higher than that of the aphids, followed by the larval stage of C. Undecimpunctata with a differance of 4.5 times between the adult stage and the larval stage of the lady bird beetle. The LC_{50} of the larvae of this predator 3.75 folds higher than that of the aphids.

- LC_{16} and LC_{84} values of Pirimicarb :

When the LC_{16} was considered as an indicator of

Table 9 :

Relative susceptibility of Aphis gossypii and its predators to primicarb

Insect	LC 50 ppm	LC 50 Upper limit	LC 50 Lower limit	LC 16 ppm	LC 84 ppm	Slope	Chi Square x^2
Aphis gossypii	5.428	6.455	4.564	0.744	39.604	1.16	5.03
Chrysopa carnea larvae	501.73	1455.66	172.93	43.30	5813.16	0.94	0.97
Coccinella undecimpunctata larvae	20.37	29.38	14.13	1.11	374.06	0.79	1.86
C. undecimpunctata Adult	91.76	124.39	67.66	28.966	290.666	1.997	0.965

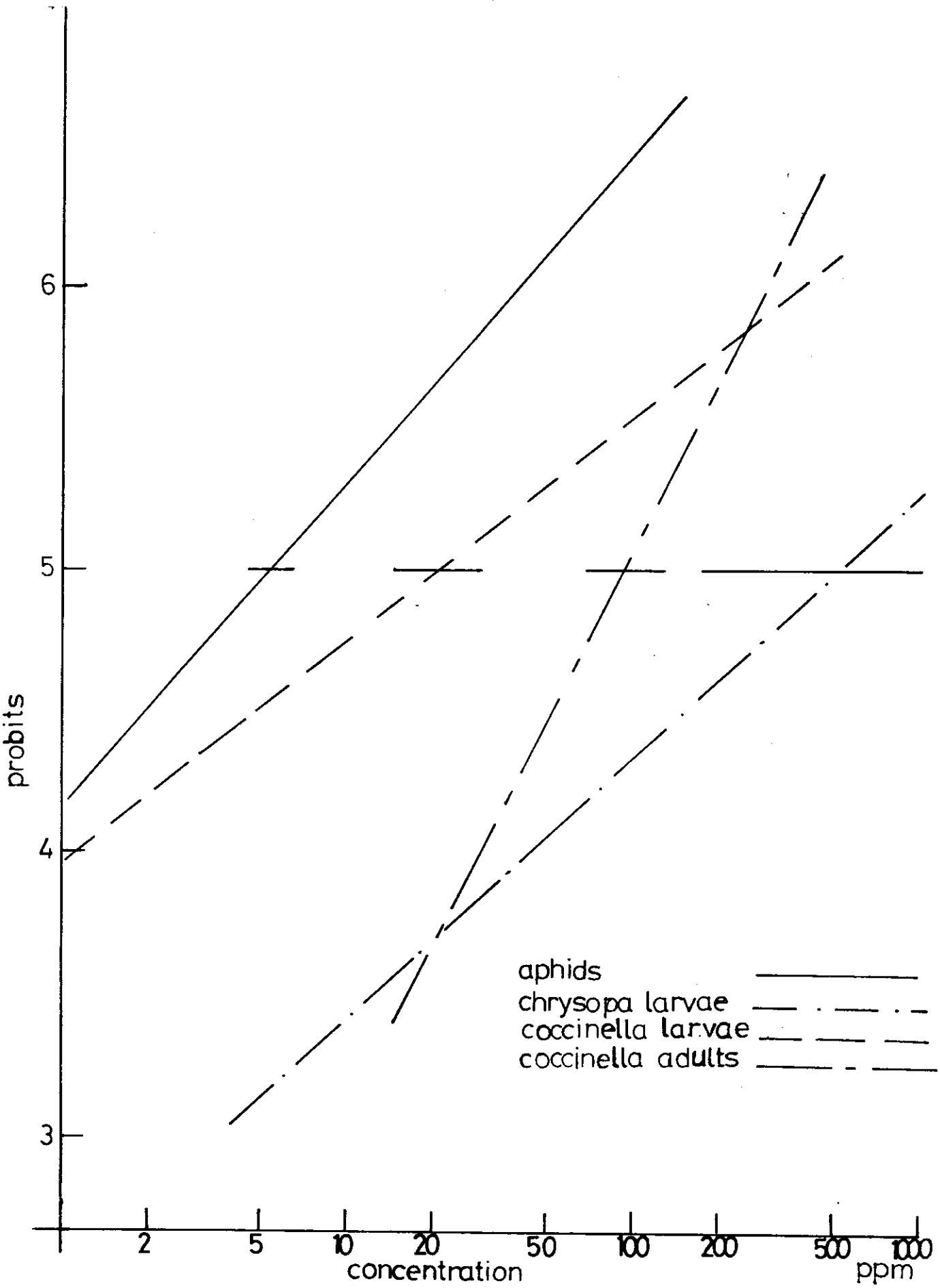

Fig. 7 : Effect of pirimicarb on Aphis gossypii and its predators Chrysopa carnea larvae and Coccinella undecimpunctata larvae and adults

the effect of low dosage rates, the same order of susceptibility reported in LC_{50} was mentioned, i.e., the aphids were more susceptible to the toxicant than the other species investigated. The larval stage of the lady bird beetle had the lowest LC_{16} value in comparison with the other predator species, its LC_{16} was 1.49 times higher than that of the aphids. The most tolerant of the species investigated to pirimicarb with the low dosage rates was Chrysopa Carnea having LC_{16} value 58.2 times higher than that of aphids, followed in toleration by C. Undecimpunctata adults with LC_{16} value 38.93 folds higher than the LC_{16} of Aphis gossypii, and 26.1 times higher than that of the larval stage of the same species.

Considering the LC_{84} value as an indicator of the high dosage rates, the aphids were more susceptible than the other species. Next in susceptibility was the adult stage of C. Undecimpunctata followed by the larval stage of the same species, with a difference of 1.29 folds between the larvae and the adults of the lady bird beetles and 9.45 times higher than that of the aphids. The most tolerant of the predator species investigated was Chrysopa Carnea larvae having LC_{84} value 146.78 folds higher than that

of Aphis gossypii.

- Slopes:

The slopes of the Ld-P lines for pirimicarb showed considerable variation (table 9 and Fig. 7). The slope for aphids was lower than that encountered with the two previously discussed toxicants (monocrotophos and malathion). At the same time it was slightly higher that of C. Carnea larvae and considerably higher than that of larvae of the lady bird C. Undecimpunctata. The slope for the adults of the last mentioned predator was conspicuously high.

When the variances were calculated (Table 10) it was found that the only large variance was that of the larvae of the lacewing C. Carnea. Accordingly the low slope of larvae of C. Undecimpunctata is not brought about by variance. This would suggest that this low slope is natural and not a reflection of variations in the data.

Studant's t was Calculated for the difference between LC_{50}'s of the aphids and its three predators. This statistic revealed that the three predators were significantly less susceptible to pirimicarb than aphids.

The above results agree with the findings of Syrett and Penman (1980) who found that pirimicarb was very toxic to the aphids more than its predators.

Helpap and schmutterer (1982) found that the application of pirimicarb concentration of 0.001% (1/30 of the recomended dose) and lower with the use of chrysopa Carnea could inibit population growth of aphids. And Kalushkov (1982) stated in laboratory tests that pirimicarb was effective against aphids but was harmless to the eggs, larvae and adults of the coccinellid predators.

The relative susceptibility of aphids and its predators to Cypermethrin :-

Table No. (11) and Fig. No. (8) demonstrate the comparative effect of Cypermethrin on Aphis gossypii and two of its predators chrysopa Carnea larvae and the larval and adult stages of Coccinella Undecimpunctata.

- LC_{50} values of Cypermethrin :

A comparison of the LC_{50} values for Aphis gossypii and its predators revealed that the aphids are considerably more susceptible than its predator to that toxicant. On the other hand, the least susceptible of the species investigated was chrysopa carnea larvae where its LC_{50} value was 58.33 folds higher than that of the aphids. followed in toleration by C. Undecimpunctata larvae with LC_{50} value 30.39 times higher than the LC_{50} for the aphids. And with considerable differance of 2.97 folds higher than that of the adult stage of the same species. Adults of C. Undecimpunctata had LC_{50} value 9.11 times higher than that of the aphids.

- LC_{16} and LC_{84} values of cypermethrin :

Considering the LC_{16} values for the aphids and the predators, the same order of susceptibility mentioned in

Table 11

Relative susceptibility of Aphis gossypii and its predators to cypermethrin

Insect	LC 5o ppm	LC 5o Upper limit	LC 5o Lower limit	LC 16 ppm	LC 84 ppm	Slope	Chi Square x^2
Aphis gossypii	8.89	11.957	6.616	o.5o8	196.4o2	o.74	3.21
Chrysopa carnea larvae	518.56	1116.29	24o.89	85.91	313o.12	1.28	o.68
Coccinella undecimpunctata larvae	27o.18	431.o3	169.36	44.71	1632.88	1.28	o.4o
C. undecimpunctata Adult	9o.825	136.882	6o.256	22.517	366.354	1.651	2.295

Table 12

Comprative response of Aphis gossypii and its predators to Cypermethrin

Insect	LC 5o ppm	Log LC 5o	Variance	t o.o5
Aphis gossypii	8.89	o.9489	o.oo43	-
Chrysopa carnea	518.56	2.7148	o.o289	9.697**
C.undecimpunctata larvae	27o.18	2.4317	o.olo7	12.lo3**
C. undecimpunctata Adult	9o.825	1.958	o.oo83	8.99o**

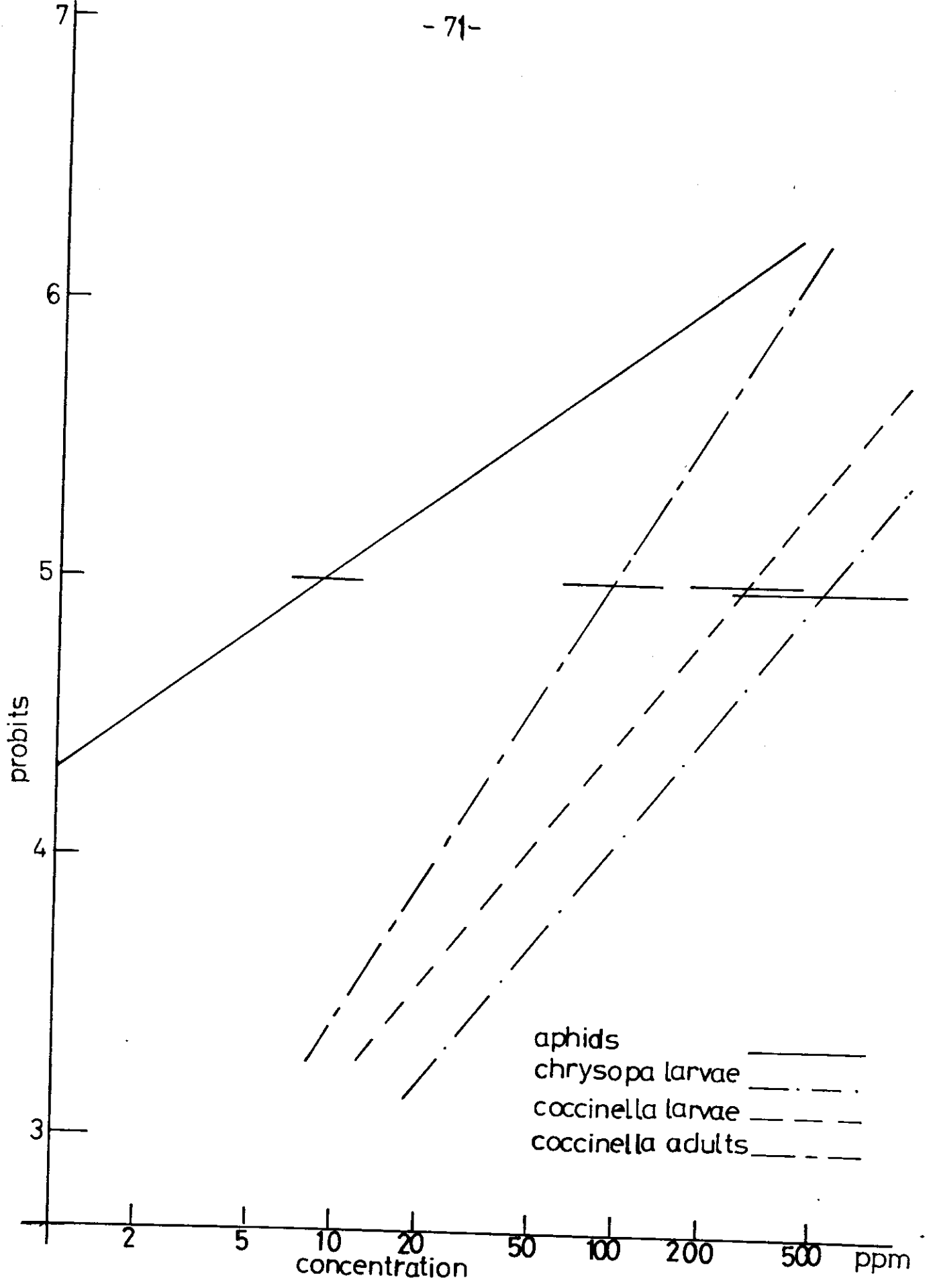

fig. 8 Effect of cypermethrin on Aphis gossypii and its predators Chrysopa carnea larvae, Coccinell undecimpunctata larvae and adults.

the LC_{50} was maintained, i.e., Aphis gossypii was the most susceptible of the insect species tested. Next in susceptibility was Coccinella Undecimpunctata adults where its LC_{16} value was 44.32 folds higher than that for Aphids gossypii, followed by the larvae of C. Undecimpunctata with a differance of 1.99 folds between the larval and adult stages of the lady birds and the larvae was 88.02 folds higher than aphids. The least susceptible of the tested insects was the larval stage of Chrysopa Carnea, where its LC_{16} value was 169.11 folds higher than that of the aphids.

The same order of susceptibility was noticeable in comparison of the LC_{84} values for the three insect species, i.e., Aphis gossypii was more susceptible than its predators, C. Undecimpunctata. Adults came next in susceptibility, followed by the larvae of the same species with LC_{84} value 8.31 and 4.46 folds higher than that for the aphids and the adult stage of the lady bird beetles respectively.

Chrysopa Carnea larvae had the highest value of the LC_{84}, where its LC_{84} was 15.94 folds higher than that of Aphis gossypii.

- Slope :

Aphids had a conspicuously low slope (Fig. 8) with a small variance (Table 12). The larvae of both C. Carnea and C. Undecimpunctata had parallel Ld-plines indicating similar slopes, although there was some difference in the variances of the two lines. C. Undecimpunctata adults, however, had the highest slope with a small variance (Table 12). The differances between LC_{50} values for aphids and it three predators under investigation were highly siginificant according to the calculated values of student's t shown in table(12).

It is evidant from the above results, that a general observation, aphids were more susceptible to insceticides than its predators investigated in this work. This was true at all the three concentrations; LC_{16}, LC_{50} and LC_{84}.

Equally evidant was the observation that the least susceptible of the predators to the insecticial treatments was the larvae of the lacewing Chrysopa Carnea. Its lack of susceptibility was evidant in all the three concentrations calculated, with the exception of monocrotophos where the threshold for toxic action appeared to be very small, and was reflected in a rather low concentration

for the LC_{16}.

As far C. Undecimpunctata it was evident from the figures that it occupies an intermediate position in susceptibility between aphids and C. Carnea. Adults were more susceptible than larvae to monocrotophos in intermediate and high concentrations, to malathion in low and intermediate concentrations. Pirimicarb in high concentration and to cypermethrin in intermediate and high concentrations. Other-wise larvae were more suceptible than adults.

The above results agree partially with the findings of Helgesen and Tauber (1974), Babrikova (1979) and Grapel (1981) who concluded that pirimicarb could be considered safe for the use against aphids in the presence of its predators Chrysopa Carnea and Coccinella septempunctata, while Syrett and Penman (1980) stated that pirimicarb was 1000 - 10,000 times toxic to aphids as to the predator coccinella Undecimpunctata. Kolushkov (1982) found that pirimicarb was effective against aphids but was harmless to coccinellid larvae if compared with methomyl, permethrin and deltamethrin.

Table 13 :

Effect of some insecticides on larvae of Coccinella undecimpunctata under semi-field conditions.

Insecticides	conc. ppm	Total Nº of larvae	Dead	% Mortality	% Pupation after 5 days
Monocrotophos	125	74	38	51.35	94.6
	250	72	48	66.67	100
Malethion	140	71	34	47.89	94.6
	280	75	50	66.67	100
Cypermethrin	75	50	0	0	52
	150	75	13	17.33	96
Primicarb	200	75	26	34.67	88
	400	75	34	45.33	94.7
Control	-	74	0	0	64.9

The above results agree with the findings of Kira et al, (1970) who stated that malathion and metaisosystox were toxic to the aphids as well as the predators, i.e., Coccinella Undecimpunctata, Paederus alferii, Orius sp. and Scymnus sp., Khalil and Rizk (1972 b) found that the application of insceticides reduced the population densities of the predators including Chrysopa Carnea, which was probably mare tolerant to the wide variety of insecticides. Metwally and Shenouda (1976) mentioned that the application of monocrotophos and mixture of endrin/bidrin in Cotton field had a lethal effect on the beneficial insects including Chrysopa Carnea and Coccinella Undecimpunctata. This report was further supported by Ullah (1977), who stated that the application of monocrotophos, in the fields, against Aphis gossypii gave good Kill of aphids but was highly toxic to the predator Coccinella septempunctata.

El-Dahan et al, (1981) found that synthetic pyrethroids, i.e., Ripcord and CCN 52 gave a slight and moderate effect on the white flies and Aphis gossypii, while the effect on Chrysopa Carnea was slight in Ripcord Case (10% larval mortality) and moderate in the case of CCN 52 (36.6% Kill). While Whalon and Elsner (1982)

mentioned that pirimor and acephate gave a high reduction in aphids numbers and had the least impact on Chrysopa Carnea if Compared with malathion and methomyl.

Effect of sub-lethal doses on adults of Chrysopa Carnea :-

It was thought of interest to investigate the effect of expasure of adults of Chrysopa Carnea to surfaces treated with sublethal doses of insecticides on surviving adults. According to results from preliminary trials, concentrations were selected which would give mortalities between 30 and 40 percent among adults.

1: Direct effect on exposed adults :-

Results tabulated in table 15 show that Mortalities recorded after six days revealed that cypermethrin caused maximum mortalities, reaching up to 47.4 percent, Malathion was next to cypermethrin, followed by monocrotophos (31.6%). The lowest mortalities were those among insects treated with pirimicarb 26.3 percent. If the Concentrations used were taken into consideration, it will be noticed that the most toxic of insecticides used was monocrotophos followed by malathion and cypermethrin, the least toxic was pirimicarb, an arrangement similar to that found with larvae.

Table 15

Effect of sub-lethal doses of some insecticides on the adult stage of Chrysopa carnea.

Insecticide	Conc ppm	N° of adults exposed	% correc. mortality after 6 days	Average eggs per female	Average hatchs per female	% failure in hatching
Monocrotophos	3.9	2o	31.6	23.9	6.92	7o.97
Malathion	9.4	2o	36.8	25.o	22.3	1o.67
Pirimicarb	1oo	2o	26.3	19.1	16.1	15.67
Cypermethrin	75	2o	47.7	26.4	24.9	4.55
Control	-	2o	5.o	1o.7	1o.1	5.88

2: Latest effect on succesive developed stages :

- Oviposition :-

It was noticed in adult survivors from insecticidal treatment that the surviving females laid more eggs than the untreated control. The average number of eggs per female (Table 15) was about double the average in untreated females from the control. The maximum egg laying per female was observed in Cypermethrin followed by malathion then monocrotophos, while the least increase was among survivors of Pirimicarb treatment.

- Effect of exposure of adults on progeny :-

Table (16) represents a follow up of the number of progeny from adults of C. Carnea exposed to sublethal doses of insecticides. The number of larvae which hatched successfuly is given in Column 3, the numbers are consistantly more than that in control with the exception of monocrotophos where failure to hatch reduced the number of larvae considerably. The larger number of larvae in malathion, pirimicarb and cypermethrin is due to the increase in oviposition refered to above.

It is apparent from column 5, however, that higher mortalities occured among larvae ensuing from treated adults than control. The result was that at the end of the larval stage, there were fewer larvae in all treatments than control, with the exception of malathion, where larval mortalities were only slightly higher than control.

The highest percentage mortality was among larvae from adults treated with monocrotophos. Mortalities in pirimicarb and cypermethrin were more or less the same.

Table 16

Effect of sub-lethal doses of some insecticides on larval survival and emergence of adults by exposing of adults of Chrysopa carnea to treated surfaces.

Insecticide	conc ppm	Total Nº of eggs	Total Nº of hatched eggs	Nº of alive larvae in end of larval stage	% mortality in larval stage	% success pupation	% emerged adult from pupae	% emerged adult from eggs
Monocrotophos	3.9	155	45	13	71.11	61.54	75.o	3.87
Malathion	9.4	15o	134	1o9	18.66	39.45	79.o7	22.67
Pirimicarb	1oo	134	113	65	42.48	47.69	77.42	17.91
Cypermethrin	75	132	122	72	4o.98	33.33	87.5o	15.91
Control	-	1o2	96	81	15.63	7o.37	94.74	52.94

- Effect of sub - lethal doses on pupae of exposed adults :-

In all treatments, the percentage pupation was lower than control. The difference however was small between monocrotophos treatment and control. In other treatments the difference was more pronounced. The percentage pupation for the other three insecticidal treatments in a descending order was pirimicearb, malathion and Cypermethrin, respectively.

- Effect on emergance of new adults :-

The percentage of adults of C. Carnea emerging from pupae was slightly lower among treatments than in the control. Between treatments there were little differences with the exception of cypermethrin, which was somewhat higher than other treatments.

The above findings may be summed in the final column in table 16 which gives the percentage of adults emerging from the eggs laid. It is noticeable from this column that this percentage was very low in monocrotophos. In pirimicarb and cypermethrin it was more or less similar, and slightly higher in ma lathion. In all cases, however, it did not reach 50 percent of the control. This

depression of all numbers in the next generation cannot be attributed to latent mortalities, since this was compensated by higher rates of oviposition (Table 15). In the case of monocrotophos, the main depressing factor may be the very high percentage of egg failing to hatch. In malathion, pirimicarb and cypermethrin the factor responsible for reducing the ensuing numbers were mostly high larval mortalities and/or failure to pupate.

3: Successive generation produced from adults treated by sub-lethal doses :-

Results tabulated in table 17 indicate that sub-lethal doses of monocrotophos, malathion, pirimicarb and cypermethrin Killed 35, 40, 24 and 5%, respectively of the exposed adults of C. Carnea after 6 days of treatment.

The final number of the new emerged adults were 11.1, 62.9, 44.4 and 38.8% of the control as compared to adults treated with monocrotophos, malathion, Pirimicarb and cypermethrin respectively.

Results also show that monocrotophos could inhibit partially the development of the next generation, while the other insecticides showed possibility to develop the next generation at the rate of 1.7 : 1 in the case of pirimicarb, and 2.1 : 1 in the case of cypermethrin, while malathion treatment resulted in the development of the next generation in a proportion equal to that of the untreated control at the rate of 3 : 1.

It is clear from the results that while the number of survivors after 6 days were 13 in the case of monocrotophos and the number of adults were 12 inthe case of

Table 17

Succession in generation development of Chrysopa carnea (*Adult to adult) following exposure of starting adults to sub-lethal doses of some insecticides

Insecticides	Conc ppm	Nº of start. adult*	Nº of survi. 6 days after exposure	Nº of new emerged adults	Average of pairs of adults produced from one pair of surviving adults
Monocrotophos	3.9	2o	13	6	o.46
Malathion	9.4	2o	12	34	2.83
Primicarb	loo	2o	14	24	1.71
Cypermethrin	75	2o	lo	21	2.1
Control	-	2o	19	54	2.84

* Confirmed sex ratio 1 : 1

malathion, the percentage of new emerged adults when compared with control were very small in the first case 11.1%, while it was 62.9% in the second case. This means that the side effect of the sub-lethal dose on the new individuals (eggs, larvae, pupae and adults)is high in the case of monocrotophos followed by cypermethrin and pirimicarb while malathion was the least effective insecticide regarding the side effect of its sub-lethal doses.

It may be concluded that although the exposure of this predator in the field to insecticides may not be lethal per ce, but it may have deleterious effect on the vitality of survivors, resulting in an additional factor to be added to acute poisoning and accentuate the population depression after insecticidal treatment. This probability is important enough to deserve detailed investigations.