RESULTS

RESULTS

1- Analysis of the soil used:

Analysis of the soil used in all experiments:

a) Mechanical analysis

clay %	63.2
silt %	28.0
sand %	8.8

type of soil clay soil.

b) Microbical analysis

Total microflora / 1 gram	1730,000
Actinomycetes / gram	763,000
Fungi / gram	50,000

c) Chemical analysis

PH	7.7
Electric conductivity	0.14
CO_3^{--} meg./L	2.10
Ca^{++} meg./L	0.63
Na^{+} meg./L	1.96
SO_4 meg./L	0.17
Cl^{-} meg./L	0.57
Mg^{++} meg./L	0.17
K^{+} meg./L	0.08

2- Effect of insecticide residues in soil on broad beans (*Vicia faba* L.)

a) Effect on germination:

Table (1) and Figure (1) indicate that decamethrin did not affect germination. The percentage of germination varied between 95-100% at all concentrations used.

Same results were obtained by cypermethrin, while in the case of fenvalerate the percentage of germination decreased at all the concentration tested. The percentage of decrease varied between 5 to 15%.

Triazophos had an adverse effect on germination. The percentage of decrease varied between 5 to 17%. This effect on germination was noticed at all concentrations used.

Mephosfolan caused a decrease in the percentage of germination at concentrations 20, 40 and 80 ppm, while it had no effect at the other concentrations.

DDT did not effect the germination at all concentrations tested except at concentration 20, and 40 ppm.

Results tabulated in table (2) and fig. (2) indicated that disulfoton and demeton severly decreased the percenage of germination. At high concentrations more than 30 ppm, the percentage of decrease varied between 20 to 30%.

Lindane had no effect on germination when its concentration was less than 30 ppm. But at high concentrations (40 and 50 ppm.) the percentage of decrease was about 15%.

TABLE (1) : Effect of some insecticide residues on germination of broad bean Vicia faba L.

CNCENTRATION OF INSECTICIDES IN (ppm)	DECAMETHRIN		CYPERMETHRIN		FENVALERATE		TRIAZOPHOS		MEPHOSFOLAN		D D T	
	% Germination	% Increase or decrease.	% Germination	% Increase or decrease.	% Germination	% Increase or decrease.	% Germination	% Increase or decrease.	% Germination	% Increase or decrease.	% Germination	% Increase or decrease.
10	95	-5	98	-2	90	-10	83	-17	98	-2	98	-2
20	100	00	98	-2	95	-5	88	-12	90	-10	83	-17
40	100	00	98	-2	85	-15	95	-5	90	-10	90	-10
60	98	-2	98	-2	88	-12	95	-5	93	-7	93	-7
80	98	-2	95	-5	95	-5	88	-12	90	-10	100	00
100	98	-2	100	00	90	-10	88	-12	95	-5	100	00
Check	100	00	100	00	100	00	100	00	100	00	100	00

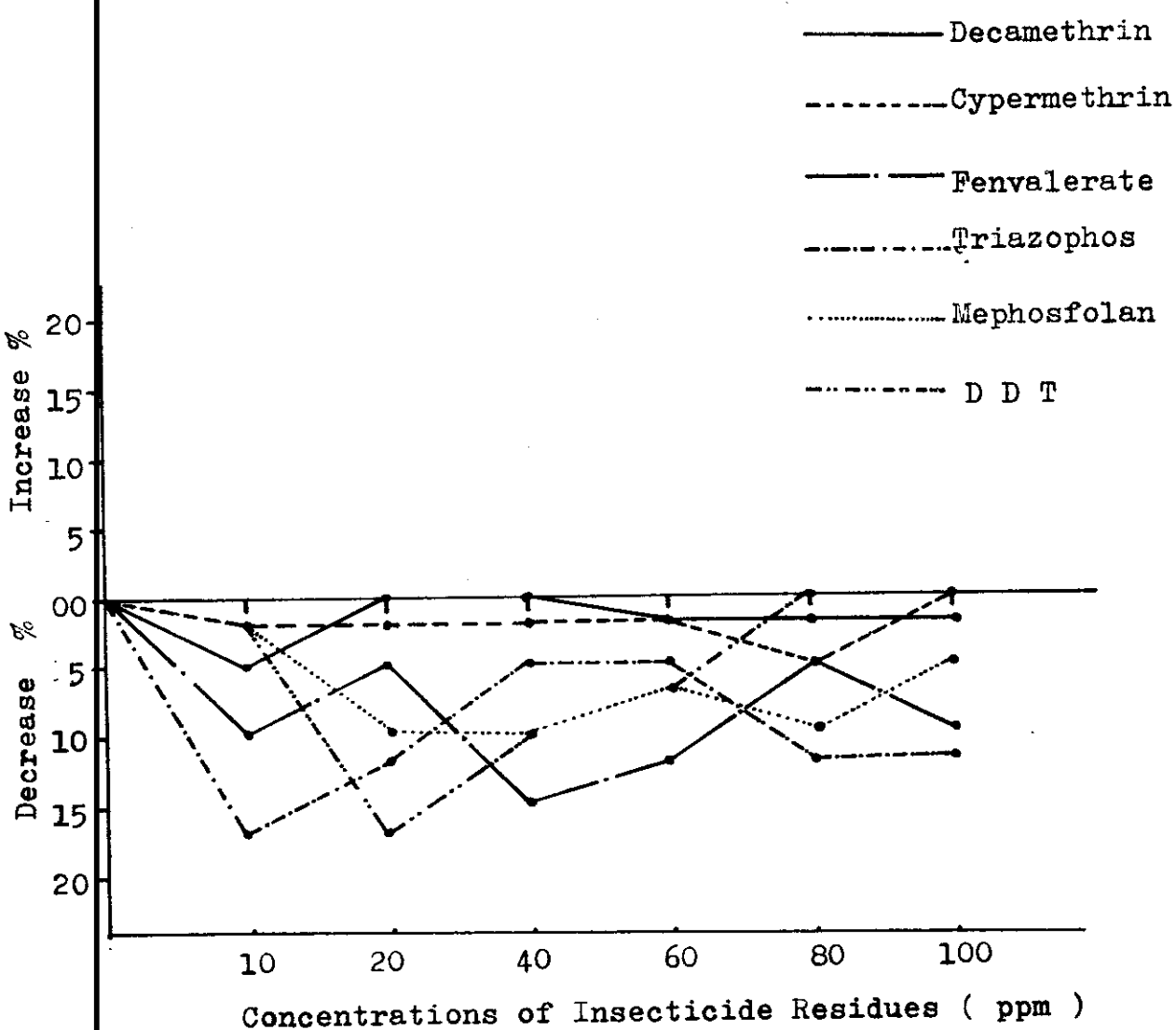

Fig.(1) Effect of some insecticide residues on germination of broad bean Vicia faba .

TABLE (2) : Effect of some insecticide residues on germination of broad bean Vicia faba L.

CONCENTRATION OF INSECTICIDES IN (ppm)	LINDANE		DISULFOTON		DEMETON	
	% Germination	% Decrease	% Germination	% Decrease	% Germination	% Decrease
5	100	00	100	00	100	00
10	95	-5	95	-5	100	00
20	100	00	95	-5	85	-15
30	100	00	80	-20	80	-20
40	85	-15	75	-25	70	-30
50	85	-15	80	-20	70	-30
Check	100	00	100	00	100	00

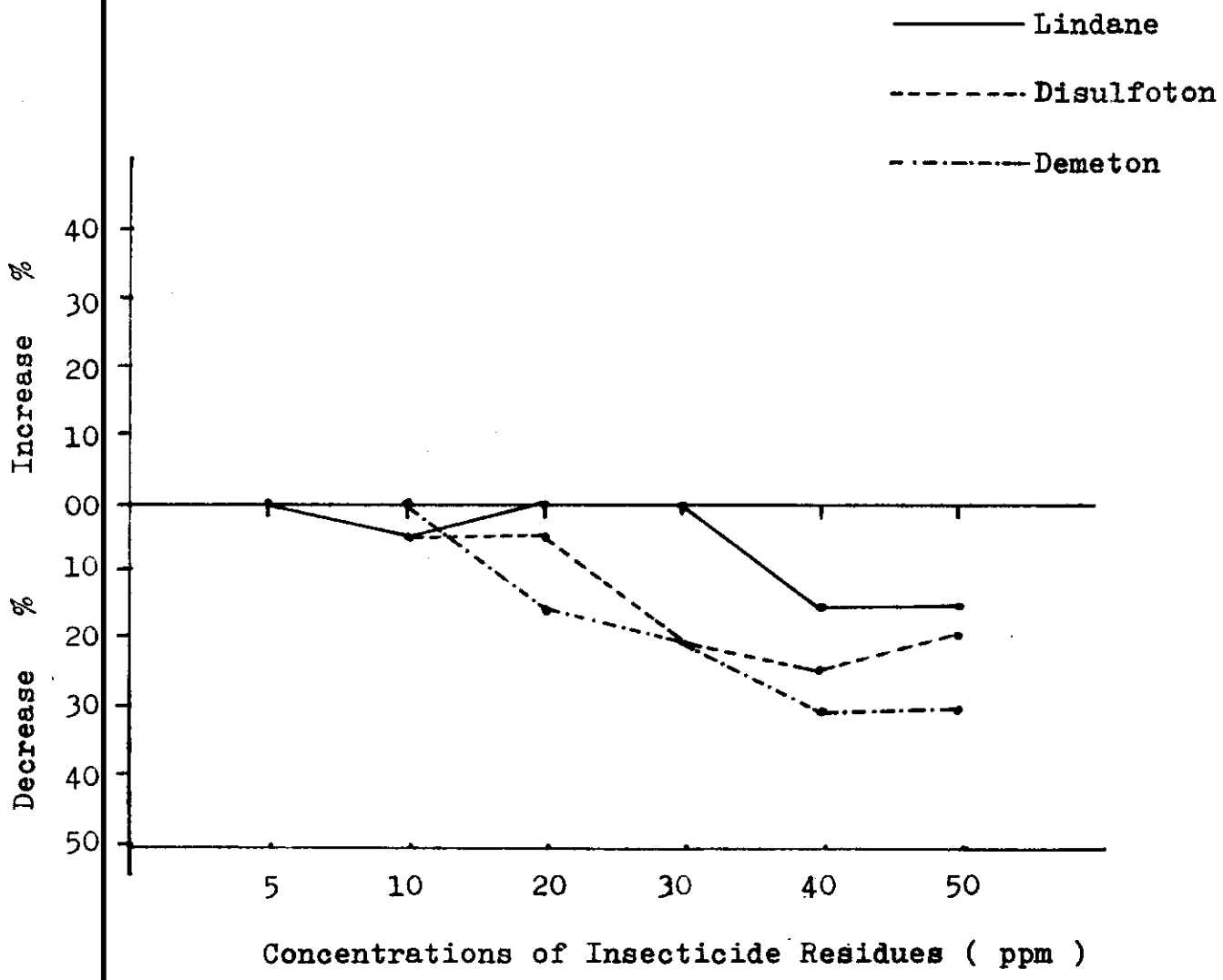

Fig.(2) Effect of some insecticide residues on germination of broad bean Vicia faba .

b) Effect on the growth:

Results tabulated in table (3) and fig.(3 & 4) showed that both decamethrin and cypermethrin increased the length of stem at all concentrations used except at the rate of 100 ppm in the case of cypermethrin. The length of root, however, was decreased by all the concentrations used of both insecticides.

The range of decrease varied between 14.4% to 28.9% in case of cypermethrin figure (5), while in decamethrin treatments the range of decrease varied between 9.8% to 20.7%.

Statistical analysis of variance indicated that decamethrin caused a significat increase in stem growth at $p = 0.01$.

There was a highly significant difference between check and (60 & 80 ppm) concentration, a significant difference between check and 40 ppm concentration and between 100 ppm and (60 & 80 ppm) concentration, a non significant difference between check and (10, 20, 40 & 100 ppm) concentration and between 10, 20, 40 and 100 ppm concentrations in the case of decamethrin.

The increase recorded when cypermethrin was used was not significant statistically.

TABLE (3): Effect of some insecticide residues on stem and root growth of broad bean, *Vicia faba* L.

CONCENTRATION OF INSECTICIDES IN (ppm)	DECAMETHRIN STEMS		CYPERMETHRIN STEMS		DECAMETHRIN ROOTS		CYPERMETHRIN ROOTS	
	Mean length of stem in cm.	% Increase or decrease.	Mean length of stem in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.
10	24.3	+ 9.2	23.5	+ 5.6	14.9	- 20.7	15.5	-20.2
20	24.5	+10.1	23.7	+ 6.5	14.9	- 20.7	15.5	-17.3
40	25.3	+13.7	22.6	+ 1.8	16.9	- 9.8	13.3	-28.9
60	25.9	+16.4	23.4	+ 5.4	15.5	- 17.5	16.0	-14.9
80	26.1	+17.6	24.2	+ 8.9	16.5	- 11.9	16.1	-14.4
100	23.3	+ 4.7	21.0	- 5.6	16.3	- 13.0	14.4	-23.1
Check	22.25		22.25		18.8		18.8	

	STEM		ROOT	
	DECAMETHRIN	CYPERMETHRIN	DECAMETHRIN	CYPERMETHRIN
L S D 5 %	2.49	n.s	n.s	3.56
L S D 1 %	3.39	n.s	n.s	4.84

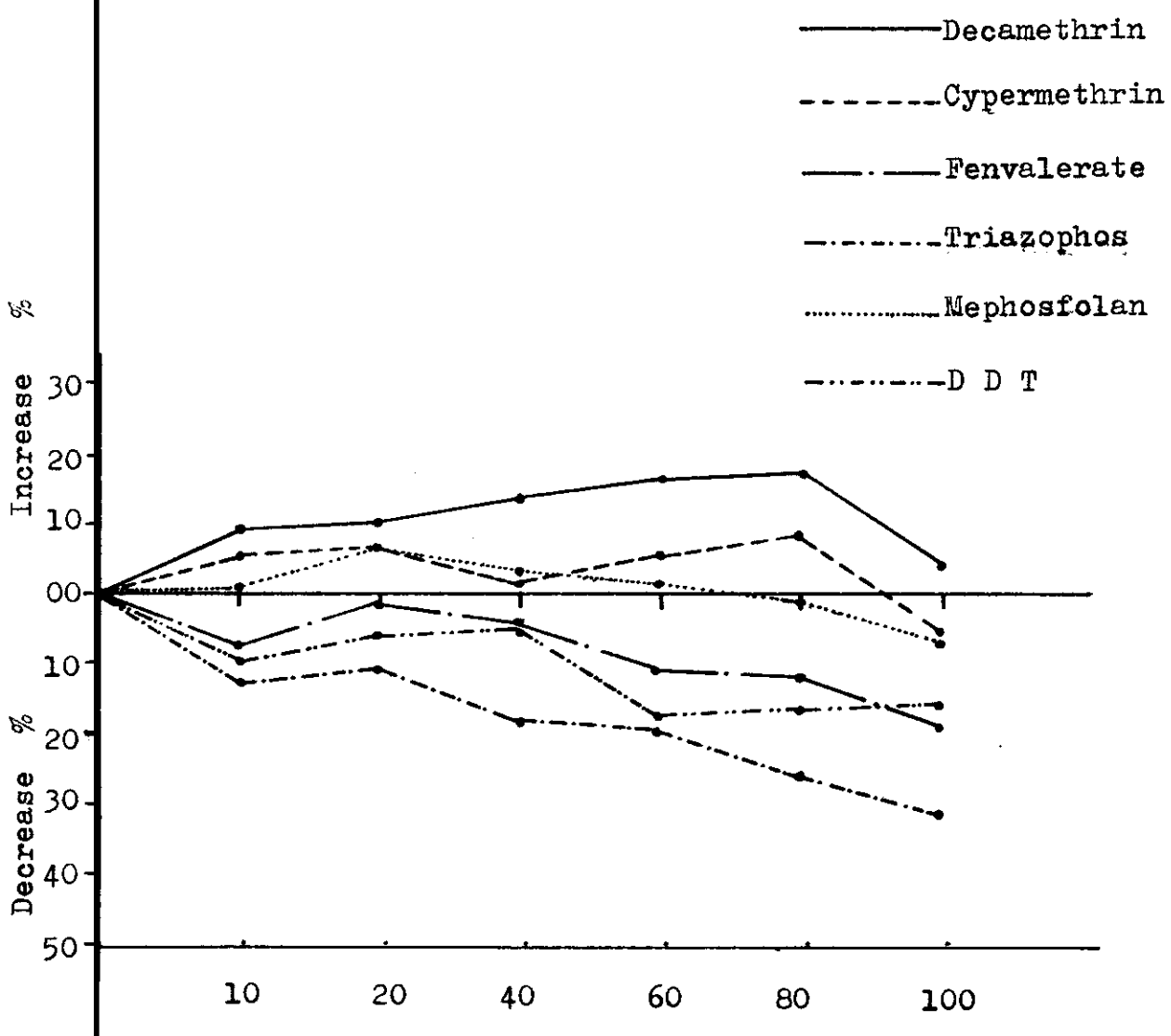

Fig.(3) Effect of some insecticide residues on stem growth of broad bean Vicia faba .

TABLE (4) : Effect of some insecticide residues on stem and root growth of broad bean Vicia faba L.

CONCENTRATION OF INSECTICIDES IN (ppm)	FENVALERATE STEMS		TRIAZOPHOS STEMS		FENVALERATE ROOTS		TRIAZOPHOS ROOTS	
	Mean length of stem in cm.	% Increase or decrease.	Mean length of stem in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.
10	30.2	- 7.6	28.6	-12.5	31.7	- 9.6	34.8	- 0.6
20	32.1	- 1.9	29.2	-10.8	27.9	-20.3	35.2	- 0.4
40	31.2	- 4.6	26.9	-17.8	29.0	-17.3	35.4	- 0.9
60	29.2	-10.8	26.3	-19.7	27.0	-22.9	32.5	- 7.2
80	29.0	-11.5	24.4	-25.5	27.2	-22.4	29.0	-17.1
100	26.5	-18.9	22.5	-31.3	23.3	-33.4	26.3	-24.9
Check	32.75		32.75		35.05		35.05	

	STEM		ROOT	
	FENVALERATE	TRIAZOPHOS	FENVALERATE	TRIAZOPHOS
L S D 5%	2.76	2.42	3.85	4.36
L S D 1%	3.76	3.29	5.25	5.93

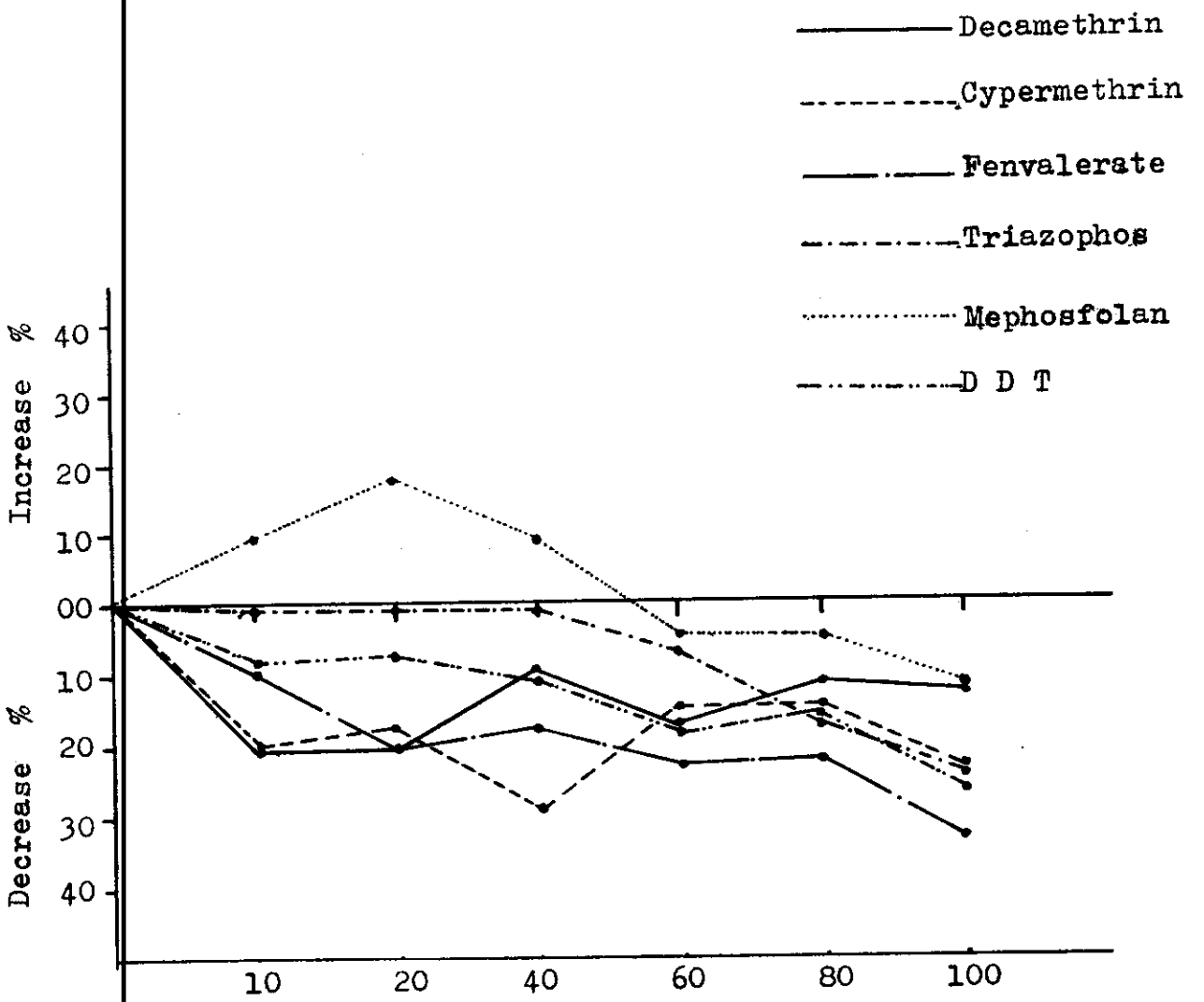

Fig.(4) Effect of some insecticide residues on root growth of broad bean Vicia faba .

Statistical analysis of variance indicated that cypermethrin significantly decreased root growth, while decamethrin did not.

The decrease recorded with cypermethrin was significant at p = 0.01 and concentration of 40 ppm. There was a significant difference between check and (10, 20 & 100 ppm) concentrations, while the difference between check and (60 & 80 ppm) was not significant statistically. There was a non significant difference between all concentrations used from 10 to 100 ppm.

Results in table (4) and figure (3 & 4) indicate that both fenvalerate and triazophos decreased the length of stem. The stem length decreased at all concentrations when compared with the check

The percentage decrease was high in the case of triazophos, figure (6), it varied between 10.8 to 31.3%, while the percentage of decrease in the case of fenvalerate varied between 1.9 to 18.9%.

The two insecticides used also supressed the growth of roots. The affect increased by the increase of concentration,it varied between 9.6% to 33.4% in case of fenvalerate. While in the case of triazophos the supressing effect became apparent only at high concentrations (80 & 100 ppm).

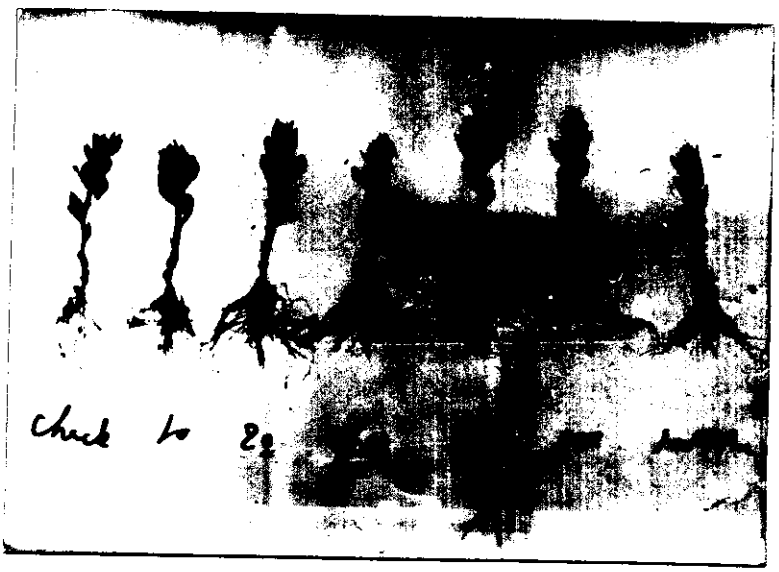

Fig. (5) Effect of Cypermethrin on stem and root growth of broad bean Vicia faba L.

Fig. (6) Effect of Triazophos on stem and root growth of broad bean Vicia faba L.

Analysis of variance indicated that fenvalerate and triazophos produced highly significant decrease in both stem and root length.

There was a highly significant difference between check and 100 ppm concentration, and between 100 ppm and (20 & 40 ppm) concentration, a significant difference between check and (60 & 80 ppm) concentration, between 100 ppm and 10 ppm concentration, and between 20 ppm and (60 & 80 ppm) concentration, non significant difference between check and (10, 20 & 40 ppm) concentrations, between (10, 20 & 40 ppm), between (10, 40, 60 & 80 ppm) concentrations, and between (60, 80 & 100 ppm) concentrations, in case of fenvalerate.

Triazophos caused significant reduction in stem length at p = 0.01 with all concentrations used from 10 to 100 ppm. There was a highly significant difference between check and (10 to 100 ppm), between 100 ppm and (10 & 20 ppm). There was a significant difference between 80 ppm and 40 ppm, 60 ppm and 20 ppm, and a non significant difference between (10, 20 & 40 ppm), between (10, 20, & 60 ppm), between (60 & 80 ppm), between (80 & 100 ppm), fenvalerate reduced significantly the root length at p = 0.01 when concentrations 20 to 100 ppm were used.

There was a highly significant difference between check and 20 to 100 ppm concentration, and between 100 ppm and

TABLE (5) : Effect of some insecticide residues on stem and root growth of broad bean Vicia faba L.

CONCENTRATION OF INSECTICIDES IN (ppm)	MEPHOSFOLAN STEMS		D D T STEMS		MEPHOSFOLAN ROOTS		D D T ROOTS	
	Mean length of stem in cm.	% Increase or decrease.	Mean length of stem in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.
10	28.9	+ 0.2	26.0	- 9.7	34.4	+ 9.7	28.9	- 7.8
20	30.7	+ 6.4	27.1	- 6.0	37.0	+18.0	29.1	- 7.0
40	29.7	+ 3.1	27.5	- 4.5	34.4	+ 9.9	28.0	-10.5
60	29.3	+ 1.7	23.8	-17.3	30.0	- 4.1	25.4	-18.9
80	28.6	- 0.9	24.1	-16.3	29.8	- 4.9	26.3	-16.1
100	26.8	- 6.9	24.4	-15.4	27.6	-11.9	23.1	-26.3
Check	28.85		28.85		31.35		31.35	

	STEM		ROOT	
	MEPHOSFOLAN	D D T	MEPHOSFOLAN	D D T
L S D (5%):	n.s.	3.14	n.s.	5.0
L S D (1%):	n.s.	4.27	n.s.	6.81

(10 & 40 ppm), a significant difference between 10 ppm and (60 & 80 ppm), between 100 ppm and 80 ppm, a non significant difference between check and 10 ppm, between (10, 20 & 40 ppm), between (20, 40, 60 & 80 ppm) and between (100 & 60 ppm).

Triazophos significantly reduced root growth at p = 0.01 with concentrations 80 and 100 ppm. There was a significant difference between check and (80 & 100 ppm), between 100 ppm and 10, 20, 40 & 60 ppm), and between 80 and (20 & 40 ppm), at p = 0.01,a significant difference between 10 and 80 ppm, at p = 0.05, and a non significant difference between (check, 10, 20, 40 & 60 ppm), between 60 and 80 ppm, and between 100 and 80 ppm.

The effects of mephosfolan and DDT on the stem and root growth of broad bean grown in polluted soils is given in table 5 and figures 3 & 4.

Mephosfolan increased the stem length at cencentrations ranging between (10 - 60 ppm). The increase of concentration beyond this level caused a decrease in stem length (80 and 100 ppm).

Figure (7) indicate that mephosfolan had a phytotoxic effect on broad beens. At high concentration more than 40 ppm, the edges of plant leaves were burnt.

DDT decreased the stem length at all concentrations used. The percentage of decrease varied between 4.5% to 17.3%.

Mephosfolan increased the root length figure (7) at low concentrations (10, 20 and 40 ppm), while it slightly decreased the root length at the other concentrations. DDT decreased the root length figure (8) at all concentrations tested and this decrease varied between 7% to 26.3%.

Analysis of variance indicated that DDT significantly decrease both stem and root growth, while mephosfolan did not.

DDT caused highly significant decrease in stem growth at 60, 80 and 100 ppm. The decrease at 10, 20 and 40 ppm was not significant. There was a significant difference between 60 ppm and (20 & 40 ppm), between (40 & 100 ppm), and between (40 & 80 ppm), a non significant difference between (10, 20 & 40 ppm), between (60, 80 & 100 ppm) between (20, 100 & 80 ppm), and between (10, 80 & 100 ppm.

DDT caused a highly significant decrease in root growth at 100 ppm and a significant decrease at 80 ppm compared to the untreated check. The difference between treatments receiving 100 ppm and the receiving 10 and 20 ppm was also significant. Non significant difference were found between (10, 20, 40, 60 & 80 ppm), between (check, 10, 20 & 40 ppm) and between 100 ppm and (40, 60 & 80 ppm) concentrations.

Fig. (7) Effect of Mephosfolan on stem and root growth of broad bean Vicia faba L.

Fig. (8) Effect of D D T on stem and root growth of broad bean Vicia faba L.

Results presented in table (6) and fig. (9) & (10) indicate that lindane had severely affected the growth of root. It decreased the length of root by 89.2% at concentration 50 ppm. (fig. 10).

At all concentrations tested lindane decreased the growth of root. It inhibited the secondary root development.

It is clear also from the same table and figures that lindane decreased the stem growth at all concentrations tested while disulfoton and demeton had slight effect on stem growth.

Phytotoxic effect of lindane was clear. At high concentrations the stem was stunted, and the leaves were twisted. Browning of parts of leaf edges was observed and small brown spots in the middle of the leaves appeared

The root growth was conspicuously inhibited specially at high concentration. Club-shaped tips of the root appeared at concentrations more than 20 ppm. The insecticde inhibited secondary root development (figure 11).

Disulfoton decreased the growth of leaves and stem, figure(12). However the plants appeared to be more heathly at all concentrations tested. No phytotoxic effect was detected on the vegetative parts.

TABLE (6) : Effect of some insecticide residues on stem and root growth of broad bean Vicia faba L.

CONCENTRATION OF INSECTICIDES IN (ppm)	Effect on root						Effect on stem					
	LINDANE		DISULFOTON		DEMETON		LINDANE		DISULFOTON		DEMETON	
	Mean length of root in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.	Mean length of stem in cm.	% Increase or decrease.	Mean length of stem in cm.	% Increase or decrease.	Mean length of stem in cm.	% Increase or decrease.
5	9.3	-56.3	14.1	-33.8	18.3	-14.0	21.7	-15.6	23.5	-8.6	26.4	+ 2.7
10	15.7	-26.3	13.9	-34.7	16.7	-21.5	20.8	-19.0	24.2	-5.8	25.6	- 0.3
15	11.6	-45.5	—	—	—	—	17.3	-32.7	—	—	—	—
20	5.3	-75.0	16.2	-23.9	17.1	-19.7	21.1	-17.9	26.7	+3.9	25.6	- 0.3
30	6.8	-68.0	14.7	-30.9	16.8	-21.0	15.4	-40.0	27.1	+5.4	28.9	+12.5
40	6.8	-68.0	14.1	-33.8	16.5	-22.5	13.2	-48.6	25.3	-1.6	27.6	+ 7.4
50	2.3	-89.2	14.1	-33.8	10.7	-49.7	9.7	-62.3	26.2	+1.9	23.7	- 7.8
Check	21.3		21.3		21.3		25.7		25.7		25.7	

	LINDANE	DISULFOTON	DEMETON	LINDANE	DISULFOTON	DEMETON
L S D (5%)	1.93	1.92	2.18	1.9	1.48	1.53
L S D (1%)	2.54	2.55	2.87	2.5	1.96	2.01

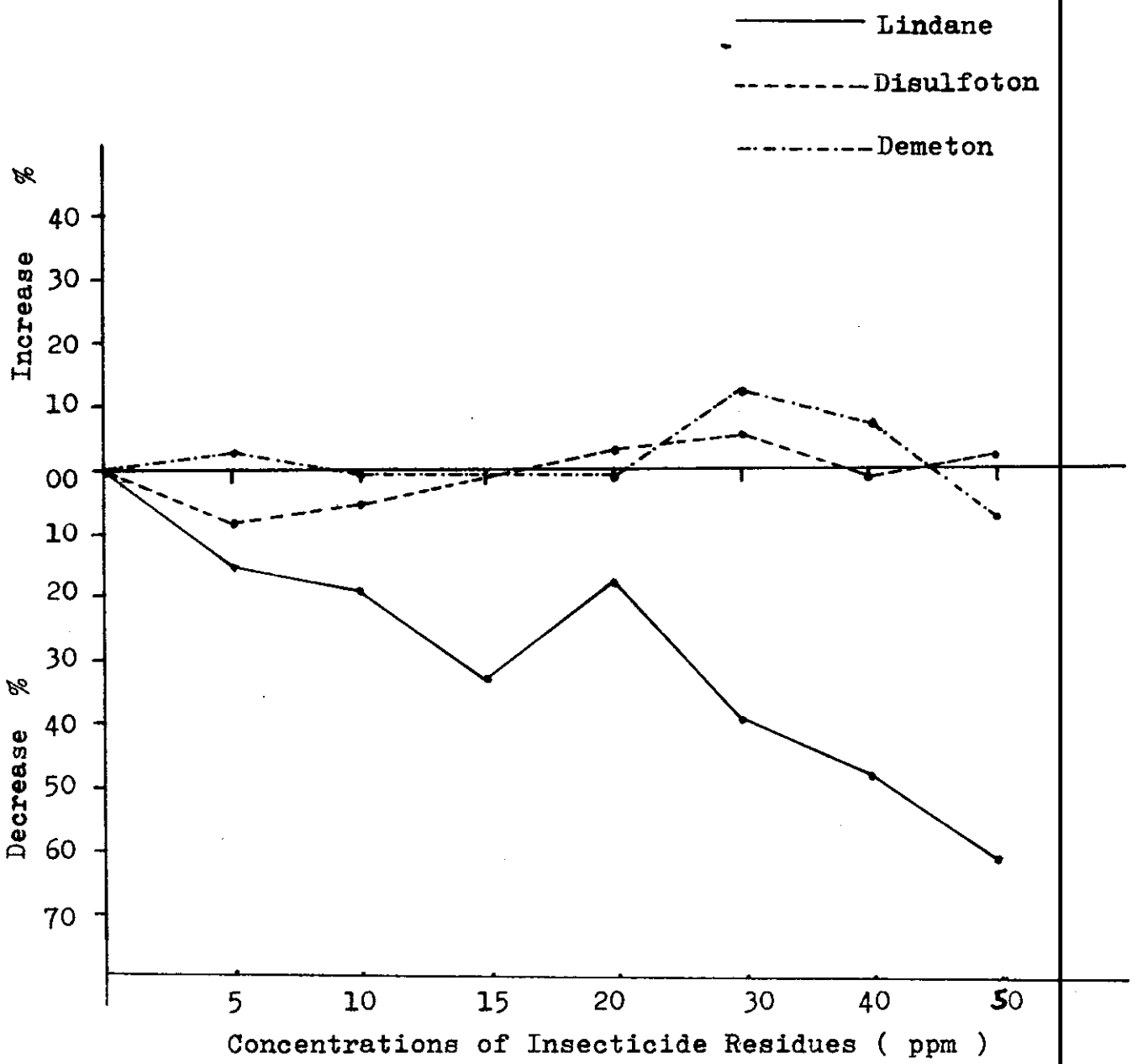

Fig.(9) Effect of some insecticide residues on stem growth of broad bean Vicia faba .

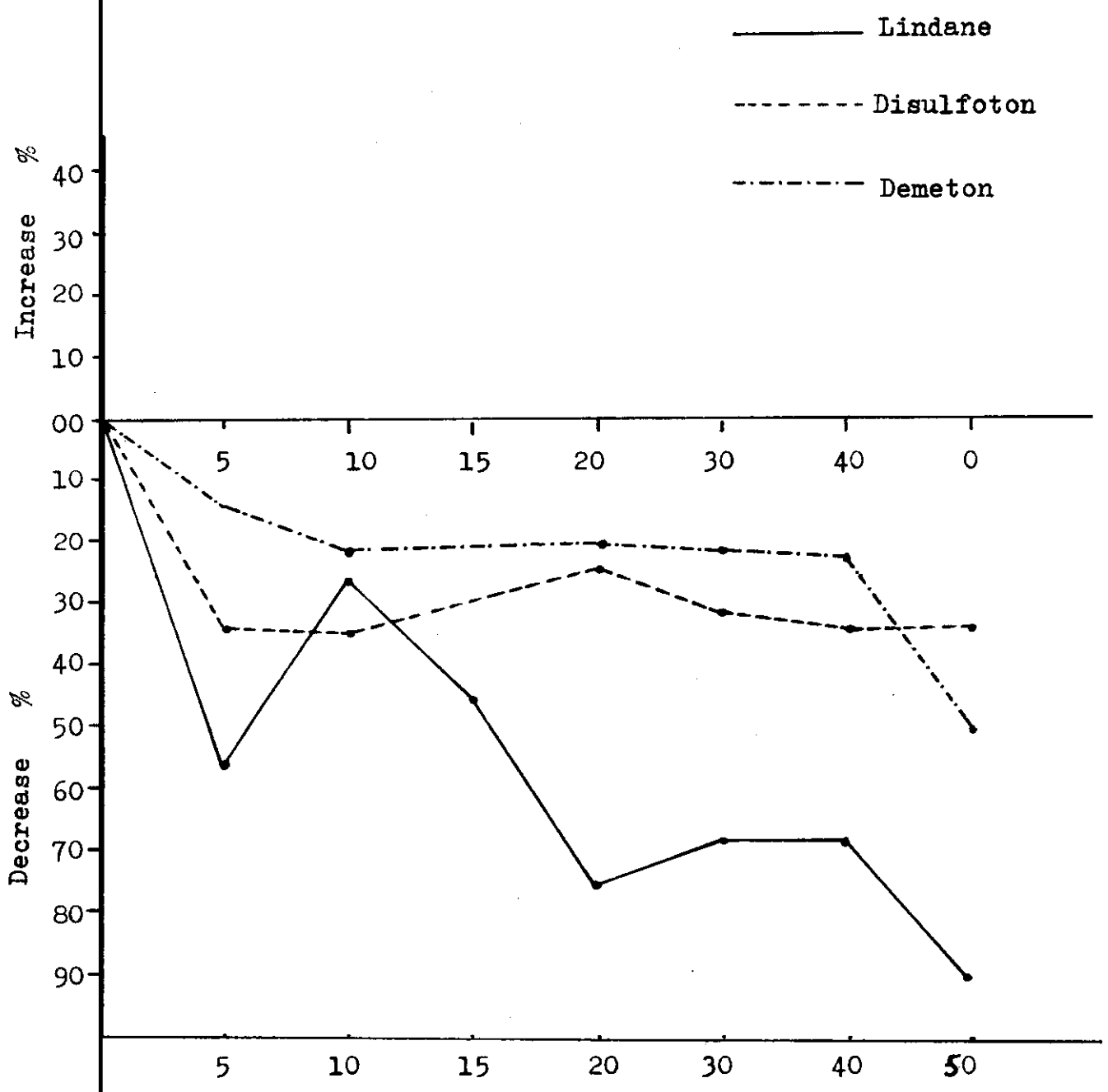

Fig. (10) Effect of some insecticide residues on root growth of broad bean Vicia faba .

Fig. (11) Effect of different concentrations of lindane on the growth of broad bean.

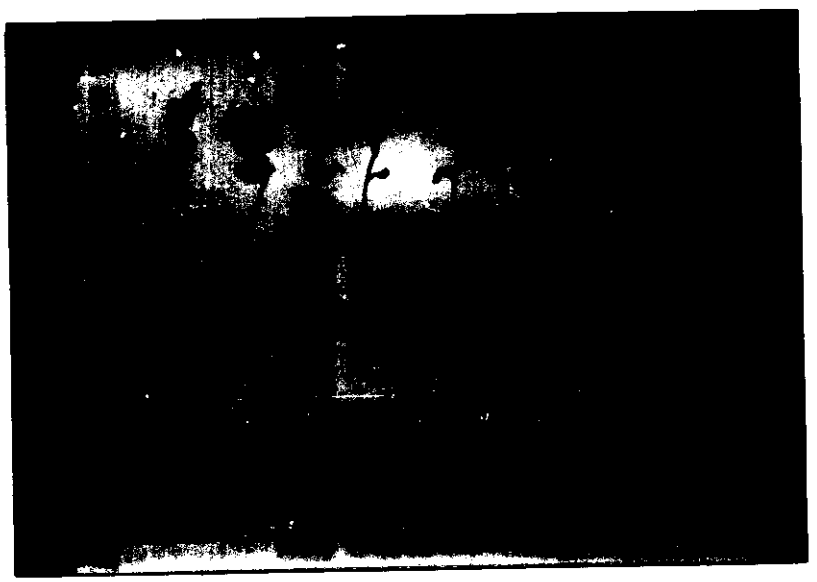

Fig. (12) Effect of different concentrations of disulfoton on the growth of broad bean.

Disulfoton inhibited root growth but without any effect on secondary root development. It was noticed however that it induced some increased in secondary root development specially at the low concentrations of (5 ppm) and high concentration of (50 ppm).

Demeton decreased the growth of root (figure 13) at all concentrations tested. The percentage of decrease was proportional to the increase concentration. At (50 ppm) the root growth was decreased by 49.7%, compared to check. This insecticide had a slight depressing effect on stem growth which was noticed at most of the concentrations used.

Demeton had nearly no effect on secondary root development and caused no remarkable phytotoxic effects on the leaves.

Statistical analysis of variance indicated that lindane decreased stem growth at all concentrations tested and the decrease was highly significant.

There was a highly significant difference between check and all concentrations tested, between 5 ppm and (15, 30, 40 & 50 ppm), between 10 ppm and (15, 30, 40 50 ppm), between 15 ppm and (20, 40 & 50 ppm), between 20 ppm and (30, 40 & 50 ppm), between (30 & 50 ppm) and

Fig. (13) Effect of different concentrations of Demeton on the growth of broad bean.

between (40 & 50 ppm), a significant difference between (15 & 30 ppm), and between (30 & 40 ppm), a non significant difference between 5 ppm and (10 & 20 ppm), and between (10 & 20 ppm).

Lindane decreased root growth at all concentrations tested and the decrease was highly significant.

There was a highly significant difference between check and all concentrations tested, between 5 ppm and (10, 20 & 50 ppm), between 10 ppm and (15, 20, 30, 40 & 50 ppm), between 15 ppm and (20, 30, 40, & 50 ppm), between (20 & 50 ppm); between (30 & 50 ppm) and between (40 & 50 ppm), a significant difference between 5 ppm and (15, 30 & 40 ppm), a non significant difference between 20 ppm and (30 & 40 ppm) and between (30 & 40 ppm).

Disulfoton caused a highly significant decrease in stem growth at the concentration of 5 ppm only.

There was a highly significant difference between (check & 5 ppm), between 5 ppm and (20, 30 & 50 ppm), between 10 ppm and (20, 30 & 50 ppm), a significant difference between (5 & 40 ppm) and between (30 & 40 ppm) a non significant difference between check and (10, 20, 30, 40 & 50 ppm), between (5 & 10 ppm), between (10 & 40 ppm), between 20 ppm and (30, 40 & 50 ppm), between (30 & 50 ppm), and between (40 & 50 ppm).

The same insecticide produced a decrease in root growth at all concentrations tested and the decrease was highly significant.

There was a highly significant difference between check and all concentrationstested, a significant difference between (5 & 20 ppm), between (10 & 20 ppm) and between 20 ppm and (40, 50 ppm), a non significant difference between 5 ppm and (10, 30, 40 & 50 ppm), between 10 ppm and (30, 40 & 50 ppm), between (20 & 30 ppm) and between (30, 40, 50 ppm).

The increase in stem growth noticed with demeton at 30 ppm was found to be highly significant. It significantly increased stem growth at 40 ppm, while at 50 ppm demeton significantly decreased stem growth.

There was a highly significant difference between (check & 30 ppm), between 5 ppm and (30, 50 ppm), between (10 & 30 ppm), between (20 & 30 ppm), between (30 & 50 ppm), and between (40 & 50 ppm), a significant difference between check and (40 & 50 ppm), between 10 ppm and (40 & 50 ppm) and between 20 ppm and (40 & 50 ppm), a non significant difference between check and (5, 10 & 20 ppm), between 5 ppm and (10, 20 & 40 ppm), between (10 & 20 ppm) and between (30 & 40 ppm).

Demeton decreased root growth at all concentrations tested,the difference was highly significant.

There was a highly significant difference between check and all concentration tested, between 50 ppm and (5, 10, 20, 30 & 40 ppm) a non significant difference between concentrations (5, 10, 20, 30 & 40 ppm).

c) Effect on flowering:

Table 7 and fig. 14 demonstrate the results of soil pollution with insecticides on the numbers of flowers produced by broad bean plants. It reveals that fenvalerate, triazophos and DDT decreased the number of flowers. The percentage of decrease varied in the case of fenvalerate (between 37.4% to 46.4%),in the case of triazophos it varied (between 26.8% to 41.3%) while in the case of DDT the range was between (30.1% to 67.9%)

The only case where an increase was recorded was that of mephosfolan at the concentration of 10 ppm only. In higher concentrations there was a decrease in the number of flowers ranging between 20.2% and 43%.

Statistical analysis of variance indicated the presense of a highly significantly decreased in flowering at all concentrationstested with fenvalerate and triazophos , while DDT decreased flowering with high significances at 20 to 80 ppm concentrations, it

TABLE (7) : Effect of some insecticide residues on flowering of broad bean Vicia faba L.

CONCENTRATION OF INSECTICIDES IN (ppm)	FENVALERATE		TRIAZOPHOS		MEPHOSFOLAN		D D T	
	Mean No. of flowers.	% Increase or decrease.	Mean No. of flowers.	% Increase or decrease.	Mean No. of flowers.	% Increase or decrease.	Mean No. of flowers.	% Increase or decrease.
10	7.35	-37.4	8.6	-26.8	10.1	+ 4.7	6.3	-34.2
20	7.2	-38.3	6.9	-41.3	7.3	-24.4	4.8	-49.7
40	6.9	-41.9	7.4	-36.6	7.7	-20.2	3.1	-67.9
60	6.8	-42.1	6.9	-40.9	5.5	-43.0	4.0	-58.5
80	7.1	-39.1	7.8	-33.2	6.6	-31.6	5.1	-47.2
100	6.3	-46.4	7.9	-32.3	6.9	-28.5	6.7	-30.1
Check	11.7		11.7		9.6		9.6	

	FENVALERATE	TRIAZOPHOS	MEPHOSFOLAN	D D T
L S D 5%	1.94	1.79	2.38	2.41
L S D 1%	2.64	2.44	3.24	3.28

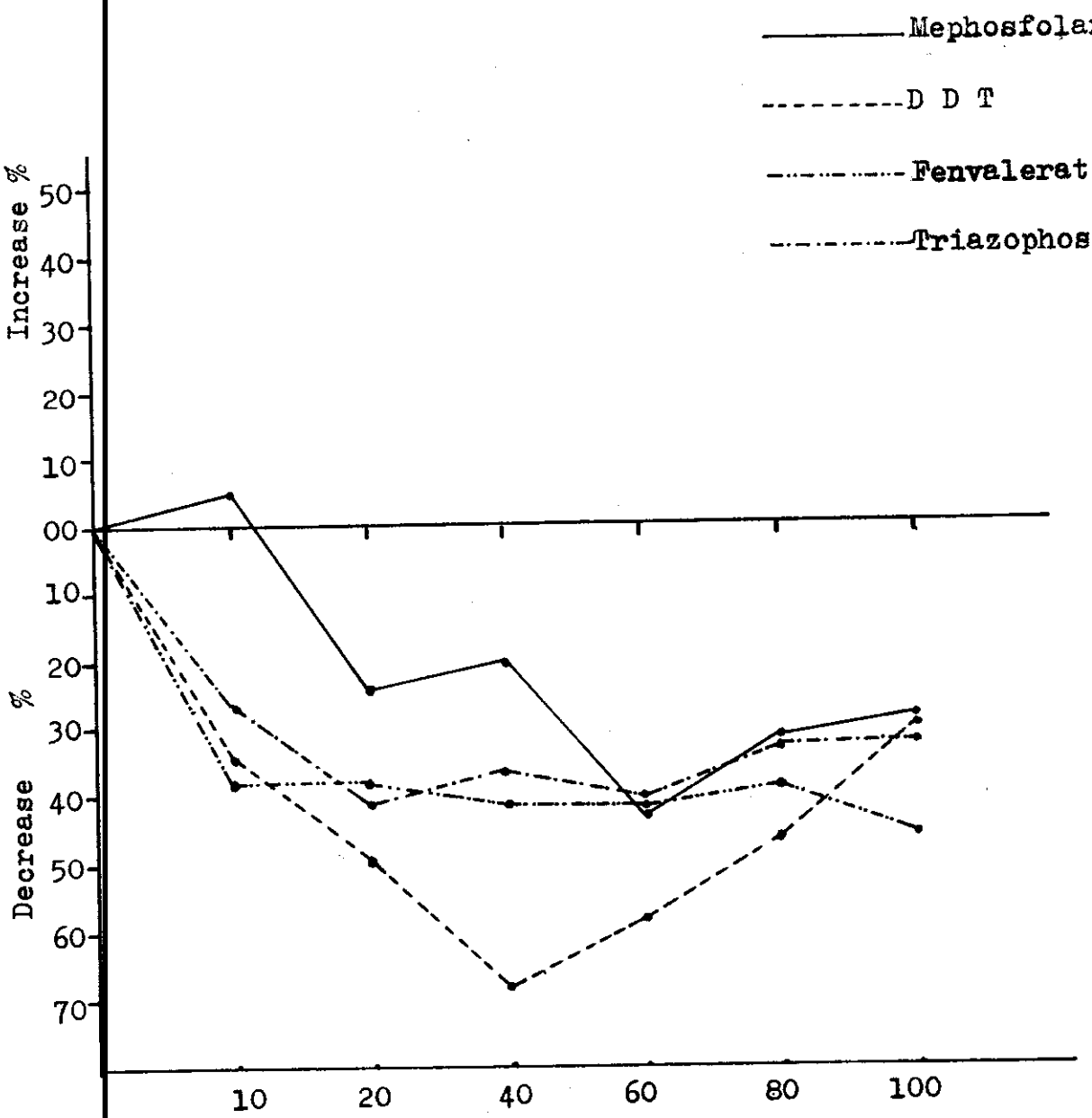

Fig.(14) Effect of some insecticide residues on flowering of bean Vicia faba .

significantly decreased flowering at 10 ppm and 100 ppm. Mephosfolan had no significant effect in increasing the number of flowers at the concentration of 10 ppm. The subsequent decrease in flowering recorded with 60 ppm was highly significant. This compound significantly decreased flowering at 80 and 100 ppm. Mephosfolan had no significant effect in decreasing the number of flowers at concentration 20 and 40 ppm. In case of fenvalerate there was a highly significant difference between check and all concentrations tested, but the differences within the concentrations used were not significant.

There was a highly significant difference between all concentrations tested and check in case of triazophos. No significant differences had been found between all concentrations tested (from 10 to 100 ppm).

When mephosfolan was used, it caused a highly significant difference between check and the concentration of 60 ppm, between 10 ppm and (60 & 80 ppm), and a significant difference between check and (80 & 100 ppm), and between 10 ppm and (20, 40 &100 ppm). No significant differenceswere found between check and (concentrations 20 & 40 ppm) or between (concentrations 20, 40, 80 & 100 ppm).

While in the case of DDT there was a highly significant difference between check and concentrations 20 ppm up to 80 ppm, between (40 ppm & 100 ppm), a significant difference between check and (10 & 100 ppm), between 60 ppm and 100 ppm, and between 10 ppm and 40 ppm, a non significant difference between 100 ppm and (10, 20 & 80 ppm), between 80 ppm and (10, 20, 40 & 60 ppm), between (10, 20 & 60 ppm) and between (20, 40 & 60 ppm).

d) Effect on the histology of root:

Cross section in the broad bean root under the light microscope (figure 15) show the following histological symptoms in the case of lindane, hypertrophy of cells, tearing of epidermis and cortex layer and spreaded necrotic flecks in the endodermis and pericycle layers, also presence of vacuoles. These symptoms become clear at high concentrations i.e. 50 and 100 ppm. While in the case of endrin (figure 16) tissues of the roots were affected at high concentrations (more than 50 ppm) . The presence of vacuoles, and necrotic flecks, were observed.

e) Effect on nodulation:

Results tabulated in table (8) and figure (17) show that decamethrin and cypermethrin increased the number of nodules at all concentrations tested. The percentage of

TABLE (8) : Effect of some insecticide residues on nodulation of broad bean Vicia faba L.

CONCENTRATION OF INSECTICIDES IN (ppm)	DECAMETHRIN		CYPERMETHRIN		FENVALERATE		TRIAZOPHOS		MEPHOSFOLAN		D D T	
	Mean No. of nodules.	% Increase or decrease.	Mean No. of nodules.	% Increase or decrease.	Mean No. of nodules.	% Increase or decrease.	Mean No. of nodules.	% Increase or decrease.	Mean No. of nodules.	% Increase or decrease.	Mean No. of nodules.	% Increase or decrease.
10	14.9	+84.6	15.1	+86.4	42.7	+ 3.6	47.8	+16.0	28.4	-35.7	32.4	-26.5
20	14.1	+74.4	13.2	+63.6	37.7	- 8.5	39.4	- 4.4	27.0	-38.8	32.7	-25.9
40	14.1	+74.1	15.6	+92.6	35.3	-14.3	36.9	-10.4	28.1	-36.2	25.9	-41.3
60	11.0	+36.4	9.9	+22.2	30.4	-26.1	33.7	-18.2	37.8	-14.3	25.8	-41.4
80	15.2	+88.3	11.6	+43.8	31.0	-24.8	31.2	-24.2	24.3	-44.9	24.8	-43.7
100	10.6	+31.5	9.1	+12.3	31.1	-24.3	24.8	-39.8	23.7	-46.3	20.2	-54.2
Check	8.1		8.1		41.2		41.2		44.1		44.1	

	DECAMETHRIN	CYPERMETHRIN	FENVALERATE	TRIAZOPHOS	MEPHOSFOLAN	D D T
L S D 5%	3.84	4.83	8.5	7.88	5.3	4.26
L S D 1%	5.22	6.75	11.58	10.73	7.21	5.79

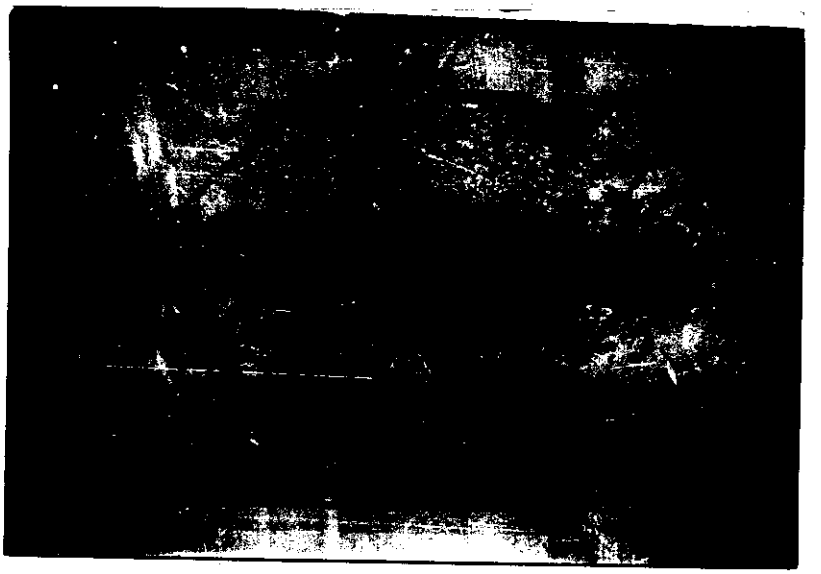

Fig. (15) Transection in a bean root grown in soil treated with 100 ppm of lindane.

Fig. (16) Transection in a bean root grown in soil treated with 100 ppm of endrin.

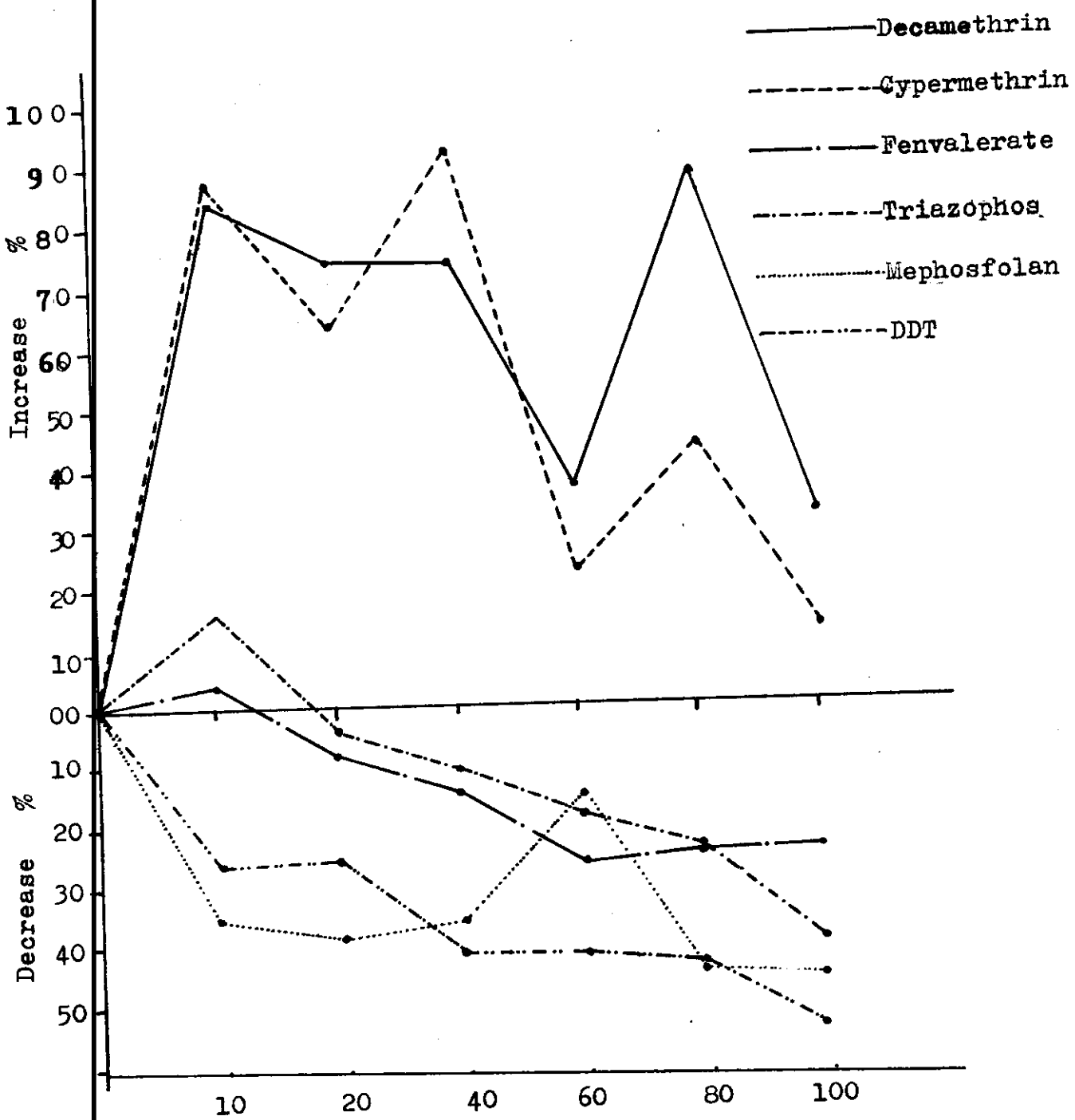

Fig. (17) Effect of some insecticide residues on nodulation of bean Vicia faba.

increase ranged between (31.5% and 88.3%) in the case of decamethrin and (12.3% to 92.6%) in the case of cypermethrin.

While on the other hand fenvalerate, triazophos, mephosfolan and DDT inhibited nodulation in the root of broad beans.

At all concentrations the number of nodules decreased except at concentration 10 ppm in the case of triazophos and fenvalerate.

The percentage of decrease varied between, (8.5% to 26.1%); (4.4% to 39.8%); (14.3% to 46.3%), and (25.9% to 54.2%) in the case of fenvalerate, triazophos, mephosfolan and DDT respectively.

Statistical analysis indicated that decamethrin caused highly significant increase in nodulation at 10, 20, 40 and 80 ppm concentrations. There was a significant difference between 10 ppm and (60 & 100 ppm), between (60 & 80 ppm) and between (80 ppm & 100 ppm), a non significant difference between check and (60 & 100 ppm), between 10 ppm and (20, 40 & 80 ppm), between 20 ppm and (40, 60, 80 & 100 ppm) between 40 ppm and (60, 80 & 100 ppm) and between (60 & 100 ppm).

Cypermethrin produced a highly significant increase in nodulation at (10 & 40 ppm concentration). There was a significcant difference between check and 20 ppm, between 10 ppm and (60 & 100 ppm), between 40 ppm and (60 & 100 ppm), a non significant difference between check and (60, 80 & 100 ppm), between 10 ppm and (20, 40 & 80 ppm), between 20 ppm and (40, 60, 80 & 100 ppm), between 40 ppm and 80 ppm, between 60 ppm and (80 & 100 ppm), and between (80 & 100 ppm).

Fenvalerate significantly decreased nodulation at 60, 80 and 100 ppm concentrations. There was a highly significant difference between 10 ppm and (60 & 80 ppm), there was a significant difference between check and (60, 80 & 100 ppm), and between 10 and 100 ppm, The differences were not significant between check and (10, 20 & 40 ppm) between 10 ppm and (20 & 40 ppm), and between (20, 40, 60, 80 & 100 ppm).

Triazophos reduced nodulation and reduction was highly significant at the concentration of 10 ppm. When compared to check also the differences were highly significant between 10 ppm and (40, 60, 80 & 100 ppm), between 20 ppm and 100 ppm, between (40 and 100 ppm), a significant difference was found between (check & 80 ppm), between (10 & 20 ppm), between (20 & 80 ppm), and between (60 ppm & 100 ppm). The

differences were not significant between check and (10, 20, 40 & 60 ppm), between 20 ppm and (40 & 60 ppm), between 40 ppm and (60 & 80 ppm), between (60 & 80 ppm), and between (80 & 100 ppm) concentrations.

Mephosfolan significantly decreased nodulation at all concentrations tested at p = 0.01. The exception was at concentration of 60 ppm where reduction was significant at p = 0.05. There was a highly significant difference between check and all concentration tested except at 60 ppm, between (10 & 60 ppm), between (20 & 60 ppm), between (40 & 60 ppm), between 60 ppm and (80 & 100 ppm), a significant difference between (10 & 60 ppm), a non significant difference between 10 ppm and (20, 40, 80 & 100 ppm), between 20 ppm and (40, 80 & 100 ppm), between 40 ppm and (80 & 100 ppm), and between (80 & 100 ppm) concentrations.

DDT decreased nodulation at all concentrations tested and the decrease was highly significant. There was a highly significant difference between check and all concentration from (10 to 100 ppm), between 10 ppm and (40, 60, 80 & 100 ppm), between 20 ppm and (40, 60, 80 & 100 ppm), a significant difference between 100 ppm and (40, 60 & 80 ppm), a non significant difference between (10 & 20 ppm), and between (40, 60 & 80 ppm) concentrations.

f) Absorption and translocation of insecticide residues by broad bean plants:

Results in table (9) show that both lindane and endrin were dectected in all samples taken from the different parts of broad bean plants cultivated in the treated soils.

Roots contained high quantities of pesticide residues in both cases than the stem and leaves.

While the lower leaves contained a high quantity of endrin than in the other parts. Stems in both cases were the lowest in their content of insecticide residues. Lindane was detected in high quantity in upper leaves than in lower leaves and stems.

TABLE (9) :

Lindane and Endrin residues in the different parts of broad bean plants.

Plant parts	Residues in ppm	
	Endrin	Lindane
Roots	3.3	4.5
Stems	0.2	1.3
Lower leaves	2.9	1.3
Upper leaves	1.8	2.7

3- Effect of insecticide residues in soil on cowpea: Vigna sinensis

a) Effect on germination:

The effect of insecticide residues on the germination of cowpea seeds are given in table 10 and fig.18.

Profenofos, endrin, and methomyl had no effect on germination. While the other insecticides tested produced slight reductions in germination. The percentage of decrease in the case of decamethrin, cypermethrin, fenvalerate and dimethoate varied between 3-27%.

b) Effect on root growth:

Results tabulated in table (11) and figure (19) show the effect of the insecticides tested on the growth of root of cowpea.

All insecticide tested except mephosfolan caused a decrease in the root growth at all concentrations tested.

Both fenvalerate and endrin produced the maximum reduction in root growth in comparison with the other insecticide, the percentage of decrease varied between (10.8 to 50.7) in fenvalerate and (2.9 to 68.8%) in endrin.

TABLE (10) : Effect of some insecticide residues on germination of cowpea Vigna sinensis.

(Mean of 30 plants)

CONCENTRATION OF INSECTICIDES IN (ppm)	DECAMETHRIN	% Decrease	CYPERMETHRIN	% Decrease	FENVALERATE	% Decrease	MEPHOSFOLAN	% Decrease	DISULFOTON	% Decrease	PROFENOFOS	% Decrease	EMDRIN	% Decrease	METHOMYL	% Decrease
10	83	-17	90	-10	73	-27	93	- 7	87	-13	90	-10	93	- 7	90	-10
20	93	- 7	83	-17	87	-13	80	-20	80	-20	90	-10	93	- 7	93	- 7
40	93	- 7	73	-27	83	-17	80	-20	80	-20	97	- 3	87	-13	90	-10
60	80	-20	90	-10	93	-7	83	-17	97	- 3	90	-10	97	- 3	97	- 3
80	93	- 7	83	-17	97	- 3	97	- 3	77	-23	100	---	90	-10	97	- 3
100	87	-13	80	-20	87	-13	80	-20	90	-10	93	- 7	90	-10	87	-13
Check	100		100		100		100		100		100		100		100	

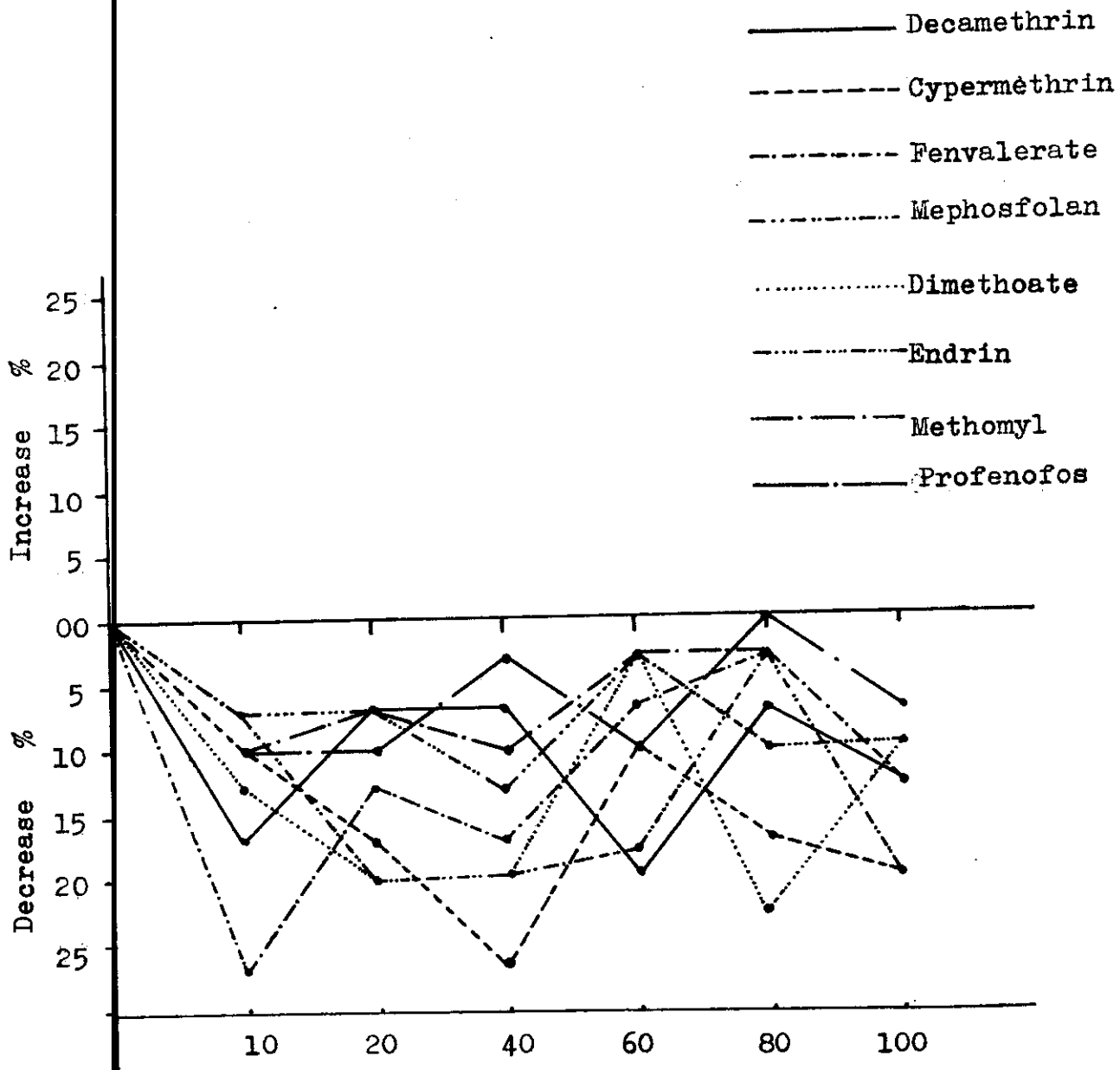

Fig. (18) Effect of insecticide residues on germination of cowpea Vigna sinensis .

Next to these two insecticides in effect, were dimethoate, methomyl and profenofos. They decreased the root growth at all cencentrations tested. The percent of decrease varied between (11.3 to 35.5), (19.8 to 41.1) and (22.3 to 45.5) % respectively.

Decamethrin and cypermethrin caused the least reduction on root growth, the percentage of decrease varied between (10.9 to 24.5) and (16.1 to 27.6) % respectively.

Mephosfolan increased the root growth at 10, 20 and 40 ppm, the percent of increase varied between (9.4 to 27.6) %. While at 60, 80 and 100 ppm, mephosfolan decreased root growth, the percent of decrease varied between (4.4 to 18.7) %.

Statistical analysis in table (11) indicated that the decrease in root growth caused by the insecticides tested were highly significant at all concentrations, except endrin, which caused a non significant increase in root growth at 20 ppm. In mephosfolan both the increase in root growth at the concentrations of 10, 20 and 40 ppm, and depression of growth at concentrations 80 and 100 ppm were found to be highly significant.

TABLE (11) : Effect of some insecticide residues on root growth of cowpea Vigna sinensis.

CONCENTRATION OF INSECTICIDES IN (ppm)	DECAMETHRIN		CYPERMETHRIN		FENVALERATE		MEPHOSFOLAN		DIMETHOATE		PROFENOFOS		ENDRIN		METHOMYL	
	Mean length of root in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.	Mean length of root in cm.	% Increase or decrease.
10	15.5	-19.3	14.9	-22.4	18.1	-10.8	22.2	+ 9.4	18.0	-11.3	15.7	-22.3	18.9	- 6.4	14.9	-26.2
20	14.7	-23.4	16.1	-16.1	15.4	-24.1	25.9	+27.6	15.3	-24.6	15.1	-25.2	20.8	+ 2.9	14.3	-29.2
40	17.1	-10.9	13.9	-27.6	15.9	-21.7	23.1	+13.8	17.0	-16.3	13.1	-35.1	15.3	-24.3	16.2	-19.8
60	14.9	-22.4	14.1	-26.6	14.0	-31.0	19.4	- 4.4	15.9	-21.7	12.9	-36.1	10.6	-47.5	14.3	-29.2
80	15.8	-17.7	15.9	-17.2	14.0	-31.0	18.3	- 9.9	14.2	-30.0	11.7	-42.1	8.3	-58.9	12.4	-38.6
100	14.5	-24.5	14.5	-24.5	10.0	-50.7	16.5	-18.7	13.1	-35.5	11.0	-45.5	6.3	-68.8	11.9	-41.1
Check	19.2		19.2		20.3		20.3		20.3		20.2		20.2		20.2	

	DECAMETHRIN	CYPERMETHRIN	FENVALERATE	MEPHOSFOLAN	DIMETHOATE	PROFENOFOS	ENDRIN	METHOMYL
LSD 5%	1.21	0.82	0.61	0.91	1.02	1.56	0.7	1.32
LSD 1%	1.86	1.14	0.84	1.26	1.42	2.16	0.97	1.84

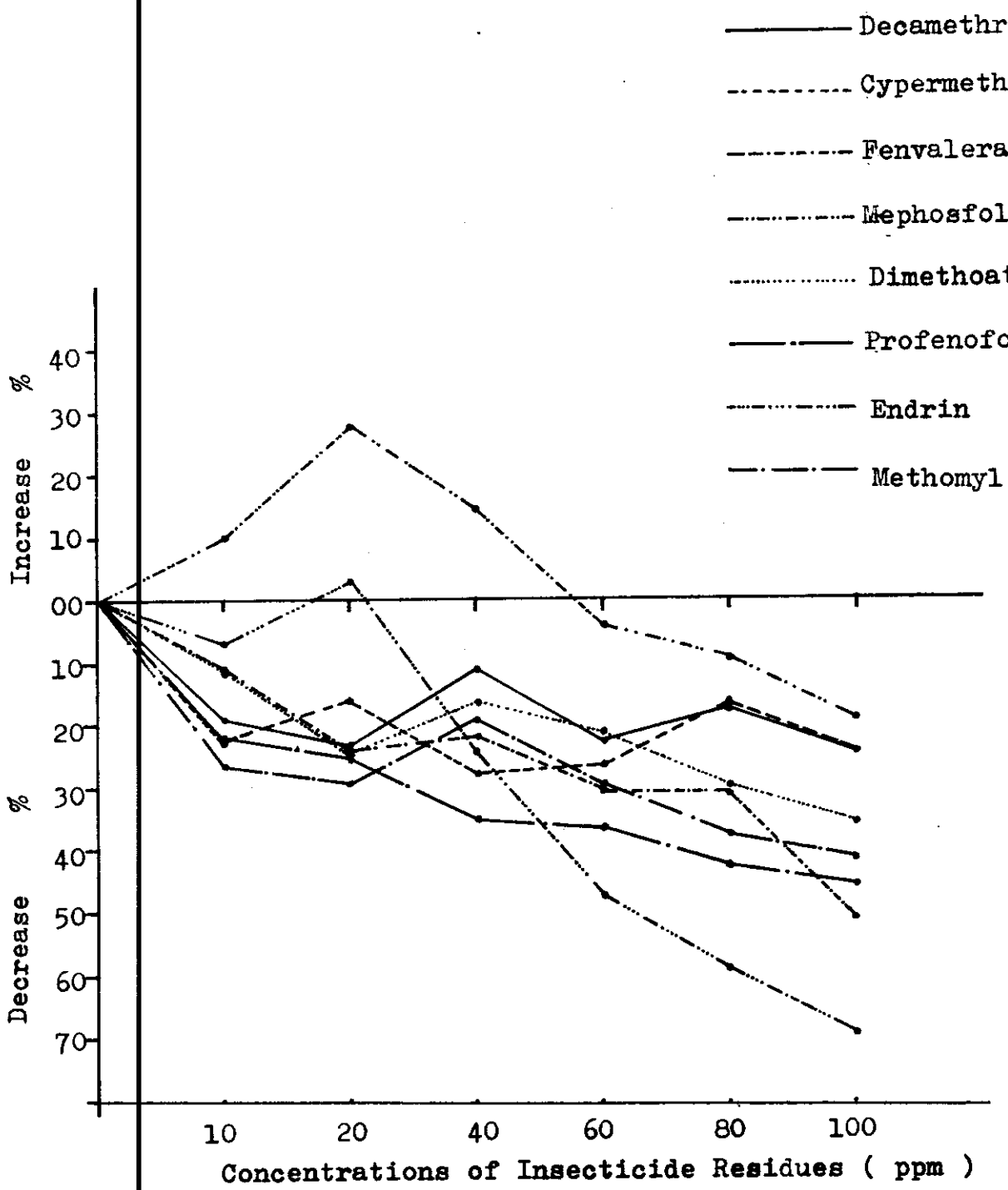

Fig.(19) Effect of some insecticide residues on root growth of cowpea Vigna sinensis .

In case of decamethrin there was a highly significant difference between check and all concentrations, tested, and also between (20 & 40 ppm), and between (40 & 60 ppm). A significant difference was found between (10 & 40 ppm) and between (40 & 80 ppm).

The differences in root growth between the concentrations of 10 ppm and (20, 60, 80 & 100 ppm), between 20 ppm and (60, 80 & 100 ppm) and between (60, 80,& 100 ppm), were not statistically significant.

In the results obtained when cypermethrin was used there was a highly significant difference between check and all concentrations tested, A highly significant difference was also found between (10 & 20 ppm), between 20 ppm and (40 & 100 ppm), between (40, 80 ppm), between (60 & 80 ppm), and between (80 & 100 ppm). A significant difference was detected between 10 ppm and (40 & 80 ppm). A non significant difference was found between 10 ppm and (60 & 100 ppm), between (20 & 80 ppm), between 40 ppm and (60 & 100 ppm), and between (60 & 100 ppm).

When fenvalerate was used there was a highly significant difference between check and all concentrations tested, the same degree of significance were found between 10 ppm and(20, 40, 60, 80 & 100 ppm), between 20 ppm and

(60, 80 & 100 ppm), between 40 ppm and (60, 80, 100 ppm), between (60 & 100 ppm), and between (80 & 100 ppm). The differences between (20, 40 ppm) and between (60 & 80 ppm) were not significant.

The differences between check and concentrations of mephosfolan of (10, 20, 40, 80 & 100 ppm) were highly significant. differences between 10 ppm and (20, 60, 80 & 100 ppm), between 20 ppm and (40, 60, 80 & 100 ppm), between (40, & 100 ppm), between (60 & 100 ppm), and between (80, 100 ppm), were also highly significant. Differences between the concentrations (60 & 80 ppm), were statistically significant. A non significant difference occured between (check & 60 ppm).

In case of dimethoate there was a highly significant difference between check and all concentrations tested, The difference between 10 ppm and (20, 60, 80 & 100 ppm), between 20 ppm and (40 & 100 ppm), between 40 and (80 & 100 ppm), between 60 ppm and (80 & 100 ppm) were also highly significant. A significant difference was found between the concentrations of (40 & 60 ppm), and between (20 & 100 ppm). The differences recorded between (10 & 40 ppm), and between (20 & 60 ppm)were not significant.

A highly significant difference was found between check and all concentrations tested, in case of prophenofos. The differences between 10 ppm and (40, 60, 80 & 100 ppm), between 20 ppm and (60, 80 & 100 ppm) were also highly significant. A significant difference occured between (40 & 100 ppm). A non significant difference was found between (10 & 20 ppm), between (20 & 40 ppm), between 40 ppm (60 & 80 ppm), and between (60, 80 & 100 ppm).

In case of endrin there was a highly significant difference between check and all concentrations tested. There was a non significant difference between check and 20 ppm. Otherwise, there was a highly significant difference between all concentrations tested.

Methomyl treatments produced a highly significant difference between check and all concentration tested, and also between 10 ppm and (80 & 100 ppm), between 20 ppm and (40, 80 & 100 ppm), between 40 ppm and (60, 80 & 100 ppm), between 60 ppm and (80 & 100 ppm). A non significant difference was found between 10 ppm and (20, 40 & 60 ppm), between (20 & 60 ppm), and between (80 & 100 ppm).

c) Effect on stem growth:

Fenvalerate and dimethoate at all concentrations decreased the stem growth, table (12) and figure (20).

Prophenofos and methomyl decreased stem growth at all concentrations except a slight increase at 40 ppm.

While mephosfolan and endrin decreased stem growth at concentrations higher than 20 ppm.

Both decamethrin and cypermethrin decreased stem growth only at a high concentration (100 ppm). At lower concentrations less than 80 ppm, the two insecticides increased the growth of stem slightly.

Figure (21a) and (21b) indicate that mephosfolan had a phytotoxic effect on cowpea. At high concentrations more than 40 ppm, the edges of plant leaves were burnt and the size of the leaflet was smaller than check.

Figure (22a) and (22b) show the side effect of methomyl on the green parts of cowpea at all concentrations tested.

It is clear that methomyl at concentrations above 60 ppm had accute phytotoxic effects on the leaflets of this plant. It also decreased there size in comparison to check.

TABLE (12) : Effect of some insecticide residues on stem growth of cowpea, Vigna sinensis.

CONCENTRATION OF INSECTICIDES IN (ppm)	DECAMETHRIN		CYPERMETHRIN		FENVALERATE		MEPHOSFOLAN		DIMETHOATE		PROFENOFOS		ENDRIN		METHOMYL	
	Mean length of stem in cm.	% Increase or decrease.	Mean length of stem in cm.	% Increase or decrease.	Mean length of stem in cm.	% Increase or decrease.	Mean length of stem in cm.	% Increase or decrease.	Mean length of stem in cm.	% Increase or decrease.	Mean length of stem in cm.	% Increase or decrease.	Mean length of stem in cm.	% Increase or decrease.	Mean length of stem in cm.	% Increase or decrease.
10	15.4	+18.5	14.2	+ 9.2	15.9	-17.2	19.3	+ 0.5	16.1	-16.1	16.7	-20.1	16.1	-22.9	17.9	-14.4
20	16.5	+26.9	14.7	+13.1	17.9	- 6.8	19.9	+ 3.6	13.9	-27.6	20.1	- 3.8	23.9	+14.4	19.3	- 7.7
40	17.5	+34.6	12.0	- 7.7	16.9	-11.9	19.1	- 0.5	15.4	-19.8	22.0	+ 5.3	18.1	-13.4	23.4	+11.9
60	18.5	+42.3	13.8	+ 6.1	15.1	-21.4	18.2	- 5.2	17.5	- 8.9	14.6	-30.1	14.9	-28.7	20.8	- 0.5
80	15.6	+20.0	15.5	+19.2	14.9	-22.4	17.8	- 7.3	13.3	-30.7	13.7	-34.4	10.0	-52.2	17.4	-16.7
100	11.7	-10.0	11.1	-14.6	11.9	-38.0	15.9	-17.2	10.1	-47.4	12.7	-39.2	8.1	-61.2	13.3	-36.4
Check	13.0		13.0		19.2		19.2		19.2		20.9		20.9		20.9	

	DECAMETHRIN	CYPERMETHRIN	FENVALERATE	MEPHOSFOLAN	DIMETHOATE	PROFENOFOS	ENDRIN	METHOMYL
LSD 5%	0.93	0.98	4.71	1.4	1.08	0.79	0.45	1.4
LSD 1%	1.28	1.35	6.54	1.97	1.49	1.09	0.62	1.95

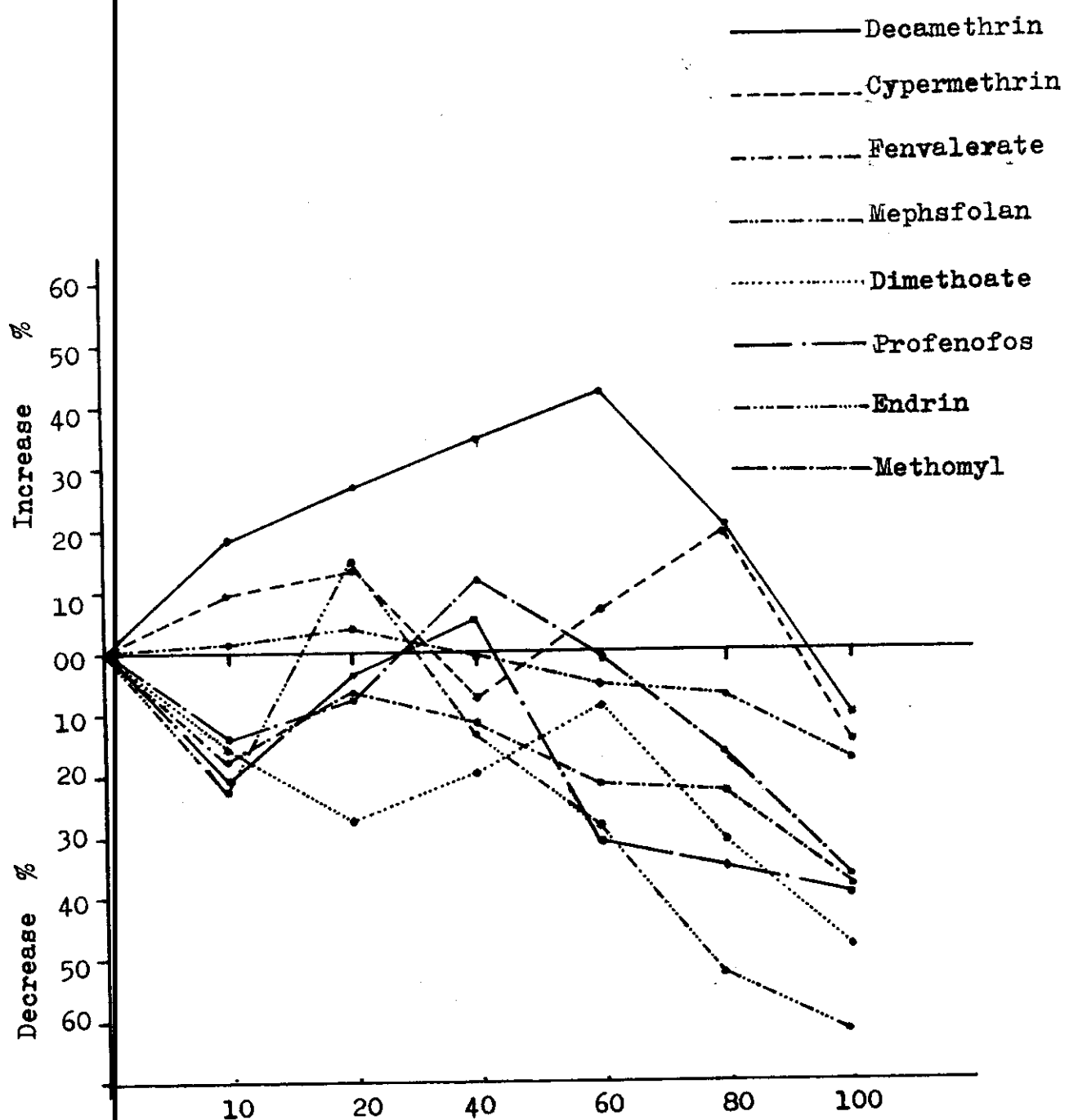

Fig. (20) Effect of some insecticide residues on stem growth of cowpea Vigna sinensis .

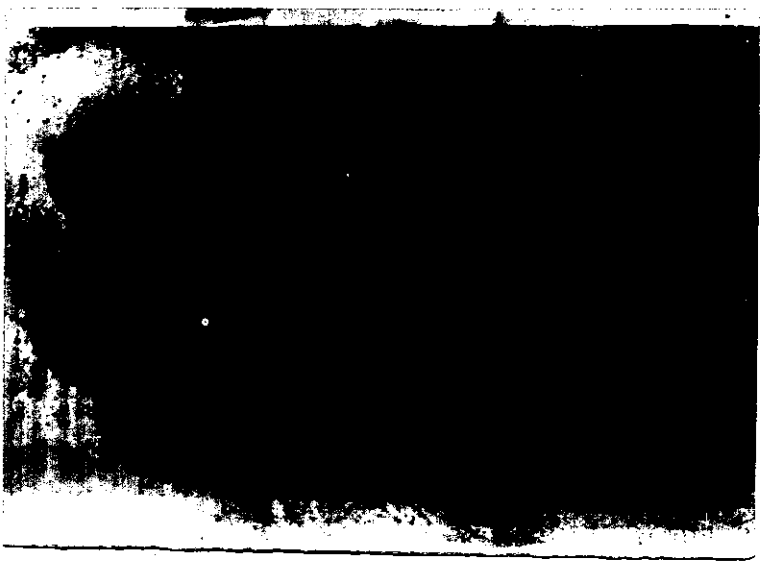

Fig.(21 a) General side effect of Mephosfolan on the green parts of cowpea at all concentrations tested.

Fig. (21 b) Phytotoxic symptoms of Mephosfolan on cowpea leaflets.

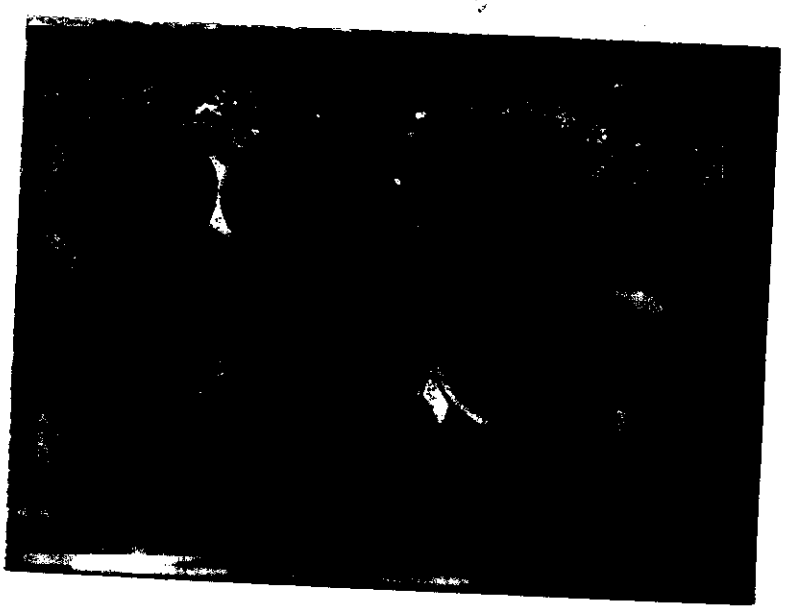

Fig. (22a) Effect of Lannate at all concentrations tested on the growth of cowpea Vigna sinensis.

Fig. (22b) The phytotoxic effects of Lannate on cowpea leaflets.

Statistical analysis tabulated in table (12) shows that the increase in stem growth caused by decamethrin was highly significant at concentrations from 10 ppm to 80 ppm. The reduction in stem growth found at the concentration of 100 ppm of decamethrin was also highly significant. There was a highly significant difference between check and all concentrations tested and also between 10 ppm and (40, 60 & 100 ppm), between 20 ppm and (60 & 100 ppm), between 40 ppm and (80 & 100 ppm) and between (60 , 80 & 100 ppm). A significant difference was found between (10 & 40 ppm), between (20 & 40 ppm), and between (40 & 60 ppm). A non significant difference was found between (10 & 80 ppm), and between (20 & 80 ppm).

Cypermethrin increased stem growth at 20 & 80 ppm, the differences from check were highly significant. The increase in stem growth at 10 ppm was significant. The increase of stem growth at 60 ppm was not significant. The compound decreased stem growth at 100 ppm and the difference from check was highly significant, the decrease recorded at 40 ppm was significant.

There was a highly significant difference between check and (20, 80 & 100 ppm), between (10 & 100 ppm), between 20 ppm and (40 & 100 ppm), between 40 ppm and

(60 & 80 ppm), and between (60, 80 & 100 ppm). A significant difference between check and (10 & 40 ppm), and between (10 & 80 ppm). A non significant difference was found between (check & 60 ppm), between 10 ppm and (20 & 60 ppm), between 20 ppm and (60 & 80 ppm), and between (40 & 100 ppm).

Fenvalerate caused a highly significant decrease in stem growth at 100 ppm. There was a significant difference between 100 ppm and (20 & 40 ppm), and a non significant difference between check, at the concentrations of (10, 20, 40, 60 & 80 ppm).

Mephosfolan caused a significant decrease in stem growth at 100 ppm. There was a highly significant difference between (check & 100 ppm), between (10 & 100 ppm), between 20 ppm and (80 & 100 ppm), between (40 & 100 ppm) and between (60 & 100 ppm). A significant difference was detected between (check & 80 ppm), between (10 & 80 ppm), between (20 & 60 ppm) and between (80 & 100 ppm). A non significant difference between check and (10, 20, 40 & 60 ppm), between 10 ppm and (20, 40 & 60 ppm), between (20 & 40 ppm) between 40 ppm and (60 & 80 ppm), and between (60 & 80 ppm).

The decrease in stem growth recorded with all the concentrations used with dimethoate was found to be highly significant.

There was a highly significant difference between check and all concentrations tested, between 10 ppm and (20, 80 & 100 ppm), between 20 ppm (40, 60 & 100 ppm), and between (40, 60, 80 & 100 ppm). A significant difference was found between (10 & 60 ppm), a non significant differences occured between (10 & 40 ppm), and between (20 & 80 ppm).

The reduction of stem growth at the concentrations of 10, 60, 80,& 100 ppm of profenofos was highly significant, and the increase in growth at 40 ppm was also had the same level of significance. The compound significantly decreased stem growth at 20 ppm.

There was a highly significant difference between check and (10, 40, 60, 80 & 100 ppm), between 10 ppm and (20, 40, 60, 80 & 100 ppm), between 20 ppm and (40 60, 80 & 100 ppm) between 40 ppm and (60, 80 & 100 ppm); and between (60 & 100 ppm). A significant difference was found between check and 20 ppm, between (60 & 80 ppm), and between (80 & 100 ppm).

Endrin caused a highly significant decrease in stem growth at all concentrations tested except at 20 ppm where there was highly significant increase in stem growth.

There was a highly significant difference between check and all concentrations tested, also there was a highly significant difference between all concentrations tested from (10 to 100 ppm).

Methomyl caused a highly significant decrease in stem growth at (10, 40, 80 & 100 ppm). It significantly decreased stem growth at 20 ppm and the decrease at 60 ppm was not significant.

There was a highly significant difference between check and (10, 40, 80 & 100 ppm), between 10 ppm and (40, 60, 80 & 100 ppm), between 20 ppm and (40 & 100 ppm), and between (40, 60, 80 & 100 ppm). A significant difference between (check & 20 ppm), between (10 & 20 ppm), between 20 ppm and (60 & 80 ppm).

d) Effect on nodulation:

Methomyl, Endrin and mephosfolan decreased the number of nodules on the root of cowpea at all concentrations tested, table (13) and figure (23). The percentage of decrease varied between (15.5 to 53.2%), (16 to 72.9%) and (6.8 to 59.1%) in the case of mephosfolan, endrin and methomyl respectively.

TABLE (13) : Effect of some insecticide residues on nodulation of cowpea Vigna sinensis.

CONCENTRATION OF INSECTICIDES IN (ppm)	DECAMETHRIN		CYPERMETHRIN		FENVALERATE		MEPHOSFOLAN		DIMETHOATE		PROFENFOS		ENDRIN		METHOMYL	
	Mean No. of nodulation	% Increase or decrease.	Mean No. of nodulation.	% Increase or decrease.	Mean No. of nodulation.	% Increase or decrease.	Mean No. of nodulation.	% Increase or decrease.	Mean No. of nodulation.	% Increase or decrease.	Mean No. of nodulation.	% Increase or decrease.	Mean No. of nodulation.	% Increase or decrease.	Mean No. of nodulation.	% Increase or decrease.
10	14.9	+36.7	16.1	+47.7	23.3	+ 5.9	14.1	-35.9	20.2	- 8.2	21.2	-10.5	19.9	-16.0	20.3	-14.3
20	13.9	+27.5	12.8	+17.4	18.5	-15.9	12.6	-42.7	19.0	-13.6	24.7	+ 4.2	17.1	-27.8	22.1	- 6.8
40	13.5	+23.9	16.1	+47.7	16.7	-24.1	14.3	-35.0	23.6	+ 7.3	26.3	+10.9	14.7	-37.9	18.4	-22.4
60	10.7	- 1.8	9.1	-16.5	14.9	-32.2	18.6	-15.5	17.9	-18.6	19.8	-16.5	10.3	-56.5	16.2	-31.6
80	15.1	+38.5	10.4	- 4.6	11.1	-49.5	11.8	-46.4	16.3	-25.9	16.9	-28.7	8.9	-62.4	13.9	-41.4
100	8.6	-21.1	7.7	-29.4	11.8	-46.4	10.3	-53.2	13.9	-36.8	10.1	-57.4	6.4	-72.9	9.7	-59.1
Check	10.9		10.9		22.0		22.0		22.0		23.7		23.7		23.7	

	DECAMETHRIN	CYPERMETHRIN	FENVALERATE	MEPHOSFOLAN	DIMETHOATE	PROFENOFOS	ENDRIN	METHOMYL
LSD 5%	0.98	0.94	0.91	0.39	1.02	0.72	1.16	1.37
LSD 1%	1.35	1.31	1.26	0.54	1.42	1.0	1.61	1.89

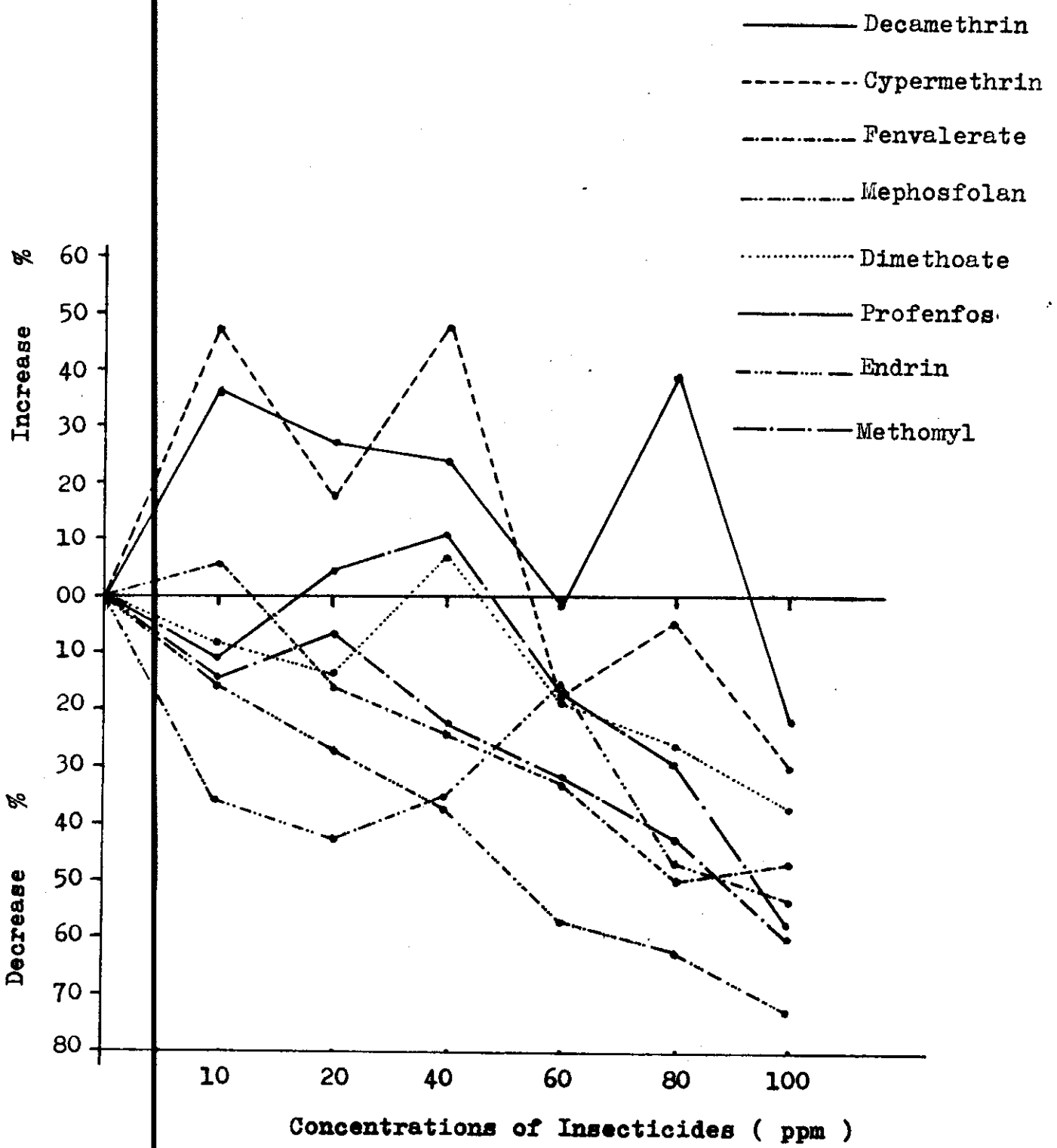

Fig.(23) **Effect of some insecticide residues on nodulation of cowpea <u>Vigna sinensis</u> .**

Fenvalerate also decreased the nodulation at all concentrations tested except at concentration 10 ppm. The percentage of decrease varied between (15.9 to 49.5%).

Both decamethrin and cypermethrin increased the number of nodules at concentrations 10, 20, 40 ppm. While at high concentrations (60, 80 & 100 ppm) the number of nodules decreased except at 80 ppm in case of decamethrin where the number of nodules increased.

Dimethoate decreased the nodulation at all concentrations tested except at 40 ppm. While profenofos increased nodulation at the concentrations of 20 & 40 ppm. At concentrations above 60 ppm, the number of nodules decreased, while at the other concentrations the effect was negligible.

Statistical analysis presented in table (13) shows that decamethrin increased nodulation at all concentrations tested except at 60 and 100 ppm and the increase was highly significant.

There was a highly significant difference between check and (10, 20, 40, 80 & 100 ppm), between 10 ppm and (40, 60, 80 & 100 ppm), between 20 ppm and (60 & 100 ppm),

and between (40, 60, 80 & 100 ppm). A significant difference occured between (10 & 20 ppm) and a non significant difference between (check & 60 ppm), between (10 & 80 ppm), and between (20 & 40 ppm).

Cypermethrin had an effect simillar to that of decamethrin, it increased nodulation at the concentrations of 10, 20 and 40 ppm, the increase was highly significant. It differed from decamethrin at higher concentration where there was a highly significant decrease in nodulation at the concentrations of 60 and 100 ppm. The decrease recorded at 80 ppm was found to be not statiscally significant.

There was a highly significantly difference between check and (10, 20, 40, 60 & 100 ppm), between 10 and (20, 60, 80 & 100 ppm), between (20, 40, 60 & 100 ppm), between (20, 40, 80 & 100 ppm), a significant difference between (60 & 80 ppm), a non significant difference between (check & 80 ppm), and between (10 & 40 ppm).

When fenvalerate was used, there was a highly significant decrease in nodulation at (20, 40, 60, 80 & 100 ppm), while at 10 ppm a highly significant increase of nodulation occured.

There was a highly significant difference between check and all concentrations tested, also between each of the concentrations, except a non significant difference between (80 & 100 ppm).

Mephosfolan caused a highly significant decrease in nodulation at all concentrations tested.

There was a highly significant difference between check and all concentrations tested, also between each of the concentrations, except a non significant difference between (10 & 40 ppm).

In dimethoate there was highly significant decrease in nodulation at (10, 20, 60, 80 & 100 ppm), and a highly significant increase in nodulation at the concentration of 40 ppm.

There was a highly significant difference between check and all concentration tested, also between each of the concentrations tested except between (10 & 20 ppm) and (20 & 60 ppm) where the differences were significant.

The increase in nodulation associated with the use of profenofos at the concentrations of (20 & 40 ppm) was highly significant, likewise the decrease noted with the

concentrations of 10, 60, 80 and 100 ppm in nodulation was also highly significant.

There was a highly significant difference between check and all concentrations tested, also between each of the concentrations from (10 to 100 ppm).

Endrin caused a highly significant decrease in nodulation at all concentrations tested.

There was a highly significant difference between check and all concentrations tested, also between all each of the concentrations tested except a significant difference between (60 & 80 ppm).

In methomyl a highly significant decrease in nodulation occured at all concentrations except a significant decrease at 20 ppm .

There was a highly significant difference between check and (10, 40, 60, 80 & 100 ppm), between all concentrations except a significant difference between (10 & 20 ppm), and between (check & concentration 20 ppm).